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FLIGHT CREW PERFORMANCE SPECIFICATION

(Preliminary)

for the

Lunar Excursion Module

Lunar Landing Mission

[U]

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FLIGHT CREW PERFORMANCE SPECIFICATION

(PRELIMINARY)

FOR THE

LUNAR EXCURSION MODULE

LUNAR LANDING MISSION

[U]

~~Available to NASA Offices and NASA Centers Only.~~

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GRUMMAN AIRCRAFT ENGINEERING CORPORATION

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REVISIONS

DATE	REV. BY	REVISIONS & ADDED PAGES	REMARKS

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ABSTRACT

This document contains an initial description of Lunar Excursion Module (LEM) crew operations for a nominal Apollo lunar landing mission. Detailed crew activities are presented in task analysis format along with coordinated time sequence tables.

Thirty (30) hours of LEM operation are described including translunar systems check-out, separation from the Command Module (CM) in an 80 n. mi. lunar orbit, injection into a complete elliptical coasting transfer orbit, followed by programmed powered descent to hover (1000 feet above the lunar surface) and a manually controlled landing. Crew operations during lunar stay (a period of 22.5 hours of which 8 hours are devoted to scientific exploration) are specified as well as those crew activities performed during programmed ascent and coasting ascent transfer orbit. Crew monitoring tasks during automatic rendezvous and crew activities during a manually controlled docking operation and crew transfer to the CM are also described.

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I. SCOPE

This document is submitted in partial fulfillment of paragraph 5.9, Exhibit E, of Contract No. NAS 9-1100. It describes the crew activities performed in all phases of a representative nominal Apollo lunar landing mission as accomplished in the Lunar Excursion Module. Crew functions and tasks are specified including the information and equipments required for their performance. Time sequence tables are presented for each mission phase. They indicate the coordinated sequence of activities of each crew member. Specific crew activities are described in the task analysis section and reflect the results of initial human engineering equipment design to insure an optimal man-machine interface.

II. PURPOSE

This document is intended to provide a detailed description of LEM crew activities involved in a nominal lunar landing mission. Future editions will include a description of crew activities related to back-up and emergency modes of operation, and abort regimes as they become more definitive.

The crew activity information, presented in task analysis format, contributes directly to three primary areas that effect total LEM system operation and mission success as follows:

Equipment Design

a. Identifies areas where functions have been allocated to man and machine for nominal modes of operation within mission limits.

b. Provides a frame of reference for determining crew maintenance and repair capabilities within subsystem design and mission requirements.

c. Contributes to the establishment of control/display design requirements.

d. Provides a basis for determining panel layout and cabin configuration.

e. Identifies areas where crew safety requirements must be considered.

Performance Evaluation

a. Determines the sequence of events as they effect inter-crew and total Apollo system coordination, work load and task assignment.

b. Determines information content and processing, and action requirements.

c. Assists in developing performance criteria measures.

Crew Training

a. Provides a basis for identifying crew skill and knowledge requirements.

b. Provides a framework for the development of training methods and procedures.

c. Contributes information for the development of training aids and devices.

d. Specifies crew task content and sequencing for use with engineering simulators and mission trainers.

III. TASK ANALYSIS VERIFICATION

The content of the crew activities described in the task analysis will be periodically updated to accommodate equipment design and mission profile modifications and to refine crew performance requirements and criteria. Updating and verification of all crew activities will be accomplished with the use of both engineering mock-ups, simulators, and part and full mission trainers.

Due to the variable pace at which individual subsystem design and development progresses, it is essential to indicate the level of confidence in the task analysis. This will provide a basis for estimating the reliability of the specified crew activities with respect to the stage of hardware development. Consequently, a confidence value will be assigned to the crew activities described in the task analysis tables as follows:

Confidence Value	Confidence Definition
1	A preliminary analysis has been made and an activity has been identified but additional analysis is required, as equipment is in the initial stage of design and development.
2	The preliminary analysis has been updated but additional equipment design and development is required.
3	The analysis has been updated following finalization of equipment design, operation and engineering sign-off and tested on mock-up or bench equipment.
4	A simulated test has been accomplished by testing the activity on a part-task or full-mission simulator or trainer.
5.	An actual test of the activity has been accomplished on operational equipment.
6.	Operational testing of the activity has been accomplished during flight.

Future editions of this document will show the assignment of the above confidence values. However, for purposes of this document, an overall value of "1" is assigned indicating that only an initial analysis has been accomplished, even though some subsystems may be further advanced in design than others.

IV. SUMMARY OF LEM MISSION

A. DESCRIPTION OF MISSION PHASES

The LEM mission has been conveniently divided into fourteen phases, each encompassing a block of events usually distinguished by its overall trajectory characteristics (e.g., translunar or coasting lunar orbital flight, powered flight-automatically or manuall controlled), or representing a large and significantly related series of activities (e.g., LEM system check-outs, preparation for lunar stay or lunar surface exploration).

LEM operations begin shortly after the transposition of the unmanned LEM to the CM. The Systems Engineer transfers to the LEM to perform a complete checkout of all systems. Upon completion, he returns to the CM to continue translunar coasting flight of approximately sixty hours.

After injection into an 80 n. mi. circular lunar orbit, the Systems Engineer re-enters the LEM to begin the second complete systems checkout. Following the determination of circular orbit parameters, the Commander transfers to the LEM to align the Inertial Measurement Unit.

After about one and one-quarter orbits, the LEM separates from the CM and the crew prepares to inject into a synchronous elliptical orbit. Following programmed injection into coasting descent flight, the Commander tracks landmarks and the landing site to update the LEM's orbital parameters. After approximately two and one-half hours of coasting flight the platform is realigned and preparations begin for powered descent.

Programmed descent (about 6 minutes) is initiated at 50,000 feet (pericynthion) and terminates at the point of hover, 1000 feet above the lunar surface. The Commander then assumes manual command of the vehicle and controls its flight to the pre-selected landing site.

Following touchdown, a complete checkout of the LEM systems is accomplished and preparations begin for an extended period of lunar surface activities. Each crew member, in turn, engages in one 4-hour period of scientific tasks. Rest periods are provided between each man's excursion to the lunar surface.

Prior to launch, all LEM systems are again checked out, the platform is aligned and the CM is tracked to update the ascent trajectory and CM orbital information.

Following launch, programmed powered ascent (of 6 minutes duration) terminates with a coasting period of about forty minutes during which time an automatic mid-course correction is monitored by the crew.

Automatic rendezvous is initiated at 20. n. mi. range from the CM and terminates at about 1000 feet from the CM. Six range rate adjustments are accomplished during this phase. The Commander assumes manual flight control at the termination of rendezvous and controls the vehicle throughout the docking maneuver to the point of attachment to the CM.

The LEM mission ends with the transfer of crew, scientific specimens and necessary equipment to the CM, and preparations begin for the jettison of LEM from the CM and the return trip to earth.

Table 1 contains the LEM phase titles, their time of occurrence and duration in the Apollo mission. The mission times indicated have not been firmly established and are subject to change as the mission profile becomes more clearly defined. In addition, other critical mission characteristics, e.g., the type of descent and ascent trajectories, the duration of lunar stay, and the number of men on the lunar surface at one time, are currently under study.

Figure 1, a time line chart of the LEM mission, identifies each phase and indicates the time of occurrence and duration of significant mission milestones. The time of appearance of the CM during the lunar stay is shown (representing the most favorable nominal launch time) in addition to the periods when each crew member is on the lunar surface.

Figures 2 and 3 correlate the mission phases with LEM's approximate position in the lunar orbit, the location of possible landmarks and the landing site, and the occurrence of critical events.

B. DESCRIPTION OF CREW RESPONSIBILITIES

In general, crew responsibilities can be divided into two basic categories: (1) flight control and navigation, as performed by the Commander, (2) systems monitoring and maintenance, as accomplished by the Systems Engineer. The division of overall responsibilities is as follows:

Commander

1. Has prime responsibility for all command decisions affecting mission planning including the continuation or modification of the flight plan, the selection of all flight modes, and the initiation of abort.

2. Has prime responsibility for manual control of the LEM vehicle, when required, and the monitoring of engine performance and flight parameters.

3. Has prime responsibility for the alignment of the primary and back-up inertial reference system.

4. Has prime responsibility for making navigational fixes, for tracking the CM and lunar landmarks during flight and for tracking the CM, while on the lunar surface.

5. Has prime responsibility for determining the duration of lunar stay, the nature of scientific activities to be performed while on the lunar surface (and during coasting flight) and the planning of work-rest cycles.

6. Has prime responsibility for, and performs scientific adtivities including the collection and analysis of specimens and the taking of photographs.

7. Assists the Systems Engineer in the monitoring and maintenance of LEM systems status, when required, and in the regeneration of life support equipment.

Systems Engineer

1. Has prime responsibility for insuring and evaluating the integrity of all LEM subsystems and in providing system status information required for decision regarding continuation of the flight plan or possible abort.

2. Has prime responsibility for performing periodic automatic check-out and maintenance on all LEM systems, including portable equipment.

3. Has prime responsibility for establishing and maintaining the communication links between the LEM crew, the CM and GOSS network.

4. Assists the Commander in monitoring flight parameters and engine performance, when required.

5. Controls the attitude of the vehicle during non-critical portions of coasting flight to assist the Commander in tracking the CM.

6. Has prime responsibility for record-keeping and the stowage of equipment and specimens on-board LEM.

7. Performs scientific activities including the collection and analysis of specimens and the taking of photographs.

During lunar stay periods, the crew member remaining in LEM performs all activities that are normally the responsibility of the other. Also, during peak activity periods inside the LEM cabin each crew member renders assistance to the other. Finally, should one crew member become incapacitated, the other would be required to complete the mission, even in the event of an emergency abort.

An inboard profile of the LEM is shown in Figure 4 and represents a preliminary configuration used for purposes of this document.

TABLE 1

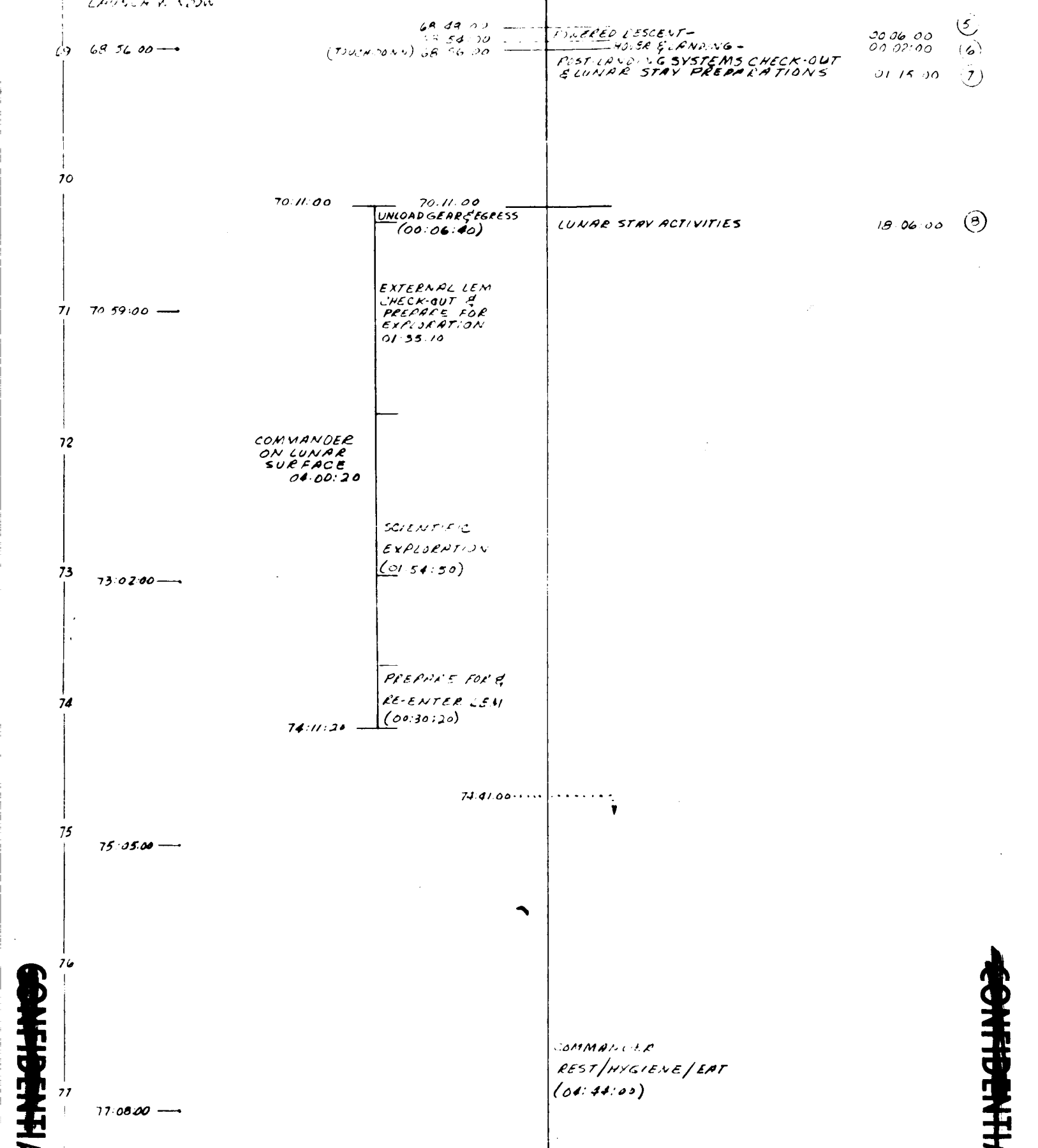
LEM MISSION PHASES

LUNAR LANDING MISSION

	Phase Title	Phase Time From	Phase Time To	Elapsed Time	
1.	Translunar Systems Checkout	04:36:00	05:53:00	01:17:00	Translunar 01:17:00
2.	Circular Lunar Orbit Systems Checkout and Readiness	64:33:40	66:03:00	01:29:20	Circumlunar 01:29:20
3.	Separation and Descent Orientation	66:03:00	66:13:00	00:10:00	Descent 02:53:00
4.	Coasting Descent Transfer Orbit	66:13:00	68:48:00	02:35:00	
5.	Powered Descent	68:48:00	68:54:00	00:06:00	
6.	Hover and Landing	68:54:00	68:56:00	00:02:00	
7.	Post-Landing Systems Checkout and Lunar Stay Preparations	68:56:00	70:11:00	01:15:00	Lunar Stay 22:33:00
8.	Lunar Stay Activities	70:11:00	88:17:00	18:06:00	
9.	Pre-Ascent Systems Checkout and Readiness	88:17:00	91:29:00	03:12:00	
10.	Powered Ascent	91:29:00	91:34:56	00:05:56	Ascent 01:23:32
11.	Coasting Ascent Transfer Orbit	91:34:56	92:11:11	00:36:15	
12.	Rendezvous	92:11:11	92:31:32	00:20:21	
13.	Docking	92:31:32	92:51:32	00:20:00	
14.	Post-Docking Systems Shut Down and Crew Transfer	92:51:32	93:05:37	00:14:05	Post-Docking 00:14:05
	Total Time LEM Operational				29:49:57
	Total Time Remaining for LEM Contingency				18:10:03
	Total LEM Design Lifetime				48:00:00

MISSION HOURS	MISSION EVENT TIMES	PHASE TITLE & ELAPSED TIME	ELAPSED TIME	LEM PHASE NUMBER
0	00:00:00	EARTH LAUNCH		
		EARTH ORBIT		
		TRANSLUNAR INJECTION		
		TRANSPOSITION		
		TRANSLUNAR FLIGHT		
	04:36:00		04:36:00	
		TRANSLUNAR SYSTEMS CHECK-OUT	01:17:00	(1)
	05:53:00			
		TRANSLUNAR FLIGHT –	58:07:00	
64	64:00:00			
	64:05:24	LUNAR ORBIT INJECTION –	00:05:24	
		PREPARATIONS FOR TRANSFERRING TO LEM –	00:28:16	
	64:33:40			
		CIRCULAR LUNAR ORBIT SYSTEMS CHECK-OUT & READINESS	01:29:20	(2)
65				
66	66:03:00			
	66:13:00	SEPARATION AND DESCENT ORIENTATION	00:10:00	(3)
		COASTING DESCENT TRANSFER ORBIT –	02:35:00	(4)
67				
68				

APPROXIMATE TIME WHEN CM IS IN NOMINAL



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78

79

79:11:00

19 25 00
19 30.00

CHANGE
DUTY
STATIONS

80

81

81 14:00

SYSTEMS
ENGINEER
REST/HYGIENE/EAT
(04 17.00)

82

83

83:17.00

83.47.00

84

84 17:00

UNLOAD GEAR & EGRESS
(00.06.40)

PREPARE FOR
EXPLORATION
(00:33.20)

85

85 20.00

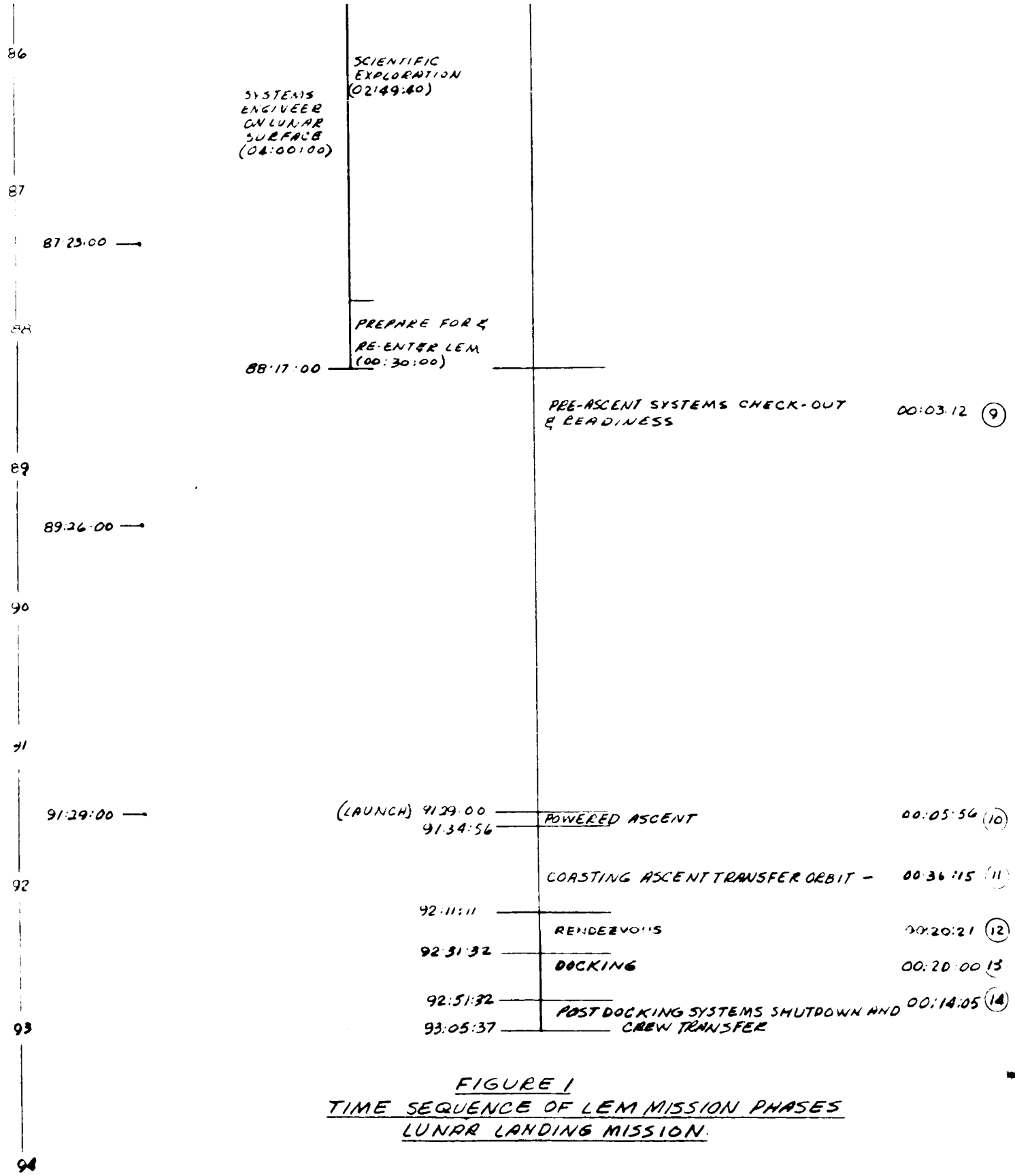

FIGURE 1
TIME SEQUENCE OF LEM MISSION PHASES
LUNAR LANDING MISSION.

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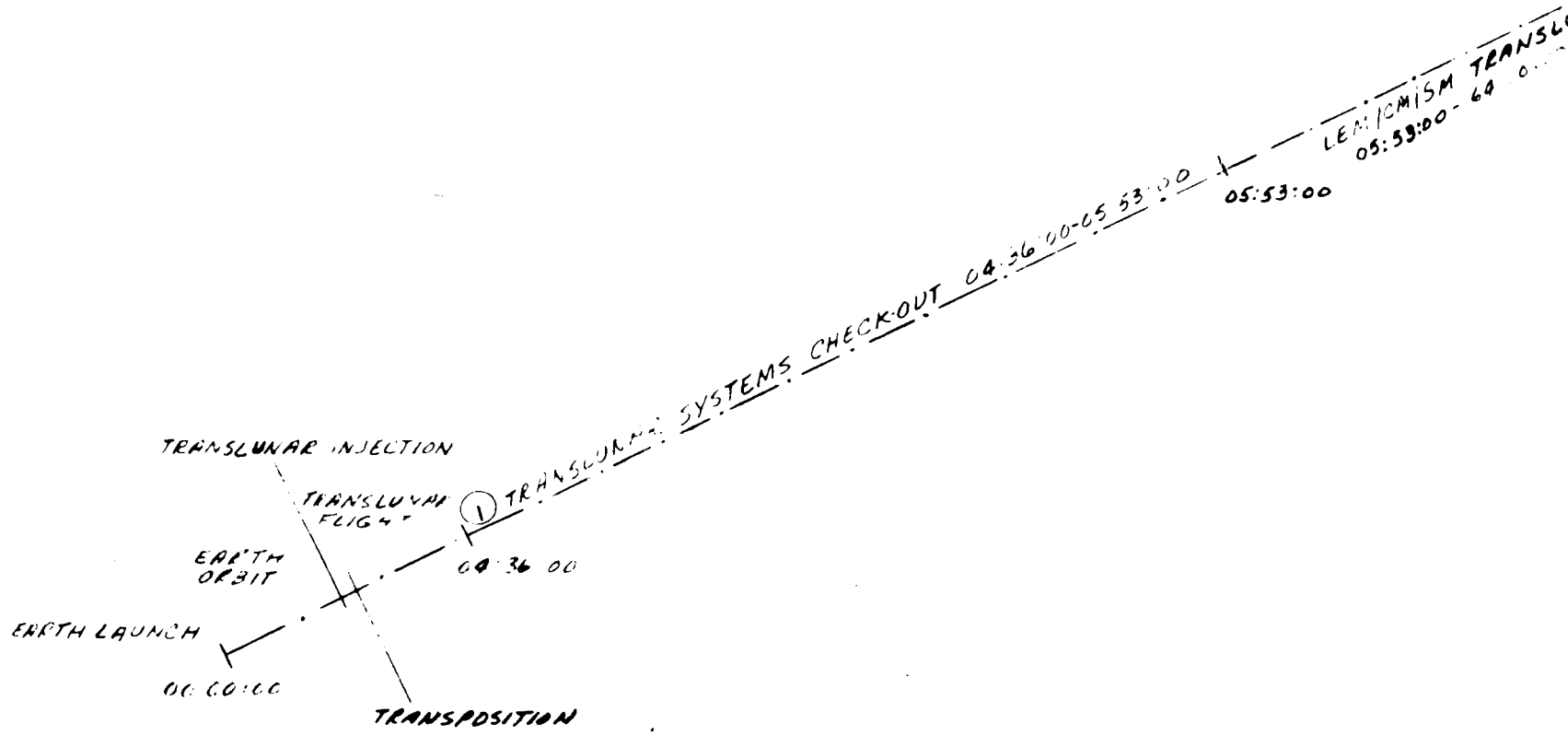

APOLLO STAGING

EARTH LAUNCH	EARTH ORBIT & TRANS-LUNAR INJECTION	TRANSPOSITION	TRANSLUNAR FLIGHT
(LES) LAUNCH ESCAPE SYSTEM			
(CM) COMMAND MODULE	CM	CM	CM
(SM) SERVICE MODULE	SM	SM	SM
(LEM) LUNAR EXCURSION MODULE	LEM	LEM	LEM
S4B	S4B	S4B	
S2			
S1C			
C5			

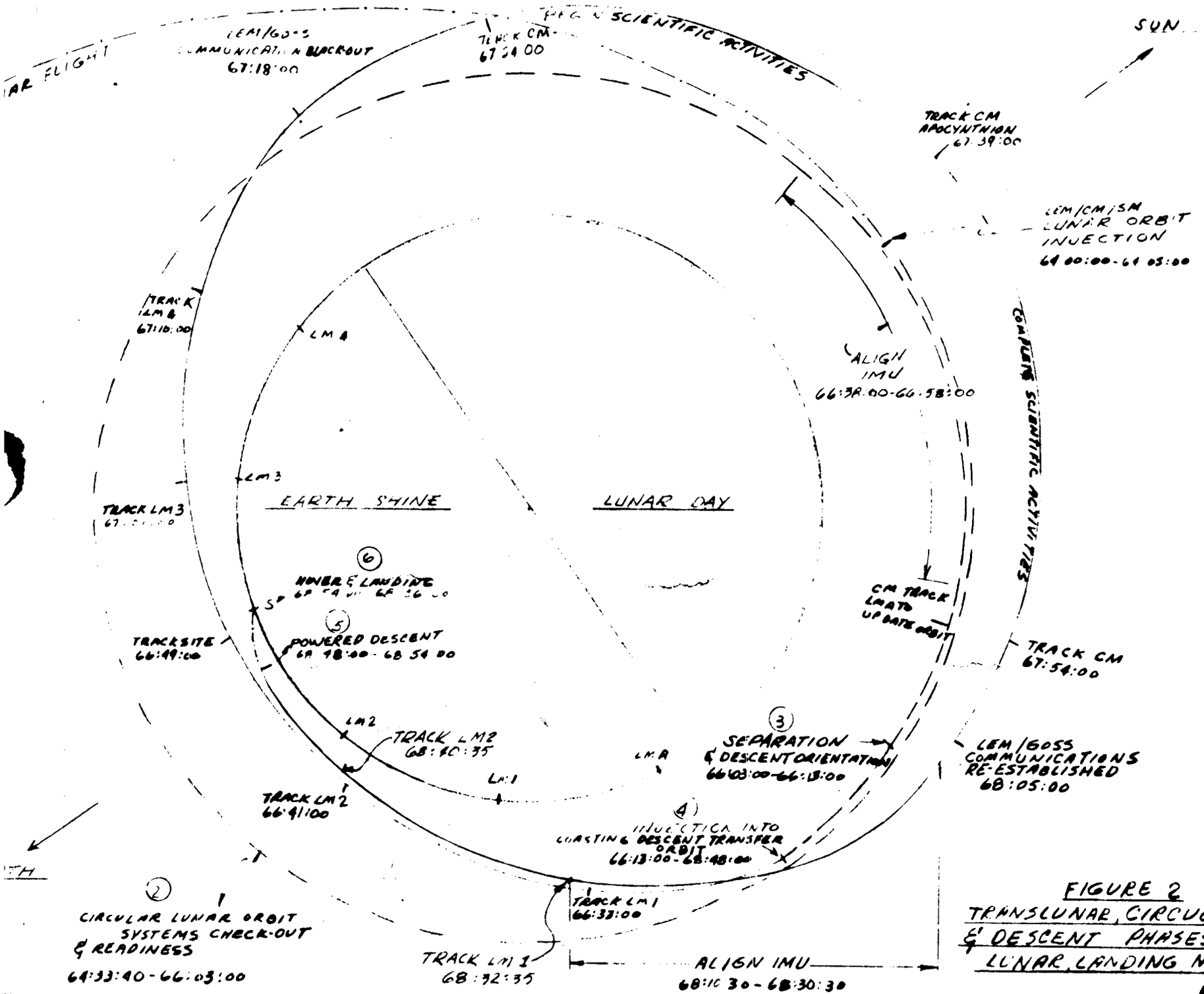

FIGURE 2
TRANSLUNAR, CIRCULAR ORBIT & DESCENT PHASES
LUNAR LANDING MISSION

V. MAJOR ASSUMPTIONS

In order to accomplish the task analysis, a number of assumptions were made regarding the LEM mission. These were required when alternate or conflicting concepts existed or when information was not currently available*. The major assumptions are as follows:

a. The circular lunar orbit is at an altitude of 80 n. mi., requiring 2 hours and 3 minutes for its completion.

b. The synchronous elliptical orbit requires 2 hours and 3 minutes with a pericynthion of 50,000 feet and an apocynthion of 152 n. mi.

c. All flight parameters (velocities, altitudes, ranges and times) indicated are derived from representative trajectory analyses.

d. Specific vehicle attitude constraints are required during coasting and are manually initiated by the crew (although the specific attitude angles are not indicated in this document).

e. Following separation from the CM, the LEM injects into a complete synchronous orbit before powered descent.

f. LEM separation from the CM is accomplished automatically.

g. The primary mode of control during hover to landing and during docking is manual.

h. Both PLSS units are initially stored on-board the CM and require transfer to the LEM.

i. Crew transfer between LEM and CM is accomplished with face plates open and with PLSS units worn.

j. During periods of powered flight, the crew's face plates are closed and gloves worn.

k. A mid-course correction occurs during the final portions of the Coasting Ascent Transfer Orbit.

l. Vehicle attitude during the programmed rendezvous is the same as would be required for a manual rendezvous (in the event of N & G subsystem failures), enabling the crew to monitor the maneuver, thereby facilitating rapid manual take over, if necessary.

m. A variable field of view, articulated telescope (SCT) is used to align the IMU, to track landmarks, to evaluate the landing site and to track the CM. The SCT may be operated with face plate closed or open.

n. The SCT is located on the outboard side of the Commander's position (left side).

o. The IFTS is located on the outboard side of the System Engineer's position (right side).

p. The navigation and guidance system computer has an independent self-checking capability.

q. Specific LEM systems are placed in a standby mode subsequent to docking to facilitate LEM re-entry.

r. The CM is always in view at the time of lunar launch.

s. Each crew member, in turn, conducts activities on the lunar surface for approximately four hours.

t. During lunar stay, each man rests or sleeps aboard LEM for approximately four and one-half hours.

u. The resting crew member wears gloves but not his helmet. The on-duty crew member wears both gloves and helmet with face plate open.

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*In some cases, where there was a significant lack of information, the notation "TO BE DETERMINED" was made.

VI. DESCRIPTION OF TASK ANALYSIS FORMAT

A. DEFINITION OF CATEGORIES

Crew activities have been presented in a conventional task analysis format at three levels of description: Functions, Tasks and Action Requirements (task elements). The numbering scheme for each level of activity is continuous, beginning in Phase 1 and ending in Phase 14. For example, the activity number 43.2.1 represents Function #43, Task #2 and Action Requirement #1.

Mission Time represents real time from earth launch and signifies the start time of an activity in hours, minutes and seconds.

Activity Time denotes the duration of a Function, Task or Action Requirement in hours, minutes and seconds. The total of all Task times is equal to Function time. In most cases, Activity Time for Action Requirements has not been indicated except that the total of all Action Requirement times equals the Task time. In some cases, an activity is Continuous indicating that it occurs simultaneously with another activity within its level of description.

Crew/Location codes indicate the crew member performing the activity and the location at which it is performed. If a Crew/Location appears at a specific level of description and not below that level, it indicates that the higher level code also applies at all lower levels of the activity hierarchy.

Information Requirement(s) represents the input cues (parameters or system events) necessary for making some decision or performing some action.

Display(s) indicates the device (visual or auditory) used to convey the information parameters to the crew.

Action Requirement(s) represents the most elemental level of activity required to complete the Task.

Control(s) indicates the device used to accomplish the Action Requirement.

System Output(s) represents the system response resulting from the action taken.

Remarks provides a means of clarifying activity details not readily explainable in the other descriptive categories.

Activities that reappear within the same phase are not repeated verbatim within that phase. Instead, a notation is made, e.g. "same as 43.2.2", and the reader is required to return to the referenced activity for its description.

Each phase is a complete package, so far as its content is concerned and the reader is not required to refer to any other phase for information.

B. ABBREVIATIONS

A list of abbreviations, used throughout the document, is included below:

A	Aisle
BP	Boarding Platform
C	Commander
CDU	Coupling Display Unit
CM	Command Module
DSIF	Deep Space Instrumentation Facility
ECS	Environmental Control System
FC	Fuel Cell
fps	Feet Per Second
GOSS	Ground Operational Support System
h	Altitude
$\dot{h}$	Altitude Rate
IFTS	In-Flight Test System
IL	Interlock
IMU	Inertial Measurement Unit
LEM	Lunar Excursion Module
LOS	Line-Of-Sight
LS	Lunar Surface
n. mi.	Nautical Miles (6080.2 feet)
N & G	Navigation and Guidance
PCM	Pulse Coding Modulation
PLSS	Portable Life Support System
R	Range
$\dot{R}$	Range Rate
RCS	Reaction Control System
S & C	Stabilization and Control
SCS	Stabilization and Control System
SCT	Scanning Telescope
SE	Systems Engineer
SOX	Supercritical Oxygen
T	Tunnel
T/W	Thrust-to-Weight
V_H	Horizontal Velocity
V_V	Vertical Velocity
$\dot{Y}$	Cross Track Velocity
$\dot{Z}$	Along Track Velocity

VII. REFERENCES

The following documents were used as a guide in developing the task analysis contained herein. Some variations in informational content exists between this report and the referenced documents since a design information freeze was required by the magnitude of this effort. Subsequent versions will correct these differences.

Project Apollo/Lunar-Landing Mission Design Plan, NASA/MSC, March 15, 1963.

Grumman Aircraft Engineering Corporation, Trajectory Characteristics During The LEM Mission I, GAEC Memo L500-M03-10, March 8, 1963

Grumman Aircraft Engineering Corporation, LEM Basic Design Mission, GAEC Memo LMO-540-59, May 13, 1963.

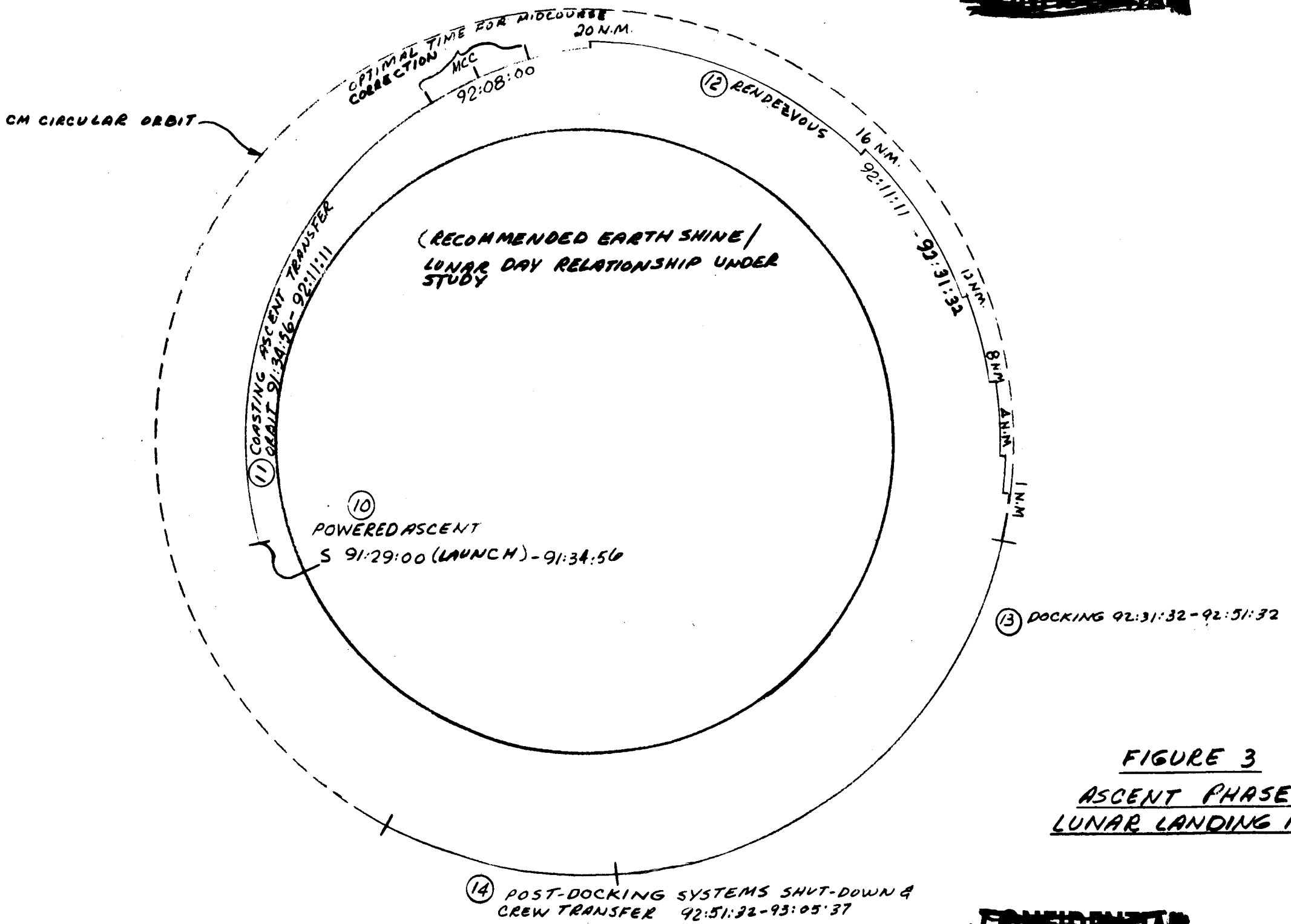

FIGURE 3

ASCENT PHASES
LUNAR LANDING MISSION

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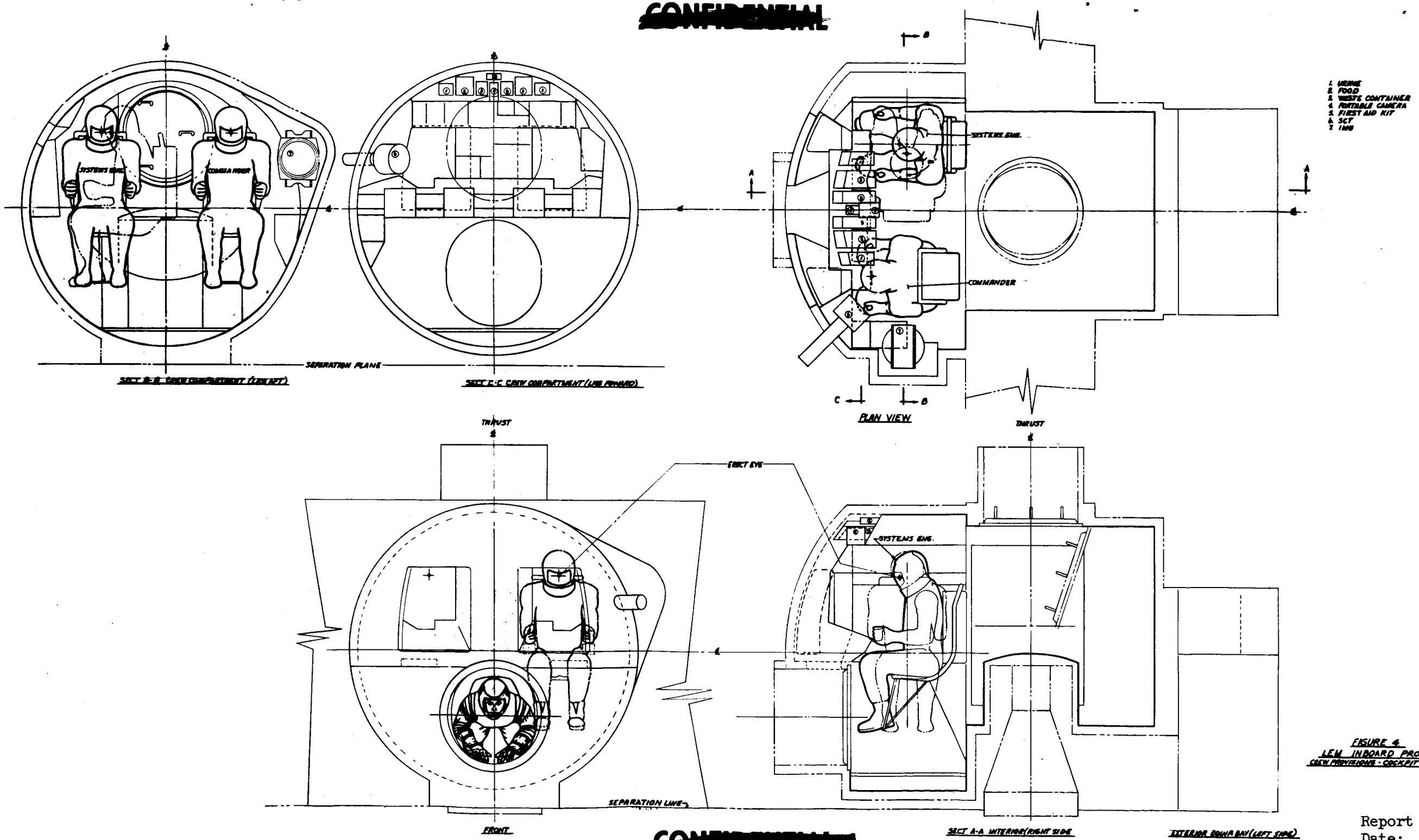

FIGURE 4
LEM INBOARD PROFILE
CREW PROVISIONS - COCKPIT & CABIN AREA

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VIII.

FLIGHT CREW TASK ANALYSIS

AND

TIME SEQUENCE TABLES

FOR THE

LUNAR EXCURSION MODULE

LUNAR LANDING MISSION

Phase 1 — TRANSLUNAR SYSTEMS CHECKOUT

From 04:36:00 To 05:53:00 — Elapsed Time 1 hr. 17 min.

Commander	Mission Time	Systems Engineer
1.0.0 Monitor LEM Systems Status from CM and Coordinate with GOSS (CM Crew)	04:36:00	2.0.0 Pressurize LEM Cabin and Interlock From Inside CM
	04:38:00	3.0.0 Prepare to Transfer to LEM
	04:43:00	4.0.0 Transfer From CM to LEM
	04:43:00	4.1.0 Proceed into LEM
	04:43:45	4.2.0 Inspect interior of cabin
	04:44:15	4.3.0 Close LEM hatch
	04:44:30	5.0.0 Prepare Commander's Position and Secure Self in Seat
	04:44:30	5.1.0 Install PLSS and take seat
	04:46:30	6.0.0 Checkout Electrical Power Generation System
	04:46:30	6.1.0 Monitor electrical power generation system status
	04:46:50	6.2.0 Check pre-positioning of switches
	04:47:15	6.3.0 Purge fuel cell #1 and bring to operational status
	04:47:25	6.4.0 Check main bus voltage
	04:47:30	7.0.0 Place Electrical Power Distribution On-Line and Checkout
	04:47:30	7.1.0 Activate DC distribution and checkout
	04:47:55	7.2.0 Activate AC distribution and checkout
	04:48:30	8.0.0 Distribute Power to Environmental Control System and Checkout
	04:48:30	8.1.0 Turn on power to ECS and monitor expendables
	04:48:45	8.2.0 Monitor status of ECS gas reconditioning subsystems
	04:48:50	8.3.0 Check cabin gas flow status
	04:49:00	8.4.0 Monitor O_2 cabin inflow
	04:49:05	8.5.0 Select normal cabin environment
	04:49:15	8.6.0 Monitor O_2 flood status
	04:49:20	8.7.0 Monitor cabin temperature
	04:49:30	8.8.0 Monitor suit temperature
	04:49:45	8.9.0 Monitor SOX heater status
	04:49:50	8.10.0 Monitor glycol management status
	04:50:00	8.11.0 Actuate LEM ECS system
	04:50:15	8.12.0 Transfer suit connection to LEM ECS and communication system
	04:50:30	9.0.0 Distribute Power to Communication System and Checkout
	04:50:30	9.1.0 Activate UHF subsystem
	04:51:00	9.2.0 Activate VHF subsystem
	04:51:30	9.3.0 Select S-band modes, transmit/receive capability, emergency keyer capability and checkout.
	04:52:30	9.4.0 Deploy UHF antenna and checkout

Phase 1 — TRANSLUNAR SYSTEMS CHECKOUT — From 04:36:00 To 05:53:00 — Elapsed Time 1 hr. 17 min.

Commander	Mission Time		Systems Engineer
	05:00:30	10.0.0	Distribute Power to Navigation and Guidance System and Checkout
	05:00:30	10.1.0	Turn on power to N & G system
	05:00:40	10.2.0	Checkout N & G status lamps and alarm circuitry
	05:00:50	10.3.0	Checkout IMU
	05:01:50	10.4.0	Checkout computer
	05:11:50	10.5.0	Checkout N & G system clock
	05:12:50	10.6.0	Checkout SCT
	05:22:50	10.7.0	Checkout radar system
	05:30:30	11.0.0	Distribute Power to Stabilization and Control System and Checkout
	05:35:30	12.0.0	Distribute Power to Main Propulsion System and Checkout
	05:35:30	12.1.0	Activate electrical loads for main propulsion system
	05:35:35	12.2.0	Select descent propulsion system and checkout
	05:35:55	12.3.0	Select ascent propulsion system and checkout
	05:36:15	13.0.0	Distribute Power to RCS and Checkout
	05:36:15	13.1.0	Activate electrical loads for RCS propulsion
	05:36:20	13.2.0	Checkout RCS propulsion
	05:36:30	14.0.0	Transfer to System Engineer's Position
	05:36:30	14.1.0	Release self from seat
	05:36:50	14.2.0	Prepare SE position
	05:37:30	14.3.0	Fasten C seat restraint
	05:37:40	14.4.0	Take SE position
	05:38:00	15.0.0	Distribute Power to In-Flight Test System and Checkout
	05:38:00	15.1.0	Turn on power to IFTS
	05:38:10	15.2.0	Calibrate IFTS
	05:43:00	16.0.0	Perform Systems Checkout with IFTS
	05:43:00	16.1.0	Perform systems checkout in automatic test mode
	05:44:55	16.2.0	Turn off power to IFTS
	05:45:00	17.0.0	Place All Subsystems in Their Specific Modes for Translunar Flight
	05:45:00	17.1.0	De-activate electrical loads for RCS propulsion
	05:45:05	17.2.0	De-activate electrical loads for main propulsion system
	05:45:10	17.3.0	Turn off power to N & G system
	05:45:20	17.4.0	Turn off power to S & C system

Phase 1 **TRANSLUNAR SYSTEMS CHECKOUT** **From 04:36:00 To 05:53:00** **Elapsed Time 1 hr. 17 min.**

Commander	Mission Time		Systems Engineer
	05:45:30	17.5.0	Turn off power to communication system
	05:45:40	17.6.0	Turn off power to ECS
	05:46:30	17.7.0	De-activate DC distribution
	05:46:35	17.8.0	Place fuel cell #1 to standby status
	05:46:45	17.9.0	Check fuel cell electrical output
	05:47:00	18.0.0	Prepare to Transfer to CM
	05:47:00	18.1.0	Disengage self from SE seat
	05:48:00	18.2.0	Secure SE seat
	05:49:00	18.3.0	Open LEM hatch
	05:52:00	19.0.0	Transfer from LEM to CM
	05:52:00	19.1.0	Proceed into interlock
	05:52:30	19.2.0	Proceed into CM
End of Phase 1	05:53:00		End of Phase 1

PHASE NUMBER: 1 **TRANSLUNAR SYSTEMS CHECKOUT**

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
1.0.0 Monitor LEM Systems Status from CM and Coordinate with GOSS	04:36:00	Continuous	---		To be determined		---		

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
2.0.0 Pressurize LEM Cabin and Interlock from Inside CM	04:36:00	00:02:00	SE/CM	---	To be determined		---		

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
3.0.0 Prepare to Transfer to LEM	04:38:00	00:05:00	SE/CM	---	To be determined		---		

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
4.0.0 Transfer from CM to LEM	04:43:00	00:01:30	SE/IL						
4.1.0 Proceed into LEM	04:43:00	00:00:45							
4.1.1				LEM cabin gas status is normal	ECS indicators on LEM instrument panel	Open LEM hatch	Hatch locking wheel	Hatch is opened	If LEM cabin gas status indicates malfunction, return to CM, purge LEM and interlock. Return to LEM under PLSS operation and trouble shoot.
4.1.2				Procedure	---	Proceed into LEM head first with face plate open wearing PLSS	---	---	If unable to get through with PLSS, doff PLSS and pull through.
4.1.3				All detents are engaged into periphery of docking seals	---	Inspect docking clamps	---	---	If docking clamps are not engaged by pneumatic actuation, manually engage the disengaged ones by employing their individual over-center locking levers.
4.2.0 Inspect interior of cabin	04:43:45	00:00:30							
4.2.1				Checklist	---	Visually inspect interior of LEM using flashlight	---	---	If flashlight fails, use backup flashlight. If cockpit is in general disarray, straighten out and checkout according to check list.
4.3.0 Close LEM hatch	04:44:15	00:00:15							
4.3.1				Checklist	---	Close LEM hatch and lock	Hatch locking wheel	LEM hatch is closed, locked and sealed.	If LEM hatch jams and will not lock, engage into lock position as close as possible, then vent the interlock thereby creating an imbalance of pressure and ramming the hatch cover up in place.

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
5.0.0 Prepare Commander's Position and Secure Self in Seat	04:44:30	00:02:00	SE/C						
5.1.0 Install PLSS and take seat	04:44:30	00:02:00							
5.1.1				Procedure	---	Install PLSS in seat	---	---	PLSS ready for use and mounted in seat; astronaut is plugged into PLSS although breathing cabin air.
5.1.2				Procedure	---	Take Commander's position and secure restraint harness	Harness latching lever	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
6.0.0 Checkout Electrical Power Generation System	04:46:30	00:01:00	SE/C						
6.1.0 Monitor electrical power generation system status	04:46:30	00:00:20							
6.1.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY. (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
6.1.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures.	FUEL CELL MONITOR SELECT rotary to 1, 2 and 3.	---	
6.1.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1, 2, 3) extinguished	Check N_2 fail warning indicators	---	---	
6.2.0 Check pre-positioning of switches	04:46:50	00:00:25							
6.2.1				AUTO AUTO ON ON AUTO ON	H_2 HEATERS (1 and 2) O_2 HEATERS (1 and 2) H_2 FLOW (1 and 2) O_2 FLOW (1 and 2) FUEL CELL HEATERS (1, 2, 3) FUEL CELL FLOW (1, 2, 3)	Check position of switches	---	---	

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
				OPEN CLOSE AUTO OFF ON OFF OFF	H_2 VENT (2, 3) H_2 VENT (1) O_2 PURGE (2, 3) O_2 PURGE (1) BUS A INPUT (FC 2 and 3) BUS A INPUT (FC 1) BUS B INPUT (FC 1, 2, 3)				
6.3.0 Purge fuel cell #1 and bring to operational status	04:47:15	00:00:10							
6.3.1				Checklist	---	Purge O_2 in fuel cell #1	O_2 PURGE (FC #1) toggle to AUTO	Contaminants and diluents removed from fuel cell #1.	
6.3.2				Checklist	---	Activate fuel cell #1	H_2 VENT (FC #1) toggle to OPEN Bus A INPUT (FC #1) toggle to ON	Fuel cell #1 temperature maintained by reactants. Fuel cell #1 ready to accept electrical load.	
6.4.0 Check main bus voltage	04:47:25	00:00:05							
6.4.1				Normal operating level	DC VOLTMETER	Check voltage output of Bus A	MONITOR SELECT rotary (volts) to BUS A	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
7.0.0 Place Electrical Power Distribution On-Line and Checkout	04:47:30	00:01:00	SE/C						
7.1.0 Activate DC distribution and checkout	04:47:30	00:00:25							
7.1.1				ON position	BUS TIE A toggle	Check prior application of essential loads to main bus	---	---	
7.1.2				Checklist	---	Apply non-essential loads to main bus	BUS TIE NON-ESSENTIAL toggle to ON	Non-essential loads placed on main bus	Cabin dome and integral panel lights are actuated. If integral panel lighting fails, place FLOOD LIGHTING toggle to ON.
7.1.3				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3 and main bus current	MONITOR SELECT rotary (amps) to FC 1, 2, 3 and BUS A	---	
7.1.4				Normal operating level	DC VOLT-METER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	
7.2.0 Activate AC distribution and checkout	04:47:55	00:00:35							
7.2.1				No. 1 position	INVERTER SELECT rotary	Check prior application of DC input to inverter No. 1	---	---	
7.2.2				Normal operating temperature level	INVERTER No. 1 TEMP. warning light extinguished	Check inverter No. 1 temperature warning indicator	---	---	
7.2.3				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
7.2.4				Normal operating levels	AC VOLTMETER, FREQUENCY meter	Check inverter No. 1 phase voltage and frequency	PHASE MONITOR SELECT rotary to A,B, and C	- - -	
7.2.5				Checklist	- - -	Apply DC input to inverter No. 2	INVERTER SELECT rotary to No. 2	Inverter No. 2 on-line	
7.2.6				Normal operating temperature level	INVERTER No. 2 TEMP. warning light extinguished	Check inverter No. 2 temperature warning indicator	- - -	- - -	
7.2.7				Proper phase relationship maintained	INVERTER NO. 2 PHASE FAILURE warning lights (A,B and C) extinguished	Check inverter No. 2 phase failure warning indicators	- - -	- - -	
7.2.8				Normal operating levels	AC VOLTMETER, FREQUENCY meter	Check inverter No. 2 phase voltage and frequency	PHASE MONITOR SELECT rotary to A,B, and C	- - -	
7.2.9				Checklist	- - -	Apply DC input to inverter No. 3	INVERTER SELECT rotary to No. 3	Inverter No. 3 on-line	
7.2.10				Normal operating temperature level	INVERTER No. 3 TEMP. warning light extinguished	Check inverter No. 3 temperature warning indicator	- - -	- - -	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
7.2.11				Proper phase relationship maintained	INVERTER No. 3 PHASE FAILURE warning lights (A,B and C) extinguished	Check inverter No. 3 phase failure warning indicators	- - -	- - -	
7.2.12				Normal operating levels	AC VOLTMETER FREQUENCY meter	Check inverter No. 3 phase voltage and frequency	PHASE MONITOR SELECT rotary to A, B and C	- - -	
7.2.13				Inverter checkout completed	- - -	Apply DC input to inverter that was active prior to inverter checkout	INVERTER SELECT rotary No. 1	Inverter No. 1 on-line and ready to accept all AC loads	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
8.0.0 Distribute Power to Environmental Control System and Checkout	04:48:30	00:02:00	SE/C						
8.1.0 Turn on power to ECS and monitor expendables	04:48:30	00:00:15							
8.1.1				Maximum 1100 psia Normal 850 psia Minimum 7 psia	SOX PRESSURE indicator	Energize ECS power and monitor SOX pressure	ECS MASTER POWER toggle to ON	ECS energized	If low SOX pressure, turn on SOX heater until pressure builds up. If still no go, check O_2 inflow lights; if illuminated, select manual, and pulse until pressure builds up.
8.1.2				Normal operating level	SOX QUANTITY indicator	Monitor SOX quantity	---	---	
8.1.3				Normal: 5.0 psia	H_2O QUANTITY indicator	Monitor water quantity	---	---	
8.1.4				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.
8.2.0 Monitor status of ECS gas reconditioning subsystems	04:48:45	00:00:05							
8.2.1				Warning lights extinguished.	Warning lights and CO_2 PARTIAL PRESS. indicator	Check LiOH, H_2O separator, and glycol temp. warning indicators	---	---	If a light illuminates, that particular H_2O separator or LiOH system is malfunctioning. Select alternate system.
8.3.0 Check cabin gas flow status	04:48:50	00:00:10							
8.3.1				Checklist	DUMP VALVE	Check that dump valve is closed	---	---	
8.3.2				Checklist	DIVERTER VALVE	Check that diverter valve is closed	---	---	
8.3.3				Checklist	SUIT CIRCUIT RELIEF VALVE	Check that suit circuit relief valve is closed	---	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
8.3.4				Checklist	CABIN GAS RETURN VALVE	Check that cabin gas return valve is closed	---	---	In the event of a rapid decompression, the O_2 system will not be depleted if dump, diverter, suit circuit relief and cabin gas return valves are closed.
8.4.0 Monitor O_2 cabin inflow	04:49:00	00:00:05							
8.4.1				Pressure reading of 5.0 psia. Lights are not illuminated	CABIN PRESSURE indicator	Check that #1 and 2 O_2 inflow switches are in AUTO position	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates. If #2 inflow valve fails in automatic, place #1 O_2 inflow valve toggle to MANUAL. If #1 light illuminates, place #2 O_2 inflow valve toggle to MANUAL.
8.5.0 Select normal cabin environment	04:49:05	00:00:10							
8.5.1				Pressure reading at 3.5 psia and holding	CABIN PRESSURE indicator	Select 3.5 psia environment	PRESSURE SELECT toggle to 3.5 psia	The emergency 3.5 psia system is checked out	If the cabin goes below 3.5 psia, the system must be checked out accordingly by checklist to ascertain the malfunction.
8.5.2				Pressure reading at 5.0 psia and holding	CABIN PRESSURE indicator	Select 5.0 psia environment and select automatic mode	PRESSURE SELECT toggle to 5.0 psia and then to AUTO	The normal 5.0 psia system is checked out and selected	
8.6.0 Monitor O_2 flood status	04:49:15	00:00:05							
8.6.1				O_2 FLOOD advisory light illuminated when manual flood selected	O_2 FLOOD advisory light	Check that O_2 flood toggle is in automatic position. Check out manual flooding feature.	O_2 FLOOD toggle to MANUAL and then back to AUTO.	---	If O_2 FLOOD light is illuminated when O_2 FLOOD toggle is in AUTO, the flood valve has failed and there is constant cabin flooding. Shut off manual flood faucet.

Report No. LED 480-3
Date 7/12/63

PHASE NUMBER: 1 **TRANSLUNAR SYSTEMS CHECKOUT**

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
8.7.0 Monitor cabin temperature	04:49:20	00:00:10							
8.7.1				Cabin temperature is within 75°F ± 5°	CABIN TEMPERATURE indicator	Check that CABIN FAN is ON position	---	---	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly.
8.8.0 Monitor suit temperature	04:49:30	00:00:15							
8.8.1				SUIT FAN warning lights 1, 2 and 3 extinguished Temp. of 75°F ± 5°	SUIT FAN warning indicators and SUIT TEMP. indicator	Select SUIT FAN 1, 2 and 3	SUIT FAN toggle to 1, 2 and 3	---	If any one light illuminates, that particular suit fan is inoperative and one of the other two fans will be utilized.
8.8.2				Checklist	EMERGENCY BOILER toggle	Check that EMERGENCY BOILER toggle is in OFF position	---	---	Should all suit fans fail, the emergency boiler switch will be turned on
8.9.0 Monitor SOX heater status	04:49:45	00:00:05							
8.9.1				SOX HEATER warning light extinguished	SOX HEATER warning indicator	Check that SOX HEATER toggle is in AUTO position	---	Gaseous O_2 is downstream from the cryogenic heat exchanger and the heat exchanger is functioning properly.	If SOX HEATER illuminates, the liquid O_2 is not being transformed to gas, indicating automatic feature of cryogenic heat exchanger has failed. Place SOX HEATER toggle to MANUAL to actuate heat exchanger. When O_2 flows in its proper state, SOX HEATER light will extinguish. Place SOX HEATER toggle to OFF.
8.10.0 Monitor glycol management status	04:49:50	00:00:10							
8.10.1				GLYCOL PUMP warning lights extinguished	GLYCOL PUMP warning indicators	Select test mode. Select glycol pump #1, #2 and #3.	GLYCOL PUMP MODE toggle to TEST. GLYCOL PUMP toggle to #1, #2 and #3	---	If any glycol pump light illuminates, that particular pump is inoperative and one of the two remaining shall be utilized.

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
8.11.0 Actuate LEM ECS system	04:50:00	00:00:15							
8.11.1				LEM ECS checked out	---	Tie-in LEM cabin environment to LEM ECS	Open DIVERTER VALVE, CABIN GAS RETURN VALVE AND SUIT CIRCUIT RELIEF VALVE.	LEM cabin gas is being revitalized and replenished by LEM ECS.	
8.12.0 Transfer suit connection to LEM ECS and communication system	04:50:15	00:00:15							
8.12.1				Checklist	---	Connect suit umbilical into LEM ECS receptacle on seat and insert communications umbilical into communication system receptacle	Umbilical snap ring	SE is sustained by LEM ECS and prepared to communicate	If suit ventilation does not function upon connecting into LEM ECS, initiate trouble-shooting for this contingency.

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
9.0.0 Distribute Power to Communication System and Check-Out	04:50:30	00:10:00	SE/C						
9.1.0 Activate UHF subystem	04:50:30	00:00:30							
9.1.1				Checklist	---	Energize UHF subsystem	S-BAND POWER toggle to LOW	Communications link to GOSS actuated.	If transmission is faint, place S BAND POWER toggle to HI. If UHF subystem inoperative, select alternate S BAND POWER toggle.
9.2.0 Activate VHF subsystem	04:51:00	00:00:30							
9.2.1				Checklist	---	Energize VHF subsystem	VHF POWER toggle to ON	Communications link to CM actuated.	
9.3.0 Select S-Band modes, transmit/ receive capability and emergency keyer capability and checkout.	04:51:30	00:01:00							
9.3.1				Checklist	---	Select PCM/NARROW mode	S-BAND MODE SELECT rotary to PCM/NARROW	Voice communications, equipment status and bio-med. telemetry transmitted via UHF narrow band to GOSS/ CM	
9.3.2				Checklist	---	Select PCM/WIDE mode	S-BAND MODE SELECT rotary to PCM/WIDE	Voice communications, equipment status and bio-med. telemetry transmitted via UHF wide band to GOSS/CM	
9.3.3				Checklist - TRANSMISSION MODE toggle in TO TALK position	---	Select transmit and receive capability	VHF toggle to T/R, S-BAND toggle to T/R and INTERCOM toggle to T/R	---	Two-way voice communication established between LEM/CM and LEM/GOSS. Adjust VOLUME control as required.
9.3.4				Checklist	---	Check emergency keyer capability	EMERGENCY KEY toggle to ON	---	Transmit message via keyer and receive acknowledgement from CM/GOSS

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
9.4.0 Deploy UHF antenna and checkout	04:52:30	00:08:00							
9.4.1				Checklist	---	Deploy UHF antenna and check out	ANTENNA DISH toggle to DEPLOY	UHF antenna is deployed.	
9.4.2				Checklist	---	Select automatic mode for UHF and VHF antennas	UHF ANTENNA MODE toggle to AUTO. VHF ANTENNA MODE toggle to AUTO.	Automatic mode and communications antenna for both systems selected.	
9.4.3				Checklist	---	Communicate with CM and GOSS and receive acknowledgement	---	Automatic feature of UHF antenna checked out.	If one antenna fails, the automatic mode will be relayed to GOSS via CM depending on UHF or VHF antenna failure. If automatic slewing fails, manual slewing is possible.
9.4.4				Checklist	AGC METER (Maximum deflection of needle). ELEVATION and AZIMUTH digital counters.	Check antenna manual control	UHF ANTENNA MODE toggle to MANUAL. VHF ANTENNA MODE toggle to MANUAL. ELEVATION MANUAL SLEW toggle to UP then DOWN. AZIMUTH MANUAL SLEW toggle to LEFT then RIGHT	---	

PHASE NUMBER 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
10.0.0 Distribute Power to Navigation and Guidance System and Check-Out	05:00:30	00:30:00	SE/C						
10.1.0 Turn on power to N & G system	05:00:30	00:00:10							
10.1.1				Checklist	---	Turn up computer power to full operating level.	COMPUTER POWER toggle to OPERATE	Computer energized to full operating level.	
10.1.2				Checklist	---	Turn up IMU power to full operating level.	IMU POWER toggle to OPERATE	IMU energized	Allow 15 minute warm-up to achieve optimal operating level. The 4-position IMU TEMP MODE rotary prepositioned to AUTO/OVER-RIDE
10.1.3				Checklist	---	Turn on SCT power	SCT POWER toggle to ON	Power to SCT reticle and servo driver energized	
10.1.4				Checklist	---	Turn on tracking radar power	TRACKING RADAR POWER toggle to ON	Tracking radar energized.	
10.1.5				Checklist	---	Turn on radar altimeter power	RADAR ALTIMETER POWER toggle to ON	Rader altimeter energized.	
10.1.6				Checklist	---	Turn on CDU power	CDU POWER toggle to ON	CDU energized.	
10.2.0 Check-out N & G status lamps and alarm circuitry	05:00:40	00:00:10							
10.2.1				Checklist	All N & G lamps illuminate	Test N & G alarm circuitry and status lamps	ALARM TEST pushbutton	N & G alarm circuitry and status lamps functioning properly	
10.3.0 Check-out IMU	05:00:50	00:01:00							
10.3.1				Checklist	---	Check IMU gyro temperature	TEMPERATURE MODE toggle to TEMPERATURE	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
10.3.2				IMU temperature level within normal limits.	IMU TEMPERATURE indicator	Read IMU temperature	----	---	
10.3.3				IMU power operating levels within normal limits.	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	---	
10.4.0 Check-out computer	05:01:50	00:10:00							
10.4.1				Functional test program: Code # Noun Verb	DATA CHART	Insert functional test program into computer	Computer-keyboard pushbuttons	— — —	
10.4.2				Procedure	---	Enter program	COMPUTER ENTER pushbutton	Test program activated.	
10.4.3				Checklist	PROGRAM DIGITAL indicators	Verify entry	---	---	
10.4.4				Procedure	COMPUTER CALL-UP DIGITAL indicators	Readout results of test program	---	---	
10.4.5				Checklist	DATA CHART. COMPUTER CALL-UP DIGITAL indicators	Compare with known results and verify	---	---	
10.4.6				Computer operating normally.	COMPUTER STATUS lights extinguished RUPT LOCK, TCA TRAP, CROSS POINT FAIL, SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY.	Check computer status lights	---	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECK OUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
10.5.0 Checkout N & G system clock	05:11:50	00:01:00							
10.5.1				Clock readout functioning properly	SYSTEM CLOCK and EVENTS TIMER	Note time and confirm with CM	---	---	
10.6.0 Checkout SCT	05:12:50	00:10:00							
10.6.1				Knowledge of eyepiece condition	SCT eyepiece	Check position and condition of eyepiece	---	---	
10.6.2				Azimuth and elevation grid lines illuminated	---	Verify that reticle illuminated and adjust brightness, as required	BRIGHTNESS control	---	
10.6.3				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggle to ZERO	---	
10.6.4				Procedure	SCT Angular readout indicators.	Verify optics zeroed	---	---	
10.6.5				Checklist	---	Rotate SCT eye-piece mechanism to 60° field of view position.	FIELD of VIEW selector to 60°	---	
10.6.6				Checklist	---	Select FAST optics speed	OPTICS SPEED toggle to FAST	---	
10.6.7				Target position	DATA CHART, Direct visual in SCT reticle	Site target (Moon or Earth) and verify image.	TRUNNION SHAFT SLEW controls	SCT operating properly.	
10.6.8				Checklist	---	Rotate SCT eye-piece mechanism to 20° field of view position	FIELD OF VIEW selector to 20°	---	
10.6.9				Checklist	---	Select SLOW optics speed.	OPTICS SPEED toggle to SLOW	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
10.6.10				Target position	DATA CHART. Direct visual in SCT reticle	Site target and verify image	TRUNNION and SHAFT SLEW controls	SCT operating properly.	
10.6.11				Checklist	---	Enter target coordinates into computer	COMPUTER MARK pushbutton	Target coordinates entered into computer.	
10.6.12				SCT operating in conjunction with computer	DATA CHART. COMPUTER CALL-UP DIGITAL indicators.	Verify results of sighting with data chart	---	---	
10.7.0 Check-out radar system	05:22:50	00:07:40							
10.7.1				Checklist	---	Activate rendez-vous radar antenna	RADAR ANTENNA AZIMUTH and ELEVATION slew controls.	Radar antenna moves to commanded position	
10.7.2				Radar antenna functioning normally	ANTENNA AZ and EL ANGLE indicators	Verify changes in antenna position	---	---	
10.7.3				Checklist	---	Check-out rendez-vous radar electronics	---	---	
10.7.4				Checklist	---	Check-out radar altimeter electronics	---	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
11.0.0 Distribute Power to Stabilization and Control System and Check-Out	05:30:30	00:05:00	SE/C	--- To be determined ---					

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
12.0.0 Distribute Power to Main Propulsion System and Check-Out	05:35:30	00:00:45	SE/C						
12.1.0 Activate electrical loads for main propulsion system	05:35:30	00:00:05							
12.1.1				Checklist	---	Energize electrical load for main propulsion system	ASCENT PROPULSION POWER toggle and DESCENT PROPULSION POWER toggle to ON	Electrical power supplied to main propulsion system	
12.2.0 Select descent propulsion system and checkout	05:35:35	00:00:20							
12.2.1				Checklist	---	Select descent mode for monitoring	MONITOR SELECT toggle to DESCENT	---	
12.2.2				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID. PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS. HELIUM TEMP.	Check tank pressures, quantities and temperatures	---	---	
12.2.3				No meter bias and zero psi in descent engine chamber	T/W RATIO meter	Check thrust-to-weight ratio indicator	---	---	
12.2.4				Pressure less than normal operating level (prior to pressurization) downstream of pressure regulators	PRESSURE REGULATOR WARN lights (#1 and #2) illuminated	Check pressure regulator warning indicators	---	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
12.2.5				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
12.3.0 Select ascent propulsion system and checkout	05:35:55	00:00:20							
12.3.1				Checklist	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	---	
12.3.2				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM TEMP.	Check tank quantities, pressures, and temperatures	---	---	
12.3.3				No meter bias and zero psi in ascent engine chamber	T/W RATIO meter	Check thrust-to-weight ratio indicator	---	---	
12.3.4				Pressure less than normal operating level (Prior to pressurization) downstream of pressure regulators	PRESSURE REGULATOR WARNING lights (#1 and #2) illuminated	Check pressure regulator warning indicators	---	---	
12.3.5				Relief valves not venting helium overboard	RELIEF VALVE WARNING lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
13.0.0 Distribute Power to RCS and Check-Out	05:36:15	00:00:15	SE/C						
13.1.0 Activate electrical loads for RCS propulsion	05:36:15	00:00:05							
13.1.1				Checklist	---	Energize electrical load for RCS propulsion	RCS POWER toggle to ON	Electrical power supplied to RCS	
13.2.0 Checkout RCS propulsion									
13.2.1				Normal operating levels	TANK METERS: FUEL & OXID. QTY; FUEL & OXID. PRESS; HELIUM PRESS. & TEMP.	Check System A & B quantities, pressures and temperatures	---	---	
13.2.2				Pressure less than normal operating level (prior to pressurization) downstream of pressure regulators.	PRESSURE REGULATOR WARN lights (#1 and #2) illuminated	Check System A & B pressure regulator warning indicators	---	---	
13.2.3				Relief valves not venting helium overboard	RELIEF VALVE WARN light (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
14.0.0 Transfer to System Engineer's Position	05:36:30	00:01:30	SE/C-SE						
14.1.0 Release self from seat	05:36:30	00:00:20							
14.1.1				Procedure	---	Unlatch C seat restraint harness	Depress and twist latching lever on harness	---	SE is free to stand up
14.1.2				Procedure	---	Unhook suit umbilical from C seat receptacle. Reach across aisle and connect umbilical into SE seat receptacle	Umbilical snap ring	---	SE suit umbilical connection to LEM ECS is transferred from C to SE position
14.2.0 Prepare SE position	05:36:50	00:00:40							
14.2.1				Procedure	---	Stand up in aisle	---	---	
14.2.2				Procedure	---	Unlatch SE seat restraint harness	Depress and twist latching lever on harness	---	SE seat prepared to accept SE and PLSS
14.2.3				Procedure	---	Transfer PLSS to SE position from C position	---	---	Although PLSS is mounted in seat, astronaut remains plugged into PLSS while breathing cabin air
14.3.0 Fasten C seat restraint	05:37:30	00:00:10							
14.3.1				Procedure	---	Engage latching lever on C harness	Latching lever	---	
14.4.0 Take SE position	05:37:40	00:00:20							
14.4.1				Procedure	---	Sit down in SE seat	---	---	
14.4.2				Procedure	---	Engage latching lever on SE harness	Latching lever	---	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
15.0.0 Distribute Power to In-Flight Test System and Check-out	05:38:00	00:05:00	SE/SE						
15.1.0 Turn on power to IFTS	05:38:00	00:00:10							
15.1.1				Checklist	- - -	Turn on power	IFTS POWER toggle to ON	IFTS energized	
15.2.0 Calibrate IFTS	05:38:10	00:04:50							
15.2.1				Checklist	- - -	Select calibrate mode	IFTS MODE toggle to CALIBRATE	IFTS calibration capability established	
15.2.2				Comparison of IFTS voltage against a standard reference	VOLTMETER	Perform necessary adjustments	- - -	IFTS calibrated	
15.2.3				Self-test results for: Comparator Limit Storage Mode Select lamps	- - -	Check-out IFTS	IFTS MODE toggle to SELF-TEST	Self-test completed	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
16.0.0 Perform Complete Systems Check-Out With IFTS	05:43:00	00:02:00	SE/SE						
16.1.0 Perform systems check-out in automatic test mode	05:43:00	00:01:55							
16.1.1				Checklist	- - -	Select automatic test mode	IFTS MODE toggle to AUTOMATIC TEST	Automatic test mode selected	
16.1.2				If all systems GO, "00" appears	ALPHA-NUMERIC STATUS DISPLAY	Activate test program and monitor	TEST pushbutton	Test program accomplished	If a NO-GO occurs, the appropriate alpha-numeric appears. Then: 1. Identify trouble spot with code book. 2. Select FAULT ISOLATION MODE. 3. Press FAULT LOCATOR pushbutton. 4. Identify malfunction to lowest replaceable part (panel, module or card). 5. Check-out malfunctioning component using voltmeter and oscilloscope. 6. Remove and replace. 7. Recycle in FAULT ISOLATION MODE. 8. Recycle in AUTOMATIC TEST MODE.
16.2.0 Turn off power to IFTS	05:44:55	00:00:05							
16.2.1				Checklist	- - -	Turn off power	IFTS POWER toggle to OFF	IFTS de-energized.	

PHASE NUMBER: 1 **TRANSLUNAR SYSTEMS CHECKOUT**

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
17.0.0 Place All Subsystems In Their Specific Modes for Translunar Flight	05:45:00	00:02:00	SE/SE						
17.1.0 De-activate electrical loads for RCS propulsion	05:45:00	00:00:05							
17.1.1				Checklist	- - -	De-energize electrical load for RCS propulsion.	RCS POWER toggle to OFF	Electrical power removed from RCS propulsion	
17.2.0 Deactivate electrical loads for main propulsion system	05:45:05	00:00:05							
17.2.1				Checklist	- - -	De-energize electrical load for main propulsion system	ASCENT PROPULSION POWER toggle and DESCENT PROPULSION POWER toggle to OFF	Electrical power removed from main propulsion system	
17.3.0 Turn off power to N & G system	05:45:10	00:00:10							
17.3.1				Checklist	- - -	Place computer power in standby condition	COMPUTER POWER toggle to STANDBY	All portions of computer de-energized except memory unit.	
17.3.2				Checklist	- - -	Place IMU power in standby condition	IMU POWER toggle to STANDBY	All portions of IMU de-energized except gyro heaters.	
17.3.3				Checklist	- - -	Turn off SCT power	SCT POWER toggle to OFF	SCT de-energized.	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
17.3.4				Checklist	- - -	Turn off tracking radar power	TRACKING RADAR POWER toggle to OFF	Tracking radar de-energized.	
17.3.5				Checklist	- - -	Turn off radar altimeter power	RADAR ALTIMETER POWER toggle to OFF	Radar altimeter de-energized.	
17.3.6				Checklist	- - -	Turn off CDU power	CDU POWER toggle OFF	CDU de-energized.	
17.4.0 Turn off power to C & C system	05:45:20	00:00:10		TO BE	DETERMINED				
17.5.0 Turn off power to communications system	05:45:30	00:00:10							
17.5.1				Checklist	- - -	De-activate UHF subsystem	S-BAND POWER toggle to OFF	Communications link to GOSS de-activated.	If subsystem does not de-energize, pull circuit breaker.
17.5.2				Checklist	- - -	De-activate VHF subsystem	VHF POWER toggle to OFF	Communications link to CM de-activated.	If subsystem does not de-energize, pull circuit breaker.
17.6.0 Turn off power to ECS	05:45:40	00:00:50							
17.6.1				Checklist	- - -	De-energize ECS	ECS MASTER POWER toggle to OFF	SOX heater, glycol pumps, suit fans, & cabin fan shutdown	If subsystem does not de-energize, pull circuit breaker.
17.6.2				Checklist	- - -	Close O_2 Flood circuit	O_2 FLOOD toggle to OFF	O_2 flood circuit de-activated.	If subsystem does not de-energize, pull its circuit breaker.

PHASE NUMBER: TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
17.6.3				Checklist	- - -	Manually close LEM ECS connection to LEM cabin	Close DIVERTER VALVE, CABIN GAS RETURN VALVE, AND SUIT CIRCUIT RELIEF VALVE	LEM ECS is manually disconnected from LEM cabin	
17.7.0 Deactivate DC distribution	05:46:30	00:00:05							
17.7.1				All subsystem electrical loads de-energized	- - -	Remove non-essential loads from main bus	BUS TIE NON-ESSENTIAL toggle to OFF	Non-essential loads removed from main bus	Cabin dome and integral panel lights are de-energized. Continue activities with flashlight.
17.8.0 Place fuel cell #1 to standby status	05:46:35	00:00:10							
17.8.1				Checklist	- - -	De-activate fuel cell #1	BUS A INPUT (FC #1) toggle to OFF O_2 PURGE (FC #1) toggle to OFF H_2 VENT (FC #1) toggle to CLOSE	Fuel Cell #1 isolated from loads. Contaminants and diluents not being removed from fuel cell #1. Fuel Cell #1 temperature maintained electrically	
17.9.0 Check fuel cell electrical output	05:46:45	00:00:15							
17.9.1				Normal operating level	DC VOLTMETER	Check fuel cell #1 voltage	MONITOR SELECT rotary (volts) to FC #1	- - -	
17.9.2				Normal operating levels	AMMETER	Check fuel cell #2 and #3 current	MONITOR SELECT rotary (amps) to FC #2 and FC #3	- - -	
17.9.3				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	- - -	

PHASE NUMBER: TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
18.0.0 Prepare to Transfer to CM	05:47:00	00:05:00	SE/A						
18.1.0 Disengage self from LM seat	05:47:00	00:01:00							
18.1.1				Checklist	---	Disconnect umbilicals from LEM ECS and communication system and insert communications umbilical into beltpack	Umbilical snap ring	PLSS is connected to suit and is ready to supply life support in event of rapid decompression. Communications established by means of beltpack.	
18.1.2				Procedure	---	Unlatch seat restraint harness	Depress and twist lever on harness	---	SE is free to stand-up.
18.1.3				Procedure	---	Stand in aisle and don PLSS	---	---	
18.2.0 Secure SE seat	05:48:00	00:01:00							
18.2.1				Checklist	---	Secure SE seat restraint harness	Latching lever	---	
18.3.0 Open LEM hatch	05:49:00	00:03:00							
18.3.1				LEM and interlock pressure in equilibrium	LEM CABIN PRESSURE indicator. Δ P indicator	Open LEM hatch and secure in open position	Hatch locking wheel	LEM hatch is open and secure in open position	

PHASE NUMBER: 1 TRANSLUNAR SYSTEMS CHECKOUT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
19.0.0 Transfer from LEM to CM	05:52:00	00:01:00	SE/IL						
19.1.0 Proceed into interlock	05:52:00	00:00:30							
19.1.1				Procedure	---	Enter interlock head first with face plate open, wearing PLSS	---	---	If unable to get through with PLSS, doff PLSS and pull through.
19.1.2				All detents are engaged into periphery of docking seals.	---	Inspect docking clamps	---	---	If docking clamps are not engaged by pneumatic actuation, manually engage the disengaged ones by employing their individual over-center locking levers.
19.2.0 Proceed into CM	05:52:30	00:00:30							
19.2.1				CM pressure equals interlock pressure - 5.0 psia	ΔP indicator on CM hatch	Open CM hatch and secure in open position	Hatch locking wheel	Hatch is opened	
19.2.2				Procedure	---	Enter CM	---	---	If unable to negotiate hatch head first, return to LEM, turn around and attempt entry into CM feet first.
19.2.3				Checklist	---	Close CM hatch and lock	Hatch locking wheel	CM hatch is closed, locked and sealed.	

Phase 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS — From 64:33:40 To 66:03:00 — Elapsed Time 1 hr. 29 min. 20 sec.

Commander	Mission Time	System Engineer
20.0.0 Monitor LEM Systems Status from CM and Coordinate With GOSS (CM Crew)	64:33:40	21.0.0 Pressurize LEM Cabin and Interlock From Inside CM
	64:35:40	22.0.0 Prepare to Transfer to LEM
	64:40:40	23.0.0 Transfer From CM to LEM
	64:40:40	23.1.0 Proceed into LEM
	64:41:25	23.2.0 Inspect interior of cabin
	64:41:55	23.3.0 Close LEM hatch
	64:42:10	24.0.0 Prepare Commander's Position and Secure Self in Seat
	64:42:10	24.1.0 Install PLSS and take seat
	64:44:10	25.0.0 Checkout Electrical Power Generation System
	64:44:10	25.1.0 Monitor electrical power generation system status
	64:44:30	25.2.0 Check pre-positioning of switches
	64:44:55	25.3.0 Purge fuel cell #1 and bring to operational status
	64:45:05	25.4.0 Check main bus voltage
	64:45:10	26.0.0 Place Electrical Power Distribution On-Line and Checkout
	64:45:10	26.1.0 Activate DC distribution and checkout
	64:45:35	26.2.0 Activate AC distribution and checkout
	64:46:10	27.0.0 Distribute Power to Environmental Control System and Checkout
	64:46:10	27.1.0 Turn on power to ECS and monitor expendables
	64:46:25	27.2.0 Monitor status of ECS gas reconditioning subsystems
	64:46:30	27.3.0 Check cabin gas flow status
	64:46:40	27.4.0 Monitor O_2 cabin inflow
	64:46:45	27.5.0 Select normal cabin environment
	64:46:55	27.6.0 Monitor O_2 flood status
	64:47:00	27.7.0 Monitor cabin temperature
	64:47:10	27.8.0 Monitor suit temperature
	64:47:25	27.9.0 Monitor SOX heater status

Phase 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS — From 64:33:40 To 66:03:00 — Elapsed Time 1 hr. 29 min. 20 sec.

Commander	Mission Time	System Engineer
	64:47:30	27.10.0 Monitor glycol management status
	64:47:40	27.11.0 Actuate LEM ECS system
	64:47:55	27:12:0 Transfer suit connection to LEM ECS and communication system
	64:48:10	28.0.0 Distribute Power to Communication System and Checkout
	64:48:10	28.1.0 Activate UHF subsystem
	64:48:40	28.2.0 Activate VHF subsystem
	64:49:10	28.3.0 Select S-band modes
	64:50:10	28.4.0 Deploy UHF antenna and checkout
	64:58:10	29.0.0 Distribute Power to Navigation and Guidance System and Checkout
	64:58:10	29.1.0 Turn on power to N & G system
	64:58:20	29.2.0 Check-out N & G status lamps and alarm circuitry
	64:58:30	29.3.0 Check-out IMU
	64:59:30	29.4.0 Check-out computer
	65:09:30	29.5.0 Check-out N & G system clock
	65:10:30	29.6.0 Check-out SCT
	65:20:30	29.7.0 Check-out radar system
	65:28:05	29.8.0 Advise Commander to prepare for transfer
30.0.0 Prepare to Transfer to LEM	65:28:10	31.0.0 Distribute Power to Stabilization and Control System and Checkout
	65:33:10	32.0.0 Distribute Power to Main Propulsion System and Checkout
	65:33:10	32.1.0 Activate electrical loads for main propulsion system
	65:33:15	32.2.0 Select descent propulsion system and checkout
	65:33:35	32.3.0 Select ascent propulsion system and checkout
	65:33:55	33.0.0 Distribute Power to RCS and Checkout
	65:33:55	33.1.0 Activate electrical loads for RCS propulsion
	65:34:00	33.2.0 Checkout RCS propulsion

Phase 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS — From 64:33:40 To 66:03:00 — Elapsed Time 1 hr. 29 min. 20 sec.

Commander	Mission Time	System Engineer
No Assigned Activity	65:34:10	34.0.0 Transfer to System Engineer's Position
	65:34:10	34.1.0 Release self from seat
	65:34:30	34.2.0 Open LEM hatch
	65:34:50	34.3.0 Advise Commander to open CM hatch
35.0.0 Transfer From CM to LEM and Secure Self in Commander's Seat	65:34:55	34.4.0 Prepare SE position
35.1.0 Open CM hatch	65:34:55	
	65:35:35	34.5.0 Take SE seat
35.2.0 Enter interlock with PLSS	65:35:40	
	65:35:55	36.0.0 Distribute Power to In-Flight Test System and Checkout
	65:35:55	36.1.0 Turn on power to IFTS
	65:36:05	36.2.0 Calibrate IFTS
35.3.0 Enter LEM	65:37:10	
35.4.0 Close LEM hatch	65:37:25	
35.5.0 Take Commander's seat	65:37:40	
37.0.0 Determine Initial Conditions from CM	65:37:55	
37.1.0 Synchronize timing mechanisms	65:37:55	
37.2.0 Obtain initial conditions from CM		
37.3.0 Insert initial conditions into computer		
38.0.0 Align IMU In Coasting Flight	65:38:55	
38.1.0 Coarse align IMU with computer controls	65:38:55	
	65:40:55	39.0.0 Perform Complete Systems Checkout With IFTS
	65:40:55	39.1.0 Perform systems checkout in automatic test mode
	65:42:55	42.0.0 Monitor LEM Systems Status
		42.1.0 Monitor subsystem master warning lights
		42.2.0 Monitor electrical system status

Phase 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS — From 64:33:40 To 66:03:00 — Elapsed Time 1 hr. 29 min. 20 sec.

Commander	Mission Time	Systems Engineer
		42.3.0 Monitor environmental control system status
		42.4.0 Monitor descent propulsion system status
		42.5.0 Monitor ascent propulsion system status
		42.6.0 Monitor RCS status
		42.7.0 Monitor navigation and guidance system status
		42.8.0 Monitor stabilization and control system status
38.2.0 Fine allign IMU to inertial coordinates		
40.0.0 Program Computer for Descent Trajectory	65:58:55	
40.1.0 Enter descent thrusting program	65:58:55	
40.2.0 Determine the parameters required for separation and injection into coasting descent transfer orbit based on updated orbital data	65:59:15	
No Assigned Activity	65:59:55	41.0.0 Prepare For Separation From CM
	65:59:55	41.1.0 Pressurize ascent stage and checkout
	66:00:15	41.2.0 Pressurize descent stage and checkout
	66:00:35	41.3.0 Pressurize RCS and checkout
	66:00:55	41.4.0 Checkout firing of RCS
41.5.0 Select descent modes	66:01:55	42.0.0 Monitor LEM Systems Status
41.6.0 Secure self and cabin interior	66:02:10	41.6.0 Secure self and cabin interior
41.7.0 Monitor countdown to separation	66:02:40	42.0.0 Monitor LEM Systems Status
End of phase 2	66:03:00	End of phase 2

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
20.[illegible] Monitor LEM Systems Status from CM and Coordinate with GOSS	64:33:40	Continuous		---	To be determined	---	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

	Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
21.0.0	Pressurize LEM Cabin and Interlock from inside CM	64:33:40	00:02:00	SE/CM	---	To be determined	---	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
22.0.0 Prepare to Transfer to LEM	64:35:40	00:05:00	SE/CM	---	To be determined	---	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description		Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
23.0.0 Transfer From CM to LEM		64:40:40	00:01:30	SE/IL						
23.1.0 Proceed into LEM		64:40:40	00:00:45							
	23.1.1				LEM cabin gas status is normal	ECS indicators on LEM instrument panel	Open LEM hatch	Hatch locking wheel	Hatch is opened	If LEM cabin gas status indicates malfunction, return to CM, purge LEM and interlock. Return to LEM under PLSS operation and troubleshoot.
	23.1.2				Procedure	---	Proceed into LEM head first with face plate open wearing PLSS	---	---	If unable to get through with PLSS, doff PLSS and pull through.
	23.1.3				All detents are engaged into periphery of docking seals	---	Insect docking clamps	---	---	If docking clamps are not engaged by pneumatic actuation, manually engage the disengaged ones by employing their individual over-center locking levers.
23.2.0 Inspect interior of cabin		64:41:25	00:00:30							
	23.2.1				Checklist	---	Visually inspect interior of LEM using flashlight	---	---	If flashlight fails, use backup flashlight. If cockpit is in general disarray, straighten out and checkout according to check list.
23.3.0 Close LEM hatch		64:41:55	00:00:15							
	23.3.1				Checklist	---	Close LEM hatch and lock	Hatch locking wheel	LEM hatch is closed, locked and sealed	If LEM hatch jams and will not lock engage into lock position as close as possible, then vent the interlock thereby creating an imbalance of pressure and ramming the hatch cover up in place.

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
24.0.0 [illegible] Commander's Position and Secure Self in Seat	64:42:10	00:02:00	SE/C						
24.1.0 Install PLSS and take seat	64:42:10	00:02:00							
24.1.1				Procedure	---	Install PLSS in seat	---	---	PLSS ready for use and mounted in seat, astronaut is plugged into PLSS although breathing cabin air.
24.1.2				Procedure	---	Take Commander's position and secure restraint harness	Harness latching lever	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
25.0.0 Checkout Electrical Power Generation System	64:44:10	00:01:00	SE/C						
25.1.0 Monitor electrical power generation system status	64:44:10	00:00:20							
25.1.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 AND 2) O_2 PRESS. (1 AND 2) H_2QTY. (1 AND 2) O_2QTY. (1 AND 2)	Check reactant tank pressures and quantities	---	---	
25.1.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 AND O_2) FUEL CELL. TEMP.	Check fuel cell pressures and temperatures.	FUEL CELL MONITOR SELECT rotary to 1,2 and 3.	---	
25.1.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1, 2, 3) extinguished	Check N_2 fail warning indicators	---	---	
25.2.0 Check pre-positioning of switches	64:44:30	00:00:25							
25.2.1				AUTO AUTO ON ON AUTO ON	H_2 HEATERS (1 AND 2) O_2 HEATERS (1 AND 2) H_2 FLOW (1&2) O_2 FLOW (1&2) FUEL CELL HEATERS (1, 2, 3) FUEL CELL FLOW (1, 2, 3)	Check position of switches	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
				OPEN CLOSE AUTO OFF ON OFF OFF	H_2 VENT (2, 3) H_2 VENT (1) O_2 PURGE (2, 3) O_2 PURGE (1) BUS A INPUT (FC 2 and 3) BUS A INPUT (FC 1) BUS B INPUT (FC 1,2,3)				
25.3.0 Purge full cell #1 and bring to operational status	64:44:55	00:00:10							
25.3.1				Checklist	---	Purge O_2 in fuel cell #1	O_2 PURGE (FC #1) toggle to AUTO	Contaminants and diluents removed from fuel cell #1	
25.3.2				Checklist	---	Activate fuel cell #1	H_2 VENT (FC #1) toggle to OPEN Bus A INPUT (FC #1) toggle to ON	Fuel cell #1 temperature maintained by reactants. Fuel cell #1 ready to accept electrical load.	
25.4.0 Check main bus voltage	64:45:05	00:00:05							
25.4.1				Normal operating level	DC VOLTMETER	Check voltage output of Bus A	MONITOR SELECT rotary (volts) to BUS A	---	

Function and Task Description	Mission Time	Activity Time	Crew Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
26.0.0 Place Electrical Power Distribution On-Line and Checkout	64:45:10	00:01:00	CE/C						
26.1. [illegible] Distribution and Checkout	64:45:10	00:00:25							
[illegible]				ON position	BUS TIE A toggle	Check prior application of essential loads to main bus	---	---	
26.1.2				Checklist	---	Apply non-essential loads to main bus	BUS TIE NON-ESSENTIAL toggle to ON	Non-essential loads placed on main bus	Cabin dome and integral panel lights are actuated. If integral panel lighting fails place FLOOD LIGHTING toggle to ON.
26.1.3				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3, and main but current	MONITOR SELECT rotary (amps) to FC 1,2,3 and BUS A	---	
26.1.4				Normal operating level	DC VOLT-METER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	
26.2.0 Activate AC distribution and checkout	64:45:35	00:00:35							
26.2.1				No. 1 position	INVERTER SELECT rotary	Check prior application of DC input to inverter No. 1	---	---	
26.2.2				Normal operating temperature level	INVERTER No. 1 TEMP warning light extinguished	Check inverter No. 1 Temperature warning indicator	---	---	
26.2.3				Proper phase relationship maintained	INVERTER No. 1 PHASE FAILURE warning lights (A, B, and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	

PHASE NUMBER: CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
26.2.4				Normal operating levels	AC VOLTMETER, FREQUENCY Meter	Check inverter No. 1 phase voltage and frequency	PHASE MONITOR SELECT rotary to A, B and C	---	
26.2.5				Checklist	---	Apply DC input to Inverter No. 2	INVERTER SELECT rotary to No. 2	Inverter No. 2 On-Line	
26.2.6				Normal operating temperature level	INVERTER No. 2 TEMP. warning light extinguished	Check inverter No. 2 temperature warning indicator	---	---	
26.2.7				Proper phase relationship maintained	INVERTER No. 2 PHASE FAILURE warning lights (A, B, and C) extinguished	Check inverter No. 2 phase failure warning indicators	---	---	
26.2.8				Normal operating levels	AC VOLTMETER, FREQUENCY meter	Check inverter No. 2 phase voltage and frequency	PHASE MONITOR SELECT rotary to A, B and C	---	
26.2.9				Checklist	---	Apply DC input to inverter No. 3	INVERTER SELECT rotary to No. 3	Inverter No. 3 On-Line	
26.2.10				Normal operating temperature level	INVERTER No. 3 TEMP. warning light extinguished	Check inverter No. 3 temperature warning indicator	---	---	
26.2.11				Proper phase relationship maintained	INVERTER No. 3 PHASE FAILURE warning lights (A, B, and C) extinguished	Check inverter No. 3 phase failure warning indicators	---	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
06.2.12				Normal operating levels	AC VOLT-METER, FRE-QUENCY Meter	Check inverter No. 3 phase voltage and frequency	PHASE MONITOR SELECT rotary to A, B and C	---	
06.2.13				Inverter checkout completed	---	Apply DC input to inverter that was active prior to inverter checkout	INVERTER SELECT rotary to No. 1	Inverter No. 1 On-Line and ready to accept all AC loads	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
27.0.0 Distribute Power to Environmental Control System and Checkout	64:46:10	00:02:00	SE/C						
27.1.0 Turn on power to ECS and monitor expendables	64:46:10	00:00:15							
27.1.1				Maximum 1100 psia Normal 850 psia Minimum 7 psia	SOX PRESSURE indicator	Energize ECS power and monitor SOX pressure	ECS MASTER POWER toggle to ON	ECS energized	If low SOX pressure, turn on SOX heater until pressure builds up. If still no go check O_2 inflow lights. If illuminated select manual, and pulse until pressure builds up.
27.1.2				Normal operating level	SOX QUANTITY indicator	Monitor SOX quantity	---	---	
27.1.3				Normal: 5.0psia	H_2O QUANTITY indicator	Monitor water quantity	---	---	
27.1.4				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.
27.2.0 Monitor status of ECS gas reconditioning subsystems	64:46:25	00:00:05							
27.2.1				Warning lights extinguished	Warning lights and CO_2 PARTIAL PRESS. INDICATOR	Check LiOH, H_2O separator, and glycol temp. warning indicators	---	---	If a light illuminates, that particular H_2O separator or LiOH system is malfunctioning. Select alternate system.
27.3.0 Check cabin gas flow status	64:46:30	00:00:10							
27.3.1				Checklist	DUMP VALVE	Check that dump valve is closed	---	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
27.3.2				Checklist	DIVERTER VALVE	Check that diverter valve is closed	---	---	
27.3.3				Checklist	SUIT CIRCUIT RELIEF VALVE	Check that suit circuit relief valve is closed	---	---	
27.3.4				Checklist	CABIN GAS RETURN VALVE	Check that cabin gas return valve is closed	---	---	In the event of a rapid decompression, the O_2 system will not be depleted if dump, diverter, suit circuit relief and cabin gas return valves are closed
27.4.0 Monitor O_2 cabin inflow	64:46:40	00:00:05							
27.4.1				Pressure reading of 5.0 psia Lights are not illuminated	CABIN PRESSURE indicator	Check that #1 and 2 O_2 inflow switches are in AUTO position	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates. If #2 inflow valve fails in automatic, place #1 O_2 inflow valve to MANUAL. If #1 light illuminates, place #2 O_2 inflow to MANUAL.
27.5.0 Select normal cabin environment	64:46:45	00:00:10							
27.5.1				Pressure reading at 3.5 psia and holding	CABIN PRESSURE indicator	Select 3.5 psia environment	PRESSURE SELECT toggle to 3.5 psia	The emergency 3.5 psia system is checked out	If the cabin goes below 3.5 psia, the system must be checked out accordingly by check list to ascertain the malfunction

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
27.5.2				Pressure reading at 5.0 psia and holding	CABIN PRESSURE indicator	Select 5.0 psia environment and select automatic mode	PRESSURE SELECT toggle to 5.0 psia and then to AUTO	The normal 5.0 psia system is checked out and selected.	
27.6.0 Monitor O_2 flood status	64:46:55	00:00:05							
27.6.1				O_2 FLOOD advisory light illuminated when manual flood selected	O_2 FLOOD advisory light	Check that O_2 flood toggle is in automatic position; check-out manual flooding feature	O_2 FLOOD toggle to MANUAL and then back to AUTO		If O_2 FLOOD light is illuminated when O_2 FLOOD toggle is in AUTO, the flood valve has failed and there is constant cabin flooding. Shut off the manual flood faucet.
27.7.0 Monitor cabin temperature	64:47:00	00:00:10							
27.7.1				Cabin temperature is within 75°F ±5°	CABIN TEMPERATURE indicator	Check than CABIN FAN is in ON position	---		If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly.
27.8.0 Monitor suit temperature	64:47:10	00:00:15							
27.8.1				SUIT FAN warning lights 1, 2, and 3 extinguished Temp of 75°F ±5°F	SUIT FAN warning indicators and SUIT TEMP. indicator	Select SUIT FAN 1, 2 and 3	SUIT FAN toggle to 1, 2 and 3	---	If anyone light illuminates, that particular suit fan is in operative and one of the other two fans will be utilized.

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Function and Task Description	Mission Time	Activity Time	Crew Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
27.8.2				Checklist	EMERGENCY BOILER toggle	Check that EMERGENCY toggle is in OFF position	---	---	Should all suit fans fail, the emergency boiler switch will be turned on.
27.9.0 Monitor SOX heater status 27.9.1	64:47:25	00:00:05		SOX HEATER warning light extinguished.	SOX HEATER warning indicator	Check that SOX HEATER toggle is in AUTO position	---	Gaseous O_2 is downstream from the cryogenic heat exchanger and the heat exchanger is functioning properly	If SOX HEATER warning light illuminates, the liquid O_2 is not being transformed to gas, indicating automatic feature of cryogenic heat exchanger has failed. Place SOX HEATER toggle to MANUAL to actuate exchanger. When O_2 flows in its proper state, SOX HEATER light will extinguish. Place SOX heater toggle to OFF.
27.10.0 Monitor glycol management status 27.10.1	64:47:30	00:00:10		GLYCOL PUMP warning lights extinguished	GLYCOL PUMP warning indicators	Select test mode. Select glycol pump #1, #2 and #3	GLYCOL PUMP MODE toggle to test GLYCOL PUMP toggle to #1, #2 and #3	---	If any flycol pump light illuminates, that particular pump is inoperative and one of the two remaining shall be utilized.
27.11.0 Actuate LEM ECS system 27.11.1	64:47:40	00:00:15		LEM ECS checked out	---	Tie-in LEM cabin environment to LEM ECS	Open DIVERTER VALVE, CABIN GAS RETURN VALVE, AND SUIT CIRCUIT RELIEF VALVE	LEM cabin gas is being revitalized and replenished by LEM ECS.	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
27.12.0 Transfer suit connection to LEM ECS and communication system 27.12.1	64:47:55	00:00:15		Checklist	---	Connect suit umbilical into LEM ECS receptacle on seat and insert communications umbilical into communication system receptacle	Umbilical snap ring	SE is sustained by LEM ECS and prepared to to communicate.	If suit ventilation does not function on connecting into LEM ECS, initiate trouble-shooting for this contingency.

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
28.0.0 Distribute Power to Communication System and Checkout	64:48:10	00:10:00	SE/C						
28.1.0 Activate UHF subsystem	64:48:10	00:00:30							
28.1.1				Checklist	---	Energize UHF subsystem	S-BAND POWER toggle to LOW	Communications link to GOSS actuated.	If transmission is faint, place S-BAND POWER toggle to HI. If UHF subsystem inoperative, select alternate S-BAND POWER toggle.
28.2.0 Activate VHF subsystem	64:48:40	00:00:30							
28.2.1				Checklist	---	Energize VHF subsystem	VHF POWER toggle to ON	Communications link to CM actuated.	
28.3.0 Select S-band modes transmit/receive capability and emergency keyer capability and checkout	64:49:10	00:01:00							
28.3.1				Checklist	---	Select PCM/NARROW mode	S-BAND MODE SELECT rotary PCM/NARROW	Voice communications, equipment status and bio-med. telemetry transmitted via UHF narrow band to GOSS/CM	
28.3.2				Checklist	---	Select PCM/WIDE mode	S-BAND MODE SELECT rotary to PCM/WIDE	Voice communications, equipment status and bio-med. telemetry transmitted via UHF wide band to GOSS/CM	
28.3.3				Checklist TRANSMISSION MODE toggle in TO TALK position	---	Select transmit and receive capability	VHF toggle to T/R, S-BAND toggle to T/R and INTERCOM toggle to T/R	---	Two-way voice communication established between LEM/CM and LEM/GOSS. Adjust VOLUME control as required.
28.3.4				Checklist	---	Check emergency keyer capability	EMERGENCY KEY toggle to ON	---	Transmit message via keyer and receive acknowledgement from CM/GOSS

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
28.4.0 Deploy UHF antenna and checkout	64:50:10	00:08:00							
28.4.1				Checklist	---	Deploy UHF antennas and check out.	ANTENNA DISH toggle to DEPLOY	UHF antenna is deployed	
28.4.2				Checklist	---	Select automatic mode for UHF and VHF antennas.	UHF ANTENNA MODE toggle to to AUTO. VHF ANTENNA MODE toggle to AUTO.	Automatic mode and communications antenna for both systems selected.	
28.4.3				Checklist	---	Communicate with CM and GOSS and and receive acknowledgement.	---	Automatic feature of UHF antenna checked out.	If one antenna fails, the automatic mode will be relayed to GOSS via CM depending on UHF or VHF antenna failure. If automatic slewing fails, manual slewing is possible.
28.4.4				Checklist	AGC meter (maximum deflectinn of needle). ELEVATION and AZIMUTH digital counters	Check antenna manual control	UHF ANTENNA MODE toggle to MANUAL. VHF ANTENNA MODE toggle to MANUAL. ELEVATION MANUAL SLEW toggle to UP then DOWN. AZIMUTH MANUAL SLEW toggle to LEFT then RIGHT.	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
29.0.0 Distribute Power to Navigation and Guidance System and Check-Out	64:58:10	00:30:00	SE/C						
29.1.0 Turn on power to N & G system	64:58:10	00:00:10							
29.1.1				Checklist	---	Turn up computer power to full operating level	COMPUTER POWER toggle to OPERATE	Computer energized to full operating level.	
29.1.2				Checklist	--	Turn up IMU power to full operating level	IMU POWER toggle to OPERATE	IMU energized.	Allow 15 minute warm-up to achieve optimal operating level
29.1.3				Checklist	---	Turn on SCT power	SCT POWER toggle to ON	Power to SCT reticle and servo driver energized.	
29.1.4				Checklist	---	Turn on tracking radar power	TRACKING RADAR POWER toggle to ON	Tracking radar energized.	
29.1.5				Checklist	---	Turn on radar altimeter power	RADAR ALTIMETER POWER toggle to ON	Radar altimeter energized.	
29.1.6				Checklist	---	Turn on CDU power	CDU POWER toggle to ON	CDU energized.	
29.2.0 Check-out N & G status lamps and alarm circuitry	64:58:20	00:00:10							
29.2.1				Checklist	All N & G lamps illuminate	Test N & G alarm circuitry and status lamps	ALARM TEST pushbutton	N & G alarm circuitry and status lamps functioning properly	
29.3.0 Check-out IMU	64:58:30	00:01:00							
29.3.1				Checklist	---	Check IMU gyro temperature	TEMPERATURE MODE toggle to TEMPERATURE	---	
29.3.2				IMU temperature level within normal limits	IMU TEMPERATURE indicator	Read IMU temperature	---	---	

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Function and Task Description		Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
	29.3.3				IMU power operating levels within normal limits	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	---	
29.4.0 Check-out computer		64:59:30	00:10:00							
	29.4.1				Functional test program: Code # Noun Verb	DATA CHART	Insert functional test program into computer	Computer key-board push-buttons	---	
	29.4.2				Procedure	---	Enter program	COMPUTER ENTER pushbutton	Test program activated.	
	29.4.3				Checklist	PROGRAM DIGITAL indicators	Verify entry	---	---	
	29.4.4				Procedure	COMPUTER CALL-UP DIGITAL indicators	Readout results of test program	---	---	
	29.4.5				Checklist	DATA CHART. COMPUTER CALL-UP DIGITAL indicators	Compare with known results and verify	---	---	
	29.4.6				Computer operating normally	COMPUTER STATUS lights extinguished RUPT LOCK, TCA TRAP, CROSS POINT FAIL, SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY.	Check computer status lights	---	---	

Report No. LED 480-3
Date 7/12/63

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
29.5.0 Check-out N & G system clock	65:09:30	00:01:00							
29.5.1				Clock readout functioning properly	SYSTEM CLOCK and EVENTS TIMER	Note time and confirm with CM	---	---	
29.6.0 Check-out SCT	65:10:30	00:10:00							
29.6.1				Knowledge of eyepiece condition	SCT eye-piece	Check position and condition of eyepiece.	---	---	
29.6.2				Azimuth and elevation grid lines illumin-ated.	---	Verify that reticle is illuminated and adjust brightness, as required.	BRIGHTNESS control	---	
29.6.3				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggle to ZERO	---	
29.6.4				Procedure	SCT angular readout indicators	Verify optics zeroed.	---	---	
29.6.5				Checklist	---	Rotate SCT eye-piece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
29.6.6				Checklist	---	Select FAST optics speed	OPTICS SPEED toggle to FAST	---	
29.6.7				Target position	DATA CHART. Direct visual in SCT reticle	Site target (moon or earth) and verify image.	TRUNNION and SHAFT SLEW controls	SCT operating properly.	
29.6.8				Checklist	---	Rotate SCT eye-piece mechanism to 20° field of view position	FIELD OF VIEW selector to 20°	---	
29.6.9				Checklist	---	Select SLOW optics speed	OPTICS SPEED toggle to SLOW	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
29.6.10				Target position	DATA CHART. Direct visual in SCT reticle	Site target and verify image	TRUNNION and SHAFT SLEW controls	SCT operating properly	
29.6.11				Checklist	---	Enter target coordinates into computer	COMPUTER MARK pushbutton	Target coordinates entered into computer.	
29.6.12				SCT operating in conjunction with computer	DATA CHART. COMPUTER CALL-UP DIGITAL indicators	Verify results of sighting with data chart	---	---	
29.7.0 Check-out radar system	65:20:30	00:07:35							
29.7.1				Checklist	---	Activate rendezvous radar antenna	RADAR ANETNNA AZIMUTH and ELEVATION slew controls	Radar antenna moves to commanded position.	
29.7.2				Radar antenna functioning normally	ANTENNA AZIMUTH and ELEVATION ANGLE indicators	Verify changes in antenna position	---	---	
29.7.3				Checklist	---	Check-out rendezvous radar electronics	---	---	
29.7.4				Checklist	---	Check-out radar altimeter electronics	---	---	
29.8.0 Advise Commander to prepare for transfer	65:28:05	00:00:05							
29.8.1				Procedure	---	Instruct Commander to prepare for transfer	---	---	If "hot mike" feature fails on VHF, select UHF.

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
30.0.0 Prepare to Transfer to LEM	65:28:10	00:06:00	C/CM	----------	----------	-To be determined-	----------	----------	----------

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
31.0.0 Distribute Power to Stabilization and Control System and Check-out	65:28:10	00:05:00	SE/C	----------	----------	-To be determined-	----------	----------	----------

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
32.0.0 Distribute Power to Main Propulsion System and Check-out	65:33:10	00:00:45	SE/C						
32.1.0 Activate electrical loads for main propulsion system	65:33:10	00:00:05							
32.1.1				Checklist	---	Energize electrical load for main propulsion system	ASCENT PROPULSION POWER toggle and DESCENT PROPULSION POWER toggle to ON	Electrical power supplied to main propulsion system.	
32.2.0 Select descent propulsion system and checkout	65:33:15	00:00:20							
32.2.1				Checklist	---	Select descent mode for monitoring	MONITOR SELECT toggle to DESCENT	---	
32.2.2				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS HELIUM TEMP.	Check tank pressures, quantities and temperatures	---	---	
32.2.3				No meter bias and zero psi in descent engine chamber	T/W RATIO meter	Check thrust-to-weight ratio indicator	---	---	
32.2.4				Pressure less than normal operating level (prior to pressurization) downstream of pressure regulators	PRESSURE REGULATOR WARN lights (#1 and #2) illuminated	Check pressure regulator warning indicators	---	---	
32.2.5				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND MONITORING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
32.3.0 Select Ascent propulsion system and checkout	65:33:35	00:00:20							
32.3.1				Checklist	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	---	
32.3.2				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS	Check tank quantities, pressures and temperatures	---	---	
32.3.3				No meter bias and zero psi in ascent engine chamber	T/W RATIO meter	Check thrust-to-weight ratio indicator	---	---	
32.3.4				Pressure less than normal operating level (prior to pressurization) downstream of pressure regulators	PRESSURE REGULATOR WARN lights (#1 and #2) illuminated	Check pressure regulator warning indicators	---	---	
32.3.5				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL AND OXID) extinguished	Check relief valve warning indicators	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
33.0.0 Distribute Power to RCS and Check-Out	65:33:55	00:00:15	SE/C						
33.1.0 Activate electrical loads for RCS propulsion	65:33:55	00:00:05							
33.1.1				Checklist	---	Energize electrical load for RCS propulsion system	RCS POWER toggle to ON	Electrical power supplied to RCS	
33.2.0 Checkout RCS propulsion	65:34:00	00:00:10							
33.2.1				Normal operating levels	TANK METERS: FUEL & OXID. QTY.; FUEL & OXID. PRESS; HELIUM PRESS & TEMP	Check system A & B quantities, pressures and temperatures	---	----	
33.2.2				Pressure less than normal operating level (prior to pressurization) downstream of pressure regulators	PRESSURE REGULATOR WARN lights (#1 and #2) illuminated	Check system A & B pressure regulator warning indicators	---	----	
33.2.3				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check system A & B relief valve warning indicators	---	----	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
34.0.0 Transfer to Stand Engineer's Position	65:34:10	00:01:45	SE/ C-A-SE						
34.1.0 Release seat from seat	65:34:10	00:00:20							
34.1.1				Procedure	---	Unlatch C seat restraint harness	Depress and twist latching lever on harness	---	SE is free to stand up
34.1.2				Procedure	---	Unhook suit umbilical from C seat receptacle. Reach across aisle and connect umbilical into SE seat receptacle	Umbilical snap ring	---	SE suit umbilical connection to LEM ECS is transferred from C to SE position
34.1.3				Procedure	---	Stand up in aisle	---	---	
34.2.0 Open LEM hatch	65:34:30	00:00:20							
34.2.1				LEM and interlock pressure in equilibrium	LEM cabin pressure indicator. ΔP indicator.	Open LEM hatch and secure in open position	Hatch locking wheel	LEM hatch is open and secure in open position	
34.3.0 Advise Commander to open CM hatch	65:34:50	00:00:05							
34.3.1				Procedure	---	Instruct Commander to transfer to LEM	---	---	
34.4.0 Prepare SE position	65:34:55	00:00:40							
34.4.1				Procedure	---	Unlatch SE seat restraint harness	Depress and twist latching lever on harness	---	SE seat prepared to accept SE and PLSS
34.4.2				Procedure	---	Transfer PLSS to SE position from C position	---	---	Although PLSS is mounted in seat, astronaut remains plugged into PLSS while breathing cabin air.

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND MEASUREMENTS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
34.5.0 Take SE seat	65:35:35	00:00:20							
34.5.1				Procedure	---	Sit down in SE seat	---	---	
34.5.2				Procedure	---	Engage latching lever on SE harness	Latching lever	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
35.0.0 Transfer From CM to LEM and Secure Self in Commander's Seat	65:34:55	00:03:00	C/CM-LEM						
35.1.0 Open CM hatch	65:34:55	00:00:45							
35.1.1				CM cabin pressure is in equilibrium with interlock and clearance received from LEM	Δ P indicator	Open CM hatch	Hatch locking wheel	CM hatch is open	If pressure differential does not allow CM hatch opening, bleed off CM cabin pressure until in equilibrium with interlock
35.2.0 Enter interlock with PLSS	65:35:40	00:01:30							
35.2.1				Procedure	---	Proceed into interlock with face plate open and wearing PLSS	---	---	If unable to get through with PLSS, doff PLSS and pull through
35.3.0 Enter LEM	65:37:10	00:00:15							
35.3.1				Procedure	---	Stand in aisle and secure PLSS in C seat	---	---	
35.4.0 Close LEM hatch	65:37:25	00:00:15							
35.4.1				Checklist	---	Close LEM hatch and lock	Hatch locking wheel	LEM hatch is closed, locked and sealed	
35.5.0 Take Commander's seat	65:37:40	00:00:15							
35.5.1				Procedure	---	Take Commander's position and secure restraint harness	Harness latching lever	---	
35.5.2				Checklist	---	Connect suit umbilical into LEM ECS receptacle on seat and insert communications umbilical into communication system receptacle	Umbilical snap ring	C is sustained by LEM ECS and prepared to communicate	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND MANEUVERS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
36.0.0 Distribute Power to In-Flight Test System and Check-out	65:35:55	00:05:00	SE/SE						
36.1.0 Turn on power to IFTS	65:35:55	00:00:10							
36.1.1				Checklist	---	Turn on power	IFTS POWER toggle to ON	IFTS energized	
36.2.0 Calibrate IFTS	65:36:05	00:04:50							
36.2.1				Checklist	---	Select calibrate mode	IFTS MODE toggle to CALIBRATE	IFTS calibration capability established	
36.2.2				Comparison of IFTS voltage against a standard reference	VOLTMETER	Perform necessary adjustments	---	IFTS calibrated	
36.2.3				Self-test results for: Comparator, Limit Storage and Mode Select lamps	---	Check-out IFTS	IFTS MODE toggle to SELF-TEST	Self-test completed	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SLEEPER CHECKOUT AND REMARKERS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
37.0.0 Determine Initial Conditions from CM	65:37:55	00:01:00	C/C						
37.1.0 Synchronize timing mechanisms	65:37:55			----------	----------	-To be determined	----------	----------	----
37.2.0 Obtain initial conditions from CM 37.2.1				Checklist	---	Request initial conditions from CM via VHF voice link	---	----	
37.3.0 Insert initial conditions into computer 37.3.1				Orbital period (velocity and altitude). Orbital plane (angle of inclination and longitude of orbital plane with reference to lunar equator). Position in orbit (time or lunar coordinate data with respect to some reference time).	Headset	Receive reply to request and insert initial conditions into computer	Computer keyboard pushbuttons	Initial conditions entered into computer keyboard	
37.3.2				Orbital period. Orbital plane. Position in orbit	COMPUTER CALL-UP DIGITAL indicators	Verify entry of initial conditions	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND PREPARING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
38.0.0 Align IMU in Coasting Flight	65:38:55	00:20:00	C/C						
38.1.0 Coarse align IMU with computer controls	65:38:55								
38.1.1				Checklist	---	Place CDU in computer mode	CDU TRANSFER toggle to computer	IMU modes selected automatically by the computer using relay logic	
38.1.2				Zero equals 135°F and is normal operating level of IMU	IMU TEMP. meter on IFTS reads zero	Check calibration of IMU temperature monitoring device	ZERO pushbutton	IMU temperature indicating and control circuitry and sensor correctly calibrated	
38.1.3				IMU temperature within normal operating limits	IMU TEMP status light extinguished IMU TEMP meter on IFTS reads zero	Check IMU Temperature	---	---	
38.1.4				IMU coarse align program: Code # Noun Verb	DATA CHART	Insert IMU coarse align program into computer	Computer keyboard pushbuttons	Information entered into computer keyboard	
38.1.5				Checklist	Computer program code #, noun and verb digital indicators	Enter program into computer and verify entry	COMPUTER ENTER pushbutton	IMU coarse align program correctly entered	
38.1.6				Checklist	---	Request attitude angles from CM via VHF voice link for coarse alignment	---	---	
38.1.7				Attitude angles for IMU coarse alignment	---	Receive attitude angles from CM and insert into computer keyboard	Computer keyboard pushbuttons	Attitude angles inserted into computer keyboard	
38.1.8				Procedure	---	Enter attitude angles into computer	COMPUTER ENTER pushbutton	Attitude angles entered into computer	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
38.1.9				CDUs are driven to their mechanical zero position	ZERO ENCODER pushbutton/indicator illuminates CDU angle readouts read zero	Check that CDUs' zero encoded	---	CDU angles stored in the computer are reset to zero. CDUs' zero encoded	
38.1.10				IMU coarse aligned	IMU COARSE ALIGNED indicator illuminates	Check that IMU coarse aligned	---	Error signals representing the difference between IMU gimbal angle and CDU angles have driven the gimbals into alignment with the CDUs. Simultaneously, the computer supplies torquing signals to cage the gyros to their null position. The IMU is then aligned to some angular orientation with respect to the spacecraft and close to the final desired orientation.	
38.1.11				Angular difference between the IMU gimbal angles and the CDU angles are zero.	IMU-CDU DIFFERENCE 3-axis meter reads zero	Monitor attitude error between IMU and CDU	---	IMU coarse erected	
38.2.0 Fine align IMU to inertial coordinates									
38.2.1				IMU fine align program: Code # Noun Verb	DATA CHART	Insert IMU fine align program into computer	Computer keyboard push-buttons	Program entered into computer keyboard	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
38.2.2				IMU fine align program: #, noun and verb	Computer Digital indicators	Enter program into computer and verify entry	COMPUTER ENTER push-button	IMU fine align program correctly entered	
38.2.3				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	---	
38.2.4				Procedure	SCT angular read-out indicator	Verify optics zeroed	---	---	
38.2.5				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
38.2.6				Checklist	---	Rotate SCT eye-piece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
38.2.7				Checklist	----	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
38.2.8				Celestial coordinates of target star #1	DATA CHART	Determine target star #1 coordinates	---	---	
38.2.9				Celestial coordinates of target star #1	DATA CHART	Request CM to maneuver to required attitude	---	---	
38.2.10				LEM attitude angle	ATTITUDE indicators	Monitor LEM attitude change	---	---	LEM positioned to correct attitude for IMU fine alignment
38.2.11				Star position in 60° field of view	DATA CHART Direct visual in SCT reticle	Sight target star #1 and verify image	TRUNNION and SHAFT SLEW controls	---	
38.2.12				Star position in center of 60° field of view	Direct visual in SCT reticle	Center target star #1 in center of 60° field of view	TRUNNION and SHAFT SLEW controls	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
38.2.13				Checklist	---	Rotate SCT eye-piece mechanism to 20° field of view position	FIELD OF VIEW selector to 20°	---	
38.2.14				Checklist	---	Select slow optics speed	OPTICS SPEED toggle to SLOW	---	
38.2.15				Star position in 20° field of view	DATA CHART and direct visual in SCT reticle	Sight target star #1 and verify image	TRUNNION and SHAFT SLEW controls	---	
38.2.16				Star position in center of 20° field of view	Direct visual in SCT reticle	Center target star #1 in center of 20° field of view	TRUNNION and SHAFT SLEW controls	---	
38.2.17				Star position in center of 20° field of view	Direct visual in SCT reticle	Enter target star #1 coordinates when star is centered in 20° field of view	COMPUTER MARK pushbutton	Star coordinates entered into computer	
38.2.18				Target star #1 Code #	DATA CHART. Computer digital indicators	Insert code # for target star #1 into computer and verify	Computer key-board push-buttons	Target star #1 code # correctly entered	
38.2.19				Same as 38.2.11		Sight,			
38.2.20				Same as 38.2.12		Center,			
38.2.21				Same as 38.2.13		and			
38.2.22				Same as 38.2.14		record			
38.2.23				Same as 38.2.15		target			
38.2.24				Same as 38.2.16		star #2			
38.2.25				Same as 38.2.17					
38.2.26				Same as 38.2.18					
38.2.27				Fine alignment of IMU achieved	FINE ALIGN light illuminated green	Check that IMU fine aligned	---	IMU fine alignment achieved. Error signals representing the differences	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
								between IMU gimbal angles and CDU angles drive the CDUs into alignment with the IMU gimbals. The CDUs are slaved to and repeat the IMU gimbal angles. Incremental digital encoders attached to the CDU motor shafts transmit IMU gimbal orientation to the computer	
38.2.28				Same as 38.2.11		Re-sight center, and record target star #1			
38.2.29				Same as 38.2.12					
38.2.30				Same as 38.2.13					
38.2.31				Same as 38.2.14					
38.2.32				Same as 38.2.15					
38.2.33				Same as 38.2.16					
38.2.34				Same as 38.2.17					
38.2.35				Same as 38.2.18					
38.2.36				Same as 38.2.27					

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
39.0.0 Perform Complete Systems Check-Out with IFTS	65:40:55	00:02:00	SE/SE						
39.1.0 Perform systems checkout in automatic test mode	65:40:55	00:02:00							
39.1.1				Checklist	---	Select automatic test mode	IFTS MODE toggle to AUTOMATIC TEST	Automatic test mode selected	
39.1.2				If all system GO, "00" appears	ALPHA- NUMERIC DISPLAY	Activate test program and monitor	TEST push-button	Test program accomplished	If a NO-GO occurs, the appropriate alpha-numeric appears. Then: 1. Identify trouble spot with code book. 2. Select FAULT ISOLATION MODE. 3. Press FAULT LOCATOR pushbutton. 4. Identify malfunction to lowest replaceable part (panel, module or card). 5. Check-out malfunctioning component using voltmeter and oscilloscope. 6. Remove and replace. 7. Recycle in FAULT ISOLATION MODE. 8. Recycle in AUTOMATIC TEST MODE.

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
40.0.0 Program Computer for Descent Trajectory	65:58:55	00:01:00	C/C						
40.1.0 Enter descent thrusting program	65:58:55	00:00:20							
40.1.1				Descent program code # Noun Verb	DATA CHART	Insert descent program into computer keyboard	Computer keyboard pushbuttons	Descent program entered into computer keyboard	
40.1.2				Descent program Code # Noun Verb	Computer digital indicators	Enter program into computer and verify	COMPUTER ENTER pushbutton	Descent program correctly entered and coordinated with initial conditions previously entered	
40.2.0 Determine the parameters required for separation and injection into coasting descent transfer orbit based on updated orbital data	65:59:15	00:00:40							
40.2.1				Δ V call-up code #	DATA CHART	Insert ΔV call-up code # into computer keyboard	Computer keyboard pushbuttons	Information entered into computer keyboard	
40.2.2				Δ V call-up code #	Computer digital indicators	Enter ΔV call-up code # into computer and verify	COMPUTER CALL-UP pushbutton	Computer interrogated and entry verified.	
40.2.3				Procedure	Computer digital indicators	Read Δ V required for thrusting	---	---	
40.2.4				Δ V required	ΔV REMAINING digital indicators	Insert ΔV required Δ V panel	ΔV SET thumbwheel	ΔV monitoring capability established	
40.2.5				Procedure	EVENTS TIMER	Check time to Δ V thrusting	---	---	Time to injection into coasting descent transfer orbit determined
40.2.6				Separation accomplished 10 minutes prior to injection into coasting descent transfer orbit	DATA CHART, EVENTS TIMER	Determine time to separation from CM	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND MAINTENANCE

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
40.2.7				Procedure	Commanded ATTITUDE indicators	Read attitude requirements	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
41.0.0 Prepare For Separation from CM	65:59:55	00:03:05							
41.1.0 Pressurize ascent stage and checkout	65:59:55	00:00:20	SE/SE						
41.1.1.				Checklist	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	---	
41.1.2				Checklist	---	Open helium squib valves	ASCENT PRESSURIZATION guarded pushbutton	System pressurized down to squib valves upstream of propellant tanks	
41.1.3				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN Lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
41.1.4				Relief valves not venting helium overboard.	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve waring indicators	---	---	
41.1.5				Normal operating levels.	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID.QTY(#1) OXID.QTY(#2) FUEL PRESS. OXID.PRESS. FUEL TEMP. OXID. TEMP. HELIUM TEMP. HELIUM PRESS	Check tank quantities, pressures and temperatures	---	---	
41.2.0 Pressurize descent stage and checkout	66:00:15	00:00:20	SE/SE						
41.2.1				Checklist	---	Select descent mode for monitoring	MONITOR SELECT toggle to DESCENT	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
41.2.2				Checklist	---	Open helium squib valves	DESCENT PRESSURIZATION guarded switch	System pressurized down to bi-propellant valves.	
41.2.3				Normal operating pressure level downstream of second stage regulators.	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators.	---	---	
41.2.4				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished.	Check relief valve warning indicators	---	---	
41.2.5				Normal operating levels.	TANK METERS: FUEL QTY (#1) FUEL QTY (#2) OXID QTY (#1) OXID QTY (#2) FUEL PRESS. OXID. PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS. HELIUM TEMP.	Check tank quantities, pressures and temperatures	---	---	
41.3.0 Pressurize RCS and checkout	66:00:35	00:00:20	SE/SE						
41.3.1				Checklist	---	Open System A & B helium squib valves.	PRESSURIZATION guarded switch	RCS pressurized down to thruster valves.	
41.3.2				Normal operating pressure level downstream of second stage regulators.	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators.	---	---	
41.3.3				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
41.3.4				Normal operating levels	TANK METERS: FUEL AND OXID. QTY; FUEL AND OXID. PRESS; HELIUM PRESS. AND TEMP.	Check System A & B tank quantities, pressures and temperatures.	---	---	
41.3.5				Proper functioning of thruster valves.	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
41.4.0 Checkout firing of RCS	66:00:55	00:01:00	SE/SE	To be determined					
41.5.0 Select descent modes	66:01:55	00:00:15	C/C						
41.5.1				Checklist	---	Select guidance mode for SCS	ATTITUDE MODE toggles to GUIDANCE	---	
41.5.2				Checklist	---	Select proper deadband limits	DEADBAND toggle to MINIMUM	---	Correct limit cycling mode selected.
41.5.3				Checklist	---	Select descent engine mode	ENGINE MODE SELECT guarded toggle to DESCENT	---	
41.6.0 Secure self and cabin interior	66:02:10	00:00:30							
41.6.1			SE/SE; C/C	Checklist	---	Visually check cabin interior to insure items are secure	---	---	
41.6.2			SE/SE; C/C	Checklist	---	Visually check that restraint harness is secure	Harness latching levers	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
41.6.3			SE/SE; C/C	Checklist	---	Slide faceplate to closed position and turn locking knob. Close DIVERTER VALVE, SUIT CIRCUIT RELIEF VALVE AND CABIN GAS RETURN VALVE	Locking knob	Faceplate is closed. Suit is a closed circuit	
41.6.4			SE/SE	Checklist	---	Shut off dome lighting	DOME LIGHTING toggle to OFF	Dome lighting de-energized	Integral panel lighting operating only.
41.6.5			SE/SE	Checklist	---	Turn on running lights	RUNNING LIGHTS toggle to ON.	Running lights energized	
41.7.0 Monitor countdown to separation	66:02:40	00:00:20	C/C						
41.7.1				Checklist	EVENTS TIMER	Check time to begin countdown	---	---	
41.7.2				Time to Separation	EVENTS TIMER	Count off time 20 seconds prior to separation to CM/GOSS via VHF/UHF voice link	---	---	All systems ready for separation

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
42.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/SE						
42.1.0 Monitor subsystem master warning lights		00:00:05							
42.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
42.2.0 Monitor electrical system status		00:00:40							
42.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
42.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1, 2, and 3	---	
42.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1, 2, 3) extinguished	Check N_2 fail warning indicators	---	---	
42.2.4				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3 and main bus current	MONITOR SELECT rotary (amps) to FC 1, 2, 3 and BUS A	---	
42.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
42.2.6				Normal operating temperature level	INVERTER NO. 1 TEMP. warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to No. 1	---	
42.2.7				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
42.3.0 Monitor environmental control system status		00:01:15							
42.3.1				Maximum 1100 psia Normal 850 psia Minimum 7 psia	SOX PRESSURE indicator	Monitor SOX pressure	---	---	If low SOX pressure, turn on SOX heater until pressure builds up. If still no go, check O_2 inflow lights; if illuminated, select manual, and pulse until pressure builds up
				Normal operating level	SOX QUANTITY indicator	Monitor SOX quantity	---	---	
				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
42.3.2				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator, and glycol temp. warning indicators	---	---	If a light illuminates, that particular H_2O separator or LiOH system is malfunctioning. Select alternate system.
42.3.3				Pressure reading of 5.0 psia	CABIN PRESSURE indicator	Check cabin pressure	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates. If #2 inflow valve fails in automatic, place #1 O_2 inflow valve to MANUAL. If #1 light illuminates, place #2 O_2 inflow valve to MANUAL
42.3.4				Cabin temperature is within 75°F ± 5°	CABIN TEMPERATURE indicator	Check cabin temperature	---	The cabin is checked out at normal temperature	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly.
42.3.5				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 flood status	---	Cabin oxygen flooding is normal.	
42.3.6				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	
42.3.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator	Check suit fan warning indicator	---	Suit fan functioning properly	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
42.4.0 Monitor descent propulsion system status		00:00:15							
42.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
42.4.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
42.4.3				Normal operating levels	TANK METERS: FUEL QTY (#1) FUEL QTY (#2) OXID QTY (#1) OXID QTY (#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS. HELIUM TEMP.	Check tank quantities, pressures and temperatures	---	---	
42.5.0 Monitor ascent propulsion system status		00:00:15							
42.5.1				Ascent system monitoring	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	---	
42.5.2				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
42.5.3				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description		Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
	42.5.4				Normal operating levels	TANK METERS: FUEL QTY (#1 FUEL QTY (#2 OXID QTY (#1 OXID QTY (#2 FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS.	Check tank quantities, pressures and temperatures	---	---	
42.6.0 Monitor RCS status			00:00:15							
	42.6.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	---	---	
	42.6.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	
	42.6.3				Normal operating levels	TANK METERS: FUEL & OXID QTY; FUEL & OXID PRESS; HELIUM PRESS. & TEMP.	Check System A & B tank quantities, pressures and temperatures	---	---	
	42.6.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
42.7.0 Monitor navigation and guidance system status			00:00:20							
	42.7.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature	---	---	
	42.7.2				IMU power operating levels within normal limits	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	---	

PHASE NUMBER: 2 CIRCULAR LUNAR ORBIT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
42.7.3				All warning lights extinguished. Computer functioning properly	WARNING INDICATORS: RUPT LOCK, TCA TRAP, CROSS POINT FAIL, SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY	Check computer operating status	---	Computer maintained in self-checking mode	
42.7.4				---	---	Check CDU operating status	---	---	
42.8.0 Monitor stabilization and control system status			TO BE DETERMINED						

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Phase 3 SEPARATION AND DESCENT ORIENTATION	From 66:03:00 To 66:13:00	Elapsed Time 10 min.
Commander	Mission Time	Systems Engineer
43.0.0 Monitor Separation Distance From CM	66:03:00	45.0.0 Monitor LEM Systems Status
43.1.0 Experience separation and check that docking latches open	66:03:00	
43.2.0 Check separation distance between LEM and CM	66:03:10	
44.0.0 Check That Conditions Established For Injection Into Coasting Descent Transfer Orbit	66:04:00	
44.1.0 Check pitch-over maneuver	66:04:00	
44.2.0 Check that correct attitude maintained for injection	66:05:00	
	66:12:20	44.3.0 Start countdown to injection
44.4.0 Set descent engine thrust level	66:12:25	
44.2.0 Check that correct attitude maintained for injection	66:12:30	
End of phase 3	66:13:00	End of phase 3

PHASE NUMBER: 3 SEPARATION AND DESCENT ORIENTATION

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
43.0.0 Monitor Separation Distance From CM	66:03:00	00:01:00	C/C						
43.1.0 Experience separation and check that docking latches open	66:03:00	00:00:10							
43.1.1				Visually check separation distance between CM and LEM. Experience vibration and acceleration	DOCKING LATCH indicator illuminates OPEN. Direct visual.	Check that docking latches open signifying initiation of separation from CM	- - - -	LEM and CM physically separated	
43.2.0 Check separation distance between LEM and CM	66:03:10	00:00:50							
43.2.1				Procedure	- - -	Rotate SCT eyepiece mechanism to 60° field of view.	FIELD OF VIEW selector to 60°	- - - -	
43.2.2				Position of CM	Direct visual in SCT field of view	Slew SCT to acquire CM	TRUNNION and SHAFT SLEW controls	CM acquired	
43.2.3				Relative size of CM in SCT 60° field of view	Direct visual in SCT	Check separation distance to approximately 100 feet	- - -	- - - -	

PHASE NUMBER: 3 **SEPARATION AND DESCENT ORIENTATION**

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
44.0.0 Check that Conditions Established For Injection Into Coasting Descent Transfer Orbit	66:04:00	00:09:00							
44.1.0 Check pitch-over maneuver 44.1.1	66:04:00	00:01:00	C/C	Procedure	ATTITUDE and ATTITUDE RATE indicators	Check 90° pitch about Y axis	- - -	- - - -	Correct attitude orientation established
44.2.0 Check that correct attitude maintained for injection 44.2.1	66:05:00 66:12:30	00:07:25 Plus 00:00:30	C/C	Procedure	ATTITUDE and ATTITUDE RATE indicators	Check attitude hold such that Y axis is along the local vertical	---	----	Correct attitude orientation maintained
44.3.0 Start countdown to injection 44.3.1	66:12:20	00:00:40	SE/SE	Checklist	EVENTS TIMER	Check and count-down time to fire	---	---	
44.3.2				Procedure	EVENTS TIMER	Countdown time to injection	---	---	
44.4.0 Set descent engine thrust level 44.4.1	66:12:25	00:00:05	C/C	SE countdown	---	Select maximum thrust level for descent engine	THRUST CON-TROLLER to MAXIMUM thrust position	---	Ready to fire descent engine

PHASE NUMBER: 3 SEPARATION AND DESCENT ORIENTATION

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
45.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/SE						
45.1.0 Monitor subsystem master warning lights		00:00:05							
45.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
45.2.0 Monitor electrical system status		00:00:40							
45.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
45.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1,2, and 3	---	
45.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1,2,3) extinguished	Check N_2 Fail warning indicators	---	---	
45.2.4				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3 and main bus current	MONITOR SELECT rotary (amps) to FC 1,2,3 and BUS A	---	
45.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	

PHASE NUMBER: 3 SEPARATION AND DESCENT ORIENTATION

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
45.2.6				Normal operating temperature level	INVERTER No. 1 TEMP. warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to NO. 1	---	
45.2.7				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
45.3.0 Monitor environmental control system status		00:01:15							
45.3.1				Maximum 1100 psia Normal 850 psia Minimum 7 psia	SOX PRESSURE indicator	Monitor SOX pressure	---	---	If low SOX pressure, turn on SOX heater until pressure builds up. If still no go, check O_2 inflow lights: if illuminated, select manual, and pulse until pressure builds up.
				Normal operating level	SOX QUANTITY indicator	Monitor SOX quantity	---	---	
				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.
45.3.2				Warning lights extinguished.	Warning lights.	Check LiOH, H_2O separator, and glycol temp. warning indicators.	---	---	If a light illumates, that particular H_2O separator or LiOH system is malfunctioning. Select alternate system.

PHASE NUMBER: 3 SEPARATION AND DESCENT ORIENTATION

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
45.3.3				Pressure reading of 5.0 psia.	CABIN PRESSURE indicator.	Check cabin pressure.	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia.	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically. and the light on #1 system illuminates. If #2 inflow valve fails in automatic. place #1 O_2 inflow valve to MANUAL. If #1 light illuminates, place #2 O_2 inflow valve to MANUAL.
45.3.4				Cabin temperature is within 75° F ± 5°	CABIN TEMPERATURE indicator	Check cabin temperature	---	The cabin is checked out at normal temperature	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly
45.3.5				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 flood status	---	Cabin oxygen flooding is normal.	
45.3.6				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	
45.3.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator	Check suit fan warn indicator	---	Suit fan functioning properly	
45.4.0 Monitor descent propulsion system status		00:00:15							
45.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
45.4.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
45.4.3				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS. HELIUM TEMP.	Check tank quantities, pressures and temperatures	---	---	
45.5.0 Monitor ascent propulsion system status		00:00:15							
45.5.1				Ascent system monitoring	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	----	
45.5.2				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
45.5.3				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
45.5.4				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS	Check tank quantities, pressures and temperatures	---	---	

PHASE NUMBER: 3 SEPARATION AND DESCENT ORIENTATION

Function and Task Description		Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
45.6.0 Monitor RCS status			00:00:15					---	---	
	45.6.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators			
	45.6.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	
	45.6.3				Normal operating levels	TANK METERS: FUEL & OXID QTY; FUEL & OXID. PRESS; HELIUM PRESS. & TEMP.	Check System A & B tank quantities pressures and temperatures	---	---	
	45.6.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
45.7.0 Monitor navigation and guidance system status			00:00:20							
	45.7.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature	---	---	
	45.7.2				IMU power operating levels within normal limits	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	---	
	45.7.3				All warning lights extinguished. Computer functioning properly.	WARNING INDICATORS: RUPT LOCK, TCA TRAP, CROSS POINT FAIL, SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY	Check computer operating status	---	Computer maintained in self-checking mode	

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PHASE NUMBER: 3 SEPARATION AND DESCENT ORIENTATION

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
45.7.4				---	---	Check CDU operating status	---	---	
45.8.0 Monitor stabilization and control system status		---	TO	BE	DETERMINED	- - -			

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Phase 4 COASTING DESCENT TRANSFER ORBIT	From 66:13:00 To 68:48:00	Elapsed Time 2 hr. 35 min.
Commander	Mission Time	Systems Engineer
46.0.0 Monitor Injection into Coasting Descent Transfer Orbit	66:13:00	82.0.0 Monitor LEM Systems Status
46.1.0 Check time of thrusting	66:13:00	
46.2.0 Check Δ V applied during thrusting	66:13:05 (continuous)	
46.3.0 Check vehicle attitude	66:13:05 (continuous)	
46.4.0 Monitor descent engine performance during thrusting	66:13:05 (continuous)	
46.5.0 Monitor achievement of proper Δ V and cutoff of descent engine	66:13:30	46.5.3 Open face plate, diverter valve, suit circuit relief valve and cabin gas return valve
48.0.0 Track CM with Tracking Radar	66:13:35	47.0.0 Control Vehicle Attitude for Radar Tracking of CM
48.1.0 Adjust optics	66:13:35	47.1.0 Select SCS control modes
	66:13:45	47.2.0 Control vehicle attitude
48.2.0 Slave radar to SCT	66:14:00	
48.3.0 Acquire CM in SCT	66:14:05	
	66:14:35	82.0.0 Monitor LEM Systems Status
48.4.0 Lock radar to CM	66:15:10	
49.0.0 Determine Updated Trajectory Parameters	66:15:35	
49.1.0 Determine velocity	66:15:35	
49.2.0 Determine range parameters	66:15:40	
49.3.0 Determine duration of coast	66:15:50	
No assigned activity	66:15:55	
	66:32:00	50.0.0 Control Vehicle Attitude for Tracking Landmark #1
	66:32:00	50.1.0 Select SCS control modes
	66:32:10	50.2.0 Control vehicle attitude
51.0.0 Perform Lunar Orbit Navigational Fix on Landmark #1 to Update Orbit	66:33:00	82.0.0 Monitor LEM Systems Status
51.1.0 Program computer	66:33:00	
51.2.0 Adjust optics	66:33:40	
51.3.0 Acquire landmark #1	66:34:05	
51.4.0 Record landmark #1 coordinates	66:36:05	
51.5.0 Determine updated orbital parameters	66:37:35	
No assigned activity	66:38:00	
	66:40:00	52.0.0 Control Vehicle Attitude for Tracking Landmark #2
	66:40:00	52.1.0 Select SCS control modes
	66:40:10	52.2.0 Control vehicle attitude

Phase 4 COASTING DESCENT TRANSFER ORBIT	From 66:13:00 To 68:48:00	Elapsed Time 2 hr. 35 min.
Commander	Mission Time	Systems Engineer
53.0.0 Perform Lunar Orbit Navigational Fix on Landmark #2 to Update Orbit	66:41:00	82.0.0 Monitor LEM Systems Status
53.1.0 Program computer	66:41:00	
53.2.0 Adjust optics	66:41:40	
53.3.0 Acquire landmark #2 in SCT	66:42:05	
53.4.0 Record landmark #2 coordinates	66:44:05	
53.5.0 Determine updated orbital parameters	66:45:35	
No assigned activity	66:46:00	
	66:48:00	54.0.0 Control Vehicle Attitude for Tracking Landmark #2
	66:48:00	54.1.0 Select SCS control modes
	66:48:10	54.2.0 Control vehicle attitude
55.0.0 Perform Lunar Orbit Navigational Fix on Landing Site and Evaluate Area	66:49:00	82.0.0 Monitor LEM Systems Status
55.1.0 Program computer	66:49:00	
55.2.0 Adjust optics	66:49:40	
55.3.0 Acquire landing site in SCT and evaluate area	66:50:05	
55.4.0 Record landing site coordinates	66:57:05	
55.5.0 Determine updated orbital parameters	66:58:35	
No assigned activity	66:59:00	
	67:01:00	56.0.0 Control Vehicle Attitude for Tracking Landmark #3
	67:01:00	56.1.0 Select SCS control modes
	67:01:10	56.2.0 Control vehicle attitude
57.0.0 Perform Lunar Orbit Navigation Fix on Landmark #3 to Update Orbit	67:02:00	82.0.0 Monitor LEM Systems Status
57.1.0 Program computer	67:02:00	
57.2.0 Adjust optics	67:02:40	
57.3.0 Acquire landmark #3 in SCT	67:03:05	
57.4.0 Record landmark #3 coordinates	67:05:05	
57.5.0 Determine updated orbital parameters	67:06:35	
No assigned activity	67:07:00	
	67:09:00	58.0.0 Control Vehicle Attitude for Tracking Landmark #4
	67:09:00	58.1.0 Select SCS control modes
	67:09:10	58.2.0 Control vehicle attitude

Phase 4 COASTING DESCENT TRANSFER ORBIT — From 66:13:00 To 68:48:00 — Elapsed Time 2 hr. 35 min.

	Commander	Mission Time	Systems Engineer
59.0.0	Perform Lunar Orbit Navigational Fix on Landmark #4 to Update Orbit	67:10:00	82.0.0 Monitor LEM Systems Status
	59.1.0 Program computer	67:10:00	
	59.2.0 Adjust optics	67:10:40	
	59.3.0 Acquire landmark #4 in SCT	67:11:05	
	59.4.0 Record landmark #4 coordinates	67:13:05	
	59.5.0 Determine updated orbital parameters	67:14:35	
60.0.0	Establish Constant Inertial Attitude	67:15:00	61.0.0 Activate Tape Recorder
	60.1.0 Select SCS control mode	67:15:00	61.1.0 Select tape recorder operating conditions
		67:15:15	61.2.0 Start tape recorder
		67:15:20	82.0.0 Monitor LEM Systems Status
	60.2.0 Control vehicle attitude	67:15:30	
62.0.0	Control Vehicle Attitude for Radar Tracking of CM	67:23:00	
	62.1.0 Select SCS control modes	67:23:00	
	62.2.0 Control vehicle attitude	67:23:10	
63.0.0	Track CM with Tracking Radar	67:24:00	
	63.1.0 Adjust optics	67:24:00	
	63.2.0 Slave radar to SCT	67:24:25	
	63.3.0 Acquire CM in SCT	67:24:30	
	63.4.0 Lock radar to CM	67:25:35	
	63.5.0 Determine range parameters	67:26:00	
64.0.0	Re-Establish Constant Inertial Attitude	67:26:05	
	64.1.0 Determine attitude requirements	67:26:05	
	64.2.0 Control vehicle attitude	67:26:25	
	No assigned activity	67:27:15	65.0.0 Perform Complete Systems Check-Out with IFTS
		67:27:15	65.1.0 Perform systems checkout in automatic test mode
		67:29:15	66.0.0 Perform Scientific Activities
		67:29:15	66.1.0 Determine lunar field characteristics
67.0.0	Control Vehicle Attitude for Radar Tracking of CM at LEM Apocynthion	67:38:00	
	67.1.0 Select SCS control modes	67:38:00	
	67.2.0 Control vehicle attitude	67:38:10	
68.0.0	Track CM with Tracking Radar	67:39:00	
	68.1.0 Adjust optics	67:39:00	

Phase 4 COASTING DESCENT TRANSFER ORBIT

From 66:13:00 To 68:48:00

Elapsed Time 2 hr. 35 min.

Commander	Mission Time	Systems Engineer
68.2.0 Slave radar	67:39:25	
68.3.0 Acquire CM in SCT	67:39:30	
68.4.0 Lock radar to CM	67:40:35	
68.5.0 Determine range parameters	67:41:00	
69.0.0 Re-Establish Constant Inertial Attitude	67:41:05	
69.1.0 Determine attitude requirements	67:41:05	
69.2.0 Control vehicle attitude	67:41:25	
No assigned activity	67:42:15	
		66.2.0 Perform photographic activities
70.0.0 Control Vehicle Attitude for Radar Tracking of CM	67:53:00	
70.1.0 Select SCS control modes	67:53:00	
70.2.0 Control vehicle attitude	67:53:10	
71.0.0 Track CM with Tracking Radar	67:54:00	
71.1.0 Adjust optics	67:54:00	
71.2.0 Slave radar to SCT	67:54:25	
71.3.0 Acquire CM in SCT	67:54:30	
71.4.0 Lock radar to CM	67:55:35	
71.5.0 Determine range parameters	67:56:00	
72.0.0 Re-Establish Constant Inertial Attitude	67:56:05	
72.1.0 Determine attitude requirements	67:56:05	
72.2.0 Control vehicle attitude	67:56:25	
No assigned activity	67:57:15	
	68:00:00	73.0.0 Remove and Replace LiOH Cannisters
	68:00:00	73.1.0 Monitor condition of CO_2 removal
	68:00:05	73.2.0 Stand in aisle
	68:00:10	73.3.0 Proceed to LiOH cannisters and check
	68:00:20	73.4.0 Change cannister
	68:00:35	73.5.0 Return to station
	68:00:45	66.2.0 Perform photographic activities
	68:05:00	74.0.0 Transmit to GOSS LEM Subsystem Performance Data and Crew Messages Recorded During Communications Black-Out
	68:05:00	74.1.0 Re-establish communications link with GOSS
	68:05:30	74.2.0 Establish tape recorder operating conditions

Phase 4 COASTING DESCENT TRANSFER ORBIT	From 66:13:00 To 68:48:00	Elapsed Time 2 hr. 35 min.
Commander	Mission Time	Systems Engineer
	68:07:40	82.0.0 Monitor LEM Systems Status
75.0.0 Orient LEM Attitude for IMU Fine Alignment	68:09:00	
75.1.0 Determine relative position and coordinates of target star #1	68:09:00	
75.2.0 Select SCS control modes	68:09:20	
75.3.0 Control vehicle attitude	68:09:30	
76.0.0 Align IMU	68:10:30	
76.1.0 Fine align IMU to inertial coordinates	68:10:30	
No assigned activity	68:30:30	
77.0.0 Control Vehicle Attitude for Tracking Landmark #1	68:31:35	
77.1.0 Select SCS control modes	68:31:35	
77.2.0 Control vehicle attitude	68:31:45	
78.0.0 Perform Lunar Orbit Navigational Fix on Landmark #1 to Update Orbit	68:32:35	
78.1.0 Program computer	68:32:35	
78.2.0 Adjust optics	68:33:15	
78.3.0 Acquire landmark #1 in SCT	68:33:40	
78.4.0 Record landmark #1 coordinates	68:35:40	
78.5.0 Determine updated orbital parameters	68:37:10	
No assigned activity	68:37:35	
79.0.0 Control Vehicle Attitude for Tracking Landmark #2	68:39:35	
79.1.0 Select SCS control modes	68:39:35	
79.2.0 Control vehicle attitude	68:39:45	
80.0.0 Perform Lunar Orbit Navigational Fix on Landmark #2 for Final Updating of Orbit	68:40:35	
80.1.0 Program computer	68:40:35	
80.2.0 Adjust optics	68:41:15	
80.3.0 Acquire landmark #2 in SCT	68:41:40	
80.4.0 Record landmark #2 coordinates	68:43:40	
80.5.0 Determine final updated orbital parameters	68:45:10	
81.0.0 Prepare for Powered Descent	68:45:35	
81.1.0 Determine updated powered descent parameters and and select automatic guidance modes	68:45:35	
81.2.0 Check that correct attitude maintained for retro-thrusting	68:46:10	
81.3.0 Secure self and cabin interior	68:46:50	81.3.0 Secure self and cabin interior

Phase 4 COASTING DESCENT TRANSFER ORBIT — From 66:13:00 To 68:48:00 — Elapsed Time 2 hr. 35 min.

Commander	Mission Time	Systems Engineer
81.2.0 Check that correct attitude maintained for retro-thrusting	68:47:20	81.4.0 Start countdown to retro-thrusting
81.5.0 Select descent engine thrust level	68:47:25	
81.2.0 Check that correct attitude maintained for retro-thrusting	68:47:30	
End of Phase 4	68:48:30	End of Phase 4

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
46.0.0 Monitor Injection Into Coasting Descent Transfer Orbit	66:13:00	00:00:35							
46.1.0 Check time of thrusting	66:13:00	00:00:05	C/C						
46.1.1				Procedure	EVENTS TIMER	Check time of thrusting	---	---	
46.2.0 Check ΔV applied during thrusting	66:13:05	00:00:25 Continuous	C/C						
46.2.1				Procedure	ΔV REMAINING Analog tape	Check ΔV applied	---	---	
46.3.0 Check vehicle attitude	66:13:05	00:00:25 Continuous	C/C						
46.3.1				Procedure	Commanded vs. actual ATTITUDE indicators	Check attitude	---	---	
46.4.0 Monitor descent engine performance during thrusting	66:13:05	00:00:25 Continuous	C/C						
46.4.1				Normal operating level	T/W RATIO meter	Check thrust-to-weight indicator	---	---	Immediately prior to descent engine ignition, the RCS jets will fire automatically for a few seconds in the vehicle's +x direction to settle propellant in the descent tanks, thereby accomplishing the required ullage.
46.5.0 Monitor achievement of proper ΔV and cutoff of descent engine	66:13:30	00:00:05							
46.5.1			C/C	Procedure	ΔV REMAINING analog tape	Check that correct ΔV has been achieved	---	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
46.5.2			C/C	Proper ΔV profile conditions	T/W RATIO meter reads zero and THRUST CONTROLLER returns to zero thrust position	Check thrust-to-weight ratio indicator and position of thrust controller	---	Descent engine cut-off	
46.5.3			C/C; SE/SE	Procedure	---	Open face plate, diverter, suit circuit relief and cabin gas return valves.	Unlock knob and slide face plate up. Open faucets of valves	C and SE maintained by cabin environment.	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
47.0.0 Control Vehicle Attitude for Radar Tracking of CM	66:13:35	00:01:00	SE/SE						
47.1.0 Select SCS control modes	66:13:35	00:00:10							
47.1.1				Procedure	---	Select proper deadband limits	DEADBAND toggle to MINIMUM	Correct limit cycling mode selected	
47.1.2				Procedure	---	Select attitude hold mode	ATTITUDE MODE toggles to ATTITUDE HOLD	Correct SCS mode selected	
47.2.0 Control vehicle attitude	66:13:45	00:00:50							
47.2.1				Position of CM	Direct visual and ATTITUDE RATE Indicators	Control vehicle attitude to achieve proper orientation for tracking CM	ATTITUDE CONTROLLER	Correct vehicle attitude achieved for tracking CM with radar	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
48.0.0 Track CM with Tracking Radar	66:13:35	00:02:00	C/C						
48.1.0 Adjust optics	66:13:35	00:00:25							
48.1.1				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	---	
48.1.2				Procedure	SCT Angular readout indicator	Verify optics zeroed	---	---	
48.1.3				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
48.1.4				Checklist	---	Rotate SCT eye-piece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
48.1.5				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
48.2.0 Slave radar to SCT	66:14:00	00:00:05							
48.2.1				Checklist	---	Place radar in SCT mode	RADAR MODE toggle to SCT	Radar slaved to SCT	
48.3.0 Acquire CM in SCT	66:14:05	00:01:05							
48.3.1				Position of CM	Direct visual in SCT 60° field of view	Search for CM and center in SCT 60° field of view	SCT TRUNNION and SHAFT SLEW controls	CM acquired in SCT 60° field of view	
48.3.2				Procedure	---	Select 20° field of view	FIELD OF VIEW selector to 20°	---	
48.3.3				Position of CM	Direct visual in SCT 20° field of view	Center CM in 20° field of view	SCT TRUNNION and SHAFT SLEW controls	CM acquired in SCT 20° field of view	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
48.4.0 Lock radar to CM	66:15:10	00:00:25							
48.4.1				Radar LOS angle and SCT optics angle indications in agreement	SEARCH light illuminates. LOS AZIMUTH and ELEVATION ANGLE indicators, SCT TRUNNION and SHAFT AXIS ANGLES	Place radar in tracking mode	RADAR MODE toggle to AUTO	Radar begins to search for CM	
48.4.2				Procedure	SEARCH light extinguished	Check that radar locked on CM	---	Radar locked on CM	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
49.0.0 Determine Updated Trajectory Parameters Resulting from Injection Errors	66:15:35	00:00:20	C/C						
49.1.0 Determine velocity	66:15:35	00:00:05							
49.1.1				Final velocity	FLIGHT PATH VELOCITY indicator	Check final velocity resulting from ΔV injection thrust	---	---	
49.2.0 Determine range parameters	66:15:40	00:00:10	---						
49.2.1				R and $\dot{R}$	R and $\dot{R}$ indicators	Check R & $\dot{R}$ to CM	---	---	
49.3.0 Determine duration of coast	66:15:50	00:00:05	---						
49.3.1				Time to powered descent	EVENTS TIMER	Determine length of coasting descent transfer orbit	---	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
50.0.0 Control Vehicle Attitude for Tracking Landmark #1	66:32:00	00:01:00	SE/SE						
50.1.0 Select SCS control mode	66:32:00	00:00:10							
50.1.1				Procedure	---	Select attitude hold SCS mode	ATTITUDE MODE toggles to ATTITUDE HOLD	---	
50.1.2				Procedure	---	Select proper deadband limits	DEADBAND toggle to MINIMUM	Correct limit cycling mode selected	
50.2.0 Control vehicle attitude	66:32:10	00:00:50							
50.2.1				Attitude angles required to orient vehicle to landmark	DATA CHART. ATTITUDE indicators	Control vehicle attitude to achieve proper orientation for tracking landmark.	ATTITUDE CONTROLLER	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
51.0.0 Perform lunar Orbit Navigational Fix on Landmark #1 to Update Orbit	66:33:00	00:05:00	C/C						
51.1.0 Program computer	66:33:00	00:00:40							
51.1.1				Checklist	EVENTS TIMER	Check mission time to begin landmark siting	---	---	
51.1.2				Select chart corresponding to time indicated on Events Timer	DATA CHART. EVENTS TIMER	Select appropriate landmark chart	---	---	
51.1.3				Landmark Siting program: Code # Noun Verb	DATA CHART	Read program code for landmark stiing	---	---	
51.1.4				Landmark Siting program: Code # Noun Verb	DATA CHART	Insert program into computer keyboard	Computer keyboard pushbuttons	Program code inserted into computer keyboard	
51.1.5				Landmark Siting program: Code # Noun Verb	DATA CHART. Computer digital indicators	Enter program into computer and verify	COMPUTER ENTER pushbutton	Correct program entered into computer	
51.2.0 Adjust optics	66:33:40	00:00:25							
51.2.1				Checklist	---	Place SCT shaft axis in zero optics mode	SHAFT AXIS MODE toggle to ZERO	---	
51.2.2				Procedure	SCT Angular readout indicator	Verify shaft axis optics zeroed	---	---	
51.2.3				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
51.2.4				Procedure	---	Rotate SCT eye-piece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
51.2.5				Procedure	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
51.3.0 Acquire landmark #1 in SCT	66:34:05	00:02:00							
51.3.1				Landmark position and characteristics	DATA CHART. Direct visual in SCT reticle	Sight landmark and verify image in 60° field of view	TRUNNION SLEW control	---	
51.3.2				Landmark position with respect to horizontal hair line	Direct visual in SCT reticle	Center landmark on horizontal hairline of SCT in 60° field of view	TRUNNION SLEW control	---	
51.3.3				Landmark position with respect to center of SCT 60° field of view	Direct visual in SCT reticle	Roll vehicle to move landmark near center of SCT 60° field of view	ATTITUDE CONTROLLER	Landmark positioned in center of SCT field of view	
51.3.4				Procedure	---	Rotate SCT eye-piece mechanism to 20° field of view position	FIELD OF VIEW selector to 20°	---	
51.3.5				Procedure	---	Select slow optics speed	OPTICS SPEED toggle to SLOW	---	
51.3.6				Landmark characteristics	DATA CHART. Direct visual in SCT reticle	Sight landmark and verify image in 20° field of view	TRUNNION SLEW control	---	
51.3.7				Landmark position with respect to horizontal hairline	Direct visual in SCT reticle	Center landmark on horizontal hairline of SCT in 20° field of view	TRUNNION SLEW control	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
51.3.8				Landmark position with respect to center of SCT 20° field of view	Direct visual in SCT reticle	Roll vehicle to move landmark back and forth across vertical hairline	ATTITUDE CONTROLLER	Landmark positioned in center of SCT field of view	
51.4.0 Record landmark #1 coordinates	66:36:05	00:01:30							
51.4.1				Landmark position with respect to center of SCT 20° field of view	Direct visual in SCT reticle	Enter coordinates when landmark drifts across center of SCT field of view	COMPUTER ENTER pushbutton	Trunnion angle, IMU gimbal angle and time entered into computer.	
51.4.2				Landmark position with respect to center of SCT 20° field of view	Direct visual in SCT reticle	Roll vehicle to move landmark back and forth across vertical hairline	ATTITUDE CONTROLLER	Landmark positioned in center of SCT field of view	
51.4.3				Landmark position with respect to center of SCT 20° field of view	Direct visual in SCT reticle	Enter coordinates when landmark drifts across center of SCT field of view	COMPUTER ENTER pushbutton	Trunnion angle, IMU gimbal angle and time entered into computer.	
51.4.4				Landmark Code #	DATA CHART and Computer digital indicators	Insert Code # for landmark into computer and verify	Computer keyboard pushbuttons	Landmark Code # correctly entered	
51.5.0 Determine updated orbital parameters	66:37:35	00:00:25							
51.5.1				Orbital parameters call-up code #	DATA CHART	Read orbital parameters call-up Code #	---	---	
51.5.2				Orbital parameters call-up code #	DATA CHART	Insert call-up code # into computer keyboard	Computer keyboard pushbuttons	Call-up code # inserted into keyboard	
51.5.3				Orbital parameters call-up code #	DATA CHART	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
51.5.4				LM position and velocity	Computer digital indicators	Read orbital parameters	---	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
52.0.0 Control Vehicle Attitude for Tracking Landmark #2	66:40:00	00:01:00	SE/SE						
52.1.0 Select SCS control modes	66:40:00	00:00:10		Same as 50.1.1 thru 50.1.2					
52.2.0 Control vehicle attitude	66:40:10	00:00:50		Same as 50.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
53.0.0 Perform Lunar Orbit Navigational Fix on Landmark #2 to Update Orbit	66:41:00	00:05:00	C/C						
53.1.0 Program computer	66:41:00	00:00:40		Same as 51.1.1 thru 51.1.5					
53.2.0 Adjust optics	66:41:40	00:00:25		Same as 51.2.1 thru 51.2.5					
53.3.0 Acquire landmark #2 in SCT	66:42:05	00:02:00		Same as 51.3.1 thru 51.3.8					
53.4.0 Record landmark #2 coordinates	66:44:05	00:01:30		Same as 51.4.1 thru 51.4.4					
53.5.0 Determine updated oribtal parameters	66:45:35	00:00:25		Same as 51.5.1 thru 51.5.4					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
54.0.0 Control Vehicle Attitude for Tracking and Evaluating Landing Site	66:48:00	00:01:00	SE/SE						
54.1.0 Select SCS control modes	66:48:00	00:00:10		Same as 50.1.1 thru 50.1.2					
54.2.0 Control vehicle attitude	66:48:10	00:00:50		Same as 50.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
55.0.0 Perform Lunar Orbit Navigational Fix on Landing Site and Evaluate Area	66:49:00	00:10:00	C/C						
55.1.0 Program computer	66:49:00	00:00:40		Same as 51.1.1 thru 51.1.5					
55.2.0 Adjust optics	66:49:40	00:00:25		Same as 51.2.1 thru 51.2.5					
55.3.0 Acquire landing site in SCT and evaluate area	66:50:05	00:07:00							
55.3.1				Same as 51.3.1					
55.3.2				Same as 51.3.2					
55.3.3				Same as 51.3.3					
55.3.4				Same as 51.3.4					
55.3.5				Same as 51.3.5					
55.3.6				Same as 51.3.6					
55.3.7				Same as 51.3.7					
55.3.8				Characteristics of nominal landing site versus alternate site in adjacent areas	Direct visual in SCT reticle	Survey landing site and evaluate	---	---	
55.3.9				Same as 51.3.8					
55.4.0 Record landing site coordinates	66:57:05	00:01:30		Same as 51.4.1 thru 51.4.4					
55.5.0 Determine updated orbital parameters	66:58:35	00:00:25		Same as 51.5.1 thru 51.5.4					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
56.0.0 Control Vehicle Attitude for Tracking Landmark #3	67:01:00	00:01:00	SE/SE						
56.1.0 Select SCS control modes	67:01:00	00:00:10		SAME AS 50.1.1 THRU 50.1.2					
56.2.0 Control vehicle attitude	67:01:10	00:00:50		SAME AS 50.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
57.0.0 Perform Lunar Orbit Navigational Fix on Landmark #3 to Update Orbit	67:02:00	00:05:00	C/C						
57.1.0 Program computer	67:02:00	00:00:40		SAME AS 51.1.1 THRU 51.1.5					
57.2.0 Adjust optics	67:02:40	00:00:25		SAME AS 51.2.1 THRU 51.2.5					
57.3.0 Acquire landmark #3 in SCT	67:03:05	00:02:00		SAME AS 51.3.1 THRU 51.3.8					
57.4.0 Record landmark #3 coordinates	67:05:05	00:01:30		SAME AS 51.4.1 THRU 51.4.4					
57.5.0 Determine updated orbital parameters	67:06:35	00:00:25		SAME AS 51.5.1 THRU 51.5.4					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
58.0.0 Control Vehicle Attitude for Tracking Landmark #4	67:09:00	00:01:00	SE/SE						
58.1.0 Select SCS control modes	67:09:00	00:00:10		SAME AS 50.1.1 THRU 50.1.2					
58.2.0 Control vehicle attitude	67:09:10	00:00:50		SAME AS 50.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
59.0.0 Perform Lunar Orbit Navigational Fix on Landmark #4 to Update Orbit	67:10:00	00:05:00	C/C						
59.1.0 Program computer	67:10:00	00:00:40		SAME AS 51.1.1 THRU 51.1.5					
59.2.0 Adjust optics	67:10:40	00:00:25		SAME AS 51.2.1 THRU 51.2.5					
59.3.0 Acquire landmark #4 in SCT	67:11:05	00:02:00		SAME AS 51.3.1 THRU 51.3.8					
59.4.0 Record landmark #4 coordinates	67:13:05	00:01:30		SAME AS 51.4.1 THRU 51.4.4					
59.5.0 Determine updated orbital parameters	67:14:35	00:00:25		SAME AS 51.5.1 THRU 51.5.4					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
60.0.0 Establish Constant Inertial Attitude	67:15:00	00:01:20	C/C						
60.1.0 Select SCS control modes	67:15:00	00:00:30							
60.1.1				Checklist	DATA CHART (Attitude requirements for thermal consider-ations)	Determine attitude requirements	---	---	
60.1.2				Procedure	---	Select atti-tude hold mode	ATTITUDE MODE toggles to ATTITUDE HOLD	Correct SCS mode selected	
60.1.3				Procedure	---	Select proper deadband limits	DEADBAND toggle to MAXIMUM	Correct SCS limit cycle selected	
60.2.0 Control vehicle attitude	67:15:30	00:00:50							
60.2.1				Attitude re-quirements	ATTITUDE indicators	Control vehicle to required attitude and monitor	ATTITUDE CONTROLLER	Correct inertial attitude achieved.	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
61.0.0 Activate Tape Recorder	67:15:00	00:00:20	SE/SE						
61.1.0 Establish tape recorder operating conditions	67:15:00	00:00:15							
61.1.1				LEM/GOSS communication black-out to begin at 67:18:00	---	Acknowledge imminence of LEM/GOSS communication black-out via UHF voice link	---	---	
61.1.2				Checklist	---	Turn on power to tape recorder	RECORDER POWER toggle on ON	Tape recorder energized	
61.1.3				Procedure	---	Select normal recording speed	SPEED toggle to NORMAL	---	
61.2.0 Start tape recorder	67:15:15	00:00:05							
61.2.1				Procedure	---	Start tape recorder operating	MODE toggle to RECORD	---	All subsystem performance data and crew messages are automatically stored and made ready for UHF transmission to GOSS at end up communication black-out

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
62.0.0 Control Vehicle Attitude for Radar Tracking of CM	67:23:00	00:01:00	C/C						
62.1.0 Select SCS control modes	67:23:00	00:00:10		SAME AS 47.1.1 THRU 47.1.2					
62.2.0 Control vehicle attitude	67:23:10	00:00:50		SAME AS 47.2.1					

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
63.0.0 Track CM with Tracking Radar	67:24:00	00:02:05	C/C						
63.1.0 Adjust optics	67:24:00	00:00:25		SAME AS 48.1.1 THRU 48.1.5					
63.2.0 Slave radar to SCT	67:24:25	00:00:05		SAME AS 48.2.1					
63.3.0 Acquire CM in SCT	67:24:30	00:00:05		SAME AS 48.3.1 THRU 48.3.3					
63.4.0 Lock radar to CM	67:25:35	00:00:25		SAME AS 48.4.1 THRU 48.4.2					
63.5.0 Determine range parameters	67:26:00	00:00:05							
63.5.1				Range and range rate	R and $\dot{R}$ indicators	Check R and $\dot{R}$ to CM	---	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
64.0.0 Re-Establish Constant Inertial Attitude	67:26:05	00:01:10	C/C						
64.1.0 Determine attitude requirements	67:26:05	00:00:20		SAME AS 60.1.1					
64.2.0 Control vehicle attitude	67:26:25	00:00:50		SAME AS 60.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
65.0.0 Perform Complete Systems Check-Out with IFTS	67:27:15	00:02:00	SE/SE						
65.1.0 Perform systems check-out in automatic test mode	67:27:15	00:02:00							
65.1.1				Checklist	---	Select automatic test mode	IFTS MODE toggle to AUTOMATIC TEST	Automatic test mode selected	
65.1.2				If all systems GO, "00" appears	ALPHA-NUMERIC STATUS DISPLAY	Activate test program and monitor	TEST push-button	Test program accomplished	If a NO-GO occurs, the appropriate alpha-numeric appears, then: 1. Identify trouble spot with code book 2. Select FAULT ISOLATION MODE 3. Press FAULT LOCATOR pushbutton 4. Identify malfunction to lowest replaceable part (panel, module or card). 5. Check-out malfunctioning component using voltmeter 6. Remove and replace. 7. Recycle in FAULT ISOLATION MODE 8. Recycle in AUTOMATIC TEST MODE

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
66.0.0 Perform Scientific Activities (if specified as a mission requirement)	67:29:15	00:35:00	SE/SE	(The following represents possible activities that could be performed).					
66.1.0 Determine lunar field characteristics									
66.1.1				---	---	Determine ion density	---	---	
66.1.2				---	---	Determine lunar atmosphere composition	---	---	
66.1.3				---	---	Determine lunar magnetic field	---	---	
66.1.4				---	---	Determine lunar gravitational field	---	---	
66.1.5				---	---	Determine lunar radiation field	---	---	
66.2.0 Perform photographic activities									
66.2.1				---	---	Accomplish lunar, stellar and earth photographic coverage	---	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
67.0.0 Control Vehicle Attitude for Radar Tracking of CM at LEM Apocynthion	67:38:00	00:01:00	C/C						
67.1.0 Select SCS control modes	67:38:00	00:00:10		Same as 47.1.1	through 47.1.2				
67.2.0 Control vehicle attitude	67:38:10	00:00:50		Same as 47.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
68.0.0 Track CM With Tracking Radar	67:39:00	00:02:05	C/C						
68.1.0 Adjust optics	67:39:00	00:00:25		Same as 48.1.1 through 48.1.5					
68.2.0 Slave radar to SCT	67:39:25	00:00:05		Same as 48.2.1					
68.3.0 Acquire CM in SCT	67:39:30	00:00:05		Same as 48.3.1 through 48.3.3					
68.4.0 Lock radar to CM	67:40:35	00:00:25		Same as 48.4.1 through 48.4.2					
68.5.0 Determine range parameters	67:41:00	00:00:05							
68.5.1				Range and range rate	R and $\dot{R}$ indicators	Check R and $\dot{R}$ to CM	---	---	

Report No. LED 480-3
Date 7/12/63

PHASE NUMBER: COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
69.0.0 Re-Establish Constant Inertial Attitude	67:41:05	00:01:10	C/C						
69.1.0 Determine attitude requirements	67:41:05	00:00:20		Same as 60.1.1					
69.2.0 Control vehicle attitude	67:41:25	00:00:50		Same as 60.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
70.0.0 Control Vehicle Attitude for Radar Tracking of CM	67:53:00	00:01:00	C/C						
70.1.0 Select SCS control modes	67:53:00	00:00:10		Same as 47.1.1 through 47.1.2					
70.2.0 Control vehicle attitude	67:53:10	00:00:50		Same as 47.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
71.0.0 Track CM with Tracking Radar	67:54:00	00:02:05	LC/C						
71.1.0 Adjust optics	67:54:00	00:00:25		Same as 48.1.1 through 48.1.5					
71.2.0 Slave radar to SCT	67:54:25	00:00:05		Same as 48.2.1					
71.3.0 Acquire CM in SCT	67:54:30	00:00:05		Same as 48.3.1 through 48.3.3					
71.4.0 Lock radar to CM	67:55:35	00:00:25		Same as 48.4.1 through 48.4.2					
71.5.0 Determine range parameters	67:56:00	00:00:05							
71.5.1				Range and range rate	R and $\dot{R}$ indicators	Check R and $\dot{R}$ to CM	---	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
72.0.0 Re-Establish Constant Inertial Attitude	67:56:05	00:01:10	C/C						
72.1.0 Determine attitude requirements	67:56:05	00:00:20		Same as 60.1.1					
72.2.0 Control vehicle attitude	67:56:25	00:00:50		Same as 60.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
73.0.0 Remove and Replace LiOH Cannister	68:00:00	00:00:45	SE/SE-A-T						
73.1.0 Monitor condition of CO_2 removal	68:00:00	00:00:05	SE/SE						
73.1.1				One LiOH warning light illuminated. Partial pressure indicator reads below 7.6 mm/hg.	Light-indicator	Check LiOH status	---	---	
73.2.0 Stand in aisle	68:00:05	00:00:05	SE/SE-A						
73.2.1				Procedure	---	Turn on dome light and unlatch seat restraint harness and stand up	DOME LIGHTING toggle to ON. Depress and twist lever on harness	---	
73.3.0 Proceed to LiOH cannisters and check	68:00:10	00:00:10	SE/T						
73.1.1				Color of chemical in cannister. New cannister checks out.	Window in cannister	Crawl into tunnel and check cannisters with flashlight.	LiOH selector valve to unilluminated cannister	---	
73.4.0 Change cannister	68:00:20	00:00:15	SE/T						
73.4.1				Procedure	---	Unscrew collar; remove used cannister; insert unused cannister; screw down collar	---	---	When LiOH light indicates saturation of other cannister, the newly inserted cannister will be ready to carry the CO_2 removal requirements.
73.5.0 Return to duty station	68:00:35	00:00:10	SE/SE						
73.5.1				Procedure	---	Crawl back to aisle, take seat and secure. Turn off dome lighting.	DOME LIGHTING toggle to OFF. Engage locking lever on restraint harness.	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
74.0.0 Transmit to GOSS LEM Subsystem Performance Data and Crew Messages Recorded During Communications Black-Out	68:05:00	00:02:40	SE/SE						
74.1.0 Re-establish communication link with GOSS	68:05:00	00:00:30							
74.1.1				LEM/GOSS communications re-established at 68:05:00	---	Acknowledge communication contact established with GOSS via UHF voice link	---	---	
74.1.2				Procedure	---	Inform GOSS via UHF of intentions to transmit tape recorded data.	---	---	
74.2.0 Establish tape recorder operating conditions	68:05:30	00:02:10							
74.2.1				Procedure	---	Re-wind tape	TRANSPORT toggle to REVERSE	Tape re-winds.	
74.2.2				Procedure	---	Select tape play-back speed	SPEED toggle to FAST	---	
74.2.3				Procedure	---	Start play-back of stored information	MODE toggle to PLAY	Play-back transmitted to GOSS	

PHASE NUMBER: COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
75.0.0 Orient LEM Attitude for IMU Fine Alignment	68:09:00	00:01:30	C/C						
75.1.0 Determine relative position and coordinates of target star #1	68:09:00	00:00:20							
75.1.1				Celestial coordinates of target star #1	DATA CHART	Determine target star #1 coordinates	---	— — —	
75.2.0 Select SCS control modes	68:09:20	00:00:10							
75.2.1				Procedure	---	Select attitude hold SCS mode	ATTITUDE MODE toggles to ATTITUDE MODE	Correct SCS mode selected	
75.2.2				Procedure	---	Select proper deadband limits	DEADBAND toggles to MINIMUM position	Correct limit cycling mode selected	
75.3.0 Control vehicle attitude	68:09:30	00:01:00							
75.3.1				Attitude angles required to orient vehicle to target star #1	DATA CHART, ATTITUDE indicators.	Control vehicle attitude to achieve proper orientation for target star #1	ATTITUDE CONTROLLER	Correct vehicle attitude achieved for star sighting	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
76.0.0 Align IMU	68:10:30	00:20:00	C/C						
76.1.0 Fine align IMU to inertial co-ordinates	68:10:30	00:20:00							
76.1.1				IMU fine align program: Code # Noun Verb	DATA CHART	Insert IMU fine align program into computer	Computer key-board push-buttons	Program entered into computer keyboard	
76.1.2				IMU fine align program: Code # Noun Verb	Computer digital indicators	Enter program into computer and verify entry	COMPUTER ENTER pushbutton	IMU fine align program correctly entered.	
76.1.3				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	---	
76.1.4				Procedure	SCT angular readout indicator	Verify optics zeroed	---	---	
76.1.5				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
76.1.6				Checklist	---	Rotate SCT eye-piece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
76.1.7				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	Fast optics speed selected	
76.1.8				Celestial coordinates of target star #1	DATA CHART	Determine target star #1 coordi-nates	---	---	
76.1.9				Celestial coordinates of target star #1	DATA CHART	Request CM to maneuver to required attitude	---	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
76.1.10				LEM attitude angle	ATTITUDE indicators	Monitor LEM attitude change	---	---	LEM positioned to correct attitude for IMU fine alignment
76.1.11				Star position in 60° field of view	DATA CHART. Direct visual in SCT reticle	Sight target star #1 and verify image	TRUNNION and SHAFT SLEW controls	---	
76.1.12				Star position in center of 60° field of view	Direct visual in SCT reticle	Center target star #1 in center of 60° field of view	TRUNNION and SHAFT SLEW controls	---	
76.1.13				Checklist	---	Rotate SCT eyepiece mechanism to 20° field of view position	FIELD of VIEW selector to 20°	---	
76.1.14				Checklist	---	Select slow optics speed	OPTICS SPEED toggle to SLOW	---	
76.1.15				Star position in 20° field of view	DATA CHART and direct visual in SCT reticle	Sight target star #1 and verify image	TRUNNION and SHAFT SLEW controls	---	
76.1.16				Star position in center of 20° field of view	Direct visual in SCT reticle	Center target star #1 in center of 20° field of view	TRUNNION and SHAFT SLEW controls	---	
76.1.17				Star position in center of 20° field of view	Direct visual in SCT reticle	Enter target star #1 coordinates when star is centered in 20° field of view	COMPUTER MARK push-button	Star coordinates entered into computer	
76.1.18				Target star #1 code #	DATA CHART. Computer digital indicators	Insert code # for target star #1 into computer and verify	Computer key-board push-buttons	Target star #1 code # correctly entered	

PHASE NUMBER: 4 COMPUTER REPORT TRANSFER CHART

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
76.1.19				Same as 76.1.11		Sight,			
76.1.20				Same as 76.1.12		center,			
76.1.21				Same as 76.1.13		and			
76.1.22				Same as 76.1.14		record			
76.1.23				Same as 76.1.15		target			
76.1.24				Same as 76.1.16		star #2			
76.1.25				Same as 76.1.17					
76.1.26				Same as 76.1.18					
76.1.27				Fine alignment of IMU achieved	FINE ALIGN light illuminates green	Check that IMU fine aligned	---	IMU fine alignment achieved. Error signals, representing the differences between IMU gimbal angles and CDU angles, drive the CDUs into alignment with the IMU gimbals. The CDUs are slaved to and repeat the IMU gimbal angles. Incremental digital encoders attached to the CDU motor shafts transmit IMU gimbal orientation to the computer.	
76.1.28				Same as 76.1.11					
76.1.29				Same as 76.1.12		Re-sight,			
76.1.30				Same as 76.1.13		center,			
76.1.31				Same as 76.1.14		and			
76.1.32				Same as 76.1.15		record			

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
76.1.33				Same as 76.1.16		target			
76.1.34				Same as 76.1.17		star #1			
76.1.35				Same as 76.1.18					
76.1.36				Same as 76.1.27					

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
77.0.0 Control Vehicle Attitude for Tracking Landmark #1	68:31:35	00:01:00	C/C						
77.1.0 Select SCS control modes	68:31:35	00:00:10		SAME AS 50.1.1 THRU 50.1.2					
77.2.0 Control vehicle attitude	68:31:45	00:00:50		SAME AS 50.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
78.0.0 Perform Lunar Orbit Navigational Fix on Landmark #1 to Update Orbit	68:32:35	00:05:00	C/C						
78.1.0 Program computer	68:32:35	00:00:40		SAME AS 51.1.1 THRU 51.1.5					
78.2.0 Adjust optics	68:33:15	00:00:25		SAME AS 51.2.1 THRU 51.2.5					
78.3.0 Acquire landmark #1 in SCT	68:33:40	00:02:00		SAME AS 51.3.1 THRU 51.3.8					
78.4.0 Record landmark #1 coordinates	68:35:40	00:01:30		SAME AS 51.4.1 THRU 51.4.4					
78.5.0 Determine updated orbital parameters	68:37:10	00:00:25		SAME AS 51.5.1 THRU 51.5.4					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
79.0.0 Control Vehicle Attitude for Tracking Landmark #2	68:39:35	00:01:00	C/C						
79.1.0 Select SCS control modes	68:39:35	00:00:10		SAME AS 50.1.1 THRU 50.1.2					
79.2.0 Control vehicle attitude	68:39:45	00:00:50		SAME AS 50.2.1					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Functions and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
80.0.0 Perform Lunar Orbit Navigational Fix on Landmark #2 for Final Updating of Orbit	68:40:35	00:05:00	C/C						
80.1.0 Program computer	68:40:35	00:00:40		SAME AS 51.1.1 THRU 51.1.5					
80.2.0 Adjust optics	68:41:15	00:00:25		SAME AS 51.2.1 THRU 51.2.5					
80.3.0 Acquire landmark #2 in SCT	68:41:40	00:02:00		SAME AS 51.3.1 THRU 51.3.8					
80.4.0 Record landmark #2 coordinates	68:43:40	00:01:30		SAME AS 51.4.1 THRU 51.4.4					
80.5.0 Determine final updated orbital parameters	68:45:10	00:00:25		SAME AS 51.5.1 THRU 51.5.4					

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
81.0.0 Prepare for Powered Descent	68:45:35	00:02:25							
81.1.0 Determine updated powered descent parameters and select automatic guidance modes	68:45:35	00:00:35	C/C						
81.1.1				ΔV call-up code #	DATA CHART	Insert ΔV call-up code # into computer keyboard	Computer keyboard push-buttons	Information entered into computer keyboard	
81.1.2				ΔV call-up code #	Computer digital indicators	Enter ΔV call-up code # into computer and verify	COMPUTER CALL-UP pushbutton	Computer interrogated and entry verified	
81.1.3				Procedure	Computer digital indicators	Read ΔV required for thrusting	---	---	
81.1.4				ΔV required	ΔV REMAINING digital indicators	Insert ΔV required into ΔV panel	ΔV SET thumbwheel	ΔV monitoring capability established	
81.1.5				Checklist	EVENTS TIMER	Check time to ΔV thrusting	---	---	
81.1.6				Procedure	---	Select deadband limits	DEADBAND toggle to MINIMUM	Correct limit cycling mode selected	
81.1.7				Procedure	---	Select automatic guidance mode for SCS	ATTITUDE MODE toggles to GUIDANCE	Correct SCS control mode selected and vehicle is automatically oriented to the programmed attitude	
81.1.8				Procedure	ALTITUDE indicator	Check present altitude	---	---	
81.2.0 Check that correct attitude maintained for retro-thrusting	68:46:10 68:47:20 68:47:30	00:00:40 00:00:05 00:00:30	C/C						
81.2.1				Automatic vehicle orientation accomplished subsequent to selection of automatic guidance mode	Commanded and actual ATTITUDE AND ATTITUDE RATE indicators	Check attitude requirements	---	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
81.3.0 Secure self and cabin interior	68:46:50	00:00:30	C/C; SE/SE						
81.3.1				Checklist	---	Visually check cabin interior to insure items are secure	---	---	
81.3.2				Checklist	---	Visually check that restraint harness is secure	Harness latching levers	---	
81.3.3				Checklist	---	Slide faceplate to closed position and turn locking knob. Close DIVERTER VALVE, SUIT CIRCUIT RELIEF VALVE AND CABIN GAS RETURN VALVE	Locking knob	Faceplate is closed. Suit is a closed circuit	
81.4.0 Start countdown to retro-thrusting	68:47:20	00:00:40	SE/SE						
81.4.1				Checklist	EVENTS TIMER	Check and countdown time to retro-thrusting	---	---	
81.4.2				Procedure	EVENTS TIMER	Countdown time to retro-thrusting	---	---	
81.5.0 Set descent engine thrust level	68:47:25	00:00:05	C/C						
81.5.1				SE countdown	---	Select appropriate thrust level for descent engine	THRUST CONTROLLER to appropriate thrust position	---	Ready to fire descent engine

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
82.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/SE						
82.1.0 Monitor subsystem master warning lights		00:00:05							
82.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
82.2.0 Monitor electrical system status		00:00:40							
82.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
82.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1,2 and 3	---	
82.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1,2,3) extinguished	Check N_2 Fail warning indicators	---	---	
82.2.4				Normal operating levels	AMMETER	Check fuel cell #1,2,3 and main bus current	MONITOR SELECT rotary (amps) to FC 1,2,3 and BUS A	---	
82.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
82.2.6				Normal operating temperature level	INVERTER No. 1 TEMP. warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to NO.1	---	
82.2.7				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
82.3.0 Monitor environmental control system status		00:01:15							
82.3.1				Maximum 1100 psia Normal 850 psia Minimum 7 psia	SOX PRESSURE indicator	Monitor SOX pressure	---	---	If low SOX pressure, turn on SOX heater until pressure builds up. If still no go, check O_2 inflow lights; if illuminated, select manual, and pulse until pressure builds-up
				Normal operating level	SOX QUANTITY indicator	Monitor SOX quantity	---	---	
				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
82.3.2				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator, and glycol temp. warning indicators	---	---	If a light illuminates, that particular H_2O separator or LiOH system is malfunctioning; select alternate system
82.3.3				Pressure reading of 5.0 psia	CABIN PRESSURE indicator	Check cabin pressure	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia	If #1 inflow valve fails; O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates. If #2 inflow valve fails in automatic, place #1 O_2 inflow valve toggle to MANUAL. If #1 light illuminates, place #2 O_2 inflow valve toggle to MANUAL
82.3.4				Cabin temperature is within $75^{o}F \pm 5^{o}$	CABIN TEMPERATURE indicator	Check cabin temperature	---	The cabin is checked out at normal temperature	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly.
82.3.5				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 flood status	---	Cabin oxygen flooding is normal	
82.3.6				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	
823.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator	Check suit fan warn indicator	---	Suit fan functioning properly	
82.4.0 Monitor descent propulsion system status		00:00:15							

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
82.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
82.4.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL AND OXID) extinguished	Check relief valve warning indicators	---	---	
82.4.3				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS. HELIUM TEMP.	Check tank quantities, pressures and temperatures	---	---	
82.5.0 Monitor ascent propulsion system status		00:00:15							
82.5.1				Ascent system monitoring	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	---	
82.5.2				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
82.5.3				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
82.5.4				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2)	Check tank quantities, pressures and temperatures	---	---	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description		Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
						FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS				
82.6.0 Monitor RCS status			00:00:15							
	82.6.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	---	---	
	82.6.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	
	82.6.3				Normal operating levels	TANK METERS: FUEL & OXID QTY; FUEL & OXID. PRESS; HELIUM PRESS & TEMP.	Check System A & B tank quantities, pressures and temperatures	---	---	
	82.6.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
82.7.0 Monitor navigation and guidance system status			00:00:20							
	82.7.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature	---	---	
	82.7.2				IMU power operating levels within normal limits	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	---	
	82.7.3				All warning lights extinguished.	WARNING INDICATORS: RUPT LOCK,	Check computer operating status	---	Computer maintained in self-checking mode	

PHASE NUMBER: 4 COASTING DESCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
				Computer functioning properly	TCA TRAP, CROSS POINT FAIL, SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY				
82.7.4				---	---	Check CDU operating status	---	---	
82.8.0 Monitor stabilization and control system status		---	TO	BE	DETERMINED	---	---	---	

Report No. LED 400-5
Date 7/12/63

Phase 5 POWERED DESCENT

From 68:48:00 To 68:54:00

Elapsed Time 6 min.

Commander	Mission Time
83.0.0 Monitor Powered Descent Parameters from Initial Powered Descent to Flare - Out	68:48:00
83.1.0 Check time of retro-thrusting	68:48:00
83.2.0 Monitor Δ V applied during retro-thrusting	68:48:05 (continuously)
83.3.0 Monitor vehicle attitude profile	68:48:05 (continuously)
83.4.0 Monitor descent engine performance during retro-thrusting	68:48:05 (continuously)
83.5.0 Monitor time to flare - out	68:48:05 (continuously)
83.6.0 Monitor range parameters	68:48:05 (continuously)
83.7.0 Monitor altitude changes	68:48:05 (continuously)
83.8.0 Monitor velocity parameters	68:48:05 (continuously)
84.0.0 Survey Landing Site	68:49:45
84.1.0 Select SCT mode	68:49:45
84.2.0 Survey site	68:49:50
83.2.0 through 83.8.0	68:50:05 (continuously)
	68:51:45
	68:51:45
86.0.0 Monitor Powered Descent Parameters from Flare-Out to Hover	68:51:50
86.1.0 Check time of flare-out	68:51:50
86.2.0 Check Δ V applied at flare-out	68:51:50
86.3.0 Check descent engine performance at flare-out	68:51:50
86.4.0 Monitor Δ V applied to hover	68:51:55 (continuously)
86.5.0 Monitor descent engine performance to hover	68:51:55 (continuously)
86.6.0 Monitor vehicle attitude profile	68:51:55 (continuously)
86.7.0 Monitor time to hover	68:51:55 (continuously)
86.8.0 Monitor range parameters	68:51:55 (continuously)
86.9.0 Monitor altitude changes	68:51:55 (continuously)
86.10.0 Monitor velocity parameters	68:51:55 (continuously)
87.0.0 Survey Landing Site	68:52:20
87.1.0 Survey site	68:52:20
86.4.0 through 86.10.0	68:52:35
88.0.0 Survey Landing Site	68:53:20
88.1.0 Survey site	68:53:20
86.4.0 through 86.10.0	68:53:35

Systems Engineer
90.0.0 Monitor LEM Systems Status
85.0.0 Check Updating of IMU at 20 n.m. Range-to-Go
85.1.0 Verify that IMU is updated with radar altimeter information
90.0.0 Monitor LEM Systems Status

Phase 5 POWERED DESCENT

From 68:48:00 To 68:54:00

Elapsed Time 6 min.

Commander	Mission Time	Systems Engineer
89.0.0 Check that Hover Conditions Achieved	68:53:50	
89.1.0 Check altitude	68:53:50	
89.2.0 Check velocity parameters	68:53:55	
Eng of phase 5	68:54:00	End of phase 5

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
83.0.0 Monitor Powered Descent Parameters from Initial Powered Descent to Flare-Out	68:48:00	00:03:50 (approximately)	C/C						
83.1.0 Check time of retro-thrusting 83.1.1	68:48:00	00:00:05		Procedure	EVENTS TIMER	Check time of retro-thrusting	---	---	
83.2.0 Monitor Δ V applied during retro-thrusting 83.2.1	68:48:05	00:03:45 Continuous		Procedure	Δ V REMAINING analog tape	Check Δ V applied	---	---	
83.3.0 Monitor vehicle attitude profile 83.3.1	68:48:05	00:03:45 Continuous		Procedure	ATTITUDE and ATTITUDE RATE Indicators	Check attitude profile	---	---	
83.4.0 Monitor descent engine performance during retro-thrusting 83.4.1	68:48:05	00:03:45 Continuous		Normal operating level	T/W RATIO meter	Check thrust-to weight ratio indicator	---	---	Immediately prior to descent engine ignition, the RCS jets will fire automatically for a few seconds in the vehicle's + x direction to settle propellant in the descent tanks, thereby accomplishing the required ullage.
83.5.0 Monitor time to flare-out 83.5.1	68:48:05	00:03:45 Continuous		Procedure	EVENTS TIMER	Check time to Flare-out	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
83.6.0 Monitor range parameters	68:48:05	00:03:45 Continuous							
83.6.1				Procedure	RANGE and RANGE RATE Indicators	Check range-to-go.	---	---	
83.7.0 Monitor altitude changes	68:48:05	00:03:45 Continuous							
83.7.1				Procedure	RADAR ALTITUDE and RADAR ALTITUDE RATE indicators	Check altitude (h) and altitude rate ($\dot{h}$)	---	---	
83.8.0 Monitor velocity parameters	68:48:05	00:03:45 Continuous							
83.8.1				Procedure	FLIGHT PATH VELOCITY indicator	Check total velocity	---	---	
83.8.2				Procedure	ALONG TRACK VELOCITY indicator	Check along track velocity ($\dot{Z}$)	---	---	
83.8.3.				Procedure	CROSS TRACK VELOCITY indicator	Check cross track velocity ($\dot{Y}$)	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
84.0.0 Survey Landing Site	68:49:45	00:00:20	C/C						
84.1.0 Select SCT mode	68:49:45	00:00:05							
84.1.1				Vehicle within observable range of landing site	---	Place SCT in computer mode	OPTICS MODE toggle to COMPUTER	SCT capability established	
84.2.0 Survey site	68:49:50	00:00:15							
84.2.1				Characteristics of landing site	Direct visual in SCT 20° field of view	View site and evaluate its suitability for landing	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
85.0.0 Check Updating of IMU at 20 nm Range-to-Go	68:51:45	00:00:05	SE/SE						
85.1.0 Verify that IMU is updated with radar altimeter information	68:51:45	00:00:05							
85.1.1				Checklist	IMU ALIGN indicator	Check that IMU is updated	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
86.0.0 Monitor Powered Descent Parameters from Flare-Out to Hover	68:51:50	00:02:00	C/C						
86.1.0 Check time of flare-out	68:51:50	00:00:05							
86.1.1				Procedure	EVENTS TIMER	Check time of flare-out	---	---	
86.2.0 Check Δ V applied at flare-out	68:51:50	00:00:05							
86.2.1				Procedure	Δ V REMAINING analog tape	Check Δ V applied	---	---	
86.3.0 Check descent engine performance at flare-out	68:51:50	00:00:05							
86.3.1				Proper Δ V profile conditions	T/W RATIO meter reading appropriate level and THRUST CONTROLLER in appropriate thrust position	Check thrust-to-weight ratio indicator and position of thrust controller	---	---	
86.4.0 Monitor Δ V applied to hover	68:51:55	00:01:55 Continuous							
86.4.1				Procedure	Δ V REMAINING analog tape	Check Δ V applied	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
86.5.0 Monitor descent engine performance to hover	68:51:55	00:01:55 Continuous							
86.5.1				Reduction in T/W ratio and corresponding changes in thrust controller position	T/W RATIO meter and THRUST CONTROLLER position	Check thrust-to-weight ratio indicator and position of thrust controller	---	---	
86.6.0 Monitor vehicle attitude profile	68:51:55	00:01:55 Continuous							
86.6.1				Procedure	ATTITUDE and ATTITUDE RATE indicators	Check attitude profile	---	---	
86.7.0 Monitor time to hover	68:51:55	00:01:55 Continuous							
86.7.1				Procedure	EVENTS TIMER	Check time to hover	---	---	
86.8.0 Monitor range parameters	68:51:55	00:01:55 Continuous							
86.8.1				Procedure	RANGE and RANGE RATE indicators	Check range-to go	---	---	
86.9.0 Monitor altitude changes	68:51:55	00:01:55 Continuous							
86.9.1				Procedure	RADAR ALTITUDE and RADAR ALTITUDE RATE indicators	Check Altitude ($\dot{h}$) and altitude rate ($\dot{h}$)	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
86.10.0 Monitor velocity parameters	68:51:55	00:01:55 Continuous							
86.10.1				Procedure	FLIGHT PATH VELOCITY indicator	Check total velocity	---	---	
86.10.2				Procedure	ALONG TRACK VELOCITY indicator	Check along track velocity (Z)	---	---	
86.10.3				Procedure	CROSS TRACK VELOCITY indicator	Check cross track velocity (Y)	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
87.0.0 Survey Landing Site	68:52:20	00:00:15	C/C						
87.1.0 Survey site	68:52:20	00:00:15							
87.1.1				Characteristics of landing site	Direct visual in SCT 20° field of view	View site and evaluate its suitability for landing	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
88.0.0 Survey Landing Site	68:53:20	00:00:15	C/C						
88.1.0 Survey site	68:53:20	00:00:15							
88.1.1				Characteristics of landing site	Direct visual in SCT 20° field of view	View site and evaluate its suitability for landing	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
89.0.0 Check that Hover Conditions Achieved	68:53:50	00:00:10	C/C						
89.1.0 Check altitude	68:53:50	00:00:05							
89.1.1				1000 ft. altitude achieved	RADAR ALTITUDE indicator	Check altitude at hover	---	---	
89.2.0 Check velocity parameters	68:53:55	00:00:05							
89.2.1				All velocity components should be zero, or near zero if there is a residual horizontal velocity	ALTITUDE RATE ($\dot{h}$) CROSS TRACK VELOCITY ($\dot{y}$) ALONG TRACK VELOCITY ($\dot{z}$) Direct visual through window	Check velocity and verify with visual check of lunar surface	---	---	Hover conditions achieved

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
90.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/SE						
90.1.0 Monitor subsystem master warning lights		00:00:05							
90.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
90.2.0 Monitor electrical system status		00:00:40							
90.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
90.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1,2, and 3	---	
90.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1, 2, 3) extinguished	Check N_2 Fail warning indicators	---	---	
90.2.4				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3 and main bus current	MONITOR SELECT rotary (amps) to FC 1,2, 3 and BUS A	---	
90.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
90.2.6				Normal operating temperature level	INVERTER No. 1 TEMP. warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to NO. 1	---	
90.2.7				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
90.3.0 Monitor environmental control system status		00:01:15							
90.3.1				Maximum 1100 psia Normal 850 psia, Minimum 7 psia	SOX PRESSURE indicator	Monitor SOX pressure	---	---	If low SOX pressure turn on SOX heater until pressure builds up. If still no go.. check O_2 inflow lights; if illuminated, select manual, and pulse until pressure builds up.
				Normal operating level	SOX QUANTITY indicator	Monitor SOX quantity	---	---	
				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.
90.3.2				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator, and glycol temp. warning indicators	---	---	If a light illuminates that particular H_2O separator or LiOH system is malfunctioning. Select alternate system

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
90.3.3				Pressure reading of 5.0 psia	CABIN PRESSURE indicator	Check cabin pressure	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates. If #2 inflow valve fails in automatic, place #1 O_2 inflow valve toggle to MAN. If #1 light illuminates, select #2 O_2 inflow toggle to MAN.
90.3.4				Cabin temperature is within 75°F ± 5°	CABIN TEMPERATURE indicator	Check cabin temperature	--- ---	The cabin is checked out at normal temperature	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly
90.3.5				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 flood status	---	Cabin oxygen flooding is normal.	
90.3.6				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	If cabin temperature is low or high, rotate cabin temperature control thumb wheel to compensate accordingly
90.3.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator extinguished	Check suit fan warn indicator	---	---	
90.4.0 Monitor descent propulsion system status		00:00:15							
90.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description		Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
	90.4.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
	90.4.3				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS. HELIUM TEMP.	Check tank quantities, pressures and temperatures	---	---	
90.5.0 Monitor ascent propulsion system status			00:00:15							
	90.5.1				Ascent system monitoring	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	---	
	90.5.2				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN light (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
	90.5.3				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
	90.5.4				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS.	Check tank quantities, pressures and temperatures	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description		Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
90.6.0 Monitor RCS status			00:00:15							
	90.6.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	---	---	
	90.6.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	
	90.6.3				Normal operating levels	TANK METERS: FUEL & OXID QTY; FUEL & OXID. PRESS; HELIUM PRESS. & TEMP.	Check System A & B tank quantities, pressure and temperatures	---	---	
	90.6.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
90.7.0 Monitor navigation and guidance system status			00:00:20							
	90.7.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature	---	---	
	90.7.2				IMU power operating levels within normal limits	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	---	
	90.7.3				All warning lights extinguished. Computer functioning properly	WARNING INDICATORS: RUPT LOCK, TCA TRAP, CROSS POINT FAIL, SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY	Check computer operating status	---	Computer maintained in self-checking mode	
	90.7.4				---	---	Check CDU operating status	---	---	

PHASE NUMBER: 5 POWERED DESCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
90.8.0 Monitor stabilization and control system status		---	TO	BE DETERMINED	---				

Phase 6 - HOVER AND LANDING

From 68:54:00 To 68:56:00

Elapsed Time 2 minutes

Commander	Mission Time	Systems Engineer
91.0.0 Take-Over Manual Control of Vehicle	68:54:00	
91.1.0 Check hover parameters	68:54:00	91.2.0 Check propellant quantity remaining in descent system and RCS
	68:54:05	92.0.0 Deploy Landing Aids and Check Terrain Slope
	68:54:05	92.1.0 Release instrumented pentrometer
91.3.0 Select SCS manual control modes	68:54:10	92.2.0 Release visual landing aids
	68:54:15	92.3.0 Interrogate pentrometer
91.4.0 Survey site (continuous)	68:54:20	92.4.0 Check terrain slope
91.5.0 Roll vehicle, if necessary, to survey area adjacent to landing site	68:54:20	
94.0.0 Control Slant Range Landing	68:54:30	93.0.0 Monitor Critical Parameters to Touchdown
94.1.0 Control vehicle translation and check maneuver (continuous)	68:54:30	93.1.0 Monitor subsystem master warning lights (continuous)
94.2.0 Control vehicle descent and check maneuver (continuous)	68:54:30	93.2.0 Monitor propellant quantity remaining in descent system and RCS (continuous)
	68:54:30	93.3.0 Start countdown to touchdown
94.3.0 Touchdown on lunar surface	68:55:55	94.3.0 Touchdown on lunar surface
End of Phase 6	68:56:00	End of Phase 6

PHASE NUMBER: 6 HOVER AND LANDING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
91.0.0 Take-Over Manual Control of Vehicle	68:54:00	00:00:30							
91.1.0 Check hover parameters	68:54:00	00:00:10	C/C						
91.1.1				1000 ft. altitude achieved	RADAR ALTITUDE indicator	Check altitude at hover	---	---	
91.1.2				All velocity component indicators read zero (or near zero, if there is a residual horizontal velocity)	ALTITUDE (h) ALTITUDE RATE (ḣ) CROSS TRACK VELOCITY (Ẏ) ALONG TRACK VELOCITY (Ż) Direct visual through window.	Check velocity parameters and verify with visual check of lunar surface.	---	---	Hover conditions verified.
91.2.0 Check propellant quantity remaining in descent system and RCS	68:54:00	00:00:05	SE/SE						
91.2.1				Procedure	FUEL & OXID TANK meters associated with descent system and RCS	Check propellant quantity remaining	---	---	
91.3.0 Select SCS manual control modes	68:54:10	00:00:10	C/C						
91.3.1				Procedure	---	Select attitude hold mode for roll control and attitude command mode for pitch and yaw control.	ROLL ATTITUDE MODE to HOLD. PITCH and YAW ATTITUDE MODE toggles to ATTITUDE COMMAND	Correct manual SCS control modes selected.	
91.3.2				Procedure	---	Select deadband limits for roll control	ROLL DEADBAND toggle to MINIMUM	Correct limit cycling for roll control selected.	
91.3.3				Procedure	---	Select translation mode.	TRANSLATION MODE toggle to MAXIMUM	Correct translation mode selected.	

PHASE NUMBER: 6 HOVER AND LANDING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
91.4.0 Survey site	68:54:20	Continuous	C/C						
91.4.1				SCT in computer mode of operation. Lunar surface characteristics	Direct visual in SCT 20° field of view	View site through SCT and evaluate	---	---	SCT locked on landing site.
91.4.2				Lunar surface characteristics	Direct visual through window.	View site directly through window and evaluate surface	---	---	
91.5.0 Roll vehicle, if necessary, to survey area adjacent to landing site	68:54:20	00:00:10	C/C						
91.5.1				Procedure	Direct visual through window.	Control roll maneuver	ATTITUDE CONTROLLER	---	Areas adjacent to landing site surveyed.

PHASE NUMBER: 6 HOVER AND LANDING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
92.0.0 Deploy Landing Aids and Check Terrain Slope	68:54:05	00:00:25	SE/SE						
92.1.0 Release instrumented pentrometer	68:54:05	00:00:05							
92.1.1				Procedure	---	Release instrumented pentrometer.	---	Pentrometer released.	Assumed free-fall of approximately 10 seconds to lunar surface.
92.2.0 Release visual landing aids	68:54:10	00:00:05							
92.2.1				Procedure	---	Release visual landing aids (flares or lights)	---	Improved visibility of landing site established.	
92.3.0 Interrogate pentrometer	68:54:15	00:00:05							
92.3.1				Procedure	---	Interrogate pentrometer.	---	Surface hardness and (possibly) sub-surface radiation determined.	
92.4.0 Check terrain slope	68:54:20	00:00:10							
92.4.1				Terrain slope not to exceed 11°	---	Check terrain slope.	---	Terrain slope determined.	

PHASE NUMBER: 6 HOVER AND LANDING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
93.0.0 Monitor Critical Parameters to Touchdown	68:54:30	00:01:30	SE/SE						
93.1.0 Monitor subsystem master warning lights	68:54:30	Continuous							
93.1.1				Subsystems status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
93.2.0 Monitor propellant quantity remaining in descent system and RCS	68:54:30	Continuous							
93.2.1				Procedure	FUEL & OXID TANK meters associated with descent system and RCS.	Check propellant quantity remaining.	---	---	
93.3.0 Start countdown to touchdown	68:54:30	Continuous							
93.3.1				Duration of landing window	EVENTS TIMER	Countdown time to touchdown	---	---	

PHASE NUMBER: 6 HOVER AND LANDING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
94.0.0 Control Slant Range Landing	68:54:30	00:01:30							
94.1.0 Control vehicle translation and check maneuver.	68:54:30	Continuous	C/C						
94.1.1				Translation rates must be within prescribed limits to insure safe impact at touchdown when V_H must be $\leq$ 5 fps. and pitch/yaw axes must be $\leq \pm 5°$.	ATTITUDE CROSS TRACK ($\dot{Y}$) ALONG TRACK ($\dot{Z}$) and ALTITUDE RATE ($\dot{h}$) indicators. ALTITUDE (h) indicator. Direct visual through window.	Pitch or yaw vehicle to establish thrust vector along Z or Y axes, respectively, and operate descent engine throttle to provide thrust for translation.	ATTITUDE CONTROLLER and THRUST CONTROLLER	Vehicle translation accomplished.	To avoid terrain obstacles at lower altitudes, translation is accomplished by providing translational thrust with the RCS.
94.2.0 Control vehicle descent and check maneuver	68:54:30	Continuous	C/C						
94.2.1				Descent rate must be within prescribed limits to insure safe impact at touchdown when V_v must be $\leq$ 10 fps.	ATTITUDE indicator. ALTITUDE (h) and ALTITUDE RATE ($\dot{h}$) indicators. Direct visual through window.	Manually operate descent engine throttle to reduce altitude.	THRUST CONTROLLER.	Vehicle descent accomplished.	
94.3.0 Touchdown on lunar surface	68:55:55	00:00:05							
94.3.1			C/C; SE/SE	Initial evaluation of impact	Auditory and/or kinesthetic cues.	Note any unusual sounds and/or vibrations upon impact.	---	---	
94.3.2			C/C	Impact on lunar surface	---	Manually cutoff descent engine at impact.	ENGINE CONTROL STOP guarded push-button	Descent engine cutoff	

PHASE NUMBER: 6 HOVER AND LANDING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
94.3.3			SE/SE	Procedure	---	Report landing completed to CM/GOSS	---	Landing reported via VHF/UHF communications link	

Phase 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS — **From 68:56:00 to 70:11:00** — **Elapsed Time 1 hr. 15 min.**

Commander	Mission Time	Systems Engineer
95.0.0 Establish Ascent Conditions	68:56:00	95.0.0 Establish Ascent Conditions
95.1.0 Check vehicle attitude to determine terrain slope and vehicle stability	68:56:00	95.2.0 Verify LEM/CM and LEM/GOSS voice communication links
95.3.0 Determine ascent trajectory parameters	68:56:10	95.4.0 Shutdown descent system
	68:56:15	95.5.0 Check stage separation capability
95.6.0 Select automatic guidance mode	68:56:30	
	68:56:35	95.7.0 Check ascent system status
95.8.0 Determine CM's orbital parameters	68:56:40	
	68:56:50	95.9.0 Check LEM system status
95.10.0 Report to CM/GOSS that ascent conditions established	68:56:55	
No assigned activity	68:57:00	96.0.0 Perform Complete Systems Check-Out With IFTS
	68:57:00	96.1.0 Perform systems checkout in automatic test mode
	68:59:00	97.0.0 Perform Descent System Check and Report to GOSS/CM
	68:59:00	97.1.0 Report to GOSS/CM magnitude of remaining descent consumables
98.0.0 Check-Out ECS Suit Circuit	68:59:30	98.0.0 Check-Out ECS Suit Circuit
98.1.0 Check suit circuit	68:59:30	98.1.0 Check suit circuit
No assigned activity	69:00:00	98.2.0 Transfer to cabin environment
98.2.2 Open face plate	69:00:15	
99.0.0 Determine Feasibility of Conducting Lunar Surface Operations	69:00:20	110.0.0 Monitor LEM Systems Status
99.1.0 Set up SCT	69:00:20	
99.2.0 Determine lunar surface condition	69:00:35	99.2.1 Operate flashlamp to aid Commander's visual observation of lunar surface conditions
99.3.0 Determine physiological condition of crew	69:01:35	100.0.0 Prepare to Check-Out Portable Systems
	69:01:35	100.1.0 Release self from seat
No assigned activity	69:01:40	
	69:01:55	101.0.0 Check-Out Lunar Stay Portable Equipment
	69:01:55	101.1.0 Check-out both PLSS units
	69:02:10	101.2.0 Check-out SE belt-pack communications system
	69:02:35	102.0.0 Return to SE Position
	69:02:35	102.1.0 Take SE station
103.0.0 Coordinate With GOSS Regarding Feasibility of Conducting Lunar Surface Operations	69:02:50	110.0.0 Monitor LEM Systems Status
103.1.0 Inform GOSS of intention to perform lunar surface activities	69:02:50	
104.0.0 Activate Tape Recorder	69:03:45	
104.1.0 Establish tape recorder operating conditions	69:03:45	

Phase 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS — **From 68:56:00 to 70:11:00** — **Elapsed Time 1 hr. 15 min.**

Commander	Mission Time	Systems Engineer
	69:03:50	105.0.0. Place LEM Systems in Lunar Stay Mode
	69:03:50	105.1.0 Disarm RCS
104.2.0 Start tape recorder	69:04:00	105.2.0 Expel RCS propellant downstream of thruster isolation valves
No assigned activity	69:04:05	
	69:05:00	105.3.0 De-activate electrical loads for RCS
	69:05:05	105.4.0 De-activate electrical loads for ascent system
	69:05:10	105.5.0 Turn off power to N & G system
	69:05:20	105.6.0 Turn off power to S & C system
	69:05:30	105.7.0 Turn off power to VHF communications system
	69:05:35	105.8.0 De-activate DC distribution
	69:05:40	105.9.0 Place fuel cell #1 to standby status
	69:05:50	105.10.0 Check fuel cell electrical output
106.0.0 Determine Unscheduled Maintenance to be Performed	69:06:05	106.0.0 Determine Unscheduled Maintenance to be Performed
106.1.0 Determine task requirements	69:06:05	106.1.0 Determine task requirements
106.2.0 Determine equipment requirements	69:26:05	106.2.0 Determine equipment requirements
107.0.0 Determine Scheduled Inspections and Adjustments	69:36:05	107.0.0 Determine Scheduled Inspections and Adjustments
107.1.0 Determine task requirements	69:36:05	107.1.0 Determine task requirements
107.2.0 Determine equipment requirements	69:41:05	107.2.0 Determine equipment requirements
108.0.0 Determine Scientific Activities to be Performed	69:46:05	108.0.0 Determine Scientific Activities to be Performed
108.1.0 Determine task requirements	69:46:05	108.1.0 Determine task requirements
108.2.0 Determine equipment requirements	69:51:05	108.2.0 Determine equipment requirements
109.0.0 Prepare for Egress to Lunar Surface	69:56:05	110.0.0 Monitor LEM Systems Status
109.1.0 Check-out Commander's communications belt-pack	69:56:05	
109.2.0 Attach radiation dosimeter to pressure suit	69:57:15	
109.3.0 Stand in aisle	69:57:20	
109.4.0 Prepare equipment to be lowered to lunar surface	69:57:30	
109.5.1 Slide faceplate closed and turn locking knob	70:10:30	109.5.0 Transfer to suit circuit
No assigned activity	70:10:40	
End of phase 7	70:11:00	End of phase 7

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
95.0.0 Establish Ascent Conditions	68:56:00	00:01:00							
95.1.0 Check vehicle attitude to determine terrain slope and vehicle stability	68:56:00	00:00:10	C/C						
95.1.1				Checklist	Attitude indicators	Check vehicle attitude	---	---	
95.1.2				Checklist	Direct visual	Visually determine vehicle stability	---	---	
95.2.0 Verify LEM/CM and LEM/GOSS voice communication links	68:56:00	00:00:10	SE/SE						
95.2.1				Procedure	---	Acknowledge voice link contact with GOSS via UHF and CM via VHF	---	---	Assume LEM/CM communications black-out approx. 8 minutes after lunar touchdown
95.3.0 Determine ascent trajectory parameters	68:56:10	00:00:20	C/C						
95.3.1				Checklist	---	Read ascent parameters call-up code #	---	---	
95.3.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard push-buttons	---	
95.3.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER push-button	Call-up code # entered into computer	
95.3.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate.	Digital indicators	Read ascent parameters	---	---	
95.4.0 Shutdown descent system									
95.4.1	68:56:10	00:00:05	SE/SE	Checklist	---	De-energize electrical load for descent system	DESCENT PROPULSION POWER toggle to OFF	Electrical power removed from descent propulsion system.	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
95.5.0 Check stage separation capability	68:56:15	00:00:20	SE/SE						
95.5.1				Checklist	---	Check continuity to stage separation explosive bolts	---	---	
95.5.2				Checklist	---	Check subsystem stage disconnect capability	---	---	
95.6.0 Select automatic guidance mode	68:56:30	00:00:10	C/C						
95.6.1				Checklist	---	Select guidance mode for SCS control	ATTITUDE MODE toggles to GUIDANCE	Correct manual SCS control mode selected	
95.6.2				Checklist	---	Select proper deadband limit	DEADBAND toggle to MINIMUM	Correct limit cycling mode selected	
95.7.0 Check ascent system status	68:56:35	00:00:15	SE/SE						
95.7.1				Checklist	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	---	
95.7.2				Normal operating levels	TANK METERS FUEL QTY. (1 & 2) OXID. QTY. (1 & 2) FUEL PRESS. OXID. PRESS. FUEL TEMP. OXID. TEMP. HELIUM TEMP. HELIUM PRESS.	Check tank quantities, pressures and temperatures	---	---	

PHASE NUMBER: 7 POST -LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
95.8.0 Determine CM's orbital parameters	68:56:40	00:00:20	C/C						
95.8.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
95.8.2				Procedure	---	Insert call-up code # into computer key-board	Computer key-board push-buttons	Call-up code # inserted into com-puter keyboard	
95.8.3				Procedure	Computer call-up digital in-dicators	Enter call-up code # and ver-ify	COMPUTER ENTER push-button	Call-up Code # entered into com-puter	
95.8.4				Orbital period (velocity or altitude) and orbital plane (angle of in-clination and longitude of orbital plane with reference to lunar equa-tor). Position in orbit (time or lunar coor-dinates with respect to some reference time).	Digital indicators	Read CM's orbi-tal parameters	---	---	CM orbital para-meters determined
95.9.0 Check LEM systems status	68:56:50	00:00:05	SE/SE						
95.9.1				Subsystem status	SUBSYSTEM WARN lights extinguish-ed	Check subsystem master warning indicators	---	---	
95.10.0 Report to CM/GOSS that ascent con-ditions established	68:56:55	00:00:05	SE/SE						
95:10.1				Procedure	---	Report to CM/GOSS that all systems are "GO" and preparations for ascent achieved	---	---	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
96.0.0 Perform Complete Systems Check-out with IFTS	68:57:00	00:02:00	SE/SE						
96.1.0 Perform systems check-out in automatic test mode	68:57:00	00:02:00							
96.1.1				Checklist	---	Select automatic test mode	IFTS MODE toggle to AUTOMATIC TEST	Automatic test mode selected	
96.1.2				If all systems GO, " 00 " appears	ALPHA-NUMERICAL STATUS DISPLAY	Activate test program and monitor	TEST pushbutton	Test program accomplished	If a NO-GO occurs, the appropriate alpha-numerical appears. Then: 1. Identify trouble spot with code book. 2. Select FAULT ISOLATION MODE. 3. Press FAULT LOCATOR pushbutton. 4. Identify malfunction to lowest re-replaceable part (panel, module or card). 5. Check-out malfunctioning component using voltmeter and oscilloscope. 6. Remove and replace. 7. Recycle in FAULT ISOLATION MODE. 8. Recycle in AUTOMATIC TEST MODE.

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
97.0.0 Perform Descent System Check and Report to GOSS/CM	68:59:00	00:00:30	SE/SE						
97.1.0 Report to GOSS/CM magnitude of remaining descent propulsion system consumables	68:59:00	00:00:30							
97.1.1				Procedure	---	Select descent mode for monitoring	MONITOR SELECT toggle to DESCENT	---	
97.1.2				Remaining tank consumables	TANK METERS: FUEL QTY. (1 & 2) OXID. QTY: (1 & 2) FUEL PRESS. OXID. PRESS. HELIUM PRESS.	Check tank quantities and pressures	---	---	
97.1.3				Procedure	---	Report remaining consumables to CM/GOSS	---	---	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
98.0.0 Check-Out ECS Suit Circuit	68:59:30	00:00:00							
98.1.0 Check suit circuit	68:59:30	00:00:30	SE/SE; C/C						
98.1.1				SUIT PRESSURE indicator reads 5.0 psia.	SUIT PRESSURE indicator	Check suit pressure	---	---	If suit pressure is not at 5.0 psia, check that pressure select switch is in 5.0 position. Check that suit circuit relief valve and cabin gas return valves are not stuck in open position.
98.1.2				Suit temperature within 45°F to 100°F range	SUIT TEMPERATURE indicator	Check suit temperature	---	---	If suit temperature is not within desired range, adjust thermostat on panel.
98.1.3				CO_2 partial pressure below 7.6 mm Hg	CO_2 PARTIAL PRESSURE indicator	Check CO_2 partial pressure	---	---	If the CO_2 partial pressure is above 7.6mm, check the LiOH lights. Switch the LiOH selector valve to the unused cannister and replace the saturated cannister.
98.1.4				Normal operating levels	H_2O QUANTITY and H_2O SEPARATOR warning lights	Check water management	---	---	If water separator light illuminates, select an operating water separator.
98.2.0 Transfer to cabin environment	69:00:00	00:00:20	SE/SE						
98.2.1				Checklist	---	Tie-in LEM cabin environment to LEM ECS	Open DIVERTER VALVE, CABIN GAS RETURN VALVE, and SUIT CIRCUIT RELIEF VALVE	LEM cabin gas is being revitalized and replenished by LEM ECS.	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
98.2.2			SE/SE C/C	Checklist	---	Open face plate	Unlock knob and slide faceplate up	---	Faceplate open. C and SE maintained by cabin environment.

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
99.0.0 Determine Feasibility of Conducting Lunar Surface Operations	69:00:20	00:01:20							
99.1.0 Set up SCT	69:00:20	00:00:15	C/C						
99.1.1				Checklist	---	Place SCT in manual mode	OPTICS MODE toggle to MANUAL	SCT manual mode selected	
99.1.2				Checklist	---	Rotate SCT eye piece mechanism to 20° field of view	FIELD OF VIEW selector to 20°	Capability established for observation of lunar surface conditions.	
99.1.3				Checklist	---	Select slow speed	OPTICS SPEED toggle to SLOW	Slow optics speed selected	
99.2.0 Determine lunar surface condition	69:00:35	00:01:00							
99.2.1			SE/SE	Checklist	---	Operate flash-lamp to aid Commander's visual observation of lunar surface conditions	---	---	
99.2.2			C/C	Penetration depth and lunar surface characteristics	Direct visual in SCT 20° field of view	Observe, if necessary, depth that forward landing gear sank into lunar surface and observe lunar surface characteristics through SCT	SCT TRUNNION and SHAFT controls	---	Commander instructs Systems Engineer to position flash-lamp into desired areas.
99.2.3			C/C	Checklist	Radiation counter located in LEM	Check lunar radiation level	---	---	
99.3.0 Determine physiological condition of crew	69:01:35	00:00:05	C/C						
99.3.1				Physiological condition of crew	---	Check bio-medical status of crew	---	---	Bio-medical status derived from crew's subjective interpretation

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
100.0.0 Prepare to Checkout Portable Systems	69:01:35	00:00:20	SE/SE-A						
100.1.0 Release self from seat	69:01:35	00:00:20							
100.1.1				Procedure	---	Turn on dome lighting and unlatch seat restraint harness	DOME LIGHTING toggle to ON. Depress and twist lever on harness	---	
100.1.2				Procedure	---	Disengage from PLSS	Unsnap buckles	---	PLSS umbilical remains connected to suit
100.1.3				Procedure	---	Stand in aisle	---	---	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
101.0.0 Check-Out Lunar Stay Portable Equipment	69:01:55	00:00:40	SE/A						
101.1.0 Check-out both PLSS units	69:01:55	00:00:15							
101.1.1				PLSS water bladder is full for both units	---	Check water quantity	Unscrew cap	---	
101.1.2				Both PLSS O_2 chamber pressure indicating properly	O_2 press. indicators on PLSS.	Check PLSS oxygen pressure	---	---	
101.1.3				Checklist	---	Check PLSS battery status for both units	---	---	
101.2.0 Check-out SE belt pack communications system	69:02:10	00:00:25							
101.2.1				Checklist	---	Disconnect communications umbilical from console jack-box and connect to belt-pack	---	---	SE is on belt-pack communications to transmit, and receive voice communications and transmit bio-med status
101.2.2				Checklist	---	Check duplex capability by voice communication acknowledgement with CM, GOSS and Commander	Select duplex mode	---	SE belt-pack duplex mode is checked out by CM acknowledging on VHF and GOSS acknowledging on UHF
101.2.3				Checklist	---	Check simplex capability by voice communication acknowledgement with Commander	Select simplex mode	---	SE belt-pack simplex mode is checked out by intercrew acknowledgement

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR SUIT PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
102.0.0 Return to SE Position	69:02:35	00:00:15	SE/SE						
102.1.0 Take SE station	69:02:35	00:00:15							
102.1.1				Procedure	---	Take SE seat	---	---	
102.1.2				Procedure	---	Attach PLSS	Snap on buckle	---	PLSS is attached to SE
102.1.3				Procedure	---	Secure self in seat	Engage restraint harness latch	---	
102.1.4				Procedure	---	Report "GO" condition of both PLSS units and SE's belt-pack to CM/GOSS	---	---	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
103.0.0 Coordinate with GOSS Regarding Feasibility of Conducting Lunar Surface Operations	69:02:50	00:00:55	C/C						
103.1.0 Inform GOSS of intention to perform lunar surface activities	69:02:50	00:00:55							
103.1.1				Checklist	---	Report intention to conduct lunar stay activities to GOSS and receive confirmation	---	---	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
104.0.0 Activate Tape Recorder	69:03:45	00:00:20	C/C						
104.1.0 Establish tape recorder operating conditions	69:03:45	00:00:15							
104.1.1				LEM/CM black-out to begin at 69:04:00	---	Acknowledge imminence of LEM/CM communications blackout via VHF voice link	---	---	
104.1.2				Checklist	---	Turn on power to tape recorder	RECORDER POWER toggle to ON	Tape recorder energized	
104.1.3				Procedure	---	Select normal recording speed	SPEED toggle to NORMAL	---	
104.2.0 Start tape recorder	69:04:00	00:00:05							
104.2.1				Procedure	---	Start tape recorder operating	MODE toggle to RECORD	All subsystem performance data and crew messages are stored and made ready for VHF transmission to CM at end of communication black-out	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
105.0.0 Place all LEM Systems in Lunar Stay Mode	69:03:50	00:02:15	SE/SE						
105.1.0 Disarm RCS	69:03:50	00:00:10							
105.1.1				Checklist	---	Close System A & B solenoid valves upstream of pressure regulators	System A & B PRESSURE REGULATOR SHUTOFF toggles (#1 and #2) to OFF	---	
105.1.2				Checklist	---	Close 8 solenoid valves upstream of thruster valves	THRUSTER PAIR SHUTOFF toggles to CLOSE	RCS system disarmed	
105.2.0 Expel RCS propellant downstream of thruster isolation valves	69:04:00	00:01:00		To be determined					
105.3.0 De-activate electrical loads for RCS	69:05:00	00:00:05							
105.3.1				Checklist	---	De-energize electrical load for RCS propulsion	RCS POWER toggle to OFF	Electrical power removed from RCS propulsion	
105.4.0 De-activate electrical loads for ascent system	69:05:05	00:00:05							
105.4.1				Checklist	---	De-energize electrical load for ascent propulsion system	ASCENT PROPULSION POWER toggle to OFF	Electrical power removed from ascent propulsion system	
105.5.0 Turn off power to N & G system	69:05:10	00:00:10							
105.5.1				Checklist	---	Place computer power in standby condition	COMPUTER POWER toggle to STANDBY	All portions of computer de-energized except memory unit.	
105.5.2				Checklist	---	Place IMU power in standby condition	IMU POWER toggle to STANDBY	All portions of IMU de-energized except gyro heaters.	
105.5.3				Checklist	---	Turn off Tracking radar power	TRACKING RADAR POWER toggle to OFF	Tracking radar de-energized.	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
105.5.4				Checklist	---	Turn off radar altimeter power	RADAR ALTI-METER POWER toggle to OFF	Radar altimeter de-energized	
105.5.5				Checklist	---	Turn off CDU power	CDU POWER toggle to OFF	CDU de-energized	
105.6.0 Turn off power to S & C system	69:05:20	00:00:10		To be determined.					
105.7.0 Turn off power to VHF communications system	69:05:30	00:00:05							
105.7.1				Checklist	---	De-activate VHF subsystem	VHF POWER toggle to OFF	VHF subsystem is de-activated	If subsystem does not de-energize, pull its circuit breaker
105.8.0 De-activate DC distribution	69:05:35	00:00:05							
105.8.1				All subsystem electrical loads de-energized	---	Remove non-essential loads from main bus and turn off running lights	BUS TIE NON-ESSENTIAL toggle to OFF and RUNNING LIGHTS toggle to OFF	Non-essential loads removed from main bus	Cabin dome lighting remains activated. Integral panel lighting de-energized.
105.9.0 Place fuel cell #1 to standby status	69:05:40	00:00:10							
105.9.1				Checklist	---	De-activate fuel cell #1	BUS A INPUT (FC #1) toggle to OFF O_2 PURGE(FC#1) toggle to OFF H_2 VENT toggle to CLOSE	Fuel Cell #1 isolated from loads. Contaminants and diluents not being removed from fuel cell #1 Fuel Cell #1 temperature maintained electrically	
105.10.0 Check fuel cell electrical output	69:05:50	00:00:15							
105.10.1				Normal operating level	DC VOLTMETER	Check fuel cell #1 voltage	MONITOR SELECT rotary (volts) to FC #1	---	
105.10.2				Normal operating levels	AMMETER	Check fuel cell #2 and #3 current	MONITOR SELECT rotary (amps) to FC #2 and FC #3	---	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
105.10.3				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A		

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
106.0.0 Determine Unscheduled Maintenance to be Performed	69:06:05	00:30:00	C/C; SE/SE						
106.1.0 Determine task requirements	69:06:05	00:20:00							
106.1.1				Malfunction identification resulting from fault isolation procedures	Operations/ Maintenance Manual	Determine order of priority for performing unscheduled maintenance	---	---	
106.1.2				Procedure	Operations/ Maintenance Manual	Determine calibration and adjustment requirements for performing unscheduled maintenance	---	---	
106.2.0 Determine equipment requirements	69:26:05	00:10:00							
106.2.1				Type of malfunction	Operations/ Maintenance Manual	Determine replacement components required for performing unscheduled maintenance.	---	---	
106.2.2				Type of malfunction	Operations/ Maintenance Manual	Determine tool requirements for performing unscheduled maintenance.	---	---	

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
107.0.0 Determine Scheduled Inspections and Adjustments	69:36:05	00:10:00	C/C; SE/SE						
107.1.0 Determine task requirements	69:36:05	00:05:00							
107.1.1				Checklist	Operations/ Maintenance Manual	Determine order of priority for performing inspections and adjustments	---	---	
107.2.0 Determine equipment requirements	69:41:05	00:05:00							
107.2.1				Checklist	Operations/ Maintenance Manual	Determine tool requirements for performing inspections and adjustments	---	---	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
108.0.0 Determine Scientific Activities to be Performed	69:46:05	00:10:00	C/C; SE/SE						
108.1.0 Determine task requirements	69:46:05	00:05:00							
108.1.1				Checklist	DATA CHART	Determine order of priority for performing scientific activities	---	---	
108.2.0 Determine equipment requirements	69:51:05	00:05:00							
108.2.1				Checklist	DATA CHART	Determine equipment to be transported to lunar surface: -from inside of LEM cabin -from Descent Stage storage area	---	---	Tentative list of scientific instrumentation from NASA Work Statement of 12/20/62: Lunar Atmosphere Analyzer. Gravitometer. Magnetometer. Radiation Spectrometer. Specimen Return containers. Rock & Soil Analysis Equipment. Soil Temperature Instrument. Seismographic Equip. Cameras - still and motion Picture. Telescope.
108.2.2				Checklist	DATA CHART	Determine equipment to be utilized from inside LEM cabin	---	---	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR EVAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
109.0.0 Prepare for Egress to Lunar Surface	69:56:05	00:14:55							
109.1.0 Check-out Commander's communications belt-pack	69:56:05	00:01:10	C/C						
109.1.1				Checklist	---	Disconnect communications umbilical from console jackbox and connect to belt-pack	---	---	Astronaut is on belt-pack communications to transmit and receive voice communications and transmit bio-med status
109.1.2				Checklist	---	Check duplex capability by voice communication acknowledgement with GOSS and other astronaut	Select duplex mode	---	Astronaut's belt-pack duplex mode is checked out by GOSS acknowledging on UHF
109.1.3				Checklist	---	Check simplex capability by voice communication acknowledgement with other astronaut	Select simplex mode	---	Astronaut's belt-pack simplex mode is checked out by inter-crew acknowledgement
109.2.0 Attach radiation dosimeter to pressure suit	69:57:15	00:00:05	C/C						
109.2.1				Checklist	Dosimeter is visible on sleeve	Attach dosimeter to suit	---	Dosimeter is properly mounted	
109.3.0 Stand in aisle	69:57:20	00:00:10	C/C-A						
109.3.1				Procedure	---	Unlatch seat restraint harness and stand up	Depress and twist lever on harness	---	
109.4.0 Prepare equipment to be lowered to lunar surface	69:57:30	00:13:00	C/T-A						
109.4.1				Checklist	---	Pull lift line out of stowage, and coil on floor	---	---	Lift line is ready for attachment of equipment to be lowered

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
109.4.2				Checklist	---	Unfasten equipment to be lowered and place on seat	Unsnap fasteners	---	
109.4.3				Checklist	---	Attach tool belt to wrist	---	---	Tool belt is attached to suit prior to suit inflation
109.4.4				Checklist	---	Place portable TV camera in radiation protective jacket	---	---	TV camera is protected from lunar environment
109.5.0 Transfer to suit circuit	70:10:30	00:00:30							
109.5.1			C/A; SE/SE	Checklist	---	Slide faceplate to closed position and turn locking knob	Locking knob	SE and C faceplates are closed Suit integrity accomplished.	
109.5.2	-		SE/SE	Checklist	---	Manually close LEM ECS connection to LEM cabin	Close: DIVERTER VALVE, CABIN GAS RETURN VALVE, SUIT CIRCUIT RELIEF VALVE	Suit is a closed circuit.	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
110.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/SE						
110.1.0 Monitor subsystem master warning lights		00:00:05							
110.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
110.2.0 Monitor electrical system status		00:00:40							
110.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
110.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1, 2 and 3	---	
110.2.3				Normal operating H_2 pressure level	H_2 FAIL lights (FC 1, 2, 3) extinguished	Check H_2 Fail warning indicators	---	---	
110.2.4				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3 and main bus current	MONITOR SELECT rotary (amps) to FC 1, 2, 3 and BUS A	---	
110.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
110.2.6				Normal operating temperature level	INVERTER No. 1 TEMP. warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to NO. 1	---	
110.2.7				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
110.3.0 Monitor environmental control system status		00:01:15							
110.3.1				Maximum 1100 psia Normal 850 psia Minimum 7 psia	SOX PRESSURE indicator	Monitor SOX pressure	---	---	If low SOX pressure, turn on SOX heater until pressure builds up. If still no go, check O_2 inflow lights; if illuminated, select manual, and pulse until pressure builds up
				Normal operating level	SOX QUANTITY indicator	Monitor SOX quantity	---	---	
				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated
110.3.2				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator, and glycol temp. warning indicators	---	---	If a light illuminates, that particular H_2O separator or LiOH system is malfunctioning. Select alternate system

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
110.3.3				Pressure reading of 5.0 psia	CABIN PRESSURE indicator	Check cabin pressure	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates. If #2 inflow valve fails in automatic, place #1 O_2 inflow valve toggle to MAN. If #1 light illuminates, place #2 O_2 inflow toggle to MAN.
110.3.4				Cabin temperature is within 75°F ± 5°	CABIN TEMPERATURE indicator	Check cabin temperature	---	The cabin is checked out at normal temperature	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly
110.3.5				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 flood status	---	Cabin oxygen flooding is normal	
110.3.6				CABIN FAN WARNING indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	
110.3.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator	Check suit fan warn indicator	---	Suit fan functioning properly	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND REMOTE SEAT PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
110.4.0 Monitor descent propulsion system status		00:00:15							
110.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
110.4.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
110.4.3				Normal operating levels	TANK METERS: FUEL QTY (#1) FUEL QTY (#2) OXID QTY (#1) OXID QTY (#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS. HELIUM TEMP.	Check tank quantities, pressures and temperatures	---	---	
110.5.0 Monitor ascent propulsion system status		00:00:15							
110.5.1				Ascent system monitoring	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	---	
110.5.2				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
110.5.3				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR SHAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
110.5.4				Normal operating levels	TANK METERS: FUEL QTY (#1) FUEL QTY (#2) OXID QTY (#1) OXID QTY (#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS.	Check tank quantities, pressures and temperatures	---	---	
110.6.0 Monitor RCS status		00:00:15							
110.6.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	---	---	
110.6.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	
110.6.3				Normal operating levels	TANK METERS: FUEL & OXID QTY; FUEL & OXID. PRESS; HELIUM PRESS. & TEMP.	Check System A & B tank quantities, pressures and temperatures	---	---	
110.6.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
110.7.0 Monitor navigation and guidance system status		00:00:20							
110.7.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature	---	---	

PHASE NUMBER: 7 POST-LANDING SYSTEMS CHECKOUT AND LUNAR STAY PREPARATIONS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
110.7.2				All warning lights extin-guished. Computer power at correct standby operating level.	WARNING INDICATORS: AGC POWER SUPPLY	Check power to computer memory unit	---	Computer maintained in self-checking mode	
110.8.0 Monitor stabilization and control system status			---	TO	BE	DETERMINED	---		

Phase 8 LUNAR STAY ACTIVITIES — From 70:11:00 to 88:17:00 — Elapsed Time 18 hr. 06 min.

Commander	Mission Time	Systems Engineer
No assigned activity	70:11:00	
	70:11:00	111.0.0 Prepare LEM Cabin for Egress
	70:11:10	111.1.1 Deactivate cabin O_2 flood.
111.1.3 Disconnect from LEM ECS	70:11:55	111.1.2 Depressurize cabin down to 0 psia.
111.2.0 Open LEM hatch	70:12:10	No assigned activity
112.0.0 Egress to Lunar Surface	70:12:40	
112.1.0 Proturde head and shoulders out of hatchway and investigate lunar surface	70:12:40	
112.2.0 Prepare for descent to lunar surface	70:13:40	112.2.2 Unlatch seat restraint harness and stand in aisle.
	70:14:10	112.2.3 Hand equipments to be lowered through hatchway to Commander.
	70:15:10	No assigned activity
112.3.0 Descend to lunar surface	70:16:40	
112.4.0 Test body mobility in lunar "G" environment	70:17:40	
113.0.0 Unload Equipment From Descent Stage Equipment Bays	70:29:40	114.0.0 Prepare LEM Cabin for Lunar Operations
113.1.0 Open access panels and secure	70:29:40	114.1.0 Repressurize LEM cabin
113.2.0 Unload equipment bays	70:30:40	
	70:31:10	115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status
		116.0.0 Monitor LEM Systems Status
117.0.0 Perform Unscheduled Maintenance	70:35:40	
117.1.0 Remove and replace malfunctioning components	70:35:40	
117.2.0 Repair punctures, if required	70:45:40	
	70:50:00	118.0.0 Track Command Module and Coordinate Information
	70:50:00	118.1.0 Place equipment in readiness condition
	70:52:00	118.2.0 Transmit tape - recorded information to CM
	70:53:00	118.3.0 Acquire CM with SCT and radar track
119.0.0 Perform Scheduled Inspection and Adjust, If Required	70:55:40	
119.1.0 Inspect and adjust malfunctions, if required	70:55:40	
119.2.0 Inspect separation capability	71:05:40	
	71:07:00	118.4.0 Determine existence of communications black-out with CM
	71:07:20	118.5.0 Determine updated ascent trajectory parameters
	71:07:50	118.6.0 Determine CM's updated orbital parameters
	71:08:20	118.7.0 Place equipment in standby condition

Report No. LED 480-3
Date 7/12/63

Phase: 8 **LUNAR STAY ACTIVITIES** From 70:11:00 to 88:17:00 Elapsed Time 18 Hr. 06 min.

Commander	Mission Time	Systems Engineer
	71:08:35	115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status
		116.0.0 Monitor LEM Systems Status
119.3.0 Report that initial activities for lunar stay completed	71:10:40	
No assigned activity	71:11:00	120.0.0 Activate Ground Power For Lunar Surface Operations
121.0.0 Set-Up and Operate Portable TV Camera	71:11:10	115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status
		116.0.0 Monitor LEM Systems Status
121.1.0 Erect DSIF (UHF) dish antenna and lock to GOSS	71:11:10	
121.2.0 Set-up and operate TV camera	71:36:10	
	71:45:00	121.2.4 Actuate TV telemetry of bio-medical status to GOSS
122.0.0 Perform Scientific Activities	71:46:10	115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status
122.1.0 Connect equipment requiring electrical power to ground link		
122.2.0 Perform experiments		116.0.0 Monitor LEM Systems Status
122.3.0 Report progress and results to LEM/GOSS		
122.4.0 Make direct visual observations		
122.5.0 Make photographic observations		
	72:00:00	123.0.0 Remove and Replace LiOH Cannister
	72:00:00	123.1.0 Monitor condition of CO_2 removal
	72:00:05	123.2.0 Stand in aisle
	72:00:10	123.3.0 Proceed to LiOH cannisters and check
	72:00:20	123.4.0 Change cannister
	72:00:35	123.5.0 Return to duty station
	72:00:45	115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status
		116.0.0 Monitor LEM Systems Status
	72:53:00	124.0.0 Track Command Module and Coordinate Information
	72:53:00	124.1.0 Place equipment in readiness condition
	72:55:00	124.2.0 Transmit tape - recorded information to CM
	72:56:00	124.3.0 Acquire CM with SCT and radar track
	73:10:00	124.4.0 Determine existence of communications black-out with CM
	73:10:20	124.5.0 Determine updated ascent trajectory parameters.
	73:10:50	124.6.0 Determine CM's updated orbital parameters.

Phase 8 LUNAR STAY ACTIVITIES — From 70:11:00 To 88:17:00 — Elapsed Time 18 hr. 06 min.

	Commander	Mission Time		Systems Engineer
		73:11:20		124.7.0 Place equipment in standby condition
		73:11:35	115.0.0	Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status
			116.0.0	Monitor LEM Systems Status
		73:40:50		125.1.1 Instruct lunar astronaut to prepare to re-enter LEM
		73:40:55		125.1.2 De-activate ground power
125.0.0	Prepare For Re-Entry to LEM	73:41:00	115.0.0	Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status
	125.1.0 Prepare equipment	73:41:00	116.0.0	Monitor LEM Systems Status
	No assigned activity	74:02:50	126.0.0	Prepare For Re-Entry of Lunar Astronaut
		74:02:50		126.1.0 Transfer to suit circuit
		74:03:20		126.2.0 Depressurize LEM cabin
		74:04:30		126.3.0 Open LEM hatch
	126.4.0 Transfer lunar surface equipment aboard LEM	74:05:00		126.4.0 Transfer lunar surface equipment aboard LEM
127.0.0	Re-Enter LEM	74:08:00		126.5.0 Take C seat
	127.1.0 Climb into LEM cabin	74:08:00		
		74:08:10	116.0.0	Monitor LEM Systems Status
	127.2.0 Close LEM hatch	74:09:30		
128.0.0	Prepare LEM Cabin for Rest and Replenishment Period	74:10:00		
	128.1.1 Connect ECS umbilical to suit	74:10:00		
	128.1.2 Check cabin purge valve closed	74:10:05		
	No assigned activity	74:10:10		128.1.3 Select 5 psia suit pressure
		74:10:20		128.1.4 Flood cabin with O_2 to 5.0 psia
	128.1.5 Open face plate	74:11:20		128.1.5 Open face plate
	128.2.0 Secure equipment in storage areas	74:11:30	116.0.0	Monitor LEM Systems Status
129.0.0	Replenish PLSS Unit and Secure Self in Seat	74:13:00		
	129.1.0 Refill O_2 tank	74:13:00		
	129.2.0 Refill PLSS water tank	74:14:00		
	129.3.0 Recharge PLSS battery	74:15:00		
	129.4.0 Secure self in seat	74:15:30		
130.0.0	Review and Record Lunar Activities	74:15:40	130.0.0	Review and Record Lunar Activities
	130.1.0 Draft map of area of operations and record findings	74:15:40		130.1.0 Draft map of lunar surface operations area and record findings
131.0.0	Perform Off-Duty Activities	74:41:00	116.0.0	Monitor LEM Systems Status
	131.1.0 Adjust seat and suit			
	131.2.0 Perform personal hygiene			
	131.3.0 Prepare and consume food			
	131.4.0 Rest and/or sleep			

Phase 8 LUNAR STAY ACTIVITIES — From 70:11:00 To 88:17:00 — Elapsed Time 18 hr. 06 min.

Commander Mission Time	Systems Engineer	
74:56:00	132.0.0	Track Command Module and Coordinate Information
74:56:00	132.1.0	Place equipment in readiness condition
74:58:00	132.2.0	Transmit tape-recorded information to CM
74:59:00	132.3.0	Acquire CM with SCT and radar track
75:13:00	132.4.0	Determine existence of communications black-out with CM
75:13:20	132.5.0	Determine updated ascent trajectory parameters
75:13:50	132.6.0	Determine CM's updated orbital parameters
75:14:20	132.7.0	Place equipment in standby condition
75:14:35	116.0.0	Monitor LEM Systems Status
76:00:00	133.0.0	Remove and Replace LiOH Cannister
76:00:00	133.1.0	Monitor condition of CO_2 removal
76:00:05	133.2.0	Stand in aisle
76:00:10	133.3.0	Proceed to LiOH cannister and check
76:00:20	133.4.0	Change cannister
76:00:35	133.5.0	Return to duty station
76:00:45	116.0.0	Monitor LEM Systems Status
76:59:00	134.0.0	Track Command Module and Coordinate Information
76:59:00	134.1.0	Place equipemnt in readiness condition
77:01:00	134.2.0	Transmit tape-recorded information to CM
77:02:00	134.3.0	Acquire CM with SCT and radar track
77:16:00	134.4.0	Determine existence of communications black-out with CM
77:16:20	134.5.0	Determine updated ascent trajectory parameters.
77:16:50	134.6.0	Determine CM's updated orbital parameters
77:17:20	134.7.0	Place equipment in standby condition
77:17:35	116.0.0	Monitor LEM Systems Status
79:02:00	135.0.0	Track Command Module and Coordinate Information
79:02:00	135.1.0	Place equipment in readiness condition
79:04:00	135.2.0	Transmit tape-recorded information to CM
79:05:00	135.3.0	Acquire CM with SCT and radar track
79:19:00	135.4.0	Determine existence of communications black-out with CM
79:19:20	135.5.0	Determine updated ascent trajectory parameters
79:19:50	135.6.0	Determine CM's updated orbital paremeters

Phase 8 LUNAR STAY ACTIVITIES — From 70:11:00 to 88:17:00 — Elapsed Time 18 hr. 06 min.

	Commander	Mission Time	Systems Engineer
		79:20:20	135.7.0 Place equipment in standby condition
		79:20:35	116.0.0 Monitor LEM Systems Status
136.0.0	Change Duty Stations	79:25:00	
	136.1.0 Proceed into tunnel	79:25:00	
	No assigned activity	79:28:00	136.2.0 SE Take System Engineer's position
	136.3.0 C take Commander's seat	79:29:00	No assigned activity
116.0.0	Monitor LEM Systems Status	79:30:00	137.0.0 Perform Off Duty Activities
			137.1.0 Adjust seat and suit
			137.2.0 Perform personal hygiene
			137.3.0 Prepare and consume food
			137.4.0 Rest and/or sleep
138.0.0	Remove and Replace LiOH Cannister	80:00:00	
	138.1.0 Monitor condition of CO_2 removal	80:00:00	
	138.2.0 Stand in aisle	80:00:05	
	138.3.0 Proceed to LiOH cannister and check	80:00:10	
	138.4.0 Change cannister	80:00:20	
	138.5.0 Return to duty station	80:00:35	
116.0.0	Monitor LEM Systems Status	80:00:45	
139.0.0	Track Command Module and Coordinate Information	81:05:00	
	139.1.0 Place equipment in readiness condition	81:05:00	
	139.2.0 Transmit tape-recorded information to CM	81:07:20	
	139.3.0 Acquire CM with SCT and radar track	81:08:00	
	139.4.0 Determine existence of communications black-out with CM	81:22:00	
	139.5.0 Determine updated ascent trajectory parameters	81:22:20	
	139.6.0 Determine CM's updated orbital parameters	81:22:50	
	139.7.0 Place equipment in standby condition	81:23:20	
116.0.0	Monitor LEM Systems Status	81:23:35	
140.0.0	Track Command Module and Coordinate Information	83:08:00	
	140.1.0 Place equipment in readiness condition	83:08:00	
	140.2.0 Transmit tape-recorded information to CM	83:10:00	
	140.3.0 Acquire CM with SCT and radar track	83:11:00	
	140.4.0 Determine existence of communications black-out with CM	83:25:00	
	140.5.0 Determine updated ascent trajectory parameters	83:25:20	
	140.6.0 Determine CM's updated orbital parameters	83:25:50	
	140.7.0 Place equipment in standby condition	83:26:20	

Phase 8 LUNAR STAY ACTIVITIES	From 70:11:00 to 88:17:00	Elapsed Time 18 Hr. 06 min.
Commander	Mission Time	Systems Engineer
116.0.0 Monitor LEM Systems Status	83:26:35	
141.0.0 Determine Scientific Activities to be Performed	83:47:00	141.0.0 Determine Scientific Activities to be Performed
141.1.0 Determine task requirements	83:47:00	141.1.0 Determine task requirements
141.2.0 Determine equipment requirements	83:52:00	141.2.0 Determine equipment requirements
116.0.0 Monitor LEM System Status	83:57:00	No assigned activity
	84:00:00	142.0.0 Remove and Replace LiOH Cannister
	84:00:00	142.1.0 Monitor condition of CO_2 removal
	84:00:05	142.2.0 Stand in aisle
	84:00:10	142.3.0 Proceed to LiOH cannister and check
	84:00:20	142.4.0 Change cannister
	84:00:35	142.5.0 Return to duty station
	84:00:45	No assigned activity
	84:02:05	143.0.0 Prepare for Egress to Lunar Surface
	84:02:05	143.1.0 Check-out SE's communication belt-pack
	84:03:15	143.2.0 Attach radiation dosimeter to pressure suit.
	84:03:20	143.3.0 Stand in aisle
	84:03:30	143.4.0 Prepare equipemnt to be lowered to lunar surface
143.5.0 Transfer to suit circuit	84:16:30	143.5.1 Slide face plate closed and turn locking knob.
	84:16:40	no assigned activity
144.0.0 Prepare LEM Cabin for Egress	84:17:00	
144.1.1 Deactivate cabin O_2 flood	84:17:00	
144.1.2 Depressurize cabin down to 0 psia	84:17:10	
No assigned activity	84:17:55	144.1.3 Disconnect from LEM ECS
	84:18:10	144.2.0 Open LEM hatch
	84:18:40	145.0.0 Egress to Lunar Surface
	84:18:40	145.1.0 Proturde head and shoulders out of hatchway and investigate lunar surface
145.2.2 Unlatch seat restraint harness and stand in aisle	84:19:40	145.2.0 Prepare for descent to lunar surface
145.2.3 Hand equipments to be lowered through hatchway to SE	84:20:10	
116.0.0 Monitor LEM System Status	84:21:10	
	84:22:40	145.3.0 Descend to lunar surface
	84:23:40	145.4.0 Test body mobility in lunar "G" environment
146.0.0 Prepare LEM Cabin for Lunar Operations	84:35:40	
146.1.0 Repressurize LEM cabin	84:35:40	

Phase 8 LUNAR STAY ACTIVITIES — From 70:11:00 To 88:17:00 — Elapsed Time 18 hr. 06 min.

Commander	Mission Time	Systems Engineer
147.0.0 Activate Ground Power for Lunar Surface Operations	84:37:10	148.0.0 Set-Up and Operate Portable T.V. Camera
	84:37:10	148.1.0 Energize DSIF (UHF) dish antenna and lock to GOSS
115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status	84:37:20	
116.0.0 Monitor LEM Systems Status		
	84:47:10	148.2.0 Set-up and operate TV camera
148.2.4 Activate TV telemetry of bio-medical status to GOSS	84:56:00	
115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status	84:57:00	149.0.0 Perform Scientific Activities
116.0.0 Monitor LEM Systems Status		149.1.0 Connect equipment requiring electrical power to ground link
		149.2.0 Perform experiments
		149.3.0 Report progress and results to LEM/GOSS
		149.4.0 Make direct visual observations
		149.5.0 Make photographic observations
150.0.0 Track Command Module and Coordinate Information	85:11:00	
150.1.0 Place equipment in readiness condition	85:11:00	
150.2.0 Transmit tape-recorded information to CM	85:13:00	
150.3.0 Acquire CM with SCT and radar track	85:14:00	
150.4.0 Determine existence of communications black-out with CM	85:28:00	
150.5.0 Determine updated ascent trajectory parameters	85:28:20	
150.6.0 Determine CM's updated orbital parameters	85:28:50	
150.7.0 Place equipment in standby condition	85:29:20	
115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status	85:29:35	
116.0.0 Monitor LEM Systems Status		
151.0.0 Track Command Module and Coordinate Information	87:14:00	
151.1.0 Place equipment in readiness condition	87:14:00	
151.2.0 Transmit tape-recorded information to CM	87:16:00	
151.3.0 Acquire CM with SCT and radar track	87:17:00	
151.4.0 Determine existence of communications black-out with CM	87:31:00	
151.5.0 Determine updated ascent trajectory parameters	87:31:20	
151.6.0 Determine CM's updated orbital parameters	87:31:50	
151.7.0 Place equipment in standby condition	87:32:20	
115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status	87:32:35	

Phase 8 **LUNAR STAY ACTIVITIES** From 70:11:00 To 88:17:00 Elapsed Time 18 hr. 06 min.

Commander	Mission Time	Systems Engineer
116.0.0 Monitor LEM Systems Status		
152.1.1 Instruct lunar astronaut to prepare to re-enter LEM	87:46:30	
152.1. De-activate ground power	87:46:35	
115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status	87:46:40	152.0.0 Prepare For Re-Entry to LEM
116.0.0 Monitor LEM Systems Status	87:46:40	152.1.0 Prepare equipment
153.0.0 Remove and Replace LiOH Cannister	88:00:00	
153.1.0 Monitor condition of CO_2 removal	88:00:00	
153.2.0 Stand in aisle	88:00:05	
153.3.0 Proceed to LiOH cannisters and check	88:00:10	
153.4.0 Change cannister	88:00:20	
153.5.0 Return to duty station	88:00:35	
115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status	88:00:45	
116.0.0 Monitor LEM Systems Status		
154.0.0 Prepare For Re-Entry of Lunar Astronaut	88:08:30	No assigned activity
154.1.0 Transfer to suit circuit	88:08:30	
154.2.0 Depressurize LEM cabin	88:09:00	
154.3.0 Open LEM hatch	88:10:10	
154.4.0 Transfer lunar surface equipment aboard LEM	88:10:40	154.4.0 Transfer lunar surface equipment aboard LEM
154.5.0 Take C seat	88:13:40	155.0.0 Re-Enter LEM
	88:13:40	155.1.0 Climb into LEM cabin
116.0.0 Monitor LEM Systems Status	88:13:50	
	88:15:10	155.2.0 Close LEM hatch
	88:15:40	156.0.0 Prepare LEM Cabin for Rest and Replenishment Period
	88:15:40	156.1.1 Connect ECS umbilical to suit
	88:15:45	156.1.2 Check cabin purge valve closed
156.1.3 Select 5 psi suit pressure	88:15:50	No assigned activity
156.1.4 Flood cabin with O_2 to 5 psi	88:16:00	
End of Phase 8	88:17:00	End of Phase 8

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PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
111.0.0 Prepare LEM Cabin for Egress	70:11:00	00:01:40							
111.1.0 Depressurize LEM cabin	70:11:00	00:01:10							
111.1.1			SE/SE	Checklist	---	Deactivate cabin O_2 flood.	O_2 FLOOD toggle to OFF	O_2 cabin flooding is neutralized.	
111.1.2			SE/SE	Cabin pressure reads 0 psia.	CABIN PRESSURE indicator.	Depressurize cabin down to 0 psi.	Reach up and turn purge valve on upper hatch till reaching 0 psi	LEM cabin stabilizes at 0 psia.	
				Suit pressure reads 3.5 psia	SUIT PRESSURE indicator.		Pressure select switch to 3.5 psia.	Suits gradually stabilize at 3.5 psia.	
111.1.3			C/A	Checklist	---	Disconnect umbilical from LEM ECS.	Umbilical snap ring	PLSS is connected to suit and is ready to supply same when total depressurization occurs, meanwhile "C" breaths 3.5 psia suit pressure.	LEM ECS continues to supply SE with 3.5 psia.
111.2.0 Open LEM hatch	70:12:10	00:00:30	C/A						
111.2.1				Assure LEM cabin pressure is 0 psia. Verify that there is no lunar surface pressure by checking ΔP indicator on hatch.	CABIN PRESSURE indicator. ΔP indicator.	Open LEM hatch and secure in open position.	Hatch locking wheel.	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
112.0.0 Egress To Lunar Surface	70:12:40	00:17:00							
112.1.0 Protrude head and shoulders out of hatchway and investigate lunar surface	70:12:40	00:01:00	C/LEM						
112.1.1				Procedure	---	Lay face down on floor, actuate flashlamp and visually inspect lunar surface immediately below	Flashlamp	---	
112.1.2				Procedure	---	Lower weighted end of lift line to lunar suface	---	---	Consistency of lunar surface tested
112.1.3				Beltpack is in duplex mode	---	Report to LEM and GOSS findings of visual observation	---	---	LEM and GOSS are advised of C's findings.
112.2.0 Prepare for descent to lunar surface	70:13:40	00:03:00	C/LEM-BP						
112.2.1				Procedure	---	Erect and lock boarding platform in level position and proceed onto BP feet first	Reach down and pull erecting lever attached to descent stage	Boarding platform is prepared for descending to lunar surface	Lunar astronaut standing on platform
112.2.2			SE/SE-A	Procedure	---	Unlatch seat restraint harness and stand in aisle	Depress and twist lever on harness	---	
112.2.3			SE/A; C/BP	Procedure	---	Hand equipments to be lowered through hatchway to lunar astronaut	---	---	Equipments are on the boarding platform ready to be attached to lift line

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
112.2.4			C/BP	Procedure	---	Attach equipments to be lowered to loops in lift line and lower to the lunar surface	---	---	Lunar surface equipment is lowered and free of LEM
112.2.5			C/BP	Belt pack is in duplex mode	---	Report to LEM and GOSS that readiness condition exists for descent to lunar surface	---	---	LEM and GOSS are advised that all is ready for descent to lunar surface
112.3.0 Descend to lunar surface	70:16:40	00:01:00	C/BP-LS						
112.3.1				Procedure	---	Face toward LEM; Grasp handholds to side of BP; Place foot on first rung and descend ladder and step off to lunar surface	---	---	Lunar astronaut standing on lunar surface
112.3.2				Belt pack is in duplex mode	---	Report to LEM and GOSS that lunar astronaut is safely on lunar surface	---		If belt pack manfunctions, visual signals may suffice until the UHF lunar stay antenna is erected.
112.4.0 Test body mobility in lunar "G" environment	70:17:40	00:12:00	C/LS						
112.4.1				Procedure	---	Actuate flash lamp and inspect immediate area	Flashlamp	---	
112.4.2				Procedure	---	Attempt slow walking to adjust to lunar gravity and surface texture	---	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
112.4.3				Procedure	---	Text adaptability to normal and rapid walking movements	---	---	
112.4.4				Procedure	---	Test adaptability to handling and lifting objects while still and moving	---	---	
112.4.5				Procedure	---	Test adaptability to throwing objects	---	---	
112.4.6				Procedure	---	Test adaptability to bending and twisting	---	---	
112.4.7				No apparent immediate problems	---	Report to LEM	---	LEM astronaut is advised of Lunar surface body mobility and advised to close LEM hatch and repressurize LEM	
112.4.8				Procedure	---	Assemble and erect U.S. flag on lunar surface	---	---	National ensign and flagstaff removed from equipment bundle

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
113.0.0 Unload Equipment From Descent Stage Equipment Bays	70:29:40	00:06:00	C/LS						
113.1.0 Open access panels and secure	70:29:40	00:01:00							
113.1.1				Procedure	---	Open both descent stage access panels and lock in open position	Handle to OPEN - snap into fastener	---	
113.2.0 Unload equipment bays	70:30:40	00:05:00							
113.2.1				Procedure	---	Remove equipment as needed to perform lunar surface experiments	---	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
114.0.0 Prepare LEM Cabin for Lunar Operations	70:29:40	00:01:30	SE/A-C						
114.1.0 Repressurize LEM cabin	70:29:40	00:01:30							
114.1.1				Procedure	---	Close LEM hatch and lock	Hatch locking wheel	LEM hatch is closed, locked and sealed	
114.1.2				Checklist	Cabin purge valve on upper hatch	Check that cabin purge valve is closed	---	---	
114.1.3				Procedure	---	Take Commander's seat	---	---	
114.1.4				Checklist	SUIT PRESSURE indicator	Select 5.0 psia suit pressure	Pressure select switch to 5.0 psia	Suit is prepared to pressurize to 5.0 psia as cabin pressure passes 3.5 psia	
114.1.5				O_2 FLOOD light remains illuminates until cabin reaches 5.0 psia	CABIN PRESSURE indicator	Flood cabin with O_2 to 5.0 psia	O_2 FLOOD toggle to AUTO	O_2 flood valve pressurizes cabin to 5.0 psia and closes automatically	
114.1.6				No ECS malfunctions indicated and cabin pressure reads 5.0 psia	CABIN PRESSURE indicator	Open face plate	Unlock knob and slide faceplate up	---	LEM astronaut sustained by cabin environment
114.1.7				LEM ECS checked out	---	Tie-in LEM cabin environment to LEM ECS	Open DIVERTER VALVE, CABIN GAS RETURN VALVE, CIRCUIT RELIEF VALVE	LEM cabin gas is being revitalized and replenished by LEM ECS	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
115.0.0 Observe Lunar Astronaut's Activities and Monitor Lunar Astronaut's Bio-Medical Status	Non-scheduled	Continuous	SE/C or C/C						
115.1.0 Observe lunar astronaut's activities									
115.1.1				Assurance of no imminent danger to lunar astronaut	---	Observe lunar astronaut through SCT or window	---	---	
115.2.0 Monitor lunar astronaut's biomedical status									
115.2.1				Lunar astronaut's physiological condition	---	Monitor lunar astronaut's biomedical condition via audio signal in headset	---	---	If hazardous condition to lunar astronaut is detected, the LEM astronaut must take immediate steps to recover and/or resuscitate lunar astronaut.

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
116.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/C or C/C						
116.1.0 Monitor subsystem master warning lights		00:00:05							
116.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
116.2.0 Monitor electrical system status		00:00:40							
116.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
116.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1, 2 and 3		
116.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1, 2, 3) extinguished	Check N_2 Fail warning indicators	---	---	
116.2.4				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3 and main bus current	MONITOR SELECT rotary (amps) to FC 1, 2, 3 and BUS A	---	
116.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
116.2.6				Normal operating temperature level	INVERTER NO. 1 TEMP. warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to No. 1	---	
116.2.7				Proper phase relationship maintained	INVERTER No. 1 PHASE FAILURE warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
116.3.0 Monitor environmental control systems status		00:01:15							
116.3.1				Maximum 1100 psia Normal 850 psia Minimum 7 psia	SOX PRESSURE indicator	Monitor SOX pressure	---	---	If low SOX pressure, turn on SOX heater until pressure builds up. If still no go, check O_2 inflow lights; if illuminated, select manual, and pulse until pressure builds up.
				Normal operating level	SOX QUANTITY indicator	Monitor SOX quantity	---	---	
				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.
116.3.2				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator, and glycol temp. warning lights	---	---	If a light illuminates, that particular H_2O separator or LiOH system is malfunctioning. Select alternate system.

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
116.3.3				Pressure reading of 5.0 psia	CABIN PRESSURE indicator	Check cabin pressure	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia.	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates. If #2 inflow valve fails in automatic, place #1 O_2 inflow valve toggle to MANUAL. If #1 light illuminates, place #2 O_2 inflow valve toggle to MANUAL
116.3.4				Cabin temperature is within 75°F ± 5°	CABIN TEMPERATURE indicator	Check cabin temperature	---	The cabin is checked out at normal temperature	If cabin temperature is not within ~~desired~~ limits, rotate cabin temperature control thumb wheel to compensate accordingly.
116.3.5				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 flood status	---	---	
116.3.6				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	
116.3.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator extinguished	Check suit fan warn indicator	---	---	
116.4.0 Monitor descent propulsion system status		00:00:15							
116.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
116.4.2				Relief valves not venting helium over-board	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
116.4.3				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY (#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS. HELIUM TEMP.	Check tank quantities, pressures and temperatures	---	---	
116.5.0 Monitor ascent propulsion system status 116.5.1		00:00:15		Ascent system monitoring	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	---	
116.5.2				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
116.5.3				Relief valves not venting helium over-board	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
116.5.4				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS.	Check tank quantities, pressures and temperatures	---	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
116.6.0 Monitor RCS status		00:00:15							
116.6.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	---	---	
116.6.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	
116.6.3				Normal operating levels	TANK METERS: FUEL and OXID QTY; FUEL and OXID. PRESS; HELIUM PRESS. and TEMP.	Check System A & B tank quantities, pressures and temperatures	---	---	
116.6.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
116.7.0 Monitor navigation and guidance system status		00:00:20							
116.7.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature	---	---	
116.7.2				All warning lights extinguished. Computer power at correct standby operating level	WARNING INDICATORS: AGC POWER SUPPLY	Check power to computer memory unit	---	Computer maintained in self-checking mode	
116.8.0 Monitor stabilization and control system status		---	---	---	---	To be Determined	---	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
117.0.0 Perform Unscheduled Maintenance	70:35:40	00:20:00	C/LS						
117.1.0 Remove and replace malfunctioning components	70:35:40	00:10:00		TO BE DETERMINED					
117.2.0 Repair punctures, if required	70:45:40	00:10:00		TO BE DETERMINED					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
118.0.0 Track Command Module and Coordinate Information	70:50:00	00:18:35	SE/C						
118.1.0 Place equipment in readiness condition	70:50:00	00:02:00							
118.1.1				CM LOS to LEM imminent	EVENTS TIMER	Check time of appearance of CM	---	---	
118.1.2				Procedure	---	Activate VHF subsystem	VHF POWER toggle to ON	VHF subsystem energized	
118.1.3				Procedure	---	Turn computer to full operating level and turn on CDU power	COMPUTER POWER toggle to OPERATE and CDU POWER toggle to ON	Computer energized to full operating level and CDU energized	
118.1.4				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	---	
118.1.5				Procedure	SCT Angular readout indicator	Verify optics zeroed	---	---	
118.1.6				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
118.1.7				Checklist	---	Rotate SCT eyepiece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	— — —	
118.1.8				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
118.1.9				Procedure	---	Turn on tracking radar power	TRACKING RADAR POWER toggle to ON	Tracking radar energized	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
118.1.10				Procedure	----	Place radar in SCT mode	RADAR MODE toggle to SCT	Radar slaved to SCT	
118.1.11				CM within LOS to LEM	---	Establish two-way voice communications with CM and receive acknowledgement	---	---	VHF communications link established to CM
118.1.12				Procedure	---	Inform CM via VHF of intention to transmit tape-recorded message	---	---	
118.2.0 Transmit tape-recorded information to CM	70:52:00	00:01:00							
118.2.1				Procedure	---	Re-wind tape	TRANSPORT toggle to REVERSE	Tape re-winds	
118.2.2				Procedure	---	Select tape play-back speed	SPEED toggle to FAST	---	
118.2.3				Procedure	---	Start play-back of stored messages	MODE toggle to PLAY	Play-back transmitted to CM	
118.3.0 Acquire CM with SCT and radar track	70:53:00	00:14:00							
118.3.1				Anticipated position of CM	Direct visual in SCT 60° field of view	Slew SCT to approximate point where CM will intersect and appear over lunar horizon.	SCT TRUNNION and SHAFT SLEW controls	---	
				Position of CM	Direct visual in SCT 60° field of view	Search for CM and center in SCT 60° field of view	SCT TRUNNION and SHAFT SLEW controls	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
118.3.2				Procedure	---	Select 20° field of view	FIELD OF VIEW selector to 20°	---	
118.3.3				Position of CM	Direct visual in SCT 20° field of view	Center CM in 20° field of view	SCT TRUNNION and SHAFT SLEW controls	---	
118.3.4				Radar LOS angle and SCT optics angle indications in agreement	SEARCH light illuminates. LOS AZIMUTH and ELEVATION ANGLE indicators, SCT TRUNNION and SHAFT AXIS ANGLES	Place radar in tracking mode	RADAR MODE toggle to AUTO	Radar begins to search for CM	
118.3.5				Procedure	SEARCH light extinguished	Check that radar locked on CM	---	---	Radar locked to CM and automatically tracks
118.4.0 Determine existence of communications black-out with CM	71:07:00	00:00:20							
118.4.1				Checklist	EVENTS TIMER	Check time of expected communications black-out with CM and acknowledge last verbal communication	---	---	
118.4.2				Procedure	---	Re-wind tape	TRANSPORT toggle to REVERSE	Tape re-winds	
118.4.3				Procedure	---	Select normal recording speed	SPEED toggle to NORMAL	---	
118.4.4				Procedure	---	Select record mode	MODE toggle to RECORD	All crew messages are automatically stored and made ready for VHF transmission to CM upon its next appearance in orbit	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
118.5.0 Determine updated ascent trajectory parameters	71:07:20	00:00:30							
118.5.1				Checklist	---	Read ascent parameters call-up code #	---	---	
118.5.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard pushbuttons	Call-up code # inserted into computer keyboard	
118.5.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
118.5.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate.	Digital indicators	Read ascent parameters	---	---	
118.5.5				Ascent trajectory parameters	---	Report to GOSS via UHF the updated ascent trajectory parameters	---	---	
118.6.0 Determine CM's updated orbital parameters	71:07:50	00:00:30							
118.6.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
118.6.2				Procedure	---	Insert call-up code into computer keyboard	Computer keyboard pushbuttons	Call-up code # inserted into computer keyboard	
118.6.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
118.6.4				Orbital period (velocity or altitude) and orbital plane (angle of inclination and longitude of orbital plane with reference to lunar equator). Position in orbit (time or lunar coordinates with respect to some reference time).	Digital indicators	Read CM's orbital parameters	---	---	CM orbital parameters determined
118.6.5				CM orbital parameters	---	Report to GOSS via UHF the updated CM orbital parameters	---	---	
118.7.0 Place equipment in standby condition	71;08:20	00:00:15							
118.7.1				Checklist	---	Place computer power in standby condition and turn off CDU power	COMPUTER POWER toggle to STANDBY and CDU POWER toggle to OFF	All positions of computer de-energized except memory unit. CDU de-energized.	
118.7.2				Checklist	---	Turn off tracking radar power	TRACKING RADAR POWER toggle to OFF	Tracking radar de-energized.	
118.7.3				Checklist	---	Turn off power to VHF	VHF POWER toggle to OFF	VHF de-energized	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
119.0.0 Perform Scheduled Inspection and Adjust, If Required	70:55:40	00:15:00	C/LS						
119.1.0 Inspect and adjust malfunctions, if required	70:55:40	00:10:00							
119.1.1				Procedure	---	Inspect vehicle skin and components for damage	---	---	Included in this inspection are the checking of docking and running lights and the inspection of x - axis and z - axis docking latches.
119.1.2				Procedure	---	Check stability of vehicle on surface including landing gear.	---	---	If required, manually level LEM to within 10° of vertical to compensate for terrain slope, if possible.
119.1.3				Procedure	---	Check for slow leaks in ECS, propulsion and fuel cell tanks and lines, that might not show up on LEM displays	---	---	
119.2.0 Inspect separation capability	71:05:40	00:05:00							
119.2.1				Procedure	---	Inspect stage separation explosive bolts	---	---	Cut explosive circuit cables to bolts, if necessary, and manually unfasten bolts.
119.2.2				Procedure	---	Inspect between stage disconnects, if accessible	---	---	
119.3.0 Report that initial activities for lunar stay completed	71:10:40	00:00:20							
119.3.1				Initial lunar surface activities completed	---	Report to LEM and GOSS that initial activities completed and request LEM astronaut to activate ground power	---	---	LEM and GOSS advised of lunar stay activities and status of lunar astronaut

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
120.0.0 Activate Ground Power for Lunar Surface Operations	71:11:00	00:00:10	SE/C	TO BE DETERMINED					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
121.0.0 Set-Up and Operate Portable TV Camera	71:11:10	00:35:00							
121.1.0 Erect DSIF (UHF) dish antenna and lock to GOSS	71:11:10	00:25:00	C/LS						
121.1.1				Procedure	---	Erect tripod; inflate or unfurl antenna; operate sighting device and aim antenna toward earth.	---	---	
121.1.2				Procedure	---	Energize antenna by connecting to ground power	---	---	
121.1.3				Procedure	---	Coordinate with LEM astronaut to lock on GOSS using sighting device.	---	Television as well as voice and telemetry capable of being transmitted to GOSS.	LEM astronaut views gain indicator on UHF antenna control and advises lunar astronaut by voice communication when locked on GOSS.
121.2.0 Set-Up and operate TV camera	71:36:10	00:10:00							
121.2.1			C/LS	Procedure	---	Erect tripod and energize TV camera by connecting cable to ground power and depress power switch	CAMERA POWER switch to on position (on pistol grip)	Portable TV camera energized and operational	
121.2.2			C/LS	Nature of target being viewed (illumination, distance, texture, etc.)	---	Operate focus control for 5° or 50° field of view and mount infra-red and/or neutral density filters as required.	CAMERA FOCUS CONTROL	— — —	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
121.2.3			C/LS	Procedure	---	Communicate with GOSS concerning reception of TV picture on GOSS TV monitor and inform LEM astronaut that TV camera operating	---	---	Proper TV picture established
121.2.4			SE/C	Informed by lunar astronaut that TV camera is set-up and operating.	---	Actuate TV telemetry of bio-medical status to GOSS and receive confirmation	MODE SELECTOR rotary to TV/BIO-MED.	---	GOSS communicates with LEM via UHF voice link, confirming reception of TV telemetry of bio-medical status.

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
122.0.0 Perform Scientific Activities	71:46:10	01:54:50	C/LS						
122.1.0 Connect equipment requiring electrical power to ground link									
122.1.1				Checklist	---	Plug equipment into external power receptacle	---	Scientific equipment energized	
122.2.0 Perform experiments									
122.2.1				Checklist	---	Perform on-the-spot analyses	---	---	Lunar surface experiments conducted within visible range of LEM astronaut. Specific requirements to be determined.
122.2.2				Checklist	---	Collect specimens	---	---	
122.2.3				Checklist	---	Store specimens in sterile cannisters	---	---	
122.3.0 Report progress and results to LEM/GOSS									
122.3.1				Procedure	---	Report progress and results to LEM crew member and GOSS	---	UHF voice link to GOSS and VHF voice link to LEM	
122.4.0 Make direct visual observations									
122.4.1				Procedure	---	Make visual evaluations of lunar surface, earth, stars, LEM and CM in orbit and report to LEM and GOSS	---	---	
122.5.0 Make photographic observations									
122.5.1				Procedure	---	Operate still and motion picture cameras	Still camera controls; motion picture camera controls	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
123.0.0 Remove and Replace LiOH Cannister	72:00:00	00:00:45	SE/C-A-T						
123.1.0 Monitor condition of CO_2 removal	72:00:00	00:00:05	SE/C						
123.1.1				One LiOH warning light illuminated. Partial pressure indicator reads below 7.6 mm/Hg	Light indicator	Check LiOH status	---	---	
123.2.0 Stand in aisle	72:00:05	00:00:05	SE/C-A						
123.2.1				Procedure	---	Unlatch seat restraint harness and stand up	Depress and twist lever on harness	---	
123.3.0 Proceed to LiOH cannisters and check	72:00:10	00:00:10	SE/T						
123.3.1				Color of chemical in cannister. New cannister checks out	Window in cannister	Crawl into tunnel and check cannisters with flashlight	LiOH selector valve to un-illuminated cannister	---	
123.4.0 Change cannister	72:00:20	00:00:15	SE/T						
123.4.1				Procedure	---	Unscrew collar; remove used cannister; insert unused cannister; screw down collar	---	---	When LiOH light indicates saturation of other cannister, the newly inserted cannister will be ready to carry the CO_2 removal requirements.
123.5.0 Return to duty station	72:00:35	00:00:10	SE/C						
123.5.1				Procedure	---	Crawl back to aisle, take seat and secure.	Engage locking lever on restraint harness	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
124.0.0 Track Command Module and Coordinate Information	72:53:00	00:18:35	SE/C						
124.1.0 Place equipment in readiness condition	72:53:00	00:02:00							
124.1.1				Same as 118.1.1					
124.1.2				Same as 118.1.2					
124.1.3				Same as 118.1.3					
124.1.4				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggle to ZERO	---	
124.1.5				Procedure	SCT Angular readout indicator	Verify optics zeroed	---	---	
124.1.6				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
124.1.7				Checklist	---	Rotate SCT eye-piece mechanism to 60° field of view position.	FIELD OF VIEW selector to 60°	---	
124.1.8				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
124.1.9				Same as 118.1.9					
124.1.10				Same as 118.1.10					
124.1.11				Same as 118.1.11					
124.1.12				Same as 118.1.12					
124.2.0 Transmit tape-recorded information to CM	72:55:00	00:01:00							
124.2.1				Same as 118.2.1					
124.2.2				Same as 118.2.2					

PHASE NUMBER: 8 LUNAR SUNAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
124.2.3				Same as 118.2.3					
124.3.0 Acquire CM with SCT and radar track	72:56:00	00:14:00							
124.3.1				Same as 118.3.1					
124.3.2				Same as 118.3.2					
124.3.3				Same as 118.3.3					
124.3.4				Same as 118.3.4					
124.3.5				Same as 118.3.5					
124.4.0 Determine existence of communications blackout with CM	73:10:00	00:00:20							
124.4.1				Same as 118.4.1					
124.4.2				Same as 118.4.2					
124.4.3				Same as 118.4.3					
124.4.4				Same as 118.4.4					
124.5.0 Determine updated ascent trajectory parameters	73:10:20	00:00:30							
124.5.1				Checklist	---	Read ascent parameters call-up code #	---	---	
124.5.2				Procedure	---	Insert call-up code into computer keyboard	Computer keyboard push-buttons	Call-up code # inserted into computer keyboard	
124.5.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
124.5.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate.	Digital indicators	Read ascent parameters	---	---	
124.5.5				Same as 118.5.5					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
124.6.0 Determine CM's updated orbital parameters	73:10:50	00:00:30							
124.6.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
124.6.2				Procedure	---	Insert call-up code into computer keyboard	Computer key-board push-buttons	Call-up code # entered into computer	
124.6.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
124.6.4				Orbital period (velocity or altitude) and orbital plane (angle of inclination and longitude of orbital plane with reference to lunar equator). Position in orbit (time or lunar coordinates with respect to some reference time).	Digital indicators	Read CM's orbital parameters	---	CM orbital parameters determined	
124.6.5				Same as 118.6.5					
124.7.0 Place equipment in standby condition	73:11:20	00:00:15							
124.7.1				Same as 118.7.1					
124.7.2				Same as 118.7.2					
124.7.3				Same as 118.7.3					

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
125.0.0 Prepare for Re-Entry to LEM	73:40:50	00:22:00							
125.1.0 Prepare equipment	73:40:50	00:22:00							
125.1.1			SE/C	Four hours maximum on PLSS	EVENTS TIMER	Instruct lunar astronaut to prepare to re-enter LEM	---	VHF voice communication to lunar astronaut	
125.1.2			SE/C	Checklist	---	Deactivate ground power	---	Power supply removed from lunar surface equipment	LEM astronaut place MODE SELECT rotary to PCM/WIDE or PCM/NARROW.
125.1.3			C/LS	Procedure	---	Disconnect equipment from ground power connections	---	---	
125.1.4			C/LS	Procedure	---	Assemble equipment and specimens to be returned to LEM	---	---	
125.1.5			C/LS	Equipment shutdown completed	---	Instruct LEM astronaut to depressurize cabin.	---	VHF voice communication to LEM astronaut.	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
126.0.0 Prepare for Re-Entry of Lunar Astronaut	74:02:50	00:05:20							
126.1.0 Transfer to suit circuit	74:02:50	00:00:30	SE/C						
126.1.1				Checklist	---	Slide faceplate to closed position and turn locking knob	Locking knob	Faceplate closed. Suit integrity accomplished	
126.1.2				Checklist	---	Manually close LEM ECS connection to LEM cabin	Close DIVERTER VALVE, CABIN GAS RETURN VALVE, SUIT CIRCUIT RELIEF VALVE	Suit is a closed circuit.	
126.2.0 Depressurize LEM cabin	74:03:20	00:01:10	SE/C						
126.2.1				Same as 111.1.1					
126.2.2				Same as 111.1.2					
126.3.0 Open LEM hatch	74:04:30	00:00:30	SE/C-A						
126.3.1				Procedure	---	Stand in aisle	---	---	
126.3.2				Same as 111.2.1					
126.4.0 Transfer lunar surface equipment aboard LEM	74:05:00	00:03:00							
126.4.1			SE/A	Signal from lunar astronaut to commence lifting	---	Kneel on aisle floor, reach through hatchway and drop lift line	---	---	
126.4.2			C/LS	Procedure	---	Attach equipment and specimens to lift line and instruct LEM astronaut to hoist.	---	---	
126.4.3			SE/A	Procedure	---	Pull specimens and equipment into LEM cabin and stow.	---	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
126.5.0 Take C Seat	74:08:00	00:00:10	SE/C						
126.5.1				Procedure	---	Take C seat	---	---	
126.5.2				Procedure	---	Secure self in seat	Engage restraint harness latch	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
127.0.0 Re-enter LEM	74:08:00	00:02:00	C/LS-BP-A						
127.1.0 Climb into LEM cabin	74:08:00	00:01:30							
127.1.1				Procedure	---	Face toward LEM; grasp handholds; ascend ladder; and step onto boarding platform	---	---	
127.1.2				Procedure	---	Proceed from boarding platform into hatch, crawling through head first and stow boarding platform	---	---	After entering LEM, astronaut turns body around; lies face down on floor; protrudes head and shoulders out of hatchway; reaches down and pushes boarding platform erecting lever; and backs up into LEM
127.2.0 Close LEM hatch	74:09:30	00:00:30							
127.2.1				Procedure	---	Close LEM hatch and lock	Hatch locking wheel	LEM hatch is locked and sealed	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
128.0.0 Prepare LEM Cabin for Rest and Replenishment Period	74:10:00	00:03:00							
128.1.0 Repressurize LEM cabin	74:10:00	00:01:30							
128.1.1			C/A	Checklist	---	Connect ECS umbilical to suit	Umbilical snap ring	Connected to LEM ECS	
128.1.2			C/A	Same as 114.1.2					
128.1.3			SE/C	Same as 114.1.4					
128.1.4			SE/C	Same as 114.1.5					
128.1.5			SE/SE; C/A	Same as 114.1.6					
128.2.0 Secure equipment in storage areas	74:11:30	00:01:30	C/A						
128.2.1				Procedure	---	Remove PLSS from back and place in SE seat	---	---	PLSS is accessible for replenishment
128.2.2				Procedure	---	Stow loose equipment and specimens in their proper area	---	---	

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
129.0.0 Replenish PLSS Unit and Secure Self in Seat	74:13:00	00:02:40	C/A-SE						
129.1.0 Refill O_2 tank	74:13:00	00:01:00	C/A						
129.1.1				Checklist	---	Connect refill hose from O_2 receptacle on PLSS to ECS O_2 outlet	Snap ring	O_2 connection accomplished between PLSS and ECS	
129.1.2				Checklist	O_2 pressure indicator	Open manual O_2 valve on outlet	Faucet	O_2 is being vented to the PLSS O_2 tank from the ECS	
129.1.3				O_2 pressure indicates full on PLSS.	O_2 pressure indicator on PLSS	Shut faucet on O_2 outlet valve	Faucet	O_2 is not being vented from ECS	
129.1.4				Checklist	---	Disconnect refill hose	Quick dis-connect	O_2 back flow not possible	
129.2.0 Refill PLSS water tank	74:14:00	00:01:00	C/A						
129.2.1				Checklist	---	Open cap on top of water tank and connect to neck of water squeeze bottle	---	---	Water in bottle ready to be deployed into PLSS water tank
129.2.2				Water no longer flowing into tank	---	Invert water bottle and squeeze	---	---	PLSS water tank refilled
129.2.3				Checklist	---	Disconnect squeeze bottle and recap PLSS tank	---	---	
129.3.0 Recharge PLSS battery	74:15:00	00:00:30	C/A						
129.3.1				Procedure	Voltmeter	Plug recharge cable into PLSS receptacle from LEM power system	---	PLSS battery is being recharged	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
129.4.0 Secure self in seat	74:15:30	00:00:10	C/SE						
129.4.1				Procedure	---	Take SE seat	---	---	
129.4.2				Procedure	---	Secure self in seat	Engage restraint harness latch	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
130.0.0 Review and Record Lunar Activities	74:15:40	00:25:20	C/SE; SE/C						
130.1.0 Draft map of lunar surface operations area and record findings	74:15:40	00:25:20							
130.1.1				Checklist	---	Consult notes and discuss sequence of lunar events and experiments	---	---	
130.1.2				Checklist	---	Define lunar locale on map. (crater, sea, etc.) and plot LEM position in relation to area	---	---	
130.1.3				Checklist	---	Plot sight of various experiments in relation to LEM	---	---	
130.1.4				Checklist	---	Record findings and comments	---	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
131.0.0 Perform Off-Duty Activities	74:41:00	04:44:00	C/SE						
131.1.0 Adjust seat and suit	as desired								
131.1.1				Procedure	---	Rotate SE seat 45° into aisle	Seat position lock handle	---	C has more room in which to stretch out
131.1.2				Procedure	---	Remove helmet and place on ascent engine housing	Release collar latch and unsnap	---	
131.1.3				Procedure	---	Remove gloves and place on ascent engine housing	Loosen palm straps, unhook zipper and unzip gloves	---	
131.2. Perform personal hygiene	As desired								
131.2.1				Procedure	---	Remove washing pad from storage location	---	---	
131.2.2				Procedure	---	Clean face and hands	---	---	
131.2.3				Procedure	---	Place washing pad in storage location	---	---	
131.[illegible] Prepare and consume food	As desired								
131.3.1				Procedure	---	Remove food tray and eating utensils from storage location	---	---	
131.3.2				Procedure	---	Attach water hose disconnect to tray inlet valve	---	---	
131.3.3				Procedure	---	Heat food, disconnect water hose and prepare food	---	---	
131.3.4				Procedure	---	Eat	---	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
131.3.5				Procedure	---	Store waste and eating utensils in tray and replace in storage location	---	---	
131.3.6				Procedure	---	Remove washing pad from storage location	---	---	
131.3.7				Procedure	---	Clean face and hands	---	---	
131.3.8				Procedure	---	Store washing pad	---	---	
131.4.0 Rest and/or sleep	As desired								
131.4.1				Procedure	---	Don gloves	Slip on to hands and zipper to suit	---	
131.4.2				---	---	Rest or sleep, as desired	---	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
132.0.0 Track Command Module and Coordinate Information	74:56:00	00:18:35	SE/C						
132.1.0 Place equipment in readiness condition	74:56:00	00:02:00							
132.1.1				Same as 118.1.1					
132.1.2				Same as 118.1.2					
132.1.3				Same as 118.1.3					
132.1.4				Checklist		Place SCT in zero optics mode	OPTICS MODE toggles to ZERO		
132.1.5				Procedure	SCT Angular readout indicator	Verify optics zeroed	- - -	- - -	
132.1.6				Checklist	- - -	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
132.1.7				Checklist	- - -	Rotate SCT eyepiece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	- - -	
132.1.8				Checklist	- - -	Select fast optics speed	OPTICS SPEED toggle to FAST	- - -	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
132.1.9				Same as 118.1.9					
132.1.10				Same as 118.1.10					
132.1.11				Same as 118.1.11					
132.1.12				Same as 118.1.12					
132.2.0 Transmit tape-recorded information to CM	74:58:00	00:01:00							
132.2.1				Same as 118.2.1					
132.2.2				Same as 118.2.2					
132.2.3				Same as 118.2.3					
132.3.0 Acquire CM with SCT and radar track	74:59:00	00:14:00							
132.3.1				Same as 118.3.1					
132.3.2				Same as 118.3.2					
132.3.3				Same as 118.3.3					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
132.3.4				Same as 118.3.4					
132.3.5				Same as 118.3.5					
132.4.0 Determine existence of communications Black-out with CM 132.4.1	75:13:00	00:00:20		Same as 118.4.1					
132.4.2				Same as 118.4.2					
132.4.3				Same as 118.4.3					
132.4.4				Same as 118.4.4					
132.5.0 Determine updated ascent trajectory parameters 132.5.1	75:13:20	00:00:30		Checklist	---	Read ascent parameters call-up code #	---	---	
132.5.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard pushbuttons	Call-up code # inserted into computer keyboard	
132.5.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
132.5.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate.	Digital indicators	Read ascent parameters	---	---	
132.5.5				Same as 118.5.5					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
132.6.0 Determine CM's updated orbital parameters	75:13:50	00:00:30							
132.6.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
132.6.2				Procedure	---	Insert call-up code # into computer key-board	Computer key-board push-buttons	Call-up code # inserted into computer key-board	
132.6.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up Code # entered into computer.	
132.6.4				Orbital period (velocity or altitude) and orbital plane (angle of inclination and longitude of orbital plane with reference to lunar equator). Position in orbit (time or lunar coordinates with respect to some reference time).	Digital indicators	Read CM's orbital parameters	---	---	CM orbital parameters determined
132.6.5				Same as 118.6.5					
132.7.0 Place equipment in standby condition	75:14:20	00:00:15							
132.7.1				Same as 118.7.1					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
132.7.2				Same as 118.7.2					
132.7.3				Same as 118.7.3					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
133.0.0 Remove and Replace LiOH Cannister	76:00:00	00:00:45	SE/C-A-T						
133.1.0 Monitor condition of CO_2 removal	76:00:00	00:00:05	SE/C						
133.1.1				One LiOH warning light illuminated. Partial pressure indicator reads below 7.6 mm/Hg	Light-indicator	Check LiOH status	---	---	
133.2.0 Stand in aisle	76:00:05	00:00:05	SE/C-A						
133.2.1				Procedure	---	Unlatch seat restraint harness and stand up	Depress and twist lever on harness	---	
133.3.0 Proceed to LiOH cannisters and check	76:00:10	00:00:10	SE/T						
133.3.1				Color of chemical in cannister. New cannister checks out	Window in cannister	Crawl into tunnel and check cannisters with flashlight	LiOH selector valve to unilluminated cannister	---	
133.4.0 Change cannister	76:00:20	00:00:15	SE/T						
133.4.1				Procedure	---	Unscrew collar; remove used cannister; insert unused cannister; screw down collar	---	---	When LiOH light indicates saturation of other cannister, the newly inserted cannister will be ready to carry the CO_2 removal requirements.
133.5.0 Return to duty station	76:00:35	00:00:10	SE/C						
133.5.1				Procedure	---	Crawl back to aisle, take seat and secure	Engage locking lever on restraint harness	---	

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PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
134.0.0 Track Command Module and Coordinate Information	76:59:00	00:18:35							
134.1.0 Place equipment in readiness condition	76:59:00	00:02:00							
134.1.1				Same as 118.1.1					
134.1.2				Same as 118.1.2					
134.1.3				Same as 118.1.3					
134.1.4				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	---	
134.1.5				Procedure	SCT angular readout indicator	Verify optics zeroed	---	---	
134.1.6				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
134.1.7				Checklist	---	Rotate SCT eyepiece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
134.1.8				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
134.1.9				Same as 118.1.9					
134.1.10				Same as 118.1.10					
134.1.11				Same as 118.1.11					
134.1.12				Same as 118.1.12					

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PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
134.2.0 Transmit tape-recorded information to CM	77:01:00	00:01:00							
134.2.1				Same as 118.2.1					
134.2.2				Same as 118.2.2					
134.2.3				Same as 118.2.3					
134.3.0 Acquire CM with SCT and radar track	77:02:00	00:14:00							
134.3.1				Same as 118.3.1					
134.3.2				Same as 118.3.2					
134.3.3				Same as 118.3.3					
134.3.4				Same as 118.3.4					
134.3.5				Same as 118.3.5					
134.4.0 Determine existence of communications black-out with CM	77:16:00	00:00:20							
134.4.1				Same as 118.4.1					
134.4.2				Same as 118.4.2					
134.4.3				Same as 118.4.3					
134.4.4				Same as 118.4.4					
134.5.0 Determine updated ascent trajectory parameters	77:16:20	00:00:30							
134.5.1				Checklist	---	Read ascent parameters call-up code #	---	---	
134.5.2				Procedure	---	Insert call-up code # into computer keyboard	Computer key-board push-buttons	Call-up code # inserted into com-puter keyboard	
134.5.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER push-button	Call-up code # entered into com-puter	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
134.5.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate.	Digital indicators	Read ascent parameters	---	---	
134.5.5				Same as 118.5.5					
134.6.0 Determine CM's updated orbital parameters	77:16:50	00:00:30							
134.6.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
134.6.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard pushbuttons	Call-up code # inserted into computer keyboard	
134.6.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
134.6.4				Orbital period (velocity or altitude) and orbital plane (angle of inclination and longitude of orbital plane with reference to lunar equator). Position in orbit (time or lunar coordinates with respect to some reference time)	Digital indicators	Read CM's orbital parameters	---	---	CM orbital parameters determined.
134.6.5				Same as 118.6.5					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
134.7.0 Place equipment in standby condition	77:17:20	00:00:15							
134.7.1				Same as 118.7.1					
134.7.2				Same as 118.7.2					
134.7.3				Same as 118.7.3					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
135.0.0 Track Command Module and Coordinate Information	79:02:00	00:18:35	SE/C						
135.1.0 Place equipment in readiness condition	79:02:00	00:02:00							
135.1.1				Same as 118.1.1					
135.1.2				Same as 118.1.2					
135.1.3				Same as 118.1.3					
135.1.4				Checklist	— — —	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	---	
135.1.5				Procedure	SCT angular readout indicator	Verify optics zeroed	---	---	
135.1.6				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
135.1.7				Checklist	---	Rotate SCT eye-piece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
135.1.8				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
135.1.9				Same as 118.1.9					
135.1.10				Same as 118.1.10					
135.1.11				Same as 118.1.11					
135.1.12				Same as 118.1.12					
135.2.0 Transmit tape-recorded information to CM	79:04:00	00:01:00							
135.2.1				Same as 118.2.1					

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
135.2.2				Same as 118.2.2					
135.2.3				Same as 118.2.3					
135.3.0 Acquire CM with SCT and radar track	79:05:00	00:14:00							
135.3.1				Same as 118.3.1					
135.3.2				Same as 118.3.2					
135.3.3				Same as 118.3.3					
135.3.4				Same as 118.3.4					
135.3.5				Same as 118.3.5					
135.4.0 Determine existence of communications black-out with CM	79:19:00	00:00:20							
135.4.1				Same as 118.4.1					
135.4.2				Same as 118.4.2					
135.4.3				Same as 118.4.3					
135.4.4				Same as 118.4.4					
135.5.0 Determine updated ascent trajectory parameters	79:19:20	00:00:30							
135.5.1				Checklist	---	Read ascent parameters call-up code #			
135.5.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard pushbuttons	Call-up code # inserted into computer keyboard	
135.5.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	

PHASE NUMBER 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
135.5.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate.	Digital indicators	Read ascent parameters	---	---	
135.5.5				Same as 118.5.5					
135.6.0 Determine CM's updated orbital parameters	79:19:50	00:00:30							
135.6.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
135.6.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard push-buttons	Call-up code # inserted into computer keyboard	
135.6.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
135.6.4				Orbital period (velocity or altitude) and orbital plane (angle of inclination and logitude of orbital plane with reference to lunar equator). Position in orbit (time or lunar coordinates with respect to some reference time.)	Digital indicators	Read CM's orbital parameters	---	---	CM orbital parameters determined.
135.6.5				Same as 118.6.5					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
135.7.0 Place equipment in standby condition	79:20:20	00:00:15							
135.7.1				Same as 118.7.1					
135.7.2				Same as 118.7.2					
135.7.3				Same as 118.7.3					

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
136.0.0 Change Duty Stations	74:25:00	00:05:00							
136.1.0 Proceed into tunnel	74:25:00	00:03:00	C/SE-T						
136.1.1				Procedure	---	Don helmet	Lower over head onto collar - latch in place	---	Face plate is open
136.1.2				Procedure	---	Rotate SE seat back into position	Seat position lock handle	---	
136.1.3				Procedure	---	Release self from SE seat	Release restraint harness latch	---	
136.1.4				Procedure	---	Stand up and proceed into tunnel	---	---	"C" is in the tunnel clear of the aisle and wearing the same PLSS he wore on the lunar surface.
136.2.0 SE take System Engineer's position	79:28:00	00:01:00	SE/C-SE						
136.2.1				Procedure	---	Release self from C seat	Release restraint harness latch	---	
136.2.2				Procedure	---	Stand in aisle	---	---	SE is in the aisle wearing his own PLSS.
136.2.3				Procedure	---	Take SE seat	---	---	
136.2.4				Procedure	---	Secure self in SE seat	Engage restraint harness latch	---	
136.2.5				Procedure	---	Remove helmet and place on ascent engine housing	Release collar latch and unsnap	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
136.3.0 C take Commander's position	79:29:00	00:01:00	C/T-A-C						
136.3.1				Procedure	---	Stand in aisle	---	---	Crawl over ascent engine housing and step into aisle
136.3.2				Procedure	---	Take C seat	---	---	
136.3.3				Procedure	---	Secure self in C seat	Engage restraint harness latch	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
137.0.0 Perform Off-Duty Activities	79:30:00	04:17:00	SE/SE						
137.1.0 Adjust seat and suit	as desired			Same as 131.1.1	and 131.1.3				
137.2.0 Perform personal hygiene	as desired			Same as 131.2.1	through 131.2.3				
137.3.0 Prepare and consume food	as desired			Same as 131.3.1	through 131.3.8				
137.4.0 Rest and/or sleep	as desired			Same as 131.4.1	through 131.4.2				

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
138.0.0 Remove and Replace LiOH Cannister	80:00:00	00:00:45	C/C-A-T						
138.1.0 Monitor condition of CO_2 removal	80:00:00	00:00:05	C/C						
138.1.1				One LiOH warning light illuminated. Partial pressure indicator reads below 7.6 mm/hg	Light-indicator	Check LiOH status	---	---	
138.2.0 Stand in aisle	80:00:05	00:00:05	C/C-A						
138.2.1				Procedure	---	Unlatch seat restraint harness and stand up	Depress and twist lever on harness	---	
138.3.0 Proceed to LiOH cannisters and check	80:00:10	00:00:10	C/T						
138.3.1				Color of chemical in cannister New cannister checks out.	Window in cannister	Crawl into tunnel and check cannister with flash light	LiOH selector valve to unilluminated cannister.	---	
138.4.0 Change cannister	80:00:20	00:00:15	C/T						
138.4.1				Procedure	---	Unscrew collar; remove used cannister; insert unused cannister; screw down collar	---	---	When LiOH light indicates saturation of other cannister, the newly inserted cannister will be ready to carry the CO_2 removal requirements.
138.5.0 Return to duty station	80:00:35	00:00:10	C/C						
138.5.1				Procedure	---	Crawl back to aisle take seat and secure	Engage locking lever on restraint harness	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
139.0.0 Track Command Module and Coordinate Information	81:05:00	00:18:35	C/C						
139.1.0 Place equipment in readiness condition	81:05:00	00:02:00							
139.1.1				Same as 118.1.1					
139.1.2				Same as 118.1.2					
139.1.3				Same as 118.1.3					
139.1.4				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	---	
139.1.5				Procedure	SCT angular readout indicator	Verify optics zeroed	---	---	
139.1.6				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
139.1.7				Checklist	---	Rotate SCT eyepiece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
139.1.8				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
139.1.9				Same as 118.1.9					
139.1.10				Same as 118.1.10					
139.1.11				Same as 118.1.11					
139.1.12				Same as 118.1.12					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
139.2.0 Transmit tape-recorded information to CM	81:07:00	00:01:00							
139.2.1				Same as 118.2.1					
139.2.2				Same as 118.2.2					
139.2.3				Same as 118.2.3					
139.3.0 Acquire CM with SCT and radar track	81:08:00	00:14:00							
139.3.1				Same as 118.3.1					
139.3.2				Same as 118.3.2					
139.3.3				Same as 118.3.3					
139.3.4				Same as 118.3.4					
139.3.5				Same as 118.3.5					
139.4.0 Determine existence of communications black-out with CM	81:22:00	00:00:20							
139.4.1				Same as 118.4.1					
139.4.2				Same as 118.4.2					
139.4.3				Same as 118.4.3					
139.4.4				Same as 118.4.4					
139.5.0 Determine updated ascent trajectory parameters	81:22:20	00:00:30							
139.5.1				Checklist	---	Read ascent parameters call-up code #	---	---	
139.5.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard push-buttons	Call-up code # inserted into computer keyboard	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
139.5.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
139.5.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate	Digital indicators	Read ascent parameters	---	---	
139.5.5				Same as 118.5.5					
139.6.0 Determine CM's updated orbital parameters	81:22:50	00:00:30							
139.6.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
139.6.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard pushbuttons	Call-up code # inserted into computer keyboard	
139.6.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
139.6.4				Orbital period (velocity or altitude) and orbital plane (angle of inclination and longitude of orbital plane with reference to lunar equator). Position in orbit (time or lunar coordinates with respect to some reference time)	Digital indicators	Read CM's orbital parameters	---	---	CM orbital parameters determined
139.6.5				Same as 118.6.5					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
139.7.0 Place equipment in standby condition	81:23:20	00:00:15							
139.7.1				Same as 118.7.1					
139.7.2				Same as 118.7.2					
139.7.3				Same as 118.7.3					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
140.0.0 Track Command Module and Coordinate Information	83:08:00	00:18:35	C/C						
140.1.0 Place equipment in readiness condition	83:08:00	00:02:00							
140.1.1				Same as 118.1.1					
140.1.2				Same as 118.1.2					
140.1.3				Same as 118.1.3					
140.1.4				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO		
140.1.5				Procedure	SCT angular readout indicator	Verify optics zeroed	---	---	
140.1.6				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
140.1.7				Checklist	---	Rotate SCT sye-piece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
140.1.8				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
140.1.9				Same as 118.1.9					
140.1.10				Same as 118.1.10					
140.1.11				Same as 118.1.11					
140.1.12				Same as 118.1.12					
140.2.0 Transmit tape-recorded information to CM	83:10:00	00:01:00							
140.2.1				Same as 118.2.1					

PHASE NUMBER: 8 LUNAR ORBIT ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
140.2.2				Same as 118.2.2					
140.2.3				Same as 118.2.3					
140.3.0 Acquire CM with SCT and radar track	83:11:00	00:14:00							
140.3.1				Same as 118.3.1					
140.3.2				Same as 118.3.2					
140.3.3				Same as 118.3.3					
140.3.4				Same as 118.3.4					
140.3.5				Same as 118.3.5					
140.4.0 Determine existence of communications black-out with CM	83:25:00	00:00:20							
140.4.1				Same as 118.4.1					
140.4.2				Same as 118.4.2					
140.4.3				Same as 118.4.3					
140.4.4				Same as 118.4.4					
140.5.0 Determine updated ascent trajectory parameters	83:25:20	00:00:30							
140.5.1				Checklist	---	Read ascent parameters call-up code #	---	---	
140.5.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard push-buttons	Call-up code # inserted into computer keyboard	
140.5.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	

PHASE NUMBER: 8 LUNAR [redacted] ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
140.5.4				Launch window. Duration of vertical rise. ΔV required, Initial pitch rate.	Digital indicators	Read ascent parameters	---	---	
140.5.5				Same as 118.5.5					
140.6.0 Determine CM's updated orbital parameters	83:25:50	00:00:30							
140.6.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
140.6.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard push-buttons	Call-up code # inserted into computer keyboard	
140.6.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER push-button	Call-up code # entered into computer	
140.6.4				Orbital period (velocity or altitude) and orbital plane (angle of inclination and longitude of orbital plane with reference to lunar equator) Position in orbit (time or lunar coordinates with respect to some reference time)	Digital indicators	Read CM's orbital parameters	---	---	CM orbital parameters determined
140.6.5				Same as 118.6.5					
140.7.0 Place equipment in standby condition	83:26:20	00:00:15							
140.7.1				Same as 118.7.1					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
140.7.2				Same as 118.7.2					
140.7.3				Same as 118.7.3					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
141.0.0 Determine Scientific Activities to be Performed	83:47:00	00:10:00	SE/SE; C/C						
141.1.0 Determine task requirements	83:47:00	00:05:00							
141.1.1				Checklist	DATA CHART	Determine order of priority for performing scientific activities	---	---	
141.2.0 Determine equipment requirements	83:52:00	00:05:00							
141.2.1				Checklist	DATA CHART	Determine equipment to be transported to lunar surface: - from inside of LEM cabin - from Descent Stage storage area.	---	---	Tentative list of scientific instrumentation from NASA Work Statement of 12/20/62: Lunar Atmosphere Analyzer. Gravitometer. Magnetometer. Radiation Spectrometer. Specimen Return Containers. Rock and Soil Analysis Equipment. Soil Temperature Instrument. Seismographic Equipment. Cameras - Still and Motion Picture. Telescope.
141.2.2				Checklist	DATA CHART	Determine equipment to be utilized from inside LEM cabin	---	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
142.0.0 Remove and Replace LiOH Cannister	84:00:00	00:00:45	SE/SE--A-T						
142.1.0 Monitor condition of CO_2 removal	84:00:00	00:00:05	SE/SE						
142.1.1				One LiOH warning light illuminated. Partial pressure indicator reads below 7.6 mm/Hg	Light - indicator	Check LiOH status	---	---	
142.2.0 Stand in aisle	84:00:05	00:00:05	SE/SE-A						
142.2.1				Procedure	---	Unlatch seat restraint harness and stand up	Depress and twist lever on harness	---	
142.3.0 Proceed to LiOH cannisters and check	84:00:10	00:00:10	SE/T						
142.3.1				Color of chemical in cannister. New cannister checks out	Window in cannister	Crawl into tunnel and check cannisters with flashlight.	LiOH selector valve to unilluminated cannister	---	
142.4.0 Change cannister	84:00:20	00:00:15	SE/T						
142.4.1				Procedure	---	Unscrew collar; remove used cannister; insert unused cannister; screw down collar	---	---	When LiOH light indicates saturation of other cannister, the newly inserted cannister will be ready to carry the CO_2 removal requirements.
142.5.0 Return to duty station	84:00:35	00:00:10	SE/SE						
142.5.1				Procedure	---	Crawl back to aisle, take seat and secure	Engage locking lever on restraint harness	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
143.0.0 Prepare For Egress To Lunar Surface	84:02:05	00:14:55							
143.1.1 Check-out SE's communications belt-pack	84:02:05	00:01:10	SE/SE						
143.1.1				Procedure	---	Don-helmet	Lower overhead onto collar. Latch in place	---	Faceplate is open
143.1.2				Checklist	---	Disconnect communications umbilical from console jackbox and connect to beltpack	---	---	Astronaut is on beltpack communications to transmit and receive voice communications and transmit bio-med. status.
143.1.3				Checklist	---	Check duplex capability by voice communication acknowledgement with GOSS and other astronaut	Select duplex mode	---	Astronaut's beltpack duplex mode is checked out by GOSS acknowledging on UHF
143.1.4				Checklist	---	Check simplex capability by voice communication acknowledgement with other astronaut	Select simplex mode	---	Astronaut's beltpack simplex mode is checked out by inter-crew acknowledgement.
143.2.0 Attach radiation dosimeter to pressure suit	84:03:15	00:00:05	SE/SE						
143.2.1				Checklist	Dosimeter is visible on sleeve	Attach dosimeter to suit	---	Dosimeter is properly mounted	
143.3.0 Stand in aisle	84:03:20	00:00:10	SE/SE-A						
143.3.1				Procedure	---	Unlatch seat restraint harness and stand up	Depress and twist lever on harness	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
143.4.0 Prepare equipment to be lowered to lunar surface	84:03:30	00:13:00	C/T-A						
143.4.1				Checklist	---	Pull lift line out of stowage, & coil on floor	---	---	Lift line is ready for attachment of equipment to be lowered
143.4.2				Checklist	---	Unfasten equipment to be lowered and place on seat	Unsnap fasteners	---	
143.4.3				Checklist	---	Attach tool belt to wrist	---	---	Tool belt is attached to suit prior to suit inflation
143.4.4				Checklist	---	Place portable TV camera in radiation protective jacket	---	---	TV camera is protected from lunar environment
143.5.0 Transfer to suit circuit	84:16:30	00:00:30							
143.5.1			SE/A; C/C	Checklist	---	Slide faceplate to closed position and turn locking knob	Locking knob	SE and C faceplates are closed. Suit integrity accomplished.	
143.5.2			C/C	Checklist	---	Manually close LEM ECS connection to LEM cabin	Close: DIVERTER VALVE, CABIN GAS RETURN VALVE, SUIT CIRCUIT RELIEF VALVE	Suit is a closed circuit	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
144.0.0 Prepare LEM Cabin for Egress	84:17:00	00:01:40							
144.1.0 Depressurize LEM cabin	84:17:00	00:01:10							
144.1.1			C/C	Same as 111.1.1					
144.1.2			C/C	Same as 111.1.2					
144.1.3			SE/A	Same as 111.1.3					
144.2.0 Open tunnel hatch	84:18:10	00:00:30	SE/A						
144.2.1				Same as 111.2.1					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
145.0.0 Egress To Lunar Surface	84:18:40	00:18:30							
145.1.0 Protrude head and shoulders out of hatchway and investigate lunar surface	84:18:40	00:01:00	SE/LEM	Same as 112.1.1 through		112.1.3			
145.2.0 Prepare for descent to lunar surface	84:19:40	00:03:00							
145.2.1			SE/BP	Same as 112.2.1					
145.2.2			C/C-A	Same as 112.2.2					
145.2.3			C/A; SE/BP	Same as 112.2.3					
145.2.4			SE/BP	Same as 112.2.4					
145.2.5			SE/BP	Same as 112.2.5					
145.3.0 Descend to lunar surface	84:22:40	00:01:00	SE/BP-LS	Same as 112.3.1	and 112.3.2				
145.4.0 Test body mobility in lunar "G" environment	84:23:40	00:13:30	SE/LS	Same as 112.4.1 through		112.4.7			

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
146.0.0 Prepare LEM Cabin for Lunar Operations	84:35:40	00:01:30	C/C-A						
146.1.0 Repressurize LEM cabin	84:35:40	00:01:30		Same as 114.1.1 through		114.1.7			

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
147.0.0 Activate Ground Power For Lunar Surface Operations	84:37:10	00:00:10	C/C	To Be Determined					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
148.0.0 Set-Up And Operate Portable TV Camera	84:37:10	00:20:00							
148.1.0 Energize DSIF (UHF) dish antenna and lock to GOSS	84:37:10	00:10:00	SE/LS						
148.1.1				Same as 121.1.2					
148.1.2				Same as 121.1.3					
148.2.0 Set-up and operate TV camera	84:47:10	00:10:00	SE/LS						
148.2.1				Procedure	---	Install camera on tripod and energize by connecting cable to ground power and depress power switch	CAMERA POWER switch to on position (on pistol grip)	Portable TV camera energized and operational.	
148.2.2			SE/LS	Same as 121.2.2					
148.2.3			SE/LS	Same as 121.2.3					
148.2.4			C/C	Same as 121.2.4					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
149.0.0 Perform Scientific Activities	84:57:00	02:49:40	SE/LS						
149.1.0 Connect equipment requiring electrical power to ground link				Same as 122.1.1					
149.2.0 Perform experiments				Same as 122.2.1	through 122.2.3				
149.3.0 Report progress and results to LEM/GOSS				Same as 122.3.1					
149.4.0 Make direct visual observations				Same as 122.4.1					
149.5.0 Make photographic observations				Same as 122.5.1					

PHASE NUMBER: 8 LUNAR SURF ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
150.0.0 Track Command Module and Coordinate Information	85:11:00	00:18:35	C/C						
150.1.0 Place equipment in readiness condition	85:11:00	00:02:00							
150.1.1				Same as 118.1.1					
150.1.2				Same as 118.1.2					
150.1.3				Same as 118.1.3					
150.1.4				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO		
150.1.5				Procedure	SCT angular readout indicator	Verify optics zeroed	---	---	
150.1.6				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
150.1.7				Checklist	---	Rotate SCT eye-piece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
150.1.8				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
150.1.9				Same as 118.1.9					
150.1.10				Same as 118.1.10					
150.1.11				Same as 118.1.11					
150.1.12				Same as 118.1.12					
150.2.0 Transmit tape-recorded information to CM	85:13:00	00:01:00							
150.2.1				Same as 118.2.1					
150.2.2				Same as 118.2.2					
150.2.3				Same as 118.2.3					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
150.3.0 Acquire CM with SCT and radar track	85:14:00	00:14:00							
150.3.1				Same as 118.3.1					
150.3.2				Same as 118.3.2					
150.3.3				Same as 118.3.3					
150.3.4				Same as 118.3.4					
150.3.5				Same as 118.3.5					
150.4.0 Determine existence of communications black-out with CM	85:28:00	00:00:20							
150.4.1				Same as 118.4.1					
150.4.2				Same as 118.4.2					
150.4.3				Same as 118.4.3					
150.4.4				Same as 118.4.4					
150.5.0 Determine updated ascent trajectory parameters	85:28:20	00:00:30							
150.5.1				Checklist	---	Read ascent parameters call-up code #	---	---	
150.5.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard push-buttons	Call-up code # inserted into computer keyboard	
150.5.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
150.5.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate.	Digital indicators	Read ascent parameters	---	---	
150.5.5				Same as 118.5.5					
150.6.0 Determine CM's updated orbital parameters	85:28:50	00:00:30							

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
150.6.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
150.6.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard push-buttons	Call-up code # inserted into computer keyboard	
150.6.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
150.6.4				Orbital period (velocity or altitude) and orbital plane (angle of inclination and longitude of orbital plane with reference to lunar equator). Position in orbit (time or lunar coordinates with respect to some reference time)	Digital indicators	Read CM's orbital parameters	---	---	CM orbital parameters determined
150.6.5				Same as 118.6.5					
150.7.0 Place equipment in standby condition	85:29:20	00:00:15							
150.7.1				Same as 118.7.1					
150.7.2				Same as 118.7.2					
150.7.3				Same as 118.7.3					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
151.0.0 Track Command Module and Coordinate Information	87:14:00	00:18:35	C/C						
151.1.0 Place equipment in readiness condition	87:14:00	00:02:00							
151.1.1				Same as 118.1.1					
151.1.2				Same as 118.1.2					
151.1.3				Same as 118.1.3					
151.1.4				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	---	
151.1.5				Procedure	SCT Angular readout indicator	Verify optics zeroed	---	---	
151.1.6				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
151.1.7				Checklist	---	Rotate SCT eye-piece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	
151.1.8				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
151.1.9				Same as 118.1.9					
151.1.10				Same as 118.1.10					
151.1.11				Same as 118.1.11					
151.1.12				Same as 118.1.12					
151.2.0 Transmit tape-recorded information to CM	87:16:00	00:01:00							
151.2.1				Same as 118.2.1					

PHASE NUMBER: 8 LUNAR SURFACE ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
151.2.2				Same as 118.2.2					
151.2.3				Same as 118.2.3					
151.3.0 Acquire CM with SCT and radar track	87:17:00	00:14:00							
151.3.1				Same as 118.3.1					
151.3.2				Same as 118.3.2					
151.3.3				Same as 118.3.3					
151.3.4				Same as 118.3.4					
151.3.5				Same as 118.3.5					
151.4.0 Determine existence of communications black-out with CM	87:31:00	00:00:20							
151.4.1				Same as 118.4.1					
151.4.2				Same as 118.4.2					
151.4.3				Same as 118.4.3					
151.4.4				Same as 118.4.4					
151.5.0 Determine updated ascent trajectory parameters	87:31:20	00:00:30							
151.5.1				Checklist	---	Read ascent parameters call-up code #	---	---	
151.5.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard push-buttons	Call-up code # inserted into computer keyboard	
151.5.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER push-button	Call-up code # entered into computer	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
151.5.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate.	Digital indicators	Read ascent parameters	---	---	
151.5.5				Same as 118.5.5					
151.6.0 Determine CM's updated orbital parameters	87:31:50	00:00:30							
151.6.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
151.6.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard pushbuttons	Call-up code # inserted into computer keyboard	
151.6.3				Procedure	Computer call-up digital indicator	Enter call-up code # and verify	COMPUTER ENTER push-button	Call-up code # entered into computer.	
151.6.4				Orbital period (velocity or altitude) and orbital plane (angle of inclination and longitude of orbital plane with reference to lunar equator). Position in orbit (time or lunar coordinates with respect to some reference time).	Digital indicators	Read CM's orbital parameters	---	---	CM orbital parameters determined
151.6.5				Same as 118.6.5					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
151.7.0 Place equipment in standby condition	87:32:20	00:00:15							
151.7.1				Same as 118.7.1					
151.7.2				Same as 118.7.2					
151.7.3				Same as 118.7.3					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
152.0.0 Prepare for Re-Entry to LEM	87:46:30	00:22:00							
152.1.0 Prepare equipment	87:46:30	00:22:00							
152.1.1			C/C	Same as 125.1.1					
152.1.2			C/C	Same as 125.1.2					
152.1.3			SE/LS	Same as 125.1.3					
152.1.4			SE/LS	Same as 125.1.4					
152.1.5			SE/LS	Same as 125.1.5					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
153.0.0 Remove and Replace LiOH Cannister	88:00:00	00:00:45	C/C-A-T						
153.1.0 Monitor condition of CO_2 removal	88:00:00	00:00:05	C/C						
153.1.1				One LiOH warning light illuminated. Partial pressure indicator reads below 7.6 mm/Hg	Light indicator	Check LiOH status	---	---	
153.2.0 Stand in aisle	88:00:05	00:00:05	C/C-A						
153.2.1				Procedure	---	Unlatch seat restraint harness and stand up.	Depress and twist lever on harness.	---	
153.3.0 Proceed to LiOH cannisters and check	88:00:10	00:00:10	C/T						
153.3.1				Color of chemical in cannister. New cannister checks out.	Window in cannister	Crawl into tunnel and check cannisters with flashlight.	LiOH selector valve to unilluminated cannister	---	
153.4.0 Change cannister	88:00:20	00:00:15	C/T						
153.4.1				Procedure	---	Unscrew collar; remove used cannister; insert unused cannister; screw down collar	---	---	When LiOH light indicates saturation of other cannister, the newly inserted cannister will be ready to carry the CO_2 removal requirements.
153.5.0 Return to duty station	88:00:35	00:00:10	C/C						
153.5.1				Procedure	---	Crawl back to aisle, take seat and secure.	Engage locking lever on restraint harness	---	

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
154.0.0 Prepare for Re-Entry of Lunar Astronaut	88:08:30	00:05:20							
154.1.0 Transfer to suit circuit	88:08:30	00:00:30	C/C	Same as 126.1.1	thru 126.1.2				
154.2.0 Depressurize LEM cabin	88:09:00	00:01:10	C/C	Same as 111.1.1	thru 111.1.2				Two contingency repressurizations remaining.
154.3.0 Open LEM hatch	88:10:10	00:00:30	C/C-A	Same as 126.3.1	thru 126.3.2				
154.4.0 Transfer lunar surface equipment aboard LEM	88:10:40	00:03:00							
154.4.1			C/A	Same as 126.4.1					
154.4.2			SE/LS	Same as 126.4.2					
154.4.3			C/A	Same as 126.4.3					
154.5.0 Take C seat	88:13:40		C/C	Same as 126.5.1	thru 126.5.2				

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
155.0.0 Re-Enter LEM	88:13:40	00:02:00	SE/LS-BP-A						
155.1.0 Climb into LEM cabin	88:13:40	00:01:30	SE/LS-BP-A	Same as 127.1.1	thru 127.1.2				
155.2.0 Close LEM hatch	88:15:10	00:00:30	SE/A	Same as 127.2.1					

PHASE NUMBER: 8 LUNAR STAY ACTIVITIES

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
156.0.0 Prepare LEM Cabin for Rest and Replenishment Period	88:15:40	00:01:20							
156.1.0 Repressurize LEM cabin	88:15:40	00:01:20							
156.1.1			SE/A	Same as 128.1.1					
156.1.2			SE/A	Same as 114.1.2					
156.1.3			C/C	Same as 114.1.4					
156.1.4			C/C	Same as 114.1.5					

Phase 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

From 88:17:00 To 91:29:00

Elapsed Time 3 hr. 12 min.

Commander	Mission Time	Systems Engineer
	88:17:00	157.0.0 Secure LEM Cabin
157.1.1 Open face plate	88:17:00	157.1.0 Secure equipment in storage areas
158.0.0 Monitor LEM Systems Status	88:17:10	
	88:18:40	159.0.0 Replenish PLSS Unit and Secure Self in Seat
	88:18:40	159.1.0 Refill O_2 tank
	88:19:40	159.2.0 Refill PLSS water tank
	88:20:40	159.3.0 Recharge PLSS battery
	88:21:10	159.4.0 Secure self in seat
160.0.0 Review and Record Lunar Activities	88:21:20	160.0.0 Review and Record Lunar Activities
160.1.0 Draft map of lunar surface operations area and record findings	88:21:20	160.1.0 Draft map of lunar surface operations area and record findings
158.0.0 Monitor LEM Systems Status	88:47:00	161.0.0 Perform Off-Duty Activities
		161.1.0 Adjust seat and suit
		161.2.0 Perform personal hygiene
		161.3.0 Prepare and consume food
		161.4.0 Rest
	89:12:00	162.0.0 Change Duty Stations
	89:12:00	162.1.0 Proceed into tunnel
162.2.0 Commander take SE position	89:15:00	No assigned activity
No assigned activity	89:16:00	162.3.0 SE take Commander's seat
164.0.0 Perform Off-Duty Activities	89:17:00	163.0.0 Track Command Module and Coordinate Information
164.1.0 Adjust seat and suit		
164.2.0 Perform personal hygiene		
164.3.0 Prepare and consume food		
164.4.0 Rest		
	89:17:00	163.1.0 Place equipment in readiness condition
	89:19:00	163.2.0 Transmit tape-recorded information to CM
	89:20:00	163.3.0 Acquire CM with SCT and radar track
	89:34:00	163.4.0 Determine existence of communications black-out with CM
	89:34:20	163.5.0 Determine updated ascent trajectory parameters
	89:34:50	163.6.0 Determine CM's updated orbital parameters
	89:35:20	163.7.0 Place equipment in standby condition

Phase 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS — From 88:17:00 To 91:29:00 — Elapsed Time 3 hr. 12 min.

Commander	Mission Time	Systems Engineer
	89:35:35	158.0.0 Monitor LEM Systems Status
165.0.0 Change Duty Stations	89:44:00	
165.1.0 Proceed into tunnel	89:44:00	
No assigned activity	89:47:00	165.2.0 SE take System Engineer's position
165.3.0 C take Commander's position	89:48:00	No assigned activity
No assigned activity	89:49:00	166.0.0 Activate All LEM Systems Required for Ascent and Checkout
	89:49:00	166.1.0 Purge fuel cell #1 and bring to operational status
	89:49:10	166.2.0 Check main bus voltage
	89:49:15	166.3.0 Activate DC distribution and checkout
	89:49:35	166.4.0 Activate electrical loads for ascent system and checkout
	89:49:55	166.5.0 Activate electrical loads for RCS and checkout
	89:50:15	166.6.0 Turn on power to N & G system
	90:06:15	166.7.0 Distribute power to S & C system and checkout
	90:11:15	167:0.0 Separate Ascent and Descent Stages
	90:11:15	167.1.0 Activate stage disconnect devices
	90:11:25	168.0.0 Perform Complete Systems Check-Out with IFTS
	90:11:25	168.1.0 Perform systems checkout in automatic test mode
	90:13:25	158.0.0 Monitor LEM Systems Status
	90:53:15	169.0.0 Remove and Replace LiOH Cannister
	90:53:15	169.1.0 Monitor condition of CO_2 removal
	90:53:20	169.2.0 Stand in aisle
	90:53:25	169.3.0 Proceed to LiOH cannister and check
	90:53:35	169.4.0 Change cannister
	90:53:50	169.5.0 Return to duty station
170.0.0 Align IMU on Lunar Surface	90:54:00	158.0.0 Monitor LEM Systems Status
170.1.0 Coarse align IMU with computer controls	90:54:00	
170.2.0 Fine align IMU		
171.0.0 Track Command Module for Final Orbital Updating and Coordinate Information	91:14:00	
171.1.0 Place equipment in readiness condition	91:14:00	
	91:14:05	171.1.4 Activate VHF subsystem
	91:14:10	158.0.0 Monitor LEM Systems Status
No assigned activity	91:14:55	

Phase 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

From 88:17:00 To 91:29:00

Elapsed Time 3 hr. 12 min.

Commander	Mission Time	Systems Engineer
	91:20:00	171.1.1 Establish two-way voice communications with CM
171.2.0 Acquire CM with SCT and radar track	91:20:30	171.3.0 Check that LEM/CM timing mechanisms synchronized
	91:22:30	172.0.0 Bring Ascent System and RCS to Readiness Condition and Checkout
	91:22:30	172.1.0 Arm ascent system and checkout
	91:22:50	172.2.0 Arm RCS and checkout
	91:23:15	172.3.0 Checkout firing of RCS
	91:24:15	158.0.0 Monitor LEM Systems Status
171.4.0 Determine the parameters required for ascent based on final updated CM orbital parameters	91:25:30	
171.5.0 Determine CM final orbital parameters	91:26:10	
No assigned activity	91:26:40	
173.0.0 Prepare For Ascent	91:27:35	
173.1.0 Select ascent modes	91:27:35	
173.2.0 Secure self and cabin interior	91:27:50	173.2.0 Secure self and cabin interior
173.4.0 Check CM lead angle	91:28:20	173.3.0 Start countdown to launch
End of Phase 9	91:29:00	End of Phase 9

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
157.0.0 Secure LEM Cabin	88:17:00	00:01:40							
157.1.0 Secure equipment in storage areas	88:17:00	00:01:40							
157.1.1			C/C; SE/A	No ECS malfunctions indicated and cabin pressure reads 5.0 psia	CABIN PRESSURE indicator	Open face plate	Unlock knob and slide face plate up	SE and C sustained by cabin environment	
157.1.2			SE/A	Procedure	---	Remove PLSS from back and place in SE seat	---	---	PLSS is accessible for replenishment
157.1.3			SE/A	Procedure	---	Stow loose equipment and specimens in their proper area	---	---	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
158.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/C or C/C						
158.1.0 Monitor subsystem master warning lights		00:00:05							
158.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
158.2.0 Monitor electrical system status		00:00:40							
158.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
158.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1, 2 and 3	---	
158.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1, 2, 3) extinguished	Check N_2 fail warning indicators	---	---	
158.2.4				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3 and main bus current	MONITOR SELECT rotary (amps) to FC 1, 2, 3 and BUS A	---	
158.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
158.2.6				Normal operating temperature level	INVERTER No. 1 TEMP. warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to No. 1	---	
158.2.7				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
158.3.0 Monitor environmental control system status		00:01:15							
158.3.1				Maximum 1100 psia Normal 850 psia Minimum 7 psia	SOX PRESSURE indicator	Monitor SOX pressure	---	---	SOX pressure not monitored after stage separation
				Normal operating level	SOX QUANTITY indicator	Monitor SOX quantity	---	---	SOX quantity not monitored after stage separation
				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated
158.3.2				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator, and glycol temp. warning lights	---	---	If a light illuminates, that particular H_2O separator or LiOH system is malfunctioning. Select alternate system
158.3.3				Pressure reading of 5.0 psia	CABIN PRESSURE indicator	Check cabin pressure	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates

Function and Task Description	Mission Time	Activity Time	Crew Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
									If #1 inflow valve fails in automatic, place #1 O_2 inflow toggle to MANUAL. If #1 light illuminates, place #2 O_2 inflow valve toggle to MANUAL.
158.3.4				Cabin temperature is within 75°F ± 5°	CABIN TEMPERATURE indicator	Check cabin temperature	---	The cabin is checked out at normal temperature	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly.
158.3.5				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 flood status	---	Cabin oxygen flooding is normal.	
158.3.6				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	
158.3.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator	Check suit fan warn indicator	---	---	
158.4.0 Monitor descent propulsion system status									
158.4.1		00:00:15		Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	Descent propulsion not monitored after stage separation
158.4.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
158.4.3				Normal operating levels	TANK METERS: FUEL QTY (#1) FUEL QTY (#2) OXID QTY (#1) OXID QTY (#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS HELIUM TEMP.	Check tank quantities, pressures and temperatures	---	---	
158.5.0 Monitor ascent propulsion system status		00:00:15							
158.5.1				Ascent system monitoring	---	Select ascent mode for monitoring	MONITOR SELECT toggle to ASCENT	---	
158.5.2				Normal operating pressure level downstream of second stage regulators	PRESSURE RESULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
158.5.3				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
158.5.4				Normal operating levels	TANK METERS: FUEL QTY (#1) FUEL QTY (#2) OXID QTY (#1) OXID QTY (#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS	Check tank quantities, pressures and temperatures	---	---	
158.6.0 Monitor RCS status		00:00:15							
158.6.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	---	---	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
158.6.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check system A & B relief valve warning indicators	---	---	
158.6.3				Normal operating levels	TANK METERS: FUEL and OXID QTY; FUEL & OXID. PRESS; HELIUM PRESS & TEMP.	Check system A & B tank quantities, pressures and temperatures	---	---	
158.6.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
158.7.0 Monitor navigation and guidance system status		00:00:20							
158.7.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature	---	---	
158.7.2				All warning lights extinguished. Computer power at correct standby operating level	WARNING INDICATORS: AGC POWER SUPPLY	Check power to computer memory unit	---	Computer maintained in self-checking mode	
158.8.0 Monitor stabilization and control system status				----------	----------	TO BE DETERMINED	----------	----------	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
159.0.0 Replenish PLSS Unit and Secure Self in Seat	88:18:40	00:02:40	SE/A-SE						
159.1.0 Refill O_2 tank	88:18:40	00:01:00	SE/A						
159.1.1				Checklist	- - -	Connect refill hose from O_2 receptacle on PLSS to ECS O_2 outlet	Snap ring	O_2 connection accomplished between PLSS and ECS	
159.1.2				Checklist	O_2 pressure indicator on PLSS	Open manual O_2 valve on outlet	Faucet	O_2 is being vented to the PLSS O_2 tank from the ECS	
159.1.3				O_2 pressure indicates full on PLSS	O_2 pressure indicator on PLSS	Shut faucet on O_2 outlet valve	Faucet	O_2 is not being vented from ECS	
159.1.4				Checklist	- - -	Disconnect refill hose	Quick dis-connect	O_2 back flow not possible	
159.2.0 Refill PLSS water tank	88:19:40	00:01:00	SE/A						
159.2.1				Checklist	- - -	Open cap on top of water tank and connect to neck of water squeeze bottle	- - -	- - -	Water in bottle ready to be deployed into PLSS water tank
159.2.2				Water no longer flowing into tank	- - -	Invert water bottle and squeeze	- - -	- - -	PLSS water tank is refilled
159.2.3				Checklist	- - -	Disconnect squeeze bottle and recap PLSS tank	- - -	- - -	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
159.3.0 Recharge PLSS battery	88:20:40	00:00:30	SE/A						
159.3.1				Procedure	Voltmeter	Plug recharge cable into PLSS receptacle from LEM power system	- - -	PLSS battery is being recharged	Four PLSS recharges remaining
159.4.0 Secure self in seat	88:21:10	00:00:10	SE/SE						
159.4.1				Procedure	- - -	Take Systems Engineer's seat	- - -	- - -	
159.4.2				Procedure	- - -	Secure self in seat	Engage restraint harness latch	- - -	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
160.0.0 Review and Record Lunar Activities	88:21:20	00:25:40	C/C; SE/SE						
160.1.0 Draft map of lunar surface operations area and record findings	88:21:20	00:25:40							
160.1.1				Checklist	- - -	Consult notes and discuss sequence of lunar events and experiments	- - -	- - -	
160.1.2				Checklist	- - -	Define lunar locale on map. (crater, sea,etc.) and plot LEM position in relation to area	- - -	- - -	
160.1.3				Checklist	- - -	Plot sight of various experiments in relation to LEM	- - -	- - -	
160.1.4				Checklist	- - -	Record findings and comments	- - -	- - -	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
161.0.0 Perform Off-Duty Activities	88:47:00	00:25:00	SE/SE						
161.1.0 Adjust seat and suit	As desired								
161.1.1				Procedure	- - -	Rotate SE seat 45° into aisle	- - -	- - -	SE has more room to stretch out
161.1.2				Procedure	- - -	Remove helmet and place on ascent engine housing	Release collar latch and unsnap	- - -	
161.1.3				Procedure	- - -	Remove gloves and place on ascent engine housing	Loosen palm straps. Unhook zipper and unzip gloves.	- - -	
161.2.0 Perform personal hygiene	As desired								
161.2.1				Procedure	- - -	Remove washing pad from storage location	- - -	- - -	
161.2.2				Procedure	- - -	Clean face and hands	- - -	- - -	
161.2.3				Procedure	- - -	Place washing pad in storage location	- - -	- - -	
161.3.0 Prepare and consume food	As desired								
161.3.1				Procedure	- - -	Remove food tray and eating utensils from storage location	- - -	- - -	

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
161.3.2				Procedure	- - -	Attach water hose disconnect to tray inlet valve	- - -	- - -	
161.3.3				Procedure	- - -	Heat food, disconnect water hose and prepare food	- - -	- - -	
161.3.4				Procedure	- - -	Eat	- - -	- - -	
161.3.5				Procedure	- - -	Store waste and eating utensils in tray and replace in storage location	- - -	- - -	
161.3.6				Procedure	- - -	Remove washing pad from storage location	- - -	- - -	
161.3.7				Procedure	- - -	Clean face and hands	- - -	- - -	
161.3.8				Procedure	- - -	Store washing pad	- - -	- - -	
161.4.0 Rest	As desired								
161.4.1				Procedure	- - -	Don gloves	Slip on to hands and zipper to suit	- - -	
161.4.2				- - -	- - -	Rest	- - -	- - -	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
162.0.0 Change Duty Stations	89:12:00	00:05:00							
162.1.0 Proceed into tunnel	89:12:00	00:03:00	SE/SE-T						
162.1.1				Procedure	- - -	Don helmet	Lower over head into collar - Latch into place	- - -	Face plate is open
162.1.2				Procedure	- - -	Rotate SE seat back into position	Seat position lock handle	- - -	
162.1.3				Procedure	- - -	Release self from SE seat	Release restraint harness latch	- - -	
162.1.4				Procedure	- - -	Stand up and proceed into tunnel	- - -	- - -	SE is in tunnel clear of the aisle
162.2.0 Commander take SE position	89:15:00	00:01:00	C/C-SE						
162.2.1				Procedure	- - -	Release self from C seat	Release restraint harness latch	- - -	
162.2.2				Procedure	- - -	Stand in aisle	- - -	- - -	
162.2.3				Procedure	- - -	Take SE seat	- - -	- - -	
162.2.4				Procedure	- - -	Secure self in SE seat	Engage restraint harness latch	- - -	
162.2.5				Procedure	- - -	Remove helmet and place on ascent engine housing	Release collar latch and unsnap	- - -	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
162.3.0 SE take Commander's seat	89:16:00	00:01:00	SE/T-A-C						
162.3.1				Procedure	- - -	Stand in aisle	- - -	- - -	Crawl over ascent engine housing and step into aisle
162.3.2				Procedure	- - -	Take C seat	- - -	- - -	
162.3.3				Procedure	- - -	Secure self in C seat	Engage restraint harness latch	- - -	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
163.0.0 Track Command Module and Coordinate Information	89:17:00	00:18:35	SE/C						
163.1.0 Place equipment in readiness condition	89:17:00	00:02:00							
163.1.1				CM LOS to LEM imminent	EVENTS TIMER	Check time of appearance of CM	- - -	- - -	
163.1.2				Procedure	- - -	Activate VHF subsystem	VHF POWER toggle to ON	VHF subsystem energized	
163.1.3				Procedure	- - -	Turn computer to full operating level and turn on CDU power	COMPUTER POWER toggle to OPERATE and CDU POWER toggle to ON	Computer energized to full operating level and CDU energized	
163.1.4				Checklist	- - -	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	- - -	
163.1.5				Procedure	SCT Angular readout indicator	Verify optics zeroed	- - -	- - -	
163.1.6				Checklist	- - -	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
163.1.7				Checklist	- - -	Rotate SCT eyepiece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	- - -	
163.1.8				Checklist	- - -	Select fast optics speed	OPTICS SPEED toggle to FAST	- - -	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
163.1.9				Procedure	---	Turn on tracking radar power	TRACKING RADAR POWER toggle to ON	Tracking radar energized	
163.1.10				Procedure	---	Place radar in SCT mode	RADAR MODE toggle to SCT	Radar slaved to SCT	
163.1.11				CM within LOS to LEM	---	Establish two-way voice communications with CM and receive acknowledgement	---	---	VHF communications link established to CM
163.1.12				Procedure	---	Inform CM via VHF of intention to transmit tape recorded messages	---	---	
163.2.0 Transmit tape-recorded information to CM	89:19:00	00:01:00							
163.2.1				Procedure	---	Re-wind tape	TRANSPORT toggle to REVERSE	Tape re-winds	
163.2.2				Procedure	---	Select tape play-back speed	SPEED toggle to FAST	---	
163.2.3				Procedure	---	Start play-back of stored messages	MODE toggle to PLAY	Play-back transmitted to CM	
163.3.0 Acquire CM with SCT and radar track	89:20:00	00:14:00							
163.3.1				Anticipated position of CM	Direct visual in SCT 60° field of view	Slew SCT to approximate point where CM will intersect and appear over lunar horizon. Search for CM and center in SCT 60° field of view	SCT TRUNNION and SHAFT SLEW controls	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
163.3.2				Procedure	- - -	Select 20° field of view	FIELD OF VIEW selector to 20°	- - -	
163.3.3				Position of CM	Direct visual in SCT 20° field of view	Center CM in 20° field of view	SCT TRUNNION and SHAFT SLEW controls	- - -	
163.3.4				Radar LOS angle and SCT optics angle indications in agreement	SEARCH light illuminates, LOS AZIMUTH and ELEVATION ANGLE indicators, SCT TRUNNION and SHAFT AXIS ANGLES	Place radar in tracking mode	RADAR MODE toggle to AUTO	Radar begins to search for CM	
163.3.5				Procedure	SEARCH light extinguished	Check that radar locked on CM	- - -	- - -	Radar locked to CM and automatically tracks
163.4.0 Determine existence of communications black-out with CM	89:34:00	00:00:20							
163.4.1				Checklist	EVENTS TIMER	Check time of expected communications black-out with CM and acknowledge last verbal communication	- - -	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
163.4.2				Procedure	- - -	Re-wind tape	TRANSPORT toggle to REVERSE	Tape re-winds	
163.4.3				Procedure	- - -	Select normal recording speed	SPEED toggle to NORMAL	- - -	
163.4.4				Procedure	- - -	Select record mode	MODE toggle to RECORD	All crew messages are automatically stored and made ready for VHF transmission to CM upon its next appearance in orbit	
163.5.0 Determine updated ascent trajectory parameters	89:34:20	00:00:30							
163.5.1				Checklist	- - -	Read ascent parameters call-up code #	- - -	- - -	
163.5.2				Procedure	- - -	Insert call-up code # into computer keyboard	Computer keyboard push-buttons	Call-up Code # inserted into computer keyboard	
163.5.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER push-button	Call-up code # entered into computer	
163.5.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate.	Digital indicators	Read ascent parameters	- - -	- - -	
163.5.5				Ascent trajectory	- - -	Report to GOSS via UHF the updated ascent trajectory parameters	- - -	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
163.6.0 Determine CM's updated orbital parameters	89:34:50	00:00:30							
163.6.1				Checklist	- - -	Read CM's orbital parameters call-up code #	- - -	- - -	
163.6.2				Procedure	- - -	Insert call-up code # into computer key-board	Computer key-board push-buttons	Call-up code # in-serted into com-puter keyboard	
163.6.3				Procedure	Computer call-up digital in-dicators	Enter call-up code # and veri-fy	COMPUTER ENTER pushbutton	Call-up code # entered into com-puter	
163.6.4				Orbital period (velocity or altitude) and orbital plane (angle of in-clination and longitude of orbital plane with reference to lunar equa-tor). Position in orbit (time or lunar coor-dinates with respect to some reference time).	Digital indicators	Read CM's orbit-al parameters	- - -	- - -	CM orbital para-meters determined
163.6.5				CM orbital parameters	- - -	Report to GOSS via UHF updated CM orbital para-meters	- - -	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
163.7.0 Place equipment in standby condition	89:35:20	00:00:15							
163.7.1				Checklist	- - -	Place computer power in standby condition and turn off CDU power	COMPUTER POWER toggle to STANDBY and CDU POWER toggle to OFF	All portions of computer de-energized except memory unit. CDU de-energized	
163.7.2				Checklist	- - -	Turn off tracking radar power	TRACKING RADAR POWER toggle to OFF	Tracking radar de-energized.	
163.7.3				Checklist	- - -	Turn off power to VHF	VHF POWER toggle to OFF	VHF de-energized	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
164.0.0 Perform Off-Duty Activities	89:17:00	00:27:00	C/SE						
164.1.0 Adjust seat and suit	As desired								
164.1.1				Procedure	- - -	Rotate SE seat 45° into aisle	Seat position lock handle	- - -	C has more room in which to stretch out
164.1.2				Procedure	- - -	Remove helmet and place on ascent engine housing	Release collar latch and un-snap	- - -	
164.1.3				Procedure	- - -	Remove gloves and place on ascent engine housing	Loosen palm straps. Un-hook zipper and unzip gloves	- - -	
164.2.0 Perform personal hygiene	As desired								
164.2.1				Procedure	- - -	Remove washing pad from storage location	- - -	- - -	
164.2.2				Procedure	- - -	Clean face and hands	- - -	- - -	
164.2.3				Procedure	- - -	Place washing pad in storage location	- - -	- - -	
164.3.0 Prepare and consume food	As desired								
164.3.1				Procedure	- - -	Remove food tray and eating utensils from storage location	- - -	- - -	
164.3.2				Procedure	- - -	Attach water hose disconnect to tray inlet valve	- - -	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
164.3.3				Procedure	- - -	Heat food, disconnect water hose and prepare food	- - -	- - -	
164.3.4				Procedure	- - -	Eat	- - -	- - -	
164.3.5				Procedure	- - -	Store waste and eating utensils in tray and replace in storage location	- - -	- - -	
164.3.6				Procedure	- - -	Remove washing pad from storage location	- - -	- - -	
164.3.7				Procedure	- - -	Clean face and hands	- - -	- - -	
164.3.8				Procedure	- - -	Store washing pad	- - -	- - -	
164.4.0 Rest	As desired								
164.4.1				Procedure	- - -	Don gloves	Slip on to hands and zipper to suit	- - -	
164.4.2				- - -	- - -	Rest	- - -	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
165.0.0 Change Duty Stations	89:44:00	00:05:00							
165.1.0 Proceed into tunnel	89:44:00	00:03:00	C/SE-T						
165.1.1				Procedure	- - -	Don helmet	Lower over head onto collar-latch in place	- - -	Face plate is open
165.1.2				Procedure	- - -	Rotate SE seat back into position	Seat position lock handle	- - -	
165.1.3				Procedure	- - -	Release self from SE seat	Release restraint harness latch	- - -	
165.2.0 Take System Engineer's position	89:47:00	00:01:00	SE/C-SE						
165.2.1				Procedure	- - -	Release self from C seat	Release restraint harness latch	- - -	
165.2.2				Procedure	- - -	Stand in aisle	- - -	- - -	SE is in the aisle wearing his own PLSS
165.2.3				Procedure	- - -	Take SE seat	- - -	- - -	
165.2.4				Procedure	- - -	Secure self in SE seat	Engage restraint harness latch	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
165.3.0 C take Commander's position	89:48:00	00:01:00	C/T-A-C						
165.3.1				Procedure	- - -	Stand in aisle	- - -	- - -	Crawl over ascent engine housing and step into aisle
165.3.2				Procedure	- - -	Take C seat	- - -	- - -	
165.3.3				Procedure	- - -	Secure self in C seat	Engage restraint harness latch	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
166.0.0 Activate All LEM Systems Required For Ascent and Checkout	89:49:00	00:22:15	SE/SE						
166.1.0 Purge fuel cell #1 and bring to operational status	89:49:00	00:00:10	- - -						
166.1.1				Checklist	- - -	Purge O_2 in fuel cell #1	O_2 PURGE (FC #1) toggle to AUTO	Contaminants and diluents removed from fuel cell #1.	
166.1.2				Checklist	- - -	Activate fuel cell #1	H_2 VENT (FC #1) toggle to OPEN Bus A INPUT (FC #1) toggle to ON	Fuel cell #1 temperatue maintained by reactants. Fuel cell #1 ready to accept electrical loads.	
166.2.0 Check main bus voltage	89:49:10	00:00:05	- - -						
166.2.1				Normal operating level	DC VOLTMETER	Check voltage output of Bus A	MONITOR SELECT rotary (volts) to BUS A	- - -	
166.3.0 Activate DC distribution and checkout	89:49:15	00:00:20	- - -						
166.3.1				Checklist	- - -	Apply non-essential loads to main bus	BUS TIE NON-ESSENTIAL toggle to ON	Non-essential loads placed on main bus	Dome lights remain illuminated and integral panel lighting actuated.
166.3.2				Normal operating levels	AMMETER	Check fuel cell #1,2,3 and main bus current	MONITOR SELECT rotary (amps) to FC 1,2,3 and BUS A	- - -	
166.3.3				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
166.4.0 Activate electrical loads for ascent system and checkout	89:49:35	00:00:20							
166.4.1				Checklist	- - -	Energize electrical load for ascent propulsion system	ASCENT PROPPULSION POWER toggle to ON	Electrical power supplied to ascent system	
166.4.2				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS.	Check tank quantities, pressures, and temperatures	- - -	- - -	
166.4.3				Pressure less than normal operating level prior to pressurization	PRESSURE REGULATOR WARNING lights (#1 and #2) illuminated	Check pressure regulator warning indicators	- - -	- - -	
166.4.4				Relief valves not venting helium overboard	RELIEF VALVE WARNING lights (FUEL and OXID) extinguished	Check relief valve warning indicators	- - -	- - -	
166.5.0 Activate electrical loads for RCS and checkout	89:49:55	00:00:20							
166.5.1				Checklist	- - -	Energize electrical load for RCS propulsion	RCS POWER toggle to ON	Electrical power supplied to RCS	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
166.5.2				Normal oper-pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	- - -	- - -	
166.5.3				Relief valves not venting helium over-board	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	- - -	- - -	
166.5.4				Normal operating levels	TANK METERS: FUEL & OXID. QTY; FUEL & OXID PRESS; HELIUM PRESS and TEMP.	Check System A & B tank quantities, pressures and temperatures	- - -	- - -	
166.5.5				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	- - -	- - -	
166.6.0 Turn on power to N & G system and check-out	89:50:15	00:16:00							
166.6.1				Checklist	- - -	Turn up computer power to full operating level	COMPUTER POWER toggle to OPERATE	Computer energized to full operating level	
166.6.2				Checklist	- - -	Turn on tracking radar power	TRACKING RADAR POWER toggle to ON	Tracking radar energized	
166.6.3				Checklist	- - -	Turn on CDU power	CDU POWER toggle to ON	CDU energized	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
166.6.4				Checklist	All N & G lamps illuminate	Test N & G alarm circuitry and status lamps	ALARM TEST pushbutton	N & G alarm circuitry and status lamps functioning properly	
166.6.5				Checklist	- - -	Turn up IMU power to full operating level	IMU POWER toggle to OPERATE	IMU energized	Allow 15 minute warm-up to achieve optimal operating level
166.6.6				Checklist	- - -	Check IMU gyro temperature	TEMPERATURE MODE toggle to TEMPERATURE	Temperature mode selected	
166.6.7				IMU temperature level within normal limits	IMU TEMPERATURE indicator	Read IMU temperature	- - -	- - -	
166.6.8				IMU power operating levels within normal limits	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	- - -	
166.7.0 Distribute power to S & C system and checkout	90:06:15	00:05:00		TO BE	DETERMINED				

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
167.0.0 Separate Ascent and Descent Stages	90:11:15	00:00:10	SE/SE						
167.1.0 Activate stage disconnect devices	90:11:15	00:00:10							
167.1.1				Checklist	STAGES SEPARATED indicator	Activate stage separation devices and verify	STAGE SEPARATION guarded toggle to SEPARATE	Structural, electrical and piping connections between ascent and descent stages severed.	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
168.0.0 Perform Complete Systems Check-Out With IFTS	90:11:25	00:02:00	SE/SE						
168.1.0 Perform systems checkout in automatic test mode	90:11:25	00:02:00							
168.1.1				Checklist	- - -	Select automatic test mode	IFTS MODE toggle to AUTOMATIC TEST	Automatic test mode selected	
168.1.2				If all systems GO, "00" appears	ALPHA-NUMERIC STATUS DISPLAY	Activate test program and monitor	TEST push-button	Test program accomplished	If a NO-GO occurs, the appropriate alpha-numeric appears. Then: 1. Identify trouble spot with code book 2. Select FAULT ISOLATION MODE 3. Press FAULT LOCATOR pushbutton 4. Identify mal-function to lowest replaceable part (panel, module or card). 5. Check-out mal-functioning com-ponent using volt-meter and oscilloscope. 6. Remove and replace. 7. Recycle in FAULT ISOLATION MODE. 8. Recycle in AUTO-MATIC TEST MODE.

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
169.0.0 Remove and Replace L_iOH Cannister	90:53:15	00:00:45	SE/SE-A-T						
169.1.0 Monitor condition of CO_2 removal	90:53:15	00:00:05	SE/SE						
169.1.1				One L_iOH warning light illuminated. Partial pressure indicator reads below 7.6 mm/Hg	Light indicator	Check L_iOH status	- - -	- - -	
169.2.0 Stand in aisle	90:53:20	00:00:05	SE/SE-A						
169.2.1				Procedure	- - -	Unlatch seat restraint harness and stand up	Depress and twist lever on harness	- - -	
169.3.0 Proceed to LiOH cannister and check	90:53:25	00:00:10	SE/T						
169.3.1				Color of chemical in cannister. New cannister checks out	Window in cannister	Crawl into tunnel and check cannisters with flashlight	L_iOH selector valve to un-illuminated cannister	- - -	
169.4.0 Change cannister	90:53:35	00:00:15	SE/T						
169.4.1				Procedure	- - -	Unscrew collar; remove used cannister; insert unused cannister; screw down collar	- - -	- - -	When L_iOH light indicates saturation of other cannister, the newly inserted cannister will be ready to carry the CO_2 removal requirements
169.5.0 Return to duty station	90:53:50	00:00:10	SE/SE						
169.5.1				Procedure	- - -	Crawl back to aisle, take seat and secure	Engage locking lever on re-straint harness	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
170.0.0 Align IMU on Lunar Surface	90:54:00	00:20:00	C/C						
170.1.0 Coarse align IMU with computer controls	90:54:00								
170.1.1				Checklist	---	Place CDU in computer mode	CDU TRANSFER toggle to COMPUTER	IMU modes selected automatically by the computer using relay logic	
170.1.2				Zero equals 135°F and is normal operating level of IMU	IMU TEMP. meter on IFTS reads zero	Check calibration of IMU temperature monitoring device	ZERO pushbutton	IMU temperature indicating and control circuitry and sensor correctly calibrated	
170.1.3				IMU temperature within normal operating limits	IMU TEMP. status light extinguished. IMU TEMP. meter on IFTS read zero	Check IMU temperature	---	---	
170.1.4				IMU coarse align program: Code # Noun Verb	DATA CHART	Insert IMU coarse align program into computer	Computer keyboard pushbuttons	Information entered into computer keyboard	
170.1.5				Checklist	Computer program code #, noun and verb digital indicators	Enter program into computer and verify entry	COMPUTER ENTER pushbutton	IMU coarse align program correctly entered.	
170.1.6				Procedure	--- TO BE DETERMINED	Enter attitude angles into computer.	COMPUTER ENTER pushbutton	Attitude angles entered into computer.	Accelerometer outputs from inner gimbal may be used to initially level platform.
170.1.7				CDUs are driven to their mechanical zero position	ZERO ENCODER pushbutton/ indicator illuminates, CDU angle readouts read zero	Check that CDUs are zero encoded	---	CDU angles stored in the computer are reset to zero. CDUs zero encoded.	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
170.1.8				IMU coarse aligned	IMU COARSE ALIGNED indicator illuminates	Check that IMU coarse aligned	---	Error signals, representing the difference between IMU gimbal angles and CDU angles have driven the gimbals into alignment with the CDUs. Simultaneously, the computer supplies torquing signals to cage the gyros to their null position. The IMU is then aligned to some angular orientation with respect to the spacecraft and close to the final desired orientation.	
170.1.9				Angular difference between the IMU gimbal angles and the CDU angles are zero.	IMU-CDU DIFFERENCE 3-axis meter reads zero	Monitor attitude error between IMU and CDU	---	IMU coarse erected	
170.2.0 Fine align IMU									
170.2.1				IMU fine align program: Code # Noun Verb	DATA CHART	Insert IMU fine align program into computer	Computer keyboard pushbuttons	Program entered into computer keyboard	
170.2.2				IMU fine align program: Code # Noun Verb	Computer digital indicators	Enter program into computer and verify entry	COMPUTER ENTER pushbutton	IMU fine align program correctly entered.	
170.2.3				Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
170.2.4				Procedure	SCT Angular readout indicator	Verify optics zeroed	---	---	
170.2.5				Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
170.2.6				Checklist	---	Rotate SCT eye-piece mechanism to 60° field to view position	FIELD OF VIEW selector to 60°	---	
170.2.7				Checklist	---	Select fast optics speed	OPTICS SPEED toggle to FAST	---	
170.2.8				Celestial coordinates of target star #1	DATA CHART	Determine target star #1 coordinates	---	---	
170.2.9				Star position in 60° field of view	DATA CHART. Direct visual in SCT reticle.	Sight target star #1 and verify image	TRUNNION and SHAFT SLEW controls	---	
170.2.10				Star position in center of 60° field of view	Direct visual in SCT reticle	Center target star #1 in center of 60° field of view	TRUNNION and SHAFT SLEW controls	---	
170.2.11				Checklist	---	Rotate SCT eye-piece mechanism to 20° field of view position	FIELD OF VIEW selector to 20°	---	
170.2.12				Checklist	---	Select slow optics speed	OPTICS SPEED toggle to SLOW	---	
170.2.13				Star position in 20° field of view	DATA CHART and direct visual in SCT reticle	Sight target star #1 and verify image	TRUNNION and SHAFT SLEW controls	---	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
170.2.14				Star position in center of 20° field of view	Direct visual in SCT reticle	Center target star #1 in center of 20° field of view	TRUNNION and SHAFT SLEW controls	---	
170.2.15				Star position in center of 20° field of view	Direct visual in SCT reticle	Enter target star #1 coordinates when star is centered in 20° field of view	COMPUTER MARK pushbutton	Star coordinates entered into computer	
170.2.16				Target star #1 code #	DATA CHART. Computer digital indicators	Insert Code # for target star #1 into computer and verify	Computer keyboard pushbuttons	Target star #1 code # correctly entered	
170.2.17				Procedure	---	Align Z axis parallel to CM orbital plane	---	---	
					TO BE DETERMINED				
170.2.18				Fine alignment of IMU achieved	FINE ALIGN light illuminates green	Check that IMU fine aligned	---	IMU fine alignment achieved. Error signals, representing the differences between IMU gimbal angles and CDU angles, drive the CDUs into alignment with the IMU gimbals. The CDUs are slaved to and repeat the IMU gimbal angles. Incremental digital encoders attached to the CDU-motor shafts transmit IMU gimbal orientation to the computer.	
170.2.19				Same as 170.2.9		Re-sight, center and record target star #1			
170.2.20				Same as 170.2.10					
170.2.21				Same as 170.2.11					

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
170.2.22				Same as 170.2.12		Re-sight, center and record target star #1			
170.2.23				Same as 170.2.13					
170.2.24				Same as 170.2.14					
170.2.25				Same as 170.2.15					
170.2.26				Same as 170.2.16					
170.2.27				Fine alignment of IMU achieved	FINE ALIGN light illuminates green	Check that IMU fine aligned	---	IMU fine alignment achieved	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
171.0.0 Track Command Module for Final Orbital Updating and Coordinate Information	91:14:00	00:12:40							
171.1.0 Place equipment in readiness condition	91:14:00	00:01:30							
171.1.1	91:14:00	00:00:05	C/C	CM LOS to LEM imminent	EVENTS TIMER	Check time of appearance of CM	---	---	
171.1.2	91:14:05	00:00:10	C/C	Ascent program Code #, noun and verb	DATA CHART	Insert ascent thrusting program into computer keyboard	Computer keyboard pushbuttons	Ascent program Code # entered into computer keyboard	
171.1.3	91:14:15	00:00:10	C/C	Ascent program Code #, Noun and verb	Computer digital indicators	Enter ascent program into computer and verify	COMPUTER ENTER pushbutton	Ascent program correctly entered and coordinated with stored initial conditions from previous tracking of CM	
171.1.4	91:14:05	00:00:05	SE/SE	Procedure	---	Activate VHF subsystem	VHF POWER toggle to ON	VHF subsystem energized	
171.1.5	91:14:25	00:00:05	C/C	Checklist	---	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	---	
171.1.6	91:14:30	00:00:05	C/C	Procedure	SCT Angular readout indicators	Verify optics zeroed	---	---	
171.1.7	91:14:35	00:00:05	C/C	Checklist	---	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
171.1.8	91:14:40	00:00:05	C/C	Checklist	---	Rotate SCT eye-piece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	---	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
171.1.9	91:14:45	00:00:05	C/C	Checklist	---	Select fast. optics speed	OPTICS SPEED toggle to FAST	---	
171.1.10	91:14:50	00:00:05	C/C	Procedure	---	Place radar in SCT mode	RADAR MODE toggle to SCT	Radar slaved to SCT	
171.1.11	91:20:00	00:00:30	SE/SE	CM within LOS to LEM	---	Establish two-way voice communications with CM and receive acknowledgement	---	---	VHF communications link established to CM
171.2.0 Acquire CM with SCT and radar track	91:20:30	00:05:00	C/C						
171.2.1				Anticipated position of CM	Direct visual in SCT 60° field of view	Slew SCT to approximate point where CM will intersect and appear over lunar horizon. Search for CM and center in SCT 60° field of view	SCT TRUNNION and SHAFT SLEW controls	---	
171.2.2				Procedure	---	Select 20° field of view	FIELD OF VIEW selector to 20°	---	
171.2.3				Position of CM	Direct visual in SCT 20° field of view	Center CM in 20° field of view	SCT TRUNNION and SHAFT SLEW controls	---	
171.2.4				Radar LOS angle and SCT optics angle indications in agreement	SEARCH light illuminates. LOS AZIMUTH and ELEVATION ANGLE indicators, SCT TRUNNION and SHAFT AXIS ANGLES	Place radar in tracking mode	RADAR MODE toggle to AUTO	Radar begins to search for CM	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
171.2.5				Procedure	SEARCH light off. RANGE and RANGE RATE indicators	Check that radar locked on CM and check range parameters throughout tracking	---	Radar locked to CM and automatically tracks CM	
171.3.0 Check that LEM/CM timing mechanisms synchronized	91:20:30	00:02:00	SE/SE						
171.3.1				Clock readout functioning properly	SYSTEM CLOCK and EVENTS TIMER	Note time and confirm with CM	---	---	
					TO BE DETERMINED				
171.4.0 Determine the parameters required for ascent based on final updated CM orbital parameters	91:25:30	00:00:40	C/C						
171.4.1				Checklist	---	Read ascent parameters call-up Code #	---	---	
171.4.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard pushbuttons	Call-up code # inserted into computer keyboard	
171.4.3				Procedure	Computer call-up digital indicators	Enter call-up code # and verify	COMPUTER ENTER pushbuttons	Call-up code # entered into computer	
171.4.4				Launch window. Duration of vertical rise. ΔV required. Initial pitch rate.	Digital indicators	Read ascent parameters	---	---	
171.4.5				ΔV required	ΔV REMAINING digital indicators	Insert ΔV required	ΔV SET thumbwheel	ΔV monitoring capability established	
171.4.6				Procedure	EVENTS TIMER	Check time to nominal launch	---	---	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
171.5.0 Determine CM final orbital parameters	91:26:10	00:00:30	C/C						
171.5.1				Checklist	---	Read CM's orbital parameters call-up code #	---	---	
171.5.2				Procedure	---	Insert call-up code # into computer keyboard	Computer keyboard push-buttons	Call-up code # inserted into computer keyboard	
171.5.3				Procedure	Computer call-up digital indicator	Enter call-up code # and verify	COMPUTER ENTER pushbutton	Call-up code # entered into computer	
171.5.4				Orbital period (velocity or altitude). Orbital plane (angle of inclination and longitude of orbital plane with reference to lunar equator). Position in orbit (time or lunar coordinates with respect to some reference time).	Digital indicators	Read CM's orbital parameters	---	---	CM orbital parameters determined

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
172.0.0 Bring Ascent and RCS to Readiness Condition and Checkout	91:22:30	00:01:45	SE/SE						
172.1.0 Arm ascent system and checkout	91:22:30	00:00:20							
172.1.1				Checklist	---	Open squib valves downstream of pressure regulators	ASCENT ARM guarded pushbutton	System pressurized down to bi-propellant valves	
172.1.2				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
172.1.3				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
172.1.4				Normal operating levels	TANK METERS: FUEL QTY. (1 & 2) OXID QTY. (1 & 2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM PRESS. HELIUM TEMP.	Check tank quantities, pressures and temperatures			
172.2.0 Arm RCS and checkout	91:22:50	00:00:25							
172.2.1				Checklist	---	Open System A & B solenoid valves upstream of pressure regulators	System A & B PRESSURE REGULATOR SHUTOFF toggles (#1 and #2) to NORMAL	---	
172.2.2				Checklist	---	Open 8 solenoid valves upstream of thruster valves	THRUSTER PAIR SHUTOFF toggles to OPEN	RCS armed	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
172.2.3				Normal oper-pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check system A & B pressure regulator warning indicators	---	---	
172.2.4				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check system A & B relief valve warning indicators	---	---	
172.2.5				Normal operating levels	TANK METERS: FUEL & OXID. QTY; FUEL & OXID. PRESS; HELIUM PRESS. & TEMP.	Check system A & B tank quantities, pressures and temperatures	---	---	
172.2.6				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
172.3.0 Checkout firing of RCS	91:23:15	00:01:00		TO BE DETERMINED					

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
173.0.0 Prepare for Ascent	91:27:35	00:01:25							
173.1.0 Select ascent modes	91:27:35	00:00:15	C/C						
173.1.1				Checklist	---	Select guidance mode for SCS	ATTITUDE MODE toggles to GUIDANCE	---	
173.1.2				Checklist	---	Select proper deadband limits	DEADBAND toggle to MINIMUM	---	Correct limit cycling mode selected
173.1.3				Checklist	---	Select ascent engine mode	ENGINE MODE SELECT guarded toggle to ASCENT	---	
173.2.0 Secure self and cabin interior	91:27:50	00:00:30							
173.2.1			SE/SE; C/C	Checklist	---	Visually check cabin interior to insure items are secure	---	---	
173.2.2			SE/SE; C/C	Checklist	---	Visually check that restraint harness is secure	Harness latching levers	---	
173.2.3			SE/SE; C/C	Checklist	---	Slide faceplate to closed position and turn locking knob. Close DIVERTER VALVE, SUIT CIRCUIT RELIEF VALVE, AND CABIN GAS RETURN VALVE	Locking Knob	Faceplate is closed. Suit is a closed circuit.	
173.2.4			SE/SE	Checklist	---	Shut off dome lighting	DOME LIGHTING toggle to OFF	Dome lighting de-energized	Integral panel lighting operating only
173.2.5			SE/SE	Checklist	---	Turn on running lights	RUNNING LIGHTS toggle to ON	Running lights energized	

PHASE NUMBER: 9 PRE-ASCENT SYSTEMS CHECKOUT AND READINESS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
173.3.0 Start countdown to launch	91:28:20	00:00:40 continuous	SE/SE						
173.3.1				Checklist	EVENTS TIMER	Check and count-down time to firing	---	---	
173.4.0 Check CM lead angle	91:28:20	00:00:40 continuous	C/C						
173.4.1				Lead angle	DATA CHART. Direct visual in SCT 20° field of view	View CM through SCT and determine CM lead angle	---	---	Correct CM lead angle achieved at time of lift-off

Phase 10 POWERED ASCENT

From 91:29:00 To 91:34:56

Elapsed Time 5 min. 56 sec.

Commander	Mission Time	Systems Engineer
174.0.0 Monitor Lift - Off and Vertical Rise	91:29:00	175.0.0 Monitor LEM Systems Status
174.1.0 Monitor ascent engine performance	91:29:00 (continuous)	
174.2.0 Monitor initial ascent profile	91:29:00 (continuous)	
176.0.0 Monitor Powered Ascent from Programmed Pitch - Over to Engine Burn - Out	91:29:17	
176.1.0 Monitor ascent engine performance from pitch - over to engine burn - out	91:29:17 (continuous)	
176.2.0 Monitor ascent profile from pitch - over to engine burn - out	91:29:17 (continuous)	
176.3.0 Monitor range parameters to CM, if available, from pitch - over to engine burn - out.	91:29:17 (continuous)	
End of Phase 10	91:34:56	End of Phase 10

PHASE NUMBER: 10 POWERED ASCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
174.0.0 Monitor Lift-Off and Vertical Rise	91:29:00	00:00:17	C/C						
174.1.0 Monitor ascent engine performance	91:29:00	00:00:17 continuous							
174.1.1				Ascent engine thrusting	T/W RATIO meter	Check automatic ignition and buildup of thrust-to weight ratio to normal operating level	---	---	
174.2.0 Monitor initial ascent profile	91:29:00	00:00:17 continuous							
174.2.1				Procedure	Commanded vs. Actual ATTITUDE and ATTITUDE RATE indicators	Check vehicle roll angle and rate to acquire correct orientation for the pitch-over manuever. Check yaw angle and rate to acquire correct plane orientation. Check pitch angle (90°) and rate to insure X axis aligned with local vertical	---	---	
174.2.2				ΔV buildup to 1150 fps at end of 17 seconds	ΔV REMAINING analog tape	Check ΔV applied during thrusting	---	---	
174.2.3				0.2 n. m. at end of 17 seconds	ALTITUDE indicator ($h^{\cdot}$) (output from IMU)	Check altitude	---	---	
174.2.4				Vertical rise conditions achieved at approximately 17 seconds	EVENTS TIMER	Check time at which vertical rise conditions achieved	---	---	

PHASE NUMBER: 10 POWERED ASCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
175.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/SE						
175.1.0 Monitor subsystem master warning lights		00:00:05							
175.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
175.2.0 Monitor electrical system status		00:00:40							
175.2.1				Normal operating levels	TANK METERS: H_2 PRESS (1 and 2) O_2 PRESS (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank prescures and quantities	---	---	
175.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1, 2, and 3	---	
175.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1, 2, 3) extinguished	Check N_2 Fail warning indicators	---	---	
175.2.4				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3 and main bus current	MONITOR SELECT rotary (amps) to FC 1, 2, 3 and BUS A	---	
175.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	

PHASE NUMBER: 10 POWERED ASCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
175.2.6				Normal operating temperature level	INVERTER No. 1 TEMP. Warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to No. 1	---	
175.2.7				Proper phase relationship maintained	INVERTER No. 1 PHASE FAILURE Warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
175.3.0 Monitor environmental control system status		00:01:15							
175.3.1				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.
175.3.2				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator and glycol temp. warning indicators	---	---	If a light illuminates, that particular H_2O separator or LiHO system is malfunctioning. Select alternate system
175.3.3				Pressure reading of 5.0 psia	CABIN PRESSURE indicator	Check cabin pressure	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates.

PHASE NUMBER: 10 POWERED ASCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
									If #2 inflow valve fails in automatic, place #1 O_2 inflow valve toggle to MANUAL If #1 light illuminates, select #2 O_2 inflow valve toggle to MANUAL
175.3.4				Cabin temperature is within 75°F ± 5°	CABIN TEMPERATURE indicator	Check cabin temperature	---	The cabin is checked out at normal temperature	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly.
175.3.5				O_2 FLOOD advisory extinguished	O_2 FLOOD advisory light	Check O_2 flood status	---	Cabin oxygen flooding is normal	
175.3.6				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	If cabin temperature is low or high, rotate cabin temperature control thumb wheel to compensate accordingly.
175.3.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator extinguished	Check suit fan warn indicator	---	---	
175.4.0 Monitor ascent propulsion system status		00:00:15					---	---	
175.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warn-indicators			

Report No. LED 480-3
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PHASE NUMBER: 10 POWERED ASCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
175.4.2				Relief valves not venting helium over-board	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	
175.4.3				Normal operating levels	TANK METERS: FUEL QTY (#1) FUEL QTY (#2) OXID QTY (#1) OXID QTY (#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS.	Check tank quantities, pressure and temperatures	---	---	
175.5.0 Monitor RCS status		00:00:15							
175.5.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	---	---	
175.5.2				Relief valves not venting helium over-board	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	
175.5.3				Normal operating levels	TANK METERS: FUEL & OXID QTY; FUEL & OXID. PRESS; HELIUM PRESS. & TEMP.	Check System A & B tank quantities, pressures and temperatures	---	---	
175.5.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	

PHASE NUMBER: 10 POWERED ASCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
175.6.0 Monitor navigation and guidance system status		00:00:20							
175.6.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature	---	---	
175.6.2				IMU power operating levels within normal limits	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	---	
175.6.3				All warning lights extinguished. Computer functioning properly	WARNING INDICATORS: RUPT LOCK, TCA TRAP, CROSS POINT FAIL, SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY	Check computer operating status	---	Computer maintained in self-checking mode	
175.6.4				---	---	Check CDU operating status	---	---	
175.7.0 Monitor stabilization and control system status		---	TO	BE DETERMINED	---				

Report No. LED 480-3
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PHASE NUMBER: 10 POWERED ASCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
176.0.0 Monitor Powered Ascent From Programmed Pitch - Over to Engine Burn - Out	01:20:17	00:05:30	C/C						
176.1. Monitor ascent engine performance from pitch - over to engine burn - out	01:20:17	00:05:30 continuous							
176.1.1				Normal operating level	T/W Ratio meter	Check thrust - to - weight ratio indicator	---	---	
176.2. Monitor ascent profile from pitch - over to engine burn - out	01:20:17	00:05:30 continuous							
176.2.1				Pitch rate of 1.02°/sec until reaching a constant inertial pitch angle of 0.75°. This critical pitch attitude must be achieved at engine burn-out.	Commanded vs. actual PITCH ATTITUDE RATE indicators	Check constant pitch rate until achieving a constant inertial pitch angle	---	---	
176.2.2				Yaw and roll rates held at zero degrees/ sec.	Commanded vs. actual YAW and ROLL ATTITUDE & ATTITUDE RATE indicators	Check yaw and roll angles and rates	---	---	
176.2.3				8.12 n.m. at end of powered ascent (after 356 sec. from launch)	ALTITUDE indicator (h) (output) from IMU)	Check altitude	---	---	

PHASE NUMBER: 10 POWERED ASCENT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
176.3.4				ΔV buildup to 9485.2 fps at 390 sec. after lift-off	ΔV REMAINING indicator. EVENTS TIMER. FLIGHT PATH VELOCITY indicator.	Check velocity before transfer injection	---	---	Correct velocity achieved for 50,000 ft. parking orbit in the event of a contingency. (maximum orbital contingency of 17.2 hrs.)
176.3.5				ΔV buildup to 9610.8 fps at 356 sec. after lift-off	ΔREMAINING indicator. EVENTS TIMER. FLIGHT PATH VELOCITY indicator.	Check velocity after transfer injection	---	---	Correct velocity achieved to accomplish coasting ascent transfer orbit
176.3.6 Monitor range parameters to CM, if available, from pitch-over to engine burn-out 176.3.1	91:29:17	00:09:39 Continuous		Procedure	RANGE and RANGE RATE indicators	Check range and range rate, if available	---	---	If radar remains locked to CM during powered ascent, updating of the ascent program is indicated.

Phase 11 COASTING ASCENT TRANSFER ORBIT — From 91:34:56 To 92:11:11 — Elapsed Time 36 min. 15 sec.

	Commander	Mission Time		Systems Engineer
177.0.0	Monitor Achievement of Proper Δ V and Cut-Off of Ascent Engine	91:34:56	178.0.0	Monitor LEM Systems Status
	177.1.0 Monitor achievement of proper Δ V	91:34:56		
	177.2.0 Monitor achievement of ascent engine cut-off	91:35:01		
180.0.0	Track CM With Tracking Radar	91:35:06	179.0.0	Control Vehicle Attitude for Radar Tracking of CM
	180.1.0 Adjust optics	91:35:06		179.1.0 Select SCS control mode
		91:35:16		179.2.0 Control vehicle attitude
	180.2.0 Slave radar to SCT	91:35:31		
	180.3.0 Acquire CM in SCT	91:35:36		
		91:36:06	181.0.0	Perform Complete Systems Check-Out With IFTS
		91:36:06		181.1.0 Perform systems check-out in automatic test mode
	180.4.0 Lock radar to CM	91:36:41		
	180.5.0 Slave SCT to radar	91:37:01		
182.0.0	Determine Updated Coasting Ascent Parameters	91:37:06		
	182.1.0 Determine velocity	91:37:06		
	182.2.0 Determine range parameters	91:37:11		
	182.3.0 Determine time to mid-course correction	91:37:16		
	No assigned activity	91:37:21		
		91:38:01	178.0.0	Monitor LEM Systems Status
183.0.0	Prepare for Mid-Course Correction	92:05:40		
	183.1.0 Determine initial conditions for mid-course correction	92:05:40		
	183.2.0 Select automatic guidance SCS mode and check orientation of vehicle	92:05:50		
	183.3.0 Determine the Δ V required for the mid-course correction	92:07:20		
184.0.0	Monitor Mid-Course Correction	92:07:40		
	184.1.0 Begin countdown to Δ V thrusting	92:07:40		
	184.2.0 Monitor RCS thrusting	92:08:00		
	184.3.0 Check results of thrusting	92:10:00		
	184.4.0 Determine initial conditions for first rendezvous maneuver	92:10:10		
	No assigned Activity	92:10:30		
	End of Phase 11	92:11:11		End of Phase 11

PHASE NUMBER: 11 COASTING ASCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
177.0.0 Monitor Achievement of Proper Δ V and Cut-Off of Ascent Engine	91:34:56	00:00:10	C/C						
177.1.0 Monitor achievement of proper Δ V	91:34:56	00:00:05							
177.1.1				Procedure	ΔV REMAINING analog tape indicator	Check that correct Δ V has been achieved	- - -	- - -	
177.2.0 Monitor achievement of ascent engine cut-off	91:35:01	00:00:05							
177.2.1				Proper ΔV profile conditions achieved	T/W RATIO meter reads zero	Check thrust-to-weight ratio indicator	- - -	Ascent engine cut-off	

PHASE NUMBER: 11 COASTING ASCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
178.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/SE						
178.1.0 Monitor subsystem master warning lights		00:00:05							
178.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	- - -	- - -	
178.2.0 Monitor electrical system status		00:00:40							
178.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	- - -	- - -	
178.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1,2, and 3	- - -	
178.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1, 2, 3) extinguished	Check N_2 Fail warning indicators	- - -	- - -	
178.2.4				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3 and main bus current	MONITOR SELECT rotary (amps) to FC 1, 2, 3 and BUS A	- - -	
178.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	- - -	

PHASE NUMBER: 11 COASTING ASCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
178.2.6				Normal operating temperature level	INVERTER No. 1 TEMP. warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to NO. 1	- - -	
178.2.7				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE Warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	- - -	- - -	
178.3.0 Monitor environmental control system status		00:01:15							
178.3.1				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	- - -	- - -	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	- - -	- - -	If glycol pressure low automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.
178.3.2				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator, and glycol temp. warning indicators	- - -	- - -	If a light illuminates that particular H_2O separator or LiOH system is malfunctioning. Select alternate system.
178.3.3				Pressure reading of 5.0 psia.	CABIN PRESSURE indicator	Check cabin pressure	- - -	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia.	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates.

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
									If #2 inflow valve fails in automatic, place #1 O_2 inflow valve toggle to MANUAL. If #1 light illuminates, select #2 O_2 inflow valve toggle to MANUAL.
178.3.4				Cabin temperature is within $75^{\circ}F \pm 5^{\circ}$	CABIN TEMP. indicator	Check cabin temperature	- - -	The cabin is checked out at normal temperature	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly.
178.3.5				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 flood status	- - -	Cabin oxygen flooding is normal.	
178.3.6				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	- - -	Cabin temperature is normal	If cabin temperature is low or high, rotate cabin temperature control thumb wheel to compensate accordingly
178.3.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator extinguished	Check suit fan warn indicator	- - -	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
178.4.0 Monitor ascent propulsion system status		00:00:15							
178.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	- - -	- - -	
178.4.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	- - -	- - -	
178.4.3				Normal operating levels	TANK METERS: FUEL QTY (#1) FUEL QTY (#2) OXID QTY (#1) OXID QTY (#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS	Check tank quantities, pressures and temperatures	- - -	- - -	
178.5.0 Monitor RCS status		00:00:15							
178.5.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	- - -	- - -	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
178.5.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	- - -	- - -	
178.5.3				Normal operating levels	TANK METERS: FUEL & OXID QTY; FUEL & OXID. PRESS; HELIUM PRESS AND TEMP.	Check System A & B tank quantities, pressures and temperatures	- - -	- - -	
178.5.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	- - -	- - -	
178.6.0 Monitor navigation and guidance system status		00:00:20							
178.6.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature	- - -	- - -	
178.6.2				IMU power operating levels within normal limits	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	- - -	
178.6.3				All warning lights extinguished. Computer functioning properly	WARNING INDICATORS: RUPT LOCK, TCA TRAP, CROSS POINT FAIL, SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY	Check computer operating status	- - -	Computer maintained in self-checking mode	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
178.6.4				- - -	- - -	Check CDU operating status	- - -	- - -	
178.7.0 Monitor stabilization and control system status		- - -	TO	BE DETERMINED	- - -				

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
179.0.0 Control Vehicle Attitude for Radar Tracking of CM	91:35:06	00:01:00	SE/SE						
179.1.0 Select SCS control mode	91:35:06	00:00:10							
179.1.1				Procedure	- - -	Select attitude hold mode	ATTITUDE MODE toggles TO ATTITUDE HOLD	Correct SCS mode selected	
179.2.0 Control vehicle attitude	91:35:16	00:00:50							
179.2.1				Position of CM	Direct visual and ATTITUDE RATE indicators	Control vehicle attitude to achieve proper orientation for tracking CM	ATTITUDE CONTROLLER	Correct vehicle attitude achieved for tracking CM with radar	

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
180.0.0 Track CM With Tracking Radar	91:35:06	00:02:00	C/C						
180.1.0 Adjust optics	91:35:06	00:00:25							
180.1.1				Checklist	- - -	Place SCT in zero optics mode	OPTICS MODE toggles to ZERO	- - -	
180.1.2				Procedure	SCT Angular readout indicator	Verify optics zeroed	- - -	- - -	
180.1.3				Checklist	- - -	Select manual optics control mode	OPTICS MODE toggle to MANUAL	Manual optics control mode selected	
180.1.4				Checklist	- - -	Rotate SCT eyepiece mechanism to 60° field of view position	FIELD OF VIEW selector to 60°	- - -	
180.1.5				Checklist	- - -	Select fast optics speed	OPTICS SPEED toggle to FAST	- - -	
180.2.0 Slave radar to SCT	91:35:31	00:00:05							
180.2.1				Checklist	- - -	Place radar in SCT mode	RADAR MODE toggle to SCT	Radar slaved to SCT	
180.3.0 Acquire CM in SCT	91:35:36	00:01:05							
180.3.1				Position of CM	Direct visual in SCT 60° field of view	Search for CM and center in SCT 60° field of view	SCT TRUNNION and SHAFT SLEW controls	CM acquired in SCT 60° field of view	
180.3.2				Procedure	- - -	Select 20° field of view	FIELD OF VIEW selector to 20°	- - -	

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Function and Task Description		Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
	180.3.3				Position of CM	Direct visual in SCT 20° field of view	Center CM in 20° field of view	SCT TRUNNION and SHAFT SLEW controls	CM acquired in SCT 20° field of view	
180.4.0 Lock radar to CM		91:36:41	00:00:20							
	180.4.1				Radar LOS angle and SCT optics angle indications in agreement	SEARCH light illuminates. LOS AZIMUTH and ELEVATION ANGLE indicators, SCT TRUNNION and SHAFT AXIS ANGLES	Place radar in tracking mode	RADAR MODE toggle to AUTO	Radar begins to search for CM	
	180.4.2				Procedure	SEARCH light extinguished	Check that radar locked on CM	- - -	Radar locked on CM	
180.5.0 Slave SCT to radar		91:37:01	00:00:05							
	180.5.1				Procedure	- - -	Place SCT in radar mode	OPTICS MODE toggle to RADAR	SCT slaved to radar	Continuous orientation of SCT to CM maintained providing crew with continual visual observation of CM

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
181.0.0 Perform Complete Systems Check-Out with IFTS	91:36:06	00:01:55	SE/SE						
181.1.0 Perform complete systems check-out in automatic test mode									
181.1.1				Checklist	- - -	Select automatic test mode	IFTS MODE toggle to AUTOMATIC TEST	Automatic test mode selected	
181.1.2				If all systems GO, "00" appears	ALPHA-NUMERIC STATUS DISPLAY	Activate test program and monitor	TEST push-button	Test program accomplished	If a NO-GO occurs the appropriate alpha-numeric appears, then: 1. Identify trouble spot with code book. 2. Select FAULT ISOLATION MODE. 3. Press FAULT LOCATION pushbutton. 4. Identify malfunction to lowest replaceable part (panel, module or card). 5. Check-out malfunctioning component using voltmeter and oscilloscope. 6. Remove and replace. 7. Recycle in FAULT ISOLATION MODE. 8. Recycle in AUTOMATIC TEST MODE.

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
182.0.0 Determine Updated Coasting Ascent Parameters	91:37:06	00:00:15	C/C						
182.1.0 Determine velocity	91:37:06	00:00:05							
182.1.1				Final velocity	FLIGHT PATH VELOCITY indicator	Check final velocity resulting from ΔV ascent thrusting	- - -	- - -	
182.2.0 Determine range parameters	91:37:11	00:00:05							
182.2.1				R and $\dot{R}$	R and $\dot{R}$ indicators	Check R and $\dot{R}$ to CM	- - -	- - -	
182.3.0 Determine time to mid-course correction	91:37:16	00:00:05							
182.3.1				Time to mid-course correction thrusting	EVENTS TIMER	Check time to mid-course correction	- - -	- - -	

PHASE NUMBER: 11 COASTING ASCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System output(s)	Remarks
183.0.0 Prepare for Mid-Course Correction	92:05:40	00:02:00	C/C						
183.1.0 Determine initial conditions for mid-course correction	92:05:40	00:00:10							
183.1.1				Time to ΔV thrusting at 92:08:00	EVENTS TIMER	Check time to mid-course correction	- - -	- - -	
183.1.2				Procedure	RANGE and RANGE RATE indicators	Check range and range rate	- - -	- - -	
183.2.0 Select automatic guidance SCS mode and check orientation of vehicle	92:05:50	00:01:30							
183.2.1				Checklist	- - -	Place SCS in automatic guidance mode	ATTITUDE MODE toggles to GUIDANCE	Correct SCS mode selected	
183.2.2				Procedure	ATTITUDE and ATTITUDE RATE indicators	Check commanded vehicle attitude orientation	- - -	Vehicle oriented to commanded attitude using inertial corrdinates	
183.2.3				SCT and radar LOS angles should be identical with respect to body axis	CM positioned in center of SCT 20° field of view. SCT SHAFT and TRUNNION ANGLES. LOS AZIMUTH and ELEVATION ANGLE indicators.	Check that SCT is boresighted along LOS to CM and compare with radar LOS angles to CM	- - -	- - -	

PHASE NUMBER: 11 COASTING ASCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
183.3.0 Determine the ΔV required for the mid-course correction	92:07:20	00:00:20							
183.3.1				ΔV call-up code #	Checklist	Insert ΔV call-up code # into computer keyboard	Computer keyboard push-buttons	Information entered into computer keyboard	
183.3.2				ΔV call-up code #	Computer digital indicators	Enter ΔV call-up code # into computer and verify	COMPUTER ENTER pushbutton	Computer interrogated and entry verified	
183.3.3				ΔV required	ΔV REMAINING analog tape indicator	Read ΔV and insert into ΔV panel	ΔV SET thumbwheel	ΔV monitoring capability established.	

PHASE NUMBER: 11 COASTING ASCENT TRANSFER ORBIT

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
184.0.0 Monitor Mid-Course Correction	92:07:40	00:02:50	C/C						
184.1.0 Begin countdown to ΔV thrusting	92:07:40	00:00:20							
184.1.1				Procedure	EVENTS TIMER	Check time 20 seconds before thrusting and begin countdown	- - -	- - -	
184.2.0 Monitor RCS thrusting	92:08:00	Range of time to be determined (Few seconds to possibly more than a minute)		Correct ΔV required to adjust the range disparity between LEM and CM	ΔV REMAINING analog tape indicator	Check ΔV applied during thrusting	- - -	RCS thrusters fire and shut-off automatically when correct ΔV is achieved	
184.2.1									
184.3.0 Check results of thrusting	92:10:00	00:00:10							
184.3.1				Range parameters within acceptable limits	RANGE and RANGE RATE indicators. Computer digital indicators.	Check range and range rate achieved against computer predicted range parameters and report to CM/GOSS	- - -	VHF voice link to CM and UHF voice link to GOSS	
184.4.0 Determine initial conditions for first rendezvous maneuver	92:10:10	00:00:20							
184.4.1				Time to ΔV thrusting at 92:13:00 (nominal)	EVENTS TIMER	Check time of first rendezvous maneuver	- - -	- - -	
184.4.2				Range test point 20 n.mi. Range Rate Bounds: 120-200 fps	Computer digital indicators	Check range parameters for first rendezvous maneuver	- - -	- - -	

Phase 12 RENDEZVOUS

From 92:11:11 To 92:31:32

Elapsed Time 20 min. 21 sec.

	Commander	Mission Time
185.0.0	Prepare for First Rendezvous Maneuver at 20 n.mi. to Null the LOS Rate	92:11:11
185.1.0	Determine initial conditions for first rendezvous correction	92:11:11
185.2.0	Determine ΔV required to accomplish first rendezvous maneuver	92:12:20
185.3.0	Begin countdown to ΔV thrusting to reduce range to 16 n.mi. and closing rate to 90-170 fps	92:12:40
187.0.0	Monitor Automatic RCS Thrusting for First Rendezvous Maneuver at 20 n.mi.	92:13:00
187.1.0	Monitor RCS thrusting	92:13:00
188.0.0	Check Results of RCS Thrusting and Prepare For Second Rendezvous Maneuver to Occur at 16 N.Mi. Range From CM	92:13:11
188.1.0	Check results of RCS thrusting	92:13:11
188.2.0	Determine initial conditions for second rendezvous correction	92:13:21
188.3.0	Determine ΔV required to accomplish second rendezvous maneuver	92:14:20
188.4.0	Begin countdown to ΔV thrusting to reduce range to 12 n.mi. and closing rate to 75-130 fps	92:14:40
189.0.0	Monitor Automatic RCS Thrusting for Second Rendezvous Maneuver at 16 N.Mi.	92:15:00
189.1.0	Monitor RCS thrusting	92:15:00
190.0.0	Check Results of RCS Thrusting and Prepare for Third Rendezvous Maneuver to Occur at 12 N.Mi. Range from CM	92:15:08
190.1.0	Check results of RCS thrusting	92:15:08
190.2.0	Determine initial conditions for third rendezvous correction	92:15:18
190.3.0	Determine ΔV required to accomplish third rendezvous maneuver	92:16:40
190.4.0	Begin countdown to ΔV thrusting to reduce range to 8 n.mi. and closing rate to 60-100 fps.	92:17:00

	Systems Engineer
186.0.0	Monitor LEM Systems Status

Phase 12	RENDEZVOUS	From 92:11:11 To 92:31:32	Elapsed Time 20 min. 21 sec.
	Commander	Mission Time	Systems Engineer
191.0.0	Monitor Automatic RCS Thrusting for Third Rendezvous Maneuver at 12 N.Mi.	92:17:20	
	191.1.0 Monitor RCS thrusting	92:17:20	
192.0.0	Check Results of RCS Thrusting and Prepare For Fourth Rendezvous Maneuver to Occur at 8 n.mi. Range From CM	92:17:29	
	192.1.0 Check results of RCS thrusting	92:17:29	
	192.2.0 Determine initial conditions for fourth rendezvous correction	92:17:39	
	192.3.0 Determine ΔV required to accomplish fourth rendezvous maneuver	92:19:45	
	192.4.0 Begin countdown to ΔV thrusting to reduce range to 4 n.mi. and closing rate to 30-70 fps.	92:20:05	
193.0.0	Monitor Automatic RCS Thrusting for Fourth Rendezvous Maneuver at 8 N.Mi.	92:20:25	
	193.1.0 Monitor RCS thrusting	92:20:25	
194.0.0	Check Results of RCS Thrusting and Prepare for Fifth Rendezvous Maneuver to Occur at 4 N.Mi. Range From CM	92:20:38	
	194.1.0 Check results of RCS thrusting	92:20:38	
	194.2.0 Determine initial conditions for fifth rendezvous correction	92:20:48	
	194.3.0 Determine ΔV required to accomplish fifth rendezvous maneuver	92:23:45	
	194.4.0 Begin countdown to ΔV thrusting to reduce range to 1 n.mi. and closing rate to 10-30 fps.	92:24:05	
195.0.0	Monitor Automatic RCS Thrusting for Fifth Rendezvous Maneuver at 4 N.Mi	92:24:25	
	195.1.0 Monitor RCS thrusting	92:24:25	
196.0.0	Check Results of RCS Thrusting and Prepare for Sixth (Final) Rendezvous Maneuver to Occur at 1 N.Mi. Range From CM	92:24:54	
	196.1.0 Check results of RCS thrusting	92:24:54	
	196.2.0 Determine initial conditions for sixth rendezvous correction	92:25:04	

Phase 12 RENDEZVOUS		From 92:11:11 to 92:31:32	Elapsed Time 20 min. 21 sec.
	Commander	Mission Time	Systems Engineer
196.3.0	Determine ΔV required to accomplish sixth rendezvous maneuver	92:28:05	
196.4.0	Begin countdown to ΔV thrusting to reduce range to 1000 ft. ($\pm$ 500 ft.) and closing rate to 10-30 fps.	92:28:25	
197.0.0	Monitor Automatic RCS Thrusting for Sixth (Final) Rendezvous Maneuver at 1 N.Mi.	92:28:45	
197.1.0	Monitor RCS thrusting	92:28:45	
198.0.0	Check Results of Final Rendezvous Thrust Maneuver and Prepare to Take-Over Manual Control of Vehicle for Docking	92:29:09	
198.1.0	Check results of RCS thrusting and continuously monitor range parameters to beginning of manual take-over	92:29:09 (continuous)	
198.2.0	Determine docking mode	92:29:09	
198.3.0	Select manual SCS control modes	92:31:09	
	End of Phase 12	92:31:32	End of Phase 12

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
185.0.0 Prepare For First Rendezvous Maneuver to Occur at 20 n.mi. Range From CM.	92:11:11	00:01:49	C/C						
185.1.0 Determine initial conditions for first rendezvous correction	92:11:11	00:01:09							
185.1.1		00:00:05		Time to ΔV thrusting	EVENTS TIMER	Check time to rendezvous maneuver and confirm with CM/GOSS	---	VHF voice link to CM and UHF voice link to GOSS	
185.1.2		continuous to RCS thrusting		Approaching range test point	RANGE and RANGE RATE indicators	Check present range parameters and confirm with CM/GOSS.	---	VHF voice link to CM and UHF voice link to GOSS.	
185.1.3		00:00:05		Range Test Point:20 n.mi. Range Rate Bounds:120-200 fps.	Computer digital indicators	Check range parameters required for range adjustment and confirm with CM/GOSS.	---	VHF voice link to CM and UHF voice link to GOSS	
185.1.4		continuous to RCS thrusting		If LOS rate excessive, ΔV thrusting is required to bring it within acceptable limits.	LOS AZIMUTH and ELEVATION ANGLE RATE indicators	Check LOS rate and confirm with CM/GOSS.	---	VHF voice link to CM and UHF voice link to GOSS.	
185.1.5		continuous to RCS thrusting		Correct vehicle orientation nulls the radar LOS angles to the CM.	ATTITUDE and ATTITUDE RATE indicators. Radar LOS AZIMUTH and ELEVATION ANGLE indicators read zero.	Check commanded vehicle attitude orientation	---	SCS automatically orients vehicle to the required commanded attitude using radar azimuth and elevation data with respect to the CM.	

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description		Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
	185.1.6		continuous to RCS thrusting		Relative movement of star background with reference to vehicle body axis.	Direct visual in SCT 20° field of view.	Determine direction of movement of the star background as a check on the automatic orientation of the vehicle.	---	Star background will appear to move from top to bottom of SCT's field of view.	
	185.1.7		continuous to RCS thrusting		SCT optical axis coincident with -Z axis of the vehicle and is in LOS to CM.	SCT SHAFT and TRUNNION AXIS ANGLE indicators read zero. LOS AZIMUTH and LOS ELEVATION ANGLE indicators read zero. CM positioned in center of SCT 20° field of view.	Check that SCT boresighted along LOS to CM.	---	+Z axis of the vehicle points down the LOS to the CM.	
185.2.0 Determine ΔV required to accomplish first rendezvous maneuver.		92:12:20	00:00:20							
	185.2.1				ΔV Call-up Code #	Checklist	Insert ΔV call-up Code # into computer keyboard.	Computer keyboard push-button.	Information entered into computer keyboard.	
	185.2.2				ΔV Call-up Code #.	Computer digital indicators.	Enter ΔV call-up code # into computer and verify.	COMPUTER ENTER push-button.	Computer interrogated and entry verified.	
	185.2.3				ΔV required.	ΔV REMAINING analog tape.	Read ΔV and insert into ΔV panel.	ΔV SET thumbwheel	ΔV monitoring capability established.	

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
185.3.0 Begin countdown to ΔV thrusting to reduce range to 16 n.mi. and closing rate to 90-170 fps.	92:12:40	00:00:20							
185.3.1				Procedure.	EVENTS TIMER	Check time 20 seconds before thrusting and begin countdown.	---	VHF voice link to CM and UHF voice link to GOSS.	

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
186.0.0 Monitor LEM Systems Status	Non-Scheduled	Continuous	SE/SE						
186.1.0 Monitor subsystems master warning lights		00:00:05							
186.1.1				All subsystem status.	SUBSYSTEM WARN lights extinguised	Check subsystem master warning indicators	---	---	
186.2.0 Monitor electrical system status		00:00:40							
186.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
186.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1, 2 and 3	— — —	
186.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1,2,3) extinguished	Check N_2 Fail warning indicators	---	---	
186.2.4				Normal operating levels	AMMETER	Check fuel cell #1,2,3, and main bus current	MONITOR SELECT rotary (amps) to FC 1,2,3 and BUS A	---	
186.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	— — —	

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
186.2.6				Normal operating temperature level	INVERTER NO. 1 TEMP. Warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to NO. 1	---	
186.2.7				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE Warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
186.3.0 Monitor environmental control system status		00:01:15							
186.3.1				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.
186.3.2				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator, and glycol temp. warning indicators	---	---	If a light illuminates, that particular H_2O separator or LiOH system is malfunctioning. Select alternate system.
186.3.3				Pressure reading of 5.0 psia.	CABIN PRESSURE indicator	Check cabin pressure	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates.

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
									If #2 inflow valve fails in automatic, place #1 O_2 inflow valve toggle to MANUAL. If #1 light illuminates, place #2 O_2 inflow valve toggle to MANUAL.
186.3.4				Cabin temperature is within 75°F ±5°	CABIN TEMPERATURE indicator	Check cabin temperature	---	The cabin is checked out at normal temperature	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly.
186.3.5				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 flood status	---	Cabin oxygen flooding is normal.	
186.3.6				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	If cabin temperature is low or high, rotate cabin temperature control thumb wheel to compensate accordingly.
186.3.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator	Check suit fan warn indicator	---	---	
186.4.0 Monitor ascent propulsion systems status		00:00:15							
186.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
186.4.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
186.4.3				Normal operating levels	TANKS METERS FUEL QTY (#1 FUEL QTY (#2 OXID QTY (#1 OXID QTY (#2 FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS	Check tank quantities, pressures and temperatures	---	---	
186.5.0 Monitor RCS status		00:00:15							
186.5.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	---	---	
186.5.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	
186.5.3				Normal operating levels	TANK METERS: FUEL & OXID QTY.; FUEL & OXID. PRESS; HELIUM PRESS & TEMP.	Check System A & B tank quantities, pressures and temperatures	---	---	
186.5.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
186.6.0 Monitor navigation and guidance system status		00:00:20							
186.6.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature indicator	---	---	
186.6.2				IMU power operating levels within normal limits	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	---	

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
186.6.3				All warning lights extinguished. Computer functioning properly.	WARNING INDICATORS: RUPT LOCK, TCA TRAP, CROSS POINT FAIL, SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY	Check computer operating status	---	Computer maintained in self-checking mode	
186.6.4				---	---	Check CDU operating status	---	---	
186.7.0 Monitor stabilization and control system status			--- TO	BE	DETERMINED	---			

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PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
187.0.0 Monitor Automatic RCS Thursting for First Rendezvous Maneuver at 20 n.mi.	92:13:00	00:00:11	C/C						
187.1.0 Monitor RCS thrusting	92:13:00	00:00:11							
187.1.1				Correct ΔV achieved.	ΔV REMAINING analog tape.	Check ΔV applied	---	The X axis RCS thrusters fire perpendicular to the CM LOS to null LOS rate; the Z axis thrusters subsequently fire along CM LOS to reduce range.	

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
188.0.0 Check Results of RCS Thrusting and Prepare for Second Rendezvous Maneuver to Occur at 16 n.mi. Range from CM	92:13:11	00:01:49	C/C						
188.1.0 Check results of RCS thrusting	92:13:11	00:00:10							
188.1.1				Δ V thrusting reduces range parameters to the required limits.	RANGE and RANGE RATE indicators. Computer digital indicators (predicted range parameters).	Check that range adjustment has been accomplished and confirm with CM/GOSS.	---	VHF voice link to CM and UHF voice link to GOSS	
188.2.0 Determine initial conditions for second rendezvous correction.	92:13:21	00:00:59					---		
188.2.1		00:00:05		Same as 185.1.1.					
188.2.2		continuous to RCS thrusting		Same as 185.1.2.			---		
188.2.3		00:00:05		Range test point: 16 n.mi. Range rate bounds: 90-170 fps.	Computer digital indicators.	Check range parameters required for range adjustment and confirm with CM/GOSS.	---	VHF voice link to CM and UHF voice link to GOSS.	
188.2.4		continuous to RCS thrusting		Same as 185.1.4					
188.2.5		continuous to RCS thrusting		Same as 185.1.5					
188.2.6		continuous to RCS thrusting		Same as 185.1.6					
188.2.7		continuous to RCS thrusting		Same as 185.1.7					

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
188.3.0 Determine Δ V required to accomplish second rendezvous maneuver.	92:14:20	00:00:20		Same as 185.2.1 thru 185.2.3.					
188.4.0 Begin countdown to V thrusting to reduce range to 12 n.mi. and closing rate to 75-130 fps.	92:14:40	00:00:20		Same as 185.3.1.					

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
189.0.0 Monitor Automatic RCS Thrusting for Second Rendezvous Maneuver at 16 n.mi.	92:15:00	00:00:08	C/C						
189.1.0 Monitor RCS thrusting	92:15:00	00:00:08		Same as 187.1.1					

PHASE NUMBER: 190 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
190.0.0 Check Results of RCS Thrusting and Prepare for Third Rendezvous Maneuver to Occur at 12 n.mi. Range from CM	92:15:08	00:02:12	C/C						
190.1.0 Check results of RCS thrusting	92:15:08	00:00:10		Same as 188.1.1					
190.2.0 Determine initial conditions for third rendezvous correction	92:15:18	00:01:22							
190.2.1		00:00:05		Same as 185.1.1					
190.2.2		continuous to RCS thrusting		Same as 185.1.2					
190.2.3		00:00:05		Range test point: 12 n.mi. Range rate bounds 75-130fps	Computer digital indicators	Check range parameters required for range adjustment and confirm with CM/GOSS	---	VHF voice link to CM and UHF voice link to GOSS	
190.2.4		continuous to RCS thrusting		Same as 185.1.4					
190.2.5		continuous to RCS thrusting		Same as 185.1.5					
190.2.6		continuous to RCS thrusting		Same as 185.1.6					
190.2.7		continuous to RCS thrusting		Same as 185.1.7					
190.3.0 Determine ΔV required to accomplish third rendezvous maneuver	92:16:40	00:00:20		Same as 185.2.1	thru 185.2.3				
190.4.0 Begin countdown to ΔV thrusting to reduce range to 8 n.mi. and closing rate to 80-100 fps.	92:17:00	00:00:20		Same as 185.3.1					

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PHASE NUMBER: 12 REDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
191.0.0 Monitor Automatic RCS Thrusting for Third Rendezvous Maneuver at 12 n.mi.	92:17:20	00:00:09	C/C						
191.1.0 Monitor RCS thrusting	92:17:20	00:00:09		Same as 187.1.1					

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
192.0.0 Check Results of RCS Thrusting and Prepare for Fourth Rendezvous Maneuver to Occur at 8 n.mi. Range from CM	92:17:29	00:02:56	C/C						
192.1.0 Check result of RCS thrusting	92:17:29	00:00:10		Same as 188.1.1					
192.2.0 Determine initial conditions for fourth rendezvous correction	92:17:39	00:02:06							
192.2.1		00:00:05		Same as 185.1.1					
192.2.2		continuous to RCS thrusting		Same as 185.1.2					
192.2.3		00:00:05		Range test point: 8 n.mi. Range rate bounds: 60-100 fps	Computer digital indicators	Check range parameters required for range adjustment and confirm with CM/GOSS	---	VHF voice link to CM and UHF voice link to GOSS	
192.2.4		continuous to RCS thrusting		Same as 185.1.4					
192.2.5		continuous to RCS thrusting		Same as 185.1.5					
192.2.6		continuous to RCS thrusting		Same as 185.1.6					
192.2.7		continuous to RCS thrusting		Same as 185.1.7					
192.3.0 Determine Δ V required to accomplish fourth rendezvous maneuver	92:19:45	00:00:20		Same as 185.2.1 thru 185.2.3					
192.4.0 Begin countdown to Δ V thrusting to reduce range to 4 n.mi. and closing rate to 30-70 fps.	92:20:05	00:00:20		Same as 185.3.1					

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
193.0.0 Monitor Automatic RCS Thrusting for Fourth Rendezvous Maneuver at 8 n.mi.	92:20:25	00:00:13	C/C						
193.1.0 Monitor RCS thrusting	92:20:25	00:00:13		Same as 187.1.1					

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
194.0.0 Check Results of RCS Thrusting and Prepare for Fifth Rendezvous Maneuver to Occur at 4 n.mi. Range from CM	94:20:38	00:03:47	C/C						
194.1.0 Check results of RCS thrusting	92:20:38	00:00:10		Same as 188.1.1					
194.2.0 Determine initial conditions for fifth rendezvous correction	92:20:48	00:02:57							
194.2.1		00:00:05		Same as 185.1.1					
194.2.2		continuous to RCS thrusting		Same as 185.1.2					
194.2.3		00:00:05		Range test point: 4 n.mi. Range rate bounds: 30-70fps	Computer digital indicators	Check range parameters required for range adjustment and confirm with CM/GOSS	---	VHF voice link to CM and UHF voice link to GOSS	
194.2.4		continuous to RCS thrusting		Same as 185.1.4					
194.2.5		continuous to RCS thrusting		Same as 185.1.5					
194.2.6		continuous to RCS thrusting		Same as 185.1.6					
194.2.7		continuous to RCS thrusting		Same as 185.1.7					
194.3.0 Determine Δ V required to accomplish fifth rendezvous maneuver	92:23:45	00:00:20		Same as 185.2.1	thru 185.2.3				
194.4.0 Begin countdown to Δ V thrusting to reduce range to 1 n.mi. and closing rate to 10-30 fps.	92:24:05	00:00:20		Same as 185.3.1					

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
195.0.0 Monitor Automatic RCS Thrusting for Fifth Rendezvous Maneuver at 4 n.mi.	92:24:25	00:00:29	C/C						
195.1.0 Monitor RCS thrusting	92:24:25	00:00:29		Same as 187.1.1					

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
196.0.0 Check Results of RCS Thrusting and Prepare for Sixth (Final) Rendezvous Maneuver to Occur at 1 n.mi. Range from CM	92:24:54	00:03:51	C/C						
196.1.0 Check results of RCS thrusting	92:24:54	00:00:10		Same as 188.1.1					
196.2.0 Determine initial conditions for sixth rendezvous correction	92:25:04	00:03:01							
196.2.1		00:00:05		Same as 185.1.1					
196.2.2		continuous to RCS thrusting		Same as 185.1.2					
196.2.3		00:00:05		Range test point: 1 n.mi. Range rate bounds: 10-30fps	Computer digital indicators	Check range parameters required for range adjustment and confirm with CM/GOSS	---	VHF voice link to CM and UHF voice link to GOSS.	
196.2.4		Continuous to RCS thrusting		Same as 185.1.4					
196.2.5		Continuous to RCS thrusting		Same as 185.1.5					
196.2.6		Continuous to RCS thrusting		Same as 185.1.6					
196.2.7		Continuous as RCS thrusting		Same as 185.1.7					
196.3.0 Determine Δ V required to accomplish sixth rendezvous maneuver	92:28:05	00:00:20		Same as 185.2.1	thru 185.2.3				
196.4.0 Begin countdown to Δ V thrusting to reduce range to 1000 ft. (±500 ft.) and closing rate to 10-30 fps	92:28:25	00:00:20		Same as 185.3.1					

PHASE NUMBER: 18 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
197.0.0 Monitor Automatic RCS Thrusting for Sixth (Final) Rendezvous Maneuver at 1 n.mi.	92:28:45	00:00:24	C/C						
197.1.0 Monitor RCS thrusting	92:28:45	00:00:24		Same as 187.1.1					

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
198.0.0 Check Results of Final Rendezvous Thrust Maneuver and Prepare to Take-Over Manual Control of Vehicle for Docking	92:29:09	00:02:23	C/C						
198.1.0 Check results of RCS thrusting and continuously monitor range parameters to beginning of manual take-over	92:29:09	Continuous							
198.1.1				Δ V thrusting reduces the range parameters to the required limits to commence docking maneuvers. Range: 1000 ft. (± 500 ft.) Range rate: 10-30 fps	RANGE and RANGE RATE indicators, computer digital indicators (predicted range parameters)	Check that final range adjustment has been accomplished and confirm with CM/GOSS	---	VHF voice link to CM and UHF voice link to GOSS	
198.2.0 Determine docking mode	92:29:09	00:02:00							
198.2.1				LEM Z and X azis docking module status. LEM to dock passive or active. Status of CM systems required for injection out of circular lunar orbit and into trans-earth trajectory	---	Make final determination of whether Z or X axis docking will be employed and coordinate with CM/GOSS	---	VHF voice link to CM and UHF voice link to GOSS	Normal mode of docking is via Z axis with LEM active. X axis docking is used for contingency purposes.
198.2.2				Procedure	---	Inform CM/GOSS that conditions are favorable to commence docking	---	VHF voice link to CM and UHF voice link to GOSS	
198.3.0 Select manual SCS control modes	92:31:09	00:00:23							
198.3.1				Checklist	---	Select attitude hold SCS mode	ATTITUDE MODE toggles to ATTITUDE HOLD	Correct SCS mode selected for manual control of attitude	

PHASE NUMBER: 12 RENDEZVOUS

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
198.3.2				Checklist	---	Select minimum translation mode	TRANSLATION MODE toggle to MINIMUM	Correct SCS mode selected for manual control of translation	
198.3.3				Checklist	---	Select minimum deadband limits	DEADBAND toggles to MINIMUM	Correct limit cycling mode selected	

Phase 13 DOCKING

From 92:31:32 to 92:51:32

Elapsed Time 20 Min.

	Commander	Mission Time	Systems Engineer
199.0.0	Control Vehicle Translation and Attitude to 30 Feet From CM	92:31:32	200.0.0 Monitor LEM Systems Status
199.1.0	Control attitude	92:31:32 (continuous)	
199.2.0	Control range and translation	92:31:32 (continuous)	
		92:39:02	199.3.0 Turn on docking lights
		92:39:17	200.0.0 Monitor LEM Systems Status
201.0.0	Perform Final Docking Maneuver to Point of Soft Docking to CM	92:46:32	
201.1.0	Align docking sight	92:46:32	
201.2.0	Control attitude rates	92:46:32	
201.3.0	Control range and translation rates	92:46:32	
201.4.0	Control final docking thrust maneuver	92:48:32	
202.0.0	Accomplish Hard Docking	92:49:32	
202.1.0	Check that docking latches locked	92:49:32	
	No assigned activity	92:49:42	202.2.0 Determine that LEM/CM static electrical equalization achieved
		92:50:02	202.3.0 Pressurize interlock
	End of Phase 13	92:51:32	End of Phase 13

PHASE NUMBER: 13 DOCKING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
199.0.0 Control Vehicle Translation and Attitude to 30 Feet from CM	92:31:32	00:15:00							
199.1.0 Control attitude	92:31:32	00:15:00 continuous	C/C						
199.1.1				LOS to CM	ATTITUDE and ATTITUDE RATE indicators	Control attitude and attitude rates	ATTITUDE CONTROLLER	Correct attitude requirements established for thrust vector positioning to accomplish translation	
199.2.0 Control range and translation	92:31:32	00:15:00 continuous	C/C						
199.2.1				Range rate to 30 feet. Closing rate should be within 3 to 5 fps.	RANGE and RANGE RATE indicators. Direct visual estimation of range	Control translation to reduce range and range rate	TRANSLATION CONTROLLER	Initial docking maneuver accomplished	
199.3.0 Turn on docking lights	92:39:02	00:00:15	SE/SE						
199.3.1				Turn on docking lights at 500 foot range	RANGE indicator	Turn on docking lights	DOCKING LIGHTS toggle to ON	Improved visibility of CM established when LEM Z axis is pointed down the LOS to the CM	

PHASE NUMBER: 13 DOCKING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
200.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/SE						
200.1.0 Monitor subsystem master warning lights		00:00:05							
200.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
200.2.0 Monitor electrical system status		00:00:40							
200.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
200.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL PRESS. (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1,2, and3	---	
200.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1, 2, 3) extinguished	Check N_2 Fail warning indicators	---	---	
200.2.4				Normal operating levels	AMMETER	Check fuel cell #1, 2, 3 and main bus current	MONITOR SELECT rotary (amps) to FC 1, 2, 3 and BUS A	---	
200.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	

PHASE NUMBER: 13 DOCKING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
200.2.6				Normal operating temperature level	INVERTER No. 1 TEMP. Warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to No. 1	---	
200.2.7				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE Warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
200.3.0 Monitor environmental control system status		00:01:15							
200.3.1				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low, automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated.
200.3.2				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator, and glycol temp. warning indicators	---	---	If a light illuminates, that particular H_2O separator or LiOH is system mal-functioning. Select alternate system
200.3.3				Pressure reading of 5.0 psia	CABIN PRESSURE indicator	Check Cabin pressure	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia.	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates. If #2 inflow valve fails in automatic, place #1 O_2 inflow valve toggle to MANUAL. If #1 light illuminates, select #2 O_2 inflow valve toggle to MANUAL.

PHASE NUMBER: 1 DOCKING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
200.3.4				Cabin temperature is within 75°F ± 5°	CABIN TEMPERATURE indicator	Check cabin temperature	---	The cabin is checked out at normal temperature	If cabin temperature is not within desired limits, rotate cabin temperature control thumb wheel to compensate accordingly
200.3.5				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 flood status	---	Cabin oxygen flooding is normal	
200.3.6				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	If cabin temperature is low or high, rotate cabin temperature control thumb wheel to compensate accordingly
200.3.7				SUIT FAN warning light extinguished	SUIT FAN warning indicator	Check suit fan warn indicator	---	---	
200.4.0 Monitor ascent propulsion system status		00:00:15							
200.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
200.4.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	---	

PHASE NUMBER: 13 DOCKING

Function and Task Description		Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
	200.4.3				Normal operating levels	TANK METERS: FUEL QTY (#1) FUEL QTY (#2) OXID QTY (#1) OXID QTY (#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP. HELIUM PRESS.	Check tank quantities, pressures and temperatures	---	---	
200.5.0 Monitor RCS status			00:00:15							
	200.5.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	---	---	
	200.5.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	
	200.5.3				Normal operating levels	TANK METERS: FUEL & OXID QTY; FUEL & OXID. PRESS; HELIUM PRESS & TEMP.	Check System A & B tank quantities, pressures and temperatures	---	---	
	200.5.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
200.6.0 Monitor navigation and guidance system status			00:00:20							
	200.6.1				IMU gyro temperature within normal operating limits	IMU TEMPERATURE indicator	Check IMU gyro temperature indicator	---	---	

PHASE NUMBER: 13 DOCKING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
200.6.2				IMU power operating	IFTS VOLTMETER	Check IMU voltage and frequency	IFTS VOLTAGE SELECTOR	---	
200.6.3				All warning lights extinguished. Computer functioning properly.	WARNING INDICATORS: RUPT LOCK, TCA TRAP, CROSS POINT FAIL, SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY	Check computer operating status	---	Computer maintained in self-checking mode	
200.6.4				---	---	Check CDU operating status	---	---	
200.7.0 Monitor stabilization and control system status		---	TO	BE DETERMINED	---				

PHASE NUMBER: 13 DOCKING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
201.0.0 Perform Final Docking Maneuver to Point of Soft Docking to CM	92:46:32	00:03:00	C/C						
201.1.0 Align docking sight	92:46:32	00:02:00							
201.1.1				Vehicle must be aligned: 1 ft. from interface centerline. ± 10° for angular and rotational misalignment	DOCKING SIGHT. ATTITUDE RATE indicators	Control vehicle attitude and translation to align docking sight to CM	ATTITUDE CONTROLLER	Vehicle aligned to null impact misalignments	
201.2.0 Control attitude rates	92:46:32	00:02:00							
201.2.1				Vehicle rotational alignment must be within ±10° for angular and rotational misalignment	ATTITUDE RATE indicators. DOCKING SIGHT	Reduce rotational rates to 1°/sec. and adjust for rotational and angular misalignment	ATTITUDE CONTROLLER	Correct docking orientation and angular rates established to insure safe docking	
201.3.0 Control range and translation rates	92:46:32	00:02:00							
201.3.1				Maximum allowable Z axial velocity is 2 fps. Maximum allowable lateral velocity is 1 fps.	Direct visual estimation of range, DOCKING SIGHT, AND RANGE RATE indicators.	Reduce closing rate ($\dot{R}$) and translation rates to 0.5 fps.	TRANSLATION CONTROLLER	Proper impact velocities established	
201.4.0 Control final docking thrust maneuver	92:48:32	00:01:00							
201.4.1				Visual alignment. Experience initial impact with CM and any rebounding against shock absorbers	Direct visual through window, DOCKING SIGHT (Probe)	Observe mating of LEM/CM docking structures	---	---	LEM/CM positioned for soft docking

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PHASE NUMBER: 13 DOCKING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
201.4.2				Separation distance between LEM and CM	Direct visual, SOFT DOCK light illuminates	Apply final +Z axis thrust to accomplish soft docking	TRANSLATION CONTROLLER	Soft docking accomplished when CM docking latches engage LEM	

PHASE NUMBER: 13 DOCKING

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
202.0.0 Accomplish Hard Docking	92:49:32	00:02:00							
202.1.0 Check that docking latches locked	92:49:32	00:00:10	C/C						
202.1.1				Checklist	HARD DOCK light illuminates green	Check that docking latches are locked.	---	All four docking latches locked in place	If one or more docking latch fails to lock: 1. Pressurize suits 2. Depressurize cabin 3. Open hatch, swing down and lock in secured position 4. Manually lock latches 5. Repressurize cabin
202.2.0 Determine that LEM/CM static electrical equalization achieved	92:49:42	00:00:20	SE/SE	To Be Determined					
202.3.0 Pressurize interlock	92:50:02	00:01:30	SE/SE						
202.3.1				LEM and interlock pressure equalized	Δ P indicator reads zero	Pressurize interlock to 5 psi and monitor	INTERLOCK PRESSURIZATION toggle to FULL position	Condition established to permit opening of LEM hatch for transfer of crew to CM	
202.3.2				Procedure	---	Report to CM/GOSS that hard docking completed	---	VHF voice link to CM and UHF voice link to GOSS	

Phase 14 POST-DOCKING SYSTEMS SHUTDOWN AND CREW TRANSFER

From 92:51:32 To 93:05:37

Elapsed Time 14 min. 05 sec.

Commander	Mission Time	Systems Engineer
203.0.0 Prepare Equipment, Specimens and Records for Transfer to CM	92:51:32	
203.1.0 Open face plate	92:51:32	203.1.0 Open face plate
203.2.0 Prepare LEM equipment and records	92:51:42	204.0.0 Check Remaining Consumables and Report to CM/GOSS
	92:51:42	204.1.0 Check ECS remaining consumables and report to CM/GOSS
	92:52:12	204.2.0 Check RCS remaining consumables and report to CM/GOSS
	92:52:32	204.3.0 Check ascent propulsion system remaining consumables and report to CM/GOSS
	92:52:52	204.4.0 Check electrical system remaining consumables and report to CM/GOSS
	92:53:12	205.0.0 Begin Shutdown of LEM Systems
	92:53:12	205.1.0 Select required lighting
	92:53:22	205.2.0 De-activate electrical loads for ascent propulsion system
	92:53:27	205.3.0 Turn off power to N & G system
	92:53:32	205.4.0 Turn off power to S & C system
	92:53:42	206.0.0 Monitor LEM System Status
207.0.0 Prepare to Transfer to CM	92:55:12	
207.1.0 Disengage self from seat and stand in aisle	92:55:12	
207.2.0 Secure C seat	92:56:12	
207.3.0 Open LEM hatch	92:56:42	
208.0.0 Transfer From LEM to CM	92:57:12	
208.1.0 Proceed into interlock	92:57:12	
208.2.0 Proceed into CM	92:57:42	
208.3.0 Prepare to receive equipment from LEM	92:58:12	
	92:59:12	209.0.0 Transfer Equipment, Specimens and Records to CM
	92:59:12	209.1.0 Disengage self from seat and stand in aisle
No assigned activity	93:00:12	209.2.0 Transfer tote bag and equipment to CM
209.2.2 Receive equipment and tote bag from SE	93:01:12	
210.0.0 Stow Equipment, Specimens and Records On Board CM	93:01:42	211.0.0 Prepare to Transfer to CM
	93:01:42	211.1.0 Disconnect umbilical from LEM ECS
	93:02:12	211.2.0 Secure SE seat

Phase 14 POST-DOCKING SYSTEMS SHUTDOWN AND CREW TRANSFER From 92:51:32 To 93:05:37 Elapsed Time 14 min. 05 sec.

Commander	Mission Time		Systems Engineer
	93:03:12	212.0.0	Complete Shutdown of LEM Systems
	93:03:12	212.1.0	Turn off power to ECS
	93:04:02	212.2.0	De-activate DC distribution
	93:04:07	213.0.0	Transfer from LEM to CM
	93:04:07	213.1.0	Proceed into interlock and close LEM hatch
No assigned activity	93:04:42		
	93:04:52	213.2.0	Proceed into CM and close CM hatch
End of Phase 14	93:05:37		End of Phase 14

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN AND CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
203.0.0 Prepare Equipment, Specimens and Records for Transfer to CM	92:51:32	00:03:40							
203.1.0 Open face plate	92:51:32	00:00:10	C/C; SE/SE						
203.1.1				Checklist	---	Open face plates	Unlock knob and slide face plate up	---	SE & C sustained by cabin environment
203.2.0 Prepare LEM equipment and records for transfer to CM	92:51:42	00:03:30	C/C						
203.2.1				Procedure	---	Release seat restraints and stand in aisle	Depress and twist latching lever on harness	---	
203.2.2				Procedure	---	Detach necessary subsystem components that may be required aboard CM including: AGC parts, SCT, TV camera, umbilicals, LiOH canisters, etc. Stow in tote bag as required	---	---	
203.2.3				Procedure	---	Place specimen containers, maps and records into tote bag	---	---	
203.2.4				Procedure	---	Place tote bag in C seat and secure	Strap tote bag into restraint harness with latching lever	---	

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN AND CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
204.0.0 Check Remaining Consumables and Report to CM/GOSS	92:51:42	00:01:30	SE/SE						
204.1.0 Check ECS remaining consumables and report to CM/GOSS	92:51:42	00:00:30							
204.1.1				Checklist	H_2O QUANTITY indicator	Check water quantity remaining	---	---	
204.1.2				Checklist	GLYCOL PRESSURE indicator	Check glycol pressure remaining	---	---	
204.1.3				Checklist	CO_2 PARTIAL PRESSURE indicator & LiOH lights	Check CO_2 removal capacity	---	---	If LiOH lights illuminate or CO_2 partial pressure high, the LiOH canisters are at the point of depletion.
204.1.4				Pressure reading of 5.0 psia	CABIN PRESSURE indicator. SUIT PRESSURE indicator	Check cabin and suit pressure	---	---	
204.1.5				Temp. reads 75°F ± 5°	CABIN TEMP. indicator. SUIT TEMP. indicator	Check cabin and suit temperature	---	---	ECS checked out
204.1.6				Procedure	---	Report to CM/ GOSS remaining ECS consumables	---	VHF voice link to CM and UHF voice link to GOSS	
204.2.0 Check RCS remaining consumables and report to CM/GOSS	92:52:12	00:00:20							
204.2.1				Checklist	TANK METERS: FUEL QTY OXID QTY FUEL PRESS.	Check system A and B tank quantities and pressures	---	---	

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN AND CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
					OXID. PRESS HELIUM PRESS	remaining			
204.2.2				Procedure	---	Report to CM/GOSS remaining RCS consumables	---	VHF voice link to CM and UHF voice link to GOSS	
204.3.0 Check ascent propulsion system remaining consumables and report to CM/GOSS	92:52:32	00:00:20							
204.3.1				Checklist	TANK METERS: FUEL QTY (1 and 2) OXID QTY (1 and 2) FUEL PRESS. OXID PRESS. HELIUM PRESS	Check tank quantities and pressures remaining	---	---	
204.3.2				Procedure	---	Report to CM/ GOSS remaining ascent system consumables	---	VHF voice link to CM and UHF voice link to GOSS	
204.4.0 Check electrical system remaining consumables and report to CM/GOSS	92:52:52	00:00:20							
204.4.1				Checklist	TANK METERS: H_2 QTY(1&2) O_2 QTY(1&2) H_2 PRESS (1 &2) O_2 PRESS (1&2)	Check reactant tank pressures and quantities remaining	---	---	
204.4.2				Procedure	---	Report to CM/ GOSS remaining electrical system consumables	---	VHF voice link to CM and UHF voice link to GOSS	

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN & CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
205.0.0 Begin Shutdown of LEM Systems	92:53:12	00:00:30	SE/SE						
205.1.0 Select required lighting	92:53:12	00:00:10							
205.1.1				Checklist	---	De-energize docking and running lights	DOCKING LIGHTS toggle to OFF; RUNNING LIGHTS toggle to OFF	Docking and running lights de-energized	
205.1.2					---	Energize cabin lights	DOME LIGHTS toggle to ON	Cabin interior illuminated by dome lights	
205.1.3					---	De-energize integral panel lighting	PANEL LIGHTS toggle to OFF	Panel lighting de-energized	
205.2.0 De-activate electrical loads for ascent propulsion system	92:53:22	00:00:05							
205.2.1				Checklist	---	De-energize electrical load for ascent propulsion system	ASCENT PROPULSION POWER toggle of OFF	Electrical power removed from ascent propulsion system	
205.3.0 Turn off power to N & G system	92:53:27	00:00:05							
205.3.1				Checklist	---	Turn off SCT power	SCT POWER toggle to OFF	SCT de-energized	
205.3.2				Checklist	---	Turn off tracking radar power	TRACKING RADAR POWER toggle to OFF	Tracking radar de-energized	
205.4.0 Turn off power to S&C system	92:53:32	00:00:10		---	To be determined				

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN & CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
206.0.0 Monitor LEM Systems Status	Non-scheduled	Continuous	SE/SE						
206.1.0 Monitor subsystem master warning lights		00:00:05							
206.1.1				All subsystem status	SUBSYSTEM WARN lights extinguished	Check subsystem master warning indicators	---	---	
206.2.0 Monitor electrical system status		00:00:40							
206.2.1				Normal operating levels	TANK METERS: H_2 PRESS. (1 and 2) O_2 PRESS. (1 and 2) H_2 QTY (1 and 2) O_2 QTY (1 and 2)	Check reactant tank pressures and quantities	---	---	
206.2.2				Normal operating levels	FUEL CELL METERS: FUEL CELL (H_2 and O_2) FUEL CELL TEMP.	Check fuel cell pressures and temperatures	FUEL CELL MONITOR SELECT rotary to 1,2, and 3	---	
206.2.3				Normal operating N_2 pressure level	N_2 FAIL lights (FC 1,2,3) extinguished	Check N_2 Fail warning indicators	---	---	
206.2.4				Normal operating levels	AMMETER	Check fuel cell #1,2,3 and main bus current	MONITOR SELECT rotary (amps) to FC 1,2,3 and BUS A	---	
206.2.5				Normal operating level	DC VOLTMETER	Check main bus voltage	MONITOR SELECT rotary (volts) to BUS A	---	
206.2.6				Normal operating temperature level	INVERTER No. 1 TEMP. Warning light extinguished	Check inverter No. 1 temperature warning indicator	INVERTER SELECT rotary to NO. 1	---	

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN & CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
206.2.7				Proper phase relationship maintained	INVERTER NO. 1 PHASE FAILURE Warning lights (A, B and C) extinguished	Check inverter No. 1 phase failure warning indicators	---	---	
206.3.0 Monitor environmental control system status		00:01:15							
206.3.1				Normal operating level	H_2O QUANTITY indicator	Monitor water quantity	---	---	
206.3.2				Normal operating level	GLYCOL PRESSURE indicator	Monitor glycol pressure	---	---	If glycol pressure low automatic feature has not selected an operative pump. Manually select a glycol pump whose light is not illuminated
206.3.3				Warning lights extinguished	Warning lights	Check LiOH, H_2O separator, and glycol temp. warning indicators	---	---	If a light illuminates that particular H_2O separator or LiOH system is malfunctioning. Select alternate system.
206.3.4				Pressure reading of 5.0 psia	CABIN PRESSURE indicator	Check cabin pressure	---	O_2 is flowing into the cabin through the #1 inflow valve at 5.0 psia	If #1 inflow valve fails, O_2 inflow will be diverted through #2 inflow valve automatically, and the light on #1 system illuminates. If #2 inflow valve fails in automatic, place #1 O_2 inflow valve toggle to MANUAL. If #1 light illuminates, select #2 O_2 inflow valve toggle to MANUAL.
206.3.5				Cabin temperature is within 75°F ± 5°	CABIN TEMPERATURE indicator	Check cabin temperature	---	The cabin is checked out at normal temperature	If cabin temperature is not within desired levels, rotate cabin temperature control thumb wheel to compensate accordingly

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
206.3.6				O_2 FLOOD advisory light extinguished	O_2 FLOOD advisory light	Check O_2 FLOOD status	---	Cabin oxygen flooding is normal	
206.3.7				CABIN FAN warning indicator extinguished	CABIN FAN warning indicator	Check cabin fan status	---	Cabin temperature is normal	If cabin temperature is low or high, rotate cabin temperature control thumb wheel to compensate accordingly
206.3.8				SUIT FAN warning light extinguished	SUIT FAN warning indicator	Check suit fan warn indicator	---	---	
206.4.0 Monitor ascent propulsion system status		00:00:15							
206.4.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check pressure regulator warning indicators	---	---	
206.4.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (FUEL and OXID) extinguished	Check relief valve warning indicators	---	----	
206.4.3				Normal operating levels	TANK METERS: FUEL QTY(#1) FUEL QTY(#2) OXID QTY(#1) OXID QTY(#2) FUEL PRESS. OXID PRESS. FUEL TEMP. OXID TEMP. HELIUM TEMP HELIUM PRESS.	Check tank quantities, pressures and temperatures	---	---	
206.5.0 Monitor RCS status		00:00:15							

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
206.5.1				Normal operating pressure level downstream of second stage regulators	PRESSURE REGULATOR WARN lights (#1 and #2) extinguished	Check System A & B pressure regulator warning indicators	---	---	
206.5.2				Relief valves not venting helium overboard	RELIEF VALVE WARN lights (#1 and #2) extinguished	Check System A & B relief valve warning indicators	---	---	
206.5.3				Normal operating levels	TANK METERS: FUEL & OXID QTY; FUEL & OXID PRESS; HELIUM PRESS & TEMP.	Check System A & B tank quantities, pressures and temperatures	---	---	
206.5.4				Proper functioning of thruster valves	THRUSTER PAIR fail lights extinguished	Check thruster pair fail indicators	---	---	
206.6.0 Monitor navigation and guidance system status		00:00:10							
206.6.1				All warning lights extinguished. Computer functioning properly	WARNING INDICATORS: RUPT LOCK, TCA TRAP, CROSS POINT FAIL. SCALAR FAIL, INACTIVITY, ILLEGAL ORDER, PARITY, PARITY ALARM, AGC POWER SUPPLY	Check computer operating status	---	Computer maintained in self-checking mode	

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN & CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
207.0.0 Prepare to Transfer to CM	92:55:12	00:02:00	C/C-A						
207.1.0 Disengage self from seat and stand in aisle	92:55:12	00:01:00							
207.1.1				Checklist	---	Disconnect umbilicals from LEM ECS and communications system and insert communications umbilical into beltpack	Umbilical snap ring	PLSS is connected to suit and is ready to supply life support in event of rapid decompression. Communications established by means of beltpack	
207.1.2				Procedure	---	Unlatch seat restraint harness	Depress and twist lever on harness	---	
207.1.3				Procedure	---	Stand in aisle	---	---	
207.2.0 Secure C seat	92:56:12	00:00:30							
207.2.1				Checklist	---	Secure C seat restraint harness	Latching lever	---	
207.3.0 Open LEM hatch	92:56:42	00:00:30							
207.3.1				LEM and IL pressure in equilibrium	LEM CABIN PRESSURE indicator, Δ P indicator	Open LEM hatch and secure in open position	Hatch locking wheel	LEM hatch is open and secure in open position	

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN & CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
208.0.0 Transfer From LEM to CM	92:57:12	00:03:00	C/IL-CM						
208.1.0 Proceed into interlock	92:57:12	00:00:30							
208.1.1				Procedure	---	Enter interlock with flashlamp head first with faceplate open, wearing PLSS	---	---	If unable to get through with PLSS, doff PLSS and pull through
208.1.2				All detents are engaged into periphery of docking seals	---	Inspect docking clamps	---	---	
208.2.0 Proceed into CM	92:57:42	00:00:30							
208.2.1				CM pressure equals interlock pressure 5.0 psia	ΔP indicator on CM hatch	Open CM hatch and secure in open position	Hatch locking wheel	Hatch is opened	
208.2.2				Procedure	---	Enter CM	---	---	If unable to negotiate hatch head first, return to LEM, turn around and attempt entry into CM feet first
208.3.0 Prepare to receive equipment from LEM	92:58:12	00:02:00							
208.3.1				Procedure	---	Connect CM ECS long umbilical to suit	Umbilical snap ring	Astronaut receives suit flow from CM ECS	
208.3.2				Procedure	---	Doff and stow PLSS	---	---	Astronaut is free to handle equipment. PLSS is secured
208.3.3				Procedure	---	Climb up into CM hatchway	---	---	

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN AND CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
209.0.0 Transfer Equipment, Specimens and Records to CM	92:59:12	00:02:30							
209.1.0 Disengage self from seat and stand in aisle	92:59:12	00:01:00	SE/A						
209.1.1				Procedure	---	Unlatch seat restraint harness	Depress and twist lever on harness	---	
209.1.2				Procedure	---	Stand in aisle and don PLSS	---	---	
209.2.0 Transfer tote bag and equipment to CM	93:00:12	00:01:30	SE/A						
209.2.1				Procedure	---	Unstrap seat restraint harness from tote bag. Place tote bag and equipments in hatchway and push through	Restraint harness latching lever	---	
209.2.2			C/CM	Procedure	---	Receive equipment and tote bag from SE	---	---	

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN AND CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
210.0.0 Stow Equipment, Specimens and Records on Board CM	93:01:42	00:03:00	C/CM	To be determined					

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Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
211.0.0 Prepare to Transfer to CM	93:01:42	00:01:30	SE/A						
211.1.0 Disconnect umbilical from LEM ECS	93:01:42	00:00:30							
211.1.1				Checklist	---	Disconnect umbilicals from LEM ECS and communications system and insert communications umbilical into beltpack	Umbilical snap ring	PLSS is connected to suit and is ready to supply life support in event of rapid decompression. Communications established by means of beltpack	
211.2.0 Secure SE seat	93:02:12	00:01:00							
211.2.1				Checklist	---	Secure SE seat restraint harness	Latching lever	---	

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHAKEDOWN AND CREW HANDOVER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
212.0.0 Complete Shutdown of LEM Systems	93:03:12	00:00:55	SE/A						
212.1.0 Turn off power to ECS	93:03:12	00:00:50							
212.1.1				Checklist	---	De-energize ECS master power	ECS MASTER POWER toggle to OFF	Glycol pumps, suit fans, and cabin fan de-energized	
212.1.2				Checklist	---	Close O_2 flood circuit	O_2 FLOOD toggle to OFF	O_2 flood circuit de-activated	
212.1.3				Checklist	---	Manually close LEM ECS connection to LEM cabin	Close DIVERTER VALVE, CABIN GAS RETURN VALVE, SUIT CIRCUIT RELIEF VALVE	LEM ECS is manually disconnected from LEM cabin	
212.2.0 De-activate DC distribution	93:04:02	00:00:05							
212.2.1				Checklist	---	Remove non-essential loads from main bus	BUS TIE NON-ESSENTIAL toggle to OFF	Non-essential loads removed from main bus	
212.2.2				Checklist	---	Turn off cabin lighting	DOME lights toggle to OFF	Cabin lighting de-energized	

PHASE NUMBER: 14 POST-DOCKING SYSTEMS SHUTDOWN AND CREW TRANSFER

Function and Task Description	Mission Time	Activity Time	Crew/ Location	Information Requirement(s)	Display(s)	Action Requirement(s)	Control(s)	System Output(s)	Remarks
213.0.0 Transfer From LEM to CM	93:04:07	00:01:30	SE/A-IL-CM						
213.1.0 Proceed into interlock and close LEM hatch	93:04:07	00:00:45							
213.1.1				Procedure	---	Enter interlock with flashlamp feet first with faceplate open wearing PLSS	---	---	
213.1.2				Procedure	---	Pull LEM hatch cover closed and secure	Hatch locking wheel	---	
213.2.0 Proceed into CM and close CM hatch	93:04:52	00:00:45							
213.2.1				Procedure	---	Proceed into CM feet first	---	---	
213.2.2				Procedure	---	Place CM hatch cover up into position and secure	Hatch locking wheel	----	Crew transfer completed and preparation can be-gin to jettison LEM