

FC021  
9/10/69



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

*FINAL  
FLIGHT MISSION RULES*

*APOLLO 12  
(AS-507/108/LM-6)*

**SEPTEMBER 10, 1969**

**PREPARED BY**

***FLIGHT CONTROL DIVISION***

**MANNED SPACECRAFT CENTER  
HOUSTON, TEXAS**



**FOR NASA/DOD INTERNAL USE ONLY  
INCLUDING APPROPRIATE CONTRACTORS**

*402/c. S. Harlan*

FC021  
10/31/69

APOLLO 12  
FINAL FLIGHT MISSION RULES  
REV. B

PREFACE

THIS DOCUMENT CONTAINS REVISION B TO THE FINAL FLIGHT MISSION RULES FOR APOLLO 12 AS OF OCTOBER 31, 1969. REVISION B IS A PAGE CHANGE REVISION AND THE PAGES SHOULD BE INSERTED IN ACCORDANCE WITH THE REVISION INSTRUCTION SHEET WHICH FOLLOWS THIS PAGE. THIS AND ALL SUBSEQUENT REVISIONS TO THIS DOCUMENT WILL BE PRINTED ON DIFFERENT COLORED PAGES FOR EASY RECOGNITION.

IT IS REQUESTED THAT ANY ORGANIZATION HAVING COMMENTS, QUESTIONS, OR SUGGESTIONS CONCERNING THESE MISSION RULES CONTACT MR. JOHN R. TEMPLE, FLIGHT CONTROL OPERATIONS BRANCH, BUILDING 45, ROOM 637, PHONE 483-3838.

ANY REQUESTS FOR ADDITIONAL COPIES OR CHANGES TO THE DISTRIBUTION LIST IN APPENDIX B OF THIS DOCUMENT MUST BE MADE IN WRITING TO MR. CHRISTOPHER C. KRAFT, JR., DIRECTOR OF FLIGHT OPERATIONS, MANNED SPACECRAFT CENTER, HOUSTON, TEXAS.

THIS IS A CONTROL DOCUMENT AND ANY CHANGES ARE SUBJECT TO THE CHANGE CONTROL PROCEDURES DELINEATED IN APPENDIX C. THIS DOCUMENT IS NOT TO BE REPRODUCED WITHOUT THE WRITTEN APPROVAL OF THE CHIEF, FLIGHT CONTROL DIVISION, MANNED SPACECRAFT CENTER, HOUSTON, TEXAS.

APPROVED BY:

*for Sigurd A. Spalberg*  
CHRISTOPHER C. KRAFT, JR.  
DIRECTOR OF FLIGHT OPERATIONS

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FC021  
10/15/69

APOLLO 12  
FINAL FLIGHT MISSION RULES  
REV. A

PREFACE

THIS DOCUMENT CONTAINS REVISION A TO THE FINAL FLIGHT MISSION RULES FOR APOLLO 12 AS OF OCTOBER 15, 1969. REVISION A IS A PAGE CHANGE REVISION AND THE PAGES SHOULD BE INSERTED IN ACCORDANCE WITH THE REVISION INSTRUCTION SHEET WHICH FOLLOWS THIS PAGE. THIS AND ALL SUBSEQUENT REVISIONS TO THIS DOCUMENT WILL BE PRINTED ON DIFFERENT COLORED PAGES FOR EASY RECOGNITION.

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APPROVED BY:

*Christopher C. Kraft, Jr.*  
CHRISTOPHER C. KRAFT, JR.  
DIRECTOR OF FLIGHT OPERATIONS

APOLLO 12  
FINAL FLIGHT MISSION RULES  
REVISION A

REVISION INSTRUCTION SHEET

11	3-10	4-9	6-8	7-15	15-2	21-1	25-1
1-4	3-11	5-1	6-9	8-1	15-4	21-4	25-9
1-6	3-13	5-6	6-10	8-2	15-5	21-5	25-10
1-13	3-14	5-8	6-11	8-3	15-7	22-1	26
2-4	3-15	5-9	7-2	8-4	15-12	22-3	27-1
2-5	3-16	5-11	7-3	8-5	16-1	22-4	27-6
2-6	3-17	5-12	7-4	10-3	16-4	22-5	ANNEX B
207	3-18	5-13	7-5	10-4	17-2	22-6	B-1
3-2	3-19	5-14	7-6	10-6	18-2	22-7	B-2
3-3	3-20	5-15	7-7	11-1	19-1	22-8	B-3
3-4	3-22	5-16	7-9	12-3	19-2	23-9	B-4
3-5	3-23	6-2	7-10	12-7	19-4	23-10	B-5
3-6	3-24	6-3	7-11	12-9	19-5	23-11	B-6
3-7	3-30	6-5	7-12	12-12	20-3	23-13	B-3
3-8	4-2	6-6	7-13	13-4	20-7	24-2	B-4
3-9	4-8	6-7	7-14	14-5	20-10	24-14	

ADD THE FOLLOWING NEW PAGES:

11a	31-3
21-6	31-6
22-9	31-7
7-16	31-8
31-1	31-9
31-2	31-10
31-3	31-11
31-4	31-12

PAGES DELETED BY THIS REVISION:

6-12  
6-13



FC021  
9/10/69

**APOLLO 12  
FINAL FLIGHT MISSION RULES**

**PREFACE**

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APPROVED BY:

*for Sigurd A. Sjoberg*  
CHRISTOPHER C. KRAFT, JR.  
DIRECTOR OF FLIGHT OPERATIONS

**PART I  
INTRODUCTION AND  
GEN GUIDELINES**

**PART II  
1 GENERAL RULES  
AND SOP'S**

**2 FLIGHT OPERATIONS  
RULES**

**3 MISSION RULE  
SUMMARY**

**4 GROUND  
INSTRUMENTATION  
REQUIREMENTS**

**5 TRAJECTORY AND  
GUIDANCE**

**6 SLY - T01 THROUGH  
T04/T04A (LAUNCH)**

**7 SLY - T05 AND  
T07 (COAST)**

**8 SLY - T06  
(RESTART)**

**9 SLY - T08 (MAPING  
AND SLINGSHOT)**

**10 CSM ENVIRONMENTAL  
CONTROL**

**11 CSM CRTOGENICS**

**12 CSM ELECTRICAL  
POWER SYSTEM**

**13 DOCKING AND  
UMBILICAL**

**14 CSM SEQUENTIAL**

**15 CSM GUIDANCE  
AND CONTROL**

**16 CSM SERVICE  
PROPULSION  
SYSTEM**

**17 CSM SM-RCS**

**18 CSM CM-RCS**

**19 EMU/EVA**

**20 COMMUNICATIONS/  
INSTRUMENTATION**

**21 LM SEQUENTIAL  
AND PYROTECHNIC**

**22 LM ELECTRICAL  
POWER**

**23 LM ENVIRONMENTAL  
CONTROL**

24 LM GUIDANCE  
AND CONTROL

25 LM OPS

26 LM APS

27 LM REACTION  
CONTROL SYSTEM

28 SPACE  
ENVIRONMENT

29 RECOVERY

30 AEROMEDICAL

31 ALSEP

APPENDICES

A ACRONYMS AND  
SYMBOLS

B DISTRIBUTION  
LIST

C CHANGE CONTROL

NASA - Manned Spacecraft Center

MISSION RULES  
TABLE OF CONTENTS

REV	ITEM	PAGE
----- TABLE OF CONTENTS -----		
	INTRODUCTION AND PURPOSE	1
	PART I GENERAL GUIDELINES	
	OMSP GENERAL RULES	1-1
	PART II FLIGHT MISSION RULES	
	SECTION	
	1 GENERAL RULES AND SOP'S	
	GENERAL	1-1
	DEFINITIONS	1-3
	TARGET POINT SELECTION CRITERIA	1-7
	PRELAUNCH RULES	1-8
	LAUNCH ABORT RULES	1-9
	CREW ABORT LIMITS	1-13
	2 FLIGHT OPERATIONS RULES	
	GENERAL	2-1
	3 MISSION RULE SUMMARY	
	LAUNCH PHASE	3-1
	EARTH ORBIT	3-3
	TDC	3-3
	TRANS-LUNAR COAST	3-6
	LUNAR ORBIT	3-7
	DOI PHASE	3-8
	POWERED DESCENT	3-9
	ASCENT	3-11
	ALL PHASES	3-11
	CONSUMABLES	3-12
	4 GROUND INSTRUMENTATION REQUIREMENTS	
	GENERAL	4-1
	MCC	4-2
	BSFC/ASC MSPA	4-8
	GROUND INSTRUMENTATION REQUIREMENTS (TOD)	4-10
	5 TRAJECTORY AND GUIDANCE	
	LAUNCH	5-1
	EARTH ORBIT AND TLE	5-3
	MANEUVERS	5-7
	TRANS-LUNAR COAST	5-8
	LUNAR ORBIT	5-10
	DESCENT	5-11
	ASCENT	5-16
	RENDÉZVOUS	5-18
	TRANS-EARTH AND ENTRY	5-19
	RANGE SAFETY	5-19
	6 SLV - T01 THROUGH TRA/T04A (LAUNCH)	6-1
	7 SLV - T05 AND T07 (COAST)	7-1
	8 SLV - T06 (RESTART)	8-1
	9 SLV - T08 (SAPING AND SLINGSHOT)	9-1
	PRELAUNCH INSTRUMENTATION	9-3

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	PNL	9/18/69	TABLE OF CONTENTS		1

# NASA - Manned Spacecraft Center

## MISSION RULES TABLE OF CONTENTS

REV	ITEM	
	10	CSM ENVIRONMENTAL CONTROL SYSTEM
		GENERAL 10-1
		MANAGEMENT 10-2
		SUITS/CABIN 10-3
		COOLANT 10-10
		WATER & WASTE MANAGEMENT 10-13
		INSTRUMENTATION REQUIREMENTS 10-15
	11	CSM CRYOGENICS
		GENERAL 11-1
		MANAGEMENT 11-2
		SPECIFIC 11-3
		INSTRUMENTATION REQUIREMENTS 11-6
	12	CSM ELECTRICAL POWER SYSTEM
		GENERAL 12-1
		MANAGEMENT 12-2
		FUEL CELLS 12-6
		BATTERIES/CHARGER 12-6
		DC DISTRIBUTION 12-8
		AC DISTRIBUTION 12-12
		INSTRUMENTATION REQUIREMENTS 12-13
	13	DOCKING AND UMBILICAL
		GENERAL 13-1
		MANAGEMENT 13-2
		SPECIFIC 13-3
	14	CSM SEQUENTIAL
		GENERAL 14-1
		MANAGEMENT 14-2
		SPECIFIC 14-3
		INSTRUMENTATION REQUIREMENTS 14-7
	15	GUIDANCE AND CONTROL
		GENERAL 15-1
		SYSTEMS/MANAGEMENT 15-4
		SCB 15-5
		CSM 15-11
		INSTRUMENTATION REQUIREMENTS 15-14
	16	CSM SERVICE PROPULSION SYSTEM
		GENERAL 16-1
		MANAGEMENT 16-4
		SPECIFIC 16-5
		INSTRUMENTATION REQUIREMENTS 16-16
	17	CSM BN-RCS
		GENERAL 17-1
		MANAGEMENT 17-2
		SPECIFIC 17-3
		INSTRUMENTATION REQUIREMENTS 17-6
	18	CSM FM-RCS
		GENERAL 18-1
		MANAGEMENT 18-2
		SPECIFIC 18-3
		INSTRUMENTATION REQUIREMENTS 18-5
	19	EMU/EVA
		GENERAL/MANAGEMENT 19-1
		SPECIFIC 19-2
		PRELUNCH INSTR 19-3

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FAL	9/20/69	TABLE OF CONTENTS		2

NASA - Manned Spacecraft Center

MISSION RULES

TABLE OF CONTENTS

REV	ITEM	
20	COMMUNICATIONS AND INSTRUMENTATION	
	FUNCTIONAL COMM GENERAL	20-1
	FUNCTIONAL COMM MANAGEMENT	20-2
	FUNCTIONAL COMM SPECIFIC	20-3
	CBM INSTRUMENTATION GENERAL	20-5
	CBM INSTRUMENTATION MANAGEMENT	20-6
	CBM INSTRUMENTATION SPECIFIC	20-7
	LM INSTRUMENTATION GENERAL	20-8
	LM INSTRUMENTATION MANAGEMENT	20-9
	LM INSTRUMENTATION SPECIFIC	20-10
	PRELAUNCH REQUIREMENTS	20-11
21	LM SEQUENTIAL & PYROTECHNIC	
	GENERAL MANAGEMENT	21-1
	SPECIFIC	21-2
	PRELAUNCH INSTRUMENTATION	21-3
		21-4
22	LM ELECTRICAL POWER	
	GENERAL MANAGEMENT	22-1
	SPECIFIC	22-2
	INSTRUMENTATION REQUIREMENTS	22-3
		22-4
23	LM ENVIRONMENTAL CONTROL	
	GENERAL MANAGEMENT	23-1
	SPECIFIC	23-2
	INSTRUMENTATION REQUIREMENTS	23-3
		23-4
		23-5
		23-6
		23-7
24	LM GUIDANCE AND CONTROL	
	GENERAL MANAGEMENT	24-1
	SPECIFIC - PMS/CES/AGS	24-2
	PRELAUNCH INSTRUMENTATION	24-3
		24-4
		24-5
25	LM GUIDANCE AND CONTROL	
	GENERAL MANAGEMENT	25-1
	SPECIFIC - DPS	25-2
	PRELAUNCH INSTRUMENTATION	25-3
		25-4
		25-5
		25-6
26	LM OPS	
	GENERAL MANAGEMENT	26-1
	SPECIFIC	26-2
	PRELAUNCH INSTRUMENTATION	26-3
		26-4
		26-5
27	LM RES	
	GENERAL MANAGEMENT	27-1
	SPECIFIC	27-2
	PRELAUNCH INSTRUMENTATION	27-3
		27-4
		27-5
28	SPACE ENVIRONMENT	
	GENERAL MANAGEMENT	28-1
	SPECIFIC	28-2
	INSTRUMENTATION REQUIREMENTS	28-3
		28-4
		28-5

NASA - Manned Spacecraft Center

MISSION RULES  
TABLE OF CONTENTS

REV	ITEM	
	29	RECOVERY
		SPECIFIC 29-1
	30	AEROMEDICAL
		GENERAL 30-1
		SPECIFIC - PHYSIOLOGICAL 30-2
		SPECIFIC - EQUIPMENT 30-3
		INSTRUMENTATION REQUIREMENTS 30-5
	31	ALSEP
		TO BE PROVIDED
		APPENDIX A - ACRONYMS AND SYMBOLS A-1
		APPENDIX B - DISTRIBUTION LIST B-1
		APPENDIX C - CHANGE CONTROL C-1

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	FNL	9/10/69	TABLE OF CONTENTS		4

**PART I  
INTRODUCTION AND  
GEN GUIDELINES**



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MISSION RULES

REV	ITEM						
		----- INTRODUCTION & PURPOSE -----					
		MISSION RULES ARE PROCEDURAL STATEMENTS WHICH PROVIDE FLIGHT CONTROL PERSONNEL WITH GUIDELINES TO EXPEDITE THE DECISION-MAKING PROCESS. THE RULES ARE BASED ON AN ANALYSIS OF MISSION EQUIPMENT CONFIGURATIONS, SYSTEMS OPERATIONS AND CONSTRAINTS, FLIGHT CREW PROCEDURES, AND MISSION OBJECTIVES. THE DIRECTOR OF FLIGHT OPERATIONS, MANNED SPACECRAFT CENTER, HOUSTON, TEXAS, HAS THE OVERALL RESPONSIBILITY FOR THE PREPARATION, CONTENTS, AND CONTROL OF THE FLIGHT MISSION RULES.					
		MISSION RULES CAN BE CATEGORIZED AS GENERAL AND SPECIFIC. GENERAL MISSION RULES CONTAIN THE BASIC PHILOSOPHIES USED IN THE DEVELOPMENT OF THE FLIGHT MISSION RULES. SPECIFIC MISSION RULES PROVIDE THE BASIC CRITERIA FROM WHICH REAL-TIME DECISIONS ARE MADE AND WILL BE FORMATTED AS FOLLOWS---					
		A. THE CONDITION/MALFUNCTION COLUMN DEFINES THE FAILURE. B. THE PHASE COLUMN IDENTIFIES THE TIME INTERVAL IN WHICH THE CONDITION/MALFUNCTION OCCURS. C. THE RULING COLUMN DEFINES FLIGHT CONTROLLER ACTION AND/OR PROCEDURES THAT MUST BE ACCOMPLISHED AS A RESULT OF THE CONDITION. D. THE CUES/NOTES/COMMENTS COLUMN PROVIDES THE FLIGHT CONTROLLER WITH ADDITIONAL INFORMATION CONCERNING THE CONDITION/MALFUNCTION AND/OR RULING.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/10/69	INTRODUCTION AND PURPOSE		1-1

**NASA - Manned Spacecraft Center**  
**MISSION RULES**

REV	ITEM													
		<p>-----            * OMSF GENERAL RULES *            -----</p>												
1-1		MISSION RULES ARE EFFECTIVE DURING THE LAUNCH COUNTDOWN, FLIGHT, RECOVERY, AND DURING PRELAUNCH TESTS WHEN APPLICABLE. FOR A LUNAR LANDING MISSION, RULES WILL BE APPLICABLE UNTIL RELEASE OF THE FLIGHT CREW, FLIGHT HARDWARE, AND LUNAR SAMPLES, WHICHEVER OCCURS LATER.												
1-2		THE DIRECTOR OF FLIGHT OPERATIONS AND THE DIRECTOR OF LAUNCH OPERATIONS OR THEIR DESIGNATED REPRESENTATIVE WILL INSURE COORDINATION OF THEIR RESPECTIVE MISSION RULE CHANGES WITH THE MISSION DIRECTOR AND OTHER APPROPRIATE ORGANIZATIONS.												
1-3		FOLLOWING THE COOT OR FRT, WHICHEVER OCCURS FIRST, MISSION DIRECTOR APPROVAL AND CONCURRENCE WILL BE REQUIRED ON ALL RULES CHANGES AFFECTING SAFETY, ACCOMPLISHMENT OF TEST OBJECTIVES, DEVIATIONS FROM THE NOMINAL MISSION AND PRELAUNCH CONSTRAINTS. CONCURRENCE MAY BE OBTAINED VERBALLY IF TIME CONSIDERATIONS SO DICTATE.												
1-4		DURING THE CONDUCT OF THE MISSION, THE MISSION DIRECTOR WILL BE ADVISED OF ALL RECOMMENDATIONS THAT INVOLVE CHANGES TO---MISSION OBJECTIVES, MISSION RULES, FLIGHT PLAN CONTENT, OR LAUNCH/FLIGHT SAFETY.												
1-5		WITHIN THEIR RESPECTIVE AREAS OF RESPONSIBILITY, THE COMMAND PILOT, THE LAUNCH DIRECTOR, FLIGHT DIRECTOR, DOD MANAGER FOR MSF SUPPORT OPERATIONS, AND THE MISSION DIRECTOR MAY TAKE OR RECOMMEND ANY ACTION REQUIRED FOR OPTIMUM CONDUCT OF THE MISSION.												
1-6		THE COMMAND PILOT, SPACECRAFT TEST CONDUCTOR, LAUNCH VEHICLE TEST CONDUCTOR, SPACE VEHICLE TEST SUPERVISOR, LAUNCH OPERATIONS MANAGER, LAUNCH DIRECTOR, FLIGHT DIRECTOR, DOD MANAGER FOR MANNED SPACE FLIGHT SUPPORT OPERATIONS, OR THE MISSION DIRECTOR MAY REQUEST A HOLD FOR CONDITIONS WITHIN THEIR RESPECTIVE AREAS OF RESPONSIBILITY.												
1-7		DURING THE COUNTDOWN, THE LAUNCH VEHICLE AND SPACECRAFT PROGRAM MANAGERS AND RESPECTIVE CENTER OPERATIONS MANAGERS SHALL PROVIDE TECHNICAL ADVICE AND SUPPORT DIRECTLY TO THE LAUNCH OPERATIONS MANAGER AND LAUNCH DIRECTOR. THE LATTER TWO WILL KEEP THE MISSION DIRECTOR FULLY INFORMED OF PROBLEMS AND PROPOSED SOLUTIONS. DURING THE FLIGHT PHASE OF OPERATIONS, SIMILAR SUPPORT AS REQUIRED WILL BE PROVIDED TO THE FLIGHT DIRECTOR AND THE MSC DIRECTOR OF FLIGHT OPERATIONS. THE MISSION DIRECTOR WILL BE KEPT FULLY INFORMED BY THESE INDIVIDUALS OF PROBLEMS AND PROPOSED SOLUTIONS DURING THE APPLICABLE PHASES OF THE MISSION.												
1-8		WHEN TIME PERMITS, THE FAILURE OF A MANDATORY OR HIGHLY DESIRABLE ITEM WILL BE REPORTED TO THE MISSION DIRECTOR BY THE LAUNCH DIRECTOR OR THE FLIGHT DIRECTOR. THE INITIAL REPORT WILL INCLUDE THE POSITION OR FACILITY THAT DETECTED THE MALFUNCTION. SUBSEQUENTLY, THE MISSION DIRECTOR WILL BE INFORMED OF ESTIMATED TIME TO REPAIR AND RECOMMENDED PROCEED, HOLD, RECYCLE, OR SCRAM ACTION AS IT DEVELOPS.												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 15%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>GENERAL GUIDELINES</td> <td>OMSF GENERAL RULES</td> <td>1-2</td> </tr> </table>			MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	GENERAL GUIDELINES	OMSF GENERAL RULES	1-2
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	FNL	9/10/69	GENERAL GUIDELINES	OMSF GENERAL RULES	1-2									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION I - GENERAL GUIDELINES

REV	ITEM												
I-9	IF A MANDATORY ITEM FAILS DURING THE COUNTDOWN, IT WILL BE CORRECTED PRIOR TO LAUNCH, HOLDING OR RECYCLING THE COUNTDOWN AS NECESSARY. IF A MANDATORY ITEM CANNOT BE CORRECTED TO PERMIT LIFTOFF WITHIN THE LAUNCH WINDOW, THE MISSION DIRECTOR MAY PROCEED WITH THE LAUNCH AFTER APPROPRIATE COORDINATION WITH THE APPROPRIATE OPERATIONS AND PROGRAM MANAGERS. GENERALLY THE LOSS OF A MANDATORY ITEM WILL RESULT IN A SCRUB.												
I-10	AS THE DESIGNATED REPRESENTATIVE OF THE PROGRAM DIRECTOR, ONLY THE MISSION DIRECTOR MAY SCRUB THE MISSION. FURTHER, THE MISSION DIRECTOR RETAINS THE PRIMARY AUTHORITY TO DOWNGRADE A MANDATORY ITEM. THIS AUTHORITY SHALL BE EXERCISED AS CIRCUMSTANCES DICTATE AND AFTER APPROPRIATE RECOMMENDATIONS FROM THE PROGRAM MANAGERS, LAUNCH DIRECTOR, AND FLIGHT DIRECTOR.												
I-11	CONSIDERATION WILL BE GIVEN TO THE REPAIR OF ANY HIGHLY DESIRABLE ITEM, BUT IN NO CASE WILL THE LAUNCH BE SCRUBBED FOR ANY SINGLE HIGHLY DESIRABLE ITEM. IF TWO OR MORE HIGHLY DESIRABLE ITEMS FAIL AND/OR OTHER AGGRAVATING CIRCUMSTANCES OCCUR, THE MISSION DIRECTOR MAY SCRUB THE MISSION AFTER COORDINATION WITH THE APPROPRIATE OPERATIONS AND PROGRAM MANAGERS.												
I-12	THE COUNTDOWN WILL NOT BE HELD NOR THE LAUNCH SCRUBBED FOR FAILURE OF DESIRABLE ITEMS.												
I-13	WHENEVER POSSIBLE, THE LAUNCH SITE AND MCC WILL VERIFY TELEMETRY READOUT DISCREPANCIES OCCURRING PRIOR TO LIFTOFF. IF THE MCC LOSES A PARAMETER BUT THE LAUNCH SITE HAS A VALID READOUT, THE MCC WILL CONTINUE ON THE LAUNCH SITE READOUT. THIS IS TRUE EXCEPT FOR THOSE MANDATORY PARAMETERS LISTED IN THE FLIGHT MISSION RULES! UPON WHICH MISSION RULES ACTION IS TAKEN. IN THIS CASE, A HOLD MAY BE CALLED TO EVALUATE THE PROBLEM.												
I-14	THE COUNTDOWN WILL CONTINUE WHERE POSSIBLE CONCURRENTLY WITH CORRECTION OF AN EXISTING PROBLEM.												
I-15	WHERE POSSIBLE, ALL MANUAL ABORT REQUESTS FROM THE GROUND DURING FLIGHT WILL BE BASED ON TWO INDEPENDENT INDICATIONS OF THE FAILURE. CREW ABORT ACTION WILL NORMALLY BE BASED UPON TWO CUES.												
I-16	PRIOR TO LIFTOFF, THE DIRECTOR OF LAUNCH OPERATIONS WILL BE RESPONSIBLE FOR ALL ACTIONS IN THE EVENT OF LAUNCH SITE EMERGENCIES, EXCEPT FOR RECOVERY OPERATIONS OF SPACECRAFT AND CREW RESULTING FROM A PAD ABORT.												
I-17	THE LAUNCH OPERATIONS MANAGER MAY SEND AN ABORT REQUEST FROM THE TIME THE LAUNCH ESCAPE SYSTEM IS ARMED UNTIL THE SPACE VEHICLE REACHES SUFFICIENT ALTITUDE TO CLEAR THE TOP OF THE UMBILICAL TOWER. THE CRITERIA FOR SENDING AN ABORT REQUEST WILL BE ESTABLISHED IN THE LAUNCH RULES.												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/20/69</td> <td>GENERAL GUIDELINES</td> <td>OMSF GENERAL RULES</td> <td>I-3</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/20/69	GENERAL GUIDELINES	OMSF GENERAL RULES	I-3
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	FNL	9/20/69	GENERAL GUIDELINES	OMSF GENERAL RULES	I-3								

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## MISSION RULES

### SECTION I - GENERAL GUIDELINES

REV	ITEM
I-18	FROM LIFTOFF TO TOWER CLEAR, THE LAUNCH DIRECTOR AND FLIGHT DIRECTOR WILL HAVE CONCURRENT RESPONSIBILITY FOR SENDING AN ABORT REQUEST. THE CRITERIA FOR SENDING AN ABORT REQUEST DURING THIS PERIOD WILL BE ESTABLISHED IN THE LAUNCH AND FLIGHT RULES RESPECTIVELY.
I-19	THE LAUNCH OPERATIONS MANAGER WILL INFORM MCC WHEN THE SPACE VEHICLE CLEARS THE UMBILICAL TOWER BY SAYING "CLEAR TOWER" OVER ONE OF THE LOOPS FROM KSC TO MCC.
I-20	IN THE EVENT OF NON-CATASTROPHIC SPACE VEHICLE COLLISION WITH THE UMBILICAL TOWER OR OTHER CONTINGENCIES WHICH DO NOT REQUIRE IMMEDIATE ACTION, THE LAUNCH OPERATIONS MANAGER WILL CONTINUE TO EVALUATE THE EXTENT OF THE DAMAGE AND PROVIDE INFORMATION TO THE FLIGHT DIRECTOR FOR ANY ACTION NECESSARY AFTER UMBILICAL TOWER CLEARANCE.
I-21	COMPLETE GROUND CONTROL OF THE SPACE VEHICLE PASSES TO THE FLIGHT DIRECTOR WHEN THE SPACE VEHICLE REACHES SUFFICIENT ALTITUDE TO CLEAR THE TOP OF THE UMBILICAL TOWER.
I-22	IN THE MCC, THE FLIGHT DIRECTOR, FLIGHT DYNAMICS OFFICER AND BOOSTER SYSTEMS ENGINEER WILL HAVE THE CAPABILITY TO SEND AN ABORT REQUEST SIGNAL. THE CRITERIA FOR SENDING AN ABORT REQUEST WILL BE ESTABLISHED IN THE FLIGHT RULES.
I-23	THE COMMAND PILOT MAY INITIATE SUCH INFIGHT ACTION AS HE DEEMS ESSENTIAL FOR CREW SAFETY.
I-24	FLIGHT CREW SAFETY SHALL TAKE PRECEDENCE OVER THE ACCOMPLISHMENT OF MISSION OBJECTIVES.
I-25	IN THE EVENT OF COMMUNICATIONS LOSS BETWEEN THE MANNED SPACE FLIGHT NETWORK AND THE SPACECRAFT, THE COMMAND PILOT WILL ASSUME RESPONSIBILITY FOR MISSION CONDUCT AS DESCRIBED WITHIN THE FLIGHT RULES.
I-26	THE FLIGHT DIRECTOR, THROUGH THE RECOVERY COORDINATOR, WILL PROVIDE THE DOD MANAGER FOR MANNED SPACE FLIGHT SUPPORT OPERATIONS THE PREDICTED LOCATION AND TIME OF SPLASHDOWN.
I-27	THE DOD MANAGER FOR MANNED SPACEFLIGHT SUPPORT OPERATIONS IS RESPONSIBLE FOR RECOVERY AND COMMAND AND CONTROL OF DOD RECOVERY FORCES. RECOMMENDATIONS, GUIDELINES AND REQUIREMENTS, AS SET FORTH BY NASA, WILL BE CONSIDERED TO EFFECT SAFE AND EXPEDITIOUS RECOVERY OF THE FLIGHT CREW AND SPACECRAFT.
I-28	THE APOLLO MISSION DIRECTOR IS RESPONSIBLE FOR THE BIOCONTAINMENT OF ALL LUNAR EXPOSED MATERIALS, LUNAR SAMPLES, AND LUNAR CREWS FROM THE COMPLETION OF PRELAUNCH MICROBIAL SAMPLING UNTIL RELEASE OF ASTRONAUTS, SAMPLES, AND MISSION-RELATED EQUIPMENT.
	RULE NUMBERS I-29 THROUGH I-35 ARE RESERVED.
	MISSION   REV   DATE   SECTION   GROUP   PAGE
	APOLLO 12   PNL   9/10/69   GENERAL GUIDELINES   OMSF GENERAL RULES   I-4

NASA - Manned Spacecraft Center

MISSION RULES

SECTION I - GENERAL GUIDELINES

REV	ITEM													
		----- ' DEFINITIONS ' -----												
I-36	REDLINE	---A REDLINE VALUE IS A MAXIMUM AND/OR MINIMUM LIMIT OF A CRITICAL PARAMETER NECESSARY TO IDENTIFY VEHICLE, SYSTEM, AND COMPONENT PERFORMANCE AND OPERATION. REDLINE VALUES WILL BE ESTABLISHED SUCH THAT FURTHER DEGRADATIONS OF THE SYSTEM OR COMPONENT COULD LEAD TO A FAILURE TO ACCOMPLISH THE PRIMARY MISSION.												
I-37	REDLINE FUNCTION	---A REDLINE FUNCTION IS A PARAMETER THAT HAS BEEN IDENTIFIED TO MONITOR THE FUNCTIONING OF A UNIT TO INSURE THE OPERATIONAL PERFORMANCE OF THAT UNIT IS ACCEPTABLE TO MEET THE PRIMARY MISSION. REDLINE FUNCTIONS ARE MANDATORY.												
I-38	PRIMARY OBJECTIVE	---A STATEMENT OF THE PRIMARY PURPOSE OF THE FLIGHT. WHEN USED IN CENTER CONTROL DOCUMENTATION THE PRIMARY OBJECTIVE MAY BE AMPLIFIED BUT NOT MODIFIED. DETAILED OBJECTIVES WILL BE GENERATED AND AMPLIFIED TO FULFILL EACH MISSION OBJECTIVE.												
I-39	PRINCIPAL DETAILED OBJECTIVE	---A SCIENTIFIC, ENGINEERING OR OPERATIONAL OBJECTIVE WHICH AMPLIFIES A PRIMARY OBJECTIVE OR DETAILS A MAJOR DEVELOPMENTAL PURPOSE OR FEATURE OF THE FLIGHT PERIOD.												
I-40	RESERVED													
I-41	SECONDARY DETAILED OBJECTIVE	---A SCIENTIFIC, ENGINEERING OR OPERATIONAL OBJECTIVE WHICH WOULD PROVIDE SIGNIFICANT DATA OR EXPERIENCE--BUT WHICH IS NOT NECESSARY TO THE ACCOMPLISHMENT OF A PRIMARY OBJECTIVE.												
I-42	MANDATORY (MI)	---A MANDATORY ITEM IS A SPACE VEHICLE OR OPERATIONAL SUPPORT ELEMENT THAT IS ESSENTIAL FOR ACCOMPLISHMENT OF THE PRIMARY MISSION, WHICH INCLUDES PRELAUNCH, FLIGHT, AND RECOVERY OPERATIONS THAT INSURE CREW SAFETY AND EFFECTIVE OPERATIONAL CONTROL AS WELL AS THE ATTAINMENT OF THE PRIMARY OBJECTIVES.												
I-43	HIGHLY DESIRABLE (HDI)	---A HIGHLY DESIRABLE ITEM IS A SPACE VEHICLE OR OPERATIONAL SUPPORT ELEMENT THAT SUPPORTS AND ENHANCES THE ACCOMPLISHMENT OF THE PRIMARY MISSION AND IS ESSENTIAL FOR THE ACCOMPLISHMENT OF THE PRINCIPAL DETAILED OBJECTIVES.												
I-44	DESIRABLE (DI)	---A DESIRABLE ITEM IS A SPACE VEHICLE ELEMENT OR OPERATIONAL SUPPORT ELEMENT THAT IS NOT ESSENTIAL FOR THE ACCOMPLISHMENT OF THE PRIMARY MISSION.												
I-45	PROCEED	---CONTINUE IN ACCORDANCE WITH PRESCRIBED COUNTDOWN PROCEDURES.												
I-46	HOLD	---INTERRUPTION OF THE COUNTDOWN FOR UNFAVORABLE WEATHER, REPAIR OF HARDWARE, OR CORRECTION OF CONDITIONS UNSATISFACTORY FOR LAUNCH OR FLIGHT.												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>GENERAL GUIDELINES</td> <td>OMSF GENERAL RULES</td> <td>I-5</td> </tr> </tbody> </table>			MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	GENERAL GUIDELINES	OMSF GENERAL RULES	I-5
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	FNL	9/10/69	GENERAL GUIDELINES	OMSF GENERAL RULES	I-5									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION I - GENERAL GUIDELINES

REV	ITEM	MISSION	REV	DATE	SECTION	GROUP	PAGE
I-47	COUNTDOWN---THE PERIOD OF TIME STARTING WITH LAUNCH VEHICLE POWER UP FOR THE LAUNCH (ON SIMULATED LAUNCH) WHICH INCLUDES SERVICE STRUCTURE REMOVAL, LAUNCH VEHICLE CRYOGENIC TANKING, SPACECRAFT CLOSEOUT, AND TERMINAL COUNT.	APOLLO 12	FNL	9/10/69	GENERAL OMSF GUIDELINES	GENERAL RULES	I-6
I-48	HOLD-POINT---A PREDETERMINED POINT WHERE THE COUNTDOWN MAY BE CONVENIENTLY INTERRUPTED.						
I-49	RECYCLE---THE COUNTDOWN IS STOPPED AND RETURNED TO A DESIGNATED POINT OR AS SPECIFIED IN THE LAUNCH MISSION RULES.						
I-50	SCRUB---THE LAUNCH IS POSTPONED.						
I-51	CUTOFF---THE AUTOMATIC OR MANUAL COMMAND TO STOP THE LAUNCH SEQUENCE AFTER INITIATION OF THE "AUTOMATIC LAUNCH SEQUENCE START."						
I-52	LIFTOFF---THE EVENT DETERMINED BY THE INSTRUMENTATION UNIT UMBILICAL DISCONNECT SIGNAL AND IS THE POINT IN TIME WHEN PLUS TIME COMMENCES.						
I-53	ABORT---MISSION TERMINATION BY UNSCHEDULED INTENTIONAL SEPARATION OF THE SPACECRAFT FROM THE LAUNCH VEHICLE PRIOR TO ORBITAL INSERTION.						
I-54	EARLY MISSION TERMINATION--- UNSCHEDULED INTENTIONAL MISSION TERMINATION AT OR AFTER ORBITAL INSERTION.						
I-55	MEASUREMENT---A MEASUREMENT IS A SPECIFIC DATA CHANNEL OF INSTRUMENTATION MONITORING A SINGLE FUNCTION.						
I-56	INSTRUMENTATION---INSTRUMENTATION IS THE EQUIPMENT THAT ACQUIRES, TRANSMITS AND MONITORS DATA FOR PERFORMANCE EVALUATION OF SPACE VEHICLE AND OPERATIONAL SUPPORT ITEMS.						
I-57	MISSION PERIOD TERMINATION (LUNAR LANDING MISSION)--- MISSION PERIOD TERMINATION OCCURS UPON THE RELEASE OF THE FLIGHT CREW, FLIGHT HARDWARE, OR RELEASE OF THE LUNAR SAMPLES TO APPROVED PRINCIPLE INVESTIGATORS, WHICHEVER OCCURS LATER.						

**PART II  
1 GENERAL RULES  
AND SOFS**

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 GENERAL RULES AND SOP'S

REV	ITEM													
		.....   GENERAL   .....												
1-1		THE FLIGHT MISSION RULES OUTLINE PREPLANNED DECISIONS DESIGNED TO MINIMIZE THE AMOUNT OF REAL-TIME RATIONALIZATION REQUIRED WHEN NON-NOMINAL SITUATIONS OCCUR DURING THE TERMINAL COUNTDOWN, THE FLIGHT PHASE, AND RECOVERY OPERATIONS.												
1-2		WHENEVER POSSIBLE, THE CREW AND GROUND WILL VERIFY ALL MALFUNCTIONS, WHENEVER THERE IS A CONFLICT BETWEEN SPACECRAFT AND GROUND TELEMETRY READOUTS, THE SPACECRAFT READOUTS ARE PRIME (ASSUMING THE SPACECRAFT HAS ADEQUATE INSTRUMENTATION AND THAT APPLICABLE SPACECRAFT COCKPIT READOUTS ARE OPERATIONAL).												
1-3		SPACECRAFT LAUNCH WILL NOT BE ATTEMPTED IF KNOWN SPACECRAFT SYSTEMS MALFUNCTIONS WILL LIMIT THE MISSION DURATION SUCH THAT ACCOMPLISHMENT OF THE PRINCIPAL DETAILED OBJECTIVES WILL BE COMPROMISED.												
1-4		WHEN A CONFLICT OF FLIGHT PLAN ACTIVITIES OCCURS, THE FLIGHT DIRECTOR WILL DETERMINE THE PRIORITY OF ACTIVITIES.												
1-5		IN SOME INSTANCES, THE SPECIFIC MISSION RULES MAY DEVIATE FROM THE GENERAL GUIDELINES CONTAINED IN PART 7 OR FROM THESE GENERAL RULES, THE SPECIFIC MISSION RULE WILL APPLY IN ALL CASES, AND THE DEVIATIONS FROM THE GENERAL GUIDELINES WILL BE NOTED.												
1-6		THE FLIGHT DIRECTOR MAY, AFTER ANALYSIS OF THE FLIGHT, CHOOSE TO TAKE ANY NECESSARY ACTION REQUIRED FOR THE SUCCESSFUL COMPLETION OF THE MISSION.												
1-7		MISSION RULE LIMITS THAT ARE CONSIDERED TO BE INTERIM OR UNCONFIRMED NUMBERS WILL BE UNDERLINED IN THIS PUBLICATION AND ALL SUBSEQUENT REVISIONS UNTIL THE NUMBERS ARE CONFIRMED BY THE RESPONSIBLE NASA AGENCY.												
1-8		THE SYSTEMS LIMITS LISTED IN THESE RULES ARE THE ACTUAL VEHICLE LIMITS AS WELL AS THEY ARE KNOWN AND UNDERSTOOD AND ARE NOT BIASED TO COMPENSATE FOR TIME DELAYS OR INSTRUMENTATION ERRORS WITHIN THE SPACECRAFT AND MSFN DATA/DISPLAY SYSTEMS.												
1-9		UNLESS STATED OTHERWISE, MANDATORY AND HIGHLY DESIRABLE INSTRUMENTATION REQUIREMENTS ARE SATISFIED BY EITHER ONBOARD OR PCM CAPABILITY.												
		<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>GENERAL RULES AND SOP'S</td> <td>GENERAL</td> <td>1-1</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	GENERAL RULES AND SOP'S	GENERAL	1-1
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	FNL	9/10/69	GENERAL RULES AND SOP'S	GENERAL	1-1									



**NASA - Manned Spacecraft Center**  
**MISSION RULES**  
**SECTION 1 GENERAL RULES AND SOP'S**

REV	ITEM													
	1-10	<p>MANDATORY SPACE VEHICLE INSTRUMENTATION FOR THE PURPOSES OF FLIGHT MISSION RULES MUST BE IN CONSONANCE WITH THE FOLLOWING CRITERIA--- (REFERENCE OMSF GENERAL RULE 1-627).</p> <p>A. REQUIRED TO INSURE FLIGHT CREW SAFETY.</p> <p>B. REQUIRED TO IMPLEMENT RULES RESULTING IN LAUNCH ABORTS.</p> <p>C. REQUIRED TO IMPLEMENT RULES RESULTING IN EARLY MISSION TERMINATION.</p> <p>D. REQUIRED TO MAKE DECISION TO CONTINUE TO THE NEXT MISSION PHASE.</p> <p>THE MANDATORY INSTRUMENTATION LISTINGS IN THIS DOCUMENT WILL BE CROSS-REFERENCED TO THE APPROPRIATE MISSION RULE MEETING THE ABOVE CRITERIA.</p>												
	1-11	<p>THE CRITERION FOR CATEGORIZING INSTRUMENTATION AS HIGHLY DESIRABLE IN THE FLIGHT MISSION RULES IS ANY INSTRUMENTATION REQUIRED FOR NORMAL SYSTEMS MANAGEMENT OR REQUIRED FOR FLIGHT CONTROL DECISIONS NOT IN THE MANDATORY CATEGORY.</p>												
	1-12	<p>RF COMMANDS WILL NOT BE TRANSMITTED TO THE SPACECRAFT OR LAUNCH VEHICLE DURING THE LAUNCH PHASE UNLESS SPECIFIC MISSION RULES ARE INVOKED WHICH REQUIRE COMMAND ACTIVITY.</p>												
	1-13	<p>THE LAUNCH OPERATIONS MANAGER WILL INFORM THE FLIGHT DIRECTOR WHEN THE SPACE VEHICLE HAS CLEARED THE UMBILICAL TOWER BY STATING "CLEAR TOWER" OVER CHANNEL 111.</p>												
	1-14	<p>THE COMMAND PILOT MAY INITIATE SUCH INFLIGHT ACTION AS HE DEEMS ESSENTIAL FOR CREW SAFETY.</p>												
	1-15	<p>IN THE EVENT OF LOSS OF COMMUNICATIONS BETWEEN THE MSFN AND THE S/C, THE COMMAND PILOT WILL ASSUME RESPONSIBILITY OF MISSION DIRECTION WITHIN THE FRAME WORK OF THE MISSION RULES.</p> <p>RULE NUMBERS 1-16 THROUGH 1-23 ARE RESERVED.</p>												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">MISSION</th> <th style="width: 5%;">REV</th> <th style="width: 10%;">DATE</th> <th style="width: 25%;">SECTION</th> <th style="width: 15%;">GROUP</th> <th style="width: 10%;">PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>GENERAL RULES AND SOP'S</td> <td>GENERAL</td> <td>1-2</td> </tr> </tbody> </table>			MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	GENERAL RULES AND SOP'S	GENERAL	1-2
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	FNL	9/10/69	GENERAL RULES AND SOP'S	GENERAL	1-2									

# NASA - Manned Spacecraft Center

## MISSION RULES

### SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM	
----- DEFINITIONS -----		
	1-24	ASAP---AS SOON AS PRACTICABLE (I.E., AS SOON AS POSSIBLE AND REASONABLE).
	1-25	PTP---A PREFERRED TARGET POINT IS A STRATEGICALLY LOCATED SET OF COORDINATES FOR WHICH THE SPACECRAFT SHOULD BE TARGETED IF IT BECOMES NECESSARY TO LAND ON THAT REVOLUTION.
	1-26	ATP--- AN "ALTERNATE TARGET POINT" IS A STRATEGICALLY LOCATED SET OF COORDINATES CHOSEN TO PROVIDE A SPACECRAFT TARGET POINT MIDWAY BETWEEN PTP'S.
	1-27	NEXT BEST PTP---A PREFERRED TARGET POINT WHICH CAN BE REACHED BY THE SPACECRAFT WITHIN THE CONSTRAINTS IMPOSED BY THE SPACECRAFT PROBLEM CAUSING AN EARLY MISSION TERMINATION AND ALLOWING THE BEST POSSIBLE REENTRY AND LANDING AREA CONDITIONS. THE MISSION WILL NOT PROCEED TO THE NEXT PHASE UNLESS SPECIFICALLY NOTED.
	1-28	REENTER ASAP---REENTER AS SOON AS PRACTICABLE (I.E., AS SOON AS POSSIBLE AND REASONABLE).
	1-29	TERMINATE ASAP---REENTER WITH THE MINIMUM TRIP TIME TO AN UNSPECIFIED LANDING AREA.
	1-30	CRITICAL MANEUVERS---FOR THE PURPOSE OF MISSION RULE ACTION, CRITICAL MANEUVERS ARE DEFINED AS THOSE MANEUVERS REQUIRED TO INSURE CREW SAFETY. THE VIOLATION OF PROPULSION SYSTEM LIMITS WILL BE ACCEPTED AS NECESSARY FOR SUCH BURNS. ALL MANEUVERS ARE CONSIDERED CRITICAL EXCEPT LO11, LO12, PLANE CHANGE, DOI, AND MCC'S NOT REQUIRED FOR ENTRY CORRIDOR CONTROL.
	1-31	NON-CRITICAL BURN---A BURN WHICH NEED NOT BE ACCOMPLISHED TO MAINTAIN AN ACCEPTABLE LEVEL OF CREW SAFETY.
	1-32	EARLY STAGING---UNSCHEDULED SEPARATION OF THE S-1VB STAGE FROM THE S-1I STAGE.
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		MISSION   REV   DATE   SECTION   GROUP   PAGE
		APOLLO 12   FNL   9/10/69   GENERAL   DEFINITIONS   1-3
-----		

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM
1-33	CONTINGENCY ORBIT INSERTION (COI)--- AN SPS PROPULSIVE MANEUVER WHICH WILL PROVIDE CSM INSERTION INTO A SAFE ORBIT (MP GREATER THAN OR EQUAL TO 75 NM) IN THE EVENT OF AN SLY FAILURE OCCURRING IMMEDIATELY PRIOR TO INSERTION; OR IN THE EVENT OF DEGRADED SLY PERFORMANCE.
1-34	S-IVB DESTROY PACKAGE SAFING---THE EMERGENCY DESTROY PACKAGE IS SAIED BY THE RSO TRANSMITTING A COMMAND WHICH PERMANENTLY REMOVES POWER FROM THE RANGE SAFETY RECEIVERS.
1-35	S-IVB SAFING---A PASSIVATION SEQUENCE IN WHICH S-IVB LOR, LM2, AND HIGH PRESSURE SPHERES ARE DEPLETED.
1-36	PRELAUNCH PHASE (PRELN)---THE TIME INTERVAL FROM THE COMPLETION OF THE FLIGHT READINESS REVIEW TO LIFTOFF.
1-37	FLIGHT PHASE---THE INTERVAL FROM LIFTOFF THROUGH SPLASHDOWN. FOR MISSION RULE PURPOSES THE FLIGHT PHASE IS FURTHER SUBDIVIDED AS SHOWN BELOW--- <ul style="list-style-type: none"> <li>A: LAUNCH PHASE--- FROM LIFTOFF THROUGH INSERTION (IS) THROUGH TEST.</li> <li>B: EARTH ORBIT PHASE---FROM INSERTION THROUGH S-IVB CUTOFF FOR TRANSLUNAR INJECTION (TLI).</li> <li>C: TDRS PHASE---FROM CSM/S-IVB SEPARATION THROUGH LM EJECTION FROM SLA.</li> <li>D: TRANSLUNAR COAST PHASE---FROM S-IVB CUTOFF PER TLI THROUGH LOI CUTOFF.</li> <li>E: DOCKED PHASE---THE TIME INTERVALS DURING WHICH THE LM AND CSM ARE DOCKED.</li> <li>F: LUNAR ORBIT PHASE---FROM LOI CUTOFF TO UNDOCKING AND FROM RED CING TO TEE CUTOFF.</li> <li>G: UNDOCKED PHASE---THE TIME INTERVAL BETWEEN LM AND CSM UNDOCKING UNTIL THE LM DOI MANEUVER.</li> <li>H: DOI PHASE---THE TIME INTERVAL FROM THE DOI MANEUVER TO THE INITIATION OF THE PDI MANEUVER.</li> <li>I: POWERED DESCENT---THE TIME INTERVAL FROM THE INITIATION OF THE PDI MANEUVER TO TOUCH DOWN.               <ul style="list-style-type: none"> <li>1: DOI TO DOI 05---DURING THIS TIME PERIOD THE LM CAN Abort THE POWERED DESCENT AND SET INTO CRUISE USING THE SPS ONLY AND RETAIN THE DESCENT STAGE AFTER INSERTION.</li> <li>2: DOI 05 TO LO DATE---LO DATE IS THE POINT AT WHICH THE CREW TAKES OVER AND MANUALLY FLIES THE DESCENT.</li> <li>3: LO DATE TO TOUCH DOWN---THE TIME INTERVAL FROM CREW TAKEOVER (APPROXIMATELY 100 FT ALTITUDE) TO LANDING.</li> </ul> </li> <li>J: LUNAR STAY PHASE---THE TIME INTERVAL FROM TOUCHDOWN UNTIL LIFTOFF.</li> <li>K: EVA---THE TIME INTERVAL FROM LM ISPROBOURIZATION UNTIL LM REPROBOURIZATION.</li> <li>L: ASCENT PHASE---THE TIME INTERVAL FROM LIFTOFF TO LM INSERTION INTO LUNAR ORBIT.</li> <li>M: MANEUVER---THE TIME INTERVAL FROM INSERTION INTO LUNAR ORBIT AFTER ASCENT OR AFTER AN ASSIGNED DESCENT UNTIL CSM/LM DOCKING; FOR AN ALTERNATE MISSION WHICH DOES NOT INCLUDE A LUNAR LANDING IT IS THE TIME FROM THE CSM L1-DOI SEPARATION MANEUVER THROUGH CSM/LM DOCKING.</li> <li>N: TRANS-EARTH COAST PHASE---FROM TEE CUTOFF TO CSM SEPARATION.</li> <li>O: ENTRY PHASE---FROM CSM SEPARATION TO SPLASHDOWN.</li> </ul>
	MISSION REV DATE SECTION GROUP PAGE
	APOLLO 13 5 10/18/79 GENERAL DEFINITIONS 1-4

NASA - Manned Spacecraft Center

MISSION RULES

SECTION I GENERAL RULES AND SOP'S

REV	ITEM
1-38	RECOVERY PHASE---THE TIME INTERVAL FROM SPLASHDOWN TO DELIVERY OF THE FLIGHT CREW AND SPACECRAFT TO DESIGNATED LAND BASED INSTALLATIONS.
1-39	REENTRY DEFINITIONS--- <ul style="list-style-type: none"> <li>A. AUTOMATIC---REENTRY CONTROLLED BY CMC WHICH OUTPUTS BANK ANGLE COMMAND TO THE RCS.</li> <li>B. CLOSED LOOP---REENTRY CONTROLLED BY THE CREW MANUALLY FLYING BANK ANGLE MODULATION USING CMC ENTRY PROGRAM OUTPUTS.</li> <li>C. OPEN LOOP REENTRY---REENTRY CONTROLLED BY THE CREW USING SPACECRAFT DISPLAYS AND FLYING---               <ul style="list-style-type: none"> <li>1. BANK ANGLE (RR 0-90) AND RETRA (RL 0-90).</li> <li>2. CONSTANT BANK ANGLE---CREW ESTABLISHES AND MAINTAINS A CONSTANT BANK ANGLE. (CONSTANT BANK ANGLES GREATER THAN 90 DEGREES WILL NOT BE FLOWN EXCEPT WHEN SKIPOUT RULE IS VIOLATED.)</li> <li>3. ROLLING REENTRY---MAINTAIN CONSTANT 18 DEGREES PER SECOND ROLL RATE.</li> <li>4. E-B RANGING---CONSTANT BANK ANGLE IS HELD TO 18; THEN THE RANGE TO GO DISPLAY AND THE RANGE POTENTIAL LINES ARE COMPARED TO MODULATE THE BANK ANGLE; AT RETRA THE PRESENT BANK ANGLE IS REVERSED.</li> </ul> </li> <li>D. CONSTANT G ENTRY---CREW CONTROLS THE BANK ANGLE TO MAINTAIN A SPECIFIED G LEVEL.</li> <li>E. E-B REENTRY---CREW CONTROLS THE BANK ANGLE TO MAINTAIN A CONSTANT G UNTIL VELOCITY LESS THAN 25100 FPS; THE E-B IS THEN USED TO CONTROL RANGE BY NULLING THE DIFFERENCE BETWEEN THE RANGE TO GO COUNTER AND THE RANGE POTENTIAL GUIDELINES. ALL MANEUVERS ARE OVERRIDDEN AS NECESSARY TO PREVENT AN G-SET OR LFFSET VIOLATION.</li> </ul>
1-40	ALTERNATE MISSION---ANY DEVIATION FROM THE NOMINAL MISSION TIMELINE WHERE FURTHER MISSION OBJECTIVES ARE CONSIDERED BEFORE THE END OF THE MISSION.
1-41	CONTINUE MISSION---THE CONTINUE MISSION RULING FOR MALFUNCTIONS INDICATES THAT THE MISSION WILL BE CONTINUED IN ACCORDANCE WITH PRESENT PLANS UNLESS OVERRIDING FACTORS ARE PRESENT WHICH WOULD CAUSE SELECTION OF AN ALTERNATE CHOICE.
1-42	BLINDSHOT MANEUVER---USE OF RESIDUAL S-IVB PROPELLANTS TO ACHIEVE IN THE FOLLOWING ORDER OF PRIORITY--- <ul style="list-style-type: none"> <li>1. A REDUCTION IN THE PROBABILITY OF S-IVB AND SPACECRAFT RECONTACTS.</li> <li>2. A REDUCTION IN THE PROBABILITY OF S-IVB EARTH IMPACTS.</li> <li>3. A REDUCTION IN THE PROBABILITY OF S-IVB LUNAR IMPACTS.</li> </ul>

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 14	14	9/18/69	GENERAL RULES AND SOP'S	DEFINITIONS	1-3

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM		
1-43	LUNAR ABORT MODES AFTER EARLY LOI SHUTOFF (REFERENCE RULE 3-82 FOR ABORT MANEUVER DEFINITION)		
	A: DPS		
	1. MODE-I--- 0 TO 630 FPS (APPROX LOI IGN TO 1+30)		
	2. MODE-II--- 630 TO 1270 FPS (APPROX 1+30 TO 2+30)		
	3. MODE-III--- 1270 TO COMPLETION (APPROX 2+30 TO C/O)		
	NOTE		
	GENERAL ABORT PLAN IS TO USE THE DPS FOR THE FIRST ABORT MANEUVER. ABORTS FROM LOI IGN PLUS 40 SEC TO LOI IGN PLUS 2+24 REQUIRES THE SPS OR APS IN ADDITION TO THE DPS.		
1-44	SATURN L/V TIMEBASES---		
	TIME BASE	DEFINITION	
		NOMINAL INITIATE TIME	
	T01	LIFTOFF TO S-1C INBOARD ENGINE CUTOFF	0+00
	T02	S-1C INBOARD ENGINE CUTOFF TO S-1C OUTBOARD ENGINE CUTOFF (S-1C/S-1E STAGING)	2+15
	T03	S-1C OUTBOARD ENGINES CUTOFF TO S-1E CUTOFF (S-1E/S-1E STAGING)	2+42
	T04	S-1E CUTOFF TO S-1VB FIRST BURN CUTOFF	9+11
	T05	S-1VB FIRST BURN CUTOFF TO S-1VB RESTART PREPARATIONS (RESTART MINUS 9' 38'')	11+30
	T06	S-1VB RESTART MINUS 9' 38'' TO S-1VB SECOND BURN CUTOFF	2+31+02
	T07	S-1VB SECOND CUTOFF TO START OF S-1VB EVASIVE MANEUVER BURN	2+53+03
	T08	START OF EVASIVE BURN TO END OF S-1VB/IV LIFETIME.	APPROX. 107 + 1+40+00 (BY GROUND CMD.)
	RULE NUMBERS 1-43 THROUGH 1-44 ARE RESERVED.		

APOLLO 13	8	10/23/69	GENERAL RULES AND SOP'S	DEFINITIONS	1-6
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NASA - Manned Spacecraft Center

MISSION RULES

SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM																				
	<p>-----                      * CRITERIA FOR TARGET POINT SELECTION *                      -----</p>																				
1-48	<p>THE CRITERIA LISTED BELOW WILL BE USED WHEN CHOOSING BETWEEN TWO OR MORE TARGET POINTS. THE CRITICALITY OF THE MISSION SITUATION WILL AFFECT THE APPLICATION OF THESE CRITERIA.</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;"></th> <th style="text-align: right; font-weight: normal;">PRIORITY</th> </tr> </thead> <tbody> <tr> <td>ACCEPTABLE LAND MASS CLEARANCE</td> <td style="text-align: right;">1</td> </tr> <tr> <td>ACCEPTABLE WEATHER CONDITIONS FOR RECOVERY OPERATIONS AND CM STRUCTURAL INTEGRITY</td> <td style="text-align: right;">2</td> </tr> <tr> <td>CAPABILITY OF RECOVERY FORCES</td> <td style="text-align: right;">3</td> </tr> <tr> <td>COMMUNICATION WITH THE SPACECRAFT FROM A GROUND STATION AT LEAST 10 MINUTES PRIOR TO DEORBIT BURN</td> <td style="text-align: right;">4</td> </tr> <tr> <td>SUFFICIENT DAYLIGHT FOR RECOVERY OPERATIONS</td> <td style="text-align: right;">5</td> </tr> <tr> <td>A GROUND STATION FOR POST-DEORBIT BURN TRACKING</td> <td style="text-align: right;">6</td> </tr> <tr> <td>VOICE CONTACT PRIOR TO AND DURING DEORBIT BURN</td> <td style="text-align: right;">7</td> </tr> <tr> <td>POST-BLACKOUT TRACKING DATA AVAILABLE FOR REENTRY (ASSUMES PRE-BLACKOUT ACQUISITIONS)</td> <td style="text-align: right;">8</td> </tr> <tr> <td>GROUND STATIONS AVAILABLE TO OBTAIN DELTA VC READOUTS AND TO PASS CREW BACKUP GUIDANCE QUANTITIES</td> <td style="text-align: right;">9</td> </tr> </tbody> </table> <p style="text-align: center;">*OR PENAL MCC MANEUVER</p>		PRIORITY	ACCEPTABLE LAND MASS CLEARANCE	1	ACCEPTABLE WEATHER CONDITIONS FOR RECOVERY OPERATIONS AND CM STRUCTURAL INTEGRITY	2	CAPABILITY OF RECOVERY FORCES	3	COMMUNICATION WITH THE SPACECRAFT FROM A GROUND STATION AT LEAST 10 MINUTES PRIOR TO DEORBIT BURN	4	SUFFICIENT DAYLIGHT FOR RECOVERY OPERATIONS	5	A GROUND STATION FOR POST-DEORBIT BURN TRACKING	6	VOICE CONTACT PRIOR TO AND DURING DEORBIT BURN	7	POST-BLACKOUT TRACKING DATA AVAILABLE FOR REENTRY (ASSUMES PRE-BLACKOUT ACQUISITIONS)	8	GROUND STATIONS AVAILABLE TO OBTAIN DELTA VC READOUTS AND TO PASS CREW BACKUP GUIDANCE QUANTITIES	9
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1-49	<p>LUNAR RETURN ENTRY RANGE PRIORITY--- THE RELATIVE ENTRY RANGE (1000000 FEET TO SPLASH) PRIORITY IS AS FOLLOWS---</p> <p>A. 1200 - 1400 NM (NOMINAL)</p> <p>B. 1400 - 1800 NM (USED TO AVOID WEATHER VIOLATIONS IN PRIORITY A &amp; B)</p> <p>C. 1800 - 2100 NM (USED TO AVOID EXTREME WEATHER VIOLATIONS IN PRIORITY A AND B)</p>																				
	<p>RULE NUMBERS 1-50 THROUGH 1-55 ARE RESERVED.</p>																				

MISSION	REV	DATE	ACTION	GROUP	PAGE
APOLLO 12	PM	9/10/69	GENERAL RULES AND SOP'S	TARGET POINT DELTA CRITERIA	1-7

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM						
		* PRELAUNCH RULES *					
1-56	<p>MANDATORY - THE COGNIZANT FLIGHT CONTROLLER WILL REQUEST A HOLD OR A CUTOFF FROM THE FLIGHT DIRECTOR IN CASE OF A LOSS OR FAILURE OF A MANDATORY ITEM; PRIOR TO T-1 MIN; FAILURES OF MANDATORY ITEMS WILL BE CONFIRMED PRIOR TO REQUESTING A HOLD OR A CUTOFF; AFTER T-1 MIN; CUTOFF WILL BE REQUESTED FOR MANDATORY ITEMS WITHOUT VERIFICATION DUE TO THE LIMITED TIME REMAINING; AT T-20 SEC; ALL MANDATORY ITEMS WILL REVERT TO HIGHLY DESIRABLE UNLESS SPECIFICALLY DESIGNATED AS MANDATORY TO L/O; REFERENCE THE LAUNCH MISSION RULES DOCUMENT FOR SPECIFIC PROCEDURES.</p>						
1-57	<p>HIGHLY DESIRABLE - THE COGNIZANT FLIGHT CONTROLLER WILL NOTIFY THE FLIGHT DIRECTOR IN CASE OF A LOSS OR A FAILURE OF A HIGHLY DESIRABLE ITEM(S); A HOLD MAY BE CALLED BY THE FLIGHT DIRECTOR TO REPAIR THIS ITEM(S) WHEN IT IS CONVENIENT AND IF THE ESTIMATED TIME TO REPAIR OR REPLACE THE ITEM(S) IS ACCEPTABLE; ALL HIGHLY DESIRABLE ITEMS REVERT TO DESIRABLE AFTER AUTO SEQUENCE START.</p>						
1-58	<p>DESIRABLE - FLIGHT CONTROLLERS WILL NOT CALL HOLDS FOR THE LOSS OF DESIRABLE ITEMS AS THEY ARE PLACED IN THIS CATEGORY BECAUSE THEY ARE ITEMS OF SUPPORT WHICH ARE OF MINOR IMPORTANCE TO FLIGHT OPERATIONS.</p>						
1-59	<p>MANUAL CUTOFF WILL NOT BE ATTEMPTED FROM T-11 SECONDS (ENGINE IGNITION) TO T-0.</p>						
		<p>RULE NUMBERS 1-60 THROUGH 1-65 ARE RESERVED.</p>					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 12	PNL	9/18/69	GENERAL RULES AND SOP'S	PRELAUNCH RULES	1-8	

# NASA - Manned Spacecraft Center

## MISSION RULES SECTION 2 GENERAL RULES AND SOP'S

REV	ITEM	
		----- LAUNCH ABORTS -----
1-66		ABORT REQUEST COMMANDS ARE COMMANDS TRANSMITTED FROM THE MCC OR ECC WHICH ILLUMINATE THE ABORT REQUEST LIGHT ON THE COMMAND PILOT'S PANEL, THE "ABORT LIGHT" AND A VOICE REPORT "ABORT". OVER AIG ARE CONSIDERED TWO CUES FOR THE CREW TO TAKE THE NECESSARY ACTION TO ABORT THE MISSION. THE GROUND WILL USE TWO INDEPENDENT CUES PRIOR TO TRANSMITTING "ABORT REQUEST." ADDITIONAL CUES FOR THE CREW WILL COME FROM ONBOARD INDICATIONS.
1-67		ABORT ACTION CAN BE INITIATED ONLY BY THE CREW OR THE EOS.
1-68		WHENEVER POSSIBLE, ALL ABORTS AND EARLY MISSION TERMINATIONS WILL BE TIMED FOR A WATER LANDING.
1-69		THE FLIGHT DIRECTOR WILL INITIATE THE ABORT REQUEST FOR SPACECRAFT SYSTEM MALFUNCTIONS.
1-70		THE FLIGHT DYNAMICS OFFICER WILL INITIATE THE ABORT REQUEST COMMAND DURING THE FLIGHT PHASE IF THE SPACE VEHICLE EXCEEDS THE FLIGHT DYNAMICS ENVELOPE.
1-71		THE BOOSTER SYSTEMS ENGINEER WILL INITIATE THE ABORT REQUEST COMMAND BASED UPON LAUNCH VEHICLE TIME-CRITICAL SYSTEMS MALFUNCTIONS THAT WOULD NOT ALLOW A SAFE INSERTION OR CONTINUATION TO A FLIGHT DYNAMICS LIMIT LINE.
1-72		THE ONLY RSC POSITION THAT WILL HAVE ABORT REQUEST CAPABILITY IS THE LAUNCH OPERATIONS MANAGER. THE LAUNCH OPERATIONS MANAGER MAY SEND AN ABORT REQUEST FROM THE TIME THE LAUNCH ESCAPE SYSTEM IS ARMED UNTIL THE SPACE VEHICLE REACHES SUFFICIENT ALTITUDE TO CLEAR THE TOP OF THE UNBILICAL TOWER, PRIOR TO TRANSFER OF CONTROL TO THE FLIGHT DIRECTOR. THE LAUNCH OPERATIONS MANAGER WILL INITIATE THE ABORT REQUEST COMMAND FROM RSC BASED ON THE CRITERIA DEFINED IN THE LMRD. THESE INCLUDE:-- <ul style="list-style-type: none"> <li>A. MAJOR STRUCTURAL FAILURE OR EXPLOSION.</li> <li>B. NEGATIVE VERTICAL MOTION.</li> <li>C. UNCONTROLLABLE VEHICLE TILTING.</li> <li>D. CATASTROPHIC FIRES PRIOR TO LIFTOFF.</li> </ul>
1-73		THE ASD CAN SHUTDOWN THE SLV BY TRANSMITTING THE NFCD COMMAND WHICH ALSO LIGHTS THE ABORT REQUEST LIGHT IN THE SPACECRAFT. THE NFCD WILL INITIATE AN AUTO-ABORT IF TRANSMITTED PRIOR TO EOS DISABLE. THE NFCD COMMAND INITIATES A 0.1 SEC TIMER ON THE GROUND (CAPE ASD CONSOLE ONLY). BASE INSERTS MANUAL TIME DELAY WHICH IN TURN ENABLES DESTROY CAPABILITY IF TRANSMITTED. THE ASD DESTROY COMMAND CAN THEN DESTROY THE SLV. THE ASD WILL ALWAYS SAFE THE SLV/D AFTER TRANSMITTING NFCD UPON VERIFICATION OF CUTOFF IF THE DESTROY COMMAND IS NOT TO BE TRANSMITTED.
		MISSION    REV    DATE    SECTION    GROUP    PAGE
		APC/LD 12    PNL    9/18/69    GENERAL    LAUNCH ABORTS    1-9
		RULES AND SOP'S    RULES



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM																					
1-74	THE RSO WILL SAFE THE S-IVB DESTRUCT SYSTEM AFTER CONFIRMATION OF S-IVB C/O FROM THE FLIGHT DYNAMICS OFFICER. IF COMMUNICATIONS ARE LOST WITH THE FIDO, THE S-IVB DESTRUCT SYSTEM WILL BE SAFED BASED ON THE RSO'S VERIFICATION OF S-IVB CUTOFF. ONCE SAFED, THE S-IVB DESTRUCT SYSTEM CANNOT BE REINITIATED. IF THE RSO INITIATES MFCO, THE RSO WILL INITIATE SAFING AFTER VERIFICATION OF S-IVB CUTOFF.																					
1-75	EMERGENCY ENGINE SHUTDOWN METHODS:																					
		<table border="1"> <thead> <tr> <th>INITIATOR</th> <th>METHOD</th> <th>STAGE</th> <th>TIME FRAME</th> </tr> </thead> <tbody> <tr> <td>ASTRONAUT</td> <td>CCU ON TMC</td> <td>S-1C; S-1D; S-1V</td> <td>T + 30 SEC. TO S-1V CUTOFF</td> </tr> <tr> <td>ASTRONAUT</td> <td>S-1E/ S-1V L/V STAGE SWITCH</td> <td>S-1E; S-1V</td> <td>T + 2-33 TO S-1V CUTOFF</td> </tr> <tr> <td>RSO</td> <td>AP CMD (MFCO)</td> <td>S-1C; S-1D; S-1V</td> <td>T-8 TO S-1V CUTOFF</td> </tr> <tr> <td>EDS</td> <td>2 OF 3 VOTING LOGIC</td> <td>S-1C</td> <td>T + 30 SEC. TO EDS AUTO OFF AT T + 2-00 MIN  NOTE--EDS WILL INITIATE ABORT FROM T+0 TO T + 30 SEC. HOWEVER S-1C ENGINES WILL NOT BE SHUTDOWN</td> </tr> </tbody> </table>	INITIATOR	METHOD	STAGE	TIME FRAME	ASTRONAUT	CCU ON TMC	S-1C; S-1D; S-1V	T + 30 SEC. TO S-1V CUTOFF	ASTRONAUT	S-1E/ S-1V L/V STAGE SWITCH	S-1E; S-1V	T + 2-33 TO S-1V CUTOFF	RSO	AP CMD (MFCO)	S-1C; S-1D; S-1V	T-8 TO S-1V CUTOFF	EDS	2 OF 3 VOTING LOGIC	S-1C	T + 30 SEC. TO EDS AUTO OFF AT T + 2-00 MIN  NOTE--EDS WILL INITIATE ABORT FROM T+0 TO T + 30 SEC. HOWEVER S-1C ENGINES WILL NOT BE SHUTDOWN
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1-76	THE AUTOMATIC EDS (TWO ENGINE C/W AND OVERRATE AUTO-ABORT CAPABILITIES) WILL BE FLOWN CLOSED LOOP UNTIL T + 02-00. DURING LAUNCH, MALFUNCTIONS AFFECTING EDS OPERATION WILL BE MANAGED AS FOLLOWS--  THE EDS AUTO SWITCH WILL BE TURNED OFF WHENEVER ANY TWO CAN ENTRY BATTERIES ARE TIED TO THE SAME MAIN BUS OR FOR CONFIRMED LOSS OF ANY CAN ENTRY BATTERY.																					
		MISSION   REV   DATE   SECTION   GROUP   PAGE																				
		APOLLO 12   PAL   9/10/69   GENERAL RULES AND SOP'S   LAUNCH ABORTS RULES   1-10																				

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM		
1-77	ABORT MODES---		
	MODE I	BOUNDARY OF APPLICATION	
	1A	LES ABORT ENABLE (APPROX: 7-43 MIN) TO GET 42 SEC. (18 K FEET)	
	1B	GET 42 SEC TO 100K FEET ALTITUDE (GET APPROX: 1 * 32)	
	1C	100K FEET ALTITUDE TO TOWER JETTISON (GET APPROX: 3 * 07)	
1-78	MODE II	BOUNDARY OF APPLICATION	PROCEDURES
		TOWER JETTISON (GET APPROX: 3 * 07) UNTIL FULL LIFF SPLASHPOINT IS 3200 NM DOWNRANGE (GET APPROX: 10-13)	
			A. MCC PROVIDES 1. GET OF 400K 2. PITCH AT 4050 3. GET DROGUE B. ENTRY IS FULL LIFF
		MISSION	REV
		DATE	SECTION
		GROUP	PAGE
		APOLLO 14 PAL	9/16/64
		GENERAL RULES AND SOP'S	LAUNCH ABORTS RULES
			1-11

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM						
1-79	MODE III	<p>BOUNDARY OF APPLICATION                      .....                      BETWEEN FULL LIFT SPLASH POINT                      +3200 NM AND INSERTION.</p>	<p>PROCEDURES                      .....</p> <p>A. MCC PROVIDES---</p> <ol style="list-style-type: none"> <li>1. GETI AT 2-IVB CUTOFF PLUS 2-03</li> <li>2. DELTA V FOR 3200 NM SPLASH POINT</li> <li>3. BURN DURATION</li> <li>4. GET OF 400K</li> <li>5. PITCH AT +030</li> <li>6. GET DROGUE</li> </ol> <p>B. MANEUVER IS SCB AUTO.</p> <p>C. ENTRY IS ROLL LEFT 55 DEGREES.</p>				
		<p>NOTE</p> <p>MODE III "NO BURN" WILL BE                      CALLED IF THE ROLL LEFT 55 DEG.                      ENTRY RANGE IS LESS THAN 3350 NM.</p>					
1-80	MODE IV	<p>BOUNDARY OF APPLICATION                      .....                      CONTINGENCY ORBIT INSERTION                      CAPABILITY TO INSERTION BASED                      ON CCI LINE ON GAMMA VS V PLOT                      FOR NEAR NOMINAL ALTITUDES</p>	<p>PROCEDURES                      .....</p> <p>A. MCC PROVIDES---</p> <ol style="list-style-type: none"> <li>1. GETI AS 2-IVB CUTOFF PLUS 2-03</li> <li>2. DELTA V REQUIRED TO ACHIEVE PERIGEE                      GREATER THAN OR EQUAL TO 75 NM</li> <li>3. BURN DURATION</li> <li>4. PITCH AT GETI</li> </ol> <p>B. MANEUVER IS SCB RATE CMD</p>				
1-81	MODE APOGEE RISK	<p>BOUNDARY OF APPLICATION                      .....                      PRE-APOGEE CUTOFF; OUTSIDE THE CCI                      BOUNDARY; CORRECTABLE TO SAFE                      ORBITAL CONDITIONS BY A MANEUVER AT                      APOGEE.</p>	<p>PROCEDURES                      .....</p> <p>A. MCC PROVIDES---</p> <ol style="list-style-type: none"> <li>1. GETI FOR BURN AT APOGEE</li> <li>2. DELTA V REQUIRED TO ACHIEVE PERIGEE                      GREATER THAN OR EQUAL TO 75 NM</li> <li>3. BURN DURATION</li> <li>4. PITCH ATTITUDE</li> </ol> <p>B. MANEUVER IS SCB AUTO</p>				
		<p>RULES 1-82 THROUGH                      1-88 ARE RESERVED</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PNL	9/18/69	GENERAL RULES AND SOP'S	LAUNCH ABORTS RULES	1-12



2 FLIGHT OPERATIONS  
RULES

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM													
		----- * GENERAL * -----												
2-1	PRELAUNCH	<p>A. LAUNCH AZIMUTH LIMITATIONS RESTRICT LAUNCHES TO OCCUR BETWEEN 72 DEG. AND 96 DEG.</p> <p>B. THE FLIGHT DIRECTOR WILL EVALUATE WIND SIMULATIONS ALONG THE MODE 1 TOWER ABORT TRACK PRIOR TO THE START OF CRITICAL COUNTDOWN ACTIVITIES AND WILL ADVISE THE LAUNCH DIRECTOR OF ANY PREDICTED PERIODS OF LAND LANDING. IF THE FLIGHT DIRECTOR IS UNABLE TO PROVIDE THIS EVALUATION, A LAND LANDING WILL BE ASSUMED AND THE SPACECRAFT WIND CONSTRAINTS FOR LAND LANDING WILL BE APPLIED. THESE CONSTRAINTS (REF LMO) REQUIRE THAT THE SPACECRAFT NOT BE LAUNCHED OR REMAIN IN A TOWER ABORT MODE IF A TOWER ABORT WOULD RESULT IN A LAND LANDING WITH A HORIZONTAL VELOCITY COMPONENT OF GREATER THAN 30 FEET PER SECOND AT IMPACT. IN ALL CASES, THE LAUNCH DIRECTOR WILL BE PRIME FOR CALLING HOLDS FOR LAND LANDING LAUNCH WIND VIOLATIONS.</p> <p>C. THE LAUNCH WILL NOT BE ATTEMPTED IF THE MINIMUM GROUND INSTRUMENTATION CAPABILITY IS COMPROMISED. (REFERENCE SECTION 4 - GROUND INSTRUMENTATION REQUIREMENTS); CONTINUOUS VOICE TELEMETRY AND TRACKING COVERAGE FOR THE SPACECRAFT IS REQUIRED FROM LIFTOFF THROUGH INSERTION PLUS 60 SEC; CONTINUOUS TELEMETRY COVERAGE IS REQUIRED FROM THE SLV FROM LIFTOFF THROUGH INSERTION PLUS 60 SEC; COMMAND IS HIGHLY DESIRABLE FOR BOTH VEHICLES.</p>												
2-2	LAUNCH	<p>IT IS PREFERABLE TO GO INTO ORBIT AND REENTER INTO THE WEST ATLANTIC RATHER THAN PERFORM A LAUNCH ABORT; THEREFORE, THE LAUNCH WILL BE CONTINUED AS LONG AS THE CREW CONDITION IS SATISFACTORY; NO S/C OR SLV PROBLEMS EXIST WHICH JEOPARDIZE CREW SAFETY; AND SUFFICIENT CONSUMABLES, COOLANTS, AND ELECTRICAL ENERGY REMAIN FOR AT LEAST ONE REVOLUTION PLUS ENTRY.</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	FNL	8/18/69	FLIGHT OPERATIONS RULES	GENERAL	2-3									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM				
2-3	EARTH ORBIT	<p>A. ENTRY WILL BE MADE AT THE NEXT BEST PIP WHEN ONE MORE CSM FAILURE WILL RESULT IN AN ASAP ENTRY OR UNCONTROLLABLE CONDITIONS.</p> <p>B. ADEQUATE CONSUMABLES WILL BE MAINTAINED FOR ENTRY IN THE NEXT PIP, MAKING ALLOWANCES FOR SETUP AND ENTRY.</p> <p>C. THE DEORBIT CAPABILITIES REQUIRED FOR EARTH ORBIT ARE---</p> <ol style="list-style-type: none"> <li>1. TWO METHODS OF DEORBIT ARE REQUIRED.</li> <li>2. IF A SUBSEQUENT SINGLE FAILURE WOULD PRECLUDE DEORBIT BY EITHER METHOD REMAINING, THE CSM WILL DEORBIT.</li> <li>3. SP8 IS THE PRIME METHOD OF DEORBIT AND SUFFICIENT DELTA V WILL BE RESERVED FOR THIS MANEUVER.</li> <li>4. SM-RCS (6 QUAD) AND SM-CM/RCS HYBRID WILL BE CONSIDERED AS INDEPENDENT DEORBIT METHODS AS LONG AS INDIVIDUAL SM-RCS QUAD AND GACS INTEGRITY IS MAINTAINED AND SUFFICIENT RCS PROPELLANT IS AVAILABLE.</li> <li>5. THE LM PROPULSION SYSTEM (DPS OR RCS) MAY BE USED TO PLACE THE CSM IN AN ORBIT (MP GREATER THAN OR EQUAL TO 60 NM) FROM WHICH A SM-RCS OR SM-CM/RCS HYBRID DEORBIT CAN BE CONDUCTED.</li> <li>6. UTILIZATION OF BACKUP DEORBIT METHODS WILL BE BASED ON THE FOLLOWING PRIORITIES---             <ol style="list-style-type: none"> <li>(A) SM-RCS</li> <li>(B) LM PROP PLUS SM-RCS</li> <li>(C) SM-CM/RCS HYBRID</li> <li>(D) LM PROP PLUS SM-CM/RCS HYBRID</li> </ol> </li> </ol> <p>RULE NUMBERS 2-4 THROUGH 2-10 ARE RESERVED</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	FNL	9/10/69	FLIGHT OPERATIONS RULES	GENERAL	2-2

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM													
	2-11	<p><b>TRANS-LUNAR INJECTION</b></p> <p>A. THE TLI WILL BE GO IF THE S/C AND L/V SATISFY THE FOLLOWING CRITERIA---</p> <ol style="list-style-type: none"> <li>1. THERE HAVE BEEN NO FAILURES IN THE LAUNCH VEHICLE WHICH RESULTS IN ---               <ol style="list-style-type: none"> <li>(A) A CATASTROPHIC HAZARD;</li> <li>(B) ACHIEVEMENT OF AN S-IVB ENGINE BURN WITH EXPECTED CUTOFF OR SHUTDOWN CONDITIONS DEFINITELY PRECLUDING AN ACCEPTABLE LUNAR MISSION; IN APPLYING THIS CRITERIA TO SPECIFIC MISSION RULES, A NO GO RECOMMENDATION WILL BE REQUIRED IF INSUFFICIENT S-IVB CONSUMABLES OR PRODUCTION PERFORMANCE IS AVAILABLE TO ASSURE A FINITE PROBABILITY OF ACHIEVING A CUTOFF ORBIT WITH 63,000 N.M. APCSEE ALTITUDE.</li> </ol> </li> <li>2. THE CSM HAS TOTAL SYSTEMS CAPABILITY WITH REDUNDANCY; REDUNDANCY VERIFICATION IS SUBJECT TO THE NUMBER AND TYPE OF REDUNDANT COMPONENT CHECKS WHICH CAN BE PERFORMED IN EARTH ORBIT.</li> </ol> <p>B. THE TLI MANEUVER WILL BE DELAYED UNTIL THE SECOND OPPORTUNITY FOR SUSPECTED FAILURE OF A CRITICAL SYSTEM (PRIME OR BACKUP) (MANEUVERS, LIFE SUPPORT, COOLING, POWER, SEQUENTIAL COMMUNICATIONS) WHICH REQUIRES TIME FOR EVALUATION.</p> <p>C. THE TLI MANEUVER WILL BE INITIATED AND CONTINUED UNDER MANUAL CONTROL FOR A SATURN GUIDANCE REFERENCE FAILURE.</p>												
	2-12	<p><b>TRANSPOSITION, DOCKING AND EJECTION (TDE)</b></p> <p>A. IN THE EVENT OF ADVERSE LIGHTING, ATTITUDES, RATES, OR MECHANICAL ANOMALIES, THE FLIGHT CREW WILL MAKE THE FINAL DECISION TO ATTEMPT DOCKING AND EJECTION.</p> <p>B. THE NORMAL MINIMUM CABIN PRESSURE REOLINE OF 4.0 PSIA FOR TUNNEL/LM PRESSURIZATION SEQUENCES MAY BE WAIVED DURING TDE. FOR TUNNEL OR LM LEAKS WHICH PREVENT NORMAL PRESSURIZATION, THE CM WILL BE DEPRESSURIZED AS REQUIRED FOR HATCH REMOVAL AND UMBILICAL HOOKUP.</p> <p>C. IF NORMAL LM EJECTION IS NOT SUCCESSFUL, NO ATTEMPT WILL MADE TO MAN THE LM AND "STAGE" TO RECOVER THE ASCENT STAGE.</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	FNL	9/10/67	FLIGHT OPERATIONS RULES	GENERAL	2-3									



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM													
	2-13	<p><b>TRANSLUNAR COAST</b></p> <p>A. NO MCC WILL BE PERFORMED IF LOI CAN BE TARGETED WITHIN OPERATIONAL CONSTRAINTS.</p> <p>B. TRANSLUNAR COAST WILL BE TERMINATED IF ADEQUATE CONSUMABLES ARE NOT AVAILABLE FOR A CIRCULUNAR EARTH RETURN OF 12 HRS.</p> <p>C. THE CREW WILL USE THEIR DISCRETION TO MAN THE LM FOR BACKUP COMMUNICATIONS AND RETURN IF CSM COMMUNICATIONS ARE LOST WITH THE MSFN. IF CSM COMMUNICATIONS CANNOT BE MAINTAINED, A LUNAR ORBIT MISSION WILL NOT BE FLOWN.</p> <p>D. A HYBRID TRAJECTORY WILL NOT BE FLOWN UNLESS THERE ARE ENOUGH CSM CONSUMABLES FOR A LUNAR LANDING MISSION, AND THE CSM SYSTEMS MEET THE LOI CRITERIA.</p> <p>E. TRANSLUNAR MIDCOURSE CORRECTIONS RESULTING IN A HYBRID TRAJECTORY WILL BE DESIGNED TO MEET LOI TARGETING CONSTRAINTS WHILE RESERVING A CAPABILITY TO PERFORM A RETURN TO EARTH MANEUVER WITH THE DPS ENGINE AS LATE AS 2 HRS AFTER PERILUNE ON THE CIRCULUNAR TRAJECTORY.</p>												
	2-14	<p><b>LUNAR ORBIT INSERTION</b></p> <p>LOI WILL BE INHIBITED AND A LUNAR FLYBY PERFORMED IF THE CSM DOES NOT SATISFY ANY OF THE FOLLOWING CONDITIONS---</p> <p>A. FULL CRITICAL SYSTEMS REDUNDANCY.</p> <p>B. ADEQUATE CONSUMABLES FOR MINIMUM LUNAR ORBIT OPERATIONS WITH CAPABILITY TO SUSTAIN A TANK LOSS AND RETURN TO EARTH WITH AN AVERAGE POWER LEVEL OF 40 AMPS.</p> <p>C. SPS PROPELLANT RESERVE CAPABILITY FOR TEI AND TRANSEARTH MCC'S.</p> <p>D. RCS PROPELLANT RESERVE TO ACCOMPLISH TEI CONTROL, TRANSEARTH MCC CONTROL, PTC, AND MINIMUM LUNAR ORBIT OPERATIONS.</p> <p>E. A DPS LOI WILL BE PERFORMED IF REQUIRED TO ACCOMPLISH A LUNAR ORBIT MISSION.</p>												
	2-15	<p><b>LUNAR ORBIT</b></p> <p>A. LOI DISPERSIONS</p> <p>1. IF A STABLE ORBIT HAS NOT BEEN ACHIEVED, A DPS 30 MIN ABORT WILL BE EXECUTED FOLLOWED BY A SPS OR APS MANEUVER IF REQUIRED.</p> <p>2. IF A STABLE ORBIT HAS BEEN ACHIEVED, AN SPS OR DPS TEI WILL BE PERFORMED AT THE NEXT PERICENTHION OR AN ALTERNATE MISSION WILL BE FLOWN.</p> <p>B. DESIGNED REDUNDANT CAPABILITY MUST BE MAINTAINED IN ALL CSM SYSTEMS CRITICAL FOR TEI AND LIFE SUPPORT.</p> <p>C. SUFFICIENT CONSUMABLES MUST REMAIN TO COMPLETE THE NEXT MISSION PHASE WITH CAPABILITY TO SUSTAIN A TANK LOSS AT ANY POINT DURING THE PHASE AND RETURN TO EARTH WITH AN AVERAGE POWER LEVEL OF 40 AMPS.</p> <p>D. THE CSM MUST MAINTAIN AN SPS FUEL RESERVE CAPABILITY FOR THE TEI MANEUVERS AND TRANSEARTH MCC'S.</p> <p>E. THE CSM MUST MAINTAIN RCS PROPELLANT RESERVE TO ACCOMPLISH TEI CONTROL, TRANSEARTH MCC CONTROL, PTC, AND MINIMAL TRANSEARTH OPERATIONS.</p> <p>F. IF NORMAL MISSION OPERATIONS ARE INHIBITED, THE DPS WILL BE USED FOR TEI WHEN THERE IS A CHOICE BETWEEN THE DPS AND SPS.</p>												
	2-16	<p><b>INTRAVENICULAR TRANSFER</b></p> <p>ONE HARDSUIT IVT FROM THE CSM TO THE LM WILL BE ACCOMPLISHED IF A REASONABLE CHANCE EXISTS THAT CORRECTIVE ACTION CAN BE TAKEN FOR A LM/TUNNEL PRESSURIZATION PROBLEM.</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	A	10/15/70	FLIGHT OPERATIONS RULES	GENERAL	2-4									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM												
2-17	<p><b>DOCKED LM OPERATION</b></p> <p>FOR AN IMPENDING HAZARDOUS SITUATION RESULTING FROM A DESCENT STAGE PROBLEM, THE STAGE WILL BE JETTISONED AND ASCENT STAGE OPERATIONS WILL CONTINUE AFTER THE VEHICLE HAS MOVED TO A SAFE DISTANCE.</p> <p>RULE NUMBERS 2-18 THROUGH 2-20 ARE RESERVED</p>												
2-21	<p><b>CSM/LM UNDOCKING AND SEPARATION</b></p> <p>A. A MANNED LM WILL NOT BE UNDOCKED FROM THE CSM WITHOUT INDEPENDENT MANEUVER CAPABILITY OF BOTH VEHICLES TO TERMINATE UNDOCKED ACTIVITIES AND TO ACCOMPLISH DOCKING. THE LM CAPABILITY TO REDOCK MUST STILL EXIST IF THE LM IS REQUIRED TO STAGE.</p> <p>B. VHF VOICE COMMUNICATIONS BETWEEN THE LM AND CSM ARE MANDATORY FOR UNDOCKING.</p> <p>C. EVT CAPABILITY IS REQUIRED FOR MANNED UNDOCKING.</p> <p>D. CREWMEN WILL BE SUITED DURING UNDOCKING AND DOCKING.</p> <p>E. IF NO LANDING ATTEMPT WILL BE MADE NO UNDOCKED MANNED ACTIVITIES WILL BE PERFORMED.</p>												
2-22	<p><b>CSM LUNAR ORBIT UNDOCKED</b></p> <p>A. UNDOCKING TO POI</p> <p>LOSS OF REDUNDANT CAPABILITY IN CRITICAL SYSTEMS WILL BE CAUSE TO TERMINATE THE MISSION AND PERFORM TEI ASAP. BETWEEN UNDOCKING AND DOI, THE VEHICLES WILL BE REDOCKED FOR LOSS OF CSM ACTIVE DOCKING OR LM RESCUE CAPABILITY.</p> <p>B. POI TO LANDING</p> <p>NO CSM FAILURES, EXCEPT FOR TIME-CRITICAL SPS FAILURES, BOTH H2 CRYO OR BOTH O2 CRYO TANKS (TO LO BATES), OR 3 FUEL CELLS, WILL BE CAUSE FOR ABORT DURING POWERED DESCENT.</p> <p>C. LUNAR STAY</p> <p>FAILURE TO MAINTAIN REDUNDANT CAPABILITY IN SYSTEMS REQUIRED FOR TEI OR LIFE SUPPORT WILL BE CAUSE FOR TERMINATION OF LUNAR STAY.</p>												
2-23	<p><b>LM-DOI</b></p> <p>FOR DOI, THE LM MUST HAVE THE CAPABILITY TO LAND, STAY ONE CSM REV, ASCEND, RENDEZVOUS AND DOCK WITHOUT VIOLATING ANY SPECIFIC MISSION RULES OR REDLINES.</p>												
2-24	<p><b>LM-PDI</b></p> <p>FOR PDI, THE LM MUST HAVE THE CAPABILITY TO LAND, STAY FOR ONE CSM REV, ASCEND, RENDEZVOUS AND DOCK WITHOUT VIOLATING ANY SPECIFIC MISSION RULES OR REDLINES.</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	A	10/19/79	FLIGHT OPERATIONS RULES	GENERAL	2-5								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM													
2-25	LM-POWERED DESCENT													
		IF A SYSTEMS FAILURE OCCURS AND A CHOICE IS AVAILABLE---												
		A. EARLY IN POWERED DESCENT WHEN OPS-TO-ORBIT CAPABILITY IS AVAILABLE, (UP TO POS + 8 MINUTES) IT IS PREFERABLE TO ABORT IN FLIGHT THAN TO CONTINUE DESCENT. REDUNDANT CAPABILITY OF CRITICAL LM SYSTEMS IS REQUIRED TO CONTINUE POWERED DESCENT DURING THIS PERIOD.												
		B. DURING THE REMAINDER OF POWERED DESCENT, IT IS PREFERABLE TO LAND AND LAUNCH FROM THE LUNAR SURFACE THAN TO ABORT; ONLY THOSE SYSTEMS FAILURES OR TRENDS THAT INDICATE IMPENDING LOSS OF THE CAPABILITY TO LAND, ASCEND AND ACHIEVE A SAFE ORBIT FROM THE LUNAR SURFACE, OR IMPENDING LOSS OF LIFE SUPPORT CAPABILITY WILL BE CAUSE FOR ABORT DURING THIS PERIOD.												
2-26	LM-LUNAR STAY													
		A. ONLY THOSE TIME-CRITICAL SYSTEMS FAILURES OR TRENDS THAT INDICATE IMPENDING LOSS OF THE CAPABILITY TO ASCEND AND ACHIEVE A SAFE ORBIT WILL BE CAUSE FOR AN IMMEDIATE ABORT (ANYTIME LIFTOFF) FROM THE LUNAR SURFACE.												
		B. LOSS OF REDUNDANT CAPABILITY IN CRITICAL LM SYSTEMS IS CAUSE FOR ABORT AT THE NEXT BEST OPPORTUNITY.												
2-27	EVA													
		A. FOR THE NOMINAL (TWO-MAN) EVA, TOTAL EMU LIFE SUPPORT SYSTEMS CAPABILITY, EVA TO EVA DUPLEX VOICE, EVA TO MSPN VOICE, AND CRITICAL INSTRUMENTATION FOR BOTH ASTRONAUTS ARE REQUIRED. FOR THE TWO-MAN EVA, THE CDR WILL ALWAYS EGRESS FIRST AND INGRESS LAST TO MAINTAIN PROPER LM CREW STATION CONFIGURATION UNLESS THE CDR HAS INITIATED AN OPS PURGE.												
		B. TO INITIATE THE EVA PHASE, THE EMU MUST HAVE SUFFICIENT CONSUMABLES TO SUPPORT CHECKOUT, PLANNED EVA (3-30) AND A 30 MINUTE POST-EVA RESERVE.												
		C. THE DUAL EVA WILL BE OPEN-ENDED TO 4:00.												
		D. IN THE EVENT PLSS TELEMETRY IS MANDATORY FOR CRITICAL INSTRUMENTATION AND FM INHIBITS EITHER LM OR PLSS TRANSMISSION, THE ERECTABLE S-BAND ANTENNA WILL BE DEPLOYED PRIOR TO LMP EGRESS.												
		E. AN EARLY TERMINATION OF THE EVA WILL BE BASED ON THE ASTRONAUT'S CAPABILITY TO COMMUNICATE WITH EACH OTHER, THE CAPABILITY OF MSPN TO COMMUNICATE WITH ONE CREWMAN, THE CAPABILITY TO MONITOR THE EMU CRITICAL INSTRUMENTATION, AND UPON THE CONSUMABLES REQUIRED TO SUPPORT SRC CLOSEOUT (LMP INGRESS) AND TRANSFER TO LM, PLUS A 30 MINUTE POST EVA RESERVE.												
		F. BOTH EVA CREWMEN WILL NOT REMAIN OUTSIDE OF MSPN COMM COVERAGE FOR A PERIOD EXCEEDING 5 MIN.												
		G. CONSIDERATION WILL BE GIVEN, TIME PERMITTING, FOLLOWING AN EARLY TERMINATION OF A TWO MAN EVA TO REINITIATE A ONE MAN EVA TO RETRIEVE LUNAR SAMPLES.												
		H. FAILURE OF ONE PLSS, ONE OPS, EVA TO EVA DUPLEX VOICE, OR THE LOSS OF CRITICAL INSTRUMENTATION WILL BE CAUSE FOR ONE-MAN ALTERNATE EVA.												
		I. ANY EMU PROBLEM REQUIRING A LM REPRESSURIZATION, AN OPS PURGE IN EXCESS OF TWO MINUTES (REALTIME DETERMINATION), OR INABILITY TO RECONFIGURE THE EMU TO A NORMAL PLSS OPERATION FOLLOWING A FINITE PURGE WILL RESULT IN AN IMMEDIATE TWO MAN EVA TERMINATION.												
		J. ANY EMU PROBLEM REQUIRING THE ACTIVATION OF THE OPS IN A MAKEUP MODE WILL RESULT IN THAT ASTRONAUT RETURNING TO THE VICINITY OF THE LM WHILE THE OTHER ASTRONAUT INITIATES THE NOMINAL TWO MAN EVA TERMINATION. PROPER CREW STATION CONFIGURATION WILL BE OBSERVED.												
		K. ALL EVA EXCURSIONS WILL BE LIMITED TO THAT VICINITY OF LM WHICH WILL ALLOW A SAFE 20 MINUTE RETURN (3000 FT TRAVERSE) TO THE LM WHILE OPERATING ON THE OPS.												
		L. BOTH PLSS'S AND OPS'S WILL BE RETAINED UNTIL TWO LIFE SUPPORT UNITS (2 OPS, 2 PLSS, OR 1 PLSS+1 OPS) HAVE BEEN VERIFIED TO HAVE SUFFICIENT CONSUMABLES TO SUPPORT CEVA.												
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MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	A	10/15/79	FLIGHT OPERATIONS RULES	GENERAL	2-8									

# NASA - Manned Spacecraft Center

## MISSION RULES

### SECTION 8 FLIGHT OPERATIONS RULES

REV	ITEM	
2-28	ASCENT	<p>IN THE EVENT OF PROCEDURAL ERRORS OR SYSTEMS PROBLEMS WHICH RESULT IN LOSS OF SOME CAPABILITY USED FOR ASCENT OR FOR RENDEZVOUS AND WHICH CAN BE CORRECTED IN ONE REV, IT IS BETTER TO DELAY ASCENT FOR ONE REV AND CORRECT THE SITUATION THAN IT IS TO LIFT OFF ON TIME.</p>
2-29	RENDEZVOUS	<p>SELECTION OF THE ACTIVE VEHICLE FOR RENDEZVOUS AND DOCKING WILL BE DETERMINED BY THE FLIGHT DIRECTOR AND THE FLIGHT CREW BASED UPON CONSUMABLES AND SYSTEMS PERFORMANCE. THE TOTAL LM CAPABILITY WILL BE DEDICATED TO ACCOMPLISHING THE RENDEZVOUS.</p>
2-30	TRANSEARTH COAST	<p>A. THE STEEP TARGET LINE WILL BE USED FOR MCC'S UNLESS THE VELOCITY AT ENTRY INTERFACE IS LESS THAN 30,000 FPS AND THE CGA IS 60 - THEN THE SHALLOW TARGET LINE WILL BE USED.</p> <p>B. MCC'S MAY BE USED FOR LANDING AREA CONTROL PRIOR TO ENTRY INTERFACE MINUS 24 HOURS FOR RECOVERY ACCESS VIOLATIONS, UNACCEPTABLE WEATHER, OR LAND MASSES IN ANY PART OF THE OPERATIONAL FOOTPRINT.</p> <p>C. IF THE FLIGHTPATH ANGLE IS OUTSIDE THE ENTRY CORRIDOR, AN MCC WILL BE EXECUTED AS SOON AS PRACTICAL.</p> <p>D. MCC'S WILL BE ACCOMPLISHED BY THE SPS IF NECESSARY TO MAINTAIN RCS REDLINES.</p>
2-31	ALTERNATE MISSION	<p>A. E.O.</p> <ol style="list-style-type: none"> <li>1. CSM ONLY - APPROXIMATE 100 NM E.O. PHOTOGRAPHY, SPS INCLINATION CHANGE, SPS MNVR TO LOWER APOGEE IF REQUIRED.</li> <li>2. CSM/LM - LM SYSTEMS POWER UP AND DPS MNVR TO LOWER APOGEE IF REQUIRED, APPROXIMATE 100 NM E.O. PHOTOGRAPHY MISSION, INCLINATION CHANGE.</li> </ol> <p>B. L.O.</p> <ol style="list-style-type: none"> <li>1. CSM ONLY - LUNAR ORBIT PHOTOGRAPHY, FREE RETURN TRAJECTORY</li> <li>2. CSM/LM (NO LANDING CAPABILITY) - LM SYSTEMS POWER UP, LO PHOTOGRAPHY, PC MANEUVER.</li> </ol> <p>C. IN ANY ALTERNATE MISSION WITHIN THE CONSTRAINTS OF PROPELLANT REMAINING AND OTHER OPERATIONAL CONSIDERATIONS SUCH AS CREW SAFETY AND SYSTEMS LIFETIME, THE COMBINED LM ASC/DES STAGES WILL BE DISPOSED OF IN THE FOLLOWING ORDER OF DESCENDING PRIORITY---</p> <ol style="list-style-type: none"> <li>1. SOLAR ORBIT</li> <li>2. LUNAR IMPACT</li> <li>3. LUNAR ORBIT</li> <li>4. OCEAN IMPACT</li> </ol>
2-32	RESERVED	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	B	10/31/69	FLIGHT OPERATIONS RULES	GENERAL	2-7

3 MISSION RULE  
SUMMARY

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM													
		<p>THIS SECTION IS A SUMMARY OF THE DATA PRIORITY GUIDELINES BY MISSION PHASE, SLY RULES BY MISSION PHASE, AND S/C SYSTEMS GO/NO-GO CRITERIA ON CHARTS BY MISSION PHASE.</p> <p>THE SUMMARY RULES PLUS THE CHART ARE REQUIRED TO ENCOMPASS EACH PHASE.</p> <p>THE CAPABILITY LISTED IN THE CHARTS ARE THE REQUIREMENTS FOR INITIATION OR CONTINUATION OF A MISSION PHASE OR EVENT; MISSION EVENTS FROM UNDOCKING TO TOUCHDOWN REQUIRED THE CAPABILITY TO LAND; STAY ONE CSM REV; ASCEND; RENDEZVOUS; AND DOCK.</p> <p style="text-align: center;">-----            * LAUNCH PHASE *            -----</p>												
3-1		<p>THE LAUNCH WILL BE ABORTED FOR THE FOLLOWING REASONS---</p> <p>A. SLY</p> <p>S-1E GIMBAL ACTUATOR HANDOVER (ONBOARD PRIOR TO S-1VB TO COI CAPABILITY)            VIOLATION OF AUTO/MANUAL EDS LIMITS            S-2I ENGINE FAILURES (TIME DEPENDENT)            FAILURE OF SECOND PLANE SEPARATION            S-1VB LOSS OF HYDRAULIC FLUID (PRIOR TO S-1VB IGNITION)            S-1VB LOSS OF THRUST (TIME DEPENDENT) (POSSIBLE COI CAPABILITY)            S-1VE LOX TANK PRESS GREATER THAN 50 PSI BEFORE THR JETT</p> <p>B. CSM</p> <p>1. ENVIRONMENTAL            LOSS OF CABIN AND SUIT PRESSURE            LOSS OF CABIN PRESSURE AND SUIT CIRCULATION            FIRE/SMOKE IN CM            LOSS OF CABIN PRESSURE AND O2 MANIFOLD LEAK</p> <p>2. ELECTRICAL            LOSS OF 3 FUEL CELLS AND 1 BATTERY            UNCONTROLLABLE SHORTED MAIN BUS            LOSS OF BOTH AC BUSES DURING MODE I OR MODE II</p> <p>3. PROPULSION            SUSTAINED LEAK OR LOSS OF HE PRESSURE (SOURCE OR MANIFOLD) IN BOTH CM-RCS RINGS (MODE I ONLY)</p> <p>C. VIOLATION OF TRAJECTORY LIMIT LINES</p> <p>D. TEAM DISCRETION WILL BE USED FOR---</p> <p>1. SUIT/CABIN CONTAMINATION</p> <p>2. MEDICAL PROBLEMS</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	FNL	9/10/69	MISSION RULE SUMMARY	LAUNCH PHASE	3-1									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 MISSION RULE SUMMARY

REV	ITEM	MISSION	REV	DATE	SECTION	GROUP	PAGE
3-2	THE 8-IVB EARLY STAGING WILL BE USED AFTER "8-IVB TO COI" CAPABILITY FOR THE FOLLOWING --- 8-II GIMBAL ACTUATOR INBOARD HARDOVER 8-II ENGINE FAILURES (TIME DEPENDENT) 8-IVB COLD HE SHUTOFF VALVE(S) FAILS OPEN (AFTER THR JETT)	APOLLO 18	A	10/15/79	MISSION RULE SUMMARY	LAUNCH PHASE	3-2
3-3	SWITCHOVER TO CSM GUIDANCE WILL BE PERFORMED FOR--- SATURN GUIDANCE REFERENCE FAILURE						
3-4	RESERVED						
3-5	RESERVED						
	RULE NUMBERS 3-6 THROUGH 3-10 ARE RESERVED.						

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM												
<u>EARTH ORBIT</u>													
3-11	<p>CSM SEPARATION FROM THE S-IVB (WITHOUT LM EXTRACTION) WILL BE PERFORMED EARLY FOR THE FOLLOWING SLY CONDITIONS (CONSIDERATION WILL BE GIVEN TO EXTRACTING THE LM LATER IF THE CONDITION CAN BE CORRECTED):</p> <ul style="list-style-type: none"> <li>*S-IVB RANGE SAFETY PROPELLANT DISPERSAL SYSTEM ARMS INADVERTENTLY AFTER INSERTION AND PRIOR TO SAFING</li> <li>*S-IVB LOX TANK PRESS IS GREATER THAN 30 PSI</li> <li>LOSS OF ATTITUDE CONTROL DURING TDS</li> <li>*S-IVB COMMON BULKHEAD DELTA PRESSURE EXCEEDS LIMITS</li> <li>*START BOTTLE GREATER THAN 1800 PSIA</li> <li>*PERFORM SPS MANEUVER TO A SAFE DISTANCE</li> </ul>												
3-12	<p>CSM SEPARATION FROM THE S-IVB (WITH LM EXTRACTION) WILL BE PERFORMED FOR---</p> <ul style="list-style-type: none"> <li>A. S-IVB NO-GO FOR TLI</li> <li>B. CSM NO-GO FOR TLI BUT GO FOR EARTH ORBIT MISSION</li> </ul>												
3-13	<p>TLI WILL BE INHIBITED FOR---</p> <ul style="list-style-type: none"> <li>INSUFFICIENT PROPELLANT REMAINS FOR ACHIEVING A 69,000 NM APOGEE ELLIPSE</li> <li>S-IVB ENGINE MAIN LOX VALVE FAILS TO CLOSE AT CUTOFF</li> <li>LOSS OF ATTITUDE CONTROL</li> <li>CONFIRMED ACTUATOR HARDOVER</li> <li>LOSS OF ENGINE HYDRAULIC FLUID</li> <li>MISALIGNMENT RATE BETWEEN THE IU AND IMU IS OUTSIDE LIMITS</li> <li>UNACCEPTABLE DIFFERENCES BETWEEN CMC AND IU PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION</li> <li>UNACCEPTABLE DIFFERENCE BETWEEN MSPN AND IU ORBITAL DECISION PARAMETERS</li> </ul>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	A	10/15/69	MISSION RULE SUMMARY	EARTH ORBIT	3-3								



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM												
3-16	<p>TLI WILL BE TERMINATED FOR ---</p> <p>A. PITCH OR YAW BODY RATES GREATER THAN 10 DEG/SEC</p> <p>B. ROLL BODY RATE GREATER THAN 20 DEG/SEC</p> <p>C. PITCH OR YAW ATTITUDE DEVIATIONS FROM NOMINAL PROFILES EXCEED 45 DEG.</p>												
3-18	<p>CSN TAKEOVER WILL BE PERFORMED FOR SATURN GUIDANCE REFERENCE FAILURE OR SATURN LOSS OF ATTITUDE CONTROL IN EARTH ORBIT OR DURING TLI.</p> <p>RULES 3-16 THROUGH 3-20 ARE RESERVED.</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	A	10/18/79	MISSION RULE SUMMARY	EARTH ORBIT	3-4								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 MISSION RULE SUMMARY

REV	ITEM						
		<u>TDGE</u>					
3-23	<p>TDGE WILL NOT BE PERFORMED FOR---</p> <p>A: PILOTS EVALUATION OF RATES AND ATTITUDES, AND SLR CONFIGURATION NOT ACCEPTABLE.</p> <p>B: THE SLV IS NO-GO FOR---</p> <p>1: VIOLATION OF S-IVB BULKHEAD DELTA P LIMITS</p> <p>2: LOX TANK PRESSURE GREATER THAN 96 PSI</p> <p>RULE NUMBERS 3-22 THROUGH 3-29 ARE RESERVED.</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	A	8/15/79	MISSION RULE SUMMARY	TDGE	3-5

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM																																								
	----- * TRANSLUNAR COAST * -----																																								
3-30	RESERVED																																								
3-31	DURING THE LOI BURN, THE FLIGHT CREW WILL TAKE THE FOLLOWING ACTION---																																								
	A. TERMINATE THE BURN FOR THE CONDITIONS DEFINED BELOW																																								
	LOI ABORT MODES -----																																								
	<table border="1"> <thead> <tr> <th>MODE</th> <th>TIME</th> <th>DELTA VM</th> <th>SPS LIMITS</th> <th>TYPE ABORT</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>0-29</td> <td>0-135</td> <td>TIGHT</td> <td>DPS 30 (CAN BLEP TO 2 MA)</td> </tr> <tr> <td>I</td> <td>20-40</td> <td>135-290</td> <td>TIGHT</td> <td>DPS 30</td> </tr> <tr> <td>I</td> <td>40-90</td> <td>290-650</td> <td>TIGHT</td> <td>DPS 30 + SPS/APS 2 1/2</td> </tr> <tr> <td>II</td> <td>90-144</td> <td>650-1060</td> <td>LOOSE</td> <td>DPS 2 + DPS AND APS PC</td> </tr> <tr> <td>II</td> <td>144-170</td> <td>1060-1270</td> <td>LOOSE</td> <td>DPS 3 + DPS PC</td> </tr> <tr> <td>III</td> <td>170-210</td> <td>1270-1800</td> <td>LOOSE</td> <td>DPS PC</td> </tr> <tr> <td>III</td> <td>210-C/O</td> <td>1800-C/O</td> <td>TIGHT</td> <td>DPS PC</td> </tr> </tbody> </table>	MODE	TIME	DELTA VM	SPS LIMITS	TYPE ABORT	I	0-29	0-135	TIGHT	DPS 30 (CAN BLEP TO 2 MA)	I	20-40	135-290	TIGHT	DPS 30	I	40-90	290-650	TIGHT	DPS 30 + SPS/APS 2 1/2	II	90-144	650-1060	LOOSE	DPS 2 + DPS AND APS PC	II	144-170	1060-1270	LOOSE	DPS 3 + DPS PC	III	170-210	1270-1800	LOOSE	DPS PC	III	210-C/O	1800-C/O	TIGHT	DPS PC
MODE	TIME	DELTA VM	SPS LIMITS	TYPE ABORT																																					
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II	144-170	1060-1270	LOOSE	DPS 3 + DPS PC																																					
III	170-210	1270-1800	LOOSE	DPS PC																																					
III	210-C/O	1800-C/O	TIGHT	DPS PC																																					
	LOI SPS SHUTDOWN RULES -----																																								
	TIGHT SPS LIMITS---																																								
	FUEL - OXID DELTA P GREATER THAN 20 PSI CONFIRMED BY LOW PC																																								
	PROP TANK PRESS LESS THAN 160 PSI CONFIRMED BY LOW PC																																								
	PC LESS THAN 80 PSI OR DECAYS 10 PSI DURING THE BURN																																								
	ANY BALL VALVE FAILS TO OPERATE, OR CLOSURE PREMATURELY, AND THE OTHER BANK GN2 TANK PRESSURE HAS DECAYED TO 1500 PSI (SHUT DOWN DECAYING BANK FIRST); IF STILL BURNING, CONTINUE																																								
	NOTE-- IF THE FIRST BANK SELECTED FAILS TO OPERATE UNDER G & N CONTROL, ATTEMPT TO START THAT BANK UNDER SCB CONTROL; IF THE BANK STARTS UNDER SCB CONTROL, CONTINUE THE BURN AND EVALUATE G & N STEERING; IF THE BANK FAILS TO START UNDER SCB CONTROL, INHIBIT LOI.																																								
	LOOSE SPS LIMITS---																																								
	PC LESS THAN 70 PSI CONFIRMED BY OTHER CUES																																								
	PROP TANK PRESS LESS THAN 115 PSI CONFIRMED BY LOW PC																																								
	PHYSIOLOGICAL INDICATIONS OF ERRATIC ENGINE PERFORMANCE (VIBRATION, POPPING, ETC)																																								
	B. PERFORM RTVC TAKEOVER AND COMPLETE THE BURN FOR THE FOLLOWING CONTROL PROBLEMS---																																								
	1: GUN NO-00																																								
	2: ATTITUDE EXCURSION GREATER THAN 10 DEG EXCLUDING START TRANSIENTS																																								
	3: RATES GREATER THAN 10 DEG/SEC																																								
	C. RESTART THE BURN AND COMPLETE UNDER SCB CONTROL FOR AN INADVERTENT SPS SHUTDOWN.																																								
	RULE NUMBER 3-32 THROUGH 3-37 ARE RESERVED.																																								

MISSION	REV	DATE	ACTION	ORIG	PAGE
APOLLO 11	0	10/31/69	MISSION RULE REVISION	TRANSLUNAR COAST	2-6

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM						
		<b>LUNAR ORBIT</b>					
3-38	PRIOR TO UNDOCKING THE FOLLOWING TRAJECTORY CONDITIONS MUST BE SATISFIED---						
	A. THE MISS DISTANCE OVER THE LLS IS LESS THAN 0.3 DEG. OUT OF PLANE AND 47-2 DEG. IN AZIMUTH						
		NOTE ADDITIONAL MANEUVERS WILL BE BE SCHEDULED, AS NEEDED, BETWEEN LOI2 AND UNDOCKING TO CORRECT DISPERSIONS.					
		RULE NUMBERS 3-39 THROUGH 3-44 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PNL	9/13/69	MISSION RULE SUMMARY	LUNAR ORBIT	3-7

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM												
	----- ! DOI PHASE ! -----												
3-45	<p>DOI IGNITION</p> <p>THE FLIGHT CREW WILL NOT ATTEMPT TO BACKUP THE DOI ULLAGE MANEUVER OR THE DPS IGNITION SHOULD EITHER FAIL TO OCCUR AUTOMATICALLY. DOI MAY BE ATTEMPTED ONE REV LATER DEPENDING ON AN ANALYSIS OF THE PROBLEM.</p>												
3-46	<p>DOI TERMINATION</p> <p>THE FLIGHT CREW WILL TERMINATE DOI FOR THE FOLLOWING---</p> <p>A. ATTITUDE DEVIATIONS GREATER THAN 3 DEG.</p> <p>B. RATES GREATER THAN 3 DEG./SEC.</p> <p>C. PNGS DELTA VS NEGATIVE OR OVERBURN OF 2 SECONDS AND PGS DELTA V INDICATES AN OVERBURN OF GREATER THAN 2 FPS.</p> <p>D. DPS FUEL OR OXIDIZER ULLAGE PRESSURE LESS THAN 129 PSIA.</p>												
3-47	<p>DOI TO POI</p> <p>A. DOI RESIDUALS OF LESS THAN 3 FPS WILL NOT BE TRIMMED.</p> <p>B. FOLLOWING DOI CUTOFF---</p> <p>IF PNGS RESIDUALS (ANY AXIS) ARE LESS THAN 10 BUT MORE THAN 3 FPS; THEN PNGS X-AXIS RESIDUALS TO 3 FPS AND</p> <p>1. IF AGS AGREES TO LESS THAN 2 FPS - CONTINUE TO POI</p> <p>2. IF AGS DISAGREES BY MORE THAN 3 FPS AND RA CONFIRMS AGS - PERFORM DIRECT ABORT</p> <p>3. IF AGS DISAGREES BY MORE THAN 2 FPS BUT LESS THAN 3 FPS AND AT 30 MINUTES AFTER DOI THE RA AGREES WITH AGS - PERFORM NO DOI +12 ABORT</p> <p>C. DIRECT RETURN TO THE ESM WILL BE PERFORMED FOR THE FOLLOWING REASONS (NOTE CAPABILITY REMAINS TILL APPROXIMATELY DOI + 10 MIN).</p> <p>1. LM CONDITIONS</p> <p>(A) ECG</p> <p>(1) LOSS OF BOTH COOLANT LOOPS</p> <p>(2) FIRE, SMOKE, OR PRESS GLYCOL IN CABIN OR SUIT</p> <p>(B) OOC</p> <p>PNSS FAIL</p> <p>RULE 3-48 IS RESERVED</p>												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>LOCATION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 10</td> <td>8</td> <td>10/31/69</td> <td>MISSION RULE SUMMARY</td> <td>DOI PHASE</td> <td>3-8</td> </tr> </table>		MISSION	REV	DATE	LOCATION	GROUP	PAGE	APOLLO 10	8	10/31/69	MISSION RULE SUMMARY	DOI PHASE	3-8
MISSION	REV	DATE	LOCATION	GROUP	PAGE								
APOLLO 10	8	10/31/69	MISSION RULE SUMMARY	DOI PHASE	3-8								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM												
	----- POWERED DESCENT PHASE -----												
3-49	<p>POI IGNITION</p> <p>THE FLIGHT CREW WILL NOT ATTEMPT TO BACK UP THE POI ULLAGE MANEUVER. IF THE ULLAGE MANEUVER DOES OCCUR AUTOMATICALLY, THE FLIGHT CREW WILL ATTEMPT TO MANUALLY IGNITE THE DPS ENGINE IF IT DOES NOT IGNITE AUTOMATICALLY. THE MANUAL IGNITION MUST OCCUR BY LOC COMPUTED TIG + 7.3 SEC. POI MAY BE ATTEMPTED 3 REV LATER, DEPENDING ON AN ANALYSIS OF THE PROBLEM.</p>												
3-50	<p>POI TO LO GATE</p> <p>POWERED DESCENT WILL BE ABORTED FOR THE FOLLOWING---</p> <p>A. LR DATA IS REQUIRED FOR LANDING - NO LR DATA BY 18 K FT - ABORT.</p> <ol style="list-style-type: none"> <li>1. LR CONVERGENCE (ALTITUDE ONLY) - DATA NOT BEING ACCEPTED OR CONVERGING FOLLOWING LOCKON FOR 60 SECONDS - ABORT.</li> <li>2. LR DATA ACCEPTED AND CONVERGED CONTINUOUS TO P-64 - CONTINUE MISSION IF LOSS OF LOCK OCCURS IN P-64.</li> <li>3. LR DATA ACCEPTED AND CONVERGED WITH SUBSEQUENT DROPOUT - CONTINUE TO P-64:             <ol style="list-style-type: none"> <li>(A) LANDING RADAR REMAINED IN P-64:                 <ol style="list-style-type: none"> <li>(1) DELTA M LESS THAN 1000 FT BETWEEN P64S AND LR - CONTINUE MISSION.</li> <li>(2) DELTA M GREATER THAN 1000 FT BETWEEN P64S AND LR - ABORT.</li> </ol> </li> <li>(B) LR NOT REGAINED AT P-64 - ABORT.</li> </ol> </li> <li>4. LATE LR LOCKON WITH DATA BEING INCORPORATED AND CONVERGING - CONTINUE TO P-64:             <ol style="list-style-type: none"> <li>(A) DELTA M LESS THAN 1000 FT BETWEEN P64S AND LR - CONTINUE MISSION.</li> <li>(B) DELTA M GREATER THAN 1000 FT BETWEEN P64S AND LR - ABORT.</li> </ol> </li> </ol> <p>B. P64S ALTITUDE LESS THAN 12000 FEET AND P64S NAVIGATION ERRORS, CONFIRMED BY MBPA OR DOPPLER RESIDUALS, THAT CAUSE THE ABS-P64S RADIAL VELOCITY DIFFERENCE TO EXCEED <u>11</u> PPS PRIOR TO LANDING RADAR ALTITUDE INCORPORATION AND CONVERGENCE (A MINUS VELOCITY DIFFERENCE INDICATES THAT THE ABS TRAJECTORY IS LOWER THAN THE P64S TRAJECTORY).</p> <p>C. P64S NAVIGATION ERRORS, CONFIRMED BY MBPA OR DOPPLER RESIDUALS, THAT RESULT IN THE FOLLOWING ABS-P64S VELOCITY DIFFERENCES---</p> <p style="margin-left: 40px;">DELTA R DOT (CROSSRANGE) GREATER THAN +/- 10 PPS              DELTA Y DOT (CROSSRANGE) GREATER THAN +/- 10 PPS              DELTA Z DOT (RADIAL) GREATER THAN +/- 11 PPS</p> <p>D. P64S ALTITUDE LESS THAN 12000 FEET AND P64S NAVIGATION ERRORS, CONFIRMED BY DOPPLER BUT NOT BY ABS, CAUSE THE MBPA-P64S RADIAL VELOCITY DIFFERENCE TO EXCEED <u>11</u> PPS PRIOR TO LANDING RADAR ALTITUDE INCORPORATION AND CONVERGENCE.</p> <p>E. P64S NAVIGATION ERRORS CONFIRMED BY DOPPLER RESIDUALS BUT NOT BY ABS, THAT RESULT IN THE FOLLOWING MBPA-P64S VELOCITY DIFFERENCES---</p> <p style="margin-left: 40px;">DELTA Y DOT (CROSSRANGE) GREATER THAN +/- 10 PPS              DELTA Z DOT (RADIAL) GREATER THAN +/- 11 PPS.</p> <p>NOTE---RULES C AND E ARE INDEPENDENT OF ANY TYPE OF LANDING RADAR UPDATE. FOR RULES D AND C, SWITCHOVER TO ABS WILL BE PERFORMED.</p>												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 10</td> <td>A</td> <td>10/10/70</td> <td>MISSION RULE SUMMARY</td> <td>POWERED DESCENT</td> <td>3-9</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 10	A	10/10/70	MISSION RULE SUMMARY	POWERED DESCENT	3-9
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 10	A	10/10/70	MISSION RULE SUMMARY	POWERED DESCENT	3-9								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM												
	<p>P. COMMANDED THRUST INCREASING PRIOR TO THROTTLE DOWN OR P63 TOO=80 SEC.</p> <p>Q. NO LANDING SITE VISIBILITY BY P64 PLUS <u>10 SEC.</u></p> <p>R. NO THROTTLE RECOVERY BY P63/P64 PROGRAM SWITCH PLUS 10 SEC.</p> <p>S. FAILURE TO ACHIEVE PTP BY NOMINAL T10 +31 SEC. (ABORT AT 6TC DIVERGENCE).</p> <p>T. FAILURE TO ENTER P64 WHEN T00 EQUALS 60 SECONDS.</p> <p>K. THE FOLLOWING PNB8 ALARMS---20109.00214; 20430+20607;21103+01107; 21204+21302+21501+00+04 (CONTINUING).</p> <p>NOTE---THE CREW WILL BE ADVISED AND CONSIDERATION WILL BE GIVEN TO TERMINATION OF POWERED DESCENT IF THE TIME BIASED DP8 ABORT BOUNDARY IS VIOLATED.</p>												
3-51	<p>LO GATE TO TD</p> <p>THERE ARE NO TRAJECTORY OR GUIDANCE CONSIDERATIONS WHICH ARE CAUSE FOR ABORT AFTER CREW TAKEOVER OF POWERED DESCENT</p> <p>RULE NUMBERS 3-52 THROUGH 3-60 ARE RESERVED.</p>												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>A</td> <td>8/19/69</td> <td>MISSION RULE SUMMARY</td> <td>POWERED DESCENT</td> <td>3-50</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	A	8/19/69	MISSION RULE SUMMARY	POWERED DESCENT	3-50
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	A	8/19/69	MISSION RULE SUMMARY	POWERED DESCENT	3-50								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM						PAGE
		----- ASCENT -----					
3-61	ASCENT	<p>A. GUIDANCE SWITCHOVER TO AGS WILL BE PERFORMED FOR ---</p> <p>1. THE FOLLOWING PGNS ALARMS---20109,00214; 20430,20607; 21103,01807; 21204,21302; AND 21901.</p> <p>2. PGNS NAVIGATION ERRORS DURING ASCENT OR FOLLOWING DESCENT ABORTS THAT RESULT IN ANY OF THE FOLLOWING CONDITIONS---</p> <p>(A) AGS PREDICTED HP AT INSERTION LESS THAN 40,000 FT</p> <p>(B) AGS PREDICTED HA AT INSERTION GREATER THAN TARGET VALUE PLUS 40 NAUTICAL MILES.</p> <p>(C) AGS PREDICTED INSERTION WEDGE ANGLES GREATER THAN 1.0 DEG.</p> <p>3. CONFIRMED PGNS NAVIGATION ERRORS THAT RESULT IN THE FOLLOWING H&amp;PN PGNS VELOCITY DIFFERENCES</p> <p style="margin-left: 40px;">DELTA V1 GREATER THAN <u>2/- 24 FPA</u>  DELTA V1 GREATER THAN <u>2/- 28 FPA</u>  DELTA V2 GREATER THAN <u>2/- 17 FPA</u></p> <p>B. THE GROUND WILL NOT REQUEST SWITCHOVER AFTER AGS TOO LESS THAN 30 SECONDS.</p> <p>C. DURING ASCENT THE AGS WILL BE DECLARED NO-GO IF CONFIRMED AGS NAVIGATION ERRORS THAT RESULT IN---</p> <p>1. PGNS PREDICTED INSERTION HP LESS THAN 30,000 FT.</p> <p>2. PGNS PREDICTED INSERTION HA GREATER THAN TARGET VALUE PLUS 40 NM.</p> <p>3. PGNS PREDICTED INSERTION WEDGE ANGLE GREATER THAN 1.0 DEGREE.</p>					
		<p>RULE 3-62 THROUGH 3-79 ARE RECEIVED.</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 14	8	10/31/79	MISSION RULE SUMMARY	ASCENT	9-11



NASA - Manned Spacecraft Center

MISSION RULES  
SECTION 3 MISSION RULE SUMMARY

REV	ITEM													
		<p style="text-align: center;">----- ALL PHASES -----</p> <p>3-00 A NON-CRITICAL SPS MANEUVER WILL BE INHIBITED FOR---</p> <p>A. SSC</p> <ol style="list-style-type: none"> <li>1. LOSS OF TWO TVC SERVO LOOPS</li> <li>2. LOSS OF THREE TVC CONTROL MODES (SSN, SSC AUTO, AND NTVC - RATE CMD IF UNDOCKED)</li> <li>3. LOSS OF THREE TVC CONTROL MODES (SSN, SSC AUTO, AND NTVC - ACCEL CMD IF DOCKED)</li> </ol> <p>B. SPS</p> <ol style="list-style-type: none"> <li>1. LOSS OF BOTH O<sub>2</sub> BOTTLES (LESS THAN 400 PSI)</li> <li>2. FUEL OR OXIDIZER PREDLINE TEMP LESS THAN 40 DEG. F.</li> <li>3. FLANGE TEMP GREATER THAN 400 DEG. F. ON PREVIOUS BURN</li> <li>4. CHAMBER PRESSURE LESS THAN 78 PSI ON PREVIOUS BURN</li> <li>5. FUEL/OXIDIZER DELTA P GREATER THAN 20 PSI</li> <li>6. LOSS OF ULLAGE CAPABILITY FOR FIRST BURN SUBSEQUENT TO DOCKED OPS BURN, OR AFTER STORAGE TANKS EMPTY</li> <li>7. FIRST BURN SUBSEQUENT TO DOCKED OPS WAS LESS THAN 40 SEC. CONTINUOUS</li> <li>8. PRESSURE IN EITHER FUEL OR OXIDIZER TANK LESS THAN 140 PSI</li> <li>9. DELTA V REMAINING LESS THAN MANEUVER PLUS DEORBIT REQUIREMENT</li> </ol>												
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 15%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>PML</td> <td>9/18/69</td> <td>MISSION RULE SUMMARY</td> <td>ALL PHASES</td> <td>3-12</td> </tr> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	PML	9/18/69	MISSION RULE SUMMARY	ALL PHASES	3-12
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APOLLO 12	PML	9/18/69	MISSION RULE SUMMARY	ALL PHASES	3-12									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM	THE FOLLOWING MANEUVERS WILL BE TERMINATED AFTER MANUAL TAKEOVER; OR COMPLETED BY SCS (MTCV OR AUTO) OR A&S TAKEOVER FOR---					
		MANEUVER	EXCURSION	RATES	ERRORS	TERMINATE AFTER MANUAL TAKEOVER (NON CRITICAL)	COMPLETE BY SCS OR A&S TAKEOVER (CRITICAL)
	3-01	MODE III	5	5	5		X
		MODE IV	5	5	5		X
		APOGEE KICK	5	5	5		X
		MCC 1 (SPS OR D*1)	10	10	10	X	
		MCC 2 (SPS OR D*2)	10	10	10	X	
		MCC 3 (SPS OR D*3)	10	10	10	X	
		MCC 4 (SPS OR D*4)	10	10	10	X	
		LOI 1 (SPS OR D*1)	10	10	10		X
		LOI 2 (SPS OR D*2)	10	10	10	X	
		DOI	5	5	5	X (ITEM THEN STABILIZE)	
		LOPC					
		ESM ONLY OR ABC STG.	10	10	10	X	
		ONLY					
		UNSTAGED LM	5	5	5	X	
		FEI	10	10	10		X
		MCC 3*4*7; LFOR	10	10	10		X
		ENTRY CORRIDOR					
		CONTROL					
		EARTH DEORBIT	10	10	10		X
		TRANSLUNAR ABORT	10	10	10		X

MISSION	REV	DATE	REVISION	GROUP	PAGE
APOLLO 16	A	10/10/69	MISSION RULE SUMMARY	ALL PHASES	2-11

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM																																																																																																									
3-83	<p>IN GENERAL THE FOLLOWING MANEUVERS WILL BE TRIMMED TO THE FOLLOWING RESIDUAL VALUES---</p> <p>A. MANEUVER</p> <table border="1"> <thead> <tr> <th></th> <th>X</th> <th>BODY</th> <th>ARIS Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>MCC1 (1)</td> <td>0.2 PPS</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>MCC2 (2)</td> <td>0.2 PPS</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>MCC3 (3)</td> <td>0.2 PPS</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>MCC4</td> <td>1 PPS</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>LO11</td> <td>NO</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>LO12</td> <td>1 PPS</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>DOI (4)</td> <td>NO</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>LOPC1</td> <td>NO</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>ASCENT</td> <td colspan="4">REAL TIME CALL OUT</td> </tr> <tr> <td>CS1</td> <td>NULL</td> <td></td> <td>NULL</td> <td>NULL</td> </tr> <tr> <td>PC</td> <td>NULL</td> <td></td> <td>NULL</td> <td>NULL</td> </tr> <tr> <td>COM</td> <td>NULL</td> <td></td> <td>NULL</td> <td>NULL</td> </tr> <tr> <td>TP1</td> <td>NULL</td> <td></td> <td>NULL</td> <td>NULL</td> </tr> <tr> <td>LOPC2</td> <td>NO</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>TE1</td> <td>0.2 PPS</td> <td></td> <td>NO</td> <td>0.2 PPS</td> </tr> <tr> <td>MCC5</td> <td>0.2 PPS</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>MCC6</td> <td>0.2 PPS</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>MCC7</td> <td>0.2 PPS</td> <td></td> <td>NO</td> <td>NO</td> </tr> <tr> <td>EARTH DEORBIT</td> <td>0.2 PPS</td> <td></td> <td>0.2 PPS</td> <td>0.2 PPS</td> </tr> <tr> <td>TRANS-LUNAR ABORT</td> <td>NO</td> <td></td> <td>NO</td> <td>NO</td> </tr> </tbody> </table> <p>(1), (2), (3) IF Z LESS THAN OR EQUAL TO 2 PPS; TRIM TO 0.2 PPS-- IF A GREATER THAN 2 PPS, DO NOT TRIM</p> <p>(4) SPECIFIC MISSION RULE REFERENCE 3-67</p> <p>B. DOCKED OPS WILL NOT BE TRIMMED.</p>		X	BODY	ARIS Y	Z	MCC1 (1)	0.2 PPS		NO	NO	MCC2 (2)	0.2 PPS		NO	NO	MCC3 (3)	0.2 PPS		NO	NO	MCC4	1 PPS		NO	NO	LO11	NO		NO	NO	LO12	1 PPS		NO	NO	DOI (4)	NO		NO	NO	LOPC1	NO		NO	NO	ASCENT	REAL TIME CALL OUT				CS1	NULL		NULL	NULL	PC	NULL		NULL	NULL	COM	NULL		NULL	NULL	TP1	NULL		NULL	NULL	LOPC2	NO		NO	NO	TE1	0.2 PPS		NO	0.2 PPS	MCC5	0.2 PPS		NO	NO	MCC6	0.2 PPS		NO	NO	MCC7	0.2 PPS		NO	NO	EARTH DEORBIT	0.2 PPS		0.2 PPS	0.2 PPS	TRANS-LUNAR ABORT	NO		NO	NO
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MCC2 (2)	0.2 PPS		NO	NO																																																																																																						
MCC3 (3)	0.2 PPS		NO	NO																																																																																																						
MCC4	1 PPS		NO	NO																																																																																																						
LO11	NO		NO	NO																																																																																																						
LO12	1 PPS		NO	NO																																																																																																						
DOI (4)	NO		NO	NO																																																																																																						
LOPC1	NO		NO	NO																																																																																																						
ASCENT	REAL TIME CALL OUT																																																																																																									
CS1	NULL		NULL	NULL																																																																																																						
PC	NULL		NULL	NULL																																																																																																						
COM	NULL		NULL	NULL																																																																																																						
TP1	NULL		NULL	NULL																																																																																																						
LOPC2	NO		NO	NO																																																																																																						
TE1	0.2 PPS		NO	0.2 PPS																																																																																																						
MCC5	0.2 PPS		NO	NO																																																																																																						
MCC6	0.2 PPS		NO	NO																																																																																																						
MCC7	0.2 PPS		NO	NO																																																																																																						
EARTH DEORBIT	0.2 PPS		0.2 PPS	0.2 PPS																																																																																																						
TRANS-LUNAR ABORT	NO		NO	NO																																																																																																						
	<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>MISSION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 10</td> <td>A</td> <td>10/1970</td> <td>MISSION RULE SUMMARY</td> <td>ALL PHASES</td> <td>2-15</td> </tr> </tbody> </table>	MISSION	REV	DATE	MISSION	GROUP	PAGE	APOLLO 10	A	10/1970	MISSION RULE SUMMARY	ALL PHASES	2-15																																																																																													
MISSION	REV	DATE	MISSION	GROUP	PAGE																																																																																																					
APOLLO 10	A	10/1970	MISSION RULE SUMMARY	ALL PHASES	2-15																																																																																																					

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MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM						
3-84		<p>THE FOLLOWING MANEUVERS WILL BE MANUALLY TERMINATED AFTER VIOLATION OF THESE OVERBURN CRITERIA--</p>					
		A. $TLE = 3 \text{ SEC}$ AND $V (PNGS)$ EQUALS $f (PAD)_{0}$					
		B. $LC11$					
		1. $SPS = 10 \text{ SEC}$					
		2. $DPB = 10 \text{ SEC}$ AND $\Delta V (AGS)$ GREATER THAN $10 \text{ FPS}$					
		C. $LO12 = 1 \text{ SEC}$					
		D. $DO1 = PNGS \Delta V$ NEGATIVE OR 2 SECOND OVERBURN AND $AGS \Delta V$ INDICATES AN OVERBURN OF GREATER THAN 2 FPS.					
		E. $TE1$					
		1. OVERBURN					
		(A) $SPB = 2 \text{ SEC}$ AND $\Delta V$ INDICATING A 40 FPS OVERBURN					
		(B) $DPB = 10 \text{ SEC}$ AND $\Delta V (AGS)$ GREATER THAN 2 FPS					
		2. UNDERBURN					
		(A) $SPB = PDR$ FOR A $GMN C/O$ OCCURRING GREATER THAN 3 SEC EARLY AND THE $\Delta V$ GREATER THAN 30 FPS; SWITCH TO SCS AUTO AND RESTART SPS					
		F. $SPB MCC = 1 \text{ SEC}$					
		<p>RULES 3-85 THROUGH 3-89 ARE RESERVED.</p>					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 12	0	10/21/70	MISSION RULE SUMMARY	ALL PHASES	3-10	

CSM RECEIVED CRITERIA

DEFINITION ITEM	LUNAR ORBIT		TLC		LUNAR ORBIT PREPARE UNDUNES		UNDOCKING	DOF	POWERED DESCENT				LUNAR STAY			LUNAR ORBIT (POST RNDZ)
	CONF REQD	CONF E.O.	FLA	FRLE	CONF TLC	LR			CONF S.O.	POB	PD TO PDMS	PDMS TO LD GATE	LD GATE TO T/D	STAY W/D EVA	2-MAN EVA	1-MAN EVA
RES																
CABIN INTEGRITY																
NO FIRE OR SMOKE IN CABIN																
NO O <sub>2</sub> MANIFOLD LEAKS																
NO O <sub>2</sub> REGULATORS																
ECS COOLANT LEAKS																
ECS REGULATORS																
ECS GLYCOLS, TANKS																
SUIT INTEGRITY																
NO GLYCOL LEAK																
NO EXCESSIVE CABIN HUMIDITY																
POTABLE W/D TANKS																POT
W/D TANKS																
SUIT COMPRESSORS																
SUIT CIRCUIT																
WATERBARS																
CRV																
W/ TANKS																
W/ TANKS																
EPS																
FUEL CELLS																
W/D TANKS																
W/D TANKS																
BATTERY BUSES																
AC BUSES																
SUIT RELAY BUS																
WATERBARS																
AC BUS																
DOCKING																
DOCKING LATCHES																
GRV BOTTLES																
SEA																
SMJG NOT ACTIVATED																
SMJG NOT ACTIVATED																

- BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING TO ORBIT TO COMPLETE MISSION WITH NECESSARY RESERVE FOR AND RESERVE CAPACITY FOR
- CONSIDERATION WILL BE GIVEN TO RECEIPT STAGE CAN BE RETURNED FOR TD
- IF ONE BATTERY HAS OPERATED THE OTHER IS FUNCTIONAL, CONTINUED TD WILL BE REQUIRED
- EXCLUDED
- W/D BY W/SAME COOLANT LOOP

BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING

BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO UNDOCKING WITH ONE GRV BOTTLE REMAINING IN AN OPERABLE SYSTEM

MODE ZERO IS ONLY IF THE CAPTIVATED

W/D MUST HAVE CABIN INTEGRITY OR VISIBLE SUIT LOOP. ITEMS MARKED BY ARE REQUIRED TO MAINTAIN VISIBLE SUIT LOOP

LEGEND:      NO REQUIREMENT

CSM EMC GD CRITERIA

COVERED ITEM	LUNAR ORBIT		FLC		LUNAR LIFT RESPONSE UNCORRECTED			UNDOCK	DOR		POWERED DESCENT			LUNAR STAY			LUNAR ORBIT (P. 7502)	
	COMP MODEP	CONF S.S.	TRD	TRKS	CONF FLC	LDR	CONF LDR	CONF S.S.	DOH	CONF JOB	POD	POB TO PDB W/S	POB-S TO NSGATE	LOGATE TO T/D	STAY W/O EVA	2-MAN EVA	1-MAN EVA	CONF L.O.
EMC/PCS																		
GROUND CAPABILITY																		
AUTO ATTITUDE CONTROL																		
SAFE DITCHING																		
UNRECT RES																		
BARRIS P. 1																		
BARRIS B																		
PDAs																		
TRC																		
ENC																		
EDS																		
CDC																		
PS																		
MS																		
OPTICS SAC																		
NO TALK BARRIS DOR CDR																		
TRC W/O LAMP																		
DSLR																		
TRC																		
NO TALK BARRIS DOR CDR																		
TRC W/O LAMP																		
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DSLR																		
TRC																		
NO TALK BARRIS DOR CDR																		
TRC W/O LAMP																		
DSLR																		
TRC																		

① 0 TO 400 FPS - 3 BARRIS - OTHERS...  
 470 TO 1000 FPS - 3 BARRIS  
 1000 TO 1000 - 3 BARRIS - OTHERS... 1000 FPS

② REQUIRES 3 BARRIS ATTITUDE CONTROL AND TRANSLATION TRANSFORMER LATERAL AXIS MAY BE DEGRADED

LEGEND: NO REQUIREMENT

LM TELMI GO CRITERIA  
10/31/69

GO/NO-GO ITEM	UNDOCK	DHI		POWERED DESCENT				LUNAR STAY			RENDEZVOUS LM ACTIVE		DOCKING
		DOI	CONT DOI	PDI	PDI TO PDI +5	PDI+5 TO LO GATE	LO GATE TO T/D	STAY W/O EVA	2-MAN EVA	1-MAN EVA	CSI/CDM	TPU/TPF	
PYRO													
1. PYRO SYSTEMS	BOTH			BOTH									
ELECTRICAL													
1. CDR AND LMP BUS	BOTH			BOTH									1 OF 2
DC FEEDERS	BOTH			BOTH		BOTH							1 OF 2
2. FEEDERS	BOTH			BOTH									1 OF 2
3. BATTERIES	BOTH			BOTH									1 OF 2
4. INVERTERS	1 OF 2			1 OF 2									
5. AC BUSES	BUS A			BUS A OR B									
ENVIRONMENTAL													
1. SUIT/CABIN INTEGRITY	SUIT AND CABIN			SUIT AND CABIN			SUIT	SUIT AND CABIN					
2. SUIT FANS	BOTH			1 OF 2				BOTH					
3. O <sub>2</sub> DEMAND RECS	1 OF 2			1 OF 2						1 OF 2 (4)			
4. H <sub>2</sub> O SEPARATORS AND LCG COOLANT LOOP	BOTH H <sub>2</sub> O SEPS OR 1 OF 2 H <sub>2</sub> O SEPARATORS + LCG			BOTH H <sub>2</sub> O SEPS OR 1 OF 2 H <sub>2</sub> O SEPARATORS + LCG				BOTH H <sub>2</sub> O SEPS OR 1 OF 2 H <sub>2</sub> O SEPS + LCG					
5. O <sub>2</sub> TANKS	DESCENT: ANY ASCENT: 2 OF 3			ANY				DESCENT					
6. COOLANT LOOPS	PRIMARY: BOTH SECONDARY		6	BOTH				BOTH					1 OF 2
7. H <sub>2</sub> O FEED PATHS	PRIMARY		6	PRIMARY				PRIMARY					PR OR SEC
8. H <sub>2</sub> O TANKS	DESCENT: DES ASCENT: BOTH					ANY		DES					1 OF 2
9. NO FIRE, SMOKE OR REVCOP IN SUIT OR CABIN			6	BOTH		2 OF 3		BOTH					

87-4

- ① DURING POWERED DESCENT WHEN TIME IS NOT AVAILABLE TO TROUBLESHOOT, A SHORT ON EITHER AN ASCENT OR DESCENT FEEDER WILL BE CONSIDERED LOSS OF A BUS AND THUS REQUIRE AN ABORT.
- ② A SHORTED DC FEEDER WILL ALWAYS BE REASON FOR ABORTING THE LANDING MISSION. ONE OPEN DESCENT FEEDER WILL NOT BE REASON FOR ABORTING THE LANDING MISSION; HOWEVER, A NEXT BEST L/D IS REQUIRED.
- ③ FUNCTIONAL CAPABILITY ONLY - SEE RED LINES FOR CONSUMABLES REQUIREMENTS.
- ④ ASSUMES CREWMAN IN LM OPERATING ON I.M ECS.
- ⑤ RESERVED.
- ⑥ PERFORM DIRECT RETURN.
- ⑦ THE TWO REMAINING DESCENT BATTERIES MUST FEED SEPARATE BUSES DURING LUNAR STAY ONLY.

LEGEND: XXXX RETAIN DESCENT STAGE ALAP  
XXXX NO REQUIREMENT

LM CONTROL GO CRITERIA  
10/31/99

GROUND ITEM	UNDOING		DESCENT ORBIT		POWERED DESCENT				LUNAR STAY			PWRZ LM ACTIVE		BOOKING
	DRY	CONT QUA	PM	PM PM	PM 25 TO	PM 25 TO	PM 25 TO	PM 25 TO	STAY	STAY	STAY	CS/COR	SPY TTY	
GNC														
1. PGR					PM 25 TO									
2. AFS	AGV (C)	AGV (C)			AGS (C)									
3. 3 AXIS AUTO ATT CNTR	REBNT (C)	REBNT (C)	PMGR		RENT (C)									
4. 3 AXIS CONTROL	ALBNT	ALBNT	3 AXIS		ALBNT									
5. ACA	1 ACA	1 ACA			1 ACA									
6. 3 AXIS TRANSLATION	3 AXIS TRAN	3 AXIS TRAN			3 AXIS TRAN									
7. ITGA	1 ITGA	1 ITGA			1 ITGA									
8. FOAM ATTITUDE SENSOR	FOAM ATT	FOAM ATT			FOAM ATT									
9. THROTTLE RESPONSE 100 SEC														
10. WPT 400/500 FT TWR	ONE	ONE												
11. WPT TRANSPONDER	DR	DR												
12. ADT	ADT (C)													
13. LR	LR	LR			LR									
14. DPT AUTO ON														
15. REDUNDANT ASC ENG GAUGE														
16. PITCH AND ROLL GMA TERM														
17. MAIN THROTTLE														
18. AUTO THROTT	AUTO (C)	AUTO (C)			AUTO (C)									
DPS														
1. FV OR INLET	400	200/250			400/125									
2. FV OR AP	400	200			400									
3. PROP TEMP 400-450					400									
4. PROP AT					400									
5. PROP QTY FLOW LLVLL/PH														
6. SHE ALTR. PWRZ 0-20														
7. VENT WITHIN 0 MIN														
8. FV OR PWRZ 20-40														
9. 30% EROSION EXCEEDED														
DPA														
1. NO PROXIME LEAKS														
2. FV OR INLET PWRZ 20-40 AND 4-20														
3. FV OR AP (EITHER HIGH) 400														
4. PROPELLANT TEMP 400-450														
5. PROP AT 400														
DPC														
1. NO PROP LEAKS														
2. FV OR INLET PWRZ 20-40 AND 4-20														
3. PROP TEMP (EITHER) 400-450														
4. 3 AXIS ATT CNTR GAINH 170														
5. 3 AXIS TRANSLATION														
6. NO IMPINGEMENT LIMITS EXCEEDED														

- ADT REQUIRED UNTIL PWRZ IS ADJUSTED
- MANUALLY FOLLOW GMA TURBID METER IF POSSIBLE
- CONSIDERATION WILL BE GIVEN TO CONTINUING BASED UPON THE FAILURE MODE
- CONSIDERATION WILL BE GIVEN TO CONTINUING BASED UPON NORMAL TRAJECTORY AND CUESAGE

① DPS WILL EVALUATE CAPABILITY TO LAND WITH RESPECT TO PROPELLANT REMAINING

LEAKS: [ ] NO REQUIREMENT



COMMUNICATIONS/INSTRUMENTATION GO CRITERIA  
10/31/69

GO/NO-GO ITEM	EARTH ORBIT		TLC		LUNAR ORBIT			UNDOCKING	DOI		POWERED DESCENT				LUNAR STAY			RENDEZVOUS		LUNAR ORBIT	
	CONT BOOST	CONT E.O.	TLI	TD&E	CONT TLC	LOI	CONT LON	CONT L.O.	NOMINAL MISSION	DOI	CONT DOI	POI	POI TO POI +5	POI+5 TO LO GATE	LO GATE TO T/D	STAY W/D EVA	2-MAN EVA	1-MAN EVA	CSU/DSN	TRV/TVV	CONT L.O.
USB 2-WAY VOICE COMM		①	CSM			CSM		CSM	CSM AND LM			CSM AND LM	②	②		CSM	③	④	④		CSM
VHF COMM LM/CSM									SIMPLEX OR DUPLEX												
VHF COMM LM/EVA																STOP AT THIS POINT	DUPLEX				
VHF COMM EVA/EVA																DUPLEX					
NSP/EVA VOICE																STRIVE CREWMAN					
CRITICAL INSTRUMENTATION		CSM				CSM		CSM	LM AND CSM			LM			LM AND CSM			LM			CSM
LM TELEMETRY									LM			LM	④	④		LM					
CSM TELEMETRY		HBR OR LBR				HBR OR LBR			HBR OR LBR							HBR OR LBR					HBR OR LBR
CSM SCE			SCE			SCE															

- ① VHF IS ACCEPTABLE
- ② CSM RELAY TO LM IS ACCEPTABLE
- ③ LM RELAY TO CSM IS ACCEPTABLE
- ④ ADEQUATE DATA TO MAKE FINAL GO/NO GO TO CONTINUE POWERED DESCENT

LEGEND: [ ] NO REQUIREMENT

EMU GO CRITERIA

GO/NO-GO ITEM	UNDOCKING	DOI		POWERED DESCENT			LUNAR STAY ②			
		DOI	CONT DOI	PDI	PDI TO PDI +5	PDI+5 TO LO GATE	LO GATE TO T/D	STAY W/O EVA	2-MAN EVA	1-MAN EVA
CRITICAL INSTRUMENTATION									← EMU →	
LCC/LTL COOLING									2 OF 2	1 OF 2
PRIMARY O <sub>2</sub> SUPPLY(S)	← ① →								2 OF 2	1 OF 2
PLSS O <sub>2</sub> PRESSURE REG(S)									2 OF 2	1 OF 2
PLSS FANS)									2 OF 2	1 OF 2
PLSS BATTERY(S)									2 OF 2	1 OF 2
EMU PRESSURE INTEGRITY									2 OF 2	1 OF 2
OPS O <sub>2</sub> BOTTLE(S)	← ① →								2 OF 2	1 OF 2
OPS PRESSURE REG(S)									2 OF 2	1 OF 2

3-21

① NOMINALLY BOTH OPS'S SOURCE PRESSURES WILL BE CHECKED OUT PRIOR TO UNDOCKING - SHOULD ONE OPS SOURCE PRESSURE FAIL TO MEET THE OPS GO/NO-GO CRITERIA AS DEFINED IN RULE 3-103, A CHECK OF POS PRESSURE WILL BE MADE ON A PLSS TO FULFILL THE RQMT FOR TWO LIFE-SUPPORT UNITS

② SUFFICIENT PLSS AND/OR OPS CONSUMABLES WILL BE RETAINED AT LM LIFTOFF TO SUPPORT A 30 MINUTE CEVA

LEGEND:  NO REQUIREMENT

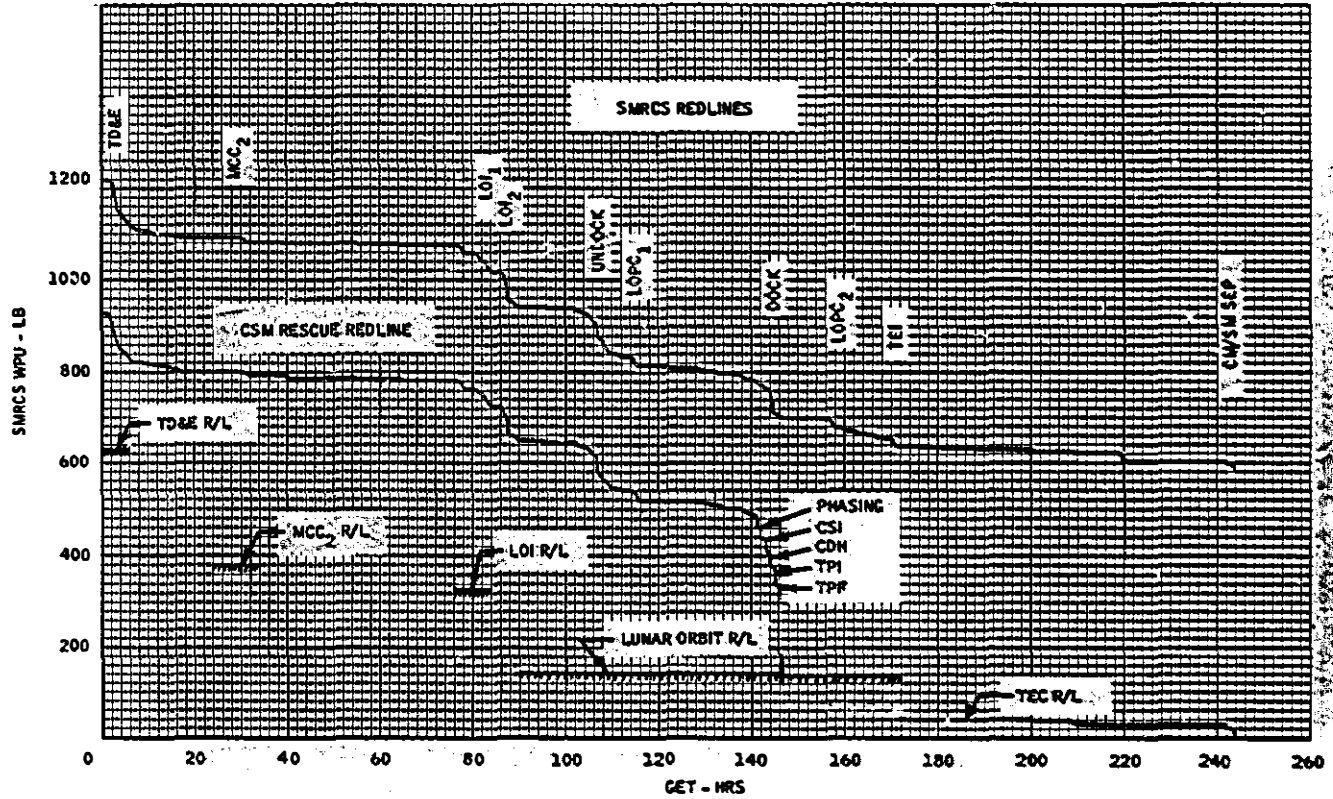
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MISSION RULES

SECTION 2 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM					
<u>CONSUMABLES</u>						
3-90	SPB	<p>A. AFTER TDSE AND THE FIRST DOCKED SPB MCC, THE DELTA V REQUIRED TO CONTINUE WITH A LUNAR MISSION IS 9500 FPS (CSM UNDOCKED CAPABILITY).</p> <p>B. THE DELTA V REQUIRED FOR LOI 60 IS 6013 (FUNCTION OF LAUNCH DAY AND LAUNCH AZ) +190 FPS (LOI2, DOCKED) +2940 FPS (TEI AND TEC MCC'S).</p> <p>C. THE DELTA V REQUIRED FOR 60 FOR UNDOCKING IS 4038 FPS. THIS DELTA V INCLUDES---</p> <p>700 FPS: LM RESCUE</p> <p>375 FPS: LOPCI</p> <p>2000 FPS: TEI (APPROXIMATELY 70 HR RETURN)</p> <p>100 FPS: S SIGMA MCC BASED ON RCS CONTROLLED TEI</p> <p>+533 FPS</p>				
3-91	SM RCS	<p>A. THE CSM RESCUE REDLINE AT EARTH LAUNCH IS 932 LB. THE REDLINE INCLUDES NOMINAL USAGE UP TO LM JETTISON, NOMINAL TEI AND TEC USAGE, AND FULL CSM RESCUE CAPABILITY (INCLUDING FOUR 11-SECOND ULLAGES AND CSM BRAKING), RCS MIDCOURSE CORRECTIONS AND THE CSM SMO PHOTOGRAPHY USAGE ARE NOT INCLUDED IN THE RESCUE REDLINE.</p> <p>THE RESCUE REDLINE IS ALSO A LINE OF GO/NO GO POINTS FOR THE NOMINAL MISSION (E.G., UNDOCKING GO/NO GO BASED ON RCS PROPELLANT IS THE RESCUE REDLINE VALUE AT THE GET OF UNDOCKING).</p> <p>B. THE REDLINE FOR TDSE IS 630 LB. AND IS CONSISTENT WITH A CSM ONLY LUNAR ORBIT MISSION (C PRIME RCS BUDGET).</p> <p>C. THE SMRCS PROPELLANT REQUIRED AT MCC2 TO COMMIT TO THE HYBRID TRAJECTORY IS 380 LB. THIS REDLINE INCLUDES---</p> <p>330 LB. LOI REDLINE</p> <p>50 LB. NOMINAL USAGE, MCC2 TO LOI</p> <p>D. THE SMRCS PROPELLANT REQUIRED FOR LOI COMMITMENT IS 330 LB. THIS REDLINE INCLUDES---</p> <p>145 LB. LUNAR ORBIT REDLINE</p> <p>135 LB. FIRST DAY DOCKED LUNAR ORBIT ACTIVITIES</p> <p>50 LB. 1 DAY CSM SMO PHOTOGRAPHY</p> <p>E. VIOLATION OF THE LUNAR ORBIT REDLINE WILL RESULT IN TERMINATION OF LUNAR ORBIT ACTIVITIES. PRIOR TO LM JETTISON, THE LUNAR ORBIT REDLINE IS 145 LB. AND INCLUDES---</p> <p>80 LB. LM SEP. 2 REVS LUNAR ORBIT, TEI ULLAGE, NOMINAL TEC USAGE</p> <p>65 LB. 20 FPS TSMC (BASED ON 20 GPH TEI CUTOFF)</p> <p>AFTER LM JETTISON, THE LUNAR ORBIT REDLINE IS 135 LB. AND INCLUDES THE ABOVE ALLOWANCES LESS LM SEP.</p> <p>F. THE TEC REDLINE IS THE MINIMUM RCS QUANTITY TO INSURE SAFE RETURN. RCS MIDCOURSES ARE NOT INCLUDED IN THE REDLINE. AT TEI CUTOFF, THE REDLINE VALUE IS 45 LB.</p> <p>RULE NUMBERS 3-92 AND 3-93 ARE RESERVED.</p>				
MISSION	REV	DATE	SECTION	GROUP	PAGE	
APOLLO 12	A	10/15/69	MISSION RULE SUMMARY	CONSUMABLES	3-22	

EE-4



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MISSION RULES

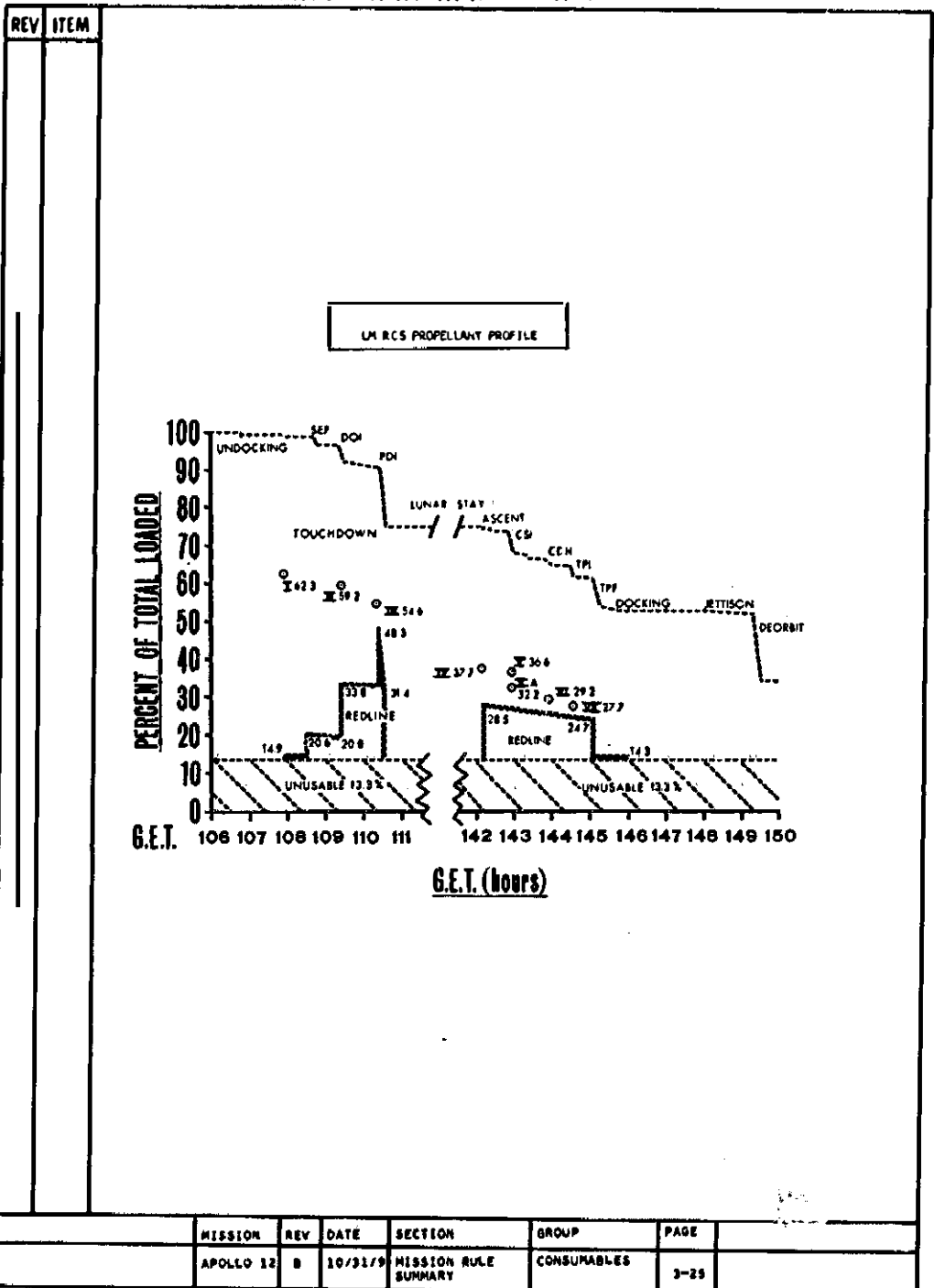
SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM																									
3-96	<p>COM BATTERY ENERGY AND CRYOGENIC O2 AND H2</p> <p>THE FOLLOWING MINIMUM USABLE ENERGY/QUANTITIES MUST BE AVAILABLE TO INITIATE THE SPECIFIC PHASES:</p> <table border="1"> <thead> <tr> <th></th> <th>LAUNCH</th> <th>LOI</th> <th>UNDOCK</th> <th>TPC-2</th> </tr> </thead> <tbody> <tr> <td>BATT AMP-HOURS REMAINING</td> <td>** 86.2</td> <td>79.4</td> <td>60.7</td> <td>55.2</td> </tr> <tr> <td></td> <td>*** 59.1</td> <td>65.0</td> <td>42.8</td> <td>41.0</td> </tr> <tr> <td>O2 (PERCENT EACH TANK)</td> <td>84.3</td> <td>60.0</td> <td>52.9</td> <td>56.2</td> </tr> <tr> <td>H2 (PERCENT EACH TANK)</td> <td>91.1</td> <td>63.8</td> <td>55.1</td> <td>50.4</td> </tr> </tbody> </table> <p>**BATTERY AMP HOURS NECESSARY TO PERFORM NOMINAL MISSION WITHOUT BATTERY CHARGER.</p> <p>***ENERGY REQUIREMENT IN TWO LOWEST BATTERIES.</p> <p>BATTERY RED LINES ARE BASED ON FAILURE OF THE BATTERY CHARGER PRIOR TO ACCOMPLISHING ANY BATTERY CHARGING. THESE REDLINES ALLOW COMPLETION OF NOMINAL MISSION WITH FULL ENTRY AND POST LANDING CAPABILITY WITH THREE BATTERIES WITH POWER DOWN OF ECS RADIATORS HEATERS OVERLOAD SENSING AT THE OCCURRENCE OF LOSS OF THE BATTERY CHARGER. THE REDLINES FOR LOI AND UNDOCKING ALLOW FOR A SUBSEQUENT LOSS OF AN ENTRY BATTERY WITH EARLY TEI, POWERED DOWN 60% ENTRY, AND 12 HOURS POSTLANDING TIME.</p> <p>CRYOGENIC REDLINES ARE BASED ON CAPABILITY TO PERFORM NOMINAL MISSION WITH CAPABILITY TO RETURN TO EARTH WITH A 60 AMP AVERAGE POWER LEVEL AFTER LOSS OF ONE CRYO TANK AT NOMINAL TEI -12 HOURS (WORST CASE TIME FOR FAILURE).</p> <p>RULES 3-95 AND 3-96 ARE RESERVED.</p>		LAUNCH	LOI	UNDOCK	TPC-2	BATT AMP-HOURS REMAINING	** 86.2	79.4	60.7	55.2		*** 59.1	65.0	42.8	41.0	O2 (PERCENT EACH TANK)	84.3	60.0	52.9	56.2	H2 (PERCENT EACH TANK)	91.1	63.8	55.1	50.4
	LAUNCH	LOI	UNDOCK	TPC-2																						
BATT AMP-HOURS REMAINING	** 86.2	79.4	60.7	55.2																						
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H2 (PERCENT EACH TANK)	91.1	63.8	55.1	50.4																						
MISSION	REV	DATE	SECTION	GROUP	PAGE																					
APOLLO 12	A	10/15/79	MISSION RULE SUMMARY	CONSUMABLES	3-24																					

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MISSION RULES

SECTION 3 - MISSION RULE SUMMARY - CONTINUED



MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	B	10/31/79	MISSION RULE SUMMARY	CONSUMABLES	3-25

NASA - Manned Spacecraft Center  
MISSION RULES  
SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM						
3-97	LM-RCS PROPELLANT GO/NO-GO'S AND REDLINES						
	A. ASSUMPTIONS						
	1. TOTAL LOADED 633 LBS EQUAL 100 PERCENT UNUSABLE						
	TRAPPED PROPELLANT	7.3 PERCENT					
	GROUND GAGING UNCERTAINTY	6.0 PERCENT					
	TOTAL UNUSABLE	13.3 PERCENT					
	2. OPS RESERVE						
	(A) PRIOR TO TPF - ONE REV LOS TRACKING OF CSM (STAGED) EQUAL 2.5 PERCENT						
	(B) AFTER TPF - CSM ACTIVE DOCKING EQUAL 2.0 PERCENT						
	B. GO/NO-GO'S						
	1. UNDOCKING/SEPARATION---						
	I. PROPELLANT REQUIRED FOR UNDOCKING, DOI, DESCENT, ASCENT AND RENDEZVOUS PLUS OPS RESERVE.						
	2. DOI						
	II. PROPELLANT REQUIRED FOR DOI, DESCENT, ASCENT AND RENDEZVOUS PLUS OPS RESERVE.						
	3. PDI						
	III. PROPELLANT REQUIRED FOR DESCENT, ASCENT AND RENDEZVOUS PLUS OPS RESERVE.						
	4. IMMEDIATELY AFTER ASCENT						
	IV. PROPELLANT REQUIRED FOR NOMINAL LM ACTIVE RNDZ PLUS OPS RESERVE.						
	5. CSI						
	V. PROPELLANT REQUIRED FOR REMAINDER OF RNDZ PLUS OPS RESERVE.						
	V.A. PROPELLANT FOR CSI, LOS TO TPI, TPI, BRAKING, DOCKING PLUS OPS RESERVE.						
	6. COH						
	VI. PROPELLANT REQUIRED FOR REMAINDER OF RNDZ PLUS OPS RESERVE.						
	7. TPI						
	VII. PROPELLANT REQUIRED FOR REMAINDER OF RENDEZVOUS PLUS OPS RESERVE.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	8	10/31/79	MISSION RULE SUMMARY	CONSUMABLES	3-26

# NASA - Manned Spacecraft Center

## MISSION RULES

### SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM															
3-97	CONT.	<p>C. REGLINES</p> <p>1. UNDOCKING TO SEP PROPELLANT REQUIRED FOR NOMINAL DOCKING PLUS OPS RESERVE</p> <p>2. SEP TO DOI PROPELLANT REQUIRED FOR REMAINDER OF MINI FOOTBALL; DOCKING PLUS OPS RESERVE.</p> <p>3. DOI TO PDI PROPELLANT REQUIRED FOR LOS IN LONGEST ABORT RNDZ WITH OPS ATTACHED UNTIL JUST BEFORE TPI (P-20 MAXIMUM DEADBAND); STAGING; BRAKING; DOCKING PLUS OPS RESERVE.</p> <p>4. PDI TO TOUCHDOWN PROPELLANT REQUIRED FOR DESCENT; NOM ASCENT; LONGEST LOS FOR CSM RESCUE (P-20 MAXIMUM DEADBAND); BRAKING; DOCKING PLUS OPS RESERVE.</p> <p>5. INSERTION TO TPF PROPELLANT REQUIRED FOR LOS TO TPF; BRAKING; DOCKING; PLUS OPS RESERVE. NOTE RCS REQUIRED DECREASES WITH LESS LOS UNTIL TPF.</p> <p>6. TPI TO DOCKING PROPELLANT REQUIRED FOR OPS RESERVE.</p>														
3-98	LN OPS	<p>THE NOMINAL OPS PROPELLANT MARGIN IS APPROXIMATELY 10691.5 LBS. THERE ARE NO REGLINES OR GO/NO-GO'S PLANNED.</p>														
3-99	LN APS	<p>THE NOMINAL APS PROPELLANT MARGIN AT INSERTION IS APPROXIMATELY 319.6 LBS. THERE ARE NO REGLINES OR GO/NO-GO'S PLANNED.</p> <p>RULE NUMBERS 3-100 AND 3-101 ARE RESERVED.</p>														
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">MISSION</th> <th style="width: 5%;">REV</th> <th style="width: 10%;">DATE</th> <th style="width: 25%;">SECTION</th> <th style="width: 15%;">GROUP</th> <th style="width: 10%;">PAGE</th> <th></th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>B</td> <td>10/31/69</td> <td>MISSION RULE SUMMARY</td> <td>CONSUMABLES</td> <td>3-27</td> <td></td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE		APOLLO 12	B	10/31/69	MISSION RULE SUMMARY	CONSUMABLES	3-27	
MISSION	REV	DATE	SECTION	GROUP	PAGE											
APOLLO 12	B	10/31/69	MISSION RULE SUMMARY	CONSUMABLES	3-27											



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM	
	3-102	<p>LM EPS, ECS</p> <p>THE LM EPS AND ECS MINIMUM CONSUMABLE REQUIREMENTS ARE DEFINED AS FOLLOWS--</p> <p>A. FROM UNDOCKING TO TOUCHDOWN, THE MINIMUM REQUIREMENTS ARE BASED ON THE TIME TO COMPLETE A LANDING, A TWO-HOUR STAY, ASCENT AND A NOMINAL (FIVE-HOUR) RENDEZVOUS THROUGH CREW TRANSFER, A TWO HOUR ORBITAL CONTINGENCY AND REDUNDANT ASCENT SOURCES FOR THE RENDEZVOUS.</p> <p>THE TIME TO COMPLETE A LANDING AND THE TWO-HOUR LUNAR STAY MAY BE SUPPORTED BY ANY COMBINATION OF DESCENT AND ASCENT CONSUMABLES. IN ADDITION, EACH ASCENT BATTERY, H<sub>2</sub>O TANK AND ONE ASCENT O<sub>2</sub> TANK (THE LM CABIN IS CONSIDERED A REDUNDANT O<sub>2</sub> SOURCE) MUST CONTAIN THE CONSUMABLES REQUIRED FOR SPLITOFF AND NOMINAL RENDEZVOUS THROUGH CREW TRANSFER; THE TWO-HOUR ORBITAL CONTINGENCY, INSPAR AS ASCENT O<sub>2</sub>, H<sub>2</sub>O AND ELECTRICAL POWER ARE CONCERNED, IS CONSIDERED TO BE SATISFIED BY THE REDUNDANCY REQUIREMENT.</p> <p>HOWEVER, FOR THE FIRST CSM REVOLUTION AFTER TOUCHDOWN, THE MINIMUM REQUIREMENTS SHALL PROVIDE FOR A TS SPLITOFF, NOMINAL INSERTION AND CSM RESCUE CAPABILITY.</p> <p>B. FOR THE REMAINDER OF THE LUNAR STAY, THE MINIMUM DESCENT STAGE REQUIREMENTS ARE BASED ON THOSE CONSUMABLES REQUIRED FOR THE SCHEDULED ACTIVITIES DURING EACH DEFINED PHASE: AN ASCENT PREPARATION AND A TWO-HOUR SURFACE RESERVE; THE LAST FOUR HOURS OF THIS REQUIREMENT FOR EPS MUST BE SPLIT-BUS OPERATION; ASCENT STAGE MINIMUM REQUIREMENTS ARE AS STATED ABOVE.</p> <p>C. FOR THE RENDEZVOUS, THE MINIMUM REQUIREMENTS ARE THOSE CONSUMABLES NECESSARY TO SUPPORT A LM-ACTIVE RENDEZVOUS THROUGH CREW TRANSFER; SHOULD THESE MINIMUM REQUIREMENTS BE VIOLATED, THE LM WILL BE POWERED DOWN WHILE THE CSM BECOMES THE ACTIVE VEHICLE; HOWEVER, THE LM WILL BE POWERED UP TO PERFORM BRAKING-- SUFFICIENT CONSUMABLES BEING RETAINED FOR THIS PURPOSE.</p>

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	PML	9/18/69	MISSION RULE SUMMARY	CONSUMABLES	3-20

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 2 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM	GO/NO GO			STAY/NO STAY		
		UNDOCK	DOI	POI	LUNAR STAY		
		ROM 111	ROM	ROM	71 AND 72 (S)	ROM 121	ROM 122
		WITH	WITH	WITH	WITH	WITH	WITH
		2-HR	2-HR	2-HR	18.75-HR	24.0-HR	30.0-HR
		STAY	STAY	STAY	STAY	EVA	EVA'S
	ASC O2 (LBS EITHER TANK)	1.5	1.0	1.5	1.5	1.5	1.5
	PLUS						
	ASC/DES O2 (LBS)	1.75	1.1	.01	0.0	21.2	32.5
	ASC H2O (LBS EACH TANK)	20	20	20	131	20	20
	PLUS						
	ASC/DES H2O (LBS)	31	27	10	131	94	118
	ASC AMP HRS (EACH BAT)	240	240	240	131	223	220
	PLUS						
	ASC/DES AMP HOURS	229	151	104	131	220	201

(1) ROM = REMAINDER OF MISSION

(2) APPLIED AT 13:00 MIN; 1.0: TOTAL SURFACE STAY TIMES ARE 19.75; 25.0 AND 31.5 HOURS.

(3) LM IS "STAY" IF SUFFICIENT ASCENT/DESCENT H2O AND ELECTRICAL POWER ARE AVAILABLE TO PROVIDE A 72 LIFTOFF NOMINAL INSERTION & ESM RESCUE CAPABILITY AS A MINIMUM. LM IS "STAY" EVEN IF ALL TANKS O2 IS LOST.

GENERAL NOTE

VALUES IN TABLE ARE THE REQUIRED USABLE AMOUNTS; UNUSABLES ARE--

	O2	H2O	A-H
ASC	1.75	2.00	11
DES	1.01	16.0	10

(PER TANK OR BATTERY FOR A FOUR DESCENT/TWO ASCENT BATTERY CONFIGURATION)

MISSION	REV	DATE	SECTION	GROW	PAGE
APOLLO 12	0	10/31/69	MISSION RULE SUMMARY	CONSUMABLES	3-10

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM							
	S-209	<p>E/V</p> <p>PLSS AMP HRS, O<sub>2</sub>, LiOH, &amp; H<sub>2</sub>O REDLINES</p> <p>A. NOMINAL EVA-THE PLSS AMP-HRS, O<sub>2</sub>, LiOH, AND H<sub>2</sub>O REDLINES FOR EACH OF THE NOMINAL EVA'S ARE DEFINED IN TWO CATEGORIES---</p> <ol style="list-style-type: none"> <li>1. THOSE VALUES REQUIRED FOR TWO MAN EVA TERMINATION AND SAFE RETURN TO A PRESSURIZED LM CABIN PLUS THE VALUES REQUIRED FOR 30 MINUTES OF POST-EVA RESERVE.</li> <li>2. THOSE VALUES REQUIRED FOR TWO MAN EVA TERMINATION; TRANSFER OF ONE SRC; AND SAFE RETURN TO A PRESSURIZED LM CABIN PLUS 30 MINUTES OF POST-EVA RESERVE.</li> </ol> <p>B. ALTERNATE EVA- THE PLSS AMP-HOURS, O<sub>2</sub>, LiOH, AND H<sub>2</sub>O REDLINES FOR THE ALTERNATE EVA'S ARE DEFINED IN TWO CATEGORIES---</p> <ol style="list-style-type: none"> <li>1. THOSE VALUES REQUIRED FOR ONE MAN EVA TERMINATION AND SAFE RETURN TO A PRESSURIZED LM CABIN PLUS THE VALUES REQUIRED FOR 30 MINUTES OF POST-EVA RESERVE.</li> <li>2. THOSE VALUES REQUIRED FOR ONE MAN EVA TERMINATION; TRANSFER OF ONE SRC; AND SAFE RETURN TO A PRESSURIZED LM CABIN PLUS 30 MINUTES OF POST-EVA RESERVE.</li> </ol>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 12	A	10/10/69	MISSION RULE SUMMARY	COMBINATION	3-30	

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM																																							
	3-103 CONT.																																							
	<p>C. PLS AMP-HRS, O<sub>2</sub>, LIQ AND H<sub>2</sub>O GO/NO-GO'S ARE DEFINED AS THOSE VALUES REQUIRED TO COMPLETE THE EVA (NOMINAL OR ALTERNATE) PLUS THE VALUES REQUIRED FOR 30 MINUTES OF POST-EVA RESERVE.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3">GO/NO-GO'S</th> </tr> <tr> <th></th> <th>EVA NO. 1</th> <th>EVA NO. 2</th> </tr> <tr> <th></th> <th>3HR 30MIN</th> <th>3HR 30MIN</th> </tr> </thead> <tbody> <tr> <td colspan="3">COR</td> </tr> <tr> <td>PO<sub>2</sub> (PSIA)</td> <td>696</td> <td>916</td> </tr> <tr> <td>H<sub>2</sub>O (LBS)</td> <td>6.36</td> <td>6.46</td> </tr> <tr> <td>AMP-HRS</td> <td>13.6</td> <td>13.6</td> </tr> <tr> <td>LIQ (BTU'S)</td> <td>4001</td> <td>3996</td> </tr> <tr> <td colspan="3">LMP</td> </tr> <tr> <td>PO<sub>2</sub> (PSIA)</td> <td>663</td> <td>662</td> </tr> <tr> <td>H<sub>2</sub>O (LBS)</td> <td>6.13</td> <td>6.13</td> </tr> <tr> <td>AMP-HRS</td> <td>13.6</td> <td>13.6</td> </tr> <tr> <td>LIQ (BTU'S)</td> <td>4235</td> <td>3970</td> </tr> </tbody> </table>	GO/NO-GO'S				EVA NO. 1	EVA NO. 2		3HR 30MIN	3HR 30MIN	COR			PO <sub>2</sub> (PSIA)	696	916	H <sub>2</sub> O (LBS)	6.36	6.46	AMP-HRS	13.6	13.6	LIQ (BTU'S)	4001	3996	LMP			PO <sub>2</sub> (PSIA)	663	662	H <sub>2</sub> O (LBS)	6.13	6.13	AMP-HRS	13.6	13.6	LIQ (BTU'S)	4235	3970
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MISSION   REV   DATE   SECTION   GROUP   PAGE																																								
APOLLO 12   0   10/51/70   MISSION RULE SUMMARY   CONSUMABLES   3-31																																								

NASA - Manned Spacecraft Center

MISSION RULES  
SECTION 3 MISSION RULE SUMMARY

REV ITEM

3-103  
CONT.

D. OPS O<sub>2</sub>, PLSS O<sub>2</sub>, H<sub>2</sub>O AND AMP-HRS GO/NO-GO'S ARE DEFINED AS THOSE VALUES REQUIRED TO COMPLETE A 30-MINUTE CEVA.

CEVA GO/NO-GO TABLE		
OPS	ACTIVATED	4000 PSIA/4.8 LBS
	UNACTIVATED	3300 PSIA/3.6 LBS
PLSS	POS	422 PSIA/0.5 LBS
	H <sub>2</sub> O	1.7 LBS
	BAT	4.8 AMP-HRS

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	PA6	9/18/69	MISSION RULE SUMMARY	CONSUMABLES	3-92

**4 GROUND  
INSTRUMENTATION  
REQUIREMENTS**

**NASA - Manned Spacecraft Center**  
**MISSION RULES**  
**SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS**

REV	ITEM													
4-1		<p><b>GENERAL</b></p> <p>A. THE FOLLOWING PRELAUNCH REQUIREMENTS DEFINE THE MCC/MSPN REQUIREMENTS WHICH MUST BE MET BEFORE A "GO" IS GIVEN FOR LAUNCH.</p> <p>B. WHEN A SPECIFIC HARDWARE ITEM OR OPERATIONAL CAPABILITY IS DEFINED AS A MANDATORY ITEM, THE HARDWARE AND/OR SOFTWARE INTERFACE REQUIRED TO PROVIDE THE MANDATORY FUNCTIONS OF THAT HARDWARE ITEM OR OPERATIONAL CAPABILITY ARE TO ASSUME A MANDATORY STATUS ALSO.</p> <p>C. WHERE REDUNDANCY EXISTS FOR MANDATORY ITEMS, A BACKUP CAPABILITY IS CONSIDERED HIGHLY DESIRABLE.</p> <p style="text-align: center;">NOTE</p> <p style="text-align: center;">THE VARIOUS EQUIPMENT LISTINGS IN THIS SECTION ARE TO BE UTILIZED AS A GUIDE ONLY. IT IS MANDATORY, PRIOR TO COMMITTING THE MISSION TO LAUNCH, TO BE ABLE TO---</p> <p>A. RECEIVE AND DISPLAY TELEMETRY AND TRACKING DATA.</p> <p>B. MAINTAIN VOICE COMMUNICATIONS WITH THE CREW.</p>												
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 10%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>1</td> <td>9/18/69</td> <td>GROUND INSTR. REQUIREMENTS</td> <td>GENERAL</td> <td>4-1</td> </tr> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	1	9/18/69	GROUND INSTR. REQUIREMENTS	GENERAL	4-1
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	1	9/18/69	GROUND INSTR. REQUIREMENTS	GENERAL	4-1									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS												
	4-2	TELEMETRY															
		A. CONSOLE DISPLAY (D/TV, EVENTS, ANALOGS)	PRELAUNCH	MANDATORY	A: FOR DISPLAY OF MANDATORY S/V PARAMETERS.												
		B. PCH GROUND STATIONS (4)	PRELAUNCH	1 OF 4 MANDATORY; 1 HIGHLY DESIRABLE	B: FOR DISPLAY OF MANDATORY S.V EVENTS AND ANALOGS.												
		C. RECORDING AND PLAYBACK ALDS MSFN	PRELAUNCH	BOTH DESIRABLE													
		D. PM - GROUND STATION	PRELAUNCH	HIGHLY DESIRABLE													
	4-3	COMMAND															
		A. MOCA TOGGLE SWITCHES (BOTH A AND B)			A: FOR LAUNCH PHASE ABORT REQUEST												
		1. BSE ABORT REQUEST	PRELAUNCH	HIGHLY DESIRABLE													
		2. PIDO ABORT REQUEST	PRELAUNCH	HIGHLY DESIRABLE													
		3. PD ABORT REQUEST	PRELAUNCH	HIGHLY DESIRABLE													
		B. COMMAND PANELS--- INCO; BUDD; BSE; TELCOM; CONTROL; CCATS	PRELAUNCH	HIGHLY DESIRABLE													
		C. MOCA CONSOLE/SITE SELECT CAPABILITY															
		1. PTE CONSOLE (CCATS)	PRELAUNCH	HIGHLY DESIRABLE													
		2. CCATS CMD CONSOLE MED															
		D. PC/MOD SWITCHING CAPABILITY															
		1. CCATS	PRELAUNCH	HIGHLY DESIRABLE													
		2. CCATS CMD MED															
	4-4	TRAJECTORY															
		A. TRAJECTORY DATA PROCESSING			A: THE TRAJECTORY DATA SOURCES ARE UTILIZED AS FOLLOWS---												
		1. AVAILABILITY OF ONE INDEPENDENT TRACKING SOURCE (1PR; USQ) FROM LIFTOFF TO T + 10 MINUTES.	PRELAUNCH	1 MANDATORY	1: (A) INDEPENDENT VERIFICATION OF S/V NAVIGATION; 1B) PROTECTION AGAINST VIOLATION OF LAUNCH ENVELOPE.												
		2. 2V AND CMC TR VECTORS FROM LIFTOFF TO INSERTION PLUS 60 SECONDS.	PRELAUNCH	BOTH MANDATORY	2:2: REQUIRED FOR ORBIT 80/NO-80												
		B. RTCC - DATA SELECT CAPABILITY	PRELAUNCH	MANDATORY	B: TO SELECT BEST AVAILABLE DATA SOURCE.												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>0</td> <td>10/31/79</td> <td>GROUND INSTRUMENTATION REQUIREMENTS</td> <td>RCC</td> <td>4-2</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	0	10/31/79	GROUND INSTRUMENTATION REQUIREMENTS	RCC	4-2
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	0	10/31/79	GROUND INSTRUMENTATION REQUIREMENTS	RCC	4-2												



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS												
	4-5	COMMUNICATIONS															
		A: MOCR---															
		APD CONF LOOP FD LOOP	PRELAUNCH	1 OF 2 MANDATORY	FOR MISSION CONTROL												
		MOCR DYN MOCR SYS 1 & 2 A/B 1 LOOP A/B 2 LOOP	PRELAUNCH	ALL HIGHLY DESIRABLE													
		B: MCC/LAUNCH COMPLEX---															
		111 CLTC 111 CVTS 212 M5TC	PRELAUNCH	1 OF 1 MANDATORY	FOR TERMINAL COUNT COORDINATION OF MCC-PAD ACTIVITIES												
		C: MCC/R50---															
		FD LINE TO R50 R50 PRIVATE LINE CAPE 111 R50 LOOP	PRELAUNCH	1 OF 3 MANDATORY	FOR TRAJECTORY VERIFICATION AND BOOSTER BAPING												
		D: MISCELLANEOUS---															
		BSE 3M MONITOR LOOP CIP/USB LOOP	PRELAUNCH	DESIRABLE	USED FOR MONITORING SPACE VEHICLES SUBSYSTEM CHECKOUT												
		E: MCC/REMOTE SITES---															
		ONE A/B PATH VIA 83PC	PRELAUNCH	MANDATORY	USED FOR COMMUNICATION WITH CREW												
	4-6	COMPUTER															
		A: MOC 118M 360/751	PRELAUNCH	MANDATORY	TO PROCESS MANDATORY S/V PARAMETERS AND TRAJECTORY DATA												
		B: DBC 118M 360/751	PRELAUNCH	HIGHLY DESIRABLE	AN DBC 118M 360/751 IS AVAILABLE AS BACKUP TO THE MOC OR DBC												
		C: CCATS (UNIVAC 496) - ONLINE	PRELAUNCH	1 MANDATORY AND 1 HIGHLY DESIRABLE	TO THROUGH PROCESS MANDATORY S/V PARAMETERS TO MOC												
		CCATS (UNIVAC 496) - STANDBY	PRELAUNCH	1 HIGHLY DESIRABLE	PRELAUNCH IF PREDICTIONS FOR MODE 1 ABORTS												
		D: RTACP - 2	PRELAUNCH	1 HIGHLY DESIRABLE	PRELAUNCH IF PREDICTIONS FOR MODE 1 ABORTS												
	4-7	TIMING SITE (3)	PRELAUNCH	1 MANDATORY	MCC TIMING STANDARD TO SUPPORT MANDATORY RTCC/CCATS COMPUTERS												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APC110 12</td> <td>PNL</td> <td>9/10/69</td> <td>GROUND INSTR REQUIREMENTS</td> <td>MCC</td> <td>4-3</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APC110 12	PNL	9/10/69	GROUND INSTR REQUIREMENTS	MCC	4-3
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APC110 12	PNL	9/10/69	GROUND INSTR REQUIREMENTS	MCC	4-3												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 6 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS		
	4-8	MCC POWER					
	A. BUS A1		PRELAUNCH	MANDATORY	UNINTERRUPTABLE POWER FOR D/TV CONVERTERS		
	B. BUS A2		PRELAUNCH	MANDATORY	UNINTERRUPTABLE POWER FOR D/TV DATA DISTRIBUTORS AND VSM		
	C. BUS B1		PRELAUNCH	HIGHLY DESIRABLE	20 SECONDS INTERRUPTABLE POWER FOR THE FOLLOWING HIGHLY DESIRABLE ITEMS--- <ul style="list-style-type: none"> <li>- FLT DYN SSR CONSOLES AND PLOTBOARDS</li> <li>- RTCC CONSOLES (EXCEPT COMP SUP)</li> <li>- RTACF</li> <li>- PDSDD</li> <li>- CMCC</li> <li>- STV</li> </ul>		
	D. BUS B2		PRELAUNCH	MANDATORY	20 SECONDS INTERRUPTABLE POWER FOR MCC AND SSR CONSOLES		
	4-9	DISPLAY					
	A. MCC D/TV CHANNELS		PRELAUNCH	10 OF 36 MANDATORY	FOR DISPLAY OF MANDATORY S/V PARAMETERS		
	POSITION	NO. OF CHANNELS					
	RETRO	1					
	GUIDO	1					
	ECCOM	1					
	RTCC	1					
	BOOSTER	4					
	B. TRAJECTORY DISPLAY						
	1. PDD LAUNCH DIGITALS		PRELAUNCH	MANDATORY ON D/TV	FOR CONTINGENCY ORBIT INSERTION MANEUVER DATA AND TFP LIMITS.		
	2. GAMMA VS V		PRELAUNCH	MANDATORY ON 1 OF 4--- (A) 10 X 20 SCRIBER PLOTTER (B) D/TV (C) RTCC PLOTBOARD (D) SSR PLOTBOARD	MONITOR FOR GAMMA III AND IV MANEUVER DATA.		
	3. RPD LAUNCH DIGITALS		PRELAUNCH	MANDATORY ON D/TV	MONITOR FOR GAMMA III AND IV MANEUVER DATA.		
	4. GAMMA/III VS V/III		PRELAUNCH	MANDATORY ON 1 OF 1--- (A) D/TV (B) SSR PLOTBOARD	MONITOR FOR G-LIMIT VIOLATION.		
	MISSION		REV	DATE	SECTION	GROUP	PAGE
	APOLLO 13		FNL	9/10/69	GROUND INSTR REQUIREMENTS	MCC	6-8

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CVES/NOTES/COMMENTS		
	4-9 CONT						
	5.	PHI VS LAMBDA	PRELAUNCH	HIGHLY DESIRABLE ON 1 OF 2---  PLOTBOARD (A) RTCC (B) SAR PLOTBOARD	MONITOR FOR CROSS-RANGE LIMITS		
	6.	T(FF) VS R(EP)	PRELAUNCH	HIGHLY DESIRABLE ON 1 OF 2---  (A) D/TV (B) SAR PLOTBOARD	MONITOR FOR ABORT MODES 11; 11E; AND 1B.		
	7.	M VS 0	PRELAUNCH	HIGHLY DESIRABLE ON 10 X 20 SCRIBER PLOTTER			
	8.	SAMM(1) VS V(1) (CMC DYNAMIC STATUS)	PRELAUNCH	HIGHLY DESIRABLE ON 10 X 10 SCRIBER PLOTTER	MONITOR FOR L/V AND S/C NAVIGATION PERFORMANCE (GUIDANCE SYSTEM ANALYSIS - COMPARES CMC WITH TRACKING).		
	9.	WEDGE ANGLE MONITOR	PRELAUNCH	HIGHLY DESIRABLE ON D/TV	MONITOR FOR L/V AND S/C NAVIGATION PERFORMANCE		
	10.	GUIDO ANALOG CHART RECORDERS ONE AND TWO	PRELAUNCH	HIGHLY DESIRABLE ON D/TV			
	11.	INERTION/INJECTION DIGITALS	PRELAUNCH	MANDATORY ON D/TV	FOR 06N 00/NO-00		
	C.	ADES CHANNELS 90-93	PRELAUNCH	HIGHLY DESIRABLE	FOR DBC DISPLAYS		
	D.	VSM	PRELAUNCH	MANDATORY	FOR D/TV		
	E.	AUX VSM	PRELAUNCH	HIGHLY DESIRABLE			
	F.	SIDPHORS (S)	PRELAUNCH	2 HIGHLY DESIRABLE			
<p>NOTE-- INDIVIDUAL FLIGHT CONTROLLERS WILL BE RESPONSIBLE FOR REPORTING LOSS OF DISPLAY CAPABILITY OF MANDATORY PARAMETERS TO THE FLIGHT DIRECTOR.</p>							
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	1	10/31/79	GROUND INSTR REQUIREMENTS	MCC	4-9

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS		
	4-10	GSFC					
		A. GSFC UNIVAC - 494 (2) COMMUNICATIONS PROCESSOR	PRELAUNCH	1 MANDATORY	A. ONE UNIVAC - 494 CAN PERFORM ALL NECESSARY FUNCTIONS; THE SECOND ONE IS BACKUP.		
		B. WBO (50.0 Kbps) LINES (2) BETWEEN MCC AND GSFC	PRELAUNCH	1 MANDATORY	B. EITHER LINE CAN BE SWITCHED TO EITHER UNIVAC - 494.		
		C. TV CHANNELS BETWEEN MCC AND GSFC			C. VTS PROVIDES TWO REDUNDANT 16 CIRCUIT TV CHANNELS.		
		1. OUTGOING	PRELAUNCH	1 OF 32 CIRCUITS HIGHLY DESIRABLE	1. FOR ACO MSG. LS CMD		
		2. INCOMING (2)	PRELAUNCH	1 OF 32 CIRCUITS MANDATORY	2. FOR RECEPTION OF LOWSPEED PADAR DATA.		
	4-11	RSC					
		TELEMETRY---					
		A. VHF TM FROM THE FOLLOWING FOR S-11, S-1V, AND S-2---			A. THESE ANTENNAS CAN BE SWITCHED TO MILA OR CIP FACILITIES		
		1. CIP ANTENNA	PRELAUNCH	1 HIGHLY DESIRABLE			
		2. MILA VHF ANTENNA					
		B. USB TM FROM THE FOLLOWING---			B. USB IS THE CSM'S ONLY SOURCE OF DATA.		
		1. MILA USB	PRELAUNCH	1 MANDATORY			
		2. CIP USB					
		COMMAND---					
		THIS CAPABILITY IS DEFINED UNDER GSFC/RSC/MSPN COMMAND RULE 4-12 FOR LAUNCH COVERAGE.					
		TRACKING---					
		THIS CAPABILITY REQUIRED TO SATISFY RULE 4-9 (TRAJECTORY) IS MANDATORY.					
		VOICE COMMUNICATIONS---					
		THIS RSC CAPABILITY IS DEFINED UNDER MCC RULE 4-5 (COMMUNICATIONS).					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 17	PNL	8/18/64	GROUND INSTR. REQUIREMENTS	GSFC/RSC/SPN	4-8

# NASA - Manned Spacecraft Center

## MISSION RULES

### SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	CONDITION/HALF FUNCTION	PHASE	RUSING	CUES/NOTES/COMMENTS
	4-12	LAUNCH COVERAGE			
		KSC/MSFN SITES (SITES NOT LISTED DUE TO VARIABLE LAUNCH AZIMUTH) MUST PROVIDE THE FOLLOWING CAPABILITIES FROM LIFTOFF THROUGH S-IVB CUTOFF PLUS 60 SECONDS. REFER TO DECISION MATRIX RULE 4-10 AND FIGURES 4-3 THROUGH 4-51 TO DETERMINE CAPABILITY.			
		A. CHD			
		CCB	*PRELAUNCH	HIGHLY DESIRABLE	
		B. TELEMETRY			
		S-1C (VHF)	*PRELAUNCH	HIGHLY DESIRABLE	S-1C DATA IS ONLY HIGHLY DESIRABLE SINCE THE MCC IS NOT PRIME FOR REQUESTING AN ABORT FOR S-1C MALFUNCTIONS.
		S-11 (VHF)	*PRELAUNCH	HIGHLY DESIRABLE FROM LIFTOFF TO S-11 CUTOFF (APPROX: 8 + 38 SEC)	FOR ABORT CUES FROM MCC
		S-IVB VHF (CP-11)	*PRELAUNCH	HIGHLY DESIRABLE	
		IU CCS (DP-18)	*PRELAUNCH	MANDATORY	FOR BULKHEAD DELTA P AFTER S/C SEP
		IU VHF (DP-11)		HIGHLY DESIRABLE	
		CSM (USB)	*PRELAUNCH	MANDATORY FROM LIFTOFF THROUGH S-IVB CUTOFF PLUS 60 SEC.	FOR ABORT CUES FROM MCC
		C. TRACKING			
		THAT CAPABILITY REQUIRED TO SATISFY RULE 4-4 (TRAJECTORY) IS MANDATORY			
		D. A/G COMMUNICATIONS			
		1. MILA VHF USB	*PRELAUNCH	1 OF 2 MANDATORY	
		2. MSFN VHF USB	*PRELAUNCH	1 OF 2 MANDATORY	

**NASA - Manned Spacecraft Center  
MISSION RULES**

**SECTION 6 GROUND INSTRUMENTATION REQUIREMENTS**

REV	ITEM	CONDITION/MALFUNCTION <sup>1</sup>	PHASE	RULING	CUES/NOTES/COMMENTS		
	4-13	GENERAL ORBITAL COVERAGE					
		IT IS REQUIRED THE MSPFN HAVE THE CAPABILITY OF PROVIDING THE MCC MINIMUM MISSION CONTROL SUPPORT LISTED BELOW (IF TWO MSPFN USB SITES PER REVOLUTION THROUGH REVOLUTION 3:					
	A. CMD						
	CCS		PRELAUNCH	HIGHLY DESIRABLE			
	CSM USB		PRELAUNCH	HIGHLY DESIRABLE			
	B. TELEMETRY						
	S-IVB VHF (CP-3)		PRELAUNCH	HIGHLY DESIRABLE			
	LV CCS (OP-18)		PRELAUNCH	1 OF 2 MANDATORY	DOWNLINKS REQUIRED TO RECOVER S-IVB DATA.		
	LV VHF (OP-3)						
	CSM USB		PRELAUNCH	MANDATORY			
	C. TRACK						
	C-BAND		PRELAUNCH	HIGHLY DESIRABLE			
	USB		PRELAUNCH	MANDATORY			
	D. A/G COMMUNICATIONS						
	VHF		PRELAUNCH	1 OF 2 MANDATORY	USB MANDATORY AT LEAST ONE STATION PRIOR TO TLI TO CONFIRM ONBOARD CSM VHF A/G CAPABILITY.		
	USB		PRELAUNCH				
	4-14	POST S/C SEPARATION					
		IT IS MANDATORY THAT 1 SITE PROVIDE THE FOLLOWING CAPABILITIES---					
	A. TLM - CCS		PRELAUNCH	MANDATORY	A. TO PROVIDE TLM FOR DETERMINING S-IVB STATUS BEYOND VHF RANGE.		
	B. CMD - CCS		PRELAUNCH	MANDATORY	B. TO PROVIDE CORRECTIVE COMMAND CAPABILITY FOR S-IVB BULKHEAD DELTA PROBLEMS.		
					C. BOTH OF THE ABOVE ARE REQUIRED TO INSURE CREW SAFETY AND LM EXTRACTION.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	A	10/3/79	GROUND INSTR. REQUIREMENTS	GSFC/KSC/MSPFN	4-8

# NASA - Manned Spacecraft Center

## MISSION RULES

### SECTION 6 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS
4-15		HSE, GDS, MAD			
		IT IS MANDATORY 2 OF 3 OF THESE SITES PROVIDE THE FOLLOWING CAPABILITIES---			
	A.	TM USB	PRELAUNCH	MANDATORY	A <sub>2</sub> TO COVER TRANSLUNAR COAST AND LPO <sub>2</sub>
	B.	TRACK USB	PRELAUNCH	MANDATORY	
	C.	VOICE USB	PRELAUNCH	MANDATORY	
	D.	CPD USB	PRELAUNCH	HIGHLY DESIRABLE	
4-16		SEISMETER NETWORK SITES	PRELAUNCH		
	A.	SEMA		HIGHLY DESIRABLE	
	B.	CRD CVI		1 OF 2 HIGHLY DESIRABLE	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	6	10/31/79	GROUND INSTR. REQUIREMENTS	SSFC/KSC/HSPN	4-9

**NASA - Manned Spacecraft Center**  
**MISSION RULES**  
**SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS**

REV	ITEM	
4-17		<p><b>INTRODUCTION TO SITE FAILURE DECISION MATRIX (FIGURES 4-3)</b></p> <p>FOR PRELAUNCH FAILURES OF LAUNCH PHASE SITE CAPABILITY, THE FOLLOWING DECISION MATRIX APPLIES THE LAUNCH PHASE GROUND INSTRUMENTATION REQUIREMENTS TO THE RESULTING DEGRADED COVERAGE.</p> <p>THIS MATRIX POINTS OUT THE LOSS OF CONTINUOUS COVERAGE BETWEEN LIFTOFF AND INSERTION PLUS 60 SECONDS FOR VARIOUS SITE FAILURES. IF SITE FAILURES OCCUR PRIOR TO LAUNCH, THE MATRIX WILL BE USED TO DETERMINE WHETHER MANDATORY CONTINUOUS COVERAGE HAS BEEN LOST.</p> <p>(NOMINAL INSERTION IS 12 ± 40)</p> <p>TO USE THE MATRIX</p> <p>A. LOOK FOR AN X UNDER THE COLUMN FOR SITE WHERE THE FAILURE OCCURRED.</p> <p>B. GO ACROSS TO THE COLUMN FOR THE CAPABILITY THAT WAS LOST AND READ THE DECISION.</p> <p>C. THE COVERAGE THAT WAS LOST IS IN THE COLUMN LABELED "APPROXIMATE MANDATORY COVERAGE LOST".</p> <p>D. MORE THAN ONE X IN A ROW SPECIFIES A FAILURE OF THE SAME CAPABILITY AT MORE THAN ONE SITE.</p>
MISSION	REV	DATE
APOLLO 12	B	10/31/79
SECTION	GROUP	
GROUND INSTR. REQUIREMENTS	GSFC/KSC/MSFN	
	PAGE	
	4-10	



**NASA - Manned Spacecraft Center**  
**MISSION RULES**  
**SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS**

REV	ITEM	SITES FAILED				APPROXIMATE MANDATORY COVERAGE LOST FOR NO-GO ITEMS FOR ALL LAUNCH AZIMUTHS	CAPABILITY LOST			
		ALDS IN	MIL/CAPE	BOA	VAN		TELEMETRY	CMD	TRACK	A/S
		'00-00' TO '08-49'	'00-00' TO '04-49'	'04-10' TO '12-49'	'09-10' TO '16-05'		USB OR CCS AND VHF	USB AND CCS	BOTH B AND C BAND	USB AND VHF
	FAILURE	X				NONE SEE NOTE 1	GO	N/A	N/A	N/A
	FAILURE		X			00-00 TO 04-10 SEE NOTE 2	GO	GO	NO-GO	NO-GO
	FAILURE			X		08-49 TO 09-10 SEE NOTE 3	GO	GO	GO	GO
	FAILURE				X	NONE	GO	GO	GO	GO
	MULTIPLE FAILURE	X	X			00-00 TO 04-10	NO-GO	GO	NO-GO	NO-GO
	FAILURE		X	X		00-00 TO 09-10 SEE NOTE 2	GO	GO	NO-GO	NO-GO
	FAILURE		X		X	00-00 TO 04-10 SEE NOTE 2	GO	GO	NO-GO	NO-GO
	FAILURE			X	X	08-49 TO 16-05	NO-GO	GO	NO-GO	NO-GO
	FAILURE	X		X		08-49 TO 09-10 SEE NOTE 3	GO	GO	GO	GO
		X			X	NONE	GO	GO	GO	GO
		X	X	X		00-00 TO 09-10	NO-GO	GO	NO-GO	NO-GO

NOTES--

1. LOSS OF ALDS RESULTS IN LOSS OF S-IC TM; HOWEVER, IT IS NOT MANDATORY FOR LAUNCH.
2. GO ON TM BECAUSE OF ALDS DATA UNTILL 08-49.
3. LOSS OF COVERAGE IS NOT SEVERE ENOUGH FOR A NO-GO CONDTION.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	B	10/31/79	GROUND INSTR. REQUIREMENTS	SSFC/KSC/MSFN	4-11

**TRAJECTORY AND  
GUIDANCE**

NASA - Manned Spacecraft Center

MISSION RULES

SECTION B TRAJECTORY AND GUIDANCE

REV	ITEM												
9-1	<p>THE LAUNCH PHASE WILL BE TERMINATED FOR ANY OF THE FOLLOWING CONDITIONS---</p> <p>A. VIOLATION OF THE VEHICLE BREAKUP LINE.</p> <p>B. TFF IS LESS THAN OR EQUAL TO <math>1 + 40</math> AND DECREASING AFTER TOWER JETTISON.</p> <p>C. VIOLATION OF ENTRY "6G" LIMIT.</p> <p>D. VS INCREASING.</p> <p>E. OVERSPEED CONDITIONS AT INSERTION.</p> <p>F. VIOLATION OF EAST HEATING LINE.</p>												
9-2	<p>THE LES WILL NOT BE JETTISONED UNTIL MODE II CAPABILITY IS ESTABLISHED BY TFF IS GREATER THAN OR EQUAL TO <math>1 + 20</math> AND INCREASING.</p>												
9-3	<p>MODE II, III, IV, AND APOGEE KICK.</p> <p>A. THE GROUND IS PRIME FOR ABORT MODE DETERMINATION AND MODE III MANEUVER COMPUTATION. THE CREW WILL BE PRIME FOR MODE IV AND APOGEE KICK MANEUVERS.</p> <p>B. MANEUVERS WILL BE INTERRUPTED WHEN <math>TFF = 1 + 40</math> AND DECREASING.</p> <p>C. MODE IV MANEUVERS WILL BE INTERRUPTED IF THE CURRENT ALTITUDE IS 75 NM, DECREASING AND HP IS LESS THAN 300K FT.</p> <p>D. IF ENTERING, UTILIZE LEFT OF AVOID LAND. UNAVOIDABLE LAND LANDING USE RL 90 DEG.</p> <p>E. IF NO SLA SEP OR IF SPS FAILS---</p> <ol style="list-style-type: none"> <li>1. HP IS LESS THAN 40 - EXECUTE CM/SN SEP BY <math>TFF = 1 + 40</math>.</li> <li>2. HP IS BETWEEN 40 AND 75 - GROUND WILL DECIDE TO USE SN RCS ASAP OR AT APOGEE TO REDUCE HP TO 40 NM.</li> </ol>												
9-4	<p>MODE III ABORTS.</p> <p>A. PREDICTED TFF AFTER SPS C/O IS LESS THAN <math>1 + 40</math>.</p> <ol style="list-style-type: none"> <li>1. FULL LIFT IF ON WATER - DO NOT BURN.</li> <li>2. G&amp;N GO AND FULL LIFT IF ON LAND - BURN TO <math>TFF = 1 + 40</math>, RL 90 DEG.</li> <li>3. G&amp;N NO-GO AND FULL LIFT IF ON LAND - BURN A REDUCED DELTA V TO MAINTAIN TFF AFTER C/O AND RL 90 DEG.</li> </ol> <p>B. IF DELTA TB IS LESS THAN OR EQUAL TO 2 SEC, DO NOT BURN.</p> <p>C. IF IGNITION OCCURS AFTER SETJ +10 SEC, BURN UNTIL G&amp;N DELTA R = 0, RL 35 DEG. (IF UNABLE TO BURN DELTA R = 0, RL 90 DEG.)</p>												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/18/69</td> <td>TRAJECTORY AND GUIDANCE</td> <td>LAUNCH</td> <td>9-1</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	A	10/18/69	TRAJECTORY AND GUIDANCE	LAUNCH	9-1
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	A	10/18/69	TRAJECTORY AND GUIDANCE	LAUNCH	9-1								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 TRAJECTORY AND GUIDANCE

REV	ITEM				
1	<p>3-3 THE S/C CMC WILL BE NO-GO FOR ABORT MANEUVER DETERMINATION AND MONITORING FOR ANY OF THE FOLLOWING--</p> <ul style="list-style-type: none"> <li>A. CMC PROGRAM ALARMS-- 00212, 00214, 00217, 00421, 00777, 01107, 01301, 01407, 02777, 04777, 07777, 10777, 12777, 14777, 21103, 21206, 21210, 21302, 21501, 21503, 21504, 21201, 21202, 21209; ISSE NATIONAL FOR DEFINITIONS)</li> <li>B. RTCC AND CMC TFF DIFFERENCE OF GREATER THAN 60 DEG.</li> <li>C. CONFIRMED ERROR IN S/C PLATFORM VELOCITY COMPONENTS OF GREATER THAN 80 FPS IN X OR 100 FPS IN Z.</li> <li>D. CMC TRAJECTORY SOURCE INDICATES "180" OR "NO-GO" INCONSISTENT WITH BEST TRAJECTORY SOURCE(S) INDICATION.</li> </ul> <p>3-6 THE ORBIT IS "180" IF HP IS GREATER THAN OR EQUAL TO 75 NM.</p> <p>RULES 3-3 THROUGH 3-19 ARE RESERVED.</p>				
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	3	10/15/69	TRAJECTORY AND GUIDANCE	LAUNCH	3-2

NASA - Manned Spacecraft Center

MISSION RULES  
SECTION B TRAJECTORY AND GUIDANCE

REV	ITEM												
5-20	<p>EARTH ORBITAL ALTITUDE CONSTRAINTS---</p> <p>A. REAL-TIME MISSION PLANNING PERIGEE = 85 NM MINIMUM. MAXIMUM MP IS DETERMINED BY SM RCS AVAILABLE FOR HYBRID DEORBIT.</p> <p>B. CONTINGENCY PERIGEE = 75 NM MINIMUM (VIOLATIONS WILL BE CORRECTED ASAP) IF MP LESS THAN 75 NM AND MANEUVER TO RAISE MP IS NOT POSSIBLE---</p> <p>1. MP IS BETWEEN 60 AND 75 = EXECUTE SPS RETROGRADE ASAP UNTIL MP IS LESS THAN 60. IF 40 SPS, USE SM-RCS.</p> <p>2. MP IS LESS THAN 60 - CM/SM SEP - RETRO WILL RECOMMEND ENTRY PROFILE.</p>												
5-21	<p>THE CONTINGENCY SEPARATION MANEUVERS FOR THE G6N ARE---</p> <p>A. IMPENDING S-IVB OR UNMANNED LM EXPLOSION - 53 FPS SPS ASAP (7000 FT SEPARATION REQUIRED IN 200 SEC.)</p> <p>B. S-IVB ATTITUDE RATES IS GREATER THAN OR EQUAL TO 3 DEG/SEC - 5 FPS RCS ASAP.</p> <p>C. S-IVB YAW ATTITUDE GREATER THAN 45 DEG - 5 FPS RCS ASAP.</p> <p>D. G6N RETROFIRE REQUIRED WHILE ATTACHED TO THE S-IVB OR LM - SEPARATION 20 MINUTES PRIOR TO RETRO. 5 FPS RCS RETROGRADE WITH LINE ON HORIZON.</p>												
5-22	<p>S/C L/O TIME (SRR) WILL BE UPDATED WITH SRO L/O TIME IF THE TWO ARE DIFFERENT BY 10 SEC.</p>												
5-23	<p>TIME BETWEEN EPO RETROFIRE GETI AND 400K MUST BE GREATER THAN 9 MIN. IF NOT, RETARGET FOR NEXT PTP.</p>												
5-24	<p>DELETED</p>												
5-25	<p>PLANNED G6N AND SCS RETROFIRE MANEUVERS WILL BE UPDATED IF---</p> <p>A. THE COMPUTED RETROFIRE POSITION CHANGES BY GREATER THAN 0.5 DEG LONGITUDE PRIOR TO GETI -30 MIN.</p> <p>B. THE COMPUTED RETROFIRE POSITION CHANGES BY GREATER THAN 2 DEG LONGITUDE AFTER GETI -30 MIN.</p>												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/68</td> <td>TRAJECTORY AND GUIDANCE</td> <td>EARTH ORBIT AND TLI</td> <td>5-3</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/68	TRAJECTORY AND GUIDANCE	EARTH ORBIT AND TLI	5-3
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	FNL	9/10/68	TRAJECTORY AND GUIDANCE	EARTH ORBIT AND TLI	5-3								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION B TRAJECTORY AND GUIDANCE

REV	ITEM					
S-26	IF A GSN FAILURE IS DETECTED PRIOR TO RETROFIRE, CREW USES SCS DELTA V MODE WITH AN EMS ENTRY.					
S-27	<p>IF SPS FAILS AFTER EPD RETROFIRE IGNITION OR NO SLS SEP---</p> <p>A. HP IS GREATER THAN 75 NM - RETARGET FOR NEXT BEST PTP USING RCS.</p> <p>B. HP BETWEEN 60 AND 75 - PITCH UP TO LOCAL HORIZONTAL ATTITUDE AND BURN SM RCS USING FOLLOWING PRIORITIES---</p> <ol style="list-style-type: none"> <li>1. BURN HP TO PAO VALUE</li> <li>2. BURN MAXIMUM SM RCS DELTA V AVAILABLE</li> <li>3. BURN CM RCS TO HP = 40 NM IF SM RCS DELTA V NOT SUFFICIENT TO OBTAIN HP = 40 NM IF HP IS LESS THAN OR EQUAL TO 60 NM TERMINATE ALL THRUSTING AT TFF = 2 MIN.</li> </ol> <p>C. HP IS LESS THAN 60 NM - REMAIN IN RETRO ATTITUDE AND BURN SM RCS USING THE FOLLOWING PRIORITY---</p> <ol style="list-style-type: none"> <li>1. BURN DELTA V RESIDUALS.</li> <li>2. BURN MAXIMUM SM DELTA V AVAILABLE.</li> </ol>					
<p>NOTE</p> <p>THE S-IVB LOR DUMP CAPABILITY MAY BE USED TO SHAPE THE ORBIT FOR RETROFIRE MANEUVER OR TO REDUCE THE S-IVB WEIGHT TO OBTAIN MORE SM RCS DELTA V.</p>						
MISSION	REV	DATE	SECTION	GROUP	PAGE	
APOLLO 12	FNL	9/10/69	TRAJECTORY AND GUIDANCE	EARTH ORBIT AND TLE	3-4	

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 TRAJECTORY AND GUIDANCE

REV	ITEM
5-28	<p>THE GSN IS NO-80 FOR ENTRY IF---</p> <p>A. THE CMC VALUE OF DOWNRANGE ERROR (RP - RT) AT T2G DIFFERS GREATER THAN +/- 100 NM FROM GROUND VALUE OR IS GREATER THAN +/- 130 NM FROM BACKUP CHART VALUE; CREW FAILOVER TO EMA ENTRY AS FIRST PRIORITY OR GROUND BANK ANGLE AND RETRA AS SECOND PRIORITY.</p> <p>B. <math>\gamma</math> AND <math>\delta</math> AT 600K ARE OUTSIDE THE CORRIDOR; GROUND WILL PROVIDE ENTRY PROFILE.</p>
5-29	<p>BOOSTER NAVIGATION AND TARGET UPDATES FOR TLI---</p> <p>A. AN IU NAVIGATION UPDATE WILL BE PERFORMED FOR EITHER TLI OPPORTUNITY WHERE A SATURN ACCELEROMETER FAIL OCCURRED PRIOR TO EARTH-ORBIT INSERTION; THE UPDATE WILL BE TIMETAGGED PRIOR TO GET = 2 HR 21 MIN FOR THE FIRST OPPORTUNITY OR GET = 3 HR 49 MIN FOR THE SECOND OPPORTUNITY.</p> <p>B. IU ORBIT TARGET UPDATES WILL BE PERFORMED WHERE A SATURN GUIDANCE REFERENCE FAILURE HAS OCCURRED PRIOR TO TLI.</p>
5-30	<p>THE CMC STATE VECTOR WILL BE UPDATED PRIOR TO TLI WITH THE BEST MSFN VECTOR.</p>
5-31	<p>GUIDANCE SYSTEM REQUIREMENTS FOR TLI</p> <p>A. A PROPERLY OPERATING SPACECRAFT GSN (CMC, IMU, AND OSS) SYSTEM IS MANDATORY FOR TLI.</p> <p>B. SATURN GUIDANCE FAILURES</p> <ol style="list-style-type: none"> <li>FOR SATURN GUIDANCE REFERENCE FAILURES, TLI WILL BE PERFORMED USING MANUAL CONTROL AND CUTOFF TECHNIQUES.</li> <li>FOR SATURN ACCELEROMETER FAILURES, TLI WILL BE CONTROLLED BY THE IU COMPUTER AND CUTOFF MANUALLY BASED ON TOTAL INERTIAL VELOCITY FROM THE CMC.</li> </ol>
5-32	<p>THE MAXIMUM ALLOWABLE MISALIGNMENT RATES BETWEEN THE IU AND IMU ARE 0.6 DEG/HR (IU) AND 1.5 DEG/HR (IMU).</p>
5-33	<p>THE S/C L/O RESFMAT WILL BE USED FOR BOTH TLI OPPORTUNITIES.</p>
5-34	<p>DISPERSED TLI C/O---</p> <p>PREDICTED DELTA V CAPABILITY (CSM ALONE) AFTER TD6E AND DOCKED SPS MI0COURSE---</p> <p>A. GREATER THAN 5500 FPS - CONTINUE MISSION</p> <p>B. LESS THAN 5500 FPS - EXECUTE EARTH ORBIT ALTERNATE</p>

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	8	10/31/79	TRAJECTORY AND GUIDANCE	EARTH ORBIT AND TLI	3-5

NASA - Manned Spacecraft Center

MISSION RULES

SECTION B TRAJECTORY AND GUIDANCE

REV	ITEM												
9-35	<p>DIFFERENCE IN CMC AND TV PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION---</p> <p>A. VIOLATION OF ANY OF THE FOLLOWING MEANS TLI IS NO-GO---</p> <p>DELTA XDOT IS GREATER THAN +/- 36 FPS</p> <p>DELTA YDOT IS GREATER THAN +/- 33 FPS</p> <p>DELTA ZDOT IS GREATER THAN +/- 87 FPS</p> <p>DELTA V7 IS GREATER THAN +/- 34 FPS</p> <p>B. VIOLATION OF ANY OF THE FOLLOWING MEANS TLI IS TEMPORARILY NO-GO---</p> <p>DELTA XDOT IS BETWEEN +/- 7.3 AND +/- 38 FPS</p> <p>DELTA YDOT IS BETWEEN +/- 43 AND +/- 78 FPS</p> <p>DELTA ZDOT IS BETWEEN +/- 18 AND +/- 87 FPS</p> <p>DELTA V7 IS BETWEEN +/- 14 AND +/- 34 FPS</p> <p style="text-align: center;">NOTE</p> <p style="text-align: center;">TLI IS NO-GO UNTIL PARTS C AND 9-36 ARE DETERMINED (ORBITAL PARAMETER DECISIONS).</p> <p>C. VIOLATION OF ANY OF THE FOLLOWING ORBITAL DECISION PARAMETERS AT GET = 1 HR 45 MIN MEANS TLI IS NO-GO. PARAMETERS ARE TV VERSUS MSFN.</p> <p>SEMI-MAJOR AXIS IS GREATER THAN +/- 19,900 FT</p> <p>CROSSRANGE VELOCITY IS GREATER THAN +/- 32 FPS</p>												
9-36	<p>DIFFERENCE IN MSFN AND TV DOWNRANGE POSITION (DELTA RV) IS GREATER THAN +/- 105,100 FT AT GET = 56 MIN MEANS TLI IS NO-GO.</p>												
9-37	<p>WITH AN 8-IVB GUID REF FAIL OR AN 8-IVS ACCELEROMETER FAIL DURING LAUNCH PHASE, VIOLATION OF ANY OF THE FOLLOWING ORBITAL DECISION PARAMETERS MEANS TLI IS NO GO. PARAMETERS ARE CMC VERSUS MSFN.</p> <p>A. DIFFERENCE IN DOWNRANGE POSITION IS GREATER THAN +/- 335,900 FEET AT GET = 56 MIN.</p> <p>B. DIFFERENCE IN SEMI MAJOR AXIS IS GREATER THAN +/- 11.6 N. MI AT GET = 1 HR 45 MIN.</p> <p>C. DIFFERENCE IN CROSSRANGE VELOCITY IS GREATER THAN +/- 78.7 FPS AT GET = 1 HR 45 MIN.</p> <p>RULES 9-38 THROUGH 9-45 ARE RESERVED.</p>												
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NASA - Manned Spacecraft Center

MISSION RULES  
SECTION B TRAJECTORY AND GUIDANCE

REV	ITEM																																												
3-46	<p>THE CMC OR LGC WILL BE TEMPORARILY NO-GO FOR MANEUVER CONTROL FOR ANY OF THE FOLLOWING---</p> <p>A. COMPUTER PROGRAM ALARMS--- 00212, 00214, 00217, 00421, 00777, 01107, 01901, 01407, 03777, 04777, 07777, 10777, 12777, 14777, 21103, 21206, 21210, 21322, 21901, 21902, 31104, 31201, 31202, 31203. (SEE NATIONAL FOR DEFINITIONS).</p> <p>B. CMC/SMU ALIGNMENT DISCREPANCY (FOR MANEUVER EXECUTION, MONITORING, AND ORBIT DETERMINATION):</p> <ol style="list-style-type: none"> <li>1. SEXTANT STAR CHECK--- AUTO OPTICS POSITIONING DOES NOT PLACE SELECTED STAR IN FIELD OF VISION OF SXT.</li> <li>2. HORIZON CHECK ERROR IS GREATER THAN 4 DEG FOR RETROFIRE FROM EPO.</li> </ol> <p>C. LGC/SMU ALIGNMENT DISCREPANCY INDICATE BY GREATER THAN 2 DEG FROM PREDICTED COAS COORDINATES.</p> <p>D. DIFFERENCE BETWEEN CMC/LGC GROUND NAV CHECK AFTER A NAV UPDATE FROM GROUND IS---</p> <ol style="list-style-type: none"> <li>1. LATITUDE IS GREATER THAN .02 DEG.</li> <li>2. LONGITUDE IS GREATER THAN .02 DEG.</li> <li>3. H IS GREATER THAN .2 NM.</li> </ol>																																												
3-47	<p>SPACECRAFT TIMING MUST BE MAINTAINED WITHIN THE LIMITS---</p> <table border="1"> <thead> <tr> <th></th> <th>CMC (SECI)</th> <th>LGC (SECI)</th> <th>ASS (SECI)</th> </tr> </thead> <tbody> <tr> <td>A. RETROFIRE</td> <td>2</td> <td>*****</td> <td>*****</td> </tr> <tr> <td>B. ENTRY</td> <td>2</td> <td>*****</td> <td>*****</td> </tr> <tr> <td>C. FLI</td> <td>2</td> <td>*****</td> <td>*****</td> </tr> <tr> <td>D. MCC'S</td> <td>2</td> <td>*****</td> <td>*****</td> </tr> <tr> <td>E. LOI</td> <td>2</td> <td>2</td> <td>*****</td> </tr> <tr> <td>F. TFI</td> <td>2</td> <td>2</td> <td>*****</td> </tr> <tr> <td>G. DESCENT</td> <td>.5</td> <td>.5</td> <td>.5</td> </tr> <tr> <td>H. ASCENT</td> <td>.5</td> <td>.5</td> <td>.5</td> </tr> <tr> <td>I. RENDEZVOUS</td> <td>.5</td> <td>.5</td> <td>.5</td> </tr> <tr> <td>J. SAT TRACKING</td> <td>.5</td> <td>*****</td> <td>*****</td> </tr> </tbody> </table> <p>RULES 3-48 THRU 3-53 ARE RESERVED.</p>		CMC (SECI)	LGC (SECI)	ASS (SECI)	A. RETROFIRE	2	*****	*****	B. ENTRY	2	*****	*****	C. FLI	2	*****	*****	D. MCC'S	2	*****	*****	E. LOI	2	2	*****	F. TFI	2	2	*****	G. DESCENT	.5	.5	.5	H. ASCENT	.5	.5	.5	I. RENDEZVOUS	.5	.5	.5	J. SAT TRACKING	.5	*****	*****
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MISSION RULES

SECTION 3 TRAJECTORY AND GUIDANCE

REV	ITEM													
1	3-54	<p>MIDCOURSE CORRECTION NOMINAL EXECUTION POINTS WILL BE AT THE FOLLOWING---</p> <ul style="list-style-type: none"> <li>A. TLE C/O +9 HRS.</li> <li>B. TLE C/O +20 HRS.</li> <li>C. LOI -22 HRS.</li> <li>D. LOIS -5 HRS.</li> </ul>												
	3-57	<p>TRANS-LUNAR MCC EXECUTION CRITERIA</p> <ul style="list-style-type: none"> <li>A. SPB MCC'S SHOULD BE GREATER THAN 3 SEC.</li> <li>B. MCC 2 AND 4 ARE PREFERRED EXECUTION POINTS.</li> <li>C. CONSIDERING THE ABOVE, FIRST MIDCOURSE WILL BE DELAYED UNTIL MCC 2 IF COST IS NOT PROHIBITIVE.</li> <li>D. IF THE NOMINAL MISSION DESIGN IS FREE RETURN, A NON-FREE MCC 2 OF 3 SEC SPB WILL BE EXECUTED TO AVOID MCC 3 WHEN FEASIBLE.</li> <li>E. FOR A NOMINAL HYBRID MISSION, THE MANEUVER TO GO NON-FREE RETURN WILL BE EXECUTED AT MCC 2.</li> </ul>												
	3-58	<p>THE GBN WILL BE THE PRIMARY MODE OF EXECUTING TRANS-LUNAR MCC.</p> <p>RULE 3-59 IS RESERVED.</p>												
	3-60	<p>LOI SHALL BE TARGETED WITHIN THESE CONSTRAINTS---</p> <ul style="list-style-type: none"> <li>A. NP IS BETWEEN 30 AND 35 NAUTICAL MILES (LUNAR PARKING ORBIT).</li> <li>B. THE PERICENTHION OF THE APPROACH HYPERBOLA WILL BE MAINTAINED WITHIN 30 AND 75 N.M.</li> <li>C. THE ALTITUDE OF THE NODE (BETWEEN THE APPROACH HYPERBOLA AND THE DESIRED LPO) WILL BE MAINTAINED BETWEEN 30 AND 75 N.M.</li> </ul>												
	3-61	<p>A 1:0311 FOR LOI REQUIRES THE FOLLOWING---</p> <ul style="list-style-type: none"> <li>A. COMMITMENT TO LEAST 4 HRS IN LPO - (PROVIDES ONE REV OF TRACK AFTER LOI FOR CALCULATION OF TILT).</li> <li>B. ADEQUATE FUEL REMAINING FOR SUBSEQUENT LUNAR ORBIT OPERATIONS (MINIMUM WOULD BE LOI2 AND LOI3).</li> </ul>												
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APOLLO 12	A	10/13/79	TRAJECTORY AND GUIDANCE	TRANS-LUNAR COAST	3-2									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 TRAJECTORY AND GUIDANCE

REV	ITEM												
3-62	<p>PREMATURE LOI SHUTDOWN (SPS PROBLEMS)</p> <p>A. FREE RETURN TRAJECTORY:</p> <ol style="list-style-type: none"> <li>1. SHUTDOWN IN MODE I REGION (LOI IGN. TO LOI IGN. + 1+30) - EXECUTE AN SPS 15 MIN. DIRECT ABORT OR A DPS 2-HR. DIRECT ABORT.</li> <li>2. SHUTDOWN IN MODE II REGION (LOI IGN. + 1+30 TO LOI IGN. + 3+00) - EXECUTE AN SPS 15-MIN. DIRECT ABORT OR A DPS TWO IMPULSE CIRCUMLUNAR ABORT.</li> <li>3. SHUTDOWN IN MODE III REGION (LOI IGN. + 3+00 TO C/O) - EXECUTE TSI (SPS OR DPS) AT NEAR PERICENTHIAN OR INITIATE AN ALTERNATE MISSION.</li> </ol> <p>B. HYBRID TRAJECTORIES:</p> <ol style="list-style-type: none"> <li>1. PREMATURE LOI SHUTDOWN AND SPS WITHIN SYSTEMS LIMITS; RESTART SPS TO COMPLETE LOI.</li> <li>2. PREMATURE LOI SHUTDOWN AND SPS OUT OF SYSTEMS LIMITS; ABORT AS FOLLOWS---                     <ol style="list-style-type: none"> <li>(A) NOMINAL ABORT REGIONS:                             <ol style="list-style-type: none"> <li>(1) MODE I = 0 TO 650 FPS (APPROX 0 TO 1+30)</li> <li>(2) MODE II = 650 TO 1270 FPS (APPROX 1+30 TO 2+30)</li> <li>(3) MODE III = 1270 TO COMPLETION (APPROX 2+30 TO C/O)</li> </ol>                             (NOTE--- ABORTS FROM LOI IGN. + 00 SEC TO LOI IGN. + 2+24, REQUIRES THE SPS OR APS IN ADDITION TO THE DPS)                         </li> <li>(B) SHUTDOWN IN MODE I - EXECUTE A DPS DIRECT ABORT AT LOI IGN. + 30 MIN. (BASED ON CREW CHART); AN SPS/APS BURN AT DPS + 2 HRS (GROUND COMPUTED) REQUIRED FOR ABORTS AFTER LOI IGN. + 60 SEC; (ABORTS PRIOR TO LOI IGN. + 20 SEC MAY BE PERFORMED AT 2 HRS WITH THE DPS)</li> <li>(C) SHUTDOWN IN MODE II - EXECUTE A DPS TWO-IMPULSE CIRCUMLUNAR ABORT (FIRST IMPULSE AT LOI IGN. PLUS 2 HRS; AN SPS/APS BURN IS REQUIRED TO COMPLETE SECOND IMPULSE FOR ABORTS PRIOR TO LOI IGN. + 2+24, TALL MANEUVERS GROUND COMPUTED).</li> <li>(D) SHUTDOWN IN MODE III - EXECUTE TSI (SPS OR SPS) AT NEAR OPPORTUNITY OR INITIATE AN ALTERNATE MISSION.</li> </ol> <p style="text-align: center;">NOTE</p> <ol style="list-style-type: none"> <li>1. MODE I SPS SYSTEMS LIMITS ALLOW SPS RESTART.</li> <li>2. MODE II SPS SYSTEMS LIMITS DO NOT ALLOW SPS RESTART.</li> </ol> </li> </ol>												
3-65	<p>IF THE SPS FAILS AT IGNITION---</p> <ol style="list-style-type: none"> <li>A. MCC = RESCHEDULE MCC FOR FLYBY TRAJECTORY WITH DPS/SM-REB EXECUTION.</li> <li>B. LOI1 = EXECUTE MCCS ABORT MANEUVER WITH DPS/SM-REB.</li> <li>C. LOI2 = EXECUTE GROUND COMPUTED TSI WITH DPS AS SOON AS PRACTICAL.</li> </ol> <p>RULES 3-64 THROUGH 3-75 ARE RESERVED.</p>												
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APOLLO 13	0	10/31/70	TRAJECTORY AND GUIDANCE	TRANS-LUNAR COAST	3-9								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 TRAJECTORY AND GUIDANCE

REV	ITEM				
3-76	THE LOI2 MANEUVER WILL BE TARGETED TO MINIMIZE THE LLS MISS DISTANCE AND TO ACHIEVE A 80 NM CIRCULAR ORBIT AT RENDEZVOUS.				
3-77	A "GO" FOR LOI2 REQUIRES COMMITMENT TO AT LEAST 4 HRS IN LUNAR ORBIT. NOTE--- THIS PROVIDES ONE FULL REV OF TRACK AFTER LOI2 FOR CALCULATION OF TET.				
RULES 3-78 THROUGH 3-83 ARE RESERVED.					
MISSION	REV	DATE	SECTION	GROUP	PAGE
AROLLO 12	P46	8/10/69	TRAJECTORY GUIDANCE	LUNAR ORBIT	3-18

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM												
5-81	PRIOR TO UNDOCKING, THE MAXIMUM ALLOWABLE MISS DISTANCE OVER THE LLS IS 0.5 DEG OUT OF PLANE AND +/- 2 DEG IN AZIMUTH. ADDITIONAL MANEUVERS WILL BE SCHEDULED, AS NEEDED, BETWEEN LOI2 AND UNDOCKING TO CORRECT DISPERSIONS.												
5-82	AN UPDATE TO THE LLS WILL BE PROVIDED THE CREW DURING PDI TO CORRECT ANY DOWNRANGE ERRORS THAT HAVE ACCUMULATED IN THE LGC ESTIMATE OF POSITION PROVIDING THIS UPDATE IS NO LESS THAN 2000 FT. NOR MORE THAN 35,000 FT.												
5-83	RESERVED												
5-84	THE PERMISSION LLS POSITION WILL BE UPDATED IF THE LLS SRT SIGHTINGS CHANGE BY--- A. SITE 7 1. DELTA H LESS THAN 4000 FT. 2. DELTA LATITUDE LESS THAN 8000 FT. 3. DELTA LONGITUDE LESS THAN 4000 FT.  B. SITE 5 1. DELTA H LESS THAN 2000 FT. 2. DELTA LATITUDE LESS THAN 8000 FT. 3. DELTA LONGITUDE LESS THAN 3000 FT.												
5-85	THE PMS AND AGS VARIABLE TARGETING CONSTANTS WILL BE UPDATED FOR ALL PDI OPPORTUNITIES.												
5-86	FOLLOWING DOI CUTOFF--- A. IF PMS RESIDUALS (ANY AXIS) ARE GREATER THAN 10 PPS - PERFORM A DIRECT ABORT. B. IF PMS RESIDUALS (ANY AXIS) ARE LESS THAN 10 BUT MORE THAN 5 PPS; TRIM PMS X-AXIS RESIDUALS TO 5 PPS AND--- 1. IF AGS AGREES TO LESS THAN 2 PPS - CONTINUE TO PDI 2. IF AGS DISAGREES BY MORE THAN 3 PPS AND RR CONFIRMS AGS - PERFORM DIRECT ABORT. 3. IF AGS DISAGREES BY MORE THAN 2 PPS BUT LESS THAN 3 PPS AND AT 30 MINUTES AFTER DOI; THE RR AGREES WITH AGS - PERFORM NO PDI & IS ABORT.  RULE 5-87 IS RESERVED.												
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NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 TRAJECTORY AND GUIDANCE

REV	ITEM												
5-88	<p>DOJ WILL BE SLEPPED ONE REV FOR--</p> <p>A. FAILURE TO IGNITE THE DPS BY DOJ TIG + 2 MIN.</p> <p>B. LN P92 BYRO TORQUE ANGLES EXCEED GROUND COMPUTED VALUES BY 0.8 DEG IN Y (PITCH) OR 3.8 DEG IN X (TAU) OR 2 (ROLL).</p>												
5-89	<p>LR DATA IS REQUIRED FOR LANDING--NO LR DATA BY 10K FT -ABORT:</p> <p>A. LR CONVERGENCE (ALTITUDE ONLY) - DATA NOT BEING ACCEPTED OR CONVERGING FOLLOWING LOCKON FOR 60 SECONDS - ABORT.</p> <p>B. LR DATA ACCEPTED AND CONVERGED CONTINUOUS TO P-64 - CONTINUE MISSION IF LOSS OF LOCK OCCURS IN P-64.</p> <p>C. LR DATA ACCEPTED AND CONVERGED WITH SUBSEQUENT DROPOUT - CONTINUE TO P-64:</p> <ol style="list-style-type: none"> <li>1. LANDING RADAR RETAINED IN P-64:                     <ol style="list-style-type: none"> <li>(A) DELTA H LESS THAN 1000 FT BETWEEN P68 AND LR - CONTINUE MISSION.</li> <li>(B) DELTA H GREATER THAN 1000 FT BETWEEN P68 AND LR - ABORT.</li> </ol> </li> <li>2. LR NOT RETAINED AT P-64 - ABORT.</li> </ol> <p>D. LATE LR LOCKON WITH DATA BEING INCORPORATED AND CONVERGING - CONTINUE TO P-64:</p> <ol style="list-style-type: none"> <li>1. DELTA H LESS THAN 1000 FT BETWEEN P68 AND LR - CONTINUE MISSION.</li> <li>2. DELTA H GREATER THAN 1000 FT BETWEEN P68 AND LR - ABORT.</li> </ol>												
5-90	<p>A. POWERED DESCENT WILL BE TERMINATED FOR--</p> <ol style="list-style-type: none"> <li>1. P68 ALTITUDE LESS THAN 22,000 FEET AND P68 NAVIGATION ERRORS, CONFIRMED BY MPR OR DOPPLER RESIDUALS, THAT CAUSE THE ABS-P68 RADIAL VELOCITY DIFFERENCE TO EXCEED MINUS 10 FPS PRIOR TO LANDING RADAR ALTITUDE INCORPORATION AND CONVERGENCE (A MINUS VELOCITY DIFFERENCE INDICATES THAT THE ABS TRAJECTORY IS LOWER THAN THE P68 TRAJECTORY).</li> <li>2. P68 NAVIGATION ERRORS, CONFIRMED BY MPR OR DOPPLER RESIDUALS, THAT RESULT IN THE FOLLOWING ABS-P68 VELOCITY DIFFERENCES--              DELTA X DOT (DOWNRANGE) GREATER THAN 4"/= 30 FPS              DELTA Y DOT (CROSSRANGE) GREATER THAN 4"/= 30 FPS              DELTA Z DOT (RADIAL) GREATER THAN 2"/= 15 FPS</li> <li>3. P68 ALTITUDE LESS THAN 18,000 FEET AND P68 NAVIGATION ERRORS, CONFIRMED BY DOPPLER BUT NOT BY ABS, CAUSE THE MPR-P68 RADIAL VELOCITY DIFFERENCE TO EXCEED MINUS 10 FPS PRIOR TO LANDING RADAR ALTITUDE INCORPORATION AND CONVERGENCE.</li> <li>4. P68 NAVIGATION ERRORS CONFIRMED BY DOPPLER RESIDUALS BUT NOT BY ABS, THAT RESULT IN THE FOLLOWING MPR-P68 VELOCITY DIFFERENCES--              DELTA Y DOT (CROSSRANGE) GREATER THAN 2"/= 15 FPS.              DELTA Z DOT (RADIAL) GREATER THAN 2"/= 15 FPS.</li> </ol> <p>NOTE--RULES 3 AND 4 ARE INDEPENDENT OF ANY TYPE OF LANDING RADAR UPDATE. FOR RULES 3 AND 4, SWITCHOVER TO ABS WILL BE PERFORMED:</p> <ol style="list-style-type: none"> <li>5. COMMAND IMMEDIATELY INCREASING PRIOR TO THROTTLE DOWN ON P68 100-06 SEC.</li> <li>6. DELETED</li> <li>7. NO THROTTLE RECOVERY BY P68/64 PROGRAM SWITCH PLUS 15 SEC.</li> <li>8. FAILURE TO ACHIEVE PTP BY NOMINAL TIG +31 SEC. (ABORT AT 6TC DIVERGENCE).</li> <li>9. FAILURE TO ENTER P64 WHEN TIG EQUALS 60 SECONDS.</li> <li>10. THE FOLLOWING P68 ALARMS--0010; 0021; 2000; 2001; 2100; 0107; 0100; 0102; 0101; 0000 (CONTINUING).</li> </ol> <p>B. THE CREW WILL BE ADVISED AND CONSIDERATION WILL BE GIVEN TO TERMINATION OF POWERED DESCENT IF THE TIME BIASED OPS ABORT BOUNDARY IS VIOLATED.</p>												
5-91	<p>THERE ARE NO TRAJECTORY OR GUIDANCE CONSTRAINTS WHICH ARE CAUSE FOR ABORT AFTER CREW TAKEOVER OF POWERED DESCENT.</p>												
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APOLLO 14	8	10/31/69	TRAJECTORY AND GUIDANCE	DESCENT	8-13								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM													
	5-92	<p>THE FOLLOWING RENDEZVOUS OPTIONS/RESCUE MODES WILL BE UTILIZED AS NECESSARY FOR FAILURES REQUIRING TERMINATION OF THE LUNAR LANDING--</p> <p>A. DOI FAILURES--DIRECT RETURN ABORTS WILL BE PERFORMED WHENEVER POSSIBLE FOR FAILURE WHICH WILL CAUSE POWERED DESCENT TO BE INHIBITED. (DIRECT ABORTS CAN BE PERFORMED UNTIL DOI +10 MINUTES.)</p> <p>B. POA FAILURES FROM DOI +10 TO POI: EXECUTE THE NO POI +12 ABORT SEQUENCE, DOCKING IN ABOUT 3-1/4 HOURS.</p> <p>C. ABORTS DURING POWERED DESCENT WILL INSERT THE LM INTO ORBIT UTILIZING THE ONBOARD VARIABLE ABORT TARGETING UTILIZING THE CPP SEQUENCING. POA ABORTS DURING THE FIRST 10 MIN DOCKING SHOULD OCCUR WITHIN 3 1/4 HRS AND FOR ABORTS AFTER 10 MIN DOCKING WILL OCCUR APPROXIMATELY 3 1/4 HRS LATER.</p> <p>D. FOR COMPLETE LM FAILURES PRIOR TO POI: THE CM WILL EXECUTE A FIVE IMPULSE RESCUE WITH DOCKING ABOUT 3-1/4 HOURS FROM POI.</p> <p>RULES 5-93 THROUGH 5-100 ARE RESERVED.</p>												
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APOLLO 13	A	10/13/79	TRAJECTORY AND GUIDANCE	DESCENT	5-11									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM
S-101	LM LIFTOFF WILL BE DELAYED ONE REVOLUTION RATHER THAN ACCEPTING A SLIP IN NOMINAL LIFTOFF TIME GREATER THAN 90 SEC.
S-102	<p>FOLLOWING A DESCENT ABORT, GUIDANCE SWITCHOVER TO AGS WILL BE PERFORMED FOR---</p> <p>A. THE FOLLOWING PONS ALARMS--- 20109, 00214, 20430, 20607, 21109, 01107, 21204, 21902, AND 21901</p> <p>B. PONS NAVIGATION ERRORS THAT RESULT IN---</p> <ol style="list-style-type: none"> <li>1. AGS PREDICTED INSERTION HP LESS THAN 40,000 FEET.</li> <li>2. AGS PREDICTED INSERTION HA GREATER THAN TARGET VALUE PLUS <u>90</u> NAUTICAL MILES.</li> <li>3. AGS PREDICTED INSERTION WEDGE ANGLE GREATER THAN <u>3.0</u> DEGREE.</li> </ol>
S-103	<p>DURING ASCENT, GUIDANCE SWITCHOVER TO AGS WILL BE PERFORMED FOR---</p> <p>A. THE FOLLOWING PONS ALARMS--- 20109, 00214, 20430, 20607, 21109, 01107, 21204, 21902, AND 21901</p> <p>B. PONS NAVIGATION ERRORS, CONFIRMED BY AGS RESIDUALS, THAT RESULT IN THE FOLLOWING MSPN-PONS VELOCITY DIFFERENCES---</p> <p>DELTA X DOT (DOWNRANGE) GREATER THAN +/- <u>24</u> FPS</p> <p>DELTA Y DOT (CROSSRANGE) GREATER THAN +/- <u>90</u> FPS</p> <p>DELTA Z DOT (RADIAL) GREATER THAN +/- <u>32</u> FPS</p> <p>C. PONS NAVIGATION ERRORS THAT RESULT IN---</p> <ol style="list-style-type: none"> <li>1. AGS PREDICTED INSERTION HP LESS THAN <u>40,000</u> FEET.</li> <li>2. AGS PREDICTED INSERTION HA GREATER THAN TARGET VALUE PLUS <u>90</u> NAUTICAL MILES.</li> <li>3. AGS PREDICTED INSERTION WEDGE ANGLE GREATER THAN <u>3.0</u> DEGREE.</li> </ol> <p>D. IF MAPN NOT VALID DURING ASCENT THE FOLLOWING DOPPLER RESIDUALS WILL BE USED TO CONFIRM SWITCHOVER CRITERIA---</p> <ol style="list-style-type: none"> <li>1. AGS - PONS DELTA X DOT (DOWNRANGE) GREATER THAN +/- <u>24</u> FPS AND DOPPLER - PONS RESIDUAL GREATER THAN <u>12</u> FPS.</li> <li>2. AGS - PONS DELTA Z DOT (RADIAL) GREATER THAN +/- <u>32</u> FPS AND DOPPLER - PONS RESIDUAL GREATER THAN <u>21</u> FPS.</li> </ol>

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	0	10/31/77	TRAJECTORY AND GUIDANCE	ASCENT	5-14



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM				
	<p>S-104 DURING ASCENT, THE AGS WILL BE DECLARED NO-GO FOR CONFIRMED AGS NAVIGATION ERRORS THAT RESULT IN---</p> <p>A: PONS PREDICTED INSERTION HP LESS THAN 30,000 FT.</p> <p>B: PONS PREDICTED INSERTION HA GREATER THAN TARGET VALUE PLUS 40 N.M.</p> <p>C: PONS PREDICTED INSERTION WEDGE ANGLE GREATER THAN 1.0 DEGREE.</p>				
	<p>S-105 THE GROUND WILL NOT REQUEST SWITCHOVER AFTER AGS TAO LESS THAN 30 SEC.</p>				
	<p>RULES S-106 THRU S-110 ARE RESERVED.</p>				
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	A	10/15/69	TRAJECTORY AND GUIDANCE	ASCENT	S-10

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM												
	<p>5-121 THE PGNCS IS PRIME FOR CSI, COM, AND TPI MANEUVER COMPUTATION/EXECUTION WITH THE AGS AS BACKUP UTILIZING THE ACCEPTED SOLUTION. THE AVAILABLE SOLUTIONS FOR THESE MANEUVERS ARE PGNCS, CMC, AND AGS.</p> <p>A. THE FOLLOWING VOTING LOGIC WILL BE OBSERVED FOR ALL MANEUVERS---</p> <ol style="list-style-type: none"> <li>1. COMPARE PGNCS AND CMC. IF THEY AGREE EXECUTE PGNCS SOLUTION.</li> <li>2. IF #1# ABOVE FAILS, COMPARE PGNCS AND AGS. IF THEY AGREE, EXECUTE PGNCS SOLUTION.</li> <li>3. IF #2# ABOVE FAILS, EXECUTE CMC SOLUTION.</li> </ol> <p>B. AGREEMENT BETWEEN SOURCES IS DEFINED AS---</p> <ol style="list-style-type: none"> <li>1. CSI = 3 FFS IN DELTA VZ</li> <li>2. COM = 2 FFS IN DELTA VX-- 8 FFS IN DELTA VZ</li> <li>3. TPI = 2 FFS IN DELTA VX-- 3 FFS IN DELTA VY-- 6 FFS IN DELTA VZ</li> </ol> <p>C. THE CMC SOLUTION FOR THE PLANE CHANGE MANEUVER WILL ALWAYS BE EXECUTED IF GREATER THAN 3 FFS IN MAGNITUDE.</p> <p>NOTE--- FOR CASES WHEN A</p>												
	<p>5-122 RENDEZVOUS PLANS SHALL, WHERE POSSIBLE, SATISFY THE FOLLOWING CONSTRAINTS---</p> <ol style="list-style-type: none"> <li>A. RENDEZVOUS MANEUVERS MUST BE AT LEAST 30 MIN APART.</li> <li>B. THE NOMINAL DELTA H FOR TPI WILL BE 10 NM ABOVE OR BELOW.</li> <li>C. THE REQUIRED ELEVATION ANGLE OF <u>22.5</u> DEG (BELOW) OR <u>22.5</u> DEG (ABOVE) WILL BE TARGETED TO OCCUR 25 MINUTES PRIOR TO SUNRISE.</li> <li>D. ARRIVAL AT THE TPI ELEVATION ANGLE CANNOT BE MOVED EARLIER THAN <u>21</u> MINUTES PRIOR TO SUNRISE.</li> </ol> <p>RULES 5-119 THROUGH 5-120 ARE RESERVED.</p>												
	<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 10</td> <td>A</td> <td>10/10/69</td> <td>TRAJECTORY GUIDANCE</td> <td>RENDEZVOUS</td> <td>2-16</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 10	A	10/10/69	TRAJECTORY GUIDANCE	RENDEZVOUS	2-16
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 10	A	10/10/69	TRAJECTORY GUIDANCE	RENDEZVOUS	2-16								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 TRAJECTORY AND GUIDANCE

REV	ITEM												
	<p>8-121 TRANSEARTH MCC WILL BE TARGETED TO ACHIEVE ENTRY CONDITIONS AS FOLLOWS--</p> <p>A. IF VEE GREATER THAN 31000 FPS USE STEEP TARGET LINE.</p> <p>B. IF VEE LESS THAN 31000 FPS AND GBN GO. USE SHALLOW TARGET LINE.</p> <p>C. TRANSEARTH MIDCOURSE CORRECTION NOMINAL EXECUTION POINTS WILL BE AT THE FOLLOWING---</p> <p>1. TEE +15 HRS.</p> <p>2. EI = 20 HRS.</p> <p>3. EI = 3 HRS.</p>												
	<p>8-122 TRANSEARTH MCC PHILOSOPHY:</p> <p>A. TEC MCC WILL NOT USE LANDING POINT CONTROL UNLESS THE LANDING POINT IS UNACCEPTABLE.</p> <p>B. IF GAMMA EI IS OUTSIDE THE ENTRY CORRIDOR, EXECUTE MCC ASAP (EXCEPTION---MCCB).</p> <p>C. THE LAST MCC WILL BE SCHEDULED NO LATER THAN EI-3 HOURS.</p> <p>D. THE GBN WILL BE THE PRIMARY MODE OF EXECUTION FOR ALL TEC MCC.</p> <p>E. MCC GREATER THAN 10 FPS WILL USE THE SPS IF PRACTICAL.</p>												
	<p>8-123 TEC MCC FOR LANDING AREA CONTROL---</p> <p>A. PRIOR TO EI-24 HRS---WILL BE EXECUTED FOR RECOVERY ACCESS VIOLATIONS, UNACCEPTABLE WEATHER AT IP, OR IF ANY PART OF THE OPERATIONAL FOOTPRINT IS ON LAND.</p> <p>B. AFTER EI-24 HRS---WILL NOT BE EXECUTED.</p>												
	<p>8-124 ENTRY CONDITIONS WILL BE CONTROLLED TO AVOID HEAT SHIELD LIMITATIONS.</p>												
	<p>8-125 BACKUP ENTRY IS CONSTRAINED AS FOLLOWS---</p> <p>A. THE CONSTANT B ENTRY MUST FALL BETWEEN 3 AND 6 G'S.</p> <p>B. B+S RANGING WILL NOT BE ATTEMPTED UNTIL V IS LESS THAN 25500 FPS.</p>												
	<p>8-126 WEATHER AVOIDANCE WITH AERODYNAMIC LIFT WILL NOT BE ATTEMPTED UNLESS THE GBN IS OPERATIONAL. ON E=2 INDICATED VELOCITY IS LESS THAN 25500 FPS.</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 10	04	9/18/69	TRAJECTORY AND GUIDANCE	TRANSEARTH ENTRY	8-59								

NASA - Manned Spacecraft Center

MISSION RULES  
SECTION 3 TRAJECTORY AND GUIDANCE

REV	ITEM												
S-127	<p>PREDICTED ENTRY CORRIDOR VIOLATION AFTER THE LAST MCC OPPORTUNITY---</p> <p>A. UNDERSHOOT LINE EXCEEDED--- GROUND ADVISE CREW TO FLY FULL LEFT UNTIL PEAK 6 IS PASSED; THEN FLY 66N.</p> <p>B. OVERSHOOT LINE EXCEEDED---GROUND ADVISE CREW TO FLY NEGATIVE LEFT TO 2 6'S FOLLOWED BY 4 6 CONSTANT ENTRY.</p>												
S-128	<p>IF THE EMB INDICATES A SKIP CONDITION, NEGATIVE LEFT SHOULD BE ACHIEVED PRIOR TO VERIFYING THE EMB WITH CROSS CHECKS.</p>												
S-129	<p>IF THE EMB INDICATES AN UNDERSHOOT CONDITION EXISTS, FULL LEFT SHOULD BE ACHIEVED PRIOR TO VERIFYING THE EMB WITH CROSS CHECKS.</p>												
S-130	<p>THE 66N IS NO-GO DURING ENTRY IF---</p> <p>A. P65 VALUE OF VL DIFFERS FROM THE GROUND COMPUTED LIMITS</p> <p>B. P65 VALUE OF DL DIFFERS FROM THE GROUND COMPUTED LIMITS.</p> <p>C. CAUSED TRAJECTORY TO VIOLATE THE OFFSET LIMITS (SKIP) ON EMB SCROLL.</p> <p>D. CAUSED TRAJECTORY TO VIOLATE THE ONSET LIMITS (6) ON EMB SCROLL.</p> <p>E. IF THE 66N TRIM ATTITUDES AT CH/BM BEP DIFFER FROM THE HORIZON MONITOR ATTITUDE BY GREATER THAN 5 DEG.</p> <p>F. IF THE 66N TRIM ATTITUDES AT 605 6 DIFFERS FROM THE GROUND VALUES BY GREATER THAN 5 DEG.</p> <p>G. IF THE CMC FAILS TO SEQUENCE FROM P63 TO P64 AT ACT 605 6 +/- 3 SEC.</p>												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 10</td> <td>8</td> <td>10/31/70</td> <td>TRAJECTORY AND GUIDANCE</td> <td>TRANS-EARTH ENTRY</td> <td>8-18</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 10	8	10/31/70	TRAJECTORY AND GUIDANCE	TRANS-EARTH ENTRY	8-18
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 10	8	10/31/70	TRAJECTORY AND GUIDANCE	TRANS-EARTH ENTRY	8-18								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 TRAJECTORY AND GUIDANCE

REV	ITEM												
<p>-----                      RANGE SAFETY RULES AND AGREEMENTS                      -----                      GENERAL                      -----</p>													
8-140	RANGE SAFETY POLICIES AND CRITERIA ARE SPECIFIED IN AFETR MANUAL (AFETRM) 127-3 DATED 3 JANUARY 1969. THE FOLLOWING MISSION RULES CONCERNING SPECIFIC AFETR/NASA INTERFACE SUPPLEMENT AFETRM 127-3.												
8-141	THE RSO WILL ACCOMPLISH THE PAD EMERGENCY RANGE CUTOFF PROCEDURE IF THE SPACE VEHICLE WILL NOT LIFT OFF AFTER IGNITION AND NASA IS UNABLE TO ACCOMPLISH CUTOFF. THE RSO WILL SEND "ARM/MFCO" ONLY IN RESPONSE TO A CODED VERBAL REQUEST FROM THE NASA LAUNCH VEHICLE TEST CONDUCTOR (CLTC). THE CLTC WILL CALL THE RSO ON THE CLTC-RSO DIRECT LINE TO TRANSMIT THIS REQUEST. THE RSO WILL NOT EXECUTE THIS PROCEDURE IF HE HAS A LIPTOFF INDICATION.												
8-142	THE FLIGHT DIRECTOR (FD) WILL INITIATE ABORT IN RESPONSE TO A CODED VERBAL REQUEST FROM THE RSO. THIS PROCEDURE WILL BE EXECUTED IF RANGE SAFETY FLIGHT TERMINATION CRITERIA HAVE BEEN VIOLATED AND RSO EFFORTS TO TERMINATE THRUST HAVE FAILED. THE REQUEST FROM RSO TO FD WILL BE TRANSMITTED ON THE FLIGHT DIRECTOR LOOP WITH THE FIDO-RSO PRIVATE LINE AS BACKUP.												
8-143	THE RSO WILL SEND "ARM/MFCO" IN RESPONSE TO A CODED VERBAL REQUEST FROM THE FLIGHT DIRECTOR (FD) OR THE FLIGHT DYNAMICS OFFICER (FIDO). THIS PROCEDURE WILL BE EXECUTED IF ABORT LIMITS HAVE BEEN EXCEEDED AND ABORT ACTION HAS BEEN UNSUCCESSFUL. THE REQUEST FROM FD/FIDO TO THE RSO WILL BE TRANSMITTED ON THE RSO LOOP (CAPE 111) WITH THE FIDO-RSO PRIVATE LINE AS BACKUP.												
8-144	THE FD WILL INFORM THE RSO WHEN THE S-IC NO. 3 OR NO. 4 ENGINE HAS SHUT DOWN BY STATING "NSO NO. 3 OUT (NO. 4 OUT)" ON THE RSO LOOP (CAPE 111) AND/OR ACTIVATE THE ENGINE OUT LIGHT ON THE RSO CONSOLE. THE NO. 3 ENGINE OUT LIGHT CIRCUIT FOR FD TO RSO IS HIGHLY DESIRABLE.												
8-145	IF RANGE SAFETY DESTRUCT LINES ARE VIOLATED, THE RSO WILL SEND "ARM/MFCO" AND NOTIFY THE FD/FIDO. NO SPS THRUSTING WILL BE INITIATED FOLLOWING SUCH RANGE SAFETY ACTION.												
8-146	IF AN ESTABLISHED IMPACT PREDICTION (IP) POINT IS ON THE CAPE KENNEDY LAND AREA, "DESTRUCT/PO" WILL BE TRANSMITTED.												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 10%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>TRAJECTORY AND GUIDANCE</td> <td>RANGE SAFETY</td> <td>5-19</td> </tr> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-19
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	FNL	9/10/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-19								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM												
5-131	<p>TEI ABORTS AND RESIDUAL TRIMMING PHILOSOPHY.</p> <p>A. IN GENERAL ONCE THE SPS HAS BEEN IGNITED, THE MANEUVER WILL BE COMPLETED WITH THE SPS ENGINE. THIS IMPLIES THAT THERE WILL BE NO MANUAL SHUTDOWNS AND AS MANY RESTARTS AS NECESSARY TO COMPLETE THE TEI MANEUVER QUANTITIES FOR THE DELTA V RULES LISTED BELOW FOR PREMATURE SHUTDOWNS ARE GUIDELINES FOR USE OF RCS PROPELLANT.</p> <ol style="list-style-type: none"> <li>1. NO SPS IGNITION - DO NOT ATTEMPT A MANUAL RESTART, SLIP 1 REV AND DO MALFUNCTION PROCEDURES.</li> <li>2. AFTER SPS IGNITION, THERE WILL BE NO MANUAL SPS SHUTDOWN.</li> <li>3. FOR PREMATURE SHUTDOWN---                     <ol style="list-style-type: none"> <li>(A) TEI DELTA V REMAINING GREATER THAN THE RCS DELTA V CAPABILITY MINUS 20 FPS - RESTART SPS AND COMPLETE THE TARGETED BURN, NO TRIM.</li> <li>(B) TEI DELTA V REMAINING LESS THAN THE RCS DELTA V CAPABILITY MINUS 20 FPS, BUT GREATER THAN 3 FPS - RCS +X OR SPS MAY BE USED TO COMPLETE THE TARGETED BURN BASED UPON CREW JUDGEMENT, NO TRIM.</li> <li>(C) RESIDUAL LESS THAN 3 FPS - TRIM 1 AND 2.</li> </ol> </li> </ol> <p>NOTE-- THIS RULE ALSO APPLIES FOR A DPS TEI WITH NO OPERATIONAL SPS FOR BACKUP.</p> <p>B. PREMATURE DPS TEI SHUTDOWN WITH AN OPERATIONAL SPS AS BACKUP.</p> <ol style="list-style-type: none"> <li>1. NO DPS IGNITION - SLIP 1 REV AND DO MALFUNCTION PROCEDURES AND RETARGET USING DPS OR SPS.</li> <li>2. FOR A PREMATURE SHUTDOWN IN THE MODE III REGION (ACHIEVED TEI DELTA V LESS THAN 1700 FPS/PRE-ABORT PERIOD LESS THAN 15 HR) - TARGET THE SPS FOR THE NEXT TEI.</li> <li>3. FOR A PREMATURE SHUTDOWN IN THE MODE I REGION (ACHIEVED TEI DELTA V GREATER THAN 1700 FPS) - TARGET THE SPS AT TET + 2 HR.</li> </ol> <p>RULES 5-132 THRU 5-139 ARE RESERVED.</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	B	10/31/79	TRAJECTORY AND GUIDANCE	TRANSEARTH ENTRY	5-19A								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 3 TRAJECTORY AND GUIDANCE

REV	ITEM												
	<p>3-147 IF AN ATTEMPT TO TERMINATE THRUST BY "ARM/MFCO" IS UNSUCCESSFUL WHILE THE SP IS ON THE CAPE KENNEDY LAND AREA, "DESTRUCT/PD" WILL BE SENT.</p>												
	<p>3-148 WHEN THE SP HAS MOVED OFF THE CAPE, FLIGHT TERMINATION ACTION WILL BE LIMITED TO "ARM/MFCO" OR CREW INITIATED ABORT. THE "DESTRUCT/PD" FUNCTION WILL BE SENT ONLY AFTER FD/FIDO CONFIRMATION OF SATISFACTORY SPACECRAFT SEPARATION, AND ONLY IF FUEL DISPERSION IS NECESSARY.</p>												
	<p>3-149 IF AN IP POINT IS ESTABLISHED AND "DESTRUCT/PD" IS DEEMED UNNECESSARY, THE RSO WILL NOTIFY FD/FIDO. "SAFE" WILL BE SENT UPON FD/FIDO'S REQUEST--"RSO SEND SAFE".</p>												
	<p>3-150 FD/FIDO WILL DECLARE TO THE RSO WHEN THERE IS NO POSSIBILITY OF INSERTING THE SPACECRAFT INTO AN ORBIT, AND THE RSO WILL NOT ALLOW THE AFRICAN GATE TO BE OVERFLOWN.</p>												
	<p>3-151 AN STR RANGE SAFETY OFFICER (BRSO) IS REQUIRED AT BERMUDA TO MONITOR PRESENT POSITION AND IMPACT PREDICTION CHARTS, TO OBSERVE TELEMETRY DISPLAYS, AND TO TRANSMIT THE RANGE SAFETY FUNCTIONS WHEN COMMANDED TO DO SO BY THE RSO, FOR FLIGHT AZIMUTHS LESS THAN 90 DEGREES THE BRSO WILL ASSUME PRIMARY RANGE SAFETY RESPONSIBILITY IN THE EVENT OF LOSS OF COMMUNICATIONS BETWEEN THE BRSO AND THE RSO.</p>												
	<p>3-152 SAFING BY THE RSO WILL BE TRANSMITTED AFTER GATE PENETRATION AND FIRST S-IVB CUTOFF WHEN THE FD/FIDO REQUESTS--"RSO SEND SAFE." WHEN SAFING IS CONFIRMED, THE RSO WILL STATE "SAFING CONFIRMED". IN THE EVENT OF LOSS OF COMM WITH FD/FIDO, THE RSO WILL SEND SAFE ONLY IF HE CAN CONFIRM S-IVB CUTOFF.</p>												
	<p>3-153 IF SAFING CANNOT BE CONFIRMED BY THE RSO, ANOTHER SAFING ATTEMPT WILL BE MADE BY THE RSO ON THE FIRST ORBITAL PASS OVER THE CAPE. COORDINATION WILL BE EFFECTED WITH THE SUPERINTENDENT OF RANGE OPERATIONS (SRO) AND FIDO TO ENSURE COMMAND COVERAGE, AND TELEMETRY DISPLAY AVAILABILITY. AT THE AGREED TIME, FIDO WILL STATE, "RSO SEND SAFE", UPON CONFIRMATION, THE RSO WILL STATE, "SAFING CONFIRMED".</p>												
	<p>3-154 THE FD/FIDO WILL INFORM THE RSO IMMEDIATELY UPON DETERMINATION OF A SPACECRAFT SEPERATION. THIS NOTIFICATION WILL BE TRANSMITTED ON THE 200 LOOP (CAPE 111) WITH THE FIDO-RSO PRIVATE LINE AS BACKUP.</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	FNL	9/20/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	3-20								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 TRAJECTORY AND GUIDANCE

REV	ITEM													
		..... * TRACKING SOURCES * .....												
5-155		AT LEAST TWO (2) VEHICLE POSITION DATA SOURCES ARE MANDATORY TO L/O FOR EACH PHASE OF POWERED FLIGHT PRIOR TO THE AFRICAN GATE TO ENABLE THE RANGE SAFETY OFFICER TO DETERMINE IF THE VEHICLE IS NORMAL OR VIOLATES ESTABLISHED ENLIGHT SAFETY CRITERIA.												
5-156		DATA FROM TWO (2) OF THE FOLLOWING THREE (3) RADARS ARE MANDATORY TO L/O (OTHER HIGHLY DESIRABLE)-- BERMUDA FPS-16; BERMUDA FPG-6; AND GRAND TURK TPG-18.												
5-157		PRESENT POSITION AND IP PLOTS AT BERMUDA (BOA) USING INPUTS FROM EITHER THE BOA FPS-16 OR BOA FPG-6 RADAR ARE HIGHLY DESIRABLE FOR LAUNCH.												
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MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	FNL	9/10/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-21									



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 TRAJECTORY AND GUIDANCE

REV	ITEM				
	<p>.....                      * AIRBORNE SYSTEMS *                      .....</p>				
S-158	TWO (2) OPERATIONAL RANGE SAFETY COMMAND RECEIVERS ON EACH LAUNCH VEHICLE STAGE (S-1C, S-2E AND S-1V8) ARE MANDATORY TO B/S. THE RANGE SAFETY SUPERVISOR (CRSS) AT THE LAUNCH CONTROL CENTER WILL DETERMINE IF THE RECEIVERS ARE OPERATING PROPERLY.				
S-159	LV C-BAND BEACON NO. 1 OR NO. 2 IS HIGHLY DESIRABLE FOR LAUNCH.				
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	FNL	9/10/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-22

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM					
		..... ** COMMAND/CONTROL ** .....				
S-100	NASA BERMUDA DRS COMMAND/CONTROL CAPABILITY IS MANDATORY TO L/O FOR FLIGHT AZIMUTHS LESS THAN 90 DEGREES.					
S-103	A 4 SECOND TIME DELAY BETWEEN **ARM/WPCO** AND **DESTRUCT/PD** WILL BE PROVIDED BY TIMERS IN THE RSO CONSOLE IN THE RCC.					
MISSION	REV	DATE	SECTION	GROUP	PAGE	
APOLLO 12	FNL	9/10/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-23	

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 TRAJECTORY AND GUIDANCE

REV	ITEM					
..... * COMMUNICATIONS * .....						
S-162	ONE (1) OF TWO (2) PRIVATE, INDEPENDENT, GEOGRAPHICALLY DIVERSIFIED COMMUNICATIONS LINKS BETWEEN THE RSO AND BRSO IS MANDATORY AND THE OTHER IS HIGHLY DESIRABLE.					
S-163	ONE (1) OF THE FOLLOWING THREE (3) COMMUNICATIONS LINKS IS MANDATORY BETWEEN THE RSO AND PD/PIDO AND THE OTHERS ARE HIGHLY DESIRABLE: (1) RSO LOOP (CAPE 111) . (2) RSO PRIVATE LINE. (3) FLIGHT DIRECTOR LOOP.					
S-164	A COMMUNICATIONS LINK BETWEEN THE RSO AND THE RANGE SAFETY SUPERVISOR (RSS) AT THE LAUNCH CONTROL CENTER IS MANDATORY FOR T-40 MINUTE DESTRUCT CHECKS.					
S-165	A DIRECT LINE COMMUNICATIONS LINK BETWEEN THE RSO AND THE LAUNCH VEHICLE TEST CONDUCTOR (LTC) IS HIGHLY DESIRABLE.					
MISSION	REV	DATE	SECTION	GROUP	PAGE	
APOLLO 12	PNL	9/10/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	S-24	

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 TRAJECTORY AND GUIDANCE

REV	ITEM						
		***** * TELEMETRY * *****					
8-166	TV TELEMETRY DATA (ONBOARD GUIDANCE PARAMETERS) TO THE RTCS ARE HIGHLY DESIRABLE UNTIL 8-148 CUTOFF FOR SP COMPUTATION AND RSO DISPLAY.						
8-167	TELEMETRY REQUIREMENTS TO BE DISPLAYED FOR THE RSO AND THE BRSO ARE HIGHLY DESIRABLE.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/10/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	8-25

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 TRAJECTORY AND GUIDANCE

.....  
 \* RANGE SAFETY WEATHER RESTRICTIONS \*  
 .....

REV	ITEM												
5-368	WIND RESTRICTIONS--- AN ANNUAL PROFILE WIND RESTRICTION OF            SIGMA WILL BE IN EFFECT FOR LAUNCH.												
5-389	CEILING AND VISIBILITY RESTRICTIONS--- NO CEILING OR VISIBILITY RESTRICTIONS WILL BE IMPOSED PROVIDING CNV FPS-16 AND MILA TPU-16 RADARS AND BEACON NO. 1 ARE OPERATIONAL.												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>PNL</td> <td>9/10/69</td> <td>TRAJECTORY AND GUIDANCE</td> <td>RANGE SAFETY</td> <td>5-26</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	PNL	9/10/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-26
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	PNL	9/10/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-26								

8 8LY - T81 THROUGH  
T84/T84A (LAUNCH)

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MISSION RULES

SECTION 6 - SLV - TB1 THROUGH TB4/TB4A

REV	ITEM						
		SUMMARY OF LAUNCH PHASE RULES					
	6-1	S-1C LOSS OF THRUST					
	6-2	LOSS OF ATTITUDE CONTROL					
	6-3	INERTIAL PLATFORM FAILURE - ACCELEROMETER					
	6-4	SLV INERTIAL PLATFORM FAILURE					
	6-7	S-1E LOSS OF THRUST					
	6-8	S-1E GIMBAL SYSTEM FAILURE					
	6-9	S-1E SECOND PLANE SEPERATION FAILS					
	6-10	S-1VB LOSS OF HYDRAULIC FLUID					
	6-11	S-1VB LOSS OF THRUST					
	6-12	S-1VB COLD HELIUM SHUTOFF VALVE(S) FAIL OPEN					
		THE FOLLOWING MISSION RULES ALSO APPLY TO THIS SECTION---					
		NONE					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/10/69	SLV - TB1 THROUGH TB4/TB4A		6-1

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 - SLV - T81 THROUGH T84/T84A

REV	ITEM												
	<p>A. BSE GENERALIZED SWITCH SELECTOR COMMAND CAPABILITY EXISTS---</p> <p>1. WHEN CREW ENABLED IU COMMAND SYSTEM (EXCEPT AS NOTED BELOW IN ITEM D)</p> <p>2. AFTER T87 + 28 MIN.</p> <p>B. BSE MANEUVER UPDATE AND INHIBIT CAPABILITY EXISTS FOR T87 MANEUVERS ONLY.</p> <p>C. BSE HAS NAVIGATION UPDATE CAPABILITY (FMR 8-3) AND TARGET UPDATE CAPABILITY (FMR 8-4)</p> <p>D. BSE HAS NO COMMAND CAPABILITY DURING POWERED BURN PHASES.</p> <p>E. A SAFE DISTANCE BETWEEN THE SPACECRAFT AND S-IVB/IU IS DEFINED AS 1000 FT.</p> <p>F. BSE WILL RECOMMEND NO S-IVB RESTART FOR ANY CONFIRMED CONDITION/ MALFUNCTION IN THE LAUNCH VEHICLE WHICH RESULTS IN---</p> <p>1. A CATASTROPHIC HAZARD</p> <p>2. ACHIEVEMENT OF AN S-IVB ENGINE MAINSTAGE BURN WITH EXPECTED CUTOFF OR SHUTDOWN CONDITIONS DEFINITELY PRECLUDING AN ACCEPTABLE LUNAR MISSION. IN APPLYING THIS CRITERIA TO SPECIFIC MISSION RULES, A GO/NO GO RECOMMENDATION WILL BE REQUIRED IF INSUFFICIENT S-IVB CONSUMABLES OR PROPULSION PERFORMANCE IS AVAILABLE TO ASSURE ANY FINITE PROBABILITY OF ACHIEVING A CUTOFF ORBIT WITH 85,000 N.M. APOGEE ALTITUDE.</p> <p>G. IN THE EVENT OF NO S-IVB IGNITION AT RESTART OR AN EARLY S-IVB SECOND BURN CUTOFF, THE SPACECRAFT SHOULD REMAIN ATTACHED TO THE S-IVB/IU AND MONITOR LH2 AND LOX ULLAGE PRESSURES UNTIL THE STAGE STATUS CAN BE ASSESSED BY GROUND. IF EMERGENCY SEPARATION IS REQUIRED IMMEDIATELY AFTER S-IVB CUTOFF, THE SPACECRAFT SHOULD IMMEDIATELY GO TO A SAFE DISTANCE (7000 FT) FROM THE S-IVB/IU.</p> <p>H. ABORT OR SPACECRAFT SEPARATION DURING LAUNCH PHASE WILL BE RECOMMENDED FOR THE FOLLOWING---</p> <p>6-1 S-IC LOSS OF THRUST</p> <p>6-2 LOSS OF ATTITUDE CONTROL</p> <p>**6-7 S-II LOSS OF THRUST</p> <p>**6-8 S-II ANY SINGLE ACTUATOR HARDOVER INBOARD</p> <p>6-9 S-II SECOND PLANE SEPARATION FAILS TO OCCUR AT T83 + 31 SEC</p> <p>6-10 S-IVB LOSS OF ENGINE HYDRAULIC FLUID PRIOR TO FIRST S-IVB BURN</p> <p>6-11 S-IVB STAGE LOSS OF THRUST</p> <p>6-12 S-IVB COLD HELIUM SHUTOFF VALVE(S) FAILS OPEN</p> <p>I. SPACECRAFT GUIDANCE TAKEOVER WILL BE RECOMMENDED FOR THE FOLLOWING---</p> <p>6-4 LAUNCH VEHICLE INERTIAL PLATFORM FAILURE-ATTITUDE REFERENCE</p> <p>7-8 LOSS OF ATTITUDE CONTROL DURING T85, T87</p> <p>J. S-II/S-IVB EARLY STAGING WILL BE RECOMMENDED FOR THE FOLLOWING---</p> <p>**6-7 S-II LOSS OF THRUST</p> <p>**6-8 S-II ANY SINGLE ACTUATOR HARDOVER INBOARD</p> <p>**6-12 S-IVB COLD HELIUM SHUTOFF VALVE(S) FAILS OPEN</p>												
	* TIME DEPENDENT												
	<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>8</td> <td>10/31/79</td> <td>SLV - T81 THROUGH T84/T84A</td> <td></td> <td>6-2</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	8	10/31/79	SLV - T81 THROUGH T84/T84A		6-2
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	8	10/31/79	SLV - T81 THROUGH T84/T84A		6-2								



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 - SLY - T81 THROUGH T84/T84A

REV	ITEM												
	<p>K. TLI INHIBIT PRIOR TO RESTART OR SPACECRAFT SEPARATION WILL BE RECOMMENDED FOR THE FOLLOWING---</p> <p>7-1 INSUFFICIENT PROPELLANTS REMAIN FOR ACHIEVEMENT OF ACCEPTABLE ALTERNATE MISSIONS.</p> <p>7-8 FAILURE OF RANGE SAFETY SYSTEM AFTER INSERTION</p> <p>7-8 LOSS OF ATTITUDE CONTROL</p> <p>7-22 S-IVB LOSS OF ENGINE HYDRAULIC FLUID</p> <p>8-6 S-IVB ACTUATOR CONFIRMED HARDOVER PRIOR TO T85 + 9 MIN 10 SEC</p> <p>8-8 LOSS OF ATTITUDE CONTROL DURING S-IVB SECOND BURN</p> <p>L. SPACECRAFT SEPARATION OR TLI INHIBIT WILL BE RECOMMENDED UNLESS COMMAND ACTION IS SUCCESSFUL FOR THE FOLLOWING---</p> <p>7-4 J-2 ENGINE MAIN OXIDIZER VALVE FAILS TO CLOSE AT FIRST SIVB CUTOFF</p> <p>07-6 S-IVB COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE</p> <p>07-14 S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS +26 OR -26 PSID</p> <p>7-20 J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS</p> <p style="text-align: center;">* EMERGENCY SEPARATION REQUIRED</p> <p>M. FOR EARLY SPACECRAFT SEPARATION THE CREW SHOULD ENABLE THE IV COMMAND SYSTEM AND THE GSE SHOULD BRING COMMAND TO LOCK OPEN THE IV COMMAND SYSTEM PRIOR TO SPACECRAFT SEPARATION IF AT ALL POSSIBLE.</p> <p>N. GSE WILL INHIBIT T88 IN THE EVENT A TLI NO-GO DECISION IS MADE IN T88.</p> <p>O. THERE MUST BE AT LEAST AN 80 MIN COAST PERIOD BETWEEN SIVB FIRST AND SECOND BURNS.</p>												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 15%;">PAGE</td> </tr> <tr> <td>APOLLO 16 A</td> <td>A</td> <td>10/19/69</td> <td>SLY - T81 THROUGH T84/T84A</td> <td></td> <td>8-8</td> </tr> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 16 A	A	10/19/69	SLY - T81 THROUGH T84/T84A		8-8
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 16 A	A	10/19/69	SLY - T81 THROUGH T84/T84A		8-8								

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MISSION RULES

SECTION 6 - SLY - T81 THROUGH T84/T84A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
6-1	S-IC STAGE LOSS OF THRUST		LAUNCH	A. CONTINUE MISSION	A88. CUES---												
	A. ANY SINGLE ENGINE PRIOR TO T83			BSE INFORM FLIGHT AND FIDO.	1. THRUST CK SWITCHES - OFF (K33-115 THROUGH K47-115)												
	B. ANY TWO OR MORE ENGINES			B. ABORT/CONTINUE MISSION	2. THRUST CHAMBER PRESSURE LESS THAN 500 PSIA (D8-101 THROUGH D8-103)												
	1. PRIOR TO DEACTIVATION OF TWO ENGINES AUTO ABORT			1. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST.	3. LONGITUDINAL ACCELERATION - ZERO (A2-603)												
	2. AFTER DEACTIVATION OF TWO ENGINES AUTO ABORT			2. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF POTENTIAL OVERRATE CONDITION.	4. FINAL THRUST OR CUTOFF - ON (K32-115 THROUGH K50-115) A88. NOTE---												
	C. LOSS OF THRUST - ENGINE 3 OR 4 (THIS RULE APPLIES ONLY FOR THE UNIQUE CASE OF ENGINE 3 OR 4 THRUST LOSS BETWEEN 0 TO 45 SEC)	LAUNCH		C. CONTINUE MISSION	C. CUES---												
	1. VOICE COMM WITH RSO			BSE INFORM FLIGHT AND FIDO. FLIGHT INFORM RSO.	1. THRUST CHAMBER PRESSURE LESS THAN 500 PSIA (D8-100, D8-104)												
	2. NO VOICE COMM WITH RSO			1(A) FLIGHT CONFIRM ENGINE 3 OR 4 OUT VIA RSO PRIVATE LINE. 1(B) FLIGHT CONFIRM NO OTHER KNOWN ANOMALIES BY LIFE ACTIVATION AND VOICE REPORT. 2. FLIGHT CONFIRM ENGINE 3 OR 4 OUT AND NO OTHER KNOWN ANOMALIES BY LIFE ACTIVATION.	2. ENGINE 3 OR ENGINE 4 THRUST OR SWITCHES OFF (K39-115 THROUGH K44-115) 3. ENGINE 3 OR 4 FINAL THRUST OR CUTOFF (K34-115, K35-115) C. NOTES---												
					1. RSO LOOP IS OR FO LOOP BACKUP TO PL 2. CONFIRMATION OF NO OTHER KNOWN ANOMALIES WILL BE BASED ON ENGINE CHAMBER PRESSURE NOT DECREASING AND TCC SWITCHES ON												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>PL</td> <td>9/17/69</td> <td>SLY-6 101 THROUGH T84/T84A</td> <td></td> <td>6-6</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	PL	9/17/69	SLY-6 101 THROUGH T84/T84A		6-6
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	PL	9/17/69	SLY-6 101 THROUGH T84/T84A		6-6												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 6 - SLY - T01 THROUGH T04/T04A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	6-2	LOSS OF ATTITUDE CONTROL A. PRIOR TO T01 + 2 MIN	LAUNCH	A. CONTINUE MISSION SEE INFORM FLIGHT AND PIDO  CREW WILL ABORT ON LIMITS (NOTE A.1)	CUES--- A.1: ANGULAR RATES-PITCH (R4-002) OR YAW (R5-002) GREATER THAN 2 DEG/SEC AND NOT DECREASING; ROLL (R6-002) GREATER THAN 5 DEG/SEC AND NOT DECREASING.  B. ANGULAR RATES-PITCH (R12-002) OR YAW (R8-002) GREATER THAN 2 DEG/SEC AND NOT DECREASING; ROLL (R12-002) GREATER THAN 5 DEG/SEC AND NOT DECREASING (SEE NOTE A.2)  C. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE A.3.)  NOTES--- A.1: CREW ABORT LIMITS--- (A) PITCH AND YAW RATE +/- 4 DEG/SEC (B) ROLL RATE +/- 20 DEG/SEC (C) PITCH, YAW, OR ROLL ERROR +/- 5 DEG AND G-BALL DELTA $\delta$ +/- 5.2 PSD  B. THESE CUES ARE VALID IF RATE CHANNEL SWITCHOVER HAS NOT OCCURRED.  C. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS--- (A) LYBC/LYDA COMPUTATIONAL FAILURE (B) ATTITUDE ERROR SIGNALS GREATER THAN +/- 3 DEG. (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE (D) S-IC ENGINE ACTUATOR HARDOVER GREATER THAN +/- 5 DEG.  CUES--- B.1: ANGULAR RATES - PITCH (R8-001), YAW (R8-002), OR ROLL (R6-002) GREATER THAN 2 DEG/SEC AND NOT DECREASING.  C. ANGULAR RATES - PITCH (R12-001), YAW (R8-001), OR ROLL (R12-001) GREATER THAN 5 DEG/SEC AND NOT DECREASING. (SEE NOTE C.1)  D. LOSS OF ATTITUDE CONTROL ALERT. (SEE NOTE C.1)  NOTES--- B.1: CREW ABORT LIMITS--- (A) PITCH OR YAW RATE +/- 10 DEG/SEC (B) ROLL RATE +/- 20 DEG/SEC  C. THESE CUES ARE VALID IF RATE CHANNEL SWITCH OVER HAS NOT OCCURRED. NOTES---												
		B. BETWEEN T01 + 2 MIN AND T02 INITIATE	LAUNCH	B. CONTINUE MISSION SEE INFORM FLIGHT AND PIDO  CREW WILL ABORT ON LIMITS (NOTE B.1)	CUES--- B.1: ANGULAR RATES - PITCH (R8-001), YAW (R8-002), OR ROLL (R6-002) GREATER THAN 2 DEG/SEC AND NOT DECREASING.  C. ANGULAR RATES - PITCH (R12-001), YAW (R8-001), OR ROLL (R12-001) GREATER THAN 5 DEG/SEC AND NOT DECREASING. (SEE NOTE C.1)  D. LOSS OF ATTITUDE CONTROL ALERT. (SEE NOTE C.1)  NOTES--- B.1: CREW ABORT LIMITS--- (A) PITCH OR YAW RATE +/- 10 DEG/SEC (B) ROLL RATE +/- 20 DEG/SEC  C. THESE CUES ARE VALID IF RATE CHANNEL SWITCH OVER HAS NOT OCCURRED. NOTES---												
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 10	A	10/10/69	SLY - T01 THROUGH T04/T04A		6-2												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 6 - SLY - T81 THROUGH T84/T84A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
6-2	CONT				<p>3. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS---</p> <p>1A) LVDC/LVDA COMPUTATIONAL FAILURE;</p> <p>1B) ATTITUDE ERROR SIGNALS PITCH; YAW; OR ROLL GREATER THAN 0.5 DEG (T81) 0.120 SEC AND 3-12 BURN)-- ROLL GREATER THAN +/- 3.5 DEG; PITCH AND YAW GREATER THAN +/- 5 DEG (3-12 BURN ONLY);</p> <p>1C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE</p> <p>1D) 3-12B ENGINE ACTUATOR HARDOVER GREATER THAN +/- 5 DEG (3-12 BURN ONLY)</p> <p>1E) FAILURE OF 3-12B ENGINE HYDRAULICS (3-12 BURN ONLY)</p>		
6-3		INERTIAL PLATFORM FAILURE - ACCELEROMETER (ONE OR MORE AXES)	LAUNCH COAST RESTART	CONTINUE MISSION 18SE INFORM FLIGHT *18DO; AND 6U100 *CAPCOM ADVISE CREW	<p>CUES---</p> <p>1. GUIDANCE STATUS WORD (MGDE CODE 24 (MG0-803))</p> <p>BITS D26 AND D25 FOR Z ACCEL SET TO 'ONE'</p> <p>BITS D24 AND D23 FOR X ACCEL SET TO 'ONE'</p> <p>BITS D22 AND D21 FOR Y ACCEL SET TO 'ONE'</p> <p>2. ACCELEROMETER PICKOFFS (A1 Y; OR Z) INDICATE IN EXCESS OF 3 DEG AND NOT DECREASING; (M10-803; M11-803; M12-803)</p> <p>NOTES---</p> <p>1. NO EFFECT ON VEHICLE TRAJECTORY DURING 3-12 STAGE BURN.</p> <p>2. LVDC SWITCHED TO A BACKUP MODE AND UTILIZES A PRECOMPUTED P/R PROFILE FOR FAILED AXIS DURING THE 3-12, 3-11, AND 3-12B BURNS. THE IV STATE VECTOR THEREAFTER MAY NOT REFLECT THE ACTUAL FLIGHT TRAJECTORY.</p> <p>3. IV STATE VECTOR AT INSERTION MAY BE NO GO AND A RAY UPDATE MAY BE REQUIRED FOR PROPER INITIATION OF T82 AND PROPER T81 GUIDANCE.</p> <p>4. CREW WILL INITIATE MANUAL 3-12B CUTOFF FOR OVERSPEED.</p> <p>5. THE SECOND BURN PRECOMPUTED P/R PROFILE FOR THE FAILED AXIS ASSUMES NOMINAL PROPULSION PERFORMANCE AND NOMINAL MASS HISTORY.</p>		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	8	10/31/70	SLY - T81 THROUGH T84/T84A		6-6

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 - SLV - T81 THROUGH T84/T84A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
6-4	LAUNCH VEHICLE INERTIAL PLATFORM FAILURE - ATTITUDE REFERENCE	ALL		CONTINUE MISSION *BSE INFORM FLIGHT AND *RECOMMEND SPACECRAFT *GUIDANCE TAKEOVER *IF THE FAILURE OCCURS *DURING LAUNCH PHASE OR *ORBIT PHASE; BSE SEND *TARGET UPDATE (SEE NOTE 2)	<p>CUES---</p> <p>1. GUIDANCE REFERENCE FAILURE (D04 OR D06 MODE CODE 26 BIT D0 SET TO "NONE" (M6C-602)</p> <p>2. GUIDANCE STATUS WORD=MODE CODE 26) (M6C-603)</p> <p>BITS D20 AND D19 FOR Z GIMBAL SET TO "NONE"</p> <p>BITS D18 AND D17 FOR X GIMBAL SET TO "NONE"</p> <p>BITS D16 AND D15 FOR Y GIMBAL SET TO "NONE"</p> <p>3. LADDER OUTPUTS CONSTANT FOR FILED AREAS (M34-603; M35-603; M36-603)</p> <p>4. ATTITUDE ERROR CONSTANT FOR FAILED AREAS (M67M9-602; M70-602; M71-602)</p> <p>NOTES---</p> <p>1. IN THE EVENT OF THIS FAILURE PRIOR TO T86, THE CREW WILL HAVE TO INITIATE T86.</p> <p>2. FOR AN ATTITUDE REFERENCE FAILURE DURING LAUNCH PHASE, OR ORBIT PHASE A LAUNCH VEHICLE TARGET UPDATE SHOULD BE SENT PRIOR TO T85 &amp; 2 HR 9 MIN; THE TARGET UPDATE SHOULD BE ACCOMPLISHED SO THAT THE LVOC COMPUTED T86 INITIATE TIME WILL OCCUR SEVERAL MINUTES LATER THAN THE CREW INITIATED T86 TIME.</p>
<p>RULE NUMBERS 6-3 THROUGH 6-6 ARE RESERVED</p>					
<p>MISSION [REV] [DATE] [SECTION] [GROUP] [PAGE]</p>					
<p>APOLLO 10 0 10/31/74 SLV - T81 THROUGH T84/T84A 6-7</p>					

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 4 - SLY - T81 THROUGH T84/T84A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
6-7		<p>S-11 LOSS OF THRUST</p> <p>A. ANY SINGLE ENGINE FAILURE TO ATTAIN THRUST OR LOSS OF THRUST PRIOR TO NOMINAL S-11 CUTOFF</p> <p>B. ANY TWO ENGINES FAILURE TO ATTAIN THRUST OR LOSS OF THRUST--</p> <p>1. IF THE DIFFERENCE IN COMMANDD AND SIMBAL ANGLES IS LESS THAN 40 DEG IN PITCH AND YAW</p> <p>2. IF THE DIFFERENCE IN COMMANDD ANGLES AND SIMBAL ANGLES EXCEEDS 40 DEG IN PITCH OR YAW</p> <p>C. THREE OR MORE ENGINES OUT</p> <p>1. PRIOR TO S-11V TO CO1 CAPABILITY</p> <p>2. AFTER S-11V TO CO1 CAPABILITY BUT PRIOR TO LOW LEVEL SENSE ARM</p> <p>3. AFTER LOW LEVEL SENSE ARM</p> <p>(A) 1 CONTROL ENGINES OUT</p> <p>(B) ALL ENGINES OUT</p>	LAUNCH	<p>A. CONTINUE MISSION BSE INFORM FLIGHT AND P100.</p> <p>B. CONTINUE MISSION/ABORT</p> <p>1. CONTINUE MISSION BSE INFORM FLIGHT AND P100.</p> <p>2. ABORT BSE INFORM FLIGHT AND P100 AND TRANSMIT ABORT REQUEST</p> <p>C. ABORT/EARLY STAGE/ CONTINUE MISSION</p> <p>1. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST.</p> <p>2. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING.</p> <p>3. EARLY STAGE/ CONTINUE MISSION</p> <p>(A) EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGE.</p> <p>(B) CONTINUE MISSION BSE INFORM FLIGHT</p>	<p>A. CUES--</p> <p>1. THRUST OK SWITCHES-OFF (R289-201 THROUGH 289; R288-201 THROUGH 287).</p> <p>2. THRUST CHAMBER PRESSURE- ZERO (012-201 THROUGH 207).</p> <p>3. LONGITUDINAL ACCELERATION (A2-603).</p> <p>B. CUES--</p> <p>1. THRUST OK SWITCHES OFF (R289-201 THROUGH 289-- R288-201 THRU 287)</p> <p>2. THRUST CHAMBER PRESSURE ZERO (012-201 THROUGH 207)</p> <p>3. LONGITUDINAL ACCELERATION (A2-603)</p> <p>4. COMMANDD ANGLES AND SIMBAL ANGLES (M60-603)</p> <p>B.1. NOTE-- CREW WOULD ABORT ON OVERRATE CONDITION.</p> <p>C. CUES--</p> <p>C.1. THRUST OK SWITCHES OFF (R289-201 THRU 289-- R288-201 THRU 287)</p> <p>2. THRUST CHAMBER PRESSURE ZERO (012-201 THRU 207)</p> <p>3. LONGITUDINAL ACCELERATION (A2-603)</p> <p>C. NOTE-- AFTER PROGRAMMED S-11 CENTER ENGINE CUTOFF, ENGINES OUT REPEAS ONLY TO CONTROL ENGINES.</p>		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 13	A	10/10/79	SLY - 701 THROUGH T84/T84A		4-9

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 6 - SLV - T81 THROUGH T84/T84A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
6-0		S-11 STAGE ANY SINGLE ACTUATOR HARDOVER INBOARD	LAUNCH	ABORT/EARLY STAGE/CONTINUE MISSION	
	A.	PRIOR TO S-11B TO CO1 CAPABILITY		ABORT- BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST	CUES--- 1. YAW ACTUATOR POSITION EXCEEDS +8 DEG (68-201 THRU 204; 630-201 THRU 204)
	B.	BETWEEN S-11B TO CO1 CAPABILITY AND 30 SEC PRIOR TO S-11 CUTOFF		EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING	2. PITCH ACTUATOR POSITION EXCEEDS +8 DEG (68-201 THRU 204; 631-201 THRU 204)
	C.	AFTER S-11 CUTOFF MINUS 30 SEC		CONTINUE MISSION- BSE INFORM FLIGHT	3. ADJACENT CONTROL ENGINE ACTUATOR IN SAME PLANE MOVES 4 1/2 DEG INBOARD (SAME MEASUREMENTS AS CUES 1 AND 2)
					NOTES--- 1. THE CREW SHOULD ABORT OR EARLY STAGE AS SOON AS POSSIBLE AFTER MALFUNCTION OCCURS TO PRELUDE EXCESSIVE THERMAL PROBLEMS IN APT INTERSTAGE.
6-0		S-11 SECOND PLANE SEPARATION FAILS TO OCCUR AT T83 + 31 SEC	LAUNCH	ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST. CREW ABORT PRIOR TO T83 + 68 SEC.	CUES--- 1. SECOND PLANE SEPARATION INDICATOR SHOWS NO SEPARATION (M86-206; M87-206) 2. GUIDANCE MODE WORD 1 MODE CODE (8 BIT D15 REMAINS ZERO (M60-603)) 3. IGNITION BUS VOLTAGE REMAINS AT APPROXIMATELY 28 VOLTS (M129-207) 4. RECIRCULATION BUS VOLTAGE REMAINS AT APPROXIMATELY 36 VOLTS (M111-207)
					NOTES--- THE CREW SHOULD ABORT AS SOON AS POSSIBLE AFTER MALFUNCTION OCCURS TO PRELUDE EXCESSIVE THERMAL PROBLEMS IN APT INTERSTAGE.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	A	10/19/70	SLV - T81 THROUGH T84/T84A		10-9

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MISSION RULES

SECTION 8 - SLV - T81 THROUGH T84/T84A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	6-10	S-1VB LOSS OF ENGINE HYDRAULIC FLUID PRIOR TO S-1VB BURN	LAUNCH	NO S1VB START BSE INFORM FLIGHT AND FIDO AND RECOMMEND NO S-1VB START.  CAPCOM ADVISE CREW	CUES--- 1. HYDRAULIC RESERVOIR OIL LEVEL APPROX ZERO PERCENT (1T-403). 2. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (041-403). 3. HYDRAULIC RESERVOIR PRESSURE APPROX ZERO PSIA (042-403).  NOTES--- 1. 1T-403 PLUS ONE OF THE OTHER CUES ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE. 2. IF ALL THREE CUES ARE FUNCTIONING PROPERLY, THEY ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE. 3. SPACECRAFT SHOULD HAVE COI CAPABILITY AT S-1E CUTOFF 4. AT S1E CUTOFF, THE CREW SHOULD INHIBIT THE S1VB START WITH THE TRANSLATION HANDCONTROLLER.												
	8-11	S-1VB STAGE LOSS OF THRUST  A. FAILS TO ATTAIN THRUST OR PREMATURE SHUTDOWN PRIOR TO OBTAINING PARKING ORBIT  B. FAILS TO ATTAIN THRUST OR PREMATURE SHUTDOWN PRIOR TO VELOCITY CUTOFF FOR SECOND BURN	LAUNCH  FLI	A. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND FIDO   B. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO. THE SPACECRAFT SHOULD REMAIN ATTACHED TO THE S-1VB/FIU AND MONITOR LNE AND LOR TANK VILLAGE PRESSURES. IF SEPARATION IS REQUIRED, THE SPACECRAFT SHOULD IMMEDIATELY GO TO A SAFE DISTANCE 17000 FT FROM THE S-1VB/FIU.	CUES--- 1. THRUST CHAMBER PRESSURE = ZERO (01-401). 2. THRUST OK SWITCHES = OFF (11A-401) (117-401). 3. LONGITUDINAL ACCELERATION = ZERO (12-501). 4. T85 IS INITIATED, MODE CODE 25; BIT D2 SET TO ONE (160-601). 5. T87 IS INITIATED, MODE CODE 26; BIT D20 SET TO ONE (160-601).  NOTE--- SEPARATION WILL BE REQUIRED FOR VIOLATION OF PWR 7-8 OR PWR 7-16.												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 18</td> <td>A</td> <td>10/18/70</td> <td>SLV - T81 THROUGH T84/T84A</td> <td></td> <td>8-10</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 18	A	10/18/70	SLV - T81 THROUGH T84/T84A		8-10
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 18	A	10/18/70	SLV - T81 THROUGH T84/T84A		8-10												



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MISSION RULES

SECTION 6 - SLV - T81 THROUGH T84/T84A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	6-12	S-IVB COLD HELIUM SHUTOFF VALVE(S) FAILS OPEN  A. PRIOR TO LAUNCH ESCAPE TOWER JETTISON AND LOX TANK ULLAGE PRESSURE IS 30 PSIA OR SATURATED AT UPPER LEVEL  B. BETWEEN LAUNCH ESCAPE TOWER JETTISON AND 30 SEC PRIOR TO SII CUTOFF  C. AFTER S-II CUTOFF MINUS 30 SEC	LAUNCH	A. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST  B. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING IMMEDIATELY  C. CONTINUE MISSION BSE INFORM FLIGHT	CUES---  A. 1. LOX TANK ULLAGE PRESSURE (D179-406) 2. LOX TANK ULLAGE PRESSURE (D180-406)  B&C 3. COLD HELIUM REG DISCHARGE PRESSURE REMAINS GREATER THAN 200 PSIA FOR A MINIMUM OF 20 SECONDS (D189-403) 3. LOX ULLAGE PRESSURE AT RELIEF SETTING (41-44 PSIA) AND RELIEVING (D179-406; D180-406) 3. COLD HE BOTTLE PRESSURE DECATING (D261-409; D263-403)												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 16</td> <td>A</td> <td>10/10/69</td> <td>SLV - T81 THROUGH T84/T84A</td> <td></td> <td>6-11</td> </tr> </tbody> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 16	A	10/10/69	SLV - T81 THROUGH T84/T84A		6-11
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 16	A	10/10/69	SLV - T81 THROUGH T84/T84A		6-11												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 6 - SLY - 781 THROUGH 784/784A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	6-10	S-1VB LOSS OF ENGINE HYDRAULIC FLUID PRIOR TO S-1VB BURN	LAUNCH	NO S1VB START BSE INFORM FLIGHT AND P100 AND RECOMMEND NO S-1VB START.  CAPCOM ADVISE CREW	CUES--- 1. HYDRAULIC RESERVOIR OIL LEVEL APPROX ZERO PERCENT (17-403). 2. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (141-403). 3. HYDRAULIC RESERVOIR PRES- SURE APPROX ZERO PSIA (142-403). NOTES--- 1. 17-403 PLUS ONE OF THE OTHER CUES ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE. 2. IF ALL THREE CUES ARE FUNCTIONING PROPERLY THEY ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE. 3. SPACECRAFT SHOULD HAVE COI CAPABILITY AT S-11 CUTOFF 4. AT S11 CUTOFFS THE CREW SHOULD IMMEDIATELY THE S1VB START WITH THE TRANSLATION HANDCONTROLLER.		
	6-11	S-1VB STAGE LOSS OF THRUST  A. FAILS TO ATTAIN THRUST OR PREMATURE SHUTDOWN PRIOR TO OBTAINING PARKING ORBIT  B. FAILS TO ATTAIN THRUST OR PREMATURE SHUTDOWN PRIOR TO VELOCITY CUTOFF FOR SECOND BURN	LAUNCH  FILE	A. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND P100  B. CONTINUE MISSION BSE INFORM FLIGHT AND P100. THE SPACECRAFT SHOULD REMAIN ATTACHED TO THE S-1VB/IV AND MONITOR LM2 AND LOX TANK VLLAGE PRESSURES. IF SEPARATION IS REQUIRED THE SPACECRAFT SHOULD IMMEDIATELY GO TO A SAFE DISTANCE (1000 FT) FROM THE S-1VB/IV.	CUES--- 1. THRUST CHAMBER PRESSURE = ZERO (11-401). 2. THRUST OR SWITCHES = OFF (114-401; 1157-401). 3. LONGITUDINAL ACCELERATION = ZERO (12-401). 4. P85 IS INITIATED; POOE CODE 29; BIT 02 SET TO ONE (140-401). 5. T87 IS INITIATED; ACDE CODE 26; BIT 020 SET TO ONE (140-401). NOTE--- SEPARATION WILL BE REQUIRED FOR VIOLATION OF P85 OR P87.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/18/69	SLY - 781 THROUGH 784/784A		6-12

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 6 - SLV - T83 THROUGH T84/T84A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	6-12	S-1VB COLD HELIUM SHUTOFF VALVE(S) FAILS OPEN	LAUNCH														
		A. PRIOR TO LAUNCH ESCAPE TOWER JETTISON AND LOX TANK ULLAGE PRESSURE IS 30 PSIA OR SATURATED AT UPPER LEVEL		A. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST	CUES--- A. 1. LOX TANK ULLAGE PRESSURE (D179-406) 2. LOX TANK ULLAGE PRESSURE (D180-406)												
		B. BETWEEN LAUNCH ESCAPE TOWER JETTISON AND 30 SEC PRIOR TO S-11 CUTOFF		B. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING IMMEDIATELY	B,C,D 3. COLD HELIUM REG DISCHARGE PRESSURE REMAINS GREATER THAN 300 PSIA FOR A MINIMUM OF 20 SECONDS (D105-403)												
		C. AFTER S-11 CUTOFF MINUS 30 SEC		C. CONTINUE MISSION BSE INFORM FLIGHT	2. LOX ULLAGE PRESSURE AT RELIEF SETTING (41-44 PSIA) AND RELIEVING (D179-406) (D180-406)												
		D. BETWEEN T83 + 3 MIN 32 SEC AND S-11 CUTOFF MINUS 30 SEC - FOR PREMATURE S-11 ENGINE(S) CUTOFF ONLY		D. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING	3. COLD HE BOTTLE PRESSURE DECAYING (D281-403) (D283-403)												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 13</td> <td>FCR</td> <td>9/18/69</td> <td>SLV - T83 THROUGH T84/T84A</td> <td></td> <td>6-13</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 13	FCR	9/18/69	SLV - T83 THROUGH T84/T84A		6-13
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 13	FCR	9/18/69	SLV - T83 THROUGH T84/T84A		6-13												

2 SLV - T88 AND  
T89(COART)

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MISSION RULES

SECTION 7 - SLV - T85 AND T87

REV	ITEM
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SUMMARY OF COAST PHASE RULES

- T-1 INSUFFICIENT PROPELLANT
- T-2 LOSS OF ONE APS MODULE
- T-3 MAIN FUEL VALVE FAILS TO CLOSE
- T-4 MAIN CRUIZER VALVE FAILS TO CLOSE
- T-5 RANGE SAFETY SYSTEM NOT SAFOED AFTER INSERTION
- T-6 COLD HELIUM SHUTOFF VALVE FAILS OPEN
- T-7 AUXILIARY HYDRAULIC PUMP FAILS
- T-8 LOSS OF ATTITUDE CONTROL
- T-9 CONTINUOUS VENT REGULATOR FAILS TO OPEN
- T-10 APS ULLAGE ENGINE FAILS ON
- T-11 RESERVED
- T-12 RESERVED
- T-13 EV ENVIRONMENTAL CONTROL SYSTEM FAILS
- T-14 COMMON BULKHEAD DELTA P
- T-15 LOSS OF S-IVB STAGE PNEUMATICS
- T-16 LOSS OF ENGINE CONTROL BOTTLE PRESSURE
- T-17 LH2 TANK VENT FAILURE OR LEAK
- T-18 LOW COLD HELIUM SUPPLY
- T-19 LOX TANK ULLAGE PRESSURE IS LESS THAN 33 PSIA
- T-20 J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS
- T-21 PU VALVE FAILURE
- T-22 S-IVB LOSS OF HYDRAULIC FLUID
- T-23 RESERVED
- T-24 RESERVED
- T-25 LOX NON-PROPLSIVE VENT FAILS TO OPEN
- T-26 LH2 LATCHING VENT VALVE FAILS TO OPEN
- T-27 GN2 START BOTTLE DUMP FAILS TO OCCUR
- T-28 COLD HELIUM DUMP FAILS TO OCCUR
- T-29 RESERVED
- T-30 RESERVED

THE FOLLOWING MISSION RULES ALSO APPLY TO THIS SECTION---

- 6-3 INERTIAL PLATFORM FAILURE - ACCELEROMETER
- 6-6 LAUNCH VEHICLE INERTIAL PLATFORM FAILURE-ATTITUDE REFERENCE

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12 FNL		9/10/69	SLV-T85 AND T87		2-1



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MISSION RULES

SECTION 7 - SLV - T85 AND T87

REV	ITEM	CONDITION/ALTERNATIVE	PHASE	RULING	QUES/NOTES/COMMENTS
1-3	J-2 ENGINE MAIN FUEL VALVE (MFV) FAILS TO CLOSE AT	A. FIRST S-1VB CUTOFF	EARTH ORBIT	<p>1. CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND COMMAND (ASAP)---</p> <p>1. PREVALVES AND RECIRC SHUTOFF VALVES CLOSED (SEE NOTE 1)</p> <p>2. ATTEMPT TO CYCLE AND CLOSE MFV</p> <p>IF SUCCESSFUL, BSE COMMAND---</p> <p>3. PREVALVE AND RECIRC SHUTOFF VALVES OPEN</p>	<p>QUES---</p> <p>1. MAIN FUEL VALVE POSITION (04-0017)</p> <p>2. MAIN FUEL VALVE OPEN (113-0017)</p> <p>3. FUEL FLOWMETER FLOWRATE (172-0017)</p> <p>4. FUEL RECIRC FLOWRATE (175-0004)</p> <p>NOTES---</p> <p>1. IF THE MFV IS OPEN, THE LH2 PUMP INLET PRESSURE WILL GO TO ZERO PSIA AFTER COMMAND ACTION (A.1).</p> <p>2. THIS FAILURE WILL REQUIRE EVALUATION OF LH2 RESIDUALS TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF (REF FMR T-1).</p> <p>3. A FAILURE FOLLOWING SECOND BURN CUTOFF WILL REQUIRE A RE-EVALUATION OF SLINGSHOT VELOCITY DESIRED.</p>
		B. SECOND S-1VB CUTOFF	TLC	<p>1. CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND COMMAND---</p> <p>1. PREVALVES AND RECIRC SHUTOFF VALVES CLOSE</p> <p>2. ATTEMPT TO CLOSE MFV</p> <p>WHEN S-1VB IS AT PROPER DUMP ATTITUDE, BSE COMMAND---</p> <p>3. PREVALVES AND RECIRC SHUTOFF VALVES OPEN</p> <p>AT TIME OF DESIRED LOX DUMP TERMINATION, BSE COMMAND---</p> <p>4. PREVALVES AND RECIRC SHUTOFF VALVES CLOSE</p>	

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MISSION RULES

SECTION 7 - SIV - T88 AND T87

REV	ITEM	CONDITION/MALFUNCTION	PHASE	ACTION	CUES/NOTES/COMMENTS												
7-4	J-2 ENGINE MAIN OXIDIZER VALVE (MOV) FAILS TO CLOSE AT---																
	A. FIRST S-IVB CUTOFF	EARTH ORBIT	A.	<p>CONTINUE MISSION/ NO S-IVB RESTART</p> <p>BSE INFORM FLIGHT AND COMMAND (ASAP)---</p> <p>1. PREVALVES AND RECIRC SHUTOFF VALVES CLOSED</p> <p>2. ATTEMPT TO CLOSE MOV</p> <p>IF A.2 IS SUCCESSFUL: BSE INFORM FLIGHT AND COMMAND</p> <p>3. PREVALVES AND RECIRC SHUTOFF VALVES OPEN</p> <p>IF A.3. IS UNSUCCESSFUL: BSE INFORM FLIGHT AND RECOMMEND NO SIVB RESTART</p>	<p>CUES---</p> <p>1. MAIN OXIDIZER VALVE POSITION (63-001) GREATER THAN 10 DEG.</p> <p>2. MAIN OXIDIZER VALVE OPEN-ON (K120-001).</p> <p>3. LOX FLOWMETER FLOWRATE (F3-401) GREATER THAN 47 LB/SEC.</p> <p>NOTES---</p> <p>1. THIS FAILURE FOLLOWING SECOND CUTOFF WILL REQUIRE A REEVALUATION OF SLINGSHOT VELOCITY DESIRED.</p> <p>2. IF THE MOV IS OPEN: THE LOX PUMP INLET PRESSURE WILL GO TO ZERO AFTER COMMAND ACTION (A.1)</p>												
	B. SECOND BURN CUTOFF	TLC	B.	<p>CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND COMMAND---</p> <p>1. PREVALVES AND RECIRC SHUTOFF VALVES CLOSED</p> <p>2. ATTEMPT TO CLOSE MOV</p> <p>AT INITIATION OF LOX PUMP: BSE COMMAND---</p> <p>3. PREVALVES AND RECIRC SHUTOFF VALVES OPER</p> <p>AT TIME OF DESIRED LOX PUMP TERMINATION: BSE COMMAND---</p> <p>4. PREVALVES AND RECIRC VALVES CLOSED.</p>													
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 11</td> <td>5</td> <td>10/31/67</td> <td>SIV - T88 AND T87</td> <td></td> <td>7-4</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	5	10/31/67	SIV - T88 AND T87		7-4
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 11	5	10/31/67	SIV - T88 AND T87		7-4												



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MISSION RULES

SECTION 7 - BLY - T88 AND T87

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	QUES/NOTES/COMMENTS												
7-3		RANGE SAFETY SYSTEM NOT ARMED AFTER INSERTION			QUES--- 1. FIRING UNIT 1 RS ESU GREATER THAN OR EQUAL TO 1.6 VOLTS (M80-411). 2. FIRING UNIT 2 RS ESU GREATER THAN OR EQUAL TO 1.6 VOLTS (M81-411).												
	A.	PROPELLANT DISPERSION SYSTEM NOT ARMED		A. CONTINUE MISSION  BSE INFORM FLIGHT AND RECOMMEND RSO SEND SAFE COMMAND													
	B.	PROPELLANT DISPERSION SYSTEM ARMED AND RSO HAS NOT SENT MFCO		B. SPACECRAFT SEPARATION  BSE INFORM FLIGHT AND 1. RECOMMEND SPACECRAFT SEPARATION TO A SAFE DISTANCE (1700 FT). 2. WHEN SPACECRAFT HAS REACHED A SAFE DISTANCE, RECOMMEND RSO SEND SAFE COMMAND.	3. RANGE SAFETY RECEIVER NO. 1 ENABLE (M87-411) BETWEEN 2.4 AND 4.5 VOLTS. 4. RANGE SAFETY RECEIVER NO. 2 ENABLE (M82-411) BETWEEN 2.4 AND 4.5 VOLTS. 5. RSO DISPLAY AND COMMAND SYSTEM STATUS.  NOTES--- 1. RSO SHOULD NOT ATTEMPT TO SAFE THE RANGE SAFETY RECEIVERS ON REVS 2 AND 3 UNTIL MCC CONFIRMS THE PROPELLANT DISPERSION SYSTEM IS NOT ARMED (CONDITION A ONLY). 2. EITHER CUE 1 OR CUE 2 IS SUFFICIENT FOR IMPLEMENTING RULE B. 3. CUES 369 ARE VALID ONLY WHEN THE VEHICLE IS RECEIVING 480 MHZ RADIATION.												
7-4		S-IVB STAGE COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE AT---			QUES--- 1. COLD HELIUM REGULATOR DISCHARGE PRESSURE GREATER THAN 200 PSIA (D0105-403). 2. LOX TANK ULLAGE PRESSURES (D0179-406, D0180-406). 3. COLD HELIUM BOTTLE PRESSURE DECAYING (D261-403, D0263-403).												
	A.	T88 + 1.4 SEC	EARTH ORBIT	A. CONTINUE MISSION/SPACECRAFT SEPARATION  BSE INFORM FLIGHT AND COMMAND--- 1. LOX NPV VALVE OPEN (REF NOTE 3) 2. ATTEMPT TO CLOSE STAGE COLD HELIUM SHUTOFF VALVES IF 2 SUCCESSFUL, BSE COMMAND IMMEDIATELY--- 3. LOX NPV VALVE CLOSE (REF NOTE 3) 4. IF LOX ULLAGE PRESSURE AT 50 PSIA OR SATURATED BSE INFORM FLIGHT AND RECOMMEND IMMEDIATE SPACECRAFT SEPARATION TO A SAFE DISTANCE.	NOTES--- 1. ACTION REQUIRED TO AVOID EXCEEDING LOX TK OVER PRESS OR BULKHEAD POSITIVE DELTA PRESS LIMITS (FMR7-14). 2. SEE FMR 7-18 FOR RESTART CRITERIA FOR OFF-NOMINAL COLD HELIUM PRESSURE. 3. IF LOX NPV VALVE FAILS TO OPEN THE LOX VENT VALVE CAN BE OPENED AS BACKUP.												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>B</td> <td>10/31/69</td> <td>BLY - T88 AND T87</td> <td></td> <td>7-3</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	B	10/31/69	BLY - T88 AND T87		7-3
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	B	10/31/69	BLY - T88 AND T87		7-3												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 7 - SLY - T88 AND T87

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
		0. T87 + 3.3 SEC	TLC	0. CONTINUE MISSION AFTER T87 + 2 MIN 30 SEC. BSE INFORM FLIGHT AND COMMAND-- 1. LOX NPV VALVE OPEN (REP NOTE 3) AT T87 + 19 MIN BSE SEND-- 2. LOX NPV VALVE CLOSE (REP NOTE 3)													
7-7	8-1VB AUXILIARY HYDRAULIC PUMP FAILS				CUES--												
	A. TO TURN OFF AS SEQUENCED	EARTH ORBIT	A. CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO TURN OFF AUXILIARY HYDRAULIC PUMP AS SOON AS POSSIBLE		A.1. SYSTEM PRESSURE (041-403); 2. RESERVOIR LEVEL (LT-403); 3. APT BUS NO. 2 CURRENT (M22-404); 4. HYDRAULIC RESERVOIR OIL PRESSURE (042-403); NOTES-- FAILURE TO TURN OFF HYDRAULIC PUMP DEPLETES APT NO. 2 BATTERY IN APPROXIMATELY 90 MIN AND OVERHEATS HYDRAULIC SYSTEM IN APPROXIMATELY 70 MIN												
	B. TO TURN ON		B. CONTINUE MISSION 1. BSE INFORM FLIGHT AUXILIARY HYDRAULIC AND ATTEMPT TO TURN ON PUMP		B.1. SYSTEM PRESSURE (041-403); 2. RESERVOIR OIL LEVEL (LT-403); 3. AFTER BUS NO. 2 CURRENT (M22-404); 4. RESERVOIR PRESSURE (042-403); 5. HYDRAULIC PUMP INLET OIL TEMP (C30-401);												
	2. AT T86 + 3 MIN 39 SEC	TLC	2. BSE INFORM FLIGHT AND COMMAND AUXILIARY HYDRAULIC PUMP OFF		6. RESERVOIR OIL TEMP (C31-403);												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 13</td> <td>8</td> <td>10/31/79</td> <td>SLY - T88 AND T87</td> <td></td> <td>7-6</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 13	8	10/31/79	SLY - T88 AND T87		7-6
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 13	8	10/31/79	SLY - T88 AND T87		7-6												

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MISSION RULES

SECTION 7 - SLV - T05 AND T07

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
7-0	LOSS OF ATTITUDE CONTROL DURING																
	A. T05 AND T07 TO T07 + 15 MIN	EARTH ORBIT/ TLC	A.	SPACECRAFT GUIDANCE TAKEOVER/ SPACECRAFT SEPARATION  BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT GUIDANCE TAKEOVER IF UNSUCCESSFUL; BSE RECOMMEND SPACECRAFT SEPARATION	CUES---  1. ANGULAR RATES - PITCH (R4-602); OR YAW (R5-602) GREATER THAN 0.5 DEG/SEC AND NOT DECREASING; OR ROLL (R6-602; R12-602); GREATER THAN 0.5 DEG/SEC AND NOT DECREASING  2. ANGULAR RATES-PITCH (R13-602); OR YAW (R8-602) GREATER THAN 0.5 DEG/SEC AND NOT DECREASING; OR ROLL (R12-602) GREATER THAN 0.5 DEG/SEC AND NOT DECREASING (SEE NOTE 3)  3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE 2)												
	B. T06 TO T06 + 9 MIN 20 SEC	TLI	B.	TLI INHIBIT  BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	1. ANGULAR RATES - PITCH (R4-602); YAW (R5-602); OR ROLL (R6-602) GREATER THAN 0.5 DEG/SEC AND NOT DECREASING  2. ANGULAR RATES-PITCH (R13-602); YAW (R8-602); OR ROLL (R12-602) GREATER THAN 0.5 DEG/SEC AND NOT DECREASING GREATER THAN 0.5 DEG/SEC AND NOT DECREASING; OR ROLL (R12-602) GREATER THAN 0.5 DEG/SEC AND NOT DECREASING (SEE NOTE 3)  3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE 2)												
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%;">MISSION</td> <td style="width:5%;">REV</td> <td style="width:15%;">DATE</td> <td style="width:15%;">SECTION</td> <td style="width:15%;">GROUP</td> <td style="width:10%;">PAGE</td> </tr> <tr> <td>APOLLO 14</td> <td>0</td> <td>10/31/64</td> <td>SLV - T05 AND T07</td> <td></td> <td>7-7</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 14	0	10/31/64	SLV - T05 AND T07		7-7
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 14	0	10/31/64	SLV - T05 AND T07		7-7												

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MISSION RULES

SECTION 7 - SLY - T88 AND T87

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	T-8 CONT	C. AFTER T87 + 15 MIN	TLC	<p>C. CREW DISCRETION</p> <p>BSE INFORM FLIGHT AND FIDO</p> <p>1. DO NOT START EVASIVE MANEUVER</p> <p>2. DO NOT INITIATE T88</p> <p>3. BSE PERFORM NON-PROPULSIVE SIVB SAFING BY GROUND COMMAND.</p>	<p>C. 1. ANGULAR RATES</p> <p>(A) FROM T87+15 MIN TO NEXT MANEUVER INITIATE AFTER T88E MANEUVER- PITCH (R4-802), YAW (R3-802), OR ROLL (R6-802) GREATER THAN 0.7 DEG/SEC AND NOT DECREASING.</p> <p>(B) AFTER NEXT MANEUVER INITIATE FOLLOWING T88E MANEUVER AND BEFORE T88E INITIATE- PITCH OR YAW GREATER THAN 0.3 DEG/SEC AND NOT DECREASING OR ROLL GREATER THAN 0.3 DEG/SEC AND NOT DECREASING.</p> <p>2. ANGULAR RATES (SEE NOTE 3)</p> <p>(A) FROM T87+15 MIN TO NEXT MANEUVER INITIATE AFTER T88E MANEUVER- PITCH (R3-802), YAW (R6-802), OR ROLL (R2-802) GREATER THAN 0.7 DEG/SEC AND NOT DECREASING.</p> <p>(B) AFTER NEXT MANEUVER INITIATE FOLLOWING T88E MANEUVER AND BEFORE T88E INITIATE- PITCH OR YAW GREATER THAN 0.3 DEG/SEC AND NOT DECREASING OR ROLL GREATER THAN 0.3 DEG/SEC AND NOT DECREASING.</p> <p>3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE 2)</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 13	8	10/21/79	SLY - T88 AND T87		7-8												



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MISSION RULES

SECTION 7 - SLV - T88 AND T87

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS												
7-9		CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO OPEN IN T88 (T89 + 59 SEC)	EARTH ORBIT TLI	CONTINUE MISSION DSE INFORM FLIGHT AND 1. ATTEMPT TO OPEN CVS RELIEF OVERRIDE SHUTOFF VALVE IF UNSUCCESSFUL, DSE--- 2. VENT THE LM2 TANK PRIOR TO T86 + 5 MIN 40 SEC TO A VALUE BELOW THE PRESSURE REQUIRED FOR S-IVB RESTART. IF THE LM2 BLOWDOWN IS COMPLETED WITHIN 30 MINUTES PRIOR TO T86 INITIATE COMMAND--- 3. ULLAGE ENGINES ON AFTER 90 SEC OF ULLAGE SEND--- 4. ULLAGE ENGINES OFF ULLAGING SHOULD BE COMPLETED PRIOR TO THE AMBIENT REPRESSURIZATION. EARTH ORBIT IF NEITHER COMMAND ACTION 1 NOR 2 IS SUCCESSFUL, DSE INFORM FLIGHT	CUES--- 1. CVS NOZZLE PRESSURE (0161-409) 0102-4097. 2. CVS REGULATOR CLOSED (4154-4157) 4158-4081. 3. LM2 ULLAGE PRESSURE (0177-408) 0178-4081. NOTES--- 1. IF THE CVS REGULATOR FAILS TO OPEN, THE LM2 SATURATION TEMPERATURE WILL INCREASE ABOVE NOMINAL RESTART LIMITS. 2. COMMAND ACTION WILL REQUIRE EVALUATION OF LM2 RESIDUES TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF.												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>8</td> <td>10/31/69</td> <td>SLV - T88 AND T87</td> <td></td> <td>7-10</td> </tr> </tbody> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	8	10/31/69	SLV - T88 AND T87		7-10
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	8	10/31/69	SLV - T88 AND T87		7-10												



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MISSION RULES

SECTION 7 - 84V - T08 AND T07

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	7-13	<p>10. ECS WATER VALVE FAILS TO CYCLE OPEN AND CLOSED</p> <p>A. WATER VALVE CLOSED AND COOLANT INLET CONTROL TEMPERATURE IS 64 DEG. F OR HIGHER; AND</p> <p>THE INERTIAL GIMBAL TEMPERATURE IS PREDICTED TO BE EQUAL TO OR GREATER THAN 113 DEG. F BEFORE THE NEXT SITE A03; OR</p> <p>THE LVDC MEMORY TEMPERATURE IS PREDICTED TO BE EQUAL TO OR GREATER THAN 124 DEG. F BEFORE THE NEXT SITE A03;</p> <p>B. WATER VALVE OPEN AND COOLANT INLET CONTROL TEMP IS 55 DEG. F OR LESS; AND</p> <p>THE INERTIAL GIMBAL TEMPERATURE IS PREDICTED TO BE 104 DEG. F OR LESS BEFORE THE NEXT SITE A03; OR</p> <p>THE LVDC MEMORY TEMPERATURE IS PREDICTED TO BE 12 DEG. F OR LESS BEFORE THE NEXT SITE A03.</p>	ALL	<p>A. CONTINUE MISSION</p> <p>00E (UPON FLIGHT AND SEND---</p> <p>1. ECS LOGIC INHIBIT COMMAND</p> <p>2. WATER VALVE OPEN</p> <p>B. CONTINUE MISSION</p> <p>00E (UPON FLIGHT AND SEND---</p> <p>1. ECS LOGIC INHIBIT COMMAND</p> <p>2. WATER VALVE CLOSED</p>	<p>CUES---</p> <p>1. WATER VALVE CLOSED/OPEN (05-001; 06-001);</p> <p>2. MEM20 TEMP (C10-001);</p> <p>3. CPU MODE CODE 27 BIT 04 SET TO ZERO (M0-001);</p> <p>4. 01-126 INERTIAL GIMBAL TEMP (C04-001);</p> <p>5. SUBLIMATOR INLET TEMP (C11-001);</p> <p>6. LVDC MEMORY TEMP (C34-001);</p> <p>7. LVDA TEMP NO. 5 (C55-001);</p> <p>8. LVDA TEMP NO. 2 (C50-001);</p>		
		MISSION	ADV	DATE	SECTION	GROUP	PAGE
		APOLLO 10	0	10/31/79	84V - T08 AND T07		7-13



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MISSION RULES

SECTION 7 - SLV - 108 AND 107

REV	ITEM	CONDITION/FAILURE/PHASE	PHASE	RULING	CUES/NOTES/COMMENTS		
	7-14	S-1V0 STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS---  A. MINUS 20 PSID OR PLUS 30 PSID          B. MINUS 20 PSID OR PLUS 30 PSID	EARTH ORBIT T/C	CONTINUE MISSION  BSE INFORM FLIGHT AND COMMAND---  LMS AND/OR LOR VENT VALVES OPEN OR CLOSED TO PRECLUDE REACHING SEPARATION LIMITS  SPACECRAFT SEPARATION  BSE INFORM FLIGHT AND FIDO AND RECOMMEND SPACECRAFT SEPARATION TO A SAFE DISTANCE	CUES--- 1. LMS TANK ULLAGE PRESSURE (1177-400; 0170-400) 2. LOR TANK ULLAGE PRESSURE (0100-400; 0170-400) 3. LMS PUMP INLET PRESSURE (02-403) 4. LOR PUMP INLET PRESSURE (03-403)  NOTES--- 1. MINUS DELTA PRESSURE IS DEFINED AS A FUEL TANK ULLAGE PRESSURE GREATER THAN THE LOR TANK ULLAGE PRESSURE. 2. PLUS DELTA PRESSURE IS DEFINED AS A LOR TANK ULLAGE PRESSURE GREATER THAN THE FUEL TANK ULLAGE PRESSURE. 3. THE MINIMUM RECOMMENDED DISTANCE BETWEEN THE S-1V0 AND THE SPACECRAFT IS 7000 FT. 4. THE BULKHEAD WILL STRUCTURALLY FAIL AT THE ULTIMATE LIMITS OF MINUS 20.0 PSID OR PLUS 40.0 PSID.		
		10810R 10710R	REV	DATE	SECTION	GROUP	PAGE
		0	10/31/70	SLV 108 AND 107			7-18

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MISSION RULES

SECTION 7 - 8LV - T08 AND T07

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
7-15	0-1VB STAGE PNEUMATIC SUPPLY PRESSURE DECAY EXCESSIVE IN T08 OR T07	EARTH ORBIT ITLC		CONTINUE MISSION 000 INFORM FLIGHT AND 1. ATTEMPT TO TERMINATE PUMP PURGE AND/OR CLOSE AMBIENT HELIUM SUPPLY SHUTOFF VALVE. 2. RE-OPEN AMBIENT HELIUM SUPPLY SHUTOFF VALVE AS REQUIRED.	CUES--- 1. ENGINE PUMP PURGE PRESSURE (D0030-403). 2. AMBIENT HELIUM PNEUMATIC SPHERE PRESSURE (D0230-403; D0236-403). 3. LOX REPRESS SUPPLY PRESSURE (D0000-403; D0234-403). NOTE--- 1. AN EXCESSIVE PNEUMATIC SUPPLY PRESSURE DECAY IS ONE WHICH WILL RESULT IN DEPLETION OF STAGE PNEUMATIC PRIOR TO COMPLETION OF T08 SAVING AND SLINGSHOT FUNCTIONS.
7-16	0-1VB ENGINE CONTROL BOTTLE PRESSURE LESS THAN 600 PSIA	EARTH ORBIT/ITLC		CONTINUE MISSION 000 INFORM FLIGHT	CUES--- 1. ENGINE CONTROL BOTTLE PRESSURE (D010-403; D042-403). 2. REPRESSURIZATION BOTTLE PRESSURE (D020-403; D08-403; D049-403; D034-403). NOTE--- THE 600 PSIA LIMIT IS VALID ONLY IF THE REPRESS SPHERES ARE AVAILABLE FOR BACKUP.

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MISSION RULES

SECTION 7 - SLY - T83 AND T87

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
7-17	LOW LHM TANK ULLAGE PRESSURE			CONTINUE MISSION	<p>CUE---</p> <p>1. LHM ULLAGE PRESSURE (D177-408; D178-408);</p> <p>2. LHM PUMP INLET PRESSURE (02-403);</p> <p>3. LHM VENT CLOSED DISCRETES (K1-410; K210-410).</p> <p>NOTES---</p> <p>1. IF THE ULLAGE PRESSURE RISES ABOVE 21 PSIA AFTER THE REGULATOR HAS BEEN CLOSED, THE REGULATOR SHOULD BE CYCLED TO MAINTAIN A 17 TO 21 PSIA ULLAGE PRESSURE IN LHM TANK.</p> <p>2. IF LHM TANK ULLAGE PRESSURE DROPS BELOW 19.5 PSIA DURING TSS, RESULTING PROPELLANT LOSSES SHOULD BE INCLUDED IN THE EVALUATION OF CAPABILITY TO ACHIEVE ACCEPTABLE ALTERNATE MISSION PER FMR 7-1.</p>												
	A. LHM TANK ULLAGE PRESSURE LESS THAN 21 PSIA IN T8 3	EARTH ORBIT	7LI	<p>A. CONTINUE MISSION</p> <p>SEE INFORM FLIGHT AND COMMAND</p> <p>1. LHM TANK VENT VALVES BOOST CLOSE ON AND OFF AND/OR CVS REGULATOR CLOSED, (ORIFICE OPEN) (NOTE 1)</p> <p>2. IF THE SITUATION CANNOT BE CORRECTED, AFTER INITIATION OF BURNER (REPRESS; SEE COMMAND---</p> <p>3. SECOND BURN RELAY OFF.</p>													
	B. LHM TANK ULLAGE PRESSURE DELTA FROM AMBIENT REPRESS LESS THAN ADVISED AT T83 3 MIN 10 SEC.			<p>B. CONTINUE MISSION</p> <p>SEE INFORM FLIGHT</p>													
7-18	LOW COLD HELIUM SUPPLY PRESSURE				<p>CUE---</p> <p>COLD HELIUM SPHERE PRESSURE (0201-403; 0202-403).</p> <p>NOTES---</p> <p>1. AN EXCESSIVE COLD HELIUM SUPPLY PRESSURE DECAY IS ONE WHICH WILL RESULT IN A COLD HELIUM BOTTLE PRESSURE OF LESS THAN 1000 PSIA AT T83 INITIATION OR LESS THAN 850 PSIA AT COMPLETION OF CRYOGENIC REPRESSURIZATION</p>												
	A. EXCESSIVE COLD HELIUM SUPPLY PRESSURE DECAY (NOTE 1)	EARTH ORBIT	7LI	<p>A. CONTINUE MISSION</p> <p>SEE INFORM FLIGHT AND COMMAND FROM LAST STATION PRIOR TO T83--</p> <p>3. BURNER LOX SHUTDOWN VALVE CLOSE ON</p>													
	B. LESS THAN 300 PSIA PRIOR TO RESTART	7LI		<p>C. CONTINUE MISSION</p> <p>SEE INFORM FLIGHT</p>													
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 13	A	10/15/79	SLY - T83 AND T87		7-19												

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MISSION RULES

SECTION 7 - SLY - T85 AND T87

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
7-19		LOX LOX TANK ULLAGE PRESSURE  A. LOX ULLAGE PRESSURE LESS THAN 21 PSIA IN T85  B. LOX ULLAGE PRESSURE LESS THAN 20 PSIA FOR FIRST OPPORTUNITY RESTART OR LESS THAN 22 PSIA FOR SECOND OPPORTUNITY RESTART AT T86 + 9 MIN 20 SEC	EARTH ORBIT	A. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND---  1. BURNER LOX SHUTOFF VALVE CLOSE  2. LOX VENT VALVES BOOST CLOSE AS CLOSE AS POSSIBLE TO T86 + 7 MIN 30 SEC; BSE COMMAND--- 3. LOX REPRESS ON  B. CONTINUE MISSION BSE INFORM FLIGHT	CUES--- 1. LOX ULLAGE PRESSURE (D179-001; D180-400). 2. LOX PUMP INLET PRESSURE (D2-403).												
7-20		J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS  A. ABOVE 1400 PSIA DURING ORBITAL COAST FOR FIRST OPPORTUNITY RESTART OR ABOVE 1500 PSIA FOR SECOND OPPORTUNITY RESTART  B. ABOVE 1500 PSIA PRIOR TO RESTART	EARTH ORBIT	A. CONTINUE MISSION BSE INFORM FLIGHT AND SEND---  1. START BOTTLE VENT OPER FOR 3 SEC  2. REPEAT COMMAND AS NECESSARY TO INQUIRE A PRESSURE OF LESS THAN 1400 PSIA FOR FIRST OPPORTUNITY RESTART OR 1500 PSIA FOR SECOND OPPORTUNITY RESTART  B. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND PFDG AND RECOMMEND SPACECRAFT SEPARATION	CUES--- 1. START BOTTLE PRESSURE (D17-001; D201-001)												
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	A	10/10/69	Sly - T85 AND T87		7-16												

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## MISSION RULES

## SECTION 7 - 8-IVB - T88 AND T87

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
7-21		PU VALVE FAILS TO A MIXTURE RATIO GREATER THAN 3.0 TO 1 ANY TIME PRIOR TO RESTART	EARTH ORBIT/TLI	RECOMMEND NO 8-IVB RESTART CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. PU VALVE HARDOVER POSITION ON LOW EMR 4.5 TO 3) (SEE NOTE 1) IF 1 IS UNSUCCESSFUL: BSE INFORM FLIGHT AND--- 2. VENT START BOTTLE TO ACCEPTABLE LIMITS	CUES--- 1. PU VALVE POSITION (010-401); 2. PU FEEDBACK VOLTAGE (M01-411) NOTES--- 1. THIS FAILURE WILL REQUIRE EVALUATION OF RESIDUALS TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF (REF PMR 7-1); 2. PU FEEDBACK VOLTAGE M01; IS ONLY VALID WHEN PU SYSTEM POWER IS ON		
7-22		8-IVB LOSS OF ENGINE HYDRAULIC FLUID	EARTH ORBIT/TLI	NO 8-IVB RESTART (T88)/TLI INHIBIT (T88) BSE INFORM FLIGHT AND RECOMMEND NO 8-IVB RESTART	CUES--- 1. HYDRAULIC RESERVOIR OIL LEVEL APPROX ZERO PERCENT (LT-483); 2. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (0-483); 3. HYDRAULIC RESERVOIR PRESSURE APPROXIMATELY ZERO PSIA (0-483); NOTES--- 1. LT-483 PLUS ONE OF THE OTHER CUES ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE. 2. IF ALL 3 CUES ARE FUNCTIONING PROPERLY, THEY ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE.		
		RULE NUMBERS 7-23 AND 7-24 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 7 - A		10/18/69	8-IVB - T88 AND T87		7-17

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MISSION RULES

SECTION 7 - SLV - T89 AND T87

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	7-26	<p>S-EVB STAGE LOX NONPROPULSIVE VENT (NPV) FAILS</p> <p>A. TO OPEN AT T87 + 0.7 SEC</p> <p>B. TO LATCH OPEN AT T88 + 23 MIN 22.8 SEC</p>	TLC	<p>A. CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND VENT THE LOX TANK TO 18-20 PSIA PRIOR TO T87 + 19 MIN.</p> <p>B. CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND</p> <p>1. ATTEMPT TO LATCH OPEN THE LOX VENT</p> <p>IF UNSUCCESSFUL: BSE COMMAND---</p> <p>2. LOX NPV OPEN</p> <p>IF BE UNSUCCESSFUL: BSE COMMAND---</p> <p>3. LOX VENT OPEN</p>	<p>CUES---</p> <p>1. LOX NPV NOZZLE PRESSURE (D249-004; D244-004);</p> <p>2. LOX TANK ULLAGE PRESSURE (D179-006; D180-006);</p> <p>3. LOX NPV DISCRETES (K190-020; K199-020);</p>												
	7-28	LME LATCHING VENT VALVE FAILS TO LATCH OPEN AS PROGRAMMED	TLC	<p>CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND</p> <p>1. ATTEMPT TO OPEN THE LME LATCHING VENT VALVE</p> <p>IF UNSUCCESSFUL: BSE COMMAND---</p> <p>2. LME LATCHING VENT VALVE CLOSED</p> <p>3. LME VENT VALVE OPEN</p> <p>AT T87 + 15 MIN OR T87 + 1 HR 15 MIN COMMAND---</p> <p>4. LME VENT VALVE CLOSE</p>	<p>CUES---</p> <p>1. LME NPV NOZZLE PRESSURE (D100-009; D104-009);</p> <p>2. LME ULLAGE PRESSURE (D177-006; D178-006);</p> <p>3. LME LATCHING VENT VALVE DISCRETES (K210-410; K211-410);</p>												
	7-27	ENGINE START BOTTLE DUMP FAILS TO INITIATE	TLC	<p>CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND ATTEMPT TO OPEN THE START BOTTLE VENT VALVE</p>	<p>CUES---</p> <p>1. ENG START BOTTLE PRESSURE (D17-001; D041-001);</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 13	PHL	9/10/68	SLV-T89 AND T87		7-18												

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MISSION RULES

SECTION 7 - SLV - TBS AND TBT

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	7-28	S-IVB STAGE COLD HELIUM DUMP FAILS TO INITIATE	TLC	CONTINUE MISSION  BBE INFORM FLIGHT AND  1. ATTEMPT TO INITIATE THE COLD HELIUM DUMP THROUGH LMS COIL ON GS/MS BURNER.  IF UNSUCCESSFUL: BBE INFORM FLIGHT AND AFTER LOX IMPV OPEN IN TBS COMMAND---  2. LOX PRESSURIZATION SHUTOFF VALVES OPEN	CUES---  1. COLD HELIUM BOTTLE PRESSURE (D261-401, D263-403).		
		RULE NUMBERS 7-29 AND 7-30 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 13	8	10/31/69	SLV-TBS AND TBT		7-19

0 8LY - 700  
(RESTART)



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MISSION RULES

SECTION 8 - SLY - T86

REV	ITEM						
		SUMMARY OF RESTART PHASE RULES					
		NOTE					
		MISSION RULES REQUIRING GROUND SUPPORT DURING T86 CANNOT BE IMPLEMENTED ON APOLLO 13 BECAUSE OF MRFM COVERAGE LIMITATION. THOSE RULES ARE MARKED BY AN ASTERISK.					
8-1	RESERVED						
8-2	OS/MS BURNER LHM VALVE FAILS						
8-3	LHM CHILLODOWN SYSTEM FAILS						
8-4	LOX CHILLODOWN SYSTEM FAILS						
8-5	RESERVED						
8-6	S-1VB ACTUATOR HARDOVER						
8-7	CONTINUOUS VENT REGULATOR FAILS TO CLOSE						
8-8	LOSS OF ATTITUDE CONTROL DURING SECOND BURN						
		THE FOLLOWING MISSION RULES ALSO APPLY TO THIS SECTION--					
6-9	INERTIAL PLATFORM FAILURE - ACCELEROMETER						
6-6	LAUNCH VEHICLE INERTIAL PLATFORM FAILURE ATTITUDE REFERENCE						
6-11	S-1VB STAGE LOSS OF THRUST						
6-7	S-1VB AUXILIARY HYDRAULIC PUMP FAILS						
6-8	LOSS OF ATTITUDE CONTROL DURING T86 TO T86 + 3 MIN TO SEC (CREW IMPLEMENTATION)						
6-9	CONTINUOUS VENT REGULATOR FAILS TO OPEN						
7-18	LV ECS WATER VALVE FAILS TO CYCLE OPEN AND CLOSED						
7-14	S-1VB STAGE COMMON BURNER'S DELTA PRESSURE REACHES OR EXCEEDS MINUS 20 PSID OR PLUS 20 PSID; MINUS 20 PSID OR PLUS 20 PSID (CREW IMPLEMENTATION)						
7-16	S-1VB ENGINE CONTROL BOTTLE PRESSURE LESS THAN 400 PSIA						
7-17	LHM TANK VENT FAILURE OR LEAK DURING ORBITAL COAST						
7-18	LOW COLD HELIUM SUPPLY PRESSURE						
7-19	LOX TANK ULLAGE PRESSURE LOW (CREW IMPLEMENTATION)						
7-20	J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS.						
7-21	PV VALVE FAILS TO A MISTURE RATIO GREATER THAN 5:1 AT ANY TIME PRIOR TO RESTART						
7-22	S-1VB LOSS OF ENGINE HYDRAULIC FLUID						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 13	8	10/18/70	SLY - T86		8-1

NASA - Manned Spacecraft Center

MISSION RULES

SECTION B - SLY - T06

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
		RULE B-1 IS RESERVED.			
	B-2	S-1V2 STAGE O2/H2 BURNER FUEL PROPELLANT VALVE FAILS CLOSED	TLI	CONTINUE MISSION DOE INFORM FLIGHT AND COMMAND--- 1. BURNER SHUTDOWN 2. CONTINUOUS VENT SYSTEM ORIFICE OPEN 3. CRYO REPRESSURIZATION OFF	CUES--- 1. BURNER CHAMBER GONE TEMPERATURE (C2024-403; C302-403); 2. BURNER PROPELLANT VALVE POSITIONS (R100-404; R198-403); 3. AMBIENT REPRESSURIZATION MODE SELECT (R199-404); NOTE--- THE O2/H2 BURNER VOTING CIRCUIT WILL NOT DETECT FAILURE OF THE BURNER TO IGNITE OR BURNER PLAME-OUT IN THE EVENT THE FUEL PROPELLANT VALVE FAILS CLOSED.
	B-3	LHE CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS	TLI	CONTINUE MISSION DOE INFORM FLIGHT AND 1. ATTEMPT TO CORRECT SITUATION SPECIFIED IN NOTE 1.A; 1.B; 1.C IF UNSUCCESSFUL, DOE INFORM FLIGHT	CUES--- 1. LHE PUMP INLET TEMP (C3-403) 2. LHE RECIRC FLOW (F3-404) 3. LHE PUMP INLET PRESS (D2-403) 4. LHE PREVALVE DISCRETES (R111-404; R112-404) 5. LHE BLEED VALVE CLOSE (R127-401) 6. LHE RECIRC VALVE CLOSE (R128-401) 7. LHE VLLAGE PRESS (D177-400; D178-400); NOTES--- 1. LHE CHILLDOWN WILL NOT BE SATISFACTORY IF--- (A) PREVALVE IS OPEN (B) RECIRCULATION VALVE IS CLOSED (C) BLEED VALVE IS CLOSED (D) CHILLDOWN PUMP IS NOT ON
MISSION REV DATE LOCATION LOGNO PAGE					
APOLLO 13 A 10/19/70 SLY - T06 0-2					

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MISSION RULES

SECTION 8 - 6LV - 700

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	8-4	8-1/2 STAGE LOX CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS	TLT	CONTINUE MISSION *SEE INFORM FLIGHT AND--- *1: ATTEMPT TO CORRECT SITUATION SPECIFIED (A NOTE 1, 2, 3, 4, 5, 6) *IF 1 IS UNSUCCESSFUL, SEE INFORM FLIGHT AND COMMAND BY T00 + 3 MIN 42 SEC 1822 (NOTE 2) *2: LOX LEAD FOR 6 SEC THRU THE PREVALVES *3: IMMEDIATELY AFTER LOX LEAD, COMMAND LOX BOME PUMP FOR 6 TO 10 SEC *IF 2 OR 3 IS UNSUCCESSFUL, SEE INFORM FLIGHT AND CONTINUE MISSION. *IF 3 IS NOT TERMINATED BY GROUND COMMAND AFTER 20 SEC OF PUMP, SEE INFORM FLIGHT AND RECOMMEND TLT INHIBIT	CUES--- 1: LOX PUMP INLET TEMPERATURE (C-403) 2: LOX CHILLDOWN FLOW RATE (F-424) 3: LOX PUMP INLET PRESSURE (D-403) AND LOX TANK VLLAGE PRESSURE (D)79-400, 8100-400 4: LOX PREVALVE DISCRETES (E109-403, E110-403) 5: LOX BLEED VALVE CLOSED (E134-403) 6: LOX RECIRCULATION VALVE CLOSED (E137-403) NOTES--- 1: LOX CHILLDOWN WILL NOT BE SATISFACTORY IF--- (A) PREVALVE IS OPEN (B) RECIRCULATION VALVE IS CLOSED (C) BLEED VALVE IS CLOSED (D) CHILLDOWN PUMP IS NOT ON 2: THE 6-SEC LOX LEAD SHOULD BE COMMANDED AS NEAR AS POSSIBLE TO T00 + 3 MIN 42 SEC BUT CAN BE COMMANDED AS LATE AS T00 + 3 MIN 22 SEC. 3: THE 6-SEC VLT ELECT NOT TO INITIATE THE LOX LEAD IF CIRCUMSTANCES INDICATE THE DESIRED LOX LEAD MAY NOT BE ACCOMPLISHED--RESTART ATTEMPT IS ACCEPTABLE WITH NO LOX LEAD.
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 13 A	4	10/13/70	6LV - 700		8-8

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 8 - SLY = 706

REV	ITEM	CONDITION/MALFUNCTION	PHASE	ACTION	QUES/NOTES/COMMENTS												
1	0-0	RESERVED															
	0-0	3-IVB ACTUATOR COMPLETED MALFUNCTION PRIOR TO T06 + + 3 MIN 10 SEC AND AUXILIARY HYDRAULIC PUMP IS OPERATING	TLE	TLE INHIBIT  SEE INFORM FLIGHT AND RECOMMEND TLE INHIBIT	CVS---  1. ACTUATOR POSITIONS +/- .005 OR GREATER (01-000; 01-000; 02-000; 03-000).  NOTE---  BOTH INDIVIDUAL ACTUATOR POSITIONS MUST CONFIRM MALFUNCTION PRIOR TO RECOMMENDING TLE INHIBIT.												
1	0-1	3-IVB STAGE CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO CLOSE DURING RESTART SEQUENCE	TLE	CONTINUE MISSION  SEE INFORM FLIGHT AND COMMAND---  1. SECOND BURN DELAY OFF  2. ATTEMPT TO CLOSE THE CVS REGULATOR  IF NEITHER 1 OR 2 ARE SUCCESSFUL SEE INFORM FLIGHT  3. IF 2 IS UNSUCCESSFUL SEE COMMAND BURNER SHUTDOWN.	CVS---  1. CVS NOZZLE PRESSURE REMAINS GREATER THAN 3 PSIA (0101-000; 0102-000).  2. CVS REGULATOR CLOSED (0104-011);  3. LMS TANK VILLAGE PRESSURE 10117-000; 0104-000.												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 13</td> <td></td> <td>10/10/79</td> <td>SLY = 706</td> <td></td> <td>0-0</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 13		10/10/79	SLY = 706		0-0
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 13		10/10/79	SLY = 706		0-0												

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MISSION RULES

SECTION 8 - SLY - 700

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
0-0		LOSS OF ATTITUDE CONTROL DURING S-1V8 SECOND BURN	TLE	CONTINUE MISSION LOSS INFORM FLIGHT AND FIDO. CREW WILL SEPARATE ON LIMITS (NOTE 1)	<p>CUES---</p> <p>1. ANGULAR RATES - PITCH (184-0021) YAW (185-0021) OR ROLL (186-0021) GREATER THAN 3 DEG/SEC AND NOT DECREASING</p> <p>2. ANGULAR RATES-PITCH (219-0021) YAW (185-0021) OR ROLL (186-0021) GREATER THAN 3 DEG/SEC AND NOT DECREASING. (SEE NOTE 3)</p> <p>3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE 2).</p> <p>NOTES---</p> <p>1. TLE BURN WILL BE TERMINATED FOR---</p> <p>A. PITCH OR YAW BODY RATES GREATER THAN +/- 10 DEG/SEC</p> <p>B. ROLL BODY RATE GREATER THAN +/- 20 DEG/SEC</p> <p>C. PITCH OR YAW ATTITUDE DEVIATION FROM NOMINAL PROFILES GREATER THAN 45 DEG</p> <p>2. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS---</p> <p>(A) LVDC/LVDA COMPUTATIONAL FAILURE.</p> <p>(B) ATTITUDE ERROR SIGNALS ROLL GREATER THAN +/- 3.5 DEG; PITCH AND YAW GREATER THAN +/- 3 DEG.</p> <p>(C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE.</p> <p>(D) FAILURE OF S-1V8 ENGINE HYDRAULICS.</p> <p>3. THE CUES ARE VALID IF RATE CHANNEL SWITCHOVER HAS NOT OCCURRED.</p>		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 13 A		10/10/79	SLY - 700		0-9

2 SLY - TBE MAPING  
AND SLINGSHOT

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 9 - SLV T88

REV	ITEM
-----	------

SUMMARY OF SAFING AND SLINGSHOT RULES

- 9-1 STAGE PNEUMATIC DUMP FAILS
- 9-2 LOX DUMP FAILS
- 9-3 ENGINE CONTROL BOTTLE DUMP FAILS
- 9-4 RESERVED
- 9-5 LOSS OF APS FOL DUMP

THE FOLLOWING REFERENCED FLIGHT MISSION RULES ARE ALSO APPLICABLE DURING TIME BASE EIGHT (T88)

- 7-3 J-2 ENGINE MAIN FUEL VALVE (MFMV) FAILS TO CLOSE AT FIRST S-IVB CUTOFF; SECOND S-IVB CUTOFF
- 7-4 J-2 ENGINE MAIN OXIDIZER VALVE FAILS TO CLOSE AT FIRST S-IVB CUTOFF; SECOND BURN CUTOFF
- 7-8 LOSS OF ATTITUDE CONTROL DURING T85 AND T87 TO SPACECRAFT SEPARATION; T86 TO T86 + 8 MIN 23 SEC AFTER SPACECRAFT SEPARATION; AFTER T88 INITIATE
- 7-13 TV ECS VALVE FAILS TO CYCLE OPEN AND CLOSED
- 7-14 S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS MINUS 20 PSID OR PLUS 30 PSID; MINUS 26 PSID OR PLUS 36 PSID.
- 7-23 S-IVB STAGE LOX NON-PROPULSIVE VENT (NPV) FAILS TO OPEN AT T87 + 0.67 SEC; TO LATCH OPEN AT T8 + 17 MIN 3 SEC
- 7-26 LH2 LATCHING VENT VALVE FAILS TO LATCH OPEN AS PROGRAMMED
- 7-28 S-IVB STAGE COLD HELIUM DUMP FAILS TO INITIATE

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	FNL	9/10/69	SLV - T88		9-1

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 9 - SLV T88

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	9-1	S-IVB STAGE PNEUMATIC DUMP FAILS TO INITIATE	FLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO OPEN THE ENGINE PUMP PURGE CONTROL VALVE	CUES--- 1. ENGINE PUMP PURGE PRESSURE (D90-403). 2. AMBIENT HELIUM SUPPLY PRESSURE (D236-403; D238-403).												
	9-2	S-IVB LOX DUMP FAILS TO INITIATE	FLC	CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND THE MAIN OXIDIZER VALVE OPEN	CUES--- 1. MAIN OXIDIZER VALVE POSITION (E3-401). 2. MAIN OXIDIZER VALVE OPEN DISCRETE (K120-401). 3. LOX PUMP INLET TEMPERATURE (C4-403). 4. LOX FLOW RATE (F3-401). NOTE--- 1. IF A LOX DUMP IS UNSUCCESSFUL, A RE-EVALUATION OF THE SLINGSHOT DELTA VELOCITY WILL BE REQUIRED.												
	9-3	ENGINE CONTROL BOTTLE DUMP FAILS TO INITIATE	FLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO OPEN THE ENGINE HELIUM CONTROL VALVE	CUES--- 1. ENGINE CONTROL RES. PRESS (D18-401). 2. ENGINE CONTROL HELIUM SPHERE PRESSURE (D19-401; D242-401).												
		RULES 9-4 AND 9-5 ARE RESERVED.															
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>B</td> <td>10/31/79</td> <td>SLV - T88</td> <td></td> <td>9-2</td> </tr> </tbody> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	B	10/31/79	SLV - T88		9-2
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	B	10/31/79	SLV - T88		9-2												



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MISSION RULES

SECTION 9 - SLV - T88 - CONTINUED

REV	ITEM	MEAS NUMBER ONBOARD	TRANS-DUCERS	CATEGORY	EFFECTIVITY	MISSION RULE REF														
----- PRELAUNCH INSTRUMENTATION -----																				
MEASUREMENT DESCRIPTION																				
STAGE COMMUNICATIONS SYSTEM AND FLIGHT CONTROL MEASUREMENT CATEGORIZATION																				
STAGE COMMUNICATIONS SYSTEM																				
S-II STAGE																				
	LINK DPI				HD															
	MUX DP1A0				HD															
	MUX SP1B0				HD															
S-IVB STAGE																				
	LINK CPI				HD															
	MUX DP1B0 (VIA IUI)				M															
	MUX CP1B0				HD															
INSTRUMENT UNIT																				
	LINK DPI				HD															
	LINK DP1B				M															
	MUX CP1A0 (VIA S-IVB)				HD															
	MUX DP1A0				HD															
EMERGENCY DETECTION SYSTEM (EDS)																				
					M															
COMMAND COMMUNICATIONS SYSTEM (CCS) UPLINK																				
					M															
FLIGHT CONTROL MEASUREMENTS																				
S-IVB STAGE																				
	PRESS: FUEL PUMP INLET	D2-403				T-14														
	PRESS: FUEL TANK ULLAGE EDS 1	D177-408	METER *	COMMON	2 OF 3	T-14														
	PRESS: FUEL TANK ULLAGE EDS 2	D178-408	METER *	COMMON	M	T-14/19														
	PRESS: OXID PUMP INLET	D3-403																		
	PRESS: OXID TANK ULLAGE EDS 1	D179-406	METER *	COMMON	2 OF 3	T-14/19; 8-5														
	PRESS: OXID TANK ULLAGE EDS 2	D180-406	METER *	COMMON	M	T-14/19; 8-5														
INSTRUMENT UNIT																				
	GUIDANCE COMPUTER OPERATION	M60-603			M	6-1/4/79; 7-8/11/8-1/8														
	COMPUTER RESET PULSE NO. 1-GUIDANCE DECODER	J71-603				REQUIRED TO COMPLETE MULTIPLE WORD GROUND COMMANDS														
	COMPUTER RESET PULSE NO. 2-GUIDANCE DECODER	J72-603			1 OF 2 M															
*ONBOARD DISPLAY MANDATORY																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 5%;">REV</td> <td style="width: 10%;">DATE</td> <td style="width: 15%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> <td style="width: 30%;"></td> </tr> <tr> <td>APOLLO 12</td> <td>PAL</td> <td>9/10/59</td> <td>SLV - T88</td> <td>PRELAUNCH INSTR</td> <td>9-3</td> <td></td> </tr> </table>							MISSION	REV	DATE	SECTION	GROUP	PAGE		APOLLO 12	PAL	9/10/59	SLV - T88	PRELAUNCH INSTR	9-3	
MISSION	REV	DATE	SECTION	GROUP	PAGE															
APOLLO 12	PAL	9/10/59	SLV - T88	PRELAUNCH INSTR	9-3															

18 CSM ENVIRONMENTAL  
CONTROL

NASA - Manned Spacecraft Center  
MISSION RULES  
SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM													
		----- ! GENERAL ! -----												
	10-1	<p><b>LAUNCH</b></p> <p>LAUNCH WILL BE CONTINUED AS LONG AS THE SUIT CIRCUIT AND O<sub>2</sub> SUPPLY WILL SUPPORT FLIGHT CREW DEMANDS FOR AT LEAST ONE REV AND ENTRY INTO 2-3; THERE ARE NO COOLANT FAILURES FOR WHICH LAUNCH/INSERTION PHASE WILL BE TERMINATED.</p> <p><b>TLC &amp; TEC</b></p> <p>WATER EVAPORATION WILL BE LIMITED TO COMPONENT TESTING.</p> <p><b>POWERED DESCENT</b></p> <p>THERE ARE NO CSM ENVIRONMENTAL CONTROL SYSTEMS FAILURES FOR WHICH POWERED DESCENT WILL BE TERMINATED.</p> <p><b>ALL PHASES</b></p> <ul style="list-style-type: none"> <li>A. BACKUP SYSTEMS AND BACKUP COMPONENTS WILL NORMALLY BE USED FOR THE MOST RAPID PRACTICAL RETURN TO EARTH; NOT FOR MISSION CONTINUATION.</li> <li>B. LM SYSTEMS WILL BE USED AS REQUIRED FOR CSM SYSTEMS BACKUP; IF CSM SYSTEMS REQUIRE LM BACKUP THE DESCENT STAGE WILL BE RETAINED WHERE POSSIBLE.</li> <li>C. TO CONTINUE; WATER QUANTITY PREDICTIONS MUST REFLECT ADEQUATE QUANTITIES TO MEET NORMAL MISSION REQUIREMENTS.</li> </ul>												
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">MISSION</th> <th style="width: 5%;">REV</th> <th style="width: 10%;">DATE</th> <th style="width: 20%;">SECTION</th> <th style="width: 10%;">GROUP</th> <th style="width: 10%;">PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>CSM ENVIRONMENT CONTROL</td> <td>GENERAL</td> <td>10-1</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	CSM ENVIRONMENT CONTROL	GENERAL	10-1
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	FNL	9/10/69	CSM ENVIRONMENT CONTROL	GENERAL	10-1									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM				
10-2	<p><b>DEFINITIONS</b></p> <p><b>LOSS OF CABIN INTEGRITY---</b>                      CM PRESSURE VESSEL LEAKAGE SUCH THAT CABIN PRESSURE CANNOT BE MAINTAINED GREATER THAN, OR EQUAL TO 6.5 PSIA BY CABIN PRESSURE REGULATORS (1.5 LB/HR TOTAL).</p> <p><b>LOSS OF SUIT INTEGRITY---</b>                      TOTAL PSA AND SUIT LOOP LEAKAGE IS GREATER THAN 0.5 PSI/MIN (1.5 LB/HR) DURING PSA SUIT LOOP PRESSURE CHECK.</p> <p><b>LOSS OF SUIT CIRCUIT---</b>                      INABILITY OF THE SUIT CIRCUIT TO MAINTAIN ADEQUATE CREW COMFORT AND/OR CO2 REMOVAL WITHOUT USING DIRECT O2.</p> <p><b>LOSS OF O2 MANIFOLD---</b>                      AN O2 MANIFOLD OR REGULATOR FAILURE WITH WHICH THE SUIT CIRCUIT O2 DEMANDS CANNOT BE SUPPLIED FOR ENTRY.</p> <p><b>LOSS OF PRIMARY LOOP COOLING---</b>                      LOSS OF ALL FLOW; A LEAK WHICH CANNOT BE ISOLATED; OR COMBINED FAILURES SUCH THAT RADIATORS AND EVAPORATOR PROVIDE NO COOLING.</p> <p><b>LOSS OF SECONDARY LOOP COOLING---</b>                      LOSS OF ALL FLOW; A LEAK WHICH CANNOT BE ISOLATED; OR COMBINED FAILURES SUCH THAT RADIATORS AND EVAPORATOR PROVIDE NO COOLING.</p> <p><b>LOSS OF COOLANT LOOP RADIATORS---</b>                      RADIATOR LEAK; BLOCKAGE OF ALL FLOW THROUGH RADIATORS; OR RADIATOR DEGRADATION SUCH THAT TOTAL LONG TERM USAGE OF WATER IS MORE THAN IS BEING PRODUCED.</p> <p><b>LOSS OF ALL COOLING---</b>                      LOSS OF PRIMARY AND SECONDARY LOOP COOLING.</p> <p><b>LOSS OF SURGE TANK AND/OR REPRESS PACK---</b>                      SURGE TANK; REPRESS PACK; OR ASSOCIATED ISOLATABLE PLUMBING FAILURES WHICH REQUIRE ISOLATION OF THE SURGE TANK AND/OR REPRESS PACK.</p> <p>RULE NUMBERS 10-3 THROUGH 10-9 ARE RESERVED.</p>				
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	FNL	9/10/69	CSM ENVIRONMENT CONTROL	GENERAL	10-2

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM													
		<p>-----                      * SYSTEMS MANAGEMENT *                      -----</p>												
	10-10	<p>O<sub>2</sub> SYSTEM</p> <p>A. SUIT FLOW RELIEF VALVE WILL REMAIN CLOSED FOR DURATION OF FLIGHT.</p> <p>B. NORMAL CM REPRESSURIZATION WITH LN MAMMO WILL UTILIZE THE REPRESS PACK.</p> <p>C. DELETED</p> <p>D. THE REPRESS PACK VALVE WILL BE IN OFF POSITION FOR ALL PHASES EXCEPT LAUNCH, ENTRY, AND TUNNEL/LN PRESSURIZATION AND RECHARGE</p> <p>E. THE SUIT CIRCUIT MUST BE PURGED OF ACCUMULATED H<sub>2</sub> ONCE EVERY 8 HOURS FOR ONE MINUTE WHEN ALL CREWMEN ARE SUITED AND THE SUIT CIRCUIT IS ISOLATED.</p> <p>F. THE SURGE TANK AND REPRESS PACK WILL NORMALLY BE RECHARGED SIMULTANEOUSLY.</p> <p>G. CM CABIN PRESSURE WILL NOT BE ALLOWED TO DROP BELOW 4.9 PSIA DURING NORMAL LN PRESSURIZATION EXCEPT DURING TDGE.</p> <p>H. THE CM ECS WILL NORMALLY SUPPLY ALL O<sub>2</sub> FOR CONSUMPTION AND LEAKAGE DURING IVT PHASES.</p> <p>I. THE FLIGHT CREW WILL DON SUITS FOR THE FOLLOWING--</p> <ol style="list-style-type: none"> <li>1. INABILITY TO MAINTAIN CABIN PRESSURE ABOVE 4.9 PSIA.</li> <li>2. ALL UNDOCKED OPERATIONS.</li> <li>3. TDGE.</li> <li>4. GLYCOL LEAKS IN COMMAND MODULE.</li> <li>5. FIRE, SMOKE, CONTAMINATION IN CABIN.</li> </ol> <p>J. THE FLIGHT CREW WILL DOFF SUITS (TIME AND CONDITIONS PERMITTING) FOR THE FOLLOWING--</p> <ol style="list-style-type: none"> <li>1. LOSS OF SUIT CIRCUIT.</li> <li>2. CONFIRMED LEAK OF GLYCOL IN SUIT CIRCUIT.</li> </ol> <p>COOLANT MANAGEMENT</p> <p>A. FOR SIMULTANEOUS PRIMARY AND SECONDARY LOOP OPERATION, NORMALLY EITHER THE PRIMARY OR SECONDARY LOOP RADIATOR WILL BE ISOLATED.</p> <p>B. GLYCOL RESERVOIR WILL BE ON LINE AND RADIATORS WILL BE BYPASSED FOR LAUNCH.</p> <p>C. INDICATED GLYCOL ACCUMULATOR QUANTITY WILL BE MAINTAINED BETWEEN 30 AND 70 PERCENT.</p> <p>D. SECONDARY COOLANT WILL BE OFF FOR LAUNCH.</p> <p>E. ADDITIONAL POWER LOADS WILL BE ADDED AS REQUIRED IN AN ATTEMPT TO MAINTAIN PRIMARY RADIATOR OUTLET TEMPERATURE GREATER THAN -20 DEG.</p>												
		<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 13</td> <td>A</td> <td>10/15/79</td> <td>CSM ENVIRONMENT CONTROL</td> <td>MANAGEMENT</td> <td>10-3</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 13	A	10/15/79	CSM ENVIRONMENT CONTROL	MANAGEMENT	10-3
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 13	A	10/15/79	CSM ENVIRONMENT CONTROL	MANAGEMENT	10-3									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM						
	10-10 (CONT)	WATER SYSTEM					
		<p>A. WASTE WATER WILL BE MANUALLY DUMPED OVERBOARD AS REQUIRED TO MAINTAIN INDICATED QUANTITY LESS THAN 85-90 PERCENT. WASTE WATER WILL NORMALLY BE DUMPED TO 25 PERCENT. HOWEVER, IF WASTE WATER QUANTITY INSTRUMENTATION (CF0009) IS LOST, WASTE WATER WILL BE DUMPED UNTIL POTABLE WATER QUANTITY (CF0010) BEGINS TO DECREASE.</p> <p>B. WATER DUMPS WILL BE MANAGED SO THAT---</p> <ol style="list-style-type: none"> <li>1. AT LOI, THE WASTE TANK WILL CONTAIN GREATER THAN 75 PERCENT.</li> <li>2. AT CM-SM SEPARATION, THE POTABLE TANK WILL BE FULL AND THE WASTE TANK WILL BE 90 PERCENT FULL.</li> </ol> <p>C. IN ORDER TO REDUCE TRAJECTORY CALCULATION PERTURBATIONS, WATER DUMPS, AND FUEL CELL PURGES WILL NOT BE SCHEDULED---</p> <ol style="list-style-type: none"> <li>1. BETWEEN MCC 3 AND LOI-3, PLUS TWO HOURS</li> <li>2. WITHIN THREE REVS OF PRE-DOI UNDOCKING</li> <li>3. BETWEEN TEB AND SEXTANT STAR CHECK PRIOR TO MCC 5</li> <li>4. DURING MSPN COVERAGE IN LUNAR ORBIT (DUMPS AND PURGES SHOULD BE SCHEDULED AS CLOSE TO THE LOS MIDPOINT AS POSSIBLE)</li> <li>5. WITHIN ONE HOUR PRIOR TO OPTICAL NAVIGATION SIGHTINGS</li> <li>6. BETWEEN MCC 6 AND EI</li> </ol>					
		SYSTEM BACKUP					
		LN SYSTEMS WILL BE USED AS REQUIRED FOR CSM SYSTEMS BACKUP. DESCENT STAGE WILL BE RETAINED IF POSSIBLE.					
		RULE NUMBERS 10-11 THROUGH 10-19 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	8	10/31/79	CSM ENVIRONMENT CONTROL	MANAGEMENT	10-4

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 10 - CAB ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/FAILURE/FUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
				***** SPECIFIC													
	10-20	CABIN PRESSURE CANNOT BE RELIEVED	LAUNCH	CONTINUE MISSION	NORMAL RELIEF STARTS AT 20 SECONDS												
	10-21	CABIN PRESSURE DECREASING AND/OR LESS THAN 4.5 PSIA AND--			CREW OPTION TO USE LM ENVIRONMENT FOR EARTH RETURN IN VIEW OF SUITED RETURN.												
		2a SUIT PRESSURE GREATER THAN 3.5 PSIA	LAUNCH	2a.1 CONTINUE MISSION													
			DOE	2a ENTER BEST BEST STPA NO GO FOR DOE RETAIN DESCENT STAGE FOR TEST													
		POWERED DESCENT		2a CONTINUE MISSION NO GO FOR LUNAR STAY													
		FALL		2a ENTER BEST BEST STPA IF CABIN PRESS NOT RESTORED GREATER THAN 4.5 PSIA													
		2a SUIT PRESSURE LESS THAN 3.5 PSIA	LAUNCH	2a.1 ABORT ASAP													
			FALL	2a ENTER ASAP													
		2a LOSS OF SUIT CIRCULATION	LAUNCH	2a.1 ABORT ASAP OPER DIRECT OR AS VED FROM LAUNCH SETTING	2a.1 CORRESPONDS TO 12.0 LB/MR (APPROX 3 CPA/CREWMAN)												
			FALL	2a ENTER ASAP													
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 12 P/M</td> <td></td> <td>5/18/68</td> <td>CAB ENVIRONMENT CONTROL SYSTEM</td> <td>SUIT/CABIN</td> <td>10-5</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12 P/M		5/18/68	CAB ENVIRONMENT CONTROL SYSTEM	SUIT/CABIN	10-5
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12 P/M		5/18/68	CAB ENVIRONMENT CONTROL SYSTEM	SUIT/CABIN	10-5												

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/PALFUNCTION	PHASE	RULING	QUES/NOTES/COMMENTS
	10-22	LOSS OF SUIT CIRCUIT, CABIN STABLE AND GREATER THAN 4.5 PSIA			LM SYSTEMS IF AVAILABLE WILL BE USED FOR CO2 AND H2O REMOVAL.
			LAUNCH	1a. CONTINUE MISSION OPEN DIRECT GZ VALVE IF REQ FROM LAUNCH SETTING.	2a. CORRESPONDS TO 12.0 LB/HR (APPROX 3 CPP/CREWMAN)
			EO	1a. ENTER NEXT BEST PTP 1b. DOPP SUITS 2. OPEN WASTE OVERBOARD DRAIN VALVE TO OBTAIN CABIN BLEED FLOW. 3. DON FACE MASKS AFTER 1 HOUR	2a. WASTE OVERBOARD BLEED @ 1.0 LB GZ/HR 3. TIME REQUIRED FOR CM CO2 PARTIAL PRESSURE TO INCREASE TO 7.0 MM HG 1 CREWMAN-- 4 HR; 3 CREWMAN-- 80 MIN.
			DOJ	1c. ENTER NEXT BEST PTP-- NO GO FOR PTP, RETAIN LM DESCENT STAGE FOR TEST	
			POWERED DESCENT	1b. CONTINUE MISSION-- NO GO FOR LUNAR STAY	
			ALL	1c. ENTER NEXT BEST PTP	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APR 68 10	A	10/15/69	CSM ENVIRONMENTAL CONTROL SYSTEM	SUIT/CABIN	10-6



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MISSION RULES

SECTION 10 - CS4 ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	10-23	LOSS OF SURGE TANK OR REPRESS PACK	LAUNCH ALL	A: CONTINUE MISSION B: CONTINUE MISSION	FOR LEAK IN SURGE TANK, ISOLATE SURGE TANK AND PLACE REPRESS PKG VALVE TO FILL			
	10-24	LOSS OF SURGE TANK AND REPRESS PACK	LAUNCH ALL FREE	A: CONTINUE MISSION B: CONTINUE MISSION PLAN TO RESTORE ENTRY OF BY STORING OPS IN CM AT FINAL LM REPRESS. C: CONTINUE MISSION DOPP BUITS FOR ENTRY	B: OPS OF DTP--- ALSO/OPS (TWO OPS AVAILABLE)			
	10-25	FIRE OR SMOKE IN COMMAND MODULE	LAUNCH DSC POWERED DESCENT ALL	A: ABOARD B: DECOMPRESS CABIN 2: TROUBLESHOOT LEAKS ISOLATE PER FLIGHT CREW CHECKLIST DOPP BUITS PROCEDURES B: ENTER NEAR DEEP STOP NO GO FOR PERM. RETAIN LM DESCENT STAGE FOR TEB C: CONTINUE MISSION NO GO FOR LUNAR STAY D: TROUBLESHOOT/COMBAT FIRE PER FLIGHT CREW CHECKLIST EMERGENCY PROCEDURES E: ASSESS DAMAGE AND REMOVE POWER FROM AFFECTED SYSTEMS B: ENTER NEAR DEEP STOP				
			MISSION	REV	DATE	SECTION	GROUP	PAGE
			APOLLO 12	PKL	9/18/69	COM ENVIRONMENT CONTROL SYSTEM	QUIP/CABIN	10-7

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MISSION RULES

SECTION 18 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	ACTIONS	CUES/NOTES/COMMENTS												
	18-26	CONTAMINATION IN CABIN	ALL	*CREW MAY ELECT TO DECOMPRESS	IF UNABLE TO CLEAR CONTAMINATION, MISSION MAY BE TERMINATED EARLY.												
	18-27	LOSS OF SUIT INTEGRITY	LAUNCH ALL	*A: CONTINUE MISSION *B: CONTINUE MISSION NO-GO FOR UNDOCK													
	18-28	LOSS OF O <sub>2</sub> MANIFOLD A: O <sub>2</sub> MANIFOLD LEAKS GREATER THAN 0 LB/MR AND CABIN PRESSURE GREATER THAN 0.5 PSIA	LAUNCH UNDOCKED DOIT/ POWERED DESCENT/ LUNAR STAY ALL	*A1: CONTINUE MISSION *2: CONTINUE MISSION-  *3: ENTER NEAR BEST DTP (A) VERIFY SURVEY TANK AND REPRESS PACK ISOLATED UNFIL ENTRY (B) RETRIEVE OPS FROM LM, IF DOCKED	*A2: APPROXIMATELY 5 HOURS ARE REQUIRED TO DEplete CABIN O <sub>2</sub> FROM 0.5 TO 0.3 PSIA AT 0.032 LB/MR LEAK RATE (CREW + CABIN LEAK + TANK PRESS BLEED)  *A3: (B) CREW OPTION TO USE LM ENVIRONMENT FOR EARTH RETURN IN LIEU OF MANUAL CABIN PRESSURE REGULATION												
		B: O <sub>2</sub> MANIFOLD LEAKS GREATER THAN 4 LB/MR AND CABIN PRESSURE LESS THAN 0.5 PSIA	LAUNCH ALL	*B1: ABOARD ASAP  *2: ENTER ASAP USE GAS IN SUITED MODE FOR ENTRY IF PRACTICAL	LM O <sub>2</sub> (IF AVAILABLE) MAY BE USED TO SUPPLEMENT CSM SUPPLY.												
	18-29	LOSS OF ONE MAIN REGULATOR	A: FAILED CLOSED LAUNCH DO ALL B: FAILED OPEN ALL	*A1: CONTINUE MISSION- *2: CONTINUE MISSION- NO GO FOR ICI *3: CONTINUE MISSION *B: CONTINUE MISSION													
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>PAL</td> <td>9/18/69</td> <td>CSM ENVIRONMENTAL CONTROL SYSTEM</td> <td>SUIT/CABIN</td> <td>18-6</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	PAL	9/18/69	CSM ENVIRONMENTAL CONTROL SYSTEM	SUIT/CABIN	18-6
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	PAL	9/18/69	CSM ENVIRONMENTAL CONTROL SYSTEM	SUIT/CABIN	18-6												

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	10-30	BOTH MAIN REGULATORS FAILED CLOSED	LAUNCH UNDOCKED/ DOI/ POWERED DESCENT/ LUNAR STAY ALL	A. CONTINUE MISSION B. CONTINUE MISSION C. ENTER NEXT BEST PTP	LM SYSTEMS (IF AVAILABLE) MAY BE USED IN LIEU OF CSM SYSTEMS		
	10-31	LOSS OF ONE SUIT COMPRESSOR	LAUNCH ED ALL	A. CONTINUE MISSION B. CONTINUE MISSION- NO GO FOR TLE C. CONTINUE MISSION			
	10-32	LOSS OF TWO SUIT COMPRESSORS	LAUNCH DOI POWERED DESCENT ALL	A. CONTINUE MISSION- OPEN DIRECT OR AS DES FROM LAUNCH SETTING B. ENTER NEXT BEST PTP- RETAIN LM DESCENT STATE FOR TLE C. CONTINUE MISSION- NO GO FOR LUNAR STAY D. ENTER NEXT BEST PTP- USE LM SUIT LOOP IF AVAILABLE			
		RULE NUMBERS 10-33 THROUGH 10-39 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	PM	8/10/68	CSM ENVIRONMENTAL CONTROL SYSTEM	SUIT/CABIN	10-0

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
10-00	PRIMARY COOLANT LOOP MALFUNCTIONS																
	A. LOSS OF EVAPORATOR		LAUNCH ALL	A.1. CONTINUE MISSION 2. CONTINUE MISSION ACTIVATE SECONDARY COOLANT LOOP WITH RADIATORS IN BYPASS AS REQUIRED TO MAINTAIN PRIMARY EVAPORATOR OUT TEMP LESS THAN 80 DEG F OR AS REQUIRED FOR CREW COMFORT	A.1.(1) MAINTAIN PRI RAD OUT TEMP GREATER THAN 20 DEGS F. (2) WATER MANAGEMENT MAY DICTATE ACTIVATION AND DEACTIVATION OF SECONDARY LOOP TO MAINTAIN PRI RAD OUT TEMP BETWEEN 45 AND 80 DEGREES F.												
	B. LOSS OF RADIATORS		LAUNCH EO FLC LUNAR ORBIT UNDOCKED DGT/POWERED DESCENT LUNAR STAY	B.1. CONTINUE MISSION 2. NO-GO FOR FLI (1) ACTIVATE SECONDARY LOOP (2) USE PRIMARY LOOP IN ADDITION TO SECONDARY LOOP FOR GSN OPERATIONS 3. ENTER NEXT BEST PFD NO-GO FOR LOT 4. BASED ON WATER AVAILABLE FOR EVAPORATIVE COOLING, CONSIDERATION WILL BE GIVEN TO CONTINUING MISSION USING SECONDARY RADIATORS SUPPLEMENTED BY PRIMARY LOOP EVAPORATOR. 5. CONTINUE MISSION 6. CONTINUE MISSION, ACTIVATE SECONDARY LOOP.	B.1. ALTERNATE MISSION MAY BE PERFORMED												
	C. TOTAL LOSS OF LOOP		LAUNCH EO DGT/POWERED DESCENT/ LUNAR STAY ALL	C.1. CONTINUE MISSION, ACTIVATE SECONDARY LOOP 2. CONTINUE MISSION NO-GO FOR FLI, ACTIVATE SECONDARY LOOP 3. CONTINUE MISSION- ACTIVATE SECONDARY LOOP. 4. ENTER NEXT BEST PFD ACTIVATE SECONDARY LOOP	C.1. ALTERNATE MISSION MAY BE PERFORMED.												
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 10	PM	8/18/69	CSM ENVIRONMENTAL CONTROL SYSTEM	COOLANT	10-10												

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION <sup>1</sup>	PHASE	RULING	CUES/NOTES/COMMENTS
	10-41	SECONDARY LOOP MALFUNCTIONS			
		A. LOSS OF EVAPORATOR	ALL	A. CONTINUE MISSION	
		B. LOSS OF RADIATORS	EO	B.1. NO-GO FOR TLI LOOP IS STILL OPERATIONAL IN EVAPORATIVE MODE.	
			FLC	B.2. ENTER NEXT BEST PTP	
			LUNAR ORBIT	B.3. CONTINUE MISSION	
		C. TOTAL LOSS OF LOOP	EO	C.1. NO-GO FOR TLI	
			FLC	C.2. ENTER NEXT BEST PTP	
			LUNAR ORBIT	C.3. CONTINUE MISSION	
	10-42	LOSS OF PRIMARY AND SECONDARY EVAPORATORS	ALL	A. CONTINUE MISSION	
	10-43	LOSS OF ALL COOLING, PRIMARY AND SECONDARY			LM SYSTEMS (IF AVAILABLE) WILL BE USED TO SUPPLEMENT CSM OPERATIONS.
			LAUNCH	A. CONTINUE MISSION	
			EO	B. ENTER NEXT BEST ATP OR PTP	B.1. LOSS OF TWO FUEL CELLS: POWER DOWN
				MAXIMUM ORBIT TIME--- 6 HOURS EMERGENCY POWER DOWN FOLLOWED BY 128 HOURS OF POWER UP FOR ENTRY.	
			POWERED DESCENT	C. CONTINUE MISSION-	
			ALL	D. ENTER ASAP	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	PAL	9/18/69	CSM ENVIRONMENT CONTROL SYSTEM	COOLANT	10-11

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS
	10-44	CONFIRMED LEAK OF BYCOL COOLANT			LM ENVIRONMENT (IF AVAILABLE) MAY BE USED FOR EARTH RETURN IN LIEU OF CSM.
	A. IN COMMAND MODULE		LAUNCH	1. CONTINUE MISSION	
			EO	2. ENTER NEXT BEST PTP DON SUITS. PURGE SUIT LOOP WITH DIRECT O2.	
			POWERED DESCENT	3. CONTINUE MISSION- NO GO FOR LUNAR STAY	
			ALL	4. ENTER NEXT BEST PTP	
	B. IN SUIT CIRCUIT		LAUNCH	1. CONTINUE MISSION	
			EO	2. ENTER NEXT BEST PTP DOPP SUITS AND USE FACE MASKS IF REQUIRED.	
			DOJ	3. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	4. ENTER NEXT BEST PTP	
		RULE NUMBERS 10-45 THROUGH 10-49 ARE RESERVED.			

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	PAL	9/10/69	CSM ENVIRONMENT CONTROL SYSTEM	COOLANT	10-12

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-88	LOSS OF OVERBOARD DUMPS A. NORMAL OVERBOARD DUMPS FROZEN OR BLOCKED B. LOSS OF ALL OVERBOARD DUMP CAPABILITY	ALL  EO TLC LUNAR ORBIT  UNDOCKED/ DOI/ POWERED DESCENT/ LUNAR STAY	A. CONTINUE MISSION  B. 1. ENTER NEXT BEST PTP  2. CONTINUE MISSION	A. 1. UTILIZE AUXILIARY DUMP FOR URINE AND WASTE WATER DISPOSAL. 2. BLEED O2 FROM WATER TANK THROUGH WASTE MANAGEMENT OVERBOARD DRAIN VALVE INTO CABIN.  B. 1. (A) IF POTABLE AND WASTE T, (OR WASTE TANKS ALONE) BECOME P, FORCED WATER BOILING WILL BE NECESSARY TO ALLOW FUEL CELL AND/OR CYCLIC ACCUMULATOR OPERATION.  (B) LM URINE STORAGE BAGS (IF AVAILABLE) WILL BE USED.  2. UNDOCKING MAY BE PERFORMED.
	10-81	UNCONTROLABLE HIGH HUMIDITY	LAUNCH  DOI  POWERED DESCENT  ALL	A. CONTINUE MISSION B. ENTER NEXT BEST PTP- NO GO FOR DOI; RETAIN LM DESCENT STAGE FOR TEB C. CONTINUE MISSION- NO GO FOR LUNAR STAY D. ENTER NEXT BEST PTP	LM SYSTEMS MAY BE USED FOR HUMIDITY CONTROL.
	10-82	WASTE WATER TANK LEAK OR LOSS OF WASTE WATER STORAGE CAPABILITY	ALL	CONTINUE MISSION	LM SYSTEMS (IF AVAILABLE) MAY BE USED TO SUPPLEMENT CSM  WHEN POTABLE WATER TANK BECOMES P, LM FUEL CELL WATER WILL BE DUMPED THROUGH OVERBOARD PRESSURE RELIEF VALVES

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 13	FAL	9/16/69	CSM ENVIRONMENT	WATER & WASTE MANAGEMENT	10-13

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS		
	10-33	CONFIRMED LEAK IN POTABLE WATER TANK OR UNABLE TO TRANSFER FUEL CELL WATER TO POTABLE TANK.			LN SYSTEMS (IF AVAILABLE) MAY BE USED TO SUPPLEMENT CSM.		
			LAUNCH	A. CONTINUE MISSION			
			EO	B. CONTINUE MISSION GO FOR TLI; ENTER NEXT BEST PTP AFTER TANK DEPLETION IF TLI NOT PERFORMED AND UNABLE TO EXTRACT LN.			
			FLC, LO UNDocking DOI, PRND DESCENT LUNAR STAY	C. CONTINUE MISSION- USE LN WATER FOR CREW CONSUMPTION; IF UNABLE TO DO THIS ENTER NEXT BEST PTP.			
			POST RND; D.	ENTER NEXT BEST PTP TRANSFER LN WATER TO CM	D. APPROX. 20 POUNDS OF LN WATER REMAIN POST RND.		
		RULE NUMBERS 10-34 THROUGH 10-39 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PM	9/10/69	CSM ENVIRONMENT	WATER & WASTE MANAGEMENT	10-14



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM - CONCLUDED

REV	ITEM	INSTRUMENTATION REQUIREMENTS					REFERENCE
	10-60	MEAS DESCRIPTION	PCN	ONBOARD	TRANSDUCER	CATEGORY	
		CABIN PRES	CP0001P	METER	COMMON	1 OF	10-20
		SUIT PRES	CP0012P	METER	COMMON	3 M	
		TANK BLADDER PRES	CP0120P	-----	-----		
		SUIT PRESS (CUFF BAGS)	-----	-----	-----	MANDATORY (EACH CREWMAN)	10-21
		BURGE TANK PRESS	CP0006P	METER	COMMON	1 OF	10-20
		OXYGEN REPRESS PRESS	-----	METER	-----	2 M	
		PRIM ACCUM QTY	CP0019Q	METER	COMMON	1 OF	10-40
		PRIM PUMP OUT PRESS	CP0016P	METER	COMMON	2 M	10-44
		POTABLE H2O QTY	CP0010Q	METER	COMMON	NO	10-33
		WASTY H2O QTY	CP0009Q	METER	COMMON	NO	10-32
		SEC STEAM PRESS	CP0073P	METER	COMMON	1 OF	10-41
		SEC EVAP OUT TEMP	CP0071T	METER	COMMON	2 M	
		SEC ACCUM QTY	CP0072P	METER	COMMON	NO	
		SEC PUMP OUT PRESS	CP0070P	METER	COMMON	NO	
		PRIM EVAP OUT TEMP	CP0018T	METER	COMMON	NO	
		PRIM STEAM PRESS	CP0034	METER	COMMON	NO	
		ECB O2 FLOW	CP0033A	METER	COMMON	NO	
		O2 MANIFOLD PRESS	CP0036P	-----	-----	NO	
		SUIT COMP PRESS	CP0015P	METER	COMMON	NO	
		PRIM RAD OUT TEMP	CP0020T	METER	COMMON	NO	
		PRIM EVAP INLET TEMP	CP0101T	-----	-----	NO	
		STEAM EJECT TEMP	CP0017T	-----	-----	NO	
		SEC RAD OUT TEMP	SP0236T	METER	-----	NO	

11 CSM CRYOGENICS

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MISSION RULES

SECTION 11 - CSM CRYOGENICS

REV	ITEM												
	***** GENERAL *****												
11-1	<p>LAUNCH</p> <p>THERE ARE NO CRYO FAILURES FOR WHICH THE LAUNCH/INSERTION PHASE WILL BE TERMINATED. FOR COMPLETE LOSS OF THE SYSTEM RESULTING IN THREE FUEL CELL FAILURES, ENTRY WILL BE PLANNED INTO DTP 3-2. THREE ENTRY BATTERIES ARE CAPABLE OF SUPPORTING THE LAUNCH, ONE REV OF POWER DOWN AND RCS ENTRY.</p>												
11-2	<p>ALL PHASES</p> <p>THE CRYOGENICS SYSTEM IS REQUIRED UNTIL CM/DM SEP SO THAT THE ENTRY AND LANDING PHASES WILL BE ENTERED INTO WITH FULL CONSUMABLES POTENTIAL, THAT IS, FULLY CHARGED ENTRY BATTERIES AND ENTRY O2 TANKS. IF THIS CAPABILITY IS POTENTIALLY JEOPARDIZED BY CRYO SYSTEM DEPLETION OR MALFUNCTION, MISSION TERMINATION PROCEDURES WILL BE ENACTED IN WHATEVER TIME FRAME IS APPROPRIATE OR AVAILABLE. ANY ENTRY BATTERY OR ENTRY O2 USAGE AFTER LOSS OF RECHARGE CAPABILITY FROM THE CRYO SYSTEM WILL REDUCE SUPPLY AVAILABLE FOR ENTRY, LANDING, AND POSTLANDING.</p>												
11-3	<p>POWERED DESCENT</p> <p>THE ONLY CRYO SYSTEM FAILURES FOR WHICH POWERED DESCENT WILL BE TERMINATED ARE LOSS OF BOTH O2 TANKS OR BOTH H2 TANKS. LO GATE TO TB WILL NOT BE TERMINATED FOR EITHER OF THESE FAILURES.</p>												
11-4	<p>LOSS OF CRYOGENIC TANK IS DEFINED AS--</p> <p>PRESSURE CANNOT BE MAINTAINED ABOVE 150 PSIA FOR O2 AND 100 PSIA FOR H2.</p>												
11-5	<p>LUNAR MISSION WILL BE CONTINUED IF ENOUGH CRYO (O2, H2) IS MAINTAINED IN LOWEST TANK TO PERFORM AN EARTH RETURN FROM ANY POINT WITH AT LEAST A POWER LEVEL OF 60 AMPS AVERAGE. EARTH ORBIT MISSION WILL BE CONTINUED AS LONG AS ENOUGH TOTAL CRYO (O2, H2) IS AVAILABLE TO PERFORM AN ENTRY INTO THE NEXT DAILY GO/NO GO AREA.</p> <p>RULE NUMBERS 11-6 THROUGH 11-9 ARE RESERVED.</p>												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 11</td> <td>8</td> <td>10/31/70</td> <td>CSM CRYOGENICS</td> <td>GENERAL</td> <td>11-1</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	8	10/31/70	CSM CRYOGENICS	GENERAL	11-1
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 11	8	10/31/70	CSM CRYOGENICS	GENERAL	11-1								

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MISSION RULES

SECTION 11 - CSM CRYOGENICS

REV	ITEM				
***** SYSTEMS MANAGEMENT *****					
11-10	CRYO MANAGEMENT	A: MANUAL PRESSURE CONTROL WILL NORMALLY BE USED AS REQUIRED TO MAINTAIN-- 1: TANK PRESSURES GREATER THAN 220 PSIA O <sub>2</sub> AND 200 PSIA FOR H <sub>2</sub> . 2: QUANTITY BALANCE WITHIN 3 PERCENT O <sub>2</sub> AND 2 PERCENT FOR H <sub>2</sub> . B: ONE FUEL CELL MAY BE PURGED OR THE SPACECRAFT ELECTRICAL LOADS MAY BE INCREASED TO PRECLUDE CRYO TANK VENTING. C: O <sub>2</sub> TANK FANS AND H <sub>2</sub> TANK FANS WILL NOT BE OPERATED IN THE AUTO MODE.			
11-11	CRYO GAGING	A: ONBOARD CRYOGENIC QUANTITY GAGING IS PRIME. ACCURACY IS +/-2.00 PERCENT (+/-0.40 LB O <sub>2</sub> , +/-0.70 LB H <sub>2</sub> ) PER TANK. B: MCC CALCULATED QUANTITY USING PRESSURE VERSUS TEMPERATURE IS BACKUP.			
RULE NUMBERS 11-12 THROUGH 11-14 ARE RESERVED.					
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 13	FNL	9/18/67	CSM CRYOGENICS	MANAGEMENT	11-2

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 11 - CSM CRYOGENICS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
..... SPECIFIC MISSION RULES .....							
	11-20	LOSS OF ONE O2 AND/OR H2 CRYO TANK (TANK PRESSURE LESS THAN 100 O2; LESS THAN 100 H2; RESPECTIVELY).	LAUNCH EO POWERED DESCENT ALL	B. CONTINUE MISSION B. CONTINUE MISSION NO-GO FOR TLI C. CONTINUE MISSION NO GO FOR LUNAR STAY D. ENTER NEXT BEST DTP	LM; PLSS; AND OPS O2 WILL BE USED AS REQUIRED TO SUPPLEMENT CSM O2.		
	11-21	LOSS OF BOTH O2 AND/OR H2 CRYO TANK (TANK PRESSURE LESS THAN 100 O2; LESS THAN 100 H2; RESPECTIVELY)	LAUNCH POWERED DESCENT ALL	A. CONTINUE MISSION ISOLATE SURGE TANK PRIOR TO 800 PSIA B.1. GO TO LO GATE - ENTER NEXT BEST DTP RETAIN LM DESCENT STAGE FOR TLI IF POSSIBLE. 2. LO GATE TO TD - CONTINUE MISSION; NO GO FOR LUNAR STAY. C. ENTER NEXT BEST ATP OR DTP MAXIMUM TIME IS 4.75 HOURS FOR LOSS OF THREE FUEL CELLS.	B. IF THREE FUEL CELLS ARE LOST PRIOR TO CM/SM SEP, SMJC'S WILL BE INOPERATIVE.		
		RULE NUMBERS 11-22 THROUGH 11-49 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PL	8/10/69	CSM CRYOGENICS	SPECIFIC	11-3

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MISSION RULES

SECTION 11 - CSM CRYOGENICS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RYLING	CVES/NOTES/COMMENTS		
----- INSTRUMENTATION REQUIREMENTS -----							
11-39	MEAS DESCRIPTION	PCM	ONCARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE	
	O2 TANK 1 QTY	SC00330	METER	COMMON	1 OF 2 MANDATORY	11-20	
	O2 TANK 2 QTY	SC00330	METER	COMMON			
	O2 TANK 1 TEMP	SC00437	-----	-----	HIGHLY DESIRABLE	11-20	
	O2 TANK 2 TEMP	SC00437	-----	-----			
	H2 TANK 1 QTY	SC00300	METER	COMMON	1 OF 2 MANDATORY	11-20	
	H2 TANK 2 QTY	SC00310	METER	COMMON			
	H2 TANK 1 TEMP	SC00437	-----	-----	HIGHLY DESIRABLE	11-20	
	H2 TANK 2 TEMP	SC00447	-----	-----			
	O2 TANK 1 PRESS	SC0037P	METER	COMMON	1 OF 2 MANDATORY	11-20	
	O2 TANK 2 PRESS	SC0038P	METER	COMMON		11-20	
	H2 TANK 1 PRESS	SC0039P	METER	COMMON	1 OF 2 MANDATORY	11-20	
	H2 TANK 2 PRESS	SC0040P	METER	COMMON		11-20	
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 16	PHL	9/10/69	CSM CRYOGENICS	INSTR REV	11-6

CSM ELECTRICAL  
POWER SYSTEM

**NASA - Manned Spacecraft Center**  
**MISSION RULES**  
**SECTION 12 - CSM ELECTRICAL POWER SYSTEM**

REV	ITEM	
		----- * GENERAL * -----
12-1	LAUNCH	<p>A. LAUNCH WILL BE CONTINUED AS LONG AS SUFFICIENT ENERGY IS AVAILABLE TO PERFORM AN ENTRY INTO AT LEAST PTP 2-1. THERE MUST BE AT LEAST ONE MAIN BUS AND ONE AC BUS OPERATIONAL TO CONTINUE.</p> <p>B. THERE ARE NO FUEL CELL FAILURES FOR WHICH THE LAUNCH PHASE WILL BE TERMINATED AS LONG AS THREE ENTRY BATTERIES ARE REMAINING TO SUPPLY MAIN BUS LOADS.</p>
12-2	POWERED DESCENT	THERE ARE NO EPS FAILURES FOR WHICH POWERED DESCENT WILL BE TERMINATED EXCEPT FOR LOSS OF THREE FUEL CELLS.
12-3	ALL PHASES	THE MISSION WILL BE CONTINUED AS LONG AS THE REQUIRED NUMBER OF FUEL CELLS ARE AVAILABLE AND ARE CAPABLE OF SUPPORTING MISSION REQUIREMENTS OF 75 TO 90 AMPS (WITHOUT BATTERY SUPPLEMENT EXCEPT DURING SPS DELTA V'S) AND THREE GOOD ENTRY BATTERIES REMAIN.
12-4	BATTERY IS CONSIDERED FAILED IF---	<p>A. OUTPUT IS LESS THAN 8 AMPS WHEN CONNECTED TO A MAIN BUS DURING SPS MANEUVERS (NOMINAL TOTAL BATTERY CURRENT FOR SPS MANEUVERS IS 20 +/- 2 AMPS).</p> <p>B. SUSTAINED BATTERY CHARGER OUTPUT IS GREATER THAN 2.0 AMPS AND ALL LOADS REMOVED.</p>
12-5	AN AC BUS IS CONSIDERED FAILED IF ANY TWO PHASES CANNOT BE MAINTAINED GREATER THAN 95 VOLTS.	
12-6	AN INVERTER IS CONSIDERED FAILED IF---	<p>A. OUTPUT VOLTAGE ON ANY PHASE IS GREATER THAN 130 VAC.</p> <p>B. OUTPUT VOLTAGE ON ANY TWO PHASES IS LESS THAN 95 VAC.</p>
12-7	FUEL CELL IS CONSIDERED FAILED FOR MISSION PLANNING IF---	<p>A. FUEL CELL CANNOT SUPPLY SUFFICIENT POWER TO MEET SPS OWN PARASITIC LOADS (5 AMPS PLUS INLINE HEATER POWER AS REQUIRED).</p> <p>B. FUEL CELL H2 LOOP IS CONTAMINATED WITH KOH.</p> <p>C. REGULATED H2 PRESSURE IS LESS THAN 36.7 PSIA (CORRESPONDS TO H2 PRESSURE SHIFT DOWN TO 28.2 PSIA FOR CRITICAL OPERATION- LOWER H2 PRESSURE CAN BE MANAGED BY TURNING OFF H2O TANK PRESSURE).</p>
12-8	FLI MINIMUM PURGE CAPABILITY IS BOTH OXYGEN AND HYDROGEN ON ONE FUEL CELL AND AT LEAST OXYGEN ON ONE OTHER FUEL CELL.	
		RULE NUMBERS 12-9 THROUGH 12-19 ARE RESERVED.
		----- * SYSTEMS MANAGEMENT * -----

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	FNL	9/10/69	CSM ELECTRICAL POWER SYSTEM	MANAGEMENT	12-1



NASA - Manned Spacecraft Center  
MISSION RULES  
SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM															
		-----														
	12-20	<p><b>BUS MANAGEMENT</b></p> <p>A. ONE AND ONLY ONE FUEL CELL WILL BE TIED TO BOTH MAIN BUSES.</p> <p>B. INVERTERS WILL BE CONFIGURED SUCH THAT MAIN BUS A WILL SUPPLY AC BUS 3 AND MAIN BUS B WILL SUPPLY AC BUS 2.</p> <p>C. MAIN BUS VOLTAGE WILL BE MAINTAINED GREATER THAN 26.5 VDC AND LESS THAN 31 VDC. ONE FUEL CELL MAY BE OPEN CIRCUITED FOR OPTIMUM VOLTAGE AND POWER MANAGEMENT.</p> <p>D. THE BATTERY CHARGER WILL BE USED TO CHECK OUT A SUSPECTED SHORTED BUS (EXCEPT MAIN BUSES) AFTER ALL EQUIPMENT AND POWER SOURCES HAVE BEEN REMOVED FROM BUS.</p> <p>E. MINIMUM MAIN BUS VOLTAGE WILL BE MAINTAINED TO BE COMPATIBLE WITH ONLINE OPERATION EQUIPMENT.</p> <table style="margin-left: 20px; border: none;"> <tr><td>1. SPS</td><td style="text-align: right;">24.5</td></tr> <tr><td>2. PONS</td><td style="text-align: right;">29.0</td></tr> <tr><td>3. AUTO SM-RCS</td><td style="text-align: right;">22.0</td></tr> <tr><td>4. AUTO CM-RCS</td><td style="text-align: right;">21.0</td></tr> <tr><td>5. DIRECT SM-RCS</td><td style="text-align: right;">21.0</td></tr> <tr><td>6. DIRECT CM-RCS</td><td style="text-align: right;">17.0</td></tr> <tr><td>7. INVERTERS</td><td style="text-align: right;">19.0</td></tr> </table>	1. SPS	24.5	2. PONS	29.0	3. AUTO SM-RCS	22.0	4. AUTO CM-RCS	21.0	5. DIRECT SM-RCS	21.0	6. DIRECT CM-RCS	17.0	7. INVERTERS	19.0
1. SPS	24.5															
2. PONS	29.0															
3. AUTO SM-RCS	22.0															
4. AUTO CM-RCS	21.0															
5. DIRECT SM-RCS	21.0															
6. DIRECT CM-RCS	17.0															
7. INVERTERS	19.0															
	12-21	<p><b>BATTERY MANAGEMENT</b></p> <p>A. BATTERIES A AND B WILL BE USED TO SUPPLEMENT MAIN BUS LOADS FROM T-75 SECONDS TO INSERTION.</p> <p>B. BATTERIES A AND B WILL BE USED TO SUPPLEMENT MAIN BUS LOADS FOR SPS MANEUVERS. BATTERY C WILL BE ROTATED TO MAINTAIN BATTERY BALANCE IN THE EVENT THE BATTERY CHARGER FAILS.</p> <p>C. BATTERY CHARGING WILL BE TERMINATED FOR ONE OF THE FOLLOWING, WHICHEVER OCCURS FIRST---</p> <table style="margin-left: 20px; border: none;"> <tr><td>1. INTEGRATED AMP-HOURS INTO BATTERY BY CHARGER EQUALS INTEGRATED AMP-HOURS OUT OF BATTERY BY LOADS.</td></tr> <tr><td>2. WHEN BATTERY CHARGER VOLTAGE AS INDICATED BY BATTERY BUS VOLTAGE INCREASES TO 39.5 VDC.</td></tr> </table> <p>D. THREE BATTERIES WILL BE TIED TO THE MAIN BUSES FOR DEORBIT MANEUVER AND ENTRY.</p> <p>E. BATTERIES ARE CONSIDERED TO HAVE 60 AMP-HR CAPABILITY INFLIGHT AND 65 AMP-HR CAPABILITY FOR POSTLANDING.</p> <p>F. A SINGLE BATTERY THAT CANNOT BE RECHARGED WILL NOT BE USED EXCEPT DURING DEORBIT, ENTRY AND POSTLANDING.</p> <p>G. BATTERY VENT VALVE WILL REMAIN CLOSED UNLESS MANIFOLD PRESSURE IS GREATER THAN 6 PSIA. VENTING OPERATION WILL BE ALLOWED TO TROUBLESHOOT A SUSPECTED FROZEN DUMP.</p>	1. INTEGRATED AMP-HOURS INTO BATTERY BY CHARGER EQUALS INTEGRATED AMP-HOURS OUT OF BATTERY BY LOADS.	2. WHEN BATTERY CHARGER VOLTAGE AS INDICATED BY BATTERY BUS VOLTAGE INCREASES TO 39.5 VDC.												
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		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 10%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 20%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>CSM ELECTRICAL POWER SYSTEM</td> <td>MANAGEMENT</td> <td>12-2</td> </tr> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	CSM ELECTRICAL POWER SYSTEM	MANAGEMENT	12-2		
MISSION	REV	DATE	SECTION	GROUP	PAGE											
APOLLO 12	FNL	9/10/69	CSM ELECTRICAL POWER SYSTEM	MANAGEMENT	12-2											

NASA - Manned Spacecraft Center  
MISSION RULES  
SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM													
	12-20	<p><b>FUEL CELL MANAGEMENT</b></p> <p>A. FUEL CELL WILL BE "SHUTDOWN" FOR THE FOLLOWING--</p> <ol style="list-style-type: none"> <li>1. SUSTAINED CURRENT OUTPUT LESS THAN 8 AMPS;</li> <li>2. FUEL CELL H<sub>2</sub> LOOP IS CONTAMINATED WITH KON;</li> <li>3. REACTANT LEAKAGE JEOPARDIZING MISSION DURATION.</li> </ol> <p>B. FUEL CELL MAY BE "OPEN CIRCUITED" FOR THE FOLLOWING--</p> <ol style="list-style-type: none"> <li>1. SKIN TEMP GREATER THAN 475 DEG. F;</li> <li>2. ICE TEMP GREATER THAN 320 DEG. F;</li> <li>3. FAILURE OF H<sub>2</sub> PUMP OR GLYCOL PUMP;</li> <li>4. VOLTAGE MANAGEMENT;</li> <li>5. FUEL CELL CANNOT BE PURGED AND TIME TO GO IS GREATER THAN PREDICTED FUEL CELL LIFETIME;</li> </ol> <p>C. FUEL CELL O<sub>2</sub> AND H<sub>2</sub> PURSES WILL NORMALLY BE PERFORMED AT 12 AND 48 HOUR INTERVALS, RESPECTIVELY. HOWEVER, THE INTERVALS WILL BE FLEXIBLE TO COINCIDE WITH WATER PUMPS (REF. MA 10-10 C).</p> <p>D. ADDITIONAL PURSES WILL BE INITIATED AS OPERATIONAL CONDITIONS DICTATE.</p> <p>E. FUEL CELLS WILL NOT BE PURGED FOR CONFIRMED HIGH PH INDICATION.</p> <p>F. EACH H<sub>2</sub> PURGE WILL NORMALLY BE PRECEDED BY 20 MINUTES OF H<sub>2</sub> VENT HEATER OPERATION FOLLOWED BY 10 MIN OF HEATER OPERATION AFTER PURGE COMPLETION.</p> <p>G. FC IN-LINE HEATERS WILL NORMALLY OPERATE IN "AUTO" CONTINUOUSLY.</p> <p>H. REACTANT VALVES MUST REMAIN OPEN AT ALL TIMES UNLESS THE FUEL CELL IS DECLARED FAILED.</p> <p>I. ADDITIONAL POWER LOADS WILL BE ADDED AS REQUIRED TO MAINTAIN FC RAD OUT TEMP GREATER THAN -40 DEG. IF CRYO BUDGET JEOPARDIZED OR RAD OUT TEMPS NOT MAINTAINED GREATER THAN -40 DEG. FC RAD WILL BE PLACED IN EMERGENCY BYPASS.</p> <p>J. ONE FUEL CELL MAY BE PURGED TO PRECLUDE VENTING OF CRYO TANKS OR FOR CRYO PRESSURE MANAGEMENT.</p>												
	12-23	<p><b>INVERTER MANAGEMENT</b></p> <p>INVERTERS MAY BE REMOVED FROM LINE FOR ANY OF THE FOLLOWING REASONS--</p> <ol style="list-style-type: none"> <li>A. INVERTER TEMP GREATER THAN 170 DEG. F;</li> <li>B. SPACECRAFT LOAD MANAGEMENT</li> </ol> <p>RULE NUMBERS 12-24 THROUGH 12-29 ARE RESERVED</p>												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 5%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 15%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/19/79</td> <td>CSM ELECTRICAL</td> <td>MANAGEMENT</td> <td>12-3</td> </tr> </table>			MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	A	10/19/79	CSM ELECTRICAL	MANAGEMENT	12-3
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	A	10/19/79	CSM ELECTRICAL	MANAGEMENT	12-3									





NASA - Manned Spacecraft Center

MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	12-36	DEGRADED FUEL CELLS (UNABLE TO SUPPORT NORMAL DRIFTING FLIGHT LOADS - SC6 & SC8 POWERED DOWN - AND MAINTAIN MN BUS VOLTAGE GREATER THAN 26.5 VOC)	LAUNCH POWERED DESCENT ALL	A. CONTINUE MISSION -  B.1. POI TO LO GATE - ENTER NEXT BEST PTP. RETAIN LN DESCENT STAGE FOR TLI IF POSSIBLE.  2. LO GATE TO TD - CONTINUE MISSION. NO GO FOR LUNAR STAY.  C. ENTER NEXT BEST PTP -			
		RULE NUMBERS 12-38 THROUGH 12-39 ARE RESERVED.					
	12-40	LOSS OF ONE ENTRY BATTERY (OUTPUT LESS THAN 3 AMPS WHEN TIED TO MAIN BUS)	LAUNCH ED DOI ALL	A. CONTINUE MISSION  1. EDS AUTO/OFF TO OFF.  2. IF LOSS OF BAT A: TIE BAT C TO MAIN A.  3. IF LOSS OF BAT B: TIE BAT C TO MAIN B.  B. NO-GO FOR TLI  C. CONTINUE MISSION -  D. BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING NOMINAL MISSION.	B. IF LOST DURING SPS MANEUVER, CONTINUE ON REMAINING BATTERY.		
	12-41	LOSS OF TWO ENTRY BATTERIES (OUTPUT LESS THAN 3 AMPS EACH WHEN CONNECTED TO MAIN BUS)	LAUNCH DOI POWERED DESCENT ALL	A. CONTINUE MISSION  1. EDS AUTO/OFF TO OFF.  2. ENTER 2-1 POWERED DOWN.  B. ENTER NEXT BEST PTP - NO GO FOR POI  C. CONTINUE MISSION - NO GO FOR LUNAR STAY  D. ENTER NEXT BEST PTP  USE ONE BATTERY ENTRY PROCEDURE.	D. IF LOSS DURING SPS MANEUVER, ATTEMPT TO TIE BATTERY C TO BOTH MAINS.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/20/67	CSM ELECTRICAL POWER SYSTEM	BATTERIES/CHARGER	12-6

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 12 - COM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	12-03	LOSS OF BATTERY CHARGER	EO TLC LO	A. CONTINUE MISSION ROTATE BATTERY C FOR DURAS TO MAINTAIN BALANCED BATTERIES  B. NO-GO FOR LOI IF SUM OF TWO LOWEST ENTRY BATTERIES LESS THAN 43.8 AMP HRS.  C. NO-GO FOR UNDOCK IF SUM OF TWO LOWEST ENTRY BATTERIES LESS THAN 43.8 AMP HRS.			
		RULE NUMBERS 12-03 THROUGH 12-09 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	A	10/16/79	COM ELECTRICAL POWER SYSTEM	BATTERIES/CHARGER	12-7

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/FUNCTION	PHASE	ACTION	CRS/NOTES/COMMENTS
12-50		MAIN BUS TIE MOTOR SWITCH FAILURES			
		A: ONE MOTOR SWITCH FAILS OPEN	LAUNCH	A.1: CONTINUE MISSION 1A) IF MOTOR B/C TIE BUS C TO MAIN BUS A 1B) IF MOTOR B/C TIE BUS C TO MAIN BUS B	
		B: ONE OR BOTH MOTOR B'S FAILED CLOSED	ALL	B: CONTINUE MISSION USE C/B'S AS MOTOR SWITCHES	A.2: BATTERIES MUST BE CHARGED THROUGH OPEN MOTOR B'S. LEAVE BAY #1V CB CLOSED FOR CHARGING.  B: IF BOTH MOTOR SWITCHES FAIL CLOSED BATTERIES CANNOT BE CHARGED.
12-51		MAIN BUS SHORTED CAUSING FUEL CELL REVERSE CURRENT DISCONNECT			
		A: FUEL CELL B DISCONNECTS FROM MAIN A	LAUNCH	A.1: CONTINUE MISSION 1A) PLACE C/B MOTOR/B'S TO OFF 1B) F/C B TO BUS B ONLY 1C) TIE BAY C TO MAIN A 1D) INVERTER B TO AC BUS A MAIN A 1E) POWER DOWN MAIN BUS B A.2: ENTER HEAT BEAT STOP NO GO FOR 50 A.3: CONTINUE MISSION- NO GO FOR LUNAR STAY A.4: ENTER HEAT BEAT STOP IF BUS NOT RESTORED POWER DOWN MAIN BUS B	A.2: GREATER THAN 20 AMP SHORT ON MAIN B WILL CAUSE REVERSE DISCONNECT DURING LAUNCH
		B: POWER DESCENT	ALL		

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MISSION RULES

SECTION 12 - CAP ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	ACTION	CUES/NOTES/COMMENTS
12-01 CONT	B.	FUEL CELL 2 DISCONNECTS FROM RAIN B	LAUNCH	<p>0.1: CONTINUE MISSION</p> <p>1A) PLACE EDS AUTO/OFF TO OFF.</p> <p>1B) FC 2 TO BUS B ONLY.</p> <p>1C) TIE BUS C TO RAIN BUS B.</p> <p>1D) INVERTER 3 TO AC BUS 2: RAIN B.</p> <p>1E) POWER DOWN RAIN BUS 2.</p> <p>1F) T/C SIGNAL DRIVE 1P/11-2.</p> <p>1G) SIGNAL MOTOR CONTROL (RAIN 2: SWITCH 2) BUS B OPER FOLLOWING SIGNAL MOTOR TURN ON.</p>	<p>D.1: GREATER THAN 25 AMPS SHORT ON RAIN A WILL CAUSE REVERSE DISCONNECT DURING LAUNCH</p>
			DO1	0.2: ENTER NEXT BEST PTP- NO GO FOR DO1	
			POWERED DESCENT	0.3: CONTINUE MISSION- NO GO FOR LUNAR STAY	
			ALL	0.4: ENTER NEXT BEST PTP IF BUS NOT RESTORED: POWER DOWN RAIN BUS A	
	C.	RAIN BUS SWITCHED GREATER THAN 25 AMPS AND FUEL CELL ENERGY BE DISCONNECTED FROM SWITCHED BUS.	LAUNCH DO1	<p>C.1: ABORT</p> <p>2: ENTER NEXT BEST PTP IF ON BUS NOT RESTORED- NO GO FOR DO1; RETAIN LD DESCENT STAGE FOR TEL</p> <p>3: CONTINUE MISSION- NO GO FOR LUNAR STAY IF ON BUS NOT RESTORED.</p> <p>4: ENTER NEXT BEST PTP IF RAIN BUS NOT RESTORED.</p>	<p>C.1: FAILURE OF MOTOR SWITCH TO DISCONNECT FROM SWITCHED BUS INDICATED BY FC SWITCHED BUS T/B DRIVE.</p> <p>C.2: IF FUEL CELL PERS. CIRCUITRY SWITCHED: CLOSE FC REACTANT VALVES.</p>
			POWERED DESCENT		
			ALL		



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MISSION RULES

SECTION 22 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/FALFUNCTION	PHASE	ACTIONS	CRS/NOTES/COMMENTS
12-32	A: BATTERY BUS SHORTED IS GREATER THAN 8 AMPS	LAUNCH	A.1: CONTINUE MISSION	(A) PLACE EBS AUTO/OFF TO OFF (B) OPEN ASSOCIATED MAIN BUS TO BAT BUS CB. (C) TIE BAT C TO ASSOCIATED MAIN BUS.	A.1: GREATER THAN 28 AMPS WILL CAUSE BATTERY BUS VOLTAGE TO BE LESS THAN OR EQUAL TO MAIN BUS VOLTAGE.
		DOE	2: ENTER NEXT BEST PIP- NO GO FOR S/L RETAIN L/D DESCENT STAGE FOR TLI		
		POWERED DESCENT	3: CONTINUE MISSION- NO GO FOR LUNAR STAT		
		ALL	4: ENTER NEXT BEST PIP IF BUS NOT RESTORED		A.4: REMOVE POWER FROM BUS; IF SHORTED LESS THAN OR EQUAL TO 10 AMPS, POWER BUS JUST PRIOR TO ENTRY TO MAINTAIN SECS REDUNDANCY.
	B: BATTERY BUS SHORTED LESS THAN 5 AMPS	ALL	5: CONTINUE MISSION REMOVE POWER FROM BUS EXCEPT FOR MANEUVERS AND ENTRY		
12-33	BATTERY RELAY BUS SHORTED	LAUNCH	A.1: CONTINUE MISSION		
	A: SHORT GREATER THAN 2.0 AMPS	UNPOWERED/DOE/POWERED DESCENT	2: CONTINUE MISSION- NO GO FOR LUNAR STAT		A.2: UNDOCKING MAY BE PERFORMED.
		ALL	3: ENTER NEXT BEST PIP OPEN BATTERY BUS TO BATTERY RELAY BUS CB'S		
	B: SHORT LESS THAN 2.0 AMPS	ALL	6: CONTINUE MISSION		6: CHANGE BAT B CONTINUOUSLY WITH BAT B POWER ENTRY AND POST LANDING CB OPEN. CONSIDER BATTERY CHARGER LOGS FOR MISSION PLANNING.

REVISION	REV	DATE	DESIGNER	GROUP	PAGE
APOLLO 16	0	10/27/69	CSM ELECTRICAL	DC DISTRIBUTION	10-10

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
12-34	A: LOSS OF ONE BATTERY BUS MAIN BUS; (UNABLE TO POWER BUS)	LAUNCH DO1 POWERED DESCENT ALL	LAUNCH DO1 POWERED DESCENT ALL	A.1: CONTINUE MISSION 2: ENTER NEXT BEST DTP - NO GO FOR PDI, RETAIN LM DESCENT STAGE FOR FEI 3: CONTINUE MISSION - NO GO FOR LUNAR STAY 4: ENTER NEXT BEST DTP			
	B: LOSS OF BATTERY RELAY BUS (UNABLE TO POWER BUS)	LAUNCH UNDOCKED DO1 POWERED DESCENT ALL	LAUNCH UNDOCKED DO1 POWERED DESCENT ALL	B.1: CONTINUE MISSION 2: CONTINUE MISSION - NO GO FOR LUNAR STAY 3: ENTER NEXT BEST DTP	B.2: UNDOCKING MAY BE PERFORMED		
	RULE NUMBERS 12-35 THROUGH 12-39 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PM	5/16/69	CSM ELECTRICAL	DC Distribution	12-11

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 12 - COM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULES	CUES/NOTES/COMMENTS												
	12-00	LOSS OF TWO INVERTERS	LAUNCH DOI POWERED DESCENT ALL	A. CONTINUE MISSION B. ENTER NEXT BEST PTP- NO GO FOR PD; RETAIN LM DESCENT STAGE FOR T&I C. CONTINUE MISSION- NO GO FOR LUNAR STAY D. ENTER NEXT BEST PTP	PLACE REMAINING INVERTER ON BOTH A CUSES.  D. CONSIDERATION WILL BE GIVEN TO RETAINING LM FOR SYSTEM BACKUP.												
	12-01	LOSS OF ONE AC BUS (TWO PHASES CANNOT BE MAINTAINED GREATER THAN 95 VAC)	LAUNCH DOI POWERED DESCENT ALL	A. CONTINUE MISSION B. ENTER NEXT BEST PTP- NO GO FOR PD; RETAIN LM DESCENT STAGE FOR T&I C. CONTINUE MISSION- NO GO FOR LUNAR STAY D. ENTER NEXT BEST PTP													
	12-02	LOSS OF BOTH AC BUSES	LAUNCH POWERED DESCENT ALL	A. ABORT MODE I OR MODE II 1. OPEN DIRECT O2 FOR SUIT VENTILATION. 2. IF AFTER MODE II: ENTER PTP 2-1. B. CONTINUE MISSION- C. ENTER NEXT BEST PTP OR ATP IF SUITED: REMOVE HELMET AND GLOVES. IF TIME PERMITS, REMOVE SUITS. IF CABIN DEPRESSURIZED, USE DIRECT O2 UNTIL CABIN IS REPRESSURIZED.	A. REF M---  A.2. INITIATE CONTINUOUS PC #2 PURGE FOR COOLING.  C.1. USE LM SYSTEMS (IF AVAILABLE) FOR AC POWERED FUNCTIONS TO ENTRY. 2. FOR COM ONLY: ENTER WITHIN 1-1/2 HOURS. INITIATE CONTINUOUS PC #2 PURGE FOR COOLING.												
		RULE NUMBERS 12-03 THROUGH 12-09 ARE RESERVED.															
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 10</td> <td>A</td> <td>10/10/70</td> <td>COM ELECTRICAL POWER SYSTEM</td> <td>AC DISTRIBUTION</td> <td>10-10</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 10	A	10/10/70	COM ELECTRICAL POWER SYSTEM	AC DISTRIBUTION	10-10
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 10	A	10/10/70	COM ELECTRICAL POWER SYSTEM	AC DISTRIBUTION	10-10												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM - CONCLUDED

REV	ITEM	INSTRUMENTATION REQUIREMENTS					MISSION RULE REFERENCE
12-70	MEAS DESCRIPTION	PCN	ONBOARD	TRANSDUCERS	CATEGORY		
	AC BUS 1 PHASE A VAC	CC0200Y	METER	SEPARATE	HIGHLY DESIRABLE	12-3,6,61	
	AC BUS 1 PHASE B VAC	-----	METER	-----	HIGHLY DESIRABLE		
	AC BUS 1 PHASE C VAC	-----	METER	-----	HIGHLY DESIRABLE		
			COMMON METER				
	AC BUS 2 PHASE A VAC	CC0203Y	METER	SEPARATE	HIGHLY DESIRABLE	12-3,6,61	
	AC BUS 2 PHASE B VAC	-----	METER	-----	HIGHLY DESIRABLE		
	AC BUS 2 PHASE C VAC	-----	METER	-----	HIGHLY DESIRABLE		
	MAIN BUS A VDC	CC0206Y	METER	SEPARATE	1 OF 2 MANDATORY	12-12,12,20C	
	MAIN BUS B VDC	CC0207Y	METER	SEPARATE	MANDATORY	12-12	
	BAT BUS A VDC	CC0210Y	METER	SEPARATE	HIGHLY DESIRABLE		
	BAT BUS B VDC	CC0211Y	METER	SEPARATE	HIGHLY DESIRABLE		
	BAT RELAY BUS VDC	CC0212Y	METER	SEPARATE	HIGHLY DESIRABLE		
	BAT A CURRENT	CC0222C	METER	COMMON			
	BAT B CURRENT	CC0223C	METER	COMMON	2 OF 3 MANDATORY	12-4,12,40,41	
	BAT C CURRENT	CC0224C	METER	COMMON			
	PC 1 CURRENT	SC2118C	METER	COMMON			
	PC 1 O2 FLO	SC2141R	METER	COMMON	1 OF 3 MANDATORY	12-7,11,12,33, 22A	
	PC 1 N2 FLO	SC2139R	METER	COMMON			
	PC 2 CURRENT	SC2114C	METER	COMMON			
	PC 2 O2 FLO	SC2143R	METER	COMMON	1 OF 3 MANDATORY	12-7,11,12,33, 22A	
	PC 2 N2 FLO	SC2140R	METER	COMMON			
	PC 3 CURRENT	SC2113C	METER	COMMON			
	PC 3 O2 FLO	SC2144R	METER	COMMON	1 OF 3 MANDATORY	12-7,11,12,33, 22A	
	PC 3 N2 FLO	SC2142R	METER	COMMON			
	BAT CHARGER CURRENT	SC0213C	METER	COMMON	HIGHLY DESIRABLE		
	PC 1 BRN TEMP	SC1006Y	METER	COMMON	HIGHLY DESIRABLE	12-220	
	PC 2 BRN TEMP	SC1008Y	METER	COMMON	HIGHLY DESIRABLE		
	PC 3 BRN TEMP	SC1007Y	METER	COMMON	HIGHLY DESIRABLE		
	PC 1 COND TEMP	SC2001Y	METER	COMMON	HIGHLY DESIRABLE	12-120	
	PC 2 COND TEMP	SC2002Y	METER	COMMON	HIGHLY DESIRABLE		
	PC 3 COND TEMP	SC2003Y	METER	COMMON	HIGHLY DESIRABLE		
	PC 1 RAD OUT TEMP	SC1007Y	METER	COMMON	HIGHLY DESIRABLE	12-121	
	PC 2 RAD OUT TEMP	SC1008Y	METER	COMMON	HIGHLY DESIRABLE		
	PC 3 RAD OUT TEMP	SC1009Y	METER	COMMON	HIGHLY DESIRABLE		
	BAT MANIPOLD PRESS	-----	METER	-----	HIGHLY DESIRABLE	-----	
	INV 1 TEMP	CC0173I	PCN	COMMON	HIGHLY DESIRABLE	-----	
	INV 2 TEMP	CC0174Y	PCN	COMMON	HIGHLY DESIRABLE	-----	
	INV 3 TEMP	CC0177Y	PCN	COMMON	HIGHLY DESIRABLE	-----	
	PC 1 PH	SC2140R	TALBACK	COMMON	HIGHLY DESIRABLE		
	PC 2 PH	SC2141R	TALBACK	COMMON	HIGHLY DESIRABLE		
	PC 3 PH	SC2142R	TALBACK	COMMON	HIGHLY DESIRABLE	12-226	

NOTE--- USE BAT C IN LIEU OF BATTERY WITH LOSS INST

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	001	0/10/70	CSM ELECTRICAL POWER SYSTEM	INSTR REQ	12-11

13 DUCRING AND  
UMBILICAL

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 13 - DOCKING AND UMBILICAL

REV	ITEM												
	<p>-----                      * GENERAL *                      -----</p>												
13-1	THREE GOOD DOCKING RING LATCHES 120 DEG. APART ARE REQUIRED FOR AN EVT.												
	RULE 13-2 IS RESERVED.												
13-3	DOCKED SPS OR DPS BURNS REQUIRE AT LEAST NINE GOOD DOCKING RING LATCHES.												
13-4	MANNED UNDOCKING OPERATIONS WILL BE TERMINATED FOR ANY FAILURE OF A DOCKING RING LATCH TO RELEASE. NO ATTEMPT WILL BE MADE TO DISASSEMBLE A DOCKING RING LATCH.												
13-5	WITH FAILURE OF THE CSM FORWARD HATCH PRIMARY LOCK/UNLOCKED MECHANISM, THE NOMINAL MISSION WILL BE PERFORMED USING THE SECONDARY LOCK/UNLOCK MECHANISM.												
13-6	LOSS OF VISUAL DOCKING AIDS (COAS AND TARGETS) WILL NOT INHIBIT DOCKING AND UNDOCKING.												
13-7	IF THE DOCKING PROBE FAILS TO INDICATE EXTENSION OR IF BOTH TALK BACK INDICATORS ARE BARBER POLES, TSB WILL BE ATTEMPTED.												
	NOTE---THE ONLY DOCKING PROBE INSTRUMENTATION CONSISTS OF TWO TALK BACK INDICATORS IN THE CSM.												
	RULE NUMBERS 13-8 THROUGH 13-10 ARE RESERVED												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 10%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 12 P/M</td> <td></td> <td>9/18/69</td> <td>DOCKING AND UMBILICAL</td> <td>GENERAL</td> <td>13-1</td> </tr> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12 P/M		9/18/69	DOCKING AND UMBILICAL	GENERAL	13-1
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12 P/M		9/18/69	DOCKING AND UMBILICAL	GENERAL	13-1								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 13 - DOCKING AND UNBILICAL

REV	ITEM						
		<p>-----                      * MANAGEMENT *                      -----</p>					
13-11		<p>FOR MISFIRE OF A DOCKING RETRACT SOLID, THE REMAINING SOLID IN THE SAME SYSTEM WILL BE USED TO ATTEMPT COMPLETION OF DOCKING. TWO NITROGEN BOTTLES REMAINING ARE NORMALLY REQUIRED TO ALLOW UNDOCKING--HOWEVER, BASED ON THE FAILURE MODES CONSIDERATION WILL BE GIVEN TO UNDOCKING WITH ONE NITROGEN BOTTLE REMAINING IN AN OPERABLE SYSTEM.</p>					
13-12		<p>THE CM FORWARD AND LM UPPER MATCH NORMALLY WILL BE INSTALLED FOR ANY TYPE OF MANEUVER OR DOCKING.</p>					
13-13		<p>DURING OPERATIONS WHEN CM/LM DOCKED STATUS IS MAINTAINED BY PROBE PRELOAD ONLY (DOCKING LATCHES COCKED) CM/LM THRUSTER ACTIVITY ABOUT CM/LM X-AXIS IS LIMITED AS FOLLOWS---</p>					
		<p>TUNNEL PRESSURE PSIA                      GREATER THAN 1.5 PSIA                      BETWEEN 0 AND 1.5 PSIA                      0 PSIA</p>	<p>COMBINED CM/LM ACTIVE THRUSTERS                      INHIBIT ALL CM ROLL AND LM YAW CONTROL                      NO MORE THAN 2 JETTS                      NO MORE THAN 4 JETTS</p>				
13-14		<p>LOW PROBE TEMPERATURE WILL NOT INHIBIT DOCKING ATTEMPTS.                      RULE NUMBERS 13-13 THROUGH                      13-16 ARE RESERVED.</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12/PM	9/10/69	DOCKING AND UNBILICAL		MANAGEMENT	13-2

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MISSION RULES

SECTION 15 - DOCKING AND UMBILICAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
<p>-----                      * SPECIFIC MISSION RULES *                      -----</p>							
15-20	FAILURE TO ACHIEVE OR MAINTAIN POWER TO X-LUNAR BUS LOADS FROM CSM	DOCKED		<p>* CONTINUE MISSION -</p> <p>1. INSURE LM DESCENT BATTERY LOW VOLTAGE TAPS = ON</p> <p>2. OPEN LM CB 1111 &amp; CB 1183 EPS---DES ECA CIRCUIT BREAKERS WITHIN 6 HOURS OF THE TIME THE DESCENT BATTERIES WERE TURNED ON.</p> <p>3. CLOSE LM CB 1111 &amp; CB 1183 EPS---DES ECA CIRCUIT BREAKERS AT FIRST PLANNED MANNING.</p>	<p>* NOMINAL MISSION MAY BE PERFORMED BECAUSE ECA THERMAL CONSTRAINTS WILL NOT BE VIOLATED WITH DESCENT ECA CIRCUIT BREAKERS OPEN, OVER CURRENT PROTECTION, HOWEVER, IS LOST UNTIL THESE CIRCUIT BREAKERS ARE CLOSED. EXTRA DESCENT AMP HOURS USED MAY AFFECT LUNAR STAY TIME.</p>		
15-21	FAILURE TO ACHIEVE S-1YB/LM SEPARATION OR FAILURE TO RATE LM UMBILICALS (P23 AND P24)	YDGE		<p>* PERFORM CSM/LM FINAL SEP</p>	<p>* S-1YB/LM SEP CANNOT BE ACHIEVED WITHOUT MATING AT LEAST ONE UMBILICAL.</p> <p>* POWER CAN BE SWITCHED AND MAINTAINED WITH EITHER PLUG.</p>		
15-22	FAILURE TO ACHIEVE CSM/LM FINAL SEPARATION	DOCKED		<p>* MUST PERFORM NORMAL UNDOCKING</p> <p>A. RETRIEVE PROBE AND GROOVE AND INSTALL.</p> <p>B. AFTER UNDOCKING, DEPRESS CSM AND JETTISON PROBE OVERBOARD.</p>			
15-23	FAILURE TO INDICATE DOCKING PROBE EXTEND ON BOTH TALE BACK INDICATORS AND HARDEN POLE.	YDGE UNDOCKED		<p>A. CONTINUE MISSION ATTEMPT YDGE</p> <p>B. CONTINUE MISSION ATTEMPT DOCKING</p>	<p>* DOCKING RING TUNNEL STRUCTURE DAMAGE MAY OCCUR TO THE EXTENT THAT TUNNEL PRESSURE CAN NOT BE MAINTAINED.</p>		
15-24	CANNOT REMOVE CSM FORWARD MATCH	YDGE DOCKED		<p>A. PERFORM CSM/LM FINAL SEP</p> <p>B. PERFORM CSM/LM FINAL SEP</p> <p>IF LM MANNED: PERFORM 1Y7 TO CSM.</p>			
<p>-----</p>							
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PNL	9/10/69	DOCKING AND UMBILICAL	SPECIFIC	15-5



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 13 - DOCKING AND UMBILICAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	13-25	CANNOT REMOVE DOCKING PROBE, LM DROGUE AND/OR LM UPPER MATCH.	DOCKED	CONTINUE MISSION PERFORM EVT IF LM MANNED	SPS AND SN RCS MANEUVERS MAY BE PERFORMED
	13-26	FAILURE TO RELEASE CAPTURE LATCHES	DOCKED	REDOCK	
	13-27	PRIMARY FORWARD MATCH LOCK/UNLOCK MECHANISM INOPERATIVE	ALL	CONTINUE MISSION	
	13-28	FAILURE TO LOCK CSM FORWARD MATCH	TO BE DOCKED	CONTINUE MISSION ENTER IN SUITS	REF SCP A13 2. A (ASSUMES MATCH CAN BE SEALED AND SECURED WITH CABIN PRESSURE)
	13-29	FAILURE TO REINSTALL PROBE AND/OR DROGUE OR FAILURE TO CLOSE LM UPPER MATCH	DOCKED	NO UNDOCKING	
	13-30	LOSS OF PRIMARY OR SECONDARY DOCKING SYSTEM	DOCKED	CONTINUE MISSION BASED ON FAILURE MODE CONSIDERATION WILL BE GIVEN TO UNDOCKING WITH ONE ONE BOTTLE REMAINING IN AN OPERABLE SYSTEM.	

MISSION	REV	DATE	ACTION	BY	DATE
APPLD TO	0	10/21/77	DOCKING AND UMBILICAL	SPECIFIC	13-3

14 CSM SEQUENTIAL

NASA - Manned Spacecraft Center  
MISSION RULES  
SECTION 14 - CSM SEQUENTIAL

REV	ITEM													
		<div style="border: 1px dashed black; padding: 2px; display: inline-block;">GENERAL</div>												
14-1	LAUNCH	THERE ARE NO SEQUENTIAL MALFUNCTIONS FOR WHICH LAUNCH WILL BE TERMINATED.												
14-2		IF AN ENTRY BATTERY IS LOST, THE EDS WILL BE FLOWN OPEN LOOP.												
14-3	ALL MISSION PHASES EXCEPT LUNAR ORBIT	TO CONTINUE THE MISSION, BOTH PYRO BUSES AND BOTH LOGIC BUSES ARE REQUIRED.												
14-4	POWERED DESCENT	THERE ARE NO CSM SEQUENTIAL SYSTEM FAILURES FOR WHICH POWERED DESCENT WILL BE TERMINATED												
14-5	SEQUENTIAL LOGIC BUS IS CONSIDERED FAILED IF---	A. VOLTAGE IS LESS THAN 22 VDC AND UNABLE TO ACTIVATE RCS ENABLE AND/OR SLA SEP RELAYS (CD0170X AND/OR CD0129X SYSTEM A; CD0171X AND/OR CD0124X SYSTEM B). B. LOGIC BUS SHORTED GREATER THAN 10 AMPS.												
14-6	PYRO BUS IS CONSIDERED FAILED IF---	A. SHORTED GREATER THAN 10 AMPS. B. FAILURE TO PERFORM ANY SEQUENTIAL FUNCTION WITH SUSPECTED FAILED PYRO SYSTEM.												
		RULE NUMBERS 14-7 THROUGH 14-9 ARE RESERVED												
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MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	FNL	9/10/69	CSM SEQUENTIAL	GENERAL	14-1									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 14 - CSM SEQUENTIAL

REV	ITEM							
		----- * MANAGEMENT * -----						
14-10		ARMING OF THE SEQUENTIAL SYSTEM WILL BE PERFORMED WHILE IN CONTACT WITH A GROUND TELEMETRY SITE. THE FLIGHT CREW WILL ARM THE LOGIC BUSES AND STAND BY FOR A GO FROM THE GROUND TO PROCEED WITH ARMING THE PYRO BUSES.						
		RULE NUMBERS 14-11 THROUGH 14-19 ARE RESERVED						
			MISSION	REV	DATE	SECTION	GROUP	PAGE
			APOLLO 12	FNL	9/10/69	CSM SEQUENTIAL	MANAGEMENT	14-2

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 14 - CSN SEQUENTIAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
-----   SPECIFIC MISSION RULES   -----																	
14-20		SEQUENTIAL LOGIC BUS A OR B LESS THAN OR EQUAL TO 22 VDC AND UNABLE TO ACTIVATE ACS ENABLE AND/OR SLA SEP RELAYS	LAUNCH EO FLC LUNAR ORBIT/ LUNAR STAY	1. CONTINUE MISSION ENTER 3-3 IF BUS NOT RESTORED 2. TERMINATE OPERATIONS ENTER NEXT BEST PTP IF BUS NOT RESTORED 3. CONTINUE MISSION	CD0120X AND/OR CD0122X SYSTEM A; CD0112X AND/OR CD0114X SYSTEM B												
14-21		PYRO BUS A OR B LESS THAN OR EQUAL TO 23 VDC  A. SHORTED GREATER THAN 10 AMPS  B. SHORTED LESS THAN 10 AMPS  C. PYRO BUS TM READS 0 VDC AND PYRO BAT ONBOARD GREATER THAN 23 VDC	LAUNCH EO FLC LUNAR ORBIT/ LUNAR STAY  ALL LAUNCH ALL	1. CONTINUE MISSION 2. TERMINATE OPERATIONS ENTER NEXT BEST PTP 3. CONTINUE MISSION  1. CONTINUE MISSION 2. ATTEMPT FUNCTION USING SUSPECTED FAILED BUS ONLY-- (A) IF FUNCTION NORMAL, CONTINUE MISSION (B) IF FUNCTION DOES NOT WORK NORMALLY, ENTER NEXT BEST PTP	A.2. USE BATTERY TIE FOR PYRO POWER TO AFFECTED E.S  B. USE BATTERY TIE FOR PYRO POWER TO AFFECTED BUS  C.2. ASSUME PYRO BAT VERIFIED GREATER THAN 23 VDC PRIOR TO ARMING. IF ENTRY BAT USED IN LIEU OF PYRO BAT, VOLTAGE SHOULD BE APPROXIMATELY = TO BAT BUS VOLTAGE.												
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	FNL	9/10/69	CSN SEQUENTIAL	SPECIFIC	14-3												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 14 - CSM SEQUENTIAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	EYES/NOTES/COMMENTS												
14-22	TELEMETRY INDICATED AN EDS VOTE INPUT 1, 2, OR 3		LAUNCH	CONTINUE MISSION  A. IF ANY ENTRY BATTERY LESS THAN 22 VDC, EDS AUTO/OFF SWITCH TO OFF  B. ALL ENTRY BATTERIES GREATER THAN 22 VDC--- CHECK CORRESPONDING EDS CB'S 1, 2, OR 3 CLOSED	PARAMETERS ARE CD0122X, CD0123X, AND CD0124X RESPECTIVELY.  A. BAT C VOLTAGE CAN ONLY BE MONITORED ONBOARD												
14-23	LET JETTISON MOTOR DOES NOT FIRE		LAUNCH	CONTINUE MISSION ATTEMPT JETTISON PER CREW CHECKLIST EMERGENCY PROCEDURE													
14-24	SMJC ACTIVATES PREMATURELY		DDI  POWERED DESCENT  ALL	A. ENTER NEXT BEST PTP-- NO GO FOR PDI, RETAIN LM DESCENT STAGE FOR TEI  B. CONTINUE MISSION-- NO GO FOR LUNAR STAY  C. ENTER NEXT BEST PTP  1. TERMINATE OPERATIONS AND POWER DOWN AFFECTED MAIN BUS. DO NOT ARM AFFECTED PYRO BUS  2. IF UNDOCKED, RETURN TO CSM AND PERFORM CSM/LM FINAL SEP  3. REPOWER AFFECTED MAIN BUS AFTER CM/SM SEP	C.1. USE GOOD SEQUENTIAL SYSTEM IF IN CONTACT WITH MSFN. ARMING OF LOGIC BUSES WILL INDICATE WHICH MAIN BUS MUST BE POWERED DOWN. MAIN A IF SYSTEM A CM/SM SEP. MAIN B IF SYSTEM B CM/SM SEP EVENT IS ACTIVATED.  C.2. USE GOOD SEQUENTIAL SYSTEM												
14-25	ACTIVATED CM RCS PRESS LOGIC RELAYS.		ALL	CONTINUE MISSION  A. PRIOR TO CM RCS PRESS---DO NOT ARM RESPECTIVE PYRO BUS  IFOR BOTH INDICATIONS PERFORM 3LA SEP WITH SECS ARM CB'S OPEN.1  B. AT CM RCS PRESS---ARM RESPECTIVE PYRO BUS	CD0175X AND/OR CD0176X												
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	PNL	9/10/69	CSM SEQUENTIAL	SPECIFIC	14-6												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 14 - CSM SEQUENTIAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
14-26	ACTIVATED SLA DEPLOY LOGIC RELAYS		ALL	CONTINUE MISSION 1A. PRIOR TO SLA SEP---DO NOT ARM RESPECTIVE PYRO BUS 1B. FOR SLA SEP---ARM RESPECTIVE PYRO BUS FIRST	CO022X AND/OR CO024X												
14-27	UNABLE TO PERFORM SLA SEPARATION		TLC	ENTER NEXT BEST PTP	REF MR---												
14-28	LOST GROUND TO RESISTOR NETWORK FOR LOGIC OR PYRO BUS VOLTS MEASUREMENTS		LAUNCH 1EO 1TO+E  ALL	CONTINUE MISSION ARM BOTH SYSTEMS  1B. CONTINUE MISSION DO NOT ARM AFFECTED SYSTEM UNTIL SEQUENTIAL GO/NO GO PRIOR TO ENTRY UNLESS OTHER SYSTEM FAILS.	ARMING AFFECTED SYSTEM WILL RESULT IN LOSS OF FOLLOWING PCM MEASUREMENTS--- <u>LOGIC A</u> SC2142R FC 1 O2 FLOW SPO930P FU SM/ENG INTERFACE P <u>LOGIC B</u> SC2140R FC 2 H2 FLOW ST082K ALPHA CT. RATE CHAN 2 <u>PYRO A</u> SC2149R FC 2 O2 FLOW <u>PYRO B</u> SC2199R FC 1 H2 FLOW ST0831K ALPHA CT. RATE CHAN 2												
	RULE NUMBERS 14-29 THROUGH 14-39 ARE RESERVED.																
14-40	ACTIVATED APX JETTISON LOGIC RELAYS		LUNAR ORBIT/ LUNAR STAY  ALL	1A. CONTINUE MISSION DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED 1B. ENTER NEXT BEST PTP DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED.	DETECTED AT BECS POWER UP (CO0230X AND CO0232X)												
14-41	ACTIVATED DROGUE CHUTE DEPLOY LOGIC RELAY		LUNAR ORBIT/ LUNAR STAY  ALL	1A. CONTINUE MISSION DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED 1B. ENTER NEXT BEST PTP.  DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED.	MAY BE DETECTED AT ANY TIME (CE0001K AND/OR CE0002K)												
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	A	10/15/68	CSM SEQUENTIAL	SPECIFIC	14-5												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 14 - CSN SEQUENTIAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	14-02	ACTIVATED PILOT CHUTE DEPLOY LOGIC RELAY	LUNAR ORBIT/ LUNAR STAY  ALL	A. CONTINUE MISSION DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED  B. ENTER NEXT BEST PTP DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED	DETECTED AT SECS POWER UP PRIOR TO ENTRY (CE00034 AND/OR CE00041) WITH ELC BAT AIB) CO CLOSED		
		RULE NUMBERS 14-03 THROUGH 14-09 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/10/69	CSN SEQUENTIAL	SPECIFIC	14-6



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 14 - CSM SEQUENTIAL - CONCLUDED

REV	ITEM	..... INSTRUMENTATION REQUIREMENTS .....					MISSION R/L REFERENCE
14-30	HEAD DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY		
	PYRO BUS A VOLTS	CD0005V	-----	-----	1 OF	14-21	
	PYRO BUS B VOLTS	CD0006V	-----	-----	2 M	14-21	
	SEQ LOGIC BUS A VOLTS	CD0020V	-----	-----	HD	14-20	
	SEQ LOGIC BUS B VOLTS	CD0020V	-----	-----	HD	14-20	
	APEX JET A	CD0023X	-----	-----	HD	14-40	
	APEX JET B	CD0023X	-----	-----	HD	14-40	
	DROGUE DEPLOY A	CE0001X	-----	-----	HD	14-01	
	DROGUE DEPLOY B	CE0002X	-----	-----	HD	14-01	
	PILOT CHUTE DEPLOY A	CE0003X	-----	-----	HD	14-02	
	PILOT CHUTE DEPLOY B	CE0004X	-----	-----	HD	14-02	
	SLA SEP RELAY A	CD0024X	-----	-----	HD	14-26	
	RCS/SCS ACTIVATE A	CD0017X	-----	-----	HD	-----	
	SLA SEP RELAY B	CD0024X	-----	-----	HD	14-26	
	RCS/SCS ACTIVATE B	CD0017X	-----	-----	HD	-----	
	CM RCS PRESS SIG A	CD0017X	-----	-----	HD	14-25	
	CM RCS PRESS SIG B	CD0017X	-----	-----	HD	14-25	
	CM-SH SEP RELAY A	CD0022X	-----	-----	HD	-----	
	CM-SH SEP RELAY B	CD0022X	-----	-----	HD	-----	
	CREW ABORT A	CD0019X	-----	-----	HD	-----	
	CREW ABORT B	CD0019X	-----	-----	HD	-----	
	EDS ABORT VOTE 1	CD0019X	-----	-----	HD	14-22	
	EDS ABORT VOTE 2	CD0019X	-----	-----	HD	14-22	
	EDS ABORT VOTE 3	CD0019X	-----	-----	HD	14-22	
	EDS ABORT A	CD0019X	-----	-----	HD	-----	
	EDS ABORT B	CD0019X	-----	-----	HD	-----	
	MAIN CHUTE DISC A	CE0021X	-----	-----	HD	-----	
	MAIN CHUTE DISC B	CE0022X	-----	-----	HD	-----	
	EDS ABORT REQ A	BS0008X	-----	-----	HD	-----	
	EDS ABORT REQ B	BS0009X	-----	-----	HD	-----	
	DOCKING PROBE TEMP	CS0220T	-----	-----	HD	-----	
	CSM-LM LOCK RING SEP RELAY A	CO1154X	-----	-----	HD	19-23	
	CSM-LM LOCK RING SEP RELAY B	CO1155X	-----	-----	HD	19-23	
	LM CURRENT	SC2902C	METER	COMMON	HD	-----	

18 CSM GUIDANCE  
AND CONTROL

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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	
		..... GENERAL .....
15-1	LAUNCH	THERE ARE NO FAILURES OF THE GSN GUIDANCE AND CONTROL SYSTEM WHICH ARE CAUSE FOR ABORT.
15-2	EARTH ORBIT PHASE	<p>A. IN ORDER TO CONTINUE THE MISSION PAST THE NEXT BEST PTP, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE SPS CRITICAL BURN CAPABILITY AND ONE BACKUP DEORBIT METHOD (SM OR HYBRID). THE FOLLOWING MINIMUM CAPABILITIES MUST BE AVAILABLE---</p> <ol style="list-style-type: none"> <li>1. ATTITUDE CONTROL---DIRECT RCS AND RATE DAMPING IN EACH AXIS.</li> <li>2. TVC (CRITICAL BURNS)--- ONE TVC SERVO LOOP IN EACH AXIS AND ONE TVC CONTROL MODE (ACCEL CMD EXCLUDED).</li> <li>3. BACKUP DEORBIT--- AS LONG AS ENOUGH PROPELLANT IS AVAILABLE FOR AN SM DEORBIT, THE GSC SYSTEMS MUST PROVIDE THAT CAPABILITY. IF SM DEORBIT IS NOT FEASIBLE DUE TO LACK OF PROPELLANT OR A SYSTEMS FAILURE, THE GSC SYSTEMS MUST PROVIDE CAPABILITY FOR A HYBRID DEORBIT.                             <ul style="list-style-type: none"> <li>(A) SM DEORBIT REQUIREMENTS---                                     <ul style="list-style-type: none"> <li>- TRANSLATION CAPABILITY</li> <li>- ONE OPERATIONAL FDAI</li> <li>- RATE DAMPING IN ALL THREE AXES DAP OR BCS</li> </ul> </li> <li>(B) HYBRID DEORBIT REQUIREMENTS---                                     <ul style="list-style-type: none"> <li>- ALL SM DEORBIT REQUIREMENTS (RATE DAMPING MUST BE GCS)</li> <li>- OPERATIONAL: EMU CMC, AND MAIN OSKY</li> <li>- TWO OPERATIONAL RMC'S</li> </ul> </li> </ul> </li> </ol> <p>B. IN ORDER TO PERFORM A NON-CRITICAL BURN AFTER THE STORAGE TANKS ARE EMPTY, THE GSC SYSTEMS MUST PROVIDE THE THE CAPABILITY TO EXECUTE AN ULLAGE MANEUVER BY EITHER CMC AUTO (RCS DAP), SCS AUTO, OR DIRECT ULLAGE.</p> <p>C. IN ORDER TO COME TO THE TRANSLUNAR COAST PHASE, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE SPS NON-CRITICAL GUIDANCE AND CONTROL SYSTEMS BURN CAPABILITY. THE FOLLOWING MINIMUM CAPABILITIES MUST ALSO BE AVAILABLE TO BE GO FOR TLI---</p> <ol style="list-style-type: none"> <li>1. ATTITUDE CONTROL---DIRECT RCS AND RATE DAMPING IN EACH AXIS.</li> <li>2. TVC---TWO SERVO LOOPS AND BOTH G6N AND ONE SCS TVC CONTROL MODES (ACCEL CMD EXCLUDED).</li> <li>3. G6N---CMC, EMU, AND MDC OSKY FULLY OPERATIONAL AND OPTICS CAPABLE OF ALIGNING PLATFORM.</li> <li>4. DISPLAYS---ONE OPERATIONAL FDAI.</li> <li>5. ATTITUDE REFERENCE---REDUNDANT ATTITUDE SOURCES ARE REQUIRED FOR ENTRY.</li> </ol>
15-3	TRANSLUNAR COAST	<p>IN ORDER TO CONTINUE THE MISSION PAST THE NEXT BEST PTP, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES---</p> <ol style="list-style-type: none"> <li>A. ATTITUDE CONTROL---DIRECT RCS AND RATE DAMPING IN EACH AXIS.</li> <li>B. RCS TRANSLATION---X-AXIS VIA AUTO COILS OR DIRECT ULLAGE PUSHBUTTON.</li> </ol>

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 13	FNL	9/10/69	GUIDANCE AND CONTROL	GENERAL	15-1

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM													
	15-4	<p>LOI; LUNAR ORBIT</p> <p>A. LOI WILL BE INHIBITED OR LUNAR ORBIT TERMINATED EARLY IF EITHER REDUNDANT ATTITUDE CONTROL, REDUNDANT SPB CONTROL OR NON-CRITICAL SPB CAPABILITY IS LOST; IN ADDITION, THE FOLLOWING MINIMUM CAPABILITIES MUST BE AVAILABLE BEFORE COMMITTING TO OR CONTINUING LUNAR ORBIT:</p> <ol style="list-style-type: none"> <li>1. ATTITUDE CONTROL---DIRECT RCS AND RATE DAMPING IN EACH AXIS.</li> <li>2. TVC---BOTH SERVO LOOPS AND TWO TVC CONTROL MODES (ACCEL CMD EXCLUDED).</li> <li>3. 66A---THE 66A MUST BE FULLY OPERATIONAL WITH THE EXCEPTION OF OPTICS AND NAV DSKEY. OPTICS MUST BE CAPABLE OF ALIGNING PLATFORM.</li> <li>4. RCS TRANSLATION---X-AXIS VIA AUTO COILS OR DIRECT ULLAGE PUSHBUTTON.</li> </ol> <p>B. IN ORDER TO PERFORM A NON-CRITICAL BURN THE 66C SYSTEMS MUST PROVIDE THE CAPABILITY TO EXECUTE AN ULLAGE MANEUVER BY EITHER CMC AUTO (RCS DAPI), RCS AUTO, OR DIRECT ULLAGE.</p>												
	15-5	<p>UNDOCKED</p> <p>THE UNDOCKED PHASE WILL BE DELETED OR TERMINATED IF THE 66C SYSTEMS CANNOT PROVIDE REDOCKING OR LM RESCUE CAPABILITY. THE 66C SYSTEMS MUST PROVIDE DIRECT RCS, RATE DAMPING AND TRANSLATION CAPABILITY IN EACH AXIS FOR DOCKING/UNDOCKING CONTROL. IN ADDITION, THE FOLLOWING MINIMUM CAPABILITIES FOR LM RESCUE MUST BE AVAILABLE---</p> <ul style="list-style-type: none"> <li>- OPERATIONAL OPTICS OR VMP SUBSYSTEM</li> <li>- ONE DSKEY</li> <li>- TRANSLATION CAPABILITY IN EACH AXIS</li> <li>- RATE DAMPING IN ALL THREE AXES</li> <li>- OPERATIONAL IMU AND CMC</li> <li>- ONE OPERATIONAL RMC</li> <li>- ONE OPERATIONAL FDAI</li> <li>- DIRECT RCS</li> <li>- NON CRITICAL SPB BURN CAPABILITY</li> </ul>												
		<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/15/79</td> <td>GUIDANCE AND CONTROL</td> <td>GENERAL</td> <td>15-2</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	A	10/15/79	GUIDANCE AND CONTROL	GENERAL	15-2
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	A	10/15/79	GUIDANCE AND CONTROL	GENERAL	15-2									

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MISSION RULES

SECTION 13 - GUIDANCE AND CONTROL

REV	ITEM						
13-6	ASCENT; DESCENT---	THERE ARE NO GUIDANCE AND CONTROL SYSTEM FAILURES THAT AFFECT THE ASCENT OR DESCENT PHASES.					
13-7	LUNAR STAY PHASE	LUNAR STAY WILL BE TERMINATED EARLY IF REDUNDANT SPS CONTROL CAPABILITY IS LOST. IN ADDITION, THE FOLLOWING MINIMUM CONTROL CAPABILITIES MUST BE AVAILABLE FOR THE ACCOMPLISHMENT OF TEST.					
		<ol style="list-style-type: none"> <li>1. ATTITUDE CONTROL - DIRECT RCS IN TWO AXES AND RATE DAMPING IN TWO AXES.</li> <li>2. TVC - BOTH SERVO LOOPS AND TWO TVC CONTROL MODES (ACCEL CMD EXCLUDED).</li> <li>3. GCR - THE GCR MUST BE FULLY OPERATIONAL WITH THE EXCEPTION OF OPTICS AND NAV DEPT.</li> </ol>					
		RULES 13-8 AND 13-9 ARE RESERVED.					
		DIABLO	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 13	PHL	8/10/69	GUIDANCE AND CONTROL	GENERAL	13-9

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 18 - GUIDANCE AND CONTROL

REV	ITEM				
<p>-----                      * SYSTEMS MANAGEMENT *                      -----</p>					
18-10	<p>ATTITUDE CONTROL---CSM IN ACTIVE RCS CONTROL- LM WILL NOT BE IN ACTIVE ATTITUDE HOLD; LM IN ACTIVE RCS CONTROL- CSM WILL NOT BE IN ACTIVE ATTITUDE HOLD. FOR DOCKING ACTIVITIES AFTER OPENING THE APS INTERCONNECT (BOTH VEHICLES IN ACTIVE RCS CONTROL); THE CSM MUST BE IN A TIGHTER DEADBAND THAN THE LM.</p>				
18-11	<p>PIPA BIAS WILL BE UPDATED WHEN ACTUAL BIAS DIFFERS FROM THE VALUE IN CMC ERASABLE BY +/-0.00 FT/SEC2. THE FAILURE LIMIT ON THE CSM ACCELEROMETER IS +/-0.100 FT/SEC2. THE FIRST GYRO BIAS DRIFT WILL BE UPDATED IF THE DRIFT IS +/- 3 MERU (0.015 DEG/HR). THEREAFTER, +/- 3 MERU (+/- 0.045 DEG/HR) WILL BE THE UPDATE CRITERIA. THE FAILURE LIMIT ON THE CSM GYRO IS +/- 100 MERU (+/- 1.5 DEG/HR).</p>				
18-12	<p>DELTA V COUNTER DRIFT</p> <p>SHOULD THE DELTA V COUNTER DRIFT BE GREATER THAN 0.01 FT/SEC2 FOR AN RCS MANEUVER; THE VC SETTING WILL BE APPROPRIATELY BIASED. SHOULD THE DRIFT BE GREATER THAN 0.1 FT/SEC2; THE SCS WILL BE CONSIDERED FAILED.</p>				
18-13	<p>SAP INITIALIZATION</p> <p>SIGNAL TRIMS---WILL BE UPDATED FOR EVERY APS MANEUVER BASED ON FINAL TRIM POSITIONS OF THE PREVIOUS MANEUVER AS MONITORED ON TELEMETRY; IF THE PREVIOUS MANEUVER WAS SCS CONTROLLED; IF THE PREVIOUS MANEUVER WAS SGA CONTROLLED; THE CMC STORED VALUES WILL BE USED. TRIMS WILL BE REINITIALIZED FROM THE GROUND AFTER EACH VEHICLE CONFIGURATION CHANGE AND AFTER EACH WEIGHT UPDATE. TRIMS MUST BE UPDATED WHEN GROUND COMPUTED VALUES DIFFER FROM CMC STORED VALUES BY 0.5 DEGREE.</p> <p>CSM; LM WEIGHT--- WILL BE UPDATED WHEN GROUND COMPUTED VALUES DIFFER FROM CMC STORED VALUES BY 1.0 PERCENT; WEIGHTS MUST BE UPDATED WHEN GROUND VALUES DIFFER FROM CMC VALUES BY 10.0 PERCENT.</p>				
<p>FILE NUMBERS 18-14 THROUGH 18-16 RESERVED.</p>					
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	A	10/15/70	GUIDANCE AND CONTROL	SYSTEMS MANAGEMENT	18-6

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 19 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
<b>SPECIFIC MISSION RULES</b>					
19-20	LOSS OF EITHER BNAG 1 OR 2 IN EITHER PITCH OR YAW CHANNEL	ALL	ALL	CONTINUE MISSION	A: REF MALF PROC--- B6C-1:3:4+0 B6B-1:3:3A+0 B: NO BCS AUTO TVC C: IF IN YAW CHANNEL, AFTER .050, RBI IS USABLE IF REMAINING SYG IS SELECTED FOR RATE. RBI MUST BE REALIGNED IN ADDITION TO THE ABOVE FOR YAW FAILURE AFTER .050.
19-21	LOSS OF BOTH BNAG 1 AND 2 IN EITHER PITCH OR YAW CHANNEL	LAUNCH PLC DESCENT ALL OTHERS ENTRY	A: CONTINUE MISSION B: NO-DO FOR LOI C: CONTINUE MISSION D: TERMINATE PHASE AND ENTER NEXT BEST PTP E: CONTINUE MISSION	A: CONTINUE MISSION B: NO-DO FOR LOI C: CONTINUE MISSION D: TERMINATE PHASE AND ENTER NEXT BEST PTP E: CONTINUE MISSION	A: NTVC ACCEL CMD IS ONLY MODE III OR MODE IV SPS CONTROL MODE.  B.1: IN LUNAR ORBIT DO SPS TVC. B: IN EARTH ORBIT: LOSS OF PITCH CHANNEL RESULTS IN ALL THREE DEGRAD METHODS BEING SUBJECT TO SINGLE FAILURE IN THE SCS SYSTEM. THE YAW LOSS PRECLUDES HYBRID DEGRAD AND SUBJECTS BOTH REMAINING DEGRAD METHODS TO SINGLE FAILURE IN THE SCS SYSTEM E: RBI AND SCS PDAI ROLL UNUSABLE WITH YAW CHANNEL FAILURES.
19-22	LOSS OF ROLL BNAG A: NUMBER ONE  B: NUMBER TWO	ALL  ALL	A: CONTINUE MISSION  B: CONTINUE MISSION	A: CONTINUE MISSION  B: CONTINUE MISSION	A.1: MANUAL ROLL ATTITUDE CONTROL REQUIRED IN ALL SCS MODES. B: NO SCS PDAI ROLL. RBI VALID.  B.1: USE OF ATT / RATE 2 AND LIM STILL MAY PROVIDE RATE DAMPED ATTITUDE HOLD WHEN SCS PDAI IS NOT USED. SYG MESSAGE 2 MUST BE POWERED DOWN TO EFFECT ATTITUDE HOLD IF FAILURE IS TRANSIENT. B: SELECTION OF RATE 1 WILL PROVIDE BOTH RBI AND SCS PDAI ROLL FOR ENTRY. RBI MUST BE REALIGNED FOR ROLL FAILURE AFTER .050.
MISSION REV DATE SECTION GROUP PAGE					
APOLLO 13 A 10/15/69 GUIDANCE AND CONTROL SCS 10-7					

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 18 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	18-23	LOSS OF BOTH ROLL SERVO'S	LAUNCH EO TLC LO ALL OTHERS	A: CONTINUE MISSION  B.1: NO GO FOR TEL 2: ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE C: NO-GO FOR LOI D: CONTINUE MISSION E: CONTINUE MISSION	C: NO SCB F0A3 ROLL OR ASI AVAILABLE FOR ENTRY.												
	18-24	LOSS OF EITHER TVC SERVO LOOP IN EITHER PITCH OR YAW AXIS	LAUNCH/ EO TLC DESCENT ALL OTHERS	A: CONTINUE ALTERNATE EO MISSION SELECT 1 OR 2 ON TVC SIMBAL DRIVE SWITCH IN APPROPRIATE AXIS B: NO-GO FOR LOI C: CONTINUE MISSION D: TERMINATE PHASE AND ENTER NEXT BEST PTP	= MAINTAIN 20 LBS/WJAD/ARIS FOR HARDOVER RECOVERY FOR UNDOCKED AND 10-15 LBS/WJAD/ ARIS FOR HARDOVER RECOVERY FOR DOCKED SPS MANEUVERS  D: IN LUNAR ORBIT DO OPS TEL.												
	18-25	LOSS OF BOTH TVC SERVO LOOPS	LAUNCH EO TLC DESCENT ALL OTHERS	A: CONTINUE MISSION  B: ENTER NEXT BEST PTP RCB DEORBIT C: NO-GO FOR LOI D: CONTINUE MISSION E: TERMINATE PHASE AND ENTER NEXT BEST PTP	A.1: REP HALP PROC 65C-1; 66A-6; SCB-A1 B: NO MODE III OR IV CAPABILITY; LIMITED LANDING POINT CONTROL IN MODE III OR IV WITH S-ACS  E: IN LUNAR ORBIT DO OPS TEL.												
	18-26	LOSS OF PROPORTIONAL CONTROL FROM-- A: EITHER RMC B: BOTH RMC'S	ALL ALL	A: CONTINUE MISSION USE REMAINING RMC B: CONTINUE MISSION USE DIRECT RCS OR ACCEL CHD FOR MANUAL MANEUVERS	B: NO NTVC RATE OR NTVC ACCEL CHD CAPABILITY												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 18</td> <td>FAL</td> <td>9/18/69</td> <td>GUIDANCE AND CONTROL</td> <td>SCB</td> <td>18-8</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 18	FAL	9/18/69	GUIDANCE AND CONTROL	SCB	18-8
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 18	FAL	9/18/69	GUIDANCE AND CONTROL	SCB	18-8												



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MISSION RULES

SECTION 18 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	ACTIONS	CUES/NOTES/COMMENTS
18-27	LOSS OF DIRECT RCS CONTROL FROM---				1. REF MALF PROC SCS 3
	A. EITHER RMC: ANY OR ALL AXES	ALL		A. CONTINUE MISSION	
	B. BOTH RMC'S: SAME AXIS	LAUNCH		B.1. CONTINUE MISSION	
		DESCENT		2. CONTINUE MISSION	
		LUNAR STAY		3. CONTINUE MISSION	
		ALL OTHERS		4. TERMINATE PHASE AND ENTER NEXT BEST PTP	B.4. FAILURE VIOLATES DIRECT RCS REQUIREMENTS.
	C. BOTH RMC'S: TWO AXES	LUNAR STAY		C. TERMINATE PHASE AND ENTER NEXT BEST PTP.	
18-28	COMPLETE LOSS OF AUTO ATTITUDE CONTROL IN PITCH AND YAW CHANNELS.				1. REF MALF PROC SCS 3 SUSPECTED FAILURE WOULD BE AUTO INHIBIT CIRCUITRY.
	A. CONTROL IS REGAINED BY OPENING EMS CO'S	ALL		A. CONTINUE MISSION AFTER OR JETTISON EMS MAY BE REENABLED WITHOUT LOSS OF AUTO RCS	
	B. CONTROL IS REGAINED BY PLACING S/C CONTROL SWITCH TO CMC.	ALL		B. CONTINUE MISSION	B. NO SCS ATTITUDE CONTROL
	C. CONTROL IS NOT REGAINED	DESCENT		C.1. CONTINUE MISSION	
		ALL OTHERS		2. TERMINATE PHASE AND ENTER NEXT BEST PTP USE DIRECT WLLAGE AND DIRECT RCS.	C.2. FAILURE VIOLATES RATE DAMPING REQUIREMENTS.
18-29	LOSS OF FLIGHT DIRECTOR ATTITUDE INDICATORS				1. REF MALF PROC SCS-1,2,3,4,5,6
	A. ONE	ALL		A. CONTINUE MISSION	
	B. BOTH	LAUNCH		B.1. CONTINUE MISSION	
		FLC		2. NO-GO FOR LOI	
		DESCENT		3. CONTINUE MISSION	
		LUNAR STAY		4. CONTINUE MISSION	
		ALL OTHERS		5. TERMINATE PHASE AND ENTER NEXT BEST PTP	B. IN LUNAR ORBIT: DO OPS TEL.
MISSION REV DATE LOCATION GROUP PAGE					
APOLLO 12 A 10/15/69 GUIDANCE AND CONTROL SCS 18-7					

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 13 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	13-30	LOSS OF ACI PHASE A			<p>- LOSS OF ACI PHASE A RESULTS IN THE LOSS OF---</p> <p>A. REDUNDANT SERVO LOOP POWER: BOTH SERVO LOOPS MUST BE POWERED BY THE SAME BUS.</p> <p>B. PROPORTIONAL ATTITUDE CONTROL FROM BOTH RHC'S. ALL PROPORTIONAL CONTROL FROM RHC NO. 1.</p> <p>C. FOAS NO. 1</p> <p>D. GYRO ASSEMBLY NO. 1</p> <p>E. SCS TOTAL ATTITUDE ERROR</p> <p>F. SCS TOTAL ATTITUDE</p> <p>G. SCS AUTO TVC CAPABILITY</p> <p>H. SCS MINIMUM IMPULSE CAPABILITY</p> <p>I. SCS ATTITUDE CONTROL RATE DAMPING</p> <p>J. GPI P&amp;T DRIVE NO. 1.</p> <p>IN EARTH ORBIT: LOSS OF ACI PRECLUDES HYBRID DEORBIT AND SUBJECTS BOTH REMAINING DEORBIT METHODS TO A SINGLE FAILURE (ACI PHASE A)</p>		
		LAUNCH	A.	CONTINUE MISSION			
		TLC	B.	NO-GO FOR LOI			
		DESCENT	C.	CONTINUE MISSION			
		ALL OTHERS	D.	TERMINATE PHASE AND ENTER NEXT BEST DTP	D. IN LUNAR ORBIT DO DPS TET.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 13	PNL	9/18/69	GUIDANCE AND CONTROL	SCS	13-8

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION*	PHASE *	RULING	CUES/NOTES/COMMENTS
15-31	LOSS OF AC2 PHASE A				- LOSS OF AC2 PHASE A RESULTS IN THE LOSS OF--- A: REDUNDANT SERVO LOOP POWER B: ALL PROPORTIONAL CONTROL C: FDAE NO. 2 D: GYRO ASSEMBLY NO. 2 E: SCS PITCH AND YAW TOTAL ATTITUDE F: ALL SCS TVC CAPABILITY (AUTO RATE AND ACCEL CMD) G: R31 H: GPI P&Y DRIVE NO. 2 I: IN EARTH ORBIT: LOSS OF AC2 RESULTS IN ALL THREE DEGRADY METHODS BEING SUBJECTED TO A SINGLE FAILURE (AC2 PHASE A) J: IN LUNAR ORBIT DO DPS TEST
			LAUNCH	A: CONTINUE MISSION	
			PLC	B: NO-GO FOR LOS	
			DESCENT	C: CONTINUE MISSION	
			ALL OTHERS	D: TERMINATE PHASE AND ENTER NEAR BEST PTP	
15-32	LOSS OF ORBIT RATE DISPLAY (ORDEAL) EARTH AND LUNAR	ALL		CONTINUE MISSION	REF MALF PROC 66C-4+5
15-33	LOSS OF ENTRY MONITOR SYSTEM	LO POST AND		TERMINATE PHASE AND ENTER NEAR BEST PTP	REF MALF PROC 66B-3
15-34	GROUND AT EITHER SPS SOL DRIVER OUTPUT AND UNABLE TO RE-OVER	ALL		CONTINUE MISSION- OPEN SPS PILOT VALVE CO'S	REF MALF PROC 66C-3

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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	QUES/NOTES/COMMENTS
15-35	LOSS OF TRANSLATION HAND CONTROLLER	LAUNCH EARTH ORBIT PLC LO UNDOCKED TALL OTHERS	A. CONTINUE MISSION B. ENTER NEXT BEST PTP C. CONTINUE MISSION D. NO-GO FOR UNDOCKING E. DOCK F. CONTINUE MISSION	B. VIOLATES BOTH SA AND HYBRID DEORBIT MINIMUM REQUIREMENTS. B. VIOLATES LR RESCUE MINIMUM REQUIREMENTS.	
		RULE NUMBERS 15-36 THROUGH 15-40 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	PNL	9/18/69	GUIDANCE AND CONTROL	SCS	15-13

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	15-30	LOSS OF COMMAND MODULE COMPUTER			• REF MALF PROC 66N-5												
			LAUNCH	A: CONTINUE MISSION													
			EO	B: CONTINUE ALTERNATE EO MISSION IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE	B: VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS												
			FLC	C: NO-GO FOR LOI													
			LO	D: ENTER NEXT BEST PTP													
			UNDOCKED	E: DOCK	E: VIOLATES LM RESCUE MINIMUM REQUIREMENTS												
			DESCENT	F: CONTINUE MISSION													
			ENTRY	G: PERFORM BACKUP ENTRY													
			ALL OTHERS	H: TERMINATE PHASE AND ENTER NEXT BEST PTP	H: IN LUNAR ORBIT DO DPS TEL.												
	15-31	LOSS OF DSRY			• REF MALF PROC 66C 5												
		A: EITHER MDC OR LEG DSRY	ALL	A: CONTINUE MISSION													
		B: BOTH MDC AND LEG DSRY	EO	B:1: CONTINUE ALTERNATE EO MISSION IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE	B:1: VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS												
			FLC	B: NO-GO FOR LOI													
			LO	3: ENTER NEXT BEST PTP													
			UNDOCKED	4: DOCK	4: VIOLATES LM RESCUE MINIMUM REQUIREMENTS												
			DESCENT	5: CONTINUE MISSION													
			ENTRY	6: PERFORM BACKUP ENTRY													
			ALL OTHERS	7: TERMINATE PHASE AND ENTER NEXT BEST PTP	7: IN LUNAR ORBIT DO DPS TEL.												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>PML</td> <td>9/18/69</td> <td>GUIDANCE AND CONTROL</td> <td>66N</td> <td>15-11</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	PML	9/18/69	GUIDANCE AND CONTROL	66N	15-11
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	PML	9/18/69	GUIDANCE AND CONTROL	66N	15-11												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-92	LOSS OF INERTIAL SUBSYSTEM	LAUNCH	A. CONTINUE MISSION	1. REF MALF PROC 66N-6
			EO	B. CONTINUE ALTERNATE EO MISSION IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE	B. VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS
			TLC LO	C. NO-GO FOR LOI D. ENTER NEXT BEST PTP	
			UNDOCKED	E. DOCK	E. VIOLATES LN RESCUE REQUIREMENTS
			DESCENT	F. CONTINUE MISSION	
			ENTRY	G. PERFORM BACKUP ENTRY	
			ALL OTHERS	H. TERMINATE PHASE AND ENTER NEXT BEST PTP	H.1. VIOLATES LN RESCUE MINIMUM REQUIREMENTS H.2. IN LUNAR ORBIT DO DPS TEST
	15-93	LOSS OF OPTICS SUBSYSTEM	LAUNCH	A. CONTINUE MISSION	1. REF MALF PROC 66N-5
			EO	B. CONTINUE ALTERNATE EO MISSION	
				USE BACKUP ALIGNMENT PROCEDURE (COAB)	
			TLC	C. NO-GO FOR LOI	
			ALL OTHERS	D. CONTINUE MISSION	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	A	10/19/68	GUIDANCE AND CONTROL	66N	15-12

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 19 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION?	PHASE	RULING	CUES/NOTES/COMMENTS		
	19-94	LOSS OF OPTICS SUBSYSTEM COUPLING DATA UNIT DIGITAL TO ANALOG CONVERTER	LAUNCH EO TLG LO UNDOCKED DESCENT ALL OTHERS	A: CONTINUE MISSION B: CONTINUE ALTERNATE EO MISSION IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE C: NO-BO FOR LOI D: ENTER NEXT BEST PTP E: DOCK F: CONTINUE MISSION G: TERMINATE PHASE AND NEXT BEST PTP	REF MALP PROC 66C-1 CONSTITUTES LOSS OF TVC DAP		
		RULE NUMBERS 19-99 THROUGH 19-99 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FM	8/18/69	GUIDANCE AND CONTROL	664	19-19

NASA - Manned Spacecraft Center  
MISSION RULES  
SECTION 18 - GUIDANCE AND CONTROL - CONCLUDED

REV	ITEM	INSTRUMENTATION REQUIREMENTS				
18-60	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
	CNC DIGITAL DATA	C60001V	-	-	MANDATORY	18-30
	SPS SOL DRIVER 1	CH3604X	EMS-SPS-ON	SEPARATE	HIGHLY DESIRABLE	18-34
	SPS SOL DRIVER 2	CH3605X	EMS-SPS-ON	SEPARATE	HIGHLY DESIRABLE	18-34
	PITCH GIMBAL POS 1 & 2	CH3917M	GPI	COMMON	1 OF 2 MANDATORY -OB/HO-PCM	18-24/25
	YAW GIMBAL POS 1 & 2	CH3918M	GPI	COMMON	1 OF 2 MANDATORY -OB/HO-PCM	18-24/25
	TM BIAS 2.5 VDC	C61110V	-	-	HIGHLY DESIRABLE	18-32/33/34
	PIPA TEMP	C62100T	-	-	HIGHLY DESIRABLE	18-32
	IMU NTR +28 VDC	CH1313Z	-	-	HIGHLY DESIRABLE	18-32
	CNC OPERATE +28 VDC	C61313Z	-	-	HIGHLY DESIRABLE	18-30
	OPTX OPERATE +28 VDC	C61313Z	-	-	HIGHLY DESIRABLE	18-34
	18 1R RSVR OUT SIN	C62112V	FDAI	COMMON	HIGHLY DESIRABLE	18-32
	18 1R RSVR OUT COS	C62111V	FDAI	COMMON	HIGHLY DESIRABLE	18-32
	18 1R RSVR OUT SIN	C62112V	FDAI	COMMON	HIGHLY DESIRABLE	18-32
	18 1R RSVR OUT COS	C62111V	FDAI	COMMON	HIGHLY DESIRABLE	18-32
	08 1R RSVR OUT SIN	C62112V	FDAI	COMMON	HIGHLY DESIRABLE	18-32
	08 1R RSVR OUT COS	C62111V	FDAI	COMMON	HIGHLY DESIRABLE	18-32
	SHAP1 CDU DAC OUT	C68721V	-	-	HIGHLY DESIRABLE	18-34
	TRUNN10 CDU DAC OUT	C68722V	-	-	HIGHLY DESIRABLE	18-34
	CNC WARNING	C63040R	CGW	COMMON	HIGHLY DESIRABLE	18-30
	PITCH ATT ERROR	CH3900M	FDAI	COMMON	HIGHLY DESIRABLE	18-20/21/22/23
	YAW ATT ERROR	CH3901M	FDAI	COMMON	HIGHLY DESIRABLE	18-20/21/22/23
	ROLL ATT ERROR	CH3902M	FDAI	COMMON	HIGHLY DESIRABLE	18-20/21/22/23
	3CS PITCH BODY RATE	CH3903R	FDAI	COMMON	HIGHLY DESIRABLE	18-20/21/22/23
	3CY YAW BODY RATE	CH3904R	FDAI	COMMON	HIGHLY DESIRABLE	18-20/21/22/23
	3CR ROLL BODY RATE	CH3905R	FDAI	COMMON	HIGHLY DESIRABLE	18-20/21/22/23
	3CS TVC PITCH AUTO CMD	CH3906V	-	-	HIGHLY DESIRABLE	18-24/25
	3CS TVC YAW AUTO CMD	CH3907V	-	-	HIGHLY DESIRABLE	18-24/25
	3VC PITCH CMD	CH3908M	-	-	HIGHLY DESIRABLE	18-24/25
	3VC YAW CMD	CH3909M	-	-	HIGHLY DESIRABLE	18-24/25
	FDAI ERROR 1: RATE 8	CH3932Z	-	-	HIGHLY DESIRABLE	18-20/21/22/23
	FDAI ERROR 10/13:	CH3932Z	-	-	HIGHLY DESIRABLE	18-20/21/22/23
	RATE 30/10	CH3932Z	-	-	HIGHLY DESIRABLE	18-24/25
	PITCH BIPP CLUTCH CUA	CH3666C	-	-	HIGHLY DESIRABLE	18-24/25
	YAW BIPP CLUTCH CUA	CH3667C	-	-	HIGHLY DESIRABLE	18-24/25



18 CSM SERVICE  
PROPULSION  
SYSTEM

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MISSION RULES

SECTION ES - CSM SPS

REV	ITEM	MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	A	10/19/79	CSM SPS	GENERAL	16-1
		----- ! GENERAL ! -----					
16-3	<p>A. CATEGORIES OF FAILURES---</p> <p>FAILURES AFFECTING THE SPS FAIL INTO ONE OF THREE CATEGORIES---</p> <ol style="list-style-type: none"> <li>1. FAILURES WHICH CAUSE THE SPS TO BE UNSAFE-- THESE FAILURES RESULT IN MISSION TERMINATION ASAP.</li> <li>2. FAILURES WHICH CAUSE THE SPS TO BE INOPERABLE OR HAZARDOUS TO OPERATE-- THESE FAILURES RESULT IN ALTERATION OF THE MISSION TO MINIMIZE USAGE OF THE SPS.</li> <li>3. FAILURES SUCH THAT CONTINUED OPERATION WILL RESULT IN SUBSEQUENT DEGRADATION-- THESE FAILURES ALLOW PERFORMANCE OF CRITICAL BURNS ONLY.</li> </ol> <p>B. ULLAGE REQUIREMENTS--- SUBSEQUENT TO THE DEPLETION OF STORAGE TANK PROPELLANTS AN ULLAGE MANEUVER WILL NORMALLY BE PERFORMED PRIOR TO ANY BURN. HOWEVER, INABILITY TO PERFORM AN ULLAGE WILL NOT PRECLUDE A CRITICAL BURN.</p> <p>C. PREMATURE TERMINATION OF BURNS--- CRITICAL BURNS WILL NOT BE TERMINATED BECAUSE OF ANOMALIES. NON-CRITICAL BURNS WILL BE TERMINATED UNDER VARIOUS CONDITIONS AS SPECIFIED IN RULE 3-31 AND THE SPECIFIC RULES OF THIS SECTION.</p>						
16-2	<p>LAUNCH PHASE</p> <p>THERE ARE NO SPS FAILURES WHICH REQUIRE A LAUNCH ABORT.</p>						
16-3	DELETED						

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MISSION RULES

SECTION 16 - CSN SPS

REV	ITEM												
16-4	<p>EARTH ORBIT PHASE</p> <p>A. CRITICAL BURNS IN THIS PHASE ARE MADE BY: APOGEE KICK AND DEORBIT. IF THE SPS IS INCAPABLE OF PERFORMING CRITICAL BURNS, THE MISSION WILL BE TERMINATED BY ENTRY INTO THE NEXT BEST PTP USING SMCS OR HYBRID TECHNIQUES.</p> <p>B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL BURNS, THE WILL BE INHIBITED AND A SUITABLE EARTH ORBIT ALTERNATE MISSION WILL BE IMPLEMENTED. THE SPS MAY BE USED FOR DEORBIT ONLY.</p> <p>C. IN ORDER TO PROVIDE THE TOTAL CAPABILITY TO DEORBIT FROM ANY POINT IN THIS PHASE, THE LM DPS AND LM RCS MAY BE USED FOR ORBIT SHAPING.</p>												
16-5	<p>TRANSLUNAR COAST PHASE</p> <p>A. CRITICAL BURNS IN THIS PHASE ARE TIME CRITICAL ABORTS, BURNS TO ASSURE FREE RETURN OR BURNS TO AVOID LUNAR OR LAND IMPACT. HOWEVER, ONCE INITIATED WITH THE SPS, THESE BURNS ARE CONSIDERED NON-CRITICAL BECAUSE SUFFICIENT TIME IS AVAILABLE FOR ANALYSIS AND POSSIBLE CORRECTIVE ACTION.</p> <p>B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL MANEUVERS, FURTHER NON-CRITICAL BURNS AND LOS WILL BE INHIBITED.</p> <p>C. CERTAIN ABORT BURNS, BURNS TO ASSURE FREE RETURN OR BURNS TO AVOID LUNAR OR LAND IMPACT MAY USE THE LM DPS AND LM RCS.</p>												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>CSN SPS</td> <td>GENERAL</td> <td>16-2</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	CSN SPS	GENERAL	16-2
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	FNL	9/10/69	CSN SPS	GENERAL	16-2								

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MISSION RULES

SECTION 16 - ESM SPS

REV	ITEM	MISSION	REV	DATE	SECTION	GROUP	PAGE
	16-6 LUNAR ORBIT PHASE A. TEI IS THE ONLY CRITICAL BURN IN THIS PHASE. B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL BURNS, FURTHER NON-CRITICAL BURNS WILL BE INHIBITED. C. LM OPS MAY BE USED FOR TEI IF THE CAPABILITY EXISTS.	APOLLO 12	FNL	9/10/69	CSM SPS	GENERAL	16-3
	16-7 DESCENT PHASE THE LM POWERED DESCENT WILL BE ABORTED FOR SPS PROPELLANT LEAKS BECAUSE THE CAPABILITY TO PERFORM TEI IS DECREASING WITH TIME.						
	16-8 UNDOCKED AND LUNAR STAY PHASES A. THE LUNAR ORBIT PLANE CHANGE IS A CRITICAL BURN IF OUTSIDE TOTAL LM CAPABILITY. B. THESE PHASES WILL BE TERMINATED FOR CONFIRMED LOSS OF SPS REDUNDANCY.						
	16-9 ASCENT PHASE LM RESCUE BURNS MAY BE REQUIRED, AND THEY ARE CRITICAL.						
	16-10 TRANSEARTH COAST PHASE CRITICAL BURNS IN THIS PHASE ARE MIDCOURSE CORRECTIONS TO ATTAIN THE PROPER ENTRY CORRIDOR WHICH ARE OUTSIDE SM-RCS CAPABILITY. HOWEVER, ONCE INITIATED, THESE BURNS ARE CONSIDERED NON-CRITICAL BECAUSE SUFFICIENT TIME IS THEN AVAILABLE FOR ANALYSIS AND POSSIBLE CORRECTIVE ACTION.						

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MISSION RULES

SECTION 16 - CSM SPS

REV	ITEM												
	<p>-----                      * SYSTEMS MANAGEMENT *                      -----</p>												
16-11	<p>PROPELLANT GAGING</p> <p>A. PRIME METHOD---ONBOARD GAGING SYSTEMS PERCENT%                      B. BACKUP METHOD---FLOW RATE X BURN TIME IS PERCENT%.</p>												
16-12	<p>THE PV VALVE WILL BE USED TO MAINTAIN THE UNBALANCE READING---</p> <p>A. PRIOR TO CROSSOVER---AT THE STABLE VALUE OCCURRING APPROXIMATELY 20 SEC AFTER LOI IGNITION. PRIOR TO LIFTOFF IT WILL BE POSITIONED ACCORDING TO PRELAUNCH PREDICTIONS AND WILL NOT BE MOVED UNTIL LOI 3.1                      B. AFTER CROSSOVER--- AT APPROXIMATELY ZERO UNBALANCE.</p>												
16-13	<p>DUAL BANK VS SINGLE BANK OPERATION</p> <p>THE SPS WILL ALWAYS BE STARTED USING A SINGLE BANK. HOWEVER, THE OTHER BANK WILL BE OPENED 2 TO 5 SECONDS AFTER IGNITION FOR BURNS PLANNED TO BE LONGER THAN 6 SECONDS. BANK A WILL BE USED FOR THE FIRST ENGINE IGNITION.</p>												
16-14	<p>PROPELLANT MANAGEMENT</p> <p>A. THE SPS PROPELLANT REDLINE PRE LOI PROVIDE CAPABILITY FOR LOI, CIRCULARIZATION, TEI AND TENC FOR THE NOMINAL MISSION IS TBD PERCENT INDICATED PROPELLANT REMAINING.                      B. THE SPS PROPELLANT REDLINE PREUNDOCKING TO PROVIDE CAPABILITY FOR LH RESCUE, LOPC 1, TEI AND TENC FOR THE NOMINAL MISSION IS TBD PERCENT INDICATED PROPELLANT REMAINING.</p>												
16-15	<p>PROPELLANT FEEDLINE TEMPERATURE MANAGEMENT</p> <p>SPS LINE HEATERS WILL BE MANUALLY CYCLED TO MAINTAIN FEEDLINE TEMPERATURES BETWEEN 45 DEG. F AND 75 DEG. F, AND ENGINE VALVE TEMPERATURE ABOVE 45 DEG. F.</p>												
16-16	<p>ULLAGE MANAGEMENT</p> <p>IN GENERAL, SPS BURNS REQUIRING ULLAGE WILL BE PRECEDED BY A TWO -JET ULLAGE. SPS BURNS ASSOCIATED WITH LH RESCUE WILL ORDINARILY BE PRECEDED BY 4-JET ULLAGES.</p> <p>RULE NUMBERS 16-17 THROUGH 16-19 ARE RESERVED.</p>												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/15/79</td> <td>CSM SPS</td> <td>MANAGEMENT</td> <td>16-4</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	A	10/15/79	CSM SPS	MANAGEMENT	16-4
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	A	10/15/79	CSM SPS	MANAGEMENT	16-4								

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## MISSION RULES

### SECTION 16 - CSM SPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
<div style="border: 1px dashed black; padding: 5px; display: inline-block;">                     SPECIFIC MISSION RULES                 </div>																	
16-20		SUSTAINED PRESSURE DECAY IN EITHER THE FUEL OR OXIDIZER TANK (COULD BE HELIUM OR FUEL OR OXIDIZER)	*LAUNCH *EO *FLC *LO *UNDocked *DESCENT *LUNAR STAY *TEC A. DURING NON-CRITICAL BURN B. DURING CRITICAL BURN	*CONTINUE MISSION *PLAN RCS DEORBIT AT NEXT BEST PTP *IF LAND IMPACT IS IMMINENT AFTER ABORTING PREPRESS MANUALLY AND *PERFORM BURN TO AVOID *LAND. *ENTER NEXT BEST PTP *RCS DEORBIT *NO-GO FOR LOI *INHIBIT NON-CRITICAL SPS *BURNS *PLAN YES ASAP *USE LM OPS IF CAPABILITY *EXISTS *DOCK ASAP *ABORT; RETURN TO CSM *RETURN TO CSM ASAP *CONTINUE MISSION *INHIBIT NON-CRITICAL *BURNS A. TERMINATE BURN B. CONTINUE BURN	* HALF PROC--- SPS 18  * MANUAL PRESSURIZATION OF THE TANKS SHOULD BE CONSIDERED PRIOR TO ANY REQUIRED SPS BURN.             DO NOT STAGE LM												
16-21		LOSS OF ONE GN2 TANK PRESSURE (LESS THAN 400 PSIA)	*UNDocked *LUNAR STAY *ALL OTHERS	A.1. REDOCK 2. VERIFY OPERATION OF SUSPECTED BANK BY ACTIVATING IT AFTER STARTING ON GOOD BANK  B. CONTINUE MISSION	* HALF PROC--- SPS 9  * TRANSDUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION.												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 15%;">MISSION</th> <th style="width: 10%;">REV</th> <th style="width: 10%;">DATE</th> <th style="width: 15%;">SECTION</th> <th style="width: 15%;">GROUP</th> <th style="width: 15%;">PAGE</th> </tr> <tr> <td>APOLLO 12</td> <td>PNL</td> <td>9/10/69</td> <td>CSM SPS</td> <td>SPECIFIC</td> <td>16-5</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	PNL	9/10/69	CSM SPS	SPECIFIC	16-5
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	PNL	9/10/69	CSM SPS	SPECIFIC	16-5												

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MISSION RULES  
SECTION 16 - CSM SPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CLUES/NOTES/COMMENTS												
16-22	LOSS OF ONE BANK OF BALL VALVES	*LAUNCH/ *EO *TLC *LO *UNDOCKED/ *DESCENT *LUNAR *STAY	*A. N/A *B. NO-GO FOR LOI *C. ENTER NEXT BEST PTP USE LM DPS IF AVAILABLE *D. N/A *E. ENTER NEXT BEST PTP	*A. N/A *B. NO-GO FOR LOI *C. ENTER NEXT BEST PTP USE LM DPS IF AVAILABLE *D. N/A *E. ENTER NEXT BEST PTP	*HALF PROC SPS-9												
16-23	LOSS OF BOTH G <sub>2</sub> TANK PRESSURES (LESS THAN 400 PSIA)	*LAUNCH *EO *TLC *LO *UNDOCKED *DESCENT *LUNAR *STAY *TEC	*A. CONTINUE MISSION *B. ENTER NEXT BEST PTP RCS DEORBIT *C. NO-GO FOR LOI *D. PLAN TEI ASAP WITH LM DPS *E. DOCK ASAP *F. CONTINUE MISSION *G. RETURN TO CSM ASAP *H. CONTINUE MISSION	*A. CONTINUE MISSION *B. ENTER NEXT BEST PTP RCS DEORBIT *C. NO-GO FOR LOI *D. PLAN TEI ASAP WITH LM DPS *E. DOCK ASAP *F. CONTINUE MISSION *G. RETURN TO CSM ASAP *H. CONTINUE MISSION	*HALF PROC--- SPS 9 *TRANSUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION. *E. DO NOT STAGE LM												
16-24	FUEL FEEDLINE AND/OR OXIDIZER FEEDLINE TEMP LESS THAN 40 DEG F <sub>0</sub> AND UNABLE TO INCREASE.	*LAUNCH *EO *TLC *LO *UNDOCKED *DESCENT *LUNAR *STAY *TEC	*A. CONTINUE MISSION *B. ENTER NEXT BEST PTP RCS DEORBIT *C. NO-GO FOR LOI *D. PLAN TEI ASAP WITH LM DPS *E. DOCK ASAP *F. CONTINUE MISSION *G. RETURN TO CSM ASAP *H. CONTINUE MISSION	*A. CONTINUE MISSION *B. ENTER NEXT BEST PTP RCS DEORBIT *C. NO-GO FOR LOI *D. PLAN TEI ASAP WITH LM DPS *E. DOCK ASAP *F. CONTINUE MISSION *G. RETURN TO CSM ASAP *H. CONTINUE MISSION	*HALF PROC--- SPS 11 *LIMITATION FOR CRITICAL BURNS IS 25 DEG F <sub>0</sub> *F. DO NOT STAGE LM												
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	FNL	9/10/69	CSM SPS	SPECIFIC	16-8												

NASA - Manned Spacecraft Center

MISSION RULES  
SECTION 16 - CSM SPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	16-29	ENGINE FLANGE TEMP GOES HIGHER THAN 680 DEG F DURING AN SPS BURN.															
			LAUNCH	NOT APPLICABLE													
			EO	ENTER NEXT BEST PTP													
				IRCS DEORBIT													
			LO	ENTER NEXT BEST PTP, USE OPS IF AVAILABLE.													
	A. DURING NON-CRITICAL BURN	ALL		A. TERMINATE BURN INHIBIT FURTHER NON-CRITICAL BURNS													
	B. DURING CRITICAL BURN	ALL		B. CONTINUE BURN INHIBIT FURTHER NON-CRITICAL BURNS													
	16-28	THRUST CHAMBER PRESSURE LESS THAN TO PST CONFIRMED BY OTHER INSTRUMENTATION			• HALF PROC--- SPS 6												
			LAUNCH	NOT APPLICABLE													
			EO	ENTER NEXT BEST PTP - IRCS DEORBIT													
			LO	ENTER NEXT BEST PTP, USE LM OPS IF AVAILABLE													
	A. DURING NON-CRITICAL BURN			A. TERMINATE BURN INHIBIT FURTHER NON-CRITICAL BURNS													
	B. DURING CRITICAL BURN			B. CONTINUE BURN INHIBIT FURTHER NON-CRITICAL BURNS													
					• CONFIRMING INSTRUMENTATION INCLUDES GBOARD, PC METER, CREW, DEGRADED THRUST, F <sub>U</sub> AND O <sub>X</sub> INTERFACE PRESSURES, F/O VALVE POSITIONS, F <sub>U</sub> AND O <sub>X</sub> TANK PRESSURES.												
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	FNL	9/10/69	CSM SPS	SPECIFIC	16-7												



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MISSION RULES  
SECTION 16 - CSM DPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
16-37	LACK OF ULLAGE CAPABILITY		LAUNCH	A. NOT APPLICABLE				
			EO	B. NO-GO FOR TLI CONTINUE MISSION IN EO WITH SUITABLE ALTERNATE				
			TLG	C. NO-GO FOR LOI				
			LO	D. ENTER NEXT BEST PTP	PRECLUDES LM RESCUE			
			UNDOCKED	E. REDOCK				
			ALL OTHERS	F. CONTINUE MISSION INHIBIT NON-CRITICAL BURNS IF POSSIBLE				
16-28	DELTA P BETWEEN FUEL AND OX TANK PRESSURES GREATER THAN 20 PSI AND UNABLE TO DECREASE		LAUNCH	CONTINUE MISSION	HALF PROC--- SPS IC			
			EO	ENTER NEXT BEST PTP RCS DEORBIT				
			TLG	NO-GO FOR LOI				
			LO	PLAN TEE ASAP WITH LM DPS				
			UNDOCKED	DO NOT STAGE LM DOCK ASAP				
			ALL OTHERS	RETURN TO CSM OR ATTEMPT CSM RESCUE CONTINUE MISSION				
	A. DURING NON-CRITICAL BURN			A. TERMINATE BURN INHIBIT FURTHER NON-CRITICAL BURNS				
	B. DURING CRITICAL BURN			B. CONTINUE BURN INHIBIT FURTHER NON-CRITICAL BURNS				
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 13	FNL	9/10/69	CSM SPS	SPECIFIC	16-8	



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MISSION RULES

SECTION 16 - CSM SPS - CONCLUDED

REV	ITEM	----- INSTRUMENTATION REQUIREMENTS -----				
16-30	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
	OX TK PRESS	SP0003P	METER/C&W	COMMON	M O/B	16-20: 20
	OX SM/ENG INTERFACE P	SP0931P	-	-	HD	16-20: 29
	FU TK PRESS	SP0006P	METER/C&W	COMMON	M O/B	16-20: 20
	FU SM/ENG INTERFACE P	SP0930P	-	-	HD	16-20: 20
	SPS VLV ACT PRESS-PR1	SP0600P	METER	COMMON	-1 OF 2 M O/B	16-21: 22
	SPS VLV ACT PRESS-SEC	SP0601P	METER	COMMON	COMMON	16-21: 22
	SPS FU FEEDLINE TEMP	SP0048T	METER	COMMON	COMMON	16-24
	SPS OX FEEDLINE TEMP	SP0049T	SYS TEST	COMMON	-1 OF 2 M	16-24
	ENG CHAMBER PRESS	SP0661P	METER	COMMON	M O/B	16-26
	HE TK PRESS	SP0001P	METER	SEPARATE	1 OF 2 M	16-29
	FU/OX VLV 1 POS	SP0022H	DISPLAY	SEPARATE M		16-21: 26
	FU/OX VLV 2 POS	SP0023H	DISPLAY	SEPARATE M	1 OF 2 O/B	16-21: 26
	FU/OX VLV 3 POS	SP0024H	DISPLAY	SEPARATE M	1 OF 2 O/B	16-21: 26
	FU/OX VLV 4 POS	SP0025H	DISPLAY	SEPARATE M		16-21: 26
	OX TK 1 QTY - TOTAL AUX	SP0635O	DISPLAY	COMMON	HD	16-10: 11: 13
	OX TK 2 QTY	SP0636O	DISPLAY	COMMON	HD	16-10: 11: 13
	FU TK 1 QTY - TOTAL AUX	SP0637O	DISPLAY	COMMON	HD	16-10: 11: 13
	FU TK 2 QTY	SP0638O	DISPLAY	COMMON	HD	16-10: 11: 13

17 CSM SM-RCS

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MISSION RULES

SECTION 17 - CSM SM-RCS

REV	ITEM						
		----- * GENERAL * -----					
	17-1	LAUNCH	THE LOSS OF ONE QUAD IS NOT CAUSE FOR ABORT AND THERE ARE NO SINGLE FAILURES NOR ANY REASONABLE REALISTIC COMBINATION OF FAILURES WHICH LEAD ONLY TO LOSS OF MULTIPLE QUADS. THERE ARE THEREFORE NO SM-RCS FAILURES WHICH ARE CONSIDERED CAUSE FOR ABORT.				
	17-2	EARTH ORBIT PHASE	<p>A. LOSS OF ONE QUAD IN ITSELF IS NOT NECESSARILY CAUSE FOR EARLY TERMINATION OF THE MISSION; THE GUIDELINE IS THAT AS LONG AS THE SPACECRAFT ATTITUDE CAN BE CONTROLLED AND THE SPS CAN BE BURNED THE MISSION NEED NOT BE TERMINATED EARLY; HOWEVER, LOSS OF ONE QUAD WILL REQUIRE IT TO BE INHIBITED AND MAY LEAD TO EARLY MISSION TERMINATION SINCE THE CAPABILITY TO PERFORM SM OR HYBRID DEORBIT WILL BE AFFECTED.</p> <p>B. LOSS OF TWO OR MORE QUADS IS CAUSE FOR ENTRY INTO THE NEXT BEST PTP.</p> <p>1. LOSS OF TWO ADJACENT QUADS WILL DESTROY THE CAPABILITY TO PERFORM ULLAGE MANEUVERS AND WILL REQUIRE SELECTION OF NON-CRITICAL SPS MANEUVERS; LOSS OF TWO ADJACENT QUADS PRECLUDES SM OR HYBRID DEORBIT.</p> <p>2. LOSS OF TWO OPPOSITE QUADS WILL DESTROY THE CAPABILITY TO PERFORM PRECISE 3-AXIS ATTITUDE CONTROL AND PRECLUDES SM OR HYBRID DEORBIT.</p>				
	17-3	TRANSLUNAR COAST	LOSS OF ONE QUAD IS NOT, IN ITSELF, CAUSE FOR TERMINATION OF THE MISSION; HOWEVER, DEPENDING ON LM RCS CAPABILITY, THE TRANSLUNAR COAST PHASE MAY BE TERMINATED BY ENTRY INTO THE NEXT BEST PTP. LOSS OF ONE QUAD IS CAUSE FOR INHIBITING LOI, BECAUSE SUBSEQUENT FAILURE OF QUADS OR JETS IMPAIR ATTITUDE CONTROL OR ULLAGE.				
	17-4	LUNAR ORBIT	LOSS OF ONE QUAD IS NOT, IN ITSELF, CAUSE FOR EARLY TERMINATION OF LUNAR ORBIT OR LUNAR STAY PHASES; UNDOCKING WILL BE NO-GO BECAUSE LOSS OF ONE QUAD PRECLUDES CSM ACTIVE DOCKING; LOSS OF TWO QUADS IS CAUSE FOR TERMINATING LUNAR ORBIT OR LUNAR STAY PHASES; AND IS ALSO CAUSE FOR PERFORMING YES WITH THE LM DPS OR RETAINING THE LM ASCENT STAGE THROUGH YES FOR ATTITUDE CONTROL.				
		RULE NUMBERS 17-5 THROUGH 17-14 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PAL	9/18/64	CSM SM-RCS	GENERAL	17-1









NASA - Manned Spacecraft Center

MISSION RULES  
SECTION 17 - CSM SM-RCS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	17-25	LOSS OF INDIVIDUAL THRUSTERS OR THRUSTER COMBINATIONS AS A RESULT OF CLOGGING, FREEZING, BURNOUT, OR CONTROL SYSTEM MALFUNCTION	LAUNCH	NOT APPLICABLE	CONTROL SYSTEM MALFUNCTION WILL CAUSE LOSS OF AUTO COILS OF THRUSTER ALTHOUGH DIRECT COILS ARE STILL AVAILABLE.		
	A:	LOSS OF ANY ROLL THRUSTER	LO UNDocked ALL OTHERS	A.1: NO-GO FOR UNDOCKING 2: DOCK ASAP 3: CONTINUE MISSION			
	B:	LOS OF FOLLOWING THRUSTER COMBINATIONS--  TWO PITCH OR TWO YAW  ONE PITCH AND ONE YAW  PITCH AND TWO ROLL IN SAME DIRECTION  ONE YAW AND TWO ROLL IN SAME  THREE ROLL IN SAME DIRECTION	EO  TLC TLC UNDocked DESCENT L/MAR STAY	B.1: CONTINUE ALTERNATE EO MISSION  IF BOTH SPS AND SM RCS DEORBIS CAPABILITY AND ALL AXIS ATTITUDE CONTROL AVAILABLE  2: NO-GO FOR LOI 3: PLAN TEB FOR NEXT OPPORTUNITY 4: DOCK ASAP 5: CONTINUE MISSION 6: ENTER NEXT BEST PTP			
	C:	LOSS OF 4X THRUSTERS ON ADJACENT QUADS.	ALL	C: INHIBIT NON-CRITICAL SPS BURNS	B.9: RETAIN LM ASCENT STAGE FOR TEB IF LOSS OF ALL THRUSTERS IN ONE DIRECTION IN SAME AXIS C: REF SPS RULE 16-27; LACK OF WALLAGE CAPABILITY		
		RULE 17-26 THROUGH 17-29 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PNL	9/18/69	CSM SM-RCS	SPECIFIC	17-5

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 17 - CSM SM-RCS - CONCLUDED

REV	ITEM	----- * INSTRUMENTATION REQUIREMENTS *					
17-90	HEAD DESCRIPTION	PCH	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE	
	SM HE TK A PRESS	SR5001P	METER	COMMON		17-20a 21	
	QTY SM-RCS PROP SYS A	SR50250	METER	COMMON	-1 OF 2 M	17-20a 21	
	SM HE TK B PRESS	SR5002P	METER	COMMON		17-20a 21	
	QTY SM-RCS PROP SYS B	SR50260	METER	COMMON	-1 OF 2 M	17-20a 21	
	SM HE TK C PRESS	SR5003P	METER	COMMON		17-20a 21	
	QTY SM-RCS PROP SYS C	SR50270	METER	COMMON	-1 OF 2 M	17-20a 21	
	SM HE TK D PRESS	SR5004P	METER	COMMON		17-20a 21	
	QTY SM-RCS PROP SYS D	SR50280	METER	COMMON	-1 OF 2 M	17-20a 21	
	SM ENG PKG A TEMP	SR5063T	METER/C&W	COMMON	ND	17-22	
	SM ENG PKG B TEMP	SR5064T	METER/C&W	COMMON	ND	17-22	
	SM ENG PKG C TEMP	SR5065T	METER/C&W	COMMON	ND	17-22	
	SM ENG PKG D TEMP	SR5066T	METER/C&W	COMMON	ND	17-22	
	SM HE TK A EMP	SR5013T	METER	COMMON	ND	17-20a 21	
	SM HE TK B EMP	SR5014T	METER	COMMON	ND	17-20a 21	
	SM HE TK C TEMP	SR5015T	METER	COMMON	ND	17-20a 21	
	SM HE TK D TEMP	SR5016T	METER	COMMON	ND	17-20a 21	
	SM HE MAN A PRESS	SR5720P	-----	-----	ND	17-20a 21	
	SM HE MAN B PRESS	SR5774P	-----	-----	ND	17-20a 21	
	SM HE MAN C PRESS	SR5817P	-----	-----	ND	17-20a 21	
	SM HE MAN D PRESS	SR5830P	-----	-----	ND	17-20a 21	
	SM PV MAN A PRESS	SR5757P	METER/C&W	COMMON	ND	17-22a 21	
	SM PV MAN B PRESS	SR5764P	METER/C&W	COMMON	ND	17-18a 21	
	SM PV MAN C PRESS	SR5822P	METER/C&W	COMMON	ND	17-18a 21	
	SM PV MAN D PRESS	SR5823P	METER/C&W	COMMON	ND	17-18a 21	
	SM OX MAN A PRESS	SR5733P	-----	-----	ND	17-21	
	SM OX MAN B PRESS	SR5780P	-----	-----	ND	17-21	
	SM OX MAN C PRESS	SR5820P	-----	-----	ND	17-21	
	SM OX MAN D PRESS	SR5821P	-----	-----	ND	17-21	

MISSION REV DATE SECTION GROUP PAGE

APOLLO 12 PML 9/10/69 CSM SM-RCS INSTR REQ 17-5

10 CM CM-RCS

NASA - Manned Spacecraft Center

MISSION RULES  
SECTION 18 - CSM CM-RCS

REV	ITEM	MISSION	REV	DATE	SECTION	GROUP	PAGE
	----- GENERAL -----						
18-1	<p>LAUNCH</p> <p>A. A SUSTAINED LEAK IN OR THE LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE IN ONE CM RCS RING IS NOT CAUSE FOR ABORT SINCE THE REMAINING RING IS CAPABLE OF ABORT OR ENTRY ALTITUDE CONTROL. THIS FAILURE WILL REQUIRE ENTRY INTO PTP 4-4 SINCE SYSTEMS ARE NO LONGER REDUNDANT.</p> <p>B. A SUSTAINED LEAK IN OR THE LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE IN BOTH CM RCS RINGS PRIOR TO POWER JETTISON IS JUSTIFICATION FOR A MODE I ABORT. AFTER POWER JETTISON, IT IS NOT CAUSE FOR ABORT SINCE THE ABILITY TO PERFORM A SAFE ENTRY INTO THE ATLANTIC AT THE END OF THE FIRST REV STILL EXISTS BY USING THE CONTINGENCY CM RCS SPIN UP PRIOR TO CM/SM SEP. THIS METHOD OF ENTRY IS CONSIDERED OPERATIONALLY PREFERABLE TO PERFORMING AN ABORT AND PRESENTS LESS POTENTIAL HAZARD TO CREW RECOVERY. FURTHERMORE, CM RCS CONTROL IS REQUIRED FOR ABORTS IN THE MODE II AND MODE III REGIONS; AND TO ABORT THE LAUNCH IN THESE REGIONS FOR LOSS OF CM RCS CAPABILITY WOULD PUT THE SPACECRAFT AND CREW INTO AN UNSAFE ENVIRONMENT.</p>						
18-2	<p>LUNAR ORBIT; LUNAR STAY PHASES</p> <p>A. LUNAR ORBIT ACTIVITIES WILL BE CONTINUED FOR LOSS OR IMPENDING LOSS OF ONE CM RCS SYSTEM.</p> <p>B. THESE PHASES WILL ALSO BE CONTINUED IF THE CM-RCS IS ARMED.</p> <p>C. LOSS OF ONE SYSTEM AND ANY DEGRADATION IN THE REMAINING SYSTEM IS CAUSE FOR ENTRY INTO THE NEXT BEST PTP.</p>						
18-3	<p>LM DESCENT PHASE</p> <p>THERE ARE NO CSM RCS FAILURES THAT ARE CAUSE FOR TERMINATING THE DESCENT PHASE.</p>						
18-4	<p>ALL OTHER PHASES</p> <p>A. SUSTAINED LEAK IN OR LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE (COULD BE EITHER FUEL OR OXIDIZER) IN ONE CM RCS RING DELETES THE REDUNDANCY OF THE ENTRY ALTITUDE CONTROL SYSTEM AND REDUCES THE DELTA V AVAILABLE FOR HYBRID DESCENT. LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE IN BOTH CM RCS RINGS DELETES ALL ENTRY ALTITUDE CONTROL CAPABILITY REQUIRING CONTINGENCY CM RCS SPIN UP PRIOR TO CM/SM SEP. THE LOSS OF ONE OR BOTH CM RCS RINGS IS CAUSE FOR TERMINATING THE PHASE AND MISSION BY ENTRY INTO THE NEXT BEST PTP.</p> <p>B. ARMING OF THE CM RCS RINGS; WHETHER THE PROPELLANT ISOLATION VALVES ARE OPENED OR CLOSED; IS CAUSE FOR TERMINATING THE PHASE AND MISSION INTO THE NEXT BEST PTP.</p> <p>RULE NUMBERS 18-5 THROUGH 18-9 ARE RESERVED.</p>						
		APOLLO 13	PML	9/18/69	CSM CM-RCS	GENERAL	18-1

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 18 - C&M CM-RCS

REV	ITEM													
		<p>-----                      ' SYSTEMS MANAGEMENT '                      -----</p>												
	18-10	<p>THRUSTER TEMP CONTROL</p> <p>CM RCS THRUSTERS MAY BE HEATED PRIOR TO ENTRY FOR 20 MINUTES OR UNTIL THE LOWEST INDICATED TEMPERATURE IS 20 DEG. F.; WHICHEVER COMES FIRST. IF THRUSTER'S HEATER FUNCTION FAILS, CM RCS IS STILL CONSIDERED OPERATIONAL PENDING RESULTS OF CM RCS CHECKOUT PRIOR TO ENTRY.</p> <p>HALF PROC RCS 5.</p>												
	18-11	<p>HELIUM INTERCONNECT</p> <p>AS A LAST RESORT, IF THE HELIUM IN ONE RING IS DEPLETED DUE TO A LEAK AND THE PROPELLANT IS DEPLETED IN THE OTHER RING, THE SYSTEMS MAY BE INTERCONNECTED IF THE REMAINING PROPELLANT IS REQUIRED FOR CONTROL. ONCE INTERCONNECTED, THE RINGS CANNOT BE ISOLATED. HALF PROC RCS 4.</p> <p>RULE NUMBERS 18-12 THROUGH 18-19 ARE RESERVED.</p>												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>POSITION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 11</td> <td></td> <td>10/10/70</td> <td>CM CM-RCS</td> <td>MANAGEMENT</td> <td>18-2</td> </tr> </tbody> </table>			MISSION	REV	DATE	POSITION	GROUP	PAGE	APOLLO 11		10/10/70	CM CM-RCS	MANAGEMENT	18-2
MISSION	REV	DATE	POSITION	GROUP	PAGE									
APOLLO 11		10/10/70	CM CM-RCS	MANAGEMENT	18-2									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 18 - CSM CM-RCS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
SPECIFIC MISSION RULES								
	18-20	SUSTAINED LEAK IN OR COMPLETE LOSS OF HELIUM SUPPLY PRESSURE						
	A: ONE RING		LAUNCH	A.1: CONTINUE MISSION AND ENTER PTP 6-4				
			LO/DESCENT/LUNAR STAY	2: CONTINUE MISSION				
			ALL OTHERS	3: TERMINATE PHASE AND ENTER NEAR BEST PTP	A.3: NORMAL ENTRY			
	B: BOTH RINGS		LAUNCH	B.1: CONTINUE MISSION AND ENTER PTP 2-1 UNLESS PRIOR TO TOWER JETTISON; IF PRIOR TO TOWER JETTISON: ABORT				
			DESCENT	2: CONTINUE MISSION				
			ALL OTHERS	3: TERMINATE PHASE AND ENTER NEAR BEST PTP	B.3: CONTINGENCY SM RCS SPINUP PRIOR TO CM/SM SEP FOR DEORBIT AND TBO FOR LUNAR RETURN ENTRY			
	18-21	SUSTAINED LEAK IN OR COMPLETE LOSS OF HELIUM MANIFOLD PRESSURE (COULD BE EITHER FUEL OR OXIDIZER)						
	A: ONE RING		LAUNCH	A.1: CONTINUE MISSION AND ENTER PTP 6-4				
			LO/DESCENT/LUNAR STAY	2: CONTINUE MISSION				
			ALL OTHERS	3: TERMINATE PHASE AND ENTER NEAR BEST PTP				
	B: BOTH RINGS		LAUNCH	B.1: CONTINUE MISSION AND ENTER PTP 2-1 UNLESS PRIOR TO TOWER JETTISON; IF PRIOR TO TOWER JETTISON: ABORT				
			DESCENT	2: CONTINUE MISSION				
			ALL OTHERS	3: TERMINATE PHASE AND ENTER NEAR BEST PTP	B.3: CONTINGENCY SM RCS SPINUP PRIOR TO CM/SM SEP FOR DEORBIT AND TBO FOR LUNAR RETURN ENTRY			
			MISSION	REV	DATE	SECTION	GROUP	PAGE
			APOLLO 12	PNL	9/18/69	CSM CM-RCS	SPECIFIC	10-3

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 10 - CSM CM-RCS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	10-22	CM RCS ES ARMED FOR ANY REASON	LO/ DESCENT/ LUNAR STAY  ALL OTHERS	CONTINUE MISSION   TERMINATE PHASE AND ENTER NEXT BEST PTP			
		RULE NUMBERS 10-23 THROUGH 10-49 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PM	9/10/69	CSM CM-RCS	SPECIFIC	10-6

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 18 - CSM CM-RCS - CONCLUDED

REV	ITEM	----- * INSTRUMENTATION REQUIREMENTS * -----					MISSION RULE REFERENCE
18-30	WEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY		
	CM HE TR A PRESS	CRO001P	METER	COMMON	M	18-20	
	CM HE TR B PRESS	CRO002P	METER	COMMON	M	18-20	
	CM TR A TEMP	CRO003P	METER	COMMON	ND	18-20	
	CM TR B TEMP	CRO004P	METER	COMMON	ND	18-20	
	CM HE MXPLO A PRESS	CRO005P	METER/C&W	SEPARATE	M	18-21	
	CM HE MXPLO B PRESS	CRO006P	METER/C&W	SEPARATE	M	18-21	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	PNL	9/10/69	CSM CM-RCS	INSTA REQ	18-3



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10 EMU/EVA

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 10 - EMU/EVA -

REV	ITEM													
		----- GENERAL -----												
10-1		<p>TO INITIATE AND CONTINUE THE FOLLOWING MISSION PHASES: THE EXTRAVEHICULAR MOBILITY UNIT (EMU) MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES---</p> <p>A. DOCKED (TUNNEL HARDWARE INSTALLED)/UNDOCKED/AND2            ANY COMBINATION OF TWO OPS AND/OR PLS8 UNITS SATISFYING THE FOLLOWING---</p> <ol style="list-style-type: none"> <li>1. OPS SOURCE PRESSURE</li> <li>2. SUFFICIENT O2 CONSUMABLES (PL88 H2O, LICH AND BATTERY ARE NOT CHECKED PRIOR TO UNDOCKING) TO SUPPORT A 30 MINUTE CONTINGENCY EVA (CEVA)</li> </ol> <p>B. EVA</p> <ol style="list-style-type: none"> <li>1. CRITICAL INSTRUMENTATION</li> <li>2. LCG/LTL COOLING</li> <li>3. EMU PRESSURE INTEGRITY</li> <li>4. PL88 O2 PRESSURE REGULATOR</li> <li>5. PL88 FAN</li> <li>6. PL88 BATTERY</li> <li>7. OPS O2 PRESSURE REGULATOR</li> <li>8. SUFFICIENT PLS8 CONSUMABLES TO SUPPORT CHECKOUT, PLANNED EVA (E+30) AND A 30 MINUTE POST-EVA RESERVE</li> <li>9. SUFFICIENT OPS CONSUMABLES TO SUPPORT 30 MINUTE PURGE OPERATIONS.</li> </ol>												
10-2		<p>DEFINITIONS</p> <p>LOSS OF EMU PRESSURE INTEGRITY</p> <ol style="list-style-type: none"> <li>1. UNABLE TO MEET 0.3 PSI/MIN PRESSURE DECAY CRITERIA DURING EMU PRESSURE INTEGRITY CHECKS.</li> <li>2. EMU REGULATED PRESSURE LESS THAN 3.75 PSID (1H) AND DECREASING ON LUNAR SURFACE WHICH REPRESENTS AN O2 USAGE RATE GREATER THAN 0.7 LBS/HR</li> </ol> <p>LOSS OF PRIMARY OXYGEN SUB-SYSTEM (POS) OXYGEN SUPPLY</p> <ol style="list-style-type: none"> <li>1. SOURCE PRESSURE LESS THAN 192 PSIA</li> <li>2. UNABLE TO SUPPLY OXYGEN TO OXYGEN VENTILATION LOOP</li> </ol> <p>LOSS OF PLS8 BATTERY</p> <ol style="list-style-type: none"> <li>1. PLS8 BATTERY VOLTAGE LESS THAN 16.0 VDC AND DECREASING</li> <li>2. PLS8 BATTERY CURRENT DRAIN GREATER THAN 9.9 AMPS AND INCREASING DOES NOT INCLUDE CHECKOUT</li> </ol> <p>LOSS OF LIQUID COOLING GARMENT/LIQUID TRANSPORT LOOP (LCG/LTL) THERMAL CONTROL</p> <ol style="list-style-type: none"> <li>1. LOSS OF LCG/LTL CIRCULATION (FLOW RATE LESS THAN 3.5 LBS/MIN AND DECREASING)</li> <li>2. LCG H2O INLET TEMPERATURE OF 80 DEG F AND INCREASING AD LCG H2O DELTA T LESS THAN 3 DEG F AND DECREASING WITH DIVERTER VALVE IN "NORMAL" POSITION (THIS CONSTITUTES A FAILED SUBLIMATOR)</li> </ol> <p>30 MINUTE OPS PURGE FLOW LIFETIME</p> <p>CONSISTS OF 20 MINUTES (1800 FT) FOR TRAVERSAL OF THE LUNAR SURFACE AND 10 MINUTES FOR TERMINATION AND INGRESS.</p>												
		<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/15/79</td> <td>EMU/EVA</td> <td>GENERAL/ MANAGEMENT</td> <td>10-1</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	A	10/15/79	EMU/EVA	GENERAL/ MANAGEMENT	10-1
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	A	10/15/79	EMU/EVA	GENERAL/ MANAGEMENT	10-1									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 19 - EMU/EVA -

REV	ITEM												
19-3	CREWMAN MAY ELECT TO ATTEMPT A WET SUBLIMATOR RESTART IF BREAKTHROUGH OCCURS.												
19-4	OPS PURGE CAPABILITY IS REQUIRED FOR EVA.												
19-5	VACUUM TRANSFERS WILL ONLY BE USED IN SUPPORT OF HIS CONTINGENCY EXTRAVEHICULAR TRANSFER (CEVT) BETWEEN S/C AND IS1 A LM CABIN REPRESS FAILURE.												
19-6	AN EMU/LM ECS HYBRID LIFE SUPPORT AND COMM CONFIGURATION IS ACCEPTABLE IF WITHIN SYSTEMS CAPABILITIES AND IF REQUIRED TO PRECLUDE TIMELINE IMPACT.												
RULES 19-7 THRU 19-9 ARE RESERVED.													
<p>-----              MANAGEMENT              -----</p>													
19-10	THE PLSS BATTERY IS CONSIDERED TO HAVE A MINIMUM OF 14 AMP-HR CAPABILITY. THIS CONSUMABLE IS GAGED BY MONITORING 6T8140C/6T8240C AND PROCESSING IN THE RTCC TO OBTAIN AMP-HRS.												
19-11	THE PLSS PRIMARY OXYGEN SUBSYSTEM (POS) MUST CONTAIN THE MINIMUM LOADED PRESSURE OF 1030 PSIA TO SATISFY THE FIRST PLANNED EVA. THE MINIMUM PRESSURE REQUIRED FOR THE SECOND EVA IS 895 PSIA. THIS CONSUMABLE IS GAGED BY MONITORING 6T8102P/6T8202P AND PROCESSING IN THE RTCC TO OBTAIN LBS MASS.												
19-12	THE PLSS FEEDWATER RESERVOIR IS CONSIDERED TO HAVE A NOMINAL LOADING OF 6.8 LBS. THIS CONSUMABLE IS GAGED BY MONITORING 6T8154T/6T8254T, 6T8195T/6T8295T, 6T8182P/6T8282P, 6T8110P/6T8210P AND PROCESSING IN THE RTCC AND HAND CALCULATIONS TO OBTAIN LBS REMAINING.												
19-13	THE CONTAMINANT CONTROL ASSEMBLY IS CONSIDERED TO HAVE A 4800 BTU TOTAL METABOLIC CAPABILITY. THIS CONSUMABLE (LION) IS GAGED BY MONITORING POS CONSUMPTION.												
19-14	SUFFICIENT PLSS AND/OR OPS CONSUMABLES WILL BE RETAINED AT LM LIFTOFF TO SUPPORT A 30 MINUTE CEVA.												
19-15	TERMINATION OF EVA ACTIVITIES WILL BE BASED UPON THE CONSUMABLES (AMP-HOURS, O2, LION, AND M20) REQUIRED TO SUPPORT SAMPLE RETURN CONTAINER CLOSEOUT AND TRANSFER TO LM PLUS 30 MINUTES POST-EVA RESERVE.												
RULES 19-16 THROUGH 19-19 ARE RESERVED.													
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/19/69</td> <td>EMU/EVA</td> <td>GENERAL/ MANAGEMENT</td> <td>19-2</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	A	10/19/69	EMU/EVA	GENERAL/ MANAGEMENT	19-2
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	A	10/19/69	EMU/EVA	GENERAL/ MANAGEMENT	19-2								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 19 - EMU/EVA -

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
				SPECIFIC				
	19-20	LOSS OF EMU PRESSURE INTEGRITY	EVA	TERMINATE EVA 1. ACTIVATE OPS	REF MALF EMU			
	19-21	PLSS O2 PRESSURE REGULATOR FAILURE	EVA	TERMINATE EVA 1. ACTIVATE OPS 2. IF REG. FAILS OPEN CLOSE POS SHUTOFF VALVE	REF MALF EMU			
	19-22	PLSS FAN FAILURE	EVA	TERMINATE EVA IMMEDIATELY 1. ACTIVATE OPS 2. OPEN PGA PURGE VALVE	REF MALF EMU			
	19-23	LOSS OF WATER SEPARATOR	EVA	TERMINATE EVA IMMEDIATELY 1. IF DEMUMIDIFICATION IS REQUIRED, ACTIVATE OPS AND OPEN PURGE PGA VALVE	REF MALF EMU			
	19-24	CONTAMINATION IN VENTILATION SYSTEM	EVA	TERMINATE EVA IMMEDIATELY 1. ACTIVATE OPS 2. OPEN PGA PURGE VALVE	REF MALF EMU			
		RULES 19-25 THROUGH 19-29 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 12	FNL	9/10/69	EMU/EVA	SPECIFIC	19-3	

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 19 - EMU/EVA -

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	QUES/NOTES/COMMENTS		
	19-30	LOSS OF LCO/LTL	EVA	TERMINATE EVA 1. IF ADDITIONAL COOLING IS REQUIRED, ACTIVATE OPS AND OPEN PGA PURGE VALVE	REF MALF EMU		
	19-31	FEED H2O PRESSURE LESS THAN 2.0 PSIA AND DECREASING	EVA	TERMINATE EVA 1. IF ADDITIONAL COOLING IS REQUIRED, ACTIVATE OPS AND OPEN PGA PURGE VALVE	REF MALF EMU		
	19-32	LOSS OF POS O2 SUPPLY	EVA	TERMINATE EVA 1. ACTIVATE OPS	REF MALF EMU		
	19-33	LOSS OF PL88 BATTERY	EVA	TERMINATE EVA IMMEDIATELY 1. ACTIVATE OPS 2. OPEN PGA PURGE VALVE	REF MALF EMU		
		RULE 19-34 IS RESERVED.					
	19-35	LOSS OF CRITICAL INSTRUMENTATION	EVA	TERMINATE EVA	REF MR 19-42		
		NOTE - REF SECTION 20 FOR EVA COMMUNICATIONS RULES					
		RULES 19-36 THROUGH 19-40 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PNL	5/10/69	EMU/EVA	SPECIFIC	19-4

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 19 - EMU/EVA - CONCLUDED

REV	ITEM	INSTRUMENTATION REQUIREMENTS				MISSION RULE REFERENCE														
REV	ITEM	PAN FM/FM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE														
19-01	MEAS DESCRIPTION																			
	FERO H2O PRESS	GT8110P/GT8210P		COMMON	MD	19-2.3.33														
	LOW FEED H2O PRESS		FLAG ANNUNCIATOR		N															
	PLSS TEG	GT8124J/GT8224J			MD	19-2.2.6.20.21.22														
	PLSS BAT CUR	GT8140C/GT8240C			N															
	PLSS BAT VOLT	GT8141V/GT8241V			MD	19-2.2.20.22														
	LC6 H2O TEMP	GT8134T/GT8234T			N															
	PGA PRESS	GT8160P/GT8260P			MD	19-2.2.20.22														
	PGA PRESS SAGE		METER		N															
	LOW PGA PRESS		FLAG ANNUNCIATOR		N	19-2.2.20.22														
	SUOL O2 OUT TEMP	GT8170T/GT8270T		COMMON	MD															
	PLSS O2 PRESS	GT8182P/GT8282P			N	19-2.2.20.22														
	PLSS O2 QTY IND		METER		N															
	HIGH O2 FLOW		FLAG ANNUNCIATOR		N	19-2.22														
	LOW VENT FLOW		FLAG ANNUNCIATOR		N															
	LC6 H2O DELTA T	GT8196T/GT8296T			MD															
	OPS PRESS SAGE		METER		N	19-2.4.16														
	OPS REG PRESS SAGE		METER		MD															
	EVC SYNC	GT8100X/GT8200X			N	19-2.4.16														
	EVC CAL 8 VDC	GT8101V/GT8201V			N															
	EVC CAL 6 VDC	GT8102V/GT8202V			MD	19-2.4.16														
	* AEROMEDICAL PARAMETER REFERENCE SECTION 31.				N															
	** 1 OF 2 OPS REG PRESS SAGES IS MANDATORY.				MD															
19-02	CRITICAL INSTRUMENTATION																			
	MEAS DESCRIPTION	PAN FM/FM	ONBOARD	TRANSDUCER																
	PLSS O2 PRESS/PLSS O2 QTY IND	GT8182P/GT8282P	METER	COMMON																
	PGA PRESS SAGE/LOW PGA PRESS																			
	FLAG ANNUNCIATOR/PGA PRESS	GT8160P/GT8260P	METER/TONE-FLAG																	
	LOW VENT FLOW																			
	FLAG ANNUNCIATOR		TONE-FLAG																	
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> <td></td> </tr> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/19/70</td> <td>EMU/EVA</td> <td>PRELAUNCH INSTR</td> <td>19-5</td> <td></td> </tr> </table>							MISSION	REV	DATE	SECTION	GROUP	PAGE		APOLLO 12	A	10/19/70	EMU/EVA	PRELAUNCH INSTR	19-5	
MISSION	REV	DATE	SECTION	GROUP	PAGE															
APOLLO 12	A	10/19/70	EMU/EVA	PRELAUNCH INSTR	19-5															

28 COMMUNICATIONS/  
INSTRUMENTATION





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MISSION RULES

SECTION 10 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM						
		<p>*****                      MANAGEMENT                      *****</p>					
20-7	VOICE CONFIGURATION						
	A. LM/CSM/MSPN						
	1.	VHF DUPLEX B AND USB WILL BE TRANSMITTED/RECEIVED SIMULTANEOUSLY FOR LAUNCH THROUGH CVI; REV 1; VHF SIMPLEX A AND USB WILL BE TRANSMITTED/RECEIVED SIMULTANEOUSLY FOR EARTH ORBIT AFTER CVI; REV 1 LOS.					
	2.	VHF A SIMPLEX 296.8 MHZ IS PRIME VOICE COMM BETWEEN VEHICLES EXCEPT DURING RANGING WHEN DUPLEX B (CSM) AND DUPLEX A (LM) WILL BE USED.					
	3.	VHF B SIMPLEX 299.7 MHZ IS BACKUP TO VHF A SIMPLEX 296.8 MHZ.					
	4.	USB IS PRIME VOICE COMM BETWEEN MSPN AND CSM OR LM.					
	5.	USB/VHF RELAY IS VOICE COMM BACKUP TO USB BETWEEN MSPN AND MALFUNCTIONED S/C.					
	6.	NORMAL VOICE COMM WILL USE SIMULTANEOUS MSPN UPLINK TO BOTH VEHICLES. HOWEVER, IF REQUIREMENT SHOULD EXIST, SIMULTANEOUS INDEPENDENT MSPN/CSM AND MSPN/LM COMM MODES WILL BE INITIATED.					
	7.	THE PRIME CSM/LM COMMUNICATIONS MODE DURING THE LUNAR ORBIT PHASE IS VHF. THE PRIME VHF MODE IS VHF A SIMPLEX UNLESS THIS MODE IS PRECLUDED BY THE USE OF VHF RANGING. DURING LUNAR STAY PHASE THE PRIME CSM/LM MODE IS MSPN RELAY WITH EACH S/C MONITORING THE VHF A FREQUENCY.					
	8.	THE CSM AND LM WILL TRANSMIT SIMULTANEOUSLY ON VHF AND USB DURING ALL LM POWERED UP PHASES IN LUNAR ORBIT.					
	9.	IN THE EVENT OF A COMPLETE LOSS OF CSM S-BAND COMMUNICATIONS WITH MSPN, THE LM WILL BE CONFIGURED FOR LM TWO-WAY RELAY AND RETAINED FOR TEL AND TEC.					
	B. LM/CSM/EVA/MSPN						
	1.	LM TWO-WAY RELAY WITH TWO-MAN EVA IS THE PRIME MODE PLANNED FOR EVA OPERATION. CSM---USB TRANSMIT/RECEIVE ONLY---LM--- TRANSMIT VHF A; RECEIVE VHF A AND B; MSPN CONFIGURED FOR USB RELAY.					
20-8	CSM VHF/USB MANAGEMENT						
	A.	FOR CREW REST PERIODS, CSM S-BAND ANTENNAS WILL BE SELECTED BY GROUND COMMANDS.					
	B.	NORMAL CONTROL OF THE S-BAND MODES WILL BE BY GROUND COMMAND. CSM COMMUNICATIONS SWITCH POSITION WILL REFLECT OUT-OF-SITE CONTACT CONFIGURATION.					
20-9	LM STEERABLE ANTENNA MANAGEMENT						
	A.	DURING ALL PHASES THE STEERABLE ANTENNA TEMPERATURE SHOULD BE MAINTAINED BETWEEN <u>-85 DEG. F</u> AND <u>185 DEG. F</u> .					
	RULES 20-10 THROUGH 20-12 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	B	10/31/79	COMM & INST	FUNCTIONAL COMM-MNG.	20-2

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	QUES/NOTES/COMMENTS												
				----- [ SPECIFIC ] -----													
20-13	1	LOSS OF TWO-WAY VHF VOICE COMM BETWEEN SPACECRAFT	'DOCKED 'UNDOCKED 'DESCENT 'ORBIT 'POWERED 'DESCENT 'LUNAR 'STAY	'CONTINUE 'NO GO FOR SEP MNRV 'DOCE ASAP 'NO GO FOR DOI 'CONTINUE MISSION 'CONTINUE MISSION 'CONTINUE MISSION	'REF LN MAL PROC COMM 3; LOSS OF VHF VOICE COMM WITH CSM  'REF CSM MAL PROCEDURE COMM 3 - LOSS OF VHF COMM WITH LN  NOTE---MSFN RELAY MAY BE UTILIZED												
20-14		LOSS OF TWO-WAY VOICE COMM WITH MSFN A. CSM ONLY	'LAUNCH 'EARTH 'ORBIT 'TLC 'DOI/ 'POWERED 'DESCENT 'LUNAR 'STAY	'A.1. CONTINUE MISSION 2. ENTER NEXT BLOCK DATA POINT 3. CONTINUE MISSION NO GO FOR LOI 4. CONTINUE MISSION 5. CONTINUE MISSION	'REF CSM MAL PROCEDURES 766 - LOSS OF CSM VOICE COMM  A.3 ENTER LN EARLY TO USE LN S-BAND FOR VOICE COMM WITH MSFN.												
		B. LM ONLY	'DOCKED 'UNDOCKED 'DESCENT 'ORBIT 'POWERED 'DESCENT 'LUNAR 'STAY	'B.1. CONTINUE MISSION NO GO FOR DOI 2. RETURN TO VICINITY OF CSM NO GO FOR POI 3.A. POI TO LO GATE RETURN TO VICINITY OF CSM ASAP B. LO GATE TO TOUCHDOWN CONTINUE MISSION. 5. LM LIFTOFF NEXT ASCENT OPPORTUNITY.	'1. REF LN MAL PROC COMM--- 4. LOSS OF S-BAND VOICE COMM 3. S-BAND RECEIVER CANNOT ACQUIRE PHASE LOCK. B.3. CSM RELAY ACCEPTABLE												
20-15		LOSS OF TWO CSM AUDIO CENTERS	'EPO 'ALL	'CONTINUE MISSION 'NO GO FOR TLT 'CONTINUE MISSION-NO GO FOR LOI													
20-16		LOSS OF VOICE FROM EVA-2 TO EVA-1	'DUAL 'EVA	'CONTINUE MISSION 'EVA-2 GO TO POSITION '1B''	'EVA-1 HAS EVC-1 EVA-2 HAS EVC-2												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 10%;">DATE</td> <td style="width: 15%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>COMM &amp; INST</td> <td>FUNCTIONAL COMM-SPECIFIC</td> <td>20-3</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	COMM & INST	FUNCTIONAL COMM-SPECIFIC	20-3
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	FNL	9/10/69	COMM & INST	FUNCTIONAL COMM-SPECIFIC	20-3												

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MISSION RULES

SECTION 26 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	QUES/NOTES/COMMENTS		
	20-17	LOSS OF VOICE FROM EVA-1 TO EVA-2	DUAL EVA	CONTINUE MISSION 1. EVA-2 GO TO POSITION '1A' 2. EVA-1 GO TO POSITION '1B'			
	20-18	LOSS OF DUPLEX VOICE BETWEEN EVA-1 AND EVA-2	DUAL EVA	TERMINATE EVA			
	20-19	LOSS OF TWO-WAY VOICE BETWEEN MSFN AND EVA	DUAL EVA	TERMINATE EVA 1. EVA-2 GO TO POSITION '1A' EVA-1 GO TO POSITION '1B' 2. IF UNABLE TO RE-ESTABLISH COMM EVA-2 RETURN TO LM AND RECONFIGURE COMM 3. IF ABLE TO RE-ESTABLISH COMM; CONTINUE EVA.			
	20-20	LOSS OF TWO-WAY VOICE BETWEEN MSFN AND BOTH LM AND EVA	ALT EVA (ONE-MAN)	TERMINATE EVA 1. RECONFIGURE LM TO RE-ESTABLISH COMM. 2. IF ABLE TO RE-ESTABLISH COMM; CONTINUE EVA.			
	20-21	LOSS OF DUPLEX VOICE BETWEEN LM AND EVA	ALT EVA (ONE-MAN)	TERMINATE EVA 1. RECONFIGURE LM AND EVA TO VHF BACKUP MODE. 2. IF ABLE TO RE-ESTABLISH DUPLEX COMM; CONTINUE EVA.			
		RULES 20-22 THROUGH 20-25 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/10/69	COMM & INST	FUNCTIONAL COMM-SPECIFIC	20-6

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM						
		----- GENERAL -----					
20-26	A.	BASELINE REQUIREMENT (ALL PHASES EXCEPT LAUNCH)					
		S: CRITICAL INSTRUMENTATION (CRITICAL INSTRUMENTATION IS THAT INSTRUMENTATION REQUIRED TO VERIFY MISSION GO/NO-GO CRITERIA)					
	B.	LAUNCH					
		THERE ARE NO CSM INSTRUMENTATION FAILURES FOR WHICH THE LAUNCH/INSERTION PHASE WILL BE TERMINATED.					
	C.	POWERED DESCENT ADDITIONAL REQUIREMENTS					
		THERE ARE NO CSM INST. SYS FAILURES FOR WHICH LM POWERED DESCENT WILL BE TERMINATED.					
20-27	THE MISSION WILL BE CONTINUED WITH THE LOSS OF THE---						
	A.	CSM UPDATA LINK					
	B.	CSM CAUTION AND WARNING SYSTEM					
	C.	CSM DSE					
	D.	CSM HIGH GAIN ANTENNA					
	E.	CSM FM DOWNLINK					
	F.	CSM USR RANGING (PRN)					
	G.	VHF RANGING					
		RULES 20-26 THROUGH 20-28 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/10/69	COMM & INSTR	CSM INST - GENERAL	20-5

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MISSION RULES  
SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	MANAGEMENT						
20-30	DSE MANAGEMENT	<p>A. LM AND CSM LOW BIT RATE TELEMETRY WILL BE RECORDED CONTINUOUSLY WHEN NOT IN CONTACT WITH GROUND TELEMETRY SITES EXCEPT DURING PERIODS OF VHF RANGING. WHEN NO LM TM WILL BE RECORDED; AND WILL BE NORMALLY PLAYED BACK AT LEAST ONCE PER REVOLUTION IN LUNAR ORBIT.</p> <p>B. CM HIGH BIT RATE DSE RECORDINGS WILL BE MADE DURING THE FOLLOWING OPERATIONS---</p> <ol style="list-style-type: none"> <li>1. LAUNCH</li> <li>2. S-IVB/CSM SEPARATION</li> <li>3. TDBE</li> <li>4. ALL SPB MANEUVERS</li> <li>5. CM/SM SEPARATION AND ENTRY</li> <li>6. DTD REQUIREMENTS (TBD)</li> <li>7. LM FINAL SEP</li> </ol> <p>C. DURING SLEEP PERIODS</p> <ol style="list-style-type: none"> <li>1. USING HIGH GAIN ANTENNAS; DSE RECORDING AND DUMPING WILL BE MANAGED PER (A) ABOVE.</li> <li>2. USING OMNIS; LM AND CSM LOW BIT RATE TELEMETRY WILL BE RECORDED CONTINUOUSLY WHEN NOT IN CONTACT WITH GROUND TELEMETRY SITES. DATA WILL NOT BE DUMPED UNLESS A MALFUNCTION SO DICTATES. IN THIS CASE THE MGA WILL BE ACTIVATED FOR THE DUMP.</li> </ol>						
20-31	CIE MANAGEMENT	<p>A. CIE WILL BE CONFIGURED TO CLOCK IN BIT FOR FLIGHT; HOWEVER, IF A HOLD OCCURS AFTER 1-15 MINUTES; CIE WILL NOT BE CORRECTED UNTIL COMPLETION OF POWERED FLIGHT.</p> <p>B. CIE WILL BE ALLOWED TO DRIFT +/- 5 SEC BEFORE BEING UPDATED AFTER ORBIT INSERTION.</p> <p>RULES 20-32 THROUGH 20-34 ARE RESERVED.</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 12	PNL	9/18/69	COMM & INSTR	CSM INST - MANAGEMENT	20-6	

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
				<u>SPECIFIC 1</u>				
20-35	LOSS OF CBM TM A: HBR OR LOR B: ALL TM	ALL LAUNCH EO LO POWERED DESCENT LUNAR STAY	ALL LAUNCH EO LO POWERED DESCENT LUNAR STAY	1A: CONTINUE MISSION 1B: CONTINUE MISSION 2: ENTER NEXT BEST PTP 3: NO GO FOR LUNAR OPERATIONS 4: CONTINUE MISSION 5: LA LIPTOFF AT THE NEXT ASCENT OPPORTUNITY.	REF CBM MAL PROCEDURE. COMM 10 - NSPH REPORTS LOSS OF REALTIME PCM. DSE MAY BE UTILIZED FOR TM IF AVAILABLE.			
20-36	LOSS OF CRITICAL INSTRUMENTATION	LAUNCH EO TLC DOI	LAUNCH EO TLC DOI	CONTINUE MISSION ENTER NEXT BEST PTP NO GO FOR TLI CONTINUE MISSION NO GO LOI NO GO FOR LUNAR OPERATIONS				
20-37	LOSS OF ONE CBM PHD POWER SUPPLY	ALL	ALL	CONTINUE MISSION				
20-38	LOSS OF BOTH CBM POWER AMPLIFIERS	EO ALL	EO ALL	NO GO FOR TLI CONTINUE MISSION IF HI GAIN ANT IS AVAILABLE				
20-39	LOSS OF THE SCE	EO TLC LUNAR ORBIT LUNAR STAY	EO TLC LUNAR ORBIT LUNAR STAY	CONTINUE MISSION NO GO FOR TLI CONTINUE MISSION NO GO FOR LOI CONTINUE MISSION CONTINUE MISSION				
		RULES 20-40 THROUGH 20-44 ARE REDUNDANT.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 13	A	09/10/69	COMM & INSTR	COMM INST - SPECIFIC	20-7	

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MISSION RULES

SECTION 26 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM												
	----- GENERAL -----												
20-45	<p>A. BASELINE REQUIREMENT</p> <p>1. CRITICAL INSTRUMENTATION (CRITICAL INSTRUMENTATION IS THAT INSTRUMENTATION ONBOARD OR TM DURING MSPN AOS, OR ONBOARD ONLY DURING MSPN LOS REQUIRED TO VERIFY MISSION GO/NO-GO CRITERIA)</p> <p>B. POWERED DESCENT ADDITIONAL REQUIREMENTS</p> <p>LM HBR TELEMETRY</p> <p>C. LUNAR STAY ADDITIONAL REQUIREMENTS</p> <p>LM LBR OR HBR TM IS REQUIRED. IF LM TM DATA IS LOST DURING THE EVA, ONE CREWMAN WILL RETURN AND ATTEMPT TO RE-ESTABLISH THE LOST COMMUNICATIONS LINK.</p>												
20-46	<p>THE MISSION WILL BE CONTINUED WITH THE LOSS OF THE---</p> <p>A. LM UPGRADE LINK</p> <p>B. LM CAUTION AND WARNING SYSTEM</p> <p>C. LM DBEA</p> <p>D. EVA TELEMETRY</p> <p>E. LM FM DOWNLINK</p> <p>F. LM VSB RANGING (PRN)</p> <p>G. VHF RANGING</p> <p>RULES 20-47 THROUGH 20-49 ARE RESERVED.</p>												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>PAL</td> <td>9/18/69</td> <td>COMM 5 1207</td> <td>LM INST - GENERAL</td> <td>20-6</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	PAL	9/18/69	COMM 5 1207	LM INST - GENERAL	20-6
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	PAL	9/18/69	COMM 5 1207	LM INST - GENERAL	20-6								





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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
				SPECIFIC 1			
20-35	LOSS OF LM TM				REF MAL PROC COMM 5		
	A. LOSS OF LBR ONLY	ALL		1. CONTINUE MISSION			
	B. LOSS OF MBR ONLY	ALL		2. CONTINUE MISSION	M&PA REPORTS LOSS OF PCM ADEQUATE DATA TO MAKE FINAL GO/NO GO TO CONTINUE POWERED DESCENT.		
	C. LOSS OF ALL TM	DOCKED ALL POWERED DESCENT LUNAR STAT		3. 1. CONTINUE MISSION-NO GO FOR UNDOCKING 2. RETURN TO VICINITY OF CSM 3. (A) PD1 TO LO GATE - ABORT-DOCK ASAP 1B) LO GATE TO TD - CONTINUE MISSION 4. LM LIFTOFF NEAR LAUNCH OPPORTUNITY			
20-36	LOSS OF CRITICAL INSTRUMENTATION	DOCKED UNDOCKED		DO NOT UNDOCK DOCK ASAP			
	RULES 20-37 THROUGH 20-39 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	0	10/31/70	COMM 5 INST	LM INST - SPECIFIC	10-10

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION CONCLUDED

REV	ITEM	COMMUNICATIONS AND INSTRUMENTATION CONCLUDED																		
----- CM- INSTRUMENTATION REQUIREMENTS -----																				
20-80	HEAD DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REF														
	UCL VALIDITY SIGNAL	CT0262V	-	-	HD	20-27A														
	USB RECEIVER AGC	CT0620E	METER	COMMON	HD	20-27,20-7A197, 20-88														
	USB RECEIVER AGC	METER	-	-	HD															
	USB RECEIVER ERROR	CT0604F	-	-	HD															
	DSB TAPE MOTION	CT0032A	TS	-	HD	20-27,20-30														
	CTE TIME	CT0149P	-	-	HD	20-31														
	BCE 10 VDC	CT0018V	-	-	HD															
	BCE 0 VDC	CT0017V	-	-	HD															
	BCE 20 VDC	CT0019V	-	-	HD															
	BCE +20 VDC	CT0016V	-	-	HD															
	PCM HI REF 85 PERCENT	CT0123V	-	-	HD															
	PCM HI REF 25 PERCENT	CT0120V	-	-	HD															
----- LM- INSTRUMENTATION REQUIREMENTS -----																				
20-81	HEAD DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REF														
	PCM OAC PAIR 2	0L0422V	-	-	I OF 2															
	PCM OAC PAIR 3	0L0423V	-	-	HD															
	CAL 85 PCT	0L0401V	-	-	HD															
	CAL 15 PCT	0L0402V	-	-	HD															
	MBT	0L0603V	-	-	HD															
	COM PWR PAIR	0L4004R	CAUTION	-	HD															
	MASTER ALARM	0L4009R	MASTER ALARM	-	HD															
	DUA STATUS	0T0041R	-	-	HD	20-44														
	S-040 81 PH ERR	0T0990B	-	-	HD															
	S-040 RCVR SIG	0T0990V	METER	-	HD	20-46														
	STEERABLE ANT TEMP	0T0004	METER	-	HD	20-90,20-96														
	AMTR PD	0T0993	-	-	HD	20-46,20-96														
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 5%;">REV</td> <td style="width: 10%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 20%;">GROUP</td> <td style="width: 10%;">PAGE</td> <td style="width: 20%;"></td> </tr> <tr> <td>APOLLO 12</td> <td>0</td> <td>10/31/70</td> <td>COMMUNICATIONS AND INSTR</td> <td>OPERATIONAL REQUIREMENTS</td> <td>20-11</td> <td></td> </tr> </table>							MISSION	REV	DATE	SECTION	GROUP	PAGE		APOLLO 12	0	10/31/70	COMMUNICATIONS AND INSTR	OPERATIONAL REQUIREMENTS	20-11	
MISSION	REV	DATE	SECTION	GROUP	PAGE															
APOLLO 12	0	10/31/70	COMMUNICATIONS AND INSTR	OPERATIONAL REQUIREMENTS	20-11															

BY THE SECRETARY  
AND PROTECTOR



NASA - Manned Spacecraft Center  
MISSION RULES  
SECTION 21 - LM SEQUENTIAL AND PYROTECHNIC

REV	ITEM	
		----- MANAGEMENT -----
21-10		APS WILL NOMINALLY BE PRESSURIZED IMMEDIATELY PRIOR TO STAGING. APS WILL NOT NORMALLY BE PRESSURIZED MORE THAN 24 HOURS PRIOR TO THE LAST APS BURN-- HOWEVER, IN A CONTINGENCY CASE, THE APS MAY BE PRESSURIZED UP TO 3-1/2 DAYS PRIOR TO THE LAST APS BURN.
21-11		IF UNABLE TO DEPLOY ONE OR MORE LANDING GEAR, A LANDING WILL NOT BE ATTEMPTED. DESCENT ENGINE BURNS WILL BE CONTINUED SINCE CONTROL PROBLEMS ARE NOT EXPECTED TO EXIST AND DAMAGE TO THE LANDING GEAR FROM THE BURN WILL NOT AFFECT ALTERNATE MISSIONS.
21-12		UNDOCKED STAGING WITH ONE PYRO SYSTEM WILL BE PERFORMED ONLY IF ABSOLUTELY NECESSARY TO MAINTAIN CREW SAFETY.
21-13		FOR A K1 THROUGH K6 FAILURE, THE GOOD SYSTEM WILL BE DISABLED AND A PYRO FUNCTION, OTHER THAN STAGING, ATTEMPTED TO DETERMINE IF K1 HAS FAILED CLOSED. IF BOTH SYSTEMS ARE FAILED IN THIS MODE, THEY MUST BOTH BE TESTED FOR A K1 FAILURE INDEPENDENTLY. A PYRO SYSTEM CANNOT BE DISABLED FOR A K1 FAILURE.
21-14		AN ARMED PYRO SYSTEM(S) THAT CANNOT BE DEARMED IS CONSIDERED UNSAFE FOR THE VIBRATION/SHOCK ENVIRONMENT ASSOCIATED WITH LUNAR TOUCHDOWN.
		RULE NUMBERS 21-15 THROUGH 21-19 ARE RESERVED.
MISSION REV DATE SECTION GROUP PAGE APOLLO 12 PM 5/10/69 LM SEQUENTIAL AND PYROTECHNIC MANAGEMENT 21-1		



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 21 - LM SEQUENTIAL AND PYROTECHNIC

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	21-22	A RELAY RT THROUGH R33 INADVERTENTLY CLOSES	ALL		RELAYS R7 - RCS PRESS R8 - LAND GEAR DEPLOY R8A - LAND GEAR DEPLOY R9 - DPS CRYO HE PRESS R10 - ASC HE TANK 1 R11 - ASC HE TANK 2 R12 - ASC FUEL AND OR COMP VALVE (SYSTEM B ONLY) R12A - ASC FUEL AND OR COMP VALVES R13 - DPS FUEL AND OR VENT R14 - DPS AMBIENT HE R15 - DPS FUEL AND OR COMP VALVES		
		A: SYSTEM A		A: CONTINUE MISSION OPEN LOGIC POWER 1. C/R UNTIL AFTER DPS 2. HE PRESSURIZATION; CLOSE DPS PROPELLION FUEL AND OR VENTS THEN CLOSE LOGIC POWER 1. A. C/R.	A AND B = PRIOR TO DPS CRYO HE PRESS; THE FAILED SYSTEM WILL BE DISABLED FOR ALL PYRO FUNCTIONS; SUBSEQUENT PYRO FUNCTIONS WILL BE ACCOMPLISHED USING SYSTEMS A AND B.		
		B: SYSTEM B		B: CONTINUE MISSION OPEN LOGIC POWER 1. C/R UNTIL AFTER DPS 2. HE PRESSURIZATION; CLOSE DPS PROPELLION FUEL AND OR VENTS THEN CLOSE LOGIC POWER 1. B. C/R.			
		C: BOTH SYSTEMS		C: 1. CONTINUE MISSION 2. PRIOR TO POSITIONING MASTER ARM GO TO 1TON CLOSE DPS HE REG 2 AND 1 AND DPS PROPELLION FUEL AND OR VENTS; ALSO THE DESCENT PROPELLANT 100% VLV SWITCH MUST BE HELD IN THE PINE POSITION UNTIL THE MASTER ARM SWITCH IS POSITIONED TO 1TON FOR THE FIRST TIME. 3. OPEN DPS HE REG 2 AT 1TG OF DPS 1 BURN			
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 16	A	10/19/70	LM SEQUENTIAL AND PYROTECHNIC	SPECIFIC MANAGEMENT	21-5

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MISSION RULES

SECTION 21 - LM SEQUENTIAL AND PYROTECHNIC

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	21-23	UNABLE TO STAGE			THIS RULE ONLY APPLIES TO ALTERNATE MISSIONS												
		A: ASCENT AND DESCENT STAGES STILL RIGIDLY TIED TOGETHER	RNDZ	A: B: CONTINUE MISSION 2: USE RCS FOR MANEUVERS	A: CSM RESCUE MAY BE INITIATED DUE TO RCS REDLINES												
		B: INCOMPLETE STAGING; VEHICLE NOT RIGID	RNDZ	B: 1: EXECUTE CSM RESCUE 2: GO TO DRIFTING FLIGHT	B: EVT MAY BE REQUIRED BECAUSE OF INABILITY TO DOCK												
		RULE NUMBERS 21-24 THROUGH 21-29 ARE RESERVED															
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>DESIGN</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 13</td> <td>PWL</td> <td>07/10/69</td> <td>LM SEQUENTIAL AND PYROTECHNIC</td> <td>SPECIFIC</td> <td>21-3</td> </tr> </table>						MISSION	REV	DATE	DESIGN	GROUP	PAGE	APOLLO 13	PWL	07/10/69	LM SEQUENTIAL AND PYROTECHNIC	SPECIFIC	21-3
MISSION	REV	DATE	DESIGN	GROUP	PAGE												
APOLLO 13	PWL	07/10/69	LM SEQUENTIAL AND PYROTECHNIC	SPECIFIC	21-3												



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MISSION RULES

SECTION 21 - LM SEQUENTIAL AND PYROTECHNIC - CONCLUDED

REV	ITEM						
		<u>PRELAUNCH INSTRUMENTATION</u>					
21-00		MEAS DESCRIPTION	PCN	ONBOARD		CATEGORY	MISSION RULE REFERENCE
		ED RLY A K1-K6	0Y0201X	SYS A STAGING LIGHT	COMMON CAUTION LIGHT	M	21-3: 2: 3: 10: 20: 21:
		ED RLY B K1-K6	0Y0202X	SYS B STAGING LIGHT		MD	
		ED RLY A K7-K19	0Y0201X	-----		MD	21-3: 3: 20
		ED RLY B K7-K19	0Y0202X	-----		MD	21-3: 3: 22
		SELECTED EC BAT VOLTS	-----	METER		M	21-3: 2: 20
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	A	10/10/79	LM SEQUENTIAL AND PYROTECHNIC	PRELAUNCH INSTR	21-6

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22 LM ELECTRICAL  
POWER

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**MISSION RULES**

**SECTION 22 - LM ELECTRICAL POWER**

REV	ITEM												
	<u>GENERAL</u>												
22-1	<p>TO INITIATE MANNED LM MISSION PHASES, THE ELECTRICAL POWER SYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES---</p> <p align="center">NOTE -----</p> <p align="center">LM ACTIVE RENDEZVOUS/CONTINGENCY RETURN ASSUMED</p> <p>A. DOCKED WITH MATCH OPEN AND TUNNEL CLEAR</p> <ol style="list-style-type: none"> <li>1. CDR OR LMP BUS</li> <li>2. TWO DESCENT BATTERIES WITH ASSOCIATED FEEDER OR ONE ASCENT BATTERY WITH ASSOCIATED FEEDER.</li> <li>3. SUFFICIENT AVAILABLE ASCENT OR DESCENT ELECTRICAL ENERGY TO COMPLETE THE PLANNED ACTIVITY PERIOD.</li> </ol> <p>B. DOCKED WITH MATCH CLOSED</p> <ol style="list-style-type: none"> <li>1. CDR AND LMP BUSES</li> <li>2. TWO DESCENT BATTERIES PLUS ONE ASCENT BATTERY OR BOTH ASCENT BATTERIES.</li> <li>3. BOTH ASCENT FEEDERS</li> <li>4. SUFFICIENT AVAILABLE ASCENT OR DESCENT ELECTRICAL ENERGY TO COMPLETE THE PLANNED ACTIVITY PERIOD PLUS A RESERVE OF 1 HOUR.</li> </ol> <p>C. UNDOCKED/SEPARATION AND SUBSEQUENT PHASES SEE LM TELCOM GO/NO GO CRITERIA - PAGE 9-18.</p>												
	<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 13 A</td> <td>A</td> <td>10/15/69</td> <td>LM ELECTRICAL</td> <td>GENERAL</td> <td>22-1</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 13 A	A	10/15/69	LM ELECTRICAL	GENERAL	22-1
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 13 A	A	10/15/69	LM ELECTRICAL	GENERAL	22-1								

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MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM												
22-2	<p>DEFINITIONS---</p> <p>LOSS OF CDR OR LMP BUS</p> <ul style="list-style-type: none"> <li>A. INABILITY TO MAINTAIN BUS VOLTAGE GREATER THAN 28.5 VDC</li> <li>B. A BUS CURRENT GREATER THAN OR EQUAL TO 90 AMPS</li> </ul> <p>LOSS OF AN EPB BATTERY</p> <ul style="list-style-type: none"> <li>A. BATTERY OUTPUT LESS THAN OR EQUAL TO 2 AMPS WHEN CONNECTED TO A BUS</li> <li>B. TEMPERATURE GREATER THAN OR EQUAL TO 145 DEB F WITH VOLTAGE EQUAL (UNSTAGED CONFIGURATION) OR LESS THAN NOMINAL (STAGED CONFIGURATION) AND CURRENT LESS THAN NOMINAL</li> <li>C. INABILITY TO MEET VOLTAGE REGULATION AT REQUIRED LOAD</li> <li>D. INABILITY TO BE CONNECTED TO A FEEDER DUE TO A MALFUNCTIONED ECA</li> <li>E. BATTERY OPEN CIRCUIT VOLTAGE BELOW 31.8 VDC STEADY STATE</li> </ul> <p>LOSS OF A DC BUS FEEDER</p> <ul style="list-style-type: none"> <li>A. DESCENT - INABILITY TO USE AS A POWER PATH THE ELECTRICAL CONNECTIONS FROM THE OUTPUT TERMINALS OF THE DESCENT ECA'S TO THE DPR</li> <li>B. ASCENT - INABILITY TO USE AS A POWER PATH THE ELECTRICAL CONNECTIONS FROM THE OUTPUT TERMINALS OF THE ASCENT ECA'S TO THE BAT FEED TIE CIRCUIT BREAKERS</li> </ul> <p>LOSS OF OVERCURRENT PROTECTION</p> <ul style="list-style-type: none"> <li>A. DEFINITE LOSS IF---</li> <ul style="list-style-type: none"> <li>(1) BOTH CIRCUIT BREAKERS POWERING THE ECA'S FAIL OPEN (ALL DESCENT OR ALL ASCENT BATTERIES, DEPENDENT ON WHICH PAIR OF CIRCUIT BREAKERS FAILED)</li> <li>(2) FAILURE OF AN ASCENT BATTERY NORMAL FEED CONTACTOR</li> </ul> <li>B. PROBABLE LOSS IF---</li> <ul style="list-style-type: none"> <li>(1) UNABLE TO MEASURE A BATTERY CURRENT BOTH ONBOARD AND ON TELEMETRY</li> <li>(2) UNABLE TO TAKE THE BATTERY OFF LINE</li> </ul> </ul> <p>LOSS OF AN INVERTER AND/OR ASSOCIATED AC DISTRIBUTION</p> <ul style="list-style-type: none"> <li>A. AC BUS VOLTAGE LESS THAN OR EQUAL TO 110.5 OR GREATER THAN OR EQUAL TO 120 VAC</li> <li>B. AC BUS FREQUENCY LESS THAN OR EQUAL TO 390 OR GREATER THAN OR EQUAL TO 410 HZ</li> <li>C. POWER CANNOT BE SUPPLIED TO AN AC BUS</li> </ul>												
22-3	<p>ANY SPECIFIC EPB MISSION RULE REQUIRING A NEXT BEST OPPORTUNITY LIFTOFF WILL BE CAUSE FOR TERMINATION OF AN EVA. ADDITIONALLY, A CREWMAN WILL RETURN FROM THE EVA TO CORRECT THE FOLLOWING---</p> <ul style="list-style-type: none"> <li>A. A DESCENT BATTERY MALFUNCTION REQUIRING THE BATTERY TO BE TAKEN OFF LINE.</li> <li>B. AN INVERTER MALFUNCTION IF THE STEERABLE ANTENNA IS AFFECTED (ASSUMES THE ERECTABLE ANTENNA IS NOT DEPLOYED).</li> </ul> <p>RULE NUMBERS 22-4 THROUGH 22-9 ARE RESERVED.</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	FNL	9/10/69	LM ELECTRICAL	GENERAL	22-2								

NASA - Manned Spacecraft Center.

MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM												
	<p>*****                      MANAGEMENT                      *****</p>												
22-10	<p>THE MISSION WILL BE CONTINUED AFTER LIPTOFF WITH THE LOSS OF OVERCURRENT PROTECTION IF THIS PROTECTION IS LOST PRIOR TO LIPTOFF; A HOLD WILL BE CALLED.</p> <p>A. IF OVERCURRENT PROTECTION IS LOST ON AN INDIVIDUAL DESCENT BATTERY, THE BATTERY WILL BE LEFT ON LINE EXCEPT FOR EVA.</p> <p>B. IF ALL DESCENT OVERCURRENT PROTECTION IS LOST, BOTH ASCENT BATTERIES WILL BE PARALLELED WITH THE DESCENT BATTERIES ON LINE PERIODICALLY TO MONITOR CURRENT AND OBTAIN A CONSUMABLE TREND.</p> <p>C. IF ONE OR BOTH ASCENT BATTERY NORMAL FEED CONTACTORS FAIL OPEN, THE SPACECRAFT WILL BE CONFIGURED WHEN ASCENT STAGE ONLY OPERATIONS ARE REQUIRED, USING THE BACKUP FEEDS ON BOTH ASCENT BATTERIES WITH THE CROSSTIES LEFT OPEN.</p>												
22-11	<p>THE ASCENT BATTERIES WILL BE PRECONDITIONED FOR--</p> <p>A. TWO ASCENT BATTERY/SPLIT BUS OPERATION AND THE CURRENT STEPS ASSOCIATED WITH AN ABORT STAGE BY REMOVING 5 AMP HOURS FROM BATTERY 8 AND 2.5 AH FROM BATTERY 9 IMMEDIATELY PRIOR TO PDI.</p> <p>B. TWO ASCENT BATTERY/SPLIT BUS OPERATION BY REMOVING 2.5 AMP HOURS FROM EACH BATTERY PRIOR TO REMOVING THE LAST DESCENT BATTERY ON EACH BUS BEFORE LUNAR LIPTOFF.</p> <p>C. ONE ASCENT BATTERY/TWO BUS OPERATION BY REMOVING A MINIMUM OF 5 AMP HOURS IMMEDIATELY PRIOR TO REMOVING THE LAST DESCENT BATTERY.</p>												
22-12	<p>THE BAL LOAD CROSSTIES (100A) WILL BE OPEN FOR MAIN PROPULSION BURNS, STAGING, AND WHENEVER AGS IS IN THE OPERATE MODE WITH BOTH "AEA" CIRCUIT BREAKERS CLOSED. THE BUS CROSSTIES (100A) WILL NORMALLY NEVER BE CLOSED.</p>												
22-13	<p>ELECTRICAL POWER WILL NEVER BE INTENTIONALLY APPLIED TO A SHORT TO HELP DETERMINE ITS LOCATION UNLESS THE FEEDER FAULT LIGHT HAS FAILED. A GOOD BUS WILL NEVER BE CROSSTIED INTO A SHORT OR POSSIBLE SHORT.</p>												
22-14	<p>THE INVERTERS WILL BE SWITCHED FOR A VOLTAGE LESS THAN OR EQUAL TO 112 VAC OR A FREQUENCY GREATER THAN OR EQUAL TO 602 OR LESS THAN OR EQUAL TO 398 HZ.</p>												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 5%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 15%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 17</td> <td>8</td> <td>10/31/69</td> <td>LM ELECTRICAL</td> <td>MANAGEMENT</td> <td>22-3</td> </tr> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 17	8	10/31/69	LM ELECTRICAL	MANAGEMENT	22-3
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 17	8	10/31/69	LM ELECTRICAL	MANAGEMENT	22-3								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM
22-15	BATTERY MANAGEMENT WILL BE PERFORMED ONLY DURING LUNAR STAY PERIODS AND THEN ONLY IF IT CAN PREVENT VIOLATION OF CONSUMABLE REDLINES DUE TO LOSS OF A SINGLE DESCENT BATTERY.
22-16	FOR A SHORTED DESCENT FEED TO THE ASCENT BATTERIES WILL BE PLACED ON NORMAL FEED WITH THE SHORT ISOLATED VIA THE DEADFACE RELAY; OPERATIONALLY THIS RESULTS IN THE LOSS OF ALL REMAINING DESCENT ELECTRICAL ENERGY FOR CONSUMABLE CONSIDERATIONS. THE TWO DESCENT BATTERIES THAT STILL HAVE AN OPERABLE FEED PATH WILL BE USED ONLY IF NECESSARY TO MAINTAIN CREW SAFETY.
22-17	WITH THE LOSS OF ONE ASCENT BATTERY, THE REMAINING ASCENT BATTERY WILL BE PLACED ON ITS BACKUP FEEDPATH WITH THE BUS CROSSTIES FLOAT CLOSED FOR STAGED OPERATIONS. ALSO PRIOR TO INITIATING AN ABORT STAGE THE DESCENT ECA C/B'S MUST BE OPENED TO PREVENT THE FAILED BATTERY FROM BEING AUTOMATICALLY PLACED ON LINE THRU ITS NORMAL FEEDPATH.
22-18	FOR AN OPEN DESCENT FEEDER OR FOR THE LOSS OF TWO DESCENT BATTERIES ON THE SAME BUS AN ASCENT BATTERY WILL BE CONNECTED TO THAT BUS VIA NORMAL FEED PATH. THE CROSS TIE BAL LOAD CIRCUIT BREAKERS MAY BE CLOSED ON THE LUNAR SURFACE IF REQUIRED FOR PROPER BATTERY SHARING.
22-19	FOR A SHORTED ASCENT FEEDER ON THE LUNAR SURFACE, THE ASCENT BATTERIES WILL NOT BE CONNECTED UNTIL THE NOMINAL TIME TO MEET PRECONDITIONING REQUIREMENTS.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	B	10/31/79	LM ELECTRICAL	MANAGEMENT	22-4

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				----- * SPECIFIC * -----	
22-20		LOSS OF EITHER DC BUS			REF MALF PROC EPG---
		ALL	A.	DELAY STAGING ALAP	1 UNSTAGED DC BUS
		DOCKED	B.	CONTINUE MISSION	2 STAGED DC BUS
			3.	DO NOT UNDOCK	
			E.	CREWMEN OPERATE WITH CONNECTING MATCHES OPEN AND TUNNEL CLEAR	LOSS OF DC BUS RESULTS IN LOSS OF ONE PYRO SYSTEM
			3.	PERFORM LIMITED SYSTEMS EVALUATION	LOSS OF EITHER DC BUS DURING DESCENT ENGINE BURN RESULTS IN THROTTLING TO 100 PERCENT. IF ON INV 2, LOSS OF THE LMP BUS CAUSES THE ENG TO SHUT DOWN.
		UNDOCKED	C.	DOCK ASAP/ NO GO DOJ	
		DESCENT ORBIT	D.	NO GO PDJ/ DOCK ASAP	
		POWERED DESCENT	E.	ABORT DOCK ASAP	
		LUNAR STAY	F.	LIFTOFF AT NEXT BEST OPPORTUNITY	

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MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	QUES/NOTES/COMMENTS												
	22-21	SHORTED DC BUS FEEDER			REF MALF PROC EPS---												
	A: DESCENT	ALL UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY		1. CONTINUE MISSION 2. NO GO DOI/DOCK ASAP 3. DOCK ASAP 4. ABORT DOCK ASAP 5. LIPTOFF AT NEXT BEST OPPORTUNITY	1 UNSTAGED DC BUS 2 STAGED DC BUS 3 SEE MANAGEMENT RULE 22-16												
	B: ASCENT	ALL DOCKED UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY		1. DELAY STAGING ALAP 2. CONTINUE MISSION (A) DO NOT UNDOCK (B) CREWMEN OPERATE WITH CONNECTING HATCHES OPEN AND TUNNEL CLEAR (C) PERFORM LIMITED SYSTEMS EVALUATION 3. DOCK ASAP/NO GO DOI 4. NO GO DOI DOCK ASAP 5. ABORT DOCK ASAP 6. LIPTOFF AT NEXT BEST OPPORTUNITY	4 SEE MANAGEMENT RULE 22-16												
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APOLLO 13	8	10/31/79	LM ELECTRICAL	MANAGEMENT POWER	22-6												



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	QUES/NOTES/COMMENTS
22-22	LOSS OF ASCENT BATTERIES				REF MALF PROC EPG---
	A. LOSS OF ONE ASCENT BATTERY	DOCKED	1A.	1. CONTINUE MISSION DO NOT STAGE UNLESS DESCENT BATTERIES AND O2 ARE DEPLETED	2 STAGED DC BUS 4 STAGED C AND V POWER 8 STAGED BATTERY
		UNDOCKED			
		DESCENT ORBIT	2.	RETURN TO VICINITY OF CSM ASAP NO GO PDI  DO NOT STAGE UNLESS DESCENT BATTERIES AND O2 ARE DEPLETED	
		POWERED DESCENT	3.	1A) PDI TO PDI + 5 - ABORT DELAY STAGING A-LAP  1B) PDI + 5 TO TD - CONTINUE MISSION	
		LUNAR STAY	4.	LEPTOFF AT NEXT BEST OPPORTUNITY	
	B. LOSS OF TWO ASCENT BATTERIES	ALL	5.	1. DO NOT STAGE DO NOT UNDOCK DOCK ASAP IF UNDOCKED	NOTE--- THIS RULE DOES NOT APPLY AFTER PDI + 5

MISSION REV DATE SECTION GROUP PAGE

APOLLO 12 8 10/31/79 LM ELECTRICAL MANAGEMENT POWER 22-7

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULINS	CUES/NOTES/COMMENTS
	22-23	LOSS OF DESCENT BATTERY(S)			REF MALF PROC EPS---
		A. LOSS OF ONE DESCENT BATTERY	ALL	A. CONTINUE MISSION	1. UNSTAGED DC BUS B. UNSTAGED BAT TO ABNORMAL
		B. LOSS OF TWO DESCENT BATTERIES (ONE ON EACH BUS)	ALL	B.1. CONTINUE MISSION	NOTE--- SEE MANAGEMENT RULE 22-18. ASCENT CONSUMABLES DICTATE GO/NO GO FOR REMAINING MISSION PHASES.
		C. LOSS OF TWO DESCENT BATTERIES ON THE SAME BUS	DOCKED UNDOCKED DESCENT ORBIT POWERED DESCENT	C. 1. CONTINUE MISSION	
			LUNAR STAY	2. LIFT OFF AT NEXT BEST OPPORTUNITY	
		D. LOSS OF THREE OR MORE DESCENT BATTERIES	DOCKED	D. 1. DO NOT UNDOCK OPERATE WITH CONNECTING MATCHES OPEN AND TUNNEL CLEAR	
			UNDOCKED	2. DOCK ASAP, NO GO DOI	
			DESCENT ORBIT	3. NO GO PDI DOCK ASAP	
			POWERED DESCENT	4. (A) PDI TO LO GATE - ABORT DOCK ASAP (B) LO GATE TO TD - CONTINUE MISSION	
			LUNAR STAY	5. LIFT OFF AT NEXT BEST OPPORTUNITY	

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MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS												
	22-24	LOSS OF INVERTER(S)			REF MALF PROC EPS---												
	A. LOSS OF ONE INVERTER	ALL	A.	1. CONTINUE MISSION	6 INVERTER												
	B. LOSS OF BOTH INVERTERS	DOCKED UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY	B.	1. CONTINUE MISSION NO GO DOI 2. DO NOT PERFORM PDI 3.(A) PDI TO LG GATE - ABORT 1B) LG GATE TO TD - CONTINUE MISSION 4. CONTINUE MISSION	1. LOSS OF AC POWER RESULTS IN LOSS OF DPS GIMBAL, RR, 8-8ND STEERABLE ANT (MBA TM IS BOTH FDI) SPHERES. MBA TM IS AVAILABLE FROM AN OMNI ANTENNA AND A 210 FT. MFPN SITE.												
	22-25	LOSS OF AC BUSES			REF MALF PROC EPS---												
	A. LOSS OF BUS A	DOCKED UNDOCKED DESCENT ORBIT/ POWERED DESCENT/ LUNAR STAY	A.	1. CONTINUE MISSION NO GO FOR DOI 2. CONTINUE MISSION	6 INVERTER LOSS OF AC BUS A RESULTS IN LOSS OF DPS GIMBAL CONTROL, RENZO RADAR, AND INTEGRAL LIGHTING LOSS OF AC BUS B RESULTS IN LOSS OF 8-1 4D STEERABLE ANTENNA (MBA TM) AND NUMERIC LIGHTING. MBA TM IS AVAILABLE FROM AN OMNI ANTENNA AND A 210 FT MFPN SITE.												
	B. LOSS OF BUS B	ALL	B.	CONTINUE MISSION	LOSS OF BOTH AC BUSES RESULTS IN THE ABOVE PLUS LOSS OF BOTH FDI SPHERES AND THE AGT												
	C. LOSS OF BOTH BUS A AND B	DOCKED/ UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY	C.	1. CONTINUE MISSION- NO GO DOI 2. DO NOT PERFORM PDI 3.(A) PDI TO LG GATE- ABORT 1B) LG GATE TO TD - CONTINUE MISSION 4. CONTINUE MISSION													
	RULE NUMBERS 22-26 THROUGH 22-49 ARE RESERVED.																
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	8	10/31/69	LM ELECTRICAL POWER	SPECIFIC	22-9												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 22 - LM ELECTRICAL POWER - CONCLUDED

REV	ITEM	----- INSTRUMENTATION REQUIREMENTS -----				
22-30	MEAS DESCRIPTION	PCM	ONBOARD	CATEGORY	MISSION RULE REFERENCE	
	AC BUS FREQ	0C0189P	CAUT	1 OF 2	22-2.5.26.25	
	AC BUS VOLTS	0C0071V	METER, CAUT	M		
	BAT 1 CUR	0C1201C	METER	1 OF 2	M PCM	
	BAT 2 CUR	0C1202C	METER	M PCM		
	CDR BUS VOLTS	0C0201V	METER	1 OF 2	22-2.10.14.20.21.22	
	BAT 1 VOLTS	0C0201V	METER	M		
	BAT 2 VOLTS	0C0202V	METER			
	BAT 3 VOLTS	0C0203V	METER			
	BAT 3 CUR	0C1203C	METER	1 OF 2	M PCM	
	BAT 4 CUR	0C1204C	METER	M PCM		
	LMP BUS VOLTS	0C0202V	METER	1 OF 2	M	
	BAT 3 VOLTS	0C0203V	METER			
	BAT 4 VOLTS	0C0204V	METER			
	BAT 5 VOLTS	0C0205V	METER	M	22-2.10.14.20.21.22	
	BAT 6 VOLTS	0C0206V	METER	M		
	BAT 5 CUR	0C1205C	METER	M PCM	M PCM	
	BAT 6 CUR	0C1206C	METER	M PCM		
	BAT 1 MAL	0C9961U	CAUT, COMP	NO	22-2.10.14.20.21.22	
	BAT 2 MAL	0C9962U	CAUT, COMP	NO		
	BAT 3 MAL	0C9963U	CAUT, COMP	NO		
	BAT 4 MAL	0C9964U	CAUT, COMP	NO		
	BAT 5 MAL	0C9965U	CAUT, COMP	NO		
	BAT 6 MAL	0C9966U	CAUT, COMP	NO	22-2.10.20.21.22.23	
	BATTERY MAL	0L4047X	COMP	NO		
	BAT 1 LOW TAP	0C4362R	FLAG	NO	22-2.10.20.21.22	
	BAT 2 LOW TAP	0C4364R	FLAG	NO		
	BAT 3 LOW TAP	0C4366R	FLAG	NO		
	BAT 4 LOW TAP	0C4368R	FLAG	NO		
	BAT 5 D/V CDR	0C4369X	FLAG	NO	22-2.10.17.20.21.22	
	BAT 4 NORM CDR	0C4370R	FLAG	NO		
	BAT 5 NORM LMP	0C4371R	FLAG	NO		
	BAT 6 D/V LMP	0C4372R	FLAG	NO		
NOTE--- LOSS OF SEVERAL OF THE NO MEASUREMENTS ABOVE WILL CAUSE SEVERELY DEGRADED MISSION MONITORING CAPABILITY.						



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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM													
		<p style="text-align: center;">-----                      * GENERAL *                      -----</p> <p>23-1 TO INITIATE THE MANNED LM PHASES THE ENVIRONMENTAL CONTROL SYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES---</p> <p style="text-align: center;">NOTE                      LM ACTIVE RENDEZVOUS/CONTINGENCY                      RETURN IS ASSUMED</p> <p>A. DOCKED WITH HATCH OPEN AND TUNNEL CLEAR</p> <ol style="list-style-type: none"> <li>1. COMBINED VEHICLE PRESSURE INTEGRITY</li> <li>2. ONE LM COOLANT LOOP</li> </ol> <p>B. DOCKED WITH HATCH CLOSED</p> <ol style="list-style-type: none"> <li>1. CABIN PRESSURE INTEGRITY</li> <li>2. SUIT LOOP INTEGRITY</li> <li>3. ONE SUIT PAN</li> <li>4. ONE DEMAND REGULATOR</li> <li>5. ONE COOLANT LOOP</li> <li>6. SUFFICIENT O<sub>2</sub>, H<sub>2</sub>O, AND LIQUID CONSUMABLES TO COMPLETE THE PLANNED ACTIVITY PERIOD PLUS A RESERVE OF 1 HOUR</li> </ol> <p>C. UNDOCKED/SEPARATION AND SUBSEQUENT PHASES SEE LM TELCOM GO/NO GO CRITERIA - PAGE 3-18.</p>												
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 15%;">E-OWP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 14</td> <td>PM</td> <td>9/10/64</td> <td>LM ENVIRONMENTAL CONTROL</td> <td>GENERAL</td> <td>23-1</td> </tr> </table>	MISSION	REV	DATE	SECTION	E-OWP	PAGE	APOLLO 14	PM	9/10/64	LM ENVIRONMENTAL CONTROL	GENERAL	23-1
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APOLLO 14	PM	9/10/64	LM ENVIRONMENTAL CONTROL	GENERAL	23-1									

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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM												
23-2	<p>DEFINITIONS--</p> <p>LOSS OF CABIN INTEGRITY</p> <p>LM PRESSURE VESSEL LEAKAGE SUCH THAT CABIN PRESSURE CANNOT BE MAINTAINED GREATER THAN OR EQUAL TO 4.6 PSIA WITH AN O2 FLOW RATE OF 0.6 LBS/HR. FOR DOCKED ACTIVITIES THIS WILL BE RELAXED TO A FLOW RATE OF 5 LBS/HR.</p> <p>LOSS OF SUIT LOOP INTEGRITY</p> <p>TOTAL PGA/SUIT LOOP LEAKAGE GREATER THAN OR EQUAL TO 0.5 PSI/MIN (0.6 LBS/HR) DURING SUIT LOOP PRESSURE CHECK OR A VISIBLE TEAR IN THE PGA.</p> <p>LOSS OF COOLANT LOOP</p> <p>A. SUSTAINED GLYCOL TEMPERATURE GREATER THAN OR EQUAL TO 80 DEGREE F AND RISING EXCEPT DURING COOLANT LOOP STARTUP AND DRYOUT (SUBLIMATOR LOSS)</p> <p>B. GLYCOL PUMP DELTA P LESS THAN OR EQUAL TO 5 PSID (CIRCULATION LOSS) OR KNOWN LOSS OF H2O FEED CAPABILITY TO THE SUBLIMATOR(S).</p> <p>GLYCOL COOLANT LEAK</p> <p>OBSERVED FLUID IN CABIN CONFIRMED BY TASTE OR PRESENCE OF GLYCOL LOW INDICATION CONFIRMED BY STATIC PRESSURE DROP.</p> <p>LOSS OF DESCENT O2 TANK</p> <p>INABILITY TO TRANSFER O2 FROM DESCENT TANK OR MSPN CONFIRMATION OF INADEQUATE DESCENT TANK PRESSURE WITH O2 MANIFOLD PRESSURE.</p> <p>LOSS OF ASCENT O2 TANK</p> <p>A. MSPN CONFIRMATION OF LOSS OF ASCENT TANK PRESSURE WITH O2 MANIFOLD PRESSURE-- OR</p> <p>B. IF O2 MANIFOLD PRESSURE CANNOT BE READ, AND VEHICLE IS UNSTAGED AND DESCENT O2 TANK GREATER THAN 33 PERCENT; CREW MAY CONFIRM LOSS BY BALANCING ONE TANK AGAINST THE OTHER, WITH MSPN COVERAGE-- OR</p> <p>C. IF STAGED OR IF DESCENT O2 LESS THAN 33 PERCENT; LOSS OF ONBOARD AND MSPN READOUTS.</p> <p>LOSS OF DESCENT H2O TANK</p> <p>A. MSPN CONFIRMATION OF LOSS OF DESCENT TANK PRESSURE WITH DES H2O P AND H2O DELTA P</p> <p>B. INABILITY TO SUPPLY H2O TO W/S RESULTING IN RISING GLYCOL AND SUIT LOOP TEMPERATURE (CREW AND MSPN) AND DROP IN H2O DELTA P (MSPN ONLY).</p> <p>LOSS OF ASCENT H2O TANK</p> <p>A. LOSS OF MEASUREMENT AND REMAINING TANK FEEDING AT TWICE NORMAL RATE</p> <p>B. ONE TANK FEEDING TWICE NORMAL RATE AND NO CHANGE IN MEASUREMENT ON OTHER TANK.</p> <p>23-3 IF A SUBLIMATOR IS LOST DUE TO BREAKTHROUGH; NO RESTART ATTEMPT WILL BE MADE.</p> <p>23-4 OXYGEN PURGE SYSTEM AND PLS CONSUMABLES WILL BE RESERVED FOR POSSIBLE EVT AND WILL NOT BE CONSIDERED FOR LM 00/NO-00'S OR REDLINES.</p> <p>23-5 TWO POUNDS OF OXYGEN CONTAINED IN THE LM CABIN WILL BE CONSIDERED AVAILABLE IN CALCULATING 00/NO-00'S OR REDLINES; THE CABIN CAN BE CONSIDERED WHEN DISCUSSING FUNCTIONAL PRESSURE VESSEL REQUIREMENTS; AS A BACKUP TO THE ASCENT O2 TANKS.</p> <p>23-6 ANY SPECIFIC MISSION RULES REQUIRING A NEXT BEST OPPORTUNITY LIFTOFF WILL BE CAUSE FOR TERMINATION OF AN EVA; ADDITIONALLY, A CREWMAN WILL BE REQUIRED TO RETURN FROM AN EVA TO CORRECT A FAILED OPEN DEMAND REGULATOR.</p> <p>RULE NUMBERS 23-7 THROUGH 23-9 ARE RESERVED.</p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	FAL	07/07/69	LM ENVIRONMENTAL CONTROL	GENERAL	23-2								

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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

SYSTEMS MANAGEMENT

REV	ITEM
23-10	DELETED
23-11	IF EITHER ASCENT O2 TANK IS LESS THAN OR EQUAL TO 95 PERCENT; IT WILL BE REPLENISHED FROM THE DESCENT O2 WHEN THE DESCENT TANK QUANTITY IS GREATER THAN OR EQUAL TO 35 PERCENT AND AS CLOSE TO STAGING AS POSSIBLE.
23-12	THE PLSS FILL VALVE WILL BE CLOSED, EXCEPT FOR REPRESSURIZING THE PLSS AND FOR MSPM REQUESTED READOUTS OF O2 MANIFOLD PRESSURE.
23-13	CREW WILL GO TO EGRESS MODE IF INSUFFICIENT O2 IS AVAILABLE TO MAINTAIN CABIN PRESSURE FOR THE REQUIRED TIME; ADDITIONALLY, A MISSION PHASE WILL NOT BE INITIATED IF THIS CONDITION CAN BE ANTICIPATED.
	RULE NUMBERS 23-14 THROUGH 23-19 ARE RESERVED.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	FNL	9/10/69	LM ENVIRONMENTAL CONTROL	MANAGEMENT	23-9











NASA - Manned Spacecraft Center

MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-24	LOSS OF H2O SEPARATOR(S) AND/OR LCG LOOP			REF HALP PROC ECS--- 7B ECS
		A: ONE H2O SEPARATOR (LCG LOOP OPERABLE)	ALL	A: CONTINUE MISSION	
		B: TWO H2O SEPARATORS (LCG LOOP OPERABLE) OR ONE H2O SEPARATOR AND LCG LOOP	DOCKED	B-1: CONTINUE MISSION	
			UNDOCKED DESCENT ORBIT	2: DOCK ASAP DO NOT STAGE WHILE UNDOCKED	
			POWERED DESCENT	3: (A) POI TO POI +3 ABORT DELAY STAGING ALAP (B) POI +3 TO 10 CONTINUE MISSION	
			LUNAR STAY	4: LIFTOFF NEXT BEST OPPORTUNITY	
			AND2	5: CONTINUE MISSION AND DOCK ASAP	
		C: TWO H2O SEPARATORS AND LCG LOOP	DOCKED	C-1: CONTINUE MISSION	
			UNDOCKED DESCENT ORBIT	2: DOCK ASAP DO NOT STAGE WHILE UNDOCKED	
			POWERED DESCENT	3: (A) POI TO POI +3 ABORT DELAY STAGING ALAP (B) POI +3 TO 10 CONTINUE MISSION	
			LUNAR STAY	4: LIFTOFF NEXT BEST OPPORTUNITY	
			AND2	5: CONTINUE MISSION AND DOCK ASAP	

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MISSION RULES

SECTION 28 - LM ENVIRONMENTAL CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	28-28	LOSS OF O2 TANK(S)			
		A. ONE ASCENT TANK	ALL	A. CONTINUE MISSION	
		B. TWO ASCENT TANKS	DOCKED	B.1. DO NOT UNDOCK	
			UNDOCKED	B.2. DOCK ASAP DELAY STAGING ALAP	
			DESCENT ORBIT	B.3(A) PD1 TO PD1 + 5 - ABORT DELAY STAGING ALAP	
			POWERED DESCENT	B.3(B) PD1 + 8 TO LO GATE ABORT	
				B.3(C) LO GATE TO TOUCHDOWN CONTINUE MISSION	B.3(C) ASSUMES DESCENT O2 STILL AVAILABLE
			LUNAR STAY	B.4. LIPT OFF AT NEXT BEST OPPORTUNITY	
			RND2	B.5. CONTINUE MISSION	
		C. DESCENT TANK	ALL	C.1. CONTINUE MISSION	
			LUNAR STAY	C.2. LIPT OFF NEXT BEST OPPORTUNITY	



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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
23-27	LOSS OF PRIMARY H2O #8EOPATH	DOCKED UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY RNDZ		CONTINUE MISSION NO GO FOR UNDOCKING RETURN TO VICINITY OF CSM 1. PDI TO PDI + 5 - ABORT 2. PDI + 5 TO TD - CONTINUE MISSION LIFTOFF NEXT BEST OPPORTUNITY CONTINUE MISSION	REF HALF PROC ECS--- GLYCOL												
23-28	LOSS OF H2O TANK(S) A. ONE ASCENT TANK	DOCKED UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY RNDZ		A.1. CONTINUE MISSION 2. RETURN TO VICINITY OF CSM ASAP DELAY STAGING ALAP NO GO PDI 3.(A) PDI TO PDI + 5 - ABORT DELAY STAGING ALAP 1(B) PDI + 5 TO TOUCHDOWN CONTINUE MISSION 4. LIFT OFF NEXT BEST OPPORTUNITY 5. CONTINUE MISSION	DURING POWERED DESCENT, IT IS IMPOSSIBLE TO CONFIRM THE LOSS OF AN ASCENT TANK												
	B. TWO ASCENT TANKS	DOCKED UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY RNDZ		B.1. CONTINUE MISSION 2. RETURN TO VICINITY OF CSM ASAP DO NOT STAGE NO GO PDI 3.(A) PDI TO PDI + 5 - ABORT DO NOT STAGE 1(B) PDI + 5 TO LO-GATE ABORT 1(C) LO GATE TO TOUCHDOWN CONTINUE MISSION 4. LIFTOFF NEXT BEST OPPORTUNITY 5. INITIATE CSM RESCUE	POWER DOWN LM												
	C. DESCENT TANK	DOCKED UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY RNDZ		C.1. CONTINUE MISSION 2. CONTINUE MISSION NO GO PDI 3. LIFTOFF NEXT BEST OPPORTUNITY													
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MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	A	10/19/69	LM ENVIRONMENTAL CONTROL	SPECIFIC	23-12												



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULES	CUES/NOTES/COMMENTS		
	23-29	FIRE OR SMOKE IN CABIN OR SUIT	ALL	TROUBLESHOOT/COMBAT FIRE  ASSESS DAMAGE AND TRANSFER TO CSM IF NECESSARY	REF AOM PROC 3-3-2		
	23-30	CONTAMINATION IN CABIN	ALL	CREW MAY ELECT TO DECOMPRESS	IF UNABLE TO CLEAR CONTAMINATION, MISSION MAY BE TERMINATED EARLY.		
	23-31	GLYCOL COOLANT LEAK	ALL	TRANSFER TO CSM	REF HALF PROC ECS---		
		A. CABIN	ALL	A. PURGE SUIT WITH DIRECT O2	B. GLYCOL		
		B. SUIT	ALL	B. DISCONNECT FROM SUIT LOOP			
		RULE NUMBERS 23-32 THROUGH 23-49 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/10/69	LM ENVIRONMENTAL CONTROL	SPECIFIC	23-12

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL - CONCLUDED

REV	ITEM	INSTRUMENTATION REQUIREMENTS				
23-30	MEAS DESCRIPTION	PCM	ONBOARD	CATEGORY	MISSION RULE REF	
	SUIT PRESS	GF1301P	METER WARNING	M HD	23-1.2.6.20,21,23	
	CABIN PRESS	GF3571P	METER	1 OF 5		
	U/H R/L PRESS	GF3581P	-----	M	23-1.2.9.19,20,21, 23,29	
	F/H R/L PRESS	GF3592P	-----			
	DES O2 PRESS	GF3584P	METER; CAUT	1 OF 2		
	O2 FLO PRESS	GF3589P	-----	M	22-1.2.6.11,12,13, 23,23,25	
	ASL 1 O2 PRESS	GF3582P	METER; CAUT	1 OF 5		
	ASC 2 O2 PRESS	GF3583P	METER; CAUT	M		
	GLYCOL PUMP DELTA P	GF2021P	-----	} } 1 OF 2	23-1.2.3.6.26,31	
	SEC GLYCOL PUMP PRESS	GF2921P	-----			
	GLYCOL PUMP PRESS	GF9997U	METER			
	SEL GLYCOL LVL LOW	GF9986U	CAUT			
	GLYCOL TEMP	GF9998U	METER; CAUT	1 OF 2	23-1.2.3.6.26,31	
	GLYCOL OUTLET TEMP	GF2981T	-----	} } M		
	SUIT TEMP	GF1201T	METER			
	GLYCOL INLET TEMP	GF2981T	-----			
	DES H2O QTY	GF4581O	METER; CAUT	1 OF 2		
	DES H2O PRESS	GF4501P	-----	M	23-1.2.27,26	
	ASC 1 H2O QTY	GF4582O	METER; CAUT	1 OF 2		
	ASC 2 H2O QTY	GF4583O	METER; CAUT	M		
	PRI H2O REG DELTA P	GF4101P	-----	M	23-1.2.27,26	
	RTG TEMP	GL8275T	-----	HD		
	REPR ELEC OPEN	GF3972X	WARNING	HD	23-1.2.9.19,20,21,23,	
	CO2 PART PRESS	GF1921P	METER; CAUT; COMP	HD	23-1.2.4,30	
	H2O SEP RATE	GF9999U	CAUT; COMP	HD	23-1.22,24	
	SUIT DIV EGRESS	GF1221X	-----	HD	23-1.2.20,21,22,29	

MISSION REV DATE SECTION GROUP PAGE

APOLLO 12 0 10/31/69 LM ENVIRONMENTAL CT INSTR REG 23-13

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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM													
		<p>*****                      ! GENERAL !                      *****</p>												
	24-1	RESERVED												
	24-2	<p><b>DEFINITIONS</b></p> <p><b>3-AXIS AUTO ATTITUDE CONTROL AND HOLD CAPABILITY</b></p> <p>3-AXIS AUTO ATTITUDE CONTROL AND HOLD CAPABILITY IS DEFINED AS THE LM'S ABILITY TO AUTOMATICALLY HOLD AND CONTROL ATTITUDE; IN ORDER TO HAVE THIS CAPABILITY THE LM REQUIRES EITHER AN OPERATIONAL PGNS OR AN OPERATIONAL AGS.</p> <p><b>3-AXIS CONTROL</b></p> <p>3-AXIS CONTROL IS DEFINED AS THE ABILITY TO CHANGE THE EXISTING VEHICLE ATTITUDE; TO HAVE THIS CAPABILITY THE LM REQUIRES AN OPERATIONAL MANUAL OR AUTOMATIC CONTROL SYSTEM.</p> <p><b>OPERATIONAL PGNS</b></p> <p>AN OPERATIONAL PGNS IS DEFINED AS NO LGC FAILURE; NO ISS FAILURE; AND NO DSKY FAILURES:</p> <p>A. ANY FAILURE OF THE LGC HARDWARE AND/OR THE ASSOCIATED INPUT/OUTPUT INTERFACES WHICH CANNOT BE REMEDIED BY CREW PROCEDURES IS CONSIDERED AN LGC FAILURE;</p> <p>B. ANY FAILURE WITHIN THE IMU; COU; PTA; OR THE PSA WHICH WOULD CAUSE A PERMANENT LOSS OF THE INERTIAL ATTITUDE AND VELOCITY MEASUREMENT; IS CONSIDERED AN ISS FAILURE;</p> <p>C. ANY FAILURE OF THE DSKY HARDWARE AND/OR THE ASSOCIATED INPUT/OUTPUT INTERFACES WHICH CANNOT BE REMEDIED BY CREW PROCEDURES IS CONSIDERED A DSKY FAILURE;</p> <p><b>OPERATIONAL AGS</b></p> <p>AN OPERATIONAL AGS IS DEFINED AS NO AEA FAILURE; NO ASA FAILURE; NO DEDA FAILURE; AND NO CES FAILURE PREVENTING ATTITUDE CONTROL.</p> <p>A. ANY FAILURE OF THE AEA HARDWARE AND/OR THE ASSOCIATED INPUT/OUTPUT INTERFACES WHICH CANNOT BE REMEDIED BY CREW PROCEDURES IS CONSIDERED AN AEA FAILURE;</p> <p>B. ANY FAILURE OF THE ASA HARDWARE AND/OR THE ASSOCIATED INPUT/OUTPUT INTERFACES WHICH CAUSE LOSS OF THE VEHICLE ATTITUDE AND VELOCITY MEASUREMENTS IS CONSIDERED AN ASA FAILURE;</p> <p>C. ANY FAILURE OF THE DEDA HARDWARE AND/OR THE ASSOCIATED INPUT/OUTPUT INTERFACES WHICH CANNOT BE REMEDIED BY CREW PROCEDURES IS CONSIDERED A DEDA FAILURE;</p> <p>D. ANY FAILURE OF THE CES HARDWARE THAT PREVENTS ATTITUDE CONTROL WHILE IN AGS IS CONSIDERED A CES FAILURE;</p> <p><b>3-AXIS TRANSLATION</b></p> <p>3-AXIS TRANSLATION IS DEFINED AS THE ABILITY TO CHANGE THE VEHICLE VELOCITY; PLUS OR MINUS; ALONG EACH BODY AXIS; TO HAVE THIS CAPABILITY THE LM REQUIRES ONE TICA AND AN OPERATIONAL PGNS OR OPERATIONAL CES CIRCUITRY.</p>												
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APOLLO 12/FHL		9/10/69	LM GUIDANCE AND CONTROL	GENERAL	24-1									

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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM													
		<p>-----                      MANAGEMENT                      -----</p>												
	24-3	<p>IMU</p> <p>A. IRIG BIAS UPDATES WILL BE ACCOMPLISHED AS FOLLOWS---</p> <ol style="list-style-type: none"> <li>1. INFLIGHT; WHEN GYRO DRIFT IS GREATER THAN OR EQUAL TO +/- .075 DEG/HR IS MERU)</li> <li>2. ON LUNAR SURFACE; WHENEVER THE GYRO DRIFT IS GREATER THAN OR EQUAL TO +/- .075 DEG/HR (S MERU) AS CALCULATED BETWEEN TWO ALIGNMENTS USING THE SAME OPTION AND ALIGNMENT TECHNIQUE.</li> <li>3. DOCKED ALIGNMENT; NO ATTEMPT WILL BE MADE TO UPDATE IRIG BIAS BASED ON DOCKED IMU ALIGNMENT</li> </ol> <p>B. THE PNGS WILL BE CONSIDERED NO-GO WITH A GYRO DRIFT GREATER THAN OR EQUAL TO +/- 1.5 DEG/HR (100 MERU); THE MAXIMUM ALLOWABLE VALUE WITHIN THE LGC IS +/- 1.99 DEG/HR (126 MERU).</p> <p>C. PIPA BIAS UPDATES WILL BE ACCOMPLISHED AS FOLLOWS---</p> <ol style="list-style-type: none"> <li>1. NO BIAS UPDATES WILL BE ACCOMPLISHED PRIOR TO 30 MIN OF IMU OPERATION.</li> <li>2. THE INITIAL BIAS UPDATES WILL BE ACCOMPLISHED IF THE ABSOLUTE VALUE IS GREATER THAN OR EQUAL TO +/- 0.3 CM/SEC 2 AND THE DELTA D1'S IS GREATER THAN OR EQUAL TO +/- 0.03 CM/SEC 2.</li> <li>3. SUBSEQUENT TO THE INITIAL BIAS UPDATE; UPDATES WILL BE ACCOMPLISHED WHENEVER THE ABSOLUTE BIAS IS GREATER THAN OR EQUAL TO +/- 0.3 CM/SEC 2 AND THE DELTA BIAS IS GREATER THAN OR EQUAL TO +/- 0.3 CM/SEC 2.</li> <li>4. PIPA BIAS WILL NOT BE UPDATED WHILE THE LM IS ON THE LUNAR SURFACE.</li> </ol> <p>D. PNGS NO-GO FOR PIPA BIAS---- THE PNGS WILL BE CONSIDERED NO-GO IF THE PIPA BIAS EXCEEDS +/- 0.06 CM/SEC 2 SEC 1; 0.106 FT/SEC 2 SEC 1; THE MAXIMUM LOAD VALUE WITHIN THE LGC IS +/- 12.03 CM/SEC 2 SEC.</p>												
	24-4	<p>LGC</p> <ol style="list-style-type: none"> <li>A. A MASS UPDATE IS REQUIRED IF THE DIFFERENCE BETWEEN THE GROUND CALCULATION AND LGC VALUE DIFFER BY MORE THAN 200 LBS.</li> <li>B. ALL DESCENT ENGINE STARTS MUST NOMINALLY BE PRECEDED BY A PROPELLANT SETTling MANEUVER USING TWO SYSTEM B JETS OR IN CASE OF A CONTINGENCY TWO SYSTEM A JETS.</li> <li>C. ULLAGE FOR ALL APS BURNS MAY BE 4 JET OR 2 JET SYSTEM A OR B.</li> <li>D. ALL +/-IV-VI JETS WILL BE INHIBITED VIA V65 DURING DOCKED OPS BURNS.</li> <li>E. DURING DOCKED MANEUVERS; ALL DPS GIMBAL TRIMMING MUST BE DONE AT GREATER THAN 55 PERCENT THROTTLE IN THE AUTO THROTTLE MODE. THE RECOMMENDED SETTING IS 40 PERCENT THROTTLE.</li> </ol>												
	24-5	<p>RENDEZVOUS RADAR</p> <ol style="list-style-type: none"> <li>A. THE RR MUST NOT BE OPERATED UNTIL 2 1/2 HOURS AFTER OPERATE HEATER ACTIVATION AND THE ANTENNA TEMPERATURE (IHPM) IS GREATER THAN OR EQUAL TO 10 DEG. F AND THE GYRO PACKAGE IS ESTIMATED TO BE GREATER THAN OR EQUAL TO 15 DEG F.</li> <li>B. THE RR SHOULD NOT BE OPERATED AT AN ANTENNA TEMPERATURE GREATER THAN OR EQUAL TO 145 DEG F AND/OR A GYRO PACKAGE TEMP (ESTIMATED) OF GREATER THAN OR EQUAL TO 200 DEG F.</li> <li>C. IF IT IS ESTIMATED THAT THE RR GYRO PACKAGE WILL EXCEED 200 DEG F (IHPM APPROX. 135 DEG F) PRIOR TO COMPLETION OF THE BRAKING PHASE; THE RR SHOULD BE TURNED OFF UNTIL REQUIRED FOR TP1 AND BRAKING.</li> <li>D. IF THE ESTIMATED GYRO PACKAGE TEMP SHOULD EXCEED 200 DEG F (IHPM APPROX. 135 DEG F) ANYTIME DURING THE BRAKING PHASE; THE AC POWER TO THE RR SHOULD NOT BE TURNED OFF.</li> </ol>												
		<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/15/69</td> <td>LM GUIDANCE AND CONTROL</td> <td>MANAGEMENT</td> <td>24-2</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	A	10/15/69	LM GUIDANCE AND CONTROL	MANAGEMENT	24-2
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	A	10/15/69	LM GUIDANCE AND CONTROL	MANAGEMENT	24-2									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM						
		<p>D. IF THE ESTIMATED BYRO PACKAGE TEMP SHOULD EXCEED 200 DEG F (MPN APPROX. 335 DEG F) ANYTIME DURING THE BREAKING PHASE, THE AC POWER TO THE RR SHOULD NOT BE TURNED OFF.</p> <p>E. IF THE RR ANTENNA TEMP (MPN) EXCEEDS THE NOMINAL TEMP PROFILE BY 15 DEG F, THE RR SHOULD BE TURNED OFF IF IT IS NOT NEEDED.</p> <p>F. IF THE RR OVEN HEATERS ARE TURNED OFF (BOTH THE PGAS---RADE RDR AND HEATERS---RADE RDR OPR OPEN), RR RANGE DATA MUST NOT BE USED UNTIL 17 MIN AFTER RE-ENERGIZING, ASSUMING THE OVEN TEMP HAS DROPPED TO THE COLD RAIL TEMP.</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PNL	9/10/69	LM GUIDANCE AND CONTROL	MANAGEMENT	24-3

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM												
24-6	<p>LANDING RADAR</p> <p>A. THE LR SHOULD NOT NORMALLY BE OPERATED AT AN ANTENNA TEMP LESS THAN + 90 DEG F; HOWEVER, THE LUNAR LANDING MISSION WILL BE ATTEMPTED IF THE ANTENNA TEMP IS ABOVE THE CRITICAL LIMIT OF +19 DEG F (HARDWARE DAMAGE).</p> <p>B. LR ACTIVATION WILL BE DELAYED TO PDJ + 4 MIN IF THE LR TEMP IS GREATER THAN 199 DEG F. AT NOMINAL TIG +1.5 MIN (LR ACTIVATION).</p> <p>C. PDJ WILL BE DELAYED ONE REV IF THE LR TEMP IS GREATER THAN 147 DEG.F, AT NOMINAL TIG +1.5 MIN (LR ACTIVATION).</p>												
24-7	<p>AGS</p> <p>A. THE AGS IS DECLARED NO-GO WITH A TEMPERATURE OF LESS THAN + 40 DEG F OR GREATER THAN + 199 DEG F.</p> <p>B. THE AGS IS DECLARED NO-GO DURING A GYRO AND ACCELEROMETER CALIBRATION IF THE GYRO DRIFT CHANGE IS GREATER THAN 2.00 DEG/HR AND IF THE ACCELEROMETER BIAS CHANGE IS GREATER THAN 0.039 FT/SEC2 FROM THE VALUE AT THE START OF THE CALIBRATION.</p> <p>C. THE AGS MUST BE UPDATED WITHIN 1 MINUTES OF A BURN.</p> <p>D. THE AGS CAN BE USED TO PERFORM DOCKED ATTITUDE HOLD CONTROL.</p> <p>E. THE AGS IN PULSE MODE USING ONLY TTCA CONTROL CAN BE USED TO PERFORM A DOCKED OPS BURN.</p> <p>RULE NUMBERS 24-8 THROUGH 24-19 ARE RESERVED.</p>												
<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>B</td> <td>10/31/79</td> <td>LM GUIDANCE AND CONTROL</td> <td>MANAGEMENT</td> <td>24-4</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	B	10/31/79	LM GUIDANCE AND CONTROL	MANAGEMENT	24-4
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	B	10/31/79	LM GUIDANCE AND CONTROL	MANAGEMENT	24-4								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				----- : SPECIFIC : -----	
24-20	LOSS OF OPERATIONAL PGNS	DOCKED/ UNDOCKED		1. RETURN TO CSM ASAP 2. NO-GO FOR DOI	0. REF MALF PROC PGNS-- 2. ISS WARN
		DESCENT/ ORBIT		1. STOP BURN IF BURNING 2. RETURN TO CSM ASAP 3. NO-GO FOR DOI	2. LGC WARN 3. TEMP CAUTION
		POWERED DESCENT		1. PRIOR TO 4000 FT. (A) NO-GO FOR LANDING (B) ABORT 2. AFTER 4000 FT. (A) LAND MANUALLY (B) NO-GO FOR EXTENDED LUNAR STAY	4. SIMBAL LOCK
		LUNAR STAY		ASCENT AT NEXT BEST OPPORTUNITY	
		RNOZ		1. SWITCH TO AGS 2. CONTINUE MISSION	
24-21	LOSS OF PDAI FUNCTIONS (ATT, RATES, ERRORS)	ALL		CONTINUE MISSION CREW OPTION	
24-22	LOSS OF AOT	DOCKED/ UNDOCKED		PRIOR TO FINE ALIGNMENT 1. RETURN TO CSM ASAP 2. NO-GO FOR DOI AFTER FINE ALIGNMENT CONTINUE MISSION	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	B	10/31/79	LM GUIDANCE AND CONTROL	SPECIFIC - PGNS/CES/AGS	24-5



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	24-23	LOSS OF BENEVOLENT RADAR AND/OR TRANSPONDER	1. DOCKED/ UNDOCKED  2. ALL OTHERS	1. RETURN TO CSM ASAP  2. NO-GO FOR DOI  3. CONTINUE MISSION	1. REF HALF PROC PGNS--- 2. TRACKER 3. RAD2 RADAR CAUTION 3A. NO TRACK REF HALF PROC HTBS--- 3C. RR TEMP ABNORMAL		
	24-24	LOSS OF LANDING RADAR	1. DOCKED/ UNDOCKED  2. DESCENT ORBIT  3. POWERED DESCENT	1. RETURN TO CSM ASAP 2. NO-GO FOR DOI  1. RETURN TO CSM ASAP 2. NO-GO FOR DOI  1. PRIOR TO ADEQUATE ALTITUDE UPDATING OF LM STATE VECTORS--- (A) NO-GO FOR LANDING (B) ABORT  2. AFTER ADEQUATE ALTITUDE UPDATING OF LM STATE VECTORS--- CONTINUE MISSION	1. GUIDO TO DECIDE WHEN ADEQUATE UPDATING OF LM STATE VECTORS HAS BEEN ACCOMPLISHED. REF HALF PROC PGNS--- 6. ALT LT 7. VEL LY REF HALF PROC HTBS--- 8. LR TEMP ABNORMAL		
	24-25	VHF BANGING/OPTICAL TRACKING  A. LOSS OF EITHER  B. LOSS OF BOTH  RULE 24-26 IS RESERVED.	1. ALL  2. DOCKED/ UNDOCKED  3. ALL OTHERS	1. CONTINUE MISSION  2. 1.1A) RETURN TO CSM ASAP (B) NO GO FOR DOI  2. CONTINUE MISSION	1. CSM OPTICAL TRACKING CAPABILITY REQUIRES THE LM TRACKING LIGHT AND THE ABILITY TO VISUALLY TRACK.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/10/69	LM GUIDANCE AND CONTROL	SPECIFIC - PGNS/CS/AGS	24-5



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS
	24-20	LOSS OF 3-AXIS CONTROL			
		A: RECOULANT	DOCKED/ UNDOCKED	A.1.1A) RETURN TO CSM ASAP  1B) NO-GO FOR DOI	
			DESCENT ORBIT	2.1A) RETURN TO CSM ASAP  1B) NO-GO FOR DOI	
			POWERED DESCENT/	3.1A) PRIOR TO MI GATE - ABORT 1B) AFTER MI GATE - CONTINUE MISSION	
			LUNAR STAY	4. ASCENT AT NEXT BEST OPPORTUNITY	
			RNDZ	5. CONTINUE MISSION	
		B: ANY AXIS	POWERED DESCENT	B.1.1A) DOI TO LOW GATE ABORT  1B) AFTER LOW GATE CONTINUE MISSION  NO-GO FOR EXTENDED LUNAR STAY	
			RNDZ	2. NO-GO FOR LM ACTIVE RNDZ	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	9/18/69	LM GUIDANCE AND CONTROL	SPECIFIC - PONS/CES/AGS	24-0



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	24-30	LOSS OF PITCH OR ROLL GOA	FALL	ENGINE SIGNAL = OFF CONTINUE MISSION UNLESS RCS IMPINGEMENT CONSTRAINTS ARE VIOLATED.	RCS IMPINGEMENT CONSTRAINTS ARE A FUNCTION OF THE GOA POSITION AT THE TIME OF FAILURE, SOOB INFO WILL BE USED TO DETERMINE CAPABILITY TO COMPLETE DESCENT FOR A GIVEN GOA POSITION.			
	24-31	LOSS OF AUTO ENGINE ON/OFF CAPABILITY	DOCKED/ UNDOCKED  DESCENT ORBIT  POWERED DESCENT  LUNAR STAY	1. RETURN TO CSM ASAP 2. NO-GO FOR DOI  1. RETURN TO CSM ASAP 2. DOI INHIBITED 3. NO-GO FOR DOI  1. BACKUP DOI WITH DES ENG CMD OVRD SW 2. DOI TO DOI + 3. ABORT ONLY IF FAILURE AFFECTS ASCENT ENGINE 3. AFTER DOI + 3. CONTINUE THROUGH LANDING 4. NO-GO FOR EXTENDED LUNAR STAY IF FAILURE AFFECTS ASCENT ENGINE.  ASCENT AT NEXT BEST OPPORTUNITY CAPABILITY VIA MANUAL START	REF HALP PROC CES---  10 MPS DOES NOT THRUST WHEN EVENT TIMER IND 00:00			
	24-32	ENGINE DOES NOT IGNITE AFTER DES ENG CMD OVRD SW IS USED	POWERED DESCENT	1. INHIBIT DOI 2. RETURN TO CSM ASAP	REF HALP PROC CES ---  10 MPS DOES NOT THRUST WHEN EVENT TIMER IND 00:00			
	24-33	LOSS OF OPERATIONAL AGS	DOCKED/ UNDOCKED  DESCENT ORBIT  POWERED DESCENT  LUNAR STAY DOI	1A. RETURN TO CSM ASAP - NO GO FOR DOI 1B. RETURN TO CSM ASAP - NO GO FOR DOI 2. (1) PRIOR TO MI GATE - ABORT (2) AFTER MI GATE - CONTINUE MISSION 3. CONTINUE MISSION	REF HALP PROC AGS---  1 AGS WARNING LIGHT 2 DEGA RESPONSE IS ABNORMAL  NOTE--- CONSIDERATION WILL BE GIVEN TO CONTINUING BASED UPON AGS FAILURE MODES			
			MISSION	REV	DATE	SECTION	GROUP	PAGE
			APOLLO 13	PLM	9/10/66	LM GUIDANCE AND CONTROL	SPECIFIC PROCEDURES/AGS	24-10

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 24 - LR GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
24-34	LOSS OF AUTO THRUST CONTROL	DOCKED/ UNDOCKED	1. RETURN TO CSM ASAP 2. NO-GO FOR DOI	1. REF MALP PROC CES-- 2. ENG THR AND CMD DO NOT AGREE DURING DPS BURN	
		DESCENT ORBIT	1. RETURN TO CSM ASAP 2. IF BURNING, CONTINUE BURN 3. NO-GO FOR DOI	1. CMD THR DOES NOT RESPOND TO TTCA OR DOES NOT FOLLOW TIMELINE.	
		POWERED DESCENT	1. PRIOR TO 4000 FT: (A) IF CHOSD THROTTLE INDICATION GOOD WITH LOW ENG THRUST (1) DO NOT SEL MAN THROTTLE (2) SUPPLEMENT AUTO THROTTLE WITH MAN THROTTLE (B) ANY OTHER AUTO THROTTLE FAILURE (1) ABORT USING DPS (2) ABORT STAGE 20 SEC AFTER LOW LEVEL 2. AFTER 4000 FT: (A) SWITCH TO MANUAL THROTTLE (B) CONTINUE MISSION		
24-35	LOSS OF ALL MANUAL THRUST CONTROL	DOCKED/ UNDOCKED	1. RETURN TO CSM ASAP 2. NO-GO FOR DOI	SEE MANAGEMENT RULE 25-18 FOR ALLOWABLE TIME IN NON THROTTLEABLE REGION;	
		DESCENT ORBIT	1. RETURN TO CSM ASAP 2. IF BURNING, CONTINUE BURN 3. NO-GO FOR DOI	1. REF MALP PROC CES-- 2. ENG THR AND CMD THR DO NOT AGREE DURING DPS BURN	
		POWERED DESCENT	1. DO NOT SWITCH TO MANUAL THROTTLE 2. SELECT OTHER TTCA (A) REPAIR WITHIN ALLOWABLE TIME CONTINUE MISSION (B) IF THROTTLE OPERATED FOR MORE THAN ALLOWABLE TIME IN NON-THROTTLEABLE REGION - ABORT 3. AFTER THROTTLE DOWN, THROTTLE REQUIREMENT MAY BE DELETED BASED ON NOMINAL TRAJECTORY AND GUIDANCE.	1. CMD THR DOES NOT RESPOND TO TTCA OR DOES NOT FOLLOW TIMELINE REF 25-18 REF 25-18	
MISSION REV DATE SECTION GROUP PAGE					
APR 66 12 0 10/31/66 LR GUIDANCE AND CONTROL SPECIFIC PARA/CES/AGG 24-11					

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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
24-36	LOSS OF ACA A: ONE B: BOTH	DOCKED/ UNDOCKED  DESCENT ORBIT  POWERED DESCENT  LUNAR STAY RANGE	ALL	A: CONTINUE MISSION  B.1.(A) RETURN TO CSM ASAP (B) NO-GO FOR DOI  2.(A) RETURN TO CSM ASAP IF BURNING CONTINUE BURN (B) NO-GO FOR DOI  3.(A) ABORT USING DPS: ABORT STAGE 20 SEC AFTER LOW LEVEL  4.(A) CONTINUE MISSION  (B) CSM ACTIVE VEHICLE FOR DOCKING	1 REF MALF PROCES 2 LM DRIFTS OUT OF DEADBAND 3 PROP CHDS ABNORMAL
24-37	LOSS OF TPFA A: ONE B: BOTH	DOCKED/ UNDOCKED  DESCENT ORBIT  POWERED DESCENT  LUNAR STAY RANGE	ALL	A: CONTINUE MISSION  B.1.(A) RETURN TO CSM ASAP (B) NO-GO FOR DOI  2.(A) RETURN TO CSM ASAP IF BURNING CONTINUE BURN  1(C) NO-GO FOR TPI, TPF, AND DOCKING  3.(A) DO NOT SWITCH TO MANUAL THRUSTLE (B) ABORT USING DPS: ABORT STAGE AFTER ALLOWABLE TIME IN NON THRUSTLE RANGE  1(C) AFTER THRUSTLE DOWN MANUAL THRUSTLE REQUIREMENT MAY BE DELETED BASED ON NOMINAL TRAJECTORY AND GUIDANCE  4: CONTINUE MISSION  5: THE CSM MUST BE THE ACTIVE VEHICLE FOR TPI, TPF, AND DOCKING	1 REF MALF PROCES --- 2 AB-NORMAL VEHICLE DYNAMICS 3 ABSENCE OF NORMAL RESPONSE VIA TPFA  REF 24-35
24-38	LOSS OF LUNAR CONTACT LIGHTS  RULE NUMBER 24-39 IS OBSOLETE.	POWERED DESCENT		CONTINUE MISSION	

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MISSION RULES

SECTION 24 - M GUIDANCE AND CONTROL - CONTINUED

REV	ITEM	PRELAUNCH INSTRUMENTATION					MISSION RULE REFERENCE
24-40	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY		
	LGC DOWNLINK	000001U	.	.	M	24-20	
	PLS TORO REP	001840V	.	.	MD	24-20	
	2.3 VDC TM BIAS	001110V	.	.	MD	24-20	
	1MV 25 VAC 800	001201V	.	.	MD	24-20	
	IRIG SUSP 3.2 RC	001331V	.	.	MD	24-20	
	1MV 510V	001332V	.	.	MD	24-20	
	LGC ORR	001333V	.	.	MD	24-20	
	1 PIPA OUT IN PHASE	001081V	.	.	MD	24-20	
	2 PIPA OUT IN PHASE	001082V	.	.	MD	24-20	
	3 PIPA OUT IN PHASE	001083V	.	.	MD	24-20	
	4 PIPA OUT IN PHASE	001084V	.	.	MD	24-20	
	18 SV0 ERR IN PHASE	001187V	.	.	MD	24-20	
	18 1R RSVR OUT SIN	001188V	FDAI	COMMON	MD	24-20	
	18 1R RSVR OUT COS	001189V	FDAI	COMMON	MD	24-20	
	18 SV0 ERR IN PHASE	001187V	.	.	MD	24-20	
	18 1R RSVR OUT SIN	001188V	FDAI	COMMON	MD	24-20	
	18 1R RSVR OUT COS	001189V	FDAI	COMMON	MD	24-20	
	00 SV0 ERR IN PHASE	001187V	.	.	MD	24-20	
	00 RSVR OUT SIN	001188V	FDAI	COMMON	MD	24-20	
	00 RSVR OUT COS	001189V	FDAI	COMMON	MD	24-20	
	PITCH ATT ERR	001210V	FDAI	COMMON	MD + PCM	24-20	
	TAW ATT ERR	001240V	FDAI	COMMON	MD + PCM	24-20	
	ROLL ATT ERR	001270V	FDAI	COMMON	MD + PCM	24-20	
	PIPA TEMP	002300V		SEPARATE	M-PCM	24-20	
	RR SHFT SIN	003304V	FDAI	COMMON	MD + PCM	24-21	
	RR SHFT COS	003305V	FDAI	COMMON	MD + PCM	24-21	
	RR TRUN SIN	003306V	FDAI	COMMON	MD + PCM	24-21	
	RR TRUN COS	003307V	FDAI	COMMON	MD + PCM	24-21	
	LGC WARNING	003011V	CSW	COMMON	MD + PCM	24-20	
	1S WARNING	003012V	CSW	COMMON	MD + PCM	24-20	
	RR ANT TEMP	047553V	TEMP MONITOR	COMMON	M + PCM	24-23	
	RR NO TRACE	047554V	CSW	COMMON	MD + PCM	24-23	
	RR ANT TEMP	047553V	TEMP MONITOR	COMMON	M-PCM	24-23	
	TAW ERR CND	041847V	.	.	M	24-20	
	PITCH ERR CND	041848V	.	.	M	24-20	
	ROLL ERR CND	041849V	.	.	M	24-20	
	JO A/D OUTPUT	041410V	.	.	MD	24-27	
	ACS TEP A/D	041032X	.	.	MD	24-27	
	JO B/D OUTPUT	041411V	.	.	MD	24-27	
	ACS TEP B/D	041033X	.	.	MD	24-27	
	JO A/D OUTPUT	041412V	.	.	MD	24-27	
	ACS TEP A/D	041040X	.	.	MD	24-27	
	JO B/D OUTPUT	041413V	.	.	MD	24-27	
	ACS TEP B/D	041041X	.	.	MD	24-27	
	JO A/D OUTPUT	041414V	.	.	MD	24-27	
	ACS TEP A/D	041042X	.	.	MD	24-27	
	JO B/D OUTPUT	041415V	.	.	MD	24-27	
	ACS TEP B/D	041043X	.	.	MD	24-27	
	JO A/D OUTPUT	041416V	.	.	MD	24-27	
	ACS TEP A/D	041044X	.	.	MD	24-27	
	JO B/D OUTPUT	041417V	.	.	MD	24-27	
	ACS TEP B/D	041045X	.	.	MD	24-27	
	ACS TEP A/D	041046X	.	.	MD	24-27	
	ACS TEP B/D	041047X	.	.	MD	24-27	
	ACS TEP A/D	041048X	.	.	MD	24-27	
	ACS TEP B/D	041049X	.	.	MD	24-27	
	ACS TEP A/D	041050X	.	.	MD	24-27	
	ACS TEP B/D	041051X	.	.	MD	24-27	
	ACS TEP A/D	041052X	.	.	MD	24-27	
	ACS TEP B/D	041053X	.	.	MD	24-27	
	ACS TEP A/D	041054X	.	.	MD	24-27	
	ACS TEP B/D	041055X	.	.	MD	24-27	
	TAW ATT ERR	041455V	FDAI	COMMON	MD	24-20	
	PITCH ATT ERR	041456V	FDAI	COMMON	MD	24-20	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 14	PLN	8/18/78	LM GUIDANCE AND CONTROL	PRELAUNCH INSTR	24-13



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MISSION RULES

SECTION 24 - M GUIDANCE AND CONTROL - CONTINUED

REV	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
	24-40 CONT						
		ROLL ATT ERR	01187Y	FDI1	COMMON	NO	24-28
		RGA YAW RATE	01188Y	FDI1	COMMON	M ON BOARD	24-28
		RGA PITCH RATE	01189Y	FDI1	COMMON	M PCM/NO	24-28
		RGA ROLL RATE	01190Y	FDI1	COMMON	M	24-28
		AGG BEL	01191X	.	.	NO	24-28
		ROLL PLSD/DIR	01192X	.	.	NO	24-28
		PITCH PLSD/DIR	01193X	.	.	NO	24-28
		YAW PLSD/DIR	01194X	.	.	NO	24-28
		AUTO ON	01195X	.	.	NO	24-28
		APD ARM	01196X	.	.	M	24-28
		ENG FIRE QVAD	01197X	.	.	NO	24-28
		MAN THRUST CMD	01198Y	METER	SEPARATE	M	24-28, 24-29
		PITCH GDA POS	01199Y	.	.	M	24-28
		ROLL GDA POS	01200Y	.	.	M	24-28
		P TRM FAIL	01201X	CSW	COMMON	NO	24-28
		R TRM FAIL	01202X	CSW	COMMON	NO	24-28
		AUTO THRUST CMD	01203Y	METER	SEPARATE	NO	24-28
		DPS ARM	01204X	.	.	NO	24-28
		YAW INJ ACT POS	01205X	.	.	NO	24-28, 24-29
		CSW AC PWR FAIL	01206X	CSW	COMMON	NO	24-28
		CSW DC PWR FAIL	01207X	CSW	COMMON	NO	24-28
		AGS DOWNLINE DATA	01208X	.	.	NO	24-28
		ASA TEMP	01209X	.	.	NO	24-28
		ASA PUR/ASA FAIL	01210X	CSW	COMMON	NO	24-28
		AUTO OFF	01211X	.	.	NO	24-28, 24-29
		AGS AUTO	01212X	.	.	NO	24-28
		AGS ATT HOLD	01213X	.	.	NO	24-28
		PONS AUTO	01214X	.	.	NO	24-28
		PONS ATT HOLD	01215X	.	.	NO	24-28
		LR ANG DATA NO GOOD	01216X	CSW	COMMON	NO	24-28
		LA VEL DATA NO GOOD	01217X	CSW	COMMON	NO	24-28

25 LM DPS





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MISSION RULES

SECTION 23 - LM PROPULSION - DPS

REV	ITEM													
		<p>-----                      * SYSTEMS MANAGEMENT *                      -----</p>												
		RULE 23-11 IS RESERVED.												
23-12		RESERVED												
23-13		THE DPS ENGINE WILL NOT NORMALLY BE OPERATED FOR LESS THAN 3.5 SEC. A 2 SEC COAST BEFORE RESTART AT LTP AND A 30 MINUTE COAST BEFORE RESTARTS GREATER THAN LTP IS REQUIRED.												
23-14		RESERVED												
23-15		30 SECONDS IN THE NON THRUSTABLE REGION (85 PERCENT TO PTP) IS AN ALLOWABLE EVENT AND ALLOWS COMPLETION OF THE NOMINAL MISSION DUTY CYCLE.												
23-16		FROM A SAFETY STANDPOINT SUPERCRITICAL HELIUM BURST DISC RUPTURE DURING MANNED OPERATION IS AN ALLOWABLE EVENT.												
23-17		RESERVED												
23-18		RESERVED												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 15%;">PAGE</td> </tr> <tr> <td>APOLLO 13</td> <td>0</td> <td>10/21/68</td> <td>LM PROPULSION -DPS</td> <td>MANAGEMENT</td> <td>23-3</td> </tr> </table>			MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 13	0	10/21/68	LM PROPULSION -DPS	MANAGEMENT	23-3
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 13	0	10/21/68	LM PROPULSION -DPS	MANAGEMENT	23-3									

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MISSION RULES

SECTION 28 - LM PROPULSION - DPS

REV	ITEM															
28-10	<p>DPS ENGINE RESTARTS CAN BE MADE WITH THE FOLLOWING CONSTRAINTS---</p> <table border="0"> <thead> <tr> <th>INITIAL BURN</th> <th>REQUIRED COAST TIME</th> <th>MAXIMUM RESTART BURN TIME</th> </tr> </thead> <tbody> <tr> <td>A. 3.8 SEC TO 40 SEC AT PTP</td> <td>2 SECONDS(SINGLE RESTART ONLY)</td> <td>NO CONSTRAINT</td> </tr> <tr> <td>B. 40 SEC TO 190 SEC AT PTP</td> <td>2 SECONDS(SINGLE RESTART ONLY)</td> <td>400 SECS</td> </tr> <tr> <td>C. 190 SECS TO 400 SECS AT PTP SEE FIGURE BELOW</td> <td></td> <td>100 SECS</td> </tr> <tr> <td>D. GREATER THAN 400 SECS AT PTP NO RESTART</td> <td></td> <td>---</td> </tr> </tbody> </table> <p>THESE CONSTRAINTS ARE BASED ON ENGINE THRUST CHAMBER HEATING AND SOAK BACK LIMITS. TERMINATE THE BURN IF THE MAXIMUM RESTART BURN TIME IS EXCEEDED.</p> <p>THERE SHALL BE NO MORE THAN 4 RESTARTS 100 SEC MAX DURATION EACH AFTER THE INITIAL BURN.</p>	INITIAL BURN	REQUIRED COAST TIME	MAXIMUM RESTART BURN TIME	A. 3.8 SEC TO 40 SEC AT PTP	2 SECONDS(SINGLE RESTART ONLY)	NO CONSTRAINT	B. 40 SEC TO 190 SEC AT PTP	2 SECONDS(SINGLE RESTART ONLY)	400 SECS	C. 190 SECS TO 400 SECS AT PTP SEE FIGURE BELOW		100 SECS	D. GREATER THAN 400 SECS AT PTP NO RESTART		---
INITIAL BURN	REQUIRED COAST TIME	MAXIMUM RESTART BURN TIME														
A. 3.8 SEC TO 40 SEC AT PTP	2 SECONDS(SINGLE RESTART ONLY)	NO CONSTRAINT														
B. 40 SEC TO 190 SEC AT PTP	2 SECONDS(SINGLE RESTART ONLY)	400 SECS														
C. 190 SECS TO 400 SECS AT PTP SEE FIGURE BELOW		100 SECS														
D. GREATER THAN 400 SECS AT PTP NO RESTART		---														
	<p>LMOE required coast time vs initial burn time for engine chamber heating limitations.</p>															

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	FAL	9/10/69	LM PROPULSION -DPS	MANAGEMENT	28-4



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MISSION RULES

SECTION 23 - LM PROPUSSION - OPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
<b>SPECIFIC MISSION RULES</b>							
23-30	LOSS OF OPERATIONAL OPS (PRIOR TO LOW GATE REF NR 23-2 FOR DEFINITION. AFTER LOW GATE ONLY LOW INLET PRESSURES LESS THAN 120 PSIA)	DOCKED/ UNDOCKED  DESCENT ORBIT  POWERED DESCENT		<b>A. INHIBIT OPS BURNS</b>  <b>B. STOP DOI IF IN PROGRESS</b>  1. INHIBIT POI 2. RNDZ WITH APS  <b>C. ABORT STAGE</b>	REF MAL PROC OPS---  1 DES REG 1A FUEL/OXID PRESS ABNORMAL 2 FUEL/OXID TEMP ABNORMAL 3 HE PRESS ABNORMAL		
23-31	START TANK LEAK PRIOR TO PRESSURIZATION A. FUEL AND/OR OXID ENGINE INLET P GREATER THAN 30 PSIA.  B. FUEL AND/OR OXID ENGINE INLET P LESS THAN 30 PSIA.	ALL		<b>A. CONTINUE MISSION INHIBIT FIRING OPS START TANK SOUV</b>  <b>B. CONTINUE MISSION</b>  1. FIRE SOUV TO START TANK  2. INHIBIT OPS BURNS IF INLET PRESSURES DO NOT COME UP GREATER THAN OR EQUAL TO 30 PSIA.	REF MAL PROC OPS---  3 HE PRESS ABNORMAL  NOTE PRESSURIZATION SYSTEM MAY BE OPENED TO START TANK LEAK. CLOSE PRIMARY HE REG SOV AFTER EACH BURN AND REOPEN AT INITIATION OF EACH BURN.		
25-32	OPS FAILS TO PRESSURIZE  A. VIA START TANK 1. INLET PRESS GREATER THAN OR EQUAL TO 30 PSIA. 2. INLET PRESS LESS THAN 30 PSIA.  B. VIA SUPERCRITICAL HELIUM	ALL  DESCENT ORBIT		<b>A. 1. CONTINUE MISSION</b>   2. INHIBIT ALL OPS BURNS  <b>B. CUT OFF DOI ON INLET PRESSURES IF NECESSARY</b>  1. IF DOI ACCOMPLISHED (A) ARM PYRO PRIOR TO POI. (B) SWITCH DES HE REGS AT POI IGNITION.  2. IF DOI SHUTDOWN (A) NO GO FOR POI. (B) RNDZ WITH APS.	REF MAL PROC OPS---  1 DES REG 3 HE PRESS ABNORMAL		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	B	10/22/79	LM PROPUSSION -OPS	SPECIFIC-OPS	25-6



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MISSION RULES

SECTION 25 - LM PROPUSSION - DPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	25-33	LOSS OF SUPERCRITICAL PRESSURE (DPS IN BLOWDOWN MODE)			REF MAL PROC DPS 3 ME PRESS ABNORMAL
		A. PRIOR TO PDI • 6 MIN, 30 SECS.	POWERED DESCENT	A. ABORT ABORT STAGE PRIOR TO INLET PRESSURES LESS THAN OR EQUAL TO 150 PSIA. TOLLAGE PRESSURE LESS THAN 260 PSIA.	
		B. AFTER PDI • 6 MIN, 30 SECS.		B. CONTINUE MISSION	REF RULE 25-2.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	8	10/31/69	LM PROPUSSION -DPS	SPECIFIC-DPS	25-7

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MISSION RULES

SECTION 29 - LM PROPULSION - DPS

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULINGS	EVES/NOTES/COMMENTS												
29-24		LEAK BETWEEN HE REG SHUTOFF AND O2AD CHECK VALVES DETECTED--- A. PRIOR TO BLOWING AND TANK SOUITS	ALL	1A. PRESSURIZE DPS WITH AIB TANK WHILE IN SITE COVERAGE  1. INHIBIT DPS BURNS FOR LEAK RATE GREATER THAN 20 PSI/SEC.  2. IF LEAK RATE LESS THAN 20 PSI/SEC  (A) CLOSE HE REG 1  (B) OPEN DES HE REG 2 IMMEDIATELY AFTER IGNITION.  (C) CLOSE DES HE REG 2 JUST PRIOR TO DOI SHUTDOWN.  (D) OPEN DES HE REG 2 AT POI IGN	REF MAL PROC DPS  1 DES REG  2 HE PRESS ABNORMAL												
		B. AFTER AIB PRESSURIZATION BUT PRIOR TO DOI.	ALL	1B.1. INHIBIT DPS BURNS FOR LEAK RATE GREATER THAN 20 PSI/SEC.  2. IF LEAK RATE LESS THAN 20 PSI/SEC  (A) CLOSE DES HE REG 1  (B) OPEN DES HE REG 2 PRIOR TO EACH BURN													
		C. AFTER DOI	DESCENT ORBIT	C.1. INHIBIT FURTHER DPS BURNS 10 HOURS FOR RISE RATE GREATER THAN 150 PSI/HR AFTER COMPLETION OF DOI.  (A) CLOSE DES HE REG 1  (B) OPEN DES HE REG 2 AT IGNITION OF SUBSEQUENT BURNS.  (C) CLOSE DES HE REG 2 AT SHUTDOWN OF SUBSEQUENT BURNS.  2. IF SHE RISE RATE IS LESS THAN 150 PSI/HR AFTER COMPLETION OF DOI CONTINUE MISSION  (A) CLOSE DES HE REG 1  (B) OPEN DES HE REG 2 AT POI IGNITION	SHE CAPABILITY MUST BE OBTAINED REAL TIME FROM ACF SHE PROGRAM TO IDENTIFY REMAINING CAPABILITIES.												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>LM PROPULSION -DPS</td> <td>SPECIFIC-DPS</td> <td>25-8</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	LM PROPULSION -DPS	SPECIFIC-DPS	25-8
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	FNL	9/10/69	LM PROPULSION -DPS	SPECIFIC-DPS	25-8												



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MISSION RULES

SECTION 28 - LM PROPULSION - DPS

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS		
	28-40	UNABLE TO VENT DPS AFTER LANDING	LUNAR STAY	ASCEND ASAP			
	28-41	90 PERCENT THROAT AREA INCREASE EXCEEDED	ALL	ABORT STAGE	NOTE--- THROTTLE DOWN TIME, THRUST LEVEL, AND SYSTEM PRESSURES ARE SECONDARY CUES WHICH INDICATE OFF NOMINAL DPS PERFORMANCE		
		RULES 28-42 THROUGH 28-49 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	A	10/19/79	LM PROPULSION -DPS	SPECIFIC-DPS	28-10

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MISSION RULES

SECTION 23 - LM DPS - CONCLUDED

REV	ITEM	----- ! DPS - PRELAUNCH INSTRUMENTATION ! -----					MISSION RULE REFERENCE
23-30	MEAS DESCRIPTION	PCN	ONBOARD	TRANSDUCER	CATEGORY		
	START TNC PRESS	603013P	ME MON	COMMON	M	23-31,32,33	
	ME REG PRESS	603018P	CGV	COMMON	MD	23-34,39,33	
	ME REG PRESS	603023P			MD	23-34,39,33	
	ME PRESS	603423P			MD	23-33,30,32	
	ME PRESS	603436P	PRESS		MD	23-33,30,30	
	FV TNC 1 QTY	603603U	QTY	COMMON	MD	23-37,30,30	
	FV TNC 2 QTY	603604U	QTY	COMMON	MD	23-37,30,30	
	OX TNC 1 QTY	604103U	QTY	COMMON	MD	23-37,30,30	
	OX TNC 2 QTY	604104U	QTY	COMMON	MD	23-37,30,30	
	FV 1 TEMP	603718T	TEMP MON	COMMON	MD	23-30	
	FV 2 TEMP	603719T	TEMP MON	COMMON	MD	23-30	
	OX 1 TEMP	604218T	TEMP MON	COMMON	MD	23-30	
	OX 2 TEMP	604219T	TEMP MON	COMMON	MD	23-30	
	FV PRESS	603611P			M	23-30,31,32,33, 35	
	OX PRESS	604111P			M	23-30,31,32,33, 35	
	TCP	604810P	THRUST	COMMON	M-PCM	23-30	
	LOW LEVEL	604653X	DPS LOW	COMMON	M	23-36	

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MISSION RULES  
SECTION 26 - LM PROPELLSION - APS

REV	ITEM						
		<div style="border: 1px dashed black; padding: 5px; display: inline-block;">           SYSTEMS MANAGEMENT         </div>					
26-10	RESERVED						
26-11	RESERVED						
		RULE 26-12 IS RESERVED.					
26-13	THE MINIMUM IMPULSE OF THE APS ENGINE IS 1257 PLUS OR MINUS 104 LBS - SEC. WHICH CORRESPONDS TO AN ELECTRICAL ON/OFF TIME OF 0.8 SEC.						
26-14	ONLY PERMISSION APPROVED APS MULTIBURN PROFILES WILL BE EXECUTED, SINCE NO DATA EXISTS TO ALLOW REALTIME SUPPORT FOR EXAMINING APS FREEZING, CHARRING, BACKWALL TEMPERATURE CONSTRAINTS FOR MULTIBURN PROFILES.						
26-15	PROPELLANT GAGING (NO ONBOARD READOUTS)---						
	A. PRIME METHOD--- APS QTY FROM LGC MASS CALCULATION (ONE PERCENT)						
	B. BACKUP METHOD--- FLOW RATE X TIME (5 PERCENT)						
		RULES 26-16 THROUGH 26-19 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PNL	9/10/69	LM PROPELLSION - APS	MANAGEMENT	26-2



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 26 - LM PROPULSION - APS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
				----- 1 SPECIFIC 1 -----													
26-20	LOSS OF AN OPERATIONAL APS	*DOCKED/ *UNDOCKED *DESCENT ORBIT *POWERED DESCENT *LUNAR STAY	1A 1B 1C 1D	RETURN TO CSM NO-GO FOR DOI RETURN TO CSM ASAP NO-GO FOR DOI ABORT USE DPS AS LONG AS POSSIBLE ASCEND NEXT BEST OPPORTUNITY	REF MAL PROC APS 1 ASC PRESS 2 FUEL OR OXID TEMP ABNORMAL 2A FUEL OR OXID PRESS ABNORMAL 3 HE PRESS ABNORMAL OR DECR.												
26-21	APS HE SOURCE PRESSURE A. LEAK PRIOR TO PRESSURIZATION B. LEAK AFTER PRESSURIZATION	*DOCKED/ *UNDOCKED *DESCENT ORBIT *POWERED DESCENT *LUNAR STAY *LUNAR STAY *RNDZ	1A 2 3 4 1A) 1B) 1C) 4 1A) 1B) 1C) 1D.1A) 1B) 2	RETURN TO CSM NO-GO FOR DOI RETURN TO CSM NO-GO FOR DOI ABORT USE OPS AS LONG AS POSSIBLE SELECT ALTERNATE APS HELIUM TANK AFTER APS GOES IN BLOWDOWN, CONFIRMED BY ULLAGE PRESS LESS THAN OR EQUAL TO 160 PSIA; SELECT LEAKING TANK IF PRESS GREATER THAN OR EQUAL TO GOOD TANK PRESS ASCEND NEXT BEST OPPORTUNITY SELECT ALTERNATE APS HELIUM TANK DO NOT ASC FEED AFTER APS GOES IN BLOWDOWN, CONFIRMED BY ULLAGE PRESS LESS THAN OR EQUAL TO 160 PSIA; SELECT LEAKING TANK IF PRESS GREATER THAN OR EQUAL TO GOOD TANK PRESS ASCEND IMMEDIATELY DO NOT ASC FEED CONTINUE MISSION	REF MAL PROC APS 1 ASC PRESS 3 HE PRESS ABNORMAL OR DECR. NOTE ONE HELIUM BOTTLE CAN SUPPLY SUFFICIENT APS DELTA V CAPABILITY FOR NONLANDING ALTERNATE MISSIONS.												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 10%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 20%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>B</td> <td>10/21/79</td> <td>LM PROPULSION - APS</td> <td>SPECIFIC</td> <td>26-3</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	B	10/21/79	LM PROPULSION - APS	SPECIFIC	26-3
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	B	10/21/79	LM PROPULSION - APS	SPECIFIC	26-3												

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MISSION RULES

SECTION 26 - LM PROPULSION - APS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	QUES/NOTES/COMMENTS		
26-22	APS HE LEAK BETWEEN QUAD CHECK VALVES AND ASC HE REG 1 AND 2 SHUTOFF VALVES	DOCKED/ UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY RNOZ	A. B. C. D. E.	RETURN TO CSM NO-GO FOR DOI RETURN TO CSM NO-GO FOR DOI ABORT 1) USE DPS AS LONG AS POSSIBLE 2) PRESSURIZE WITH HE BOTTLE IMMEDIATELY PRIOR TO IGNITION 3) USE SECOND HE BOTTLE WHEN APS ULLAGE PRESS GREATER THAN OR EQUAL TO 123 PSIA OR AFTER 200 SEC INTO THE ASCENT BURN CONTINUE MISSION 1. PRESSURIZE WITH ONE BOTTLE IMMEDIATELY PRIOR TO IGNITION 2. DO NOT ASC FEED 3. USE SECOND BOTTLE WHEN APS ULLAGE PRESS GREATER THAN OR EQUAL TO 123 PSIA OR AFTER 200 SEC INTO THE ASCENT BURN CONTINUE MISSION CLOSE HE SOV'S	REF MAL PROC APS 3 HE PRESS ABNORMAL OR DECR. NOTE SHORT APS BURNS MIGHT BE POSSIBLE.		
26-23	APS PROPELLANT VAPOR LEAK DOWNSTREAM OF QUAD CHECK VALVES	UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY RNDZ	A. B. C. D. E. F.	DOCK ASAP DOCK ASAP ABORT 1. USE DPS AS LONG AS POSSIBLE LIFTOFF IMMEDIATELY DO NOT ASC FEED CONTINUE MISSION	REF MAL PROC APS 1 ASC PRESS 2A FUEL OR OXID PRESS ABNORMAL 3 HE PRESS ABNORMAL OR DECR.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	R	10/31/69	LM PROPULSION - APS	SPECIFIC	26-4

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 26 - LM PROPULSION - APS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	24-24	APS PROP VALVE MISMATCH (DELTA POS)	ALL	CONTINUE MISSION IF BURNING OR HAVE HAD AT LEAST ONE APS BURN INHIBIT SUBSEQUENT APS BURNS	THIS INDICATION PRIOR TO FIRST APS ENGINE ON WILL BE CONSIDERED A TM FAILURE		
	26-29	APS PU AND/OR OASD LOW LEVEL	ASCENT	1. CONTINUE MISSION 2. OPEN RCS MAINS 3. CLOSE ASC FEED	APS MAL PROC APS & ASC WTY		
		RULES 26-26 THROUGH 26-29 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	TORNOV	PAGE
		APOLLO 12/PL	0/10/69	LM PROPULSION	APC/PC	26-5	

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 26 - LM APS - CONCLUDED

REV	ITEM	----- * APS - PRELAUNCH INSTRUMENTATION * -----				MISSION RULE REFERENCE
26-30	MEAS DESCRIPTION	PCM	ONBOARD TRANSDUCER	CATEGORY		
	APS HE 1 PRESS	GP0001P	MEL MON C&W	COMMON	M - PCM	26-20,21,22
	APS HE 2 PRESS	GP0002P	MEL MON C&W	COMMON	M - PCM	26-20,21,22
	APS HE RES PRESS	GP0018P			NO	26-20,22
	APS HE RES PRESS	GP0020P	CSW	COMMON	NO	26-20,22
	APS HE 1 TEMP	GP0201P	MEL MON	COMMON	M - PCM	26-22
	APS HE 2 TEMP	GP0202P	MEL MON	COMMON	M - PCM	26-22
	APS FUEL TEMP	GP071AT	TEMP	COMMON	M - PCM	26-20
	APS FUEL LOW	GP0908X	CSW	COMMON	NO	26-20
	APS OXID TEMP	GP1218T	TEMP	COMMON	M - PCM	26-20
	APS OXID LOW	GP1408X	CSW	COMMON	NO	26-20
	APS FUEL PRESS	GP1501P	CSW	COMMON	M - PCM	26-20,21,22,22
	APS OXID PRESS	GP1503P	CSW	COMMON	M - PCM	26-20,21,22,22
	VLVS A DELTA POS	GP2997U			NO	26-24
	VLVS B DELTA POS	GP2998U			NO	26-20
	APS TCR	GP2010P			NO	

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27 LM REACTION  
CONTROL SYSTEM

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MISSION RULES  
SECTION 27 - LM REACTION CONTROL SYSTEM

REV	ITEM	
		<u>GENERAL</u>
27-1	RESERVED	
27-2	DEFINITIONS	
	A. RCS SYSTEM	<p>AN RCS SYSTEM CONTAINS EIGHT OPERATIONAL THRUSTERS SUPPLIED BY ITS OWN PRESSURIZATION AND PROPELLANT FEED SYSTEM INDEPENDENT OF ASCENT FEED AND CROSSPEED.</p> <p>INDIVIDUAL THRUSTERS REQUIRED FOR DIFFERENT MISSION PHASES WILL BE COVERED SEPARATELY.</p>
	B. OPERATIONAL RCS SYSTEM	<ol style="list-style-type: none"> <li>1. FUEL AND/OR OXID MANIFOLD PRESSURES GREATER THAN OR EQUAL TO 100 PSI;</li> <li>2. FUEL TEMP GREATER THAN OR EQUAL TO 40 DEG F AND LESS THAN OR EQUAL TO 100 DEG F;</li> <li>3. OXID TEMP GREATER THAN 110 DEG F.</li> </ol>
		RULE NUMBERS 27-3 THROUGH 27-9 ARE RESERVED.
MISSION    REV    DATE    SECTION    GROUP    PAGE		
APOLLO 12    A    10/19/70    LM REACTION CONTROL SYSTEM    GENERAL - RCS    27-1		



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 27 - LM REACTION CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
* SPECIFIC MISSION RULES *																	
27-20	LOSS OF RCS SYSTEM A OR B	ALL		A. CLOSE MAINS OF AFFECTED SYSTEM IF LOSS OF SYSTEM RELATED FROM ANYTHING OTHER THAN ISOLATION OF JETS B. CROSSFEED FROM GOOD SYSTEM DOCKED DO NOT UNDOCK UNDOCKED DOCK ASAP NO-GO FOR DOI DESCENT RETURN TO CSN ASAP ORBIT NO-GO FOR DOI POWERED DESCENT A. PRIOR TO PDI + 3 - ABORT B. AFTER PDI + 3 - CONTINUE THROUGH LANDING NO GO FOR LUNAR STAY LUNAR STAY ASCENT NEXT BEST OPPORTUNITY RNOZ CONTINUE MISSION	REF MAL PROC RCS 1 RCS 2A HE PRESS LOW OR DECR. 1B PGHD ABNORMAL 2 RCS PRESS OR TEMP ABNORMAL 3 RCS AID REG												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 5%;">REV</td> <td style="width: 10%;">DATE</td> <td style="width: 15%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>PM</td> <td>9/18/69</td> <td>LM REACTION CONTROL SYSTEM</td> <td>SPECIFIC - RCS</td> <td>27-3</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	PM	9/18/69	LM REACTION CONTROL SYSTEM	SPECIFIC - RCS	27-3
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	PM	9/18/69	LM REACTION CONTROL SYSTEM	SPECIFIC - RCS	27-3												





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MISSION RULES  
SECTION 37 - LN REACTION CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	RULING	CUES/NOTES/COMMENTS		
27-22	DECREASING OR LOSS OF RCS HE PRESSURE	ALL  DOCKED  UNDOCKED  DESCENT ORBIT  POWERED DESCENT/ AND2  LUNAR STAY	A.  B.  C.  D.  E. 1.  E. 2.  F.	1. CONTINUE USING BOTH SYSTEMS UNTIL MFLD PRESS IN BAD SYSTEM IS LESS THAN 100 PSI; THEN CLOSE MAINS OF BAD SYSTEM  2. CROSFEEED FROM GOOD SYSTEM  DO NOT UNDOCK UNLESS SUFFICIENT PROPELLANT TO REDOCK EXISTS IN BLOWDOWN  RETURN TO CSM AND DOCK ASAP  NO-GO FOR DOI  RETURN TO CSM AND DOCK ASAP  NO-GO FOR DOI  1. PD1 TO PD1 + 5 CONTINUE MISSION IF SUFFICIENT BLOWDOWN CAPABILITY EXISTS IN FAILED SYSTEM FOR 5 HRS OF LINE OF SIGHT AND 5 MIN OF ATT HOLD  2. PD1 + 5 TO TOUCHDOWN CONTINUE MISSION  CONTINUE MISSION IF SUFFICIENT BLOWDOWN CAPABILITY EXISTS IN FAILED SYSTEM FOR 6 HOURS OF LINE OF SIGHT AND 5 MINUTES OF ATT HOLD  IF THIS CAPABILITY DOES NOT EXIST, ASCEND NEXT BEST OPPORTUNITY	REF MAL PROC RCS  1 RCS  1A HE PRESS LOW OR DECR.  1B PUMD ABNORMAL  WHEN MFLD PRESS DROPS BELOW 100 PSI; THE SYSTEM IS CONSIDERED NON-OPERATIONAL REF RULE 27-2             E. REQUIRES 30 LBS (15.8 PERCENT OF TOTAL LOADED IN ONE SYSTEM.)		
27-23	RCS PROPELLANT LEAK	DOCKED  UNDOCKED  DESCENT ORBIT  POWERED DESCENT  LUNAR STAY  AND2	A.  B.  C.  D. 1.  D. 2.  E.  F.	NO GO FOR DOI  UNDOCK AND STATIONKEEP  DOCK ASAP  NO-GO FOR DOI  DOCK ASAP  NO-GO FOR DOI  1. NO-GO FOR DOI  D. 1. PD1 TO PD1 + 5 - ASCEND  D. 2. PD1 + 5 TO 10 - CONTINUE MISSION  ASCEND NEXT BEST OPPORTUNITY  CONTINUE MISSION	REF MAL PROC RCS  1 RES  1A HE PRESS LOW OR DECR.  1B PUMD ABNORMAL		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	8	10/21/68	LN REACTION CONTROL SYSTEM	SPECIFIC - RCS	27-5

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 27 - LM REACTION CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	27-24	RCS QUAD TEMP LESS THAN 119 DEG	ALL	ISOLATE BOTH THRUSTER PAIRS IN AFFECTED QUAD (REF RULE 27-23)	REF MAL PROC NTR.  1A RCS QUAD 1; 2; 3; 4 TEMP ABNORMAL  QUAD TEMP LESS THAN 119 DEG INDICATES THE POSSIBILITY OF INCOMPLETE COMBUSTION WHICH COULD CAUSE HARD STARTS AND POSSIBLE EXPLOSIONS.		
	27-25	IMPINGEMENT CONSTRAINTS VIOLATED	DOCKED/ UNDOCKED  DESCENT ORBIT  POWERED DESCENT  LUNAR STAY/ RNDZ	A. DOCK ASAP CSM ACTIVE DOCKING  B. CSM RESCUE CSM ACTIVE DOCKING  C. PDI TO TOUCHDOWN 1. ABORT 2. ABORT STAGE AS SOON AS POSSIBLE  D. CONTINUE MISSION	REF MAL PROC RCS 10 POND ABNORMAL		
		RULES 27-26 THROUGH 27-29 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	FORM	PAGE
		APOLLO 12	A	10/15/69	LM REACTION CONTROL SYSTEM	SPECIFIC - RCS	12-4

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 27 - LM REACTION CONTROL - CONCLUDED

REV	ITEM	PRELAUNCH INSTRUMENTATION					MISSION RULE REFERENCE
27-30	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCER	CATEGORY		
	RCS 'A' PROP QTY	G10850	QUANTITY	COMMON	M	27-23,23,20	
	RCS 'A' PROP QTY	G10930	QUANTITY	COMMON	M	27-23,23,20	
	RCS 'A' REG PRESS	G1201P	PRESS MON C6W	COMMON	M-PCM	27-20,23,23	
	RCS 'B' REG PRESS	G1202P	PRESS MON C6W	COMMON	M-PCM	27-20,23,23	
	RCS 'A' HE PRESS	G1101P	PRESS MON C6W	COMMON	M-PCM	27-23,20	
	RCS 'B' HE PRESS	G1102P	PRESS MON C6W	COMMON	M-PCM	27-23,20	
	RCS 'A' FUEL TEMP	G2121P	TEMP MON	COMMON	M-PCM	27-20	
	RCS 'B' FUEL TEMP	G2122P	TEMP MON	COMMON	M-PCM	27-20	
	RCS MAIN 'A' CLSD	G9909U	MAIN SOV	COMMON	ND		
	RCS MAIN 'B' CLSD	G9910U	MAIN SOV	COMMON	ND		
	RCS 'A' FUEL WFLD PRESS	G2201P	PRESS MON	COMMON	M	23-20,23	
	RCS 'B' FUEL WFLD PRESS	G2202P	PRESS MON	COMMON	M	27-23,23	
	RCS 'A' OR WFLD PRESS	G2301P	PRESS MON	COMMON	M	27-20,23	
	RCS 'B' OR WFLD PRESS	G2302P	PRESS MON	COMMON	M	27-20,23	
	A/B XFEED OPEN	G9913U	CASFD	COMMON	ND		
	QUAD 1 'A' TCA ISOL VLV	G9967U	SVS A QUAD 1	COMMON	ND	27-23	
	QUAD 2 'A' TCA ISOL VLV	G9968U	SVS A QUAD 2	COMMON	ND	27-23	
	QUAD 3 'A' TCA ISOL VLV	G9969U	SVS A QUAD 3	COMMON	ND	27-23	
	QUAD 4 'A' TCA ISOL VLV	G9970U	SVS A QUAD 4	COMMON	ND	27-21	
	QUAD 1 'B' TCA ISOL VLV	G9967U	SVS B QUAD 1	COMMON	ND	27-21	
	QUAD 2 'B' TCA ISOL VLV	G9968U	SVS B QUAD 2	COMMON	ND	27-23	
	QUAD 3 'B' TCA ISOL VLV	G9969U	SVS B QUAD 3	COMMON	ND	27-23	
	QUAD 4 'B' TCA ISOL VLV	G9970U	SVS B QUAD 4	COMMON	ND	27-23	
	QUAD 1 TEMP	G9604P	TEMP MON C6W	COMMON	ND	27-24	
	QUAD 2 TEMP	G9605P	TEMP MON C6W	COMMON	ND	27-24	
	QUAD 3 TEMP	G9606P	TEMP MON C6W	COMMON	ND	27-24	
	QUAD 4 TEMP	G9607P	TEMP MON C6W	COMMON	ND	27-24	
	ASC FEED ORID 'A' OPEN	G9961U	SVS A ASC CRID	COMMON	ND		
	ASC FEED FUEL 'A' OPEN	G9963U	ASC FUEL	COMMON	ND		
	ASC FEED FUEL 'B' OPEN	G9962U	ASC FUEL	COMMON	ND		
	ASC FEED ORID 'B' OPEN	G9964U	SVS B ASC CRID	COMMON	ND		
			ASC FUEL	COMMON	ND		

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28 SPACS  
ENVIRONMENT

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NASA - Manned Spacecraft Center

MISSION RULES

SECTION 28 - SPACE ENVIRONMENT

REV	ITEM	
		----- GENERAL -----
28-1		ALL DECISIONS WILL BE BASED ON CONFIRMED MEASUREMENTS AND/OR EVENTS AND PROJECTIONS BASED ON CONFIRMED EVENTS.
28-2		DEFINITIONS---
	A.	THE MAXIMUM OPERATIONAL DOSE (MOD) IS THE MAXIMUM RADIATION DOSE TO WHICH THE CREW WOULD BE SUBJECTED BASED ON A SKIN DOSE OF 400 RAD AND/OR A DEPTH (GASTROINTESTINAL) DOSE OF 30 RAD.
	B.	THE PLANNING OPERATIONAL DOSE (POD) IS THE MAXIMUM RADIATION DOSE TO THE CREW WHICH ANY MISSION WOULD BE DESIGNATED DURING THE PLANNING PERIOD BASED ON A SKIN DOSE OF 250 RAD AND/OR A DEPTH DOSE OF 25 RADS.
	C.	THESE DOSES REPRESENT THE CUTOFF POINT WHERE A DECISION MUST BE MADE WHETHER TO CONTINUE OR TERMINATE THE MISSION.
	D.	THE RADIATION ABSORBED DOSE (RAD) IS A UNIT OF ABSORBED DOSE WHICH IS EQUAL TO AN ENERGY DEPOSITION OF 100 ERGS/GRAM.
	E.	THE RELATIVE BIOLOGICAL EFFECTIVENESS (RBE) EXPRESSES THE EFFECTIVENESS OF PARTICULAR TYPES OF RADIATION IN PRODUCING THE SAME BIOLOGICAL RESPONSE.
		THE AVERAGE RBE THAT WILL BE USED FOR SOLAR PARTICLE EVENT RADIATION FROM PROTONS IS 1.2.
	F.	THE ROENTGEN EQUIVALENT MAN (REM) IS THE PRODUCT OF THE RAD AND THE RBE (REM = RAD X RBE).
	G.	A CONFIRMED EVENT IS DEFINED AS AN EVENT THAT HAS BEEN MEASURED BY TWO OR MORE INDEPENDENT SOURCES.
	H.	A SIGNIFICANT INCREASE OF THE MOD WILL BE DEFINED BY THE FLIGHT SURGEON IN REAL TIME BASED ON THE CHARACTER AND ACCURACY OF THE DATA AT THE TIME.
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		MISSION   REV   DATE   SECTION   GROUP   PAGE
		APOLLO 12   PML   6/16/69   SPACE ENVIRONMENT   GENERAL   28-1

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 28 - SPACE ENVIRONMENT

REV	ITEM												
	----- * MANAGEMENT * -----												
28-3	THE EXISTING AND PROJECTED RADIATION ENVIRONMENT WILL BE A PART OF THE GO/NO-GO DECISION PROCESS.												
28-4	PRIORITY OF DATA-- A. NATURAL (SOLAR PARTICLE EVENT) 1. PRELAUNCH AND EPO (A) SOLAR PARTICLE ALERT NETWORK (SPAN) (B) VELA NATURAL RADIATION SATELLITE (C) PIONEER RADIATION SATELLITE (D) EXPLORER RADIATION SATELLITE (E) SOLAR PARTICLE MONITORING SYSTEM (SPMS) 2. ALL OTHER PHASES (A) S/C INSTRUMENTATION (1) VAN ALLEN BELT DOSIMETER (VAD) (2) PERSONAL RADIATION DOSIMETER (PRD) (3) NUCLEAR PARTICLE DETECTION SYSTEM (NPOSI) (B) SOLAR PARTICLE ALERT NETWORK (SPAN) (C) VELA NATURAL RADIATION SATELLITE (D) PIONEER RADIATION SATELLITE (E) EXPLORER RADIATION SATELLITE (F) SOLAR PARTICLE MONITORING SYSTEM (SPMS) B. ARTIFICIAL 1. ALL PHASES EXCEPT EPO (A) JAEIC (B) RICHMETERS 2. EPO (A) JAEIC (B) RICHMETERS (C) PRD 3. EARTH ORBITAL MISSION (A) PRD (B) JAEIC (C) RICHMETERS (D) SAAP RULE NUMBERS 28-5 THROUGH 28-9 ARE RESERVED.												
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 20%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 15%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>SPACE ENVIRONMENT</td> <td>MANAGEMENT</td> <td>28-2</td> </tr> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	SPACE ENVIRONMENT	MANAGEMENT	28-2
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	FNL	9/10/69	SPACE ENVIRONMENT	MANAGEMENT	28-2								

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MISSION RULES

SECTION 26 - SPACE ENVIRONMENT

REV	ITEM	CONDITION/MALFUNCTION*	PHASE	ACTION	CUES/NOTES/COMMENTS												
				SPECIFIC MISSION RULES													
	26-10	ANY SOURCE REPORTS A POSSIBLE ARTIFICIAL EVENT	ALL	PROCEED UNTIL VERIFICATION FROM ALL OTHER SOURCES.													
	26-11	DEFINITE ARTIFICIAL EVENT CONFIRMED BY REPORTING SOURCES	PRE-LAUNCH EPO	A. HOLD UNTIL INFORMATION FROM REPORTING SOURCES INDICATES THE MOD WILL NOT BE EXCEEDED.  B.1. CONTINUE MISSION, UNLESS DATA ANALYSIS INDICATES THAT THE DOSE PROJECTED THROUGH TLT WILL EXCEED THE MOD BY A SIGNIFICANT AMOUNT. IF THE MOD WILL BE EXCEEDED BY A SIGNIFICANT AMOUNT, PERFORM A LOW EARTH ORBIT ALTERNATE MISSION.  2. FOR DOSES APPROACHING THE MOD CONTINUE MISSION WITH CONTINUOUS PRO MONITORING AND CREW ASSESSMENT. CONSIDERATIONS WILL BE GIVEN TO CHANGING THE TRAJECTORY TO A LOW EARTH ORBIT OR REENTERING ASAP BASED ON ACTUAL CONDITIONS.	B.1. CREW SHOULD BEGIN PERSONAL DOSEMETER READOUTS PER SOP 2-8												
			ALL OTHER	C. CONTINUE MISSION.													
	26-12	RADIATION CONFIRMED BY PRD READOUTS OR ONBOARD TM AND PROJECTED TO EXCEED THE MOD	ALL	REENTER NEXT BEST PTP	ALSO APPLIES TO ALTERNATE EARTH ORBIT MISSION.												
	26-13	MAJOR SOLAR FLARE PREDICTED	ALL	CONTINUE MISSION.													
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 15%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>B</td> <td>10/31/69</td> <td>SPACE ENVIRONMENT</td> <td>SPECIFIC</td> <td>26-3</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	B	10/31/69	SPACE ENVIRONMENT	SPECIFIC	26-3
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	B	10/31/69	SPACE ENVIRONMENT	SPECIFIC	26-3												



NASA - Manned Spacecraft Center

MISSION RULES  
SECTION 28 - SPACE ENVIRONMENT

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
28-24	MAJOR SOLAR FLARE HAS OCCURRED				
A.	UNCONFIRMED PARTICLE EVENT	ALL		A. CONTINUE MISSION.	
B.	CONFIRMED PARTICLE EVENT AND SOLAR PARTICLE ALERT NETWORK/HTAF ANALYSIS INDICATES THE MOD WILL BE EXCEEDED DURING THE MISSION	PRE-LAUNCH		B.1. HOLD UNTIL DATA ANALYSIS INDICATES THAT THE MOD WILL NOT BE EXCEEDED.	
		EPO		B.2. CONTINUE MISSION. IF DATA ANALYSIS INDICATES THAT THE MOD WILL BE EXCEEDED BY A SIGNIFICANT AMOUNT PRIOR TO MISSION COMPLETION. TLE IS NO-GO.	
		ALL OTHERS		B.3. CONTINUE MISSION. CONSIDERATION WILL BE GIVEN TO EARLY (OR EXTENDED) TEE AND EXHIBITING CREW TRANSFER TO LM.	
C.	CONFIRMED PARTICLE EVENT AND S/C TLM OR PRD READOUT PROJECTIONS INDICATE THE MOD WILL BE EXCEEDED DURING THE MISSION	TLC		C.1. CONTINUE MISSION. CONSIDERATION SHOULD BE GIVEN TO ENTER IN BEST BEST PTP IF THE TOTAL DOSE CAN BE REDUCED SIGNIFICANTLY WITHOUT INCREASING THE TOTAL RISK TO THE CREW.	C.1. CREW SHOULD BEGIN PERSONAL DOSIMETER AND RADIATION SURVEY METER READOUTS PER SGP 2-8
		LO		2. CONTINUE MISSION. CONSIDER EXTENDING LUNAR ORBIT STAY TIME IF THE TOTAL DOSE TO THE CREW WOULD BE REDUCED SIGNIFICANTLY BY LUNAR SHIELDING.	2.1A) MATCH-DOWN ATTITUDE MAY BE USED TO REDUCE THE TOTAL DOSE. 1B) IF A PARTICLE EVENT IS CONFIRMED THE CREW WILL TRANSFER FROM THE LM TO THE CSM ASAP.
		LUNAR STAY		3. CONSIDER REDUCING THE LUNAR STAY TIME AND/OR EVA IF THE TOTAL DOSE TO THE CREW CAN BE REDUCED SIGNIFICANTLY WITHOUT INCREASING THE TOTAL RISK TO THE CREW.	
		ALL OTHER PHASES		4. CONTINUE MISSION	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	FNL	9/10/69	SPACE ENVIRONMENT	SPECIFIC	28-4

NASA - Manned Spacecraft Center  
MISSION RULES  
SECTION 28 - SPACE ENVIRONMENT - CONCLUDED

REV	ITEM	INSTRUMENTATION REQUIREMENTS				
	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REF
28-15	RADIATION DOSIMETER 1 (CM DEPTH DOSE RATE)	CK1051K	-	-	HD	28-12
		VABO				
	RADIATION DOSIMETER 2 (CM SKIN DOSE RATE)	CK1052K	-	-	HD	28-12
	DOSIMETER RATE CHANGE	CK1053R	-	-	HD	28-12
		NPDS				
	PROTON COUNT RATE CHAN 1	ST0820K	-	-	HD	28-14
	PROTON COUNT RATE CHAN 2	ST0821K	-	-	HD	28-14
	PROTON COUNT RATE CHAN 3	ST0822K	-	-	HD	28-14
	PROTON COUNT RATE CHAN 4	ST0823K	-	-	HD	28-14
	ALPHA COUNT RATE CHAN 1	ST0830K	-	-	HD	28-14
	ALPHA COUNT RATE CHAN 2	ST0831K	-	-	HD	28-14
	ALPHA COUNT RATE CHAN 3	ST0832K	-	-	HD	28-14
	PROTON INTEGER COUNT RATE	ST0838K	-	-	HD	28-14
	TEMP NUCLEAR PART. DET	ST0840T	-	-	HD	28-14
	TEMP NUCLEAR PART. ANAL	ST0843T	-	-	HD	28-14
	PERSONAL RADIATION DOSIMETER (PROJ) - 3 - ONBOARD				MANDATORY TO BE ONBOARD	28-14
	RATE SURVEY METER (RSM) - 1 - ONBOARD				MANDATORY TO BE ONBOARD	28-14

30 RECOVERY

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MISSION RULES

SECTION 29 - RECOVERY

REV	ITEM	CONDITION/HALF/JUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS															
				* SPECIFIC *																
29-1	ACCEPTABLE WEATHER CONDITIONS AND RECOVERY CAPABILITY IN THE LAUNCH SITE AREA.		PRELAUNCH	MANDATORY																
29-2	ACCEPTABLE WEATHER CONDITIONS AND RECOVERY CAPABILITY IN THE LAUNCH ABORT AREA TO 1000 NM DOWNRANGE AND IN THE MIDPACIFIC RECOVERY ZONE		PRELAUNCH	HIGHLY DESIRABLE																
29-3	MINIMUM OF 71 AMP HOURS OF CM POSTLANDING POWER AVAILABLE AT LANDING.			HIGHLY DESIRABLE	TO PROVIDE 40 HOURS OF CM POSTLANDING POWER PLUS ONE UPRIGHTING.															
29-4	MINIMUM OF 85 AMP HOURS OF CM POSTLANDING POWER AVAILABLE AT LANDING.			MANDATORY	TO PROVIDE 10 HOURS OF CM POSTLANDING POWER PLUS ONE UPRIGHTING.															
29-5	UNTIL ENTRY - 24 HOURS, RETAIN DELTA V CAPABILITY TO MOVE ENTRY POINT +/-500 NM			HIGHLY DESIRABLE	TO PROVIDE WEATHER AVOIDANCE CAPABILITY.															
<p>*RECOVERY CAPABILITY WILL BE BASED PRIMARILY UPON THE LOCAL RECOVERY UNIT COMMANDER'S EVALUATION OF HIS CAPABILITY TO PERFORM THE RECOVERY OPERATION. WEATHER CONDITIONS AT THE TIME OF CM LANDING AFFECT BOTH RECOVERY CAPABILITY AND STRUCTURAL INTEGRITY OF THE CM. THE FOLLOWING GUIDELINES ARE USED TO INDICATE WHEN IT MAY BE NECESSARY TO RE-EVALUATE---</p> <table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">WORLD WIDE</td> <td style="text-align: center;">LAUNCH SITE</td> </tr> <tr> <td>SURFACE WINDS</td> <td style="text-align: center;">85 KNOTS</td> <td style="text-align: center;">25 KNOTS</td> </tr> <tr> <td>CEILING</td> <td style="text-align: center;">1500 FT</td> <td style="text-align: center;">500 FT.</td> </tr> <tr> <td>VISIBILITY</td> <td style="text-align: center;">3 NM</td> <td style="text-align: center;">1/2 NM</td> </tr> <tr> <td>WAVE HEIGHT</td> <td style="text-align: center;">8 FT</td> <td style="text-align: center;">8 FT</td> </tr> </table>							WORLD WIDE	LAUNCH SITE	SURFACE WINDS	85 KNOTS	25 KNOTS	CEILING	1500 FT	500 FT.	VISIBILITY	3 NM	1/2 NM	WAVE HEIGHT	8 FT	8 FT
	WORLD WIDE	LAUNCH SITE																		
SURFACE WINDS	85 KNOTS	25 KNOTS																		
CEILING	1500 FT	500 FT.																		
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MISSION	REV	DATE	SECTION	GROUP	PAGE
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APOLLO 13	FNL	9/10/69	RECOVERY	SPECIFIC	29-1
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MISSION RULES

SECTION 29 - RECOVERY

REV	ITEM	CONDITION/MAGFUNCTION	PHASE	RULE NO	CUES/NOTES/COMMENTS		
	29-6	AN ELLIPSE 109 NM UPRANGE: 132 NM DOWNRANGE AND 89 NM TO EITHER SIDE OF 90 DEG/330 DEG TARGET POINT-- AND AN ELLIPSE 109 NM UPRANGE AND DOWNRANGE AND 48 NM TO EITHER SIDE OF THE ROLL RIGHT 90 DEG (DELAYED) TARGET POINT WILL BE CLEAR OF ALL LAND.	EARTH ORBITAL	MANDATORY			
	29-7	REMAINDER OF MANUEVER FOOTPRINT AND AN ELLIPSE 109 NM UPRANGE AND DOWNRANGE AND 40 NM TO EITHER SIDE OF 90 DEG/300 DEG TARGET POINT-- AND ELIPSE 109 NM UPRANGE AND DOWNRANGE AND 40 NM TO EITHER SIDE OF ROLL RIGHT 90 DEG TARGET POINT WILL BE CLEAR OF LARGE LAND MASSES.	EARTH ORBITAL	HIGHLY DESIRABLE			
	29-8	A 5 NM RADIUS CIRCLE CENTERED ON THE GNC'S TARGET POINT AND AN ELLIPSE 58 NM UPRANGE: 88 NM DOWNRANGE AND 40 NM EITHER SIDE OF THE EWS TARGET POINT WILL BE CLEAR OF ALL LAND.	POST-TLE	MANDATORY			
	29-9	REMAINDER OF OPERATIONAL FOOTPRINT AND AN ELLIPSE 112 NM UPRANGE: 112 NM DOWNRANGE: AND 47 NM TO EITHER SIDE OF THE CONSTANT 112 NM TARGET POINT WILL BE CLEAR OF LARGE LAND MASSES	POST-TLE	HIGHLY DESIRABLE			
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	8	10/31/68	RECOVERY	SPECIFIC	29-2

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30 AEROMEDICAL

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MISSION RULES

SECTION 30 - AEROMEDICAL

REV	ITEM												
	<p>*****                      * GENERAL *                      *****</p>												
30-1	<p>PRELAUNCH</p> <p>PRIOR TO COMMITTING TO LAUNCH, THE FOLLOWING CONDITIONS MUST BE MET---</p> <p>A. SATISFACTORY FLIGHT CREW PHYSIOLOGICAL STATUS,</p> <p>B. THE MINIMUM CABIN OXYGEN CONCENTRATION FOR LAUNCH IS 90 PERCENT,</p> <p>C. THE MINIMUM SUIT OXYGEN CONCENTRATION FOR LAUNCH IS 93 PERCENT.</p>												
30-2	<p>THE SUIT CIRCUIT MUST BE MAINTAINED AT LEAST 2 IN. WATER PRESSURE ABOVE THE CABIN PRESSURE. SUIT LOOP PURGE IS REQUIRED IF THE SUIT-TO-CABIN DELTA PRESSURE REMAINS AT ZERO FOR A PERIOD OF 5 MINUTES.</p>												
30-3	<p>THE POTABLE WATER PH MUST BE WITHIN 6.0 TO 8.0 AT SERVICING AND FINAL SAMPLING.</p>												
30-4	<p>THE MAXIMUM ALLOWABLE CONCENTRATION OF PCO<sub>2</sub> IS 5MM OF HG.</p>												
30-5	<p>LAUNCH</p> <p>THERE ARE NO MEDICAL REASONS FOR ABORTING DURING THE LAUNCH PHASE OTHER THAN THOSE CONDITIONS INTOLERABLE TO THE CREW.</p>												
30-6	<p>EARTH ORBIT AND DEEP SPACE OPERATIONS.</p> <p>EARLY MISSION TERMINATION FOR MEDICAL FALL INTO TWO CATEGORIES---</p> <p>A. ONSET OF CONDITIONS WHICH ADVERSELY AFFECT CREW SAFETY HEALTH, OR FUNCTION AND PERFORMANCE.</p> <p>B. FAILURE OF SPACECRAFT SYSTEMS TO MAINTAIN A PHYSIOLOGICALLY SATISFACTORY ENVIRONMENT.</p>												
30-7	<p>WATER PALATABILITY</p> <p>CREW EVALUATION OF THE DRINKING WATER TASTE WILL BE THE BASIS FOR DETERMINING WATER PALATABILITY, EVEN FOR KHM CONTAMINATION.</p> <p>RULE NUMBERS 30-8 THROUGH 30-14 ARE RESERVED</p>												
	<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>FNL</td> <td>9/10/69</td> <td>AEROMEDICAL</td> <td>GENERAL</td> <td>30-1</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	FNL	9/10/69	AEROMEDICAL	GENERAL	30-1
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	FNL	9/10/69	AEROMEDICAL	GENERAL	30-1								

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 30 - AEROMEDICAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CLUES/NOTES/COMMENTS		
* SPECIFIC MISSION RULES *							
30-15	LOSS OR UNREADABLE EKG		ALL PHASES EVA	A. CONTINUE MISSION B. CONTINUE MISSION	A. ARTIFACTS ANTICIPATED DURING LAUNCH. MCC SURGEON WILL EVALUATE THE PROBLEM AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS NOT EFFECTIVE. B. MCC SURGEON WILL EVALUATE PROBLEM AND RECOMMEND CORRECTIVE ACTION, IF NOT EFFECTIVE. CEVA MAY BE RECOMMENDED.		
30-16	ABNORMAL HEART RATE, RHYTHM OR EKG		LAUNCH EPO TLC LO EVA TEC	A. CONTINUE MISSION B. NO-GO FOR TLI C. NO-GO FOR LOI D. ENTER NEXT BEST PTP E. TERMINATE EVA F. ENTER NEXT BEST PTP	MCC SURGEON WILL EVALUATE THE PROBLEM AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS NOT EFFECTIVE.		
30-17	ABNORMAL RESPIRATORY RATE		LAUNCH EPO TLC LO TEC	A. CONTINUE MISSION B. NO-GO FOR TLI C. NO-GO FOR LOI D. ENTER NEXT BEST PTP E. ENTER NEXT BEST PTP	THE ABNORMAL RATES WILL BE EVALUATED BY THE MCC SURGEON AND EARLY MISSION TERMINATION MAY BE RECOMMENDED IF CORRECTIVE ACTION IS NOT EFFECTIVE.		
30-18	ONSET OF SERIOUS MEDICAL PROBLEM		LAUNCH EPO TLC LO EVA TEC	A. CONTINUE MISSION CREW MAY ELECT TO ABORT IF INTOLERABLE B. ENTER NEXT BEST PTP C. ENTER NEXT BEST PTP D. ENTER NEXT BEST PTP E. TERMINATE EVA F. ENTER NEXT BEST PTP	MCC SURGEON WILL EVALUATE AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS NOT EFFECTIVE.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FNL	9/10/69	AEROMEDICAL	SPECIFIC PHYSIOLOGICAL	30-2



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 30 - AEROMEDICAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
30-19	DYBARISM IN JAY CREWMAN		LAUNCH	<p>1. CONTINUE MISSION</p> <p>KREW MAY ELECT TO ABORT IF CONDITION IS INTOLERABLE</p>	<p>1. CHECK SUIT INTEGRITY.</p> <p>2. IF CONDITIONS PERMIT CREW MAY ELECT TO OVER-PRESSURIZE.</p> <p>1A) ALL THREE SUITS CONNECTED TO SUIT CIRCUIT.</p> <p>1B) SUIT DEMAND REG TO PRESS POSITION</p> <p>1C) MONITOR SUIT PRESS (SHOULD REACH 4 PSID IN 75 SEC).</p> <p>1D) SELECT SUIT DEMAND REG INLET SEL VALVE TO OFF WHEN SUIT PRESS REACHES 4.0 PSID.</p> <p>1E) MAINTAIN SUIT OVERPRESSURE BY OPENING INLET SELECTOR VALVE AS NECESSARY.</p> <p>NOTE--- RELIEF FUNCTION OF DEMAND REGULATOR IS ISOLATED WHEN USING THIS PROCEDURE.</p>		
			ALL	<p>2. TERMINATE PHASE</p> <p>ENTER NEXT BEST PTP</p>	<p>2. MCC SURGEON WILL EVALUATE AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS NOT EFFECTIVE.</p>		
30-20	ORAL TEMP EXCEEDS 100 DEG F; DESPITE CORRECTIVE ACTION:		LAUNCH	<p>1. NOT APPLICABLE</p>			
	A. IF DUE TO ILLNESS		ALL	<p>2. TERMINATE PHASE</p> <p>ENTER NEXT BEST PTP</p>			
	B. IF RESULTANT FROM THERMAL OVERLOAD		LAUNCH	<p>1. NOT APPLICABLE</p>			
			ALL	<p>2. TERMINATE PHASE</p> <p>ENTER NEXT BEST PTP</p>			
30-21	PLAS METABOLIC OVERLOAD.		EV	<p>1. IF AMBER LINE IS EXCEEDED--- DECREASE ACTIVITY.</p> <p>2. IF RED LINE IS EXCEEDED--- STOP ACTIVITY AND REST.</p>	<p>1. AMBER LINE LIMIT IS WORK SUSTAINED AT A RATE GREATER THAN 3000 BTU/HR FOR A PERIOD LONGER THAN 5 MINUTES, AS DETERMINED BY PREFLIGHT ENDOMETRY CALIBRATIONS. THE MCC SURGEON WILL EVALUATE AND MAY RECOMMEND DECREASED CREW ACTIVITY.</p> <p>2. RED LINE LIMIT IS WORK SUSTAINED AT A RATE GREATER THAN 3000 BTU/HR FOR A PERIOD LONGER THAN 2 MINUTES, AS DETERMINED BY PREFLIGHT ENDOMETRY CALIBRATIONS. MCC SURGEON WILL EVALUATE AND MAY RECOMMEND THAT THE CREW STOP ACTIVITY AND REST.</p>		
	PLAS NUMBERS 30-21 THROUGH 30-24 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	1A	9/18/69	AEROMEDICAL	SPECIFIC PHYSIOLOGICAL	30-3

NASA - Manned Spacecraft Center

MISSION RULES  
SECTION 30 - AEROMEDICAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
30-25		INCREASE IN PCO <sub>2</sub> A. IS GREATER THAN OR EQUAL TO 7.6 MM HG	LAUNCH ALL	A.1. CONTINUE MISSION  2. CONTINUE MISSION CHANGE L10M CANISTER	A. PCO <sub>2</sub> SHOULD DECREASE BELOW 2 MM HG WITHIN 30 MINUTES.		
		B. GREATER THAN OR EQUAL TO 7.6 MM HG AND UNABLE TO DECREASE	LAUNCH ALL	B.1. CONTINUE MISSION  2. CONTINUE MISSION (A) OPEN SUITS AND BREATHE FROM CABIN (B) CHANGE SECOND L10M CANISTER (C) TEST PCO <sub>2</sub> SENSOR	B.2. L10M CANISTERS WILL NOT BE CHANGED IN AN UNPRESSURIZED CABIN.  B.2.(C) PCO <sub>2</sub> SENSOR TEST-- <ul style="list-style-type: none"> <li>• ISOLATE SUIT CIRCUIT BY DISCONNECTING SUIT HOSES FROM THE SPACECRAFT</li> <li>• SUIT CIR RET AIR VALVE CLOSED</li> <li>• CRACK O<sub>2</sub> METERING VALVE TO OPEN</li> <li>• PURGE FOR 30 SECONDS</li> <li>• CLOSED O<sub>2</sub> METERING VALVE</li> <li>• IF ABOVE PROCEDURE RESULTS IN A PCO<sub>2</sub> READING NEAR 2.0, THE PCO<sub>2</sub> SENSOR IS OPERATING PROPERLY</li> </ul>		
		C. GREATER THAN OR EQUAL TO 10 MMHG	LAUNCH ALL	C.1. CONTINUE MISSION 2. TERMINATE PHASE ENTER NEXT BEST PTP			
30-26		PCO <sub>2</sub> INSTRUMENTATION FAILURE	ALL	CONTINUE MISSION USE ONBOARD CO <sub>2</sub> TAPES			
		RULE NUMBER 30-27 THROUGH 30-34 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	FAL	9/10/69	AEROMEDICAL	SPECIFIC EQUIPMENT	30-6

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 30 - AEROMEDICAL - CONCLUDED

REV	ITEM	* INSTRUMENTATION REQUIREMENTS *					MISSION RULE REFERENCE
		CSM					
30-33	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY		
	ELECTROCARDIOGRAM	CJ0060J	NOT DISPLAYED		NO	30-15/16	
	ELECTROCARDIOGRAM	CJ0061J	NOT DISPLAYED		NO	30-15/16	
	ELECTROCARDIOGRAM	CJ0062J	NOT DISPLAYED		NO	30-15/16	
	CO2 PARTIAL PRESSURE	CF0005P	METER	COMMON	NO	30-2/27/28	
	SUIT CABIN DELTA PRESS	CF0005P	NOT DISPLAYED		NO	30-9/19	
	ORAL TEMPERATURE		CLINICAL THERMOMETER		NO	30-20	
	PNEUMOGRAM	CJ0200R	NOT DISPLAYED		NO	30-17	
	PNEUMOGRAM	CJ0201R	NOT DISPLAYED		NO	30-17	
	PNEUMOGRAM	CJ0202R	NOT DISPLAYED		NO	30-17	
	LM						
	CO2 PARTIAL PRESSURE	GF1521P	METER		NO		
	ELECTROCARDIOGRAM	GT9999	NOT DISPLAYED		NO	30-15/16	
	PNEUMOGRAM		NOT DISPLAYED		NO	30-17	
	PLSS						
	PLSS ELECTROCARDIOGRAM	GT0124J			NO	30-15/16	
	*MANDATORY TO CABIN CLOSOUT						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 12	PNL	9/18/66	AEROMEDICAL	1487R REV	30-5

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MISSION RULES

SECTION 22 - ALSEP 3

REV	ITEM				
<u>GENERAL</u>					
24	GENERAL				
	(A) THESE ALSEP GENERAL OPERATIONAL GUIDELINES ARE BASED ON OBJECTIVES IN THE FOLLOWING PRIORITIES---				
	(1) PSE				
	(2) LSM				
	(3) SWS				
	(4) SIDE				
	(5) ENGINEERING				
	(B) THE GATHERING OF SCIENTIFIC DATA WILL NOT BE COMPROMISED FOR ENGINEERING OR TEST PURPOSES.				
	(C) REDUNDANT OR BACKUP SYSTEMS WILL NOT BE SELECTED UNLESS A FAILURE WARRANTS SUCH ACTION; SWITCHING TO REDUNDANT SYSTEMS WILL NOT BE ACCOMPLISHED TO SATISFY ENGINEERING TESTS UNLESS ALL SCIENTIFIC MISSION OBJECTIVES HAVE BEEN COMPLETED.				
	(D) BIT RATES WILL NOT BE CHANGED ON THE ALSEP UNLESS THIS ACTION WILL CORRECT CERTAIN SYNC PROBLEMS (FROM THAT OPERATIONAL MSPA SITE) OR UNLESS A CHANGE OF BIT RATE IS NECESSARY TO SATISFY CERTAIN SCIENTIFIC OBJECTIVES. IF THE BIT RATE IS CHANGED FROM THE NORM BECAUSE OF A MSPA PROBLEM, THE ALSEP WILL BE CONFIGURED BACK TO NORMAL (1.00 KBPS) PRIOR TO TERMINATION OF SUPPORT OF THAT SITE.				
	(E) BEFORE IMPLEMENTING ANY MISSION RULE ACTION BASED ON AN APPARENT ALSEP MALFUNCTION, IT WILL BE ASCERTAINED THAT THERE IS NO PROBLEM WITH THE MSPA SUPPORTING SITE.				
	(F) THE TIMER INHIBIT COMMAND WILL NOT BE SENT PRIOR TO ALL EXPERIMENTS BEING ON AND PROPERLY ADJUSTED FOR OPTIMUM SCIENTIFIC DATA RETURN.				
	(G) THE TIMER WILL NEVER BE INHIBITED WHILE THE ALSEP TRANSMITTER IS OFF; AND THE ALSEP TRANSMITTER WILL NEVER BE COMMANDED OFF WHILE THE TIMER IS INHIBITED.				
	(H) ALSEP EXPERIMENTS WILL NOT BE COMMANDED TO "STANDBY OFF" ("STANDBY" IN THE CASE OF LSM) UNLESS THE ACTION IS JUSTIFIED BY AN ANOMALY.				
	(I) ANYTIME THERE IS AN AUTOMATIC SWITCHOVER TO PCV NO. 2 NOT IDENTIFIABLE TO A FAILURE IN PCV NO. 1, A ONE-TIME COMMAND WILL BE ATTEMPTED TO RETURN TO PCV NO. 1 IF THE +12 VDC BUS IS GREATER THAN 11.0.				
	(J) NO COMMAND FUNCTION CAN BE EXECUTED (OTHER THAN "STANDBY OFF," "STANDBY SELECT," OR "OPERATE SELECT") IN AN EXPERIMENT, BY GROUND COMMAND OR BY ONBOARD TIMER, UNLESS THE EXPERIMENT IS IN THE "OPERATE" MODE.				
	(K) THE ALSEP TURN-ON SEQUENCE IS---				
	(1) ASTRONAUT REMOVE SHORTING PLUG SWITCH ASAP AFTER DEPLOYMENT OF THE PSE, LSM, SIDE AND SWS.				
	(2) CREW WILL ACTIVATE ASTRO SWITCH NO. 1 PER DIRECTION FROM THE GROUND; SWITCH NO. 1 ACTIVATION WILL BE BASED ON PREDICTED AVAILABILITY OF 30.0 WATTS FROM THE A70 (SEE FIGURE 4.1, ALSEP SYSTEMS HANDBOOK).				
	(L) IF THE GROUND IS UNABLE TO COMMAND TRANSMITTER 2 ON AND/OR EXPERIMENTS ON, THE ASTRONAUT WILL TURN ON ASTRO SWITCHES NO. 2 AND/OR NO. 3 DURING EVA NO. 2.				
	(M) THE CENTRAL STATION HEATERS AND PDR'S WILL BE UTILIZED TO MAINTAIN AN AVERAGE INTERNAL THERMAL PLATE TEMPERATURE WITH THE LOWEST TEMPERATURE GREATER THAN 0 DEG F, AND THE HIGHEST TEMPERATURE LESS THAN 125 DEG F.				
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 13	A	10/15/70	ALSEP 2	MANAGEMENT	51-1

NASA - Manned Spacecraft Center

MISSION RULES  
SECTION 91 - ALSEP 1

REV	ITEM													
		<p>2. <u>PSE</u></p> <p>(S) THE PSE WILL BE UNCAGED ASAP AFTER THE PSE IS COMMANDED ON.</p> <p>(B) THE PSE LEVELING MOTORS WILL NOT BE ACTIVATED PRIOR TO UNCAGING.</p> <p>(C) AFTER PSE LEVELING OF THE HORIZONTAL COMPONENTS (LPA AND LPY) HAS BEEN COMPLETED, THE COARSE LEVEL SENSORS WILL BE GROUND COMMANDED OUT (VIA CMD 102).</p> <p>(D) FOR PROPER OPERATION OF THE PSE, THE FEEDBACK FILTER MUST BE IN THE FOLLOWING MODES (CMD 101: PSE FILTER IN/OUT)---</p> <p>    (1) LEVELING MODE--FILTER OUT</p> <p>    (2) LONG PERIOD CALIBRATION--FILTER IN.</p> <p>    (3) NORMAL OPERATIONAL MODE--FILTER IN.</p> <p>(E) THE X-AXIS AND Y-AXIS MASSES OF THE PSE SHOULD BE LEVEL BEFORE LEVELING THE Z-AXIS MASS.</p> <p>(F) THE PSE SENSOR HEATERS SHOULD BE OFF DURING OPERATION OF THE PSE LEVELING MOTORS.</p> <p>(G) DURING FORCED LEVELING OPERATIONS, CAUTION SHALL BE EXERCISED PRIOR TO INITIATING LEVELING MOTOR OPERATION TO INSURE THAT PROPER DIRECTION AND SPEED HAVE BEEN SELECTED.</p> <p>3. <u>LSM</u></p> <p>(A) A SITE SURVEY WILL NOT BE PERFORMED UNTIL THE PUN CTIONAMERIFICATION OF EXACTLY FOUR FLIP/CALS IS COMPLETE. NO FLIP/CAL WILL BELOWED BETWEEN THE 1, Y AND 2 SITE SURVEYS. EITHER INITIATED FLIP/CAL SHALL BE INHIBITED (BY LSM FLIP/CAL INHIBIT) UNTIL COMPLETION OF THE SITE SURVEY.</p> <p>(B) OPERATIONAL POWER WILL NOT BE REMOVED FROM THE LSM DURING THE LUNAR NIGHT PERIODS, EXCEPT AS NOTED IN RULE 91-53. (CRITICAL TEMPERATURE IS -30 DEG C.)</p> <p>(C) NO ALSEP CMD'S SHOULD BE PLANNED DURING THE SITE SURVEY.</p> <p>4. <u>ISA</u></p> <p>HIGH GAIN (CMD 122) THREE TIMES WITHIN 10 SECONDS) WILL BE COMMANDED WHEN LEVEL 14 READS 25 PA DURING OPERATE MODE.</p> <p>5. <u>SLD</u></p> <p>(A) GROUND COMMAND 107 (REMOVES DUST COVER) WILL NOT BE SENT TO THE ALSEP PRIOR TO LM LUNAR ASCENT.</p> <p>(B) THE SLD SHOULD REMAIN IN THE OPERATE MODE UNTIL AFTER DUST COVER REMOVAL.</p>												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">MISSION</td> <td style="width: 10%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 15%;">SECTION</td> <td style="width: 15%;">GROUP</td> <td style="width: 10%;">PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/10/69</td> <td>ALSEP 1</td> <td>MANAGEMENT</td> <td>51-8</td> </tr> </table>			MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	A	10/10/69	ALSEP 1	MANAGEMENT	51-8
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 12	A	10/10/69	ALSEP 1	MANAGEMENT	51-8									

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 31 - ALSEP 1

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	31-1	A. ST-01 FAILED CLOSED		A. DSS 3 HTR (10W)--OFF	A. DSS 3 HTR OFF--CMD 023 CUE-- AT-04 THERMAL PLATE TEMP 2 GREATER THAN 18 DEG F.												
		B. ST-01 FAILED OPEN		B. SEE GENERAL RULE NO. 3M													
		31-2 TO 31-10 RESERVED FOR THERMAL															
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 10</td> <td>A</td> <td>10/10/69</td> <td>ALSEP 1</td> <td>THERMAL</td> <td>31-1</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 10	A	10/10/69	ALSEP 1	THERMAL	31-1
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 10	A	10/10/69	ALSEP 1	THERMAL	31-1												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 31 - ALSEP 1

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS																												
	31-11	FAILURE OF AUTO SWITCHOVER TO PCU NO. 2		SELECT PCU NO. 2	<p>PCU NO. 2 SEL-CMD 002 AUTO SWITCHOVER TO PCU NO. 2 SHOULD OCCUR AT +12 VDC OUT OF LIMITS (LESS THAN 11 VDC/GREATER THAN 13 VDC)</p> <p>CUE--- THE FOLLOWING TM WILL BE OUT-OF-LIMITS---</p> <table border="1"> <thead> <tr> <th>TM</th> <th>NOMINAL</th> <th>H1</th> <th>L0</th> </tr> </thead> <tbody> <tr> <td>AE-9</td> <td>+12</td> <td>+13.0</td> <td>+11.0</td> </tr> <tr> <td>AE-7</td> <td>+29</td> <td>+31.5</td> <td>+29.7</td> </tr> <tr> <td>AE-8</td> <td>+18</td> <td>+16.2</td> <td>+19.8</td> </tr> <tr> <td>AE-10</td> <td>+8</td> <td>+9.4</td> <td>+6.6</td> </tr> <tr> <td>AE-11</td> <td>-12</td> <td>-11.0</td> <td>-13.0</td> </tr> <tr> <td>AE-12</td> <td>-A</td> <td>-3.5</td> <td>-6.5</td> </tr> </tbody> </table>	TM	NOMINAL	H1	L0	AE-9	+12	+13.0	+11.0	AE-7	+29	+31.5	+29.7	AE-8	+18	+16.2	+19.8	AE-10	+8	+9.4	+6.6	AE-11	-12	-11.0	-13.0	AE-12	-A	-3.5	-6.5
TM	NOMINAL	H1	L0																														
AE-9	+12	+13.0	+11.0																														
AE-7	+29	+31.5	+29.7																														
AE-8	+18	+16.2	+19.8																														
AE-10	+8	+9.4	+6.6																														
AE-11	-12	-11.0	-13.0																														
AE-12	-A	-3.5	-6.5																														
	31-12	RESERVE POWER LESS THAN 2.0V		<p>COMMAND EXPERIMENTS TO "STANDBY CM" IN THE FOLLOWING PRIORITY---</p> <p>PSIB                      TMS                      TSM                      PSB</p>	<p>CUE--- C02 FOR PCU NO. 1                      C04 FOR PCU NO. 2</p>																												
	31-13 TO 31-20 RESERVED FOR ELECTRICAL																																
		MISSION	REV	DATE	SECTION	GROUP	PAGE																										
		APOLLO 12	A	8/18/70	ALSEP 1	ELECTRICAL	31-9																										



NASA - Manned Spacecraft Center

MISSION RULES

SECTION 21 - ALSEP 1

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	21-21	ALSEP FAILS TO RESPOND TO A COMMAND		A. RETRIEATE THE COMMAND  B. IF UNSUCCESSFUL, SELECT OTHER DECODER (ALSEP 1A OR 1B) AND RETRIEATE THE COMMAND.	CUE-- NO FUNCTIONAL VERIFICATION AND NO CMD VERIFICATION WORD (CVW)  VERIFY RECEIVER CB (CS-01) HAS NOT OPENED. AE-14 OR AE-13 OUT-OF-LIMITS. 12 HR PULSE WILL CLOSE CB.												
	21-22	CMD YIELDS FUNCTION BUT NO CVW		A. SEND "SPARE" CMD  B. IF NO CVW, SWITCH TO OTHER DATA PROCESSOR	A. "SPARE" CMDS SHOULD YIELD CVW BUT NO FUNCTION. CMD 150, 153, 154 AND 155 ARE "SPARE" CMDS.  B. CMD 024 PROC. "R" SEL CMD 025 PROC. "V" SEL												
		21-23 TO 21-25 RESERVED FOR CMD															
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 13</td> <td>A</td> <td>10/18/70</td> <td>ALSEP 1</td> <td>COMMAND</td> <td>21-5</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 13	A	10/18/70	ALSEP 1	COMMAND	21-5
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 13	A	10/18/70	ALSEP 1	COMMAND	21-5												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 31 - ALSEP 1

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	31-21	WEAK TM SIGNAL		A. SELECT REDUNDANT XMTR B. SELECT LOW BIT RATE	A. XMTR A SEL--CMD 012 XMTR B SEL--CMD 013 B. LOW BIT RATE SEL--CMD 007 LSH DATA NOT USABLE IN LOW BIT RATE.
	31-22	LOSS OF SYNC OR BAD DECODED DATA		A. SELECT REDUNDANT PROCESSOR B. SELECT LOW BIT RATE	A. PROC '1A1' SEL--CMD 034 B. LOW BIT RATE SELECT--CMD 007
	31-23	LOSS OF TM SIGNAL		A. SEND TM ON. B. SELECT REDUNDANT XMTR C. APT R NEXT 12 HR PULSE-- REPEAT A & B.	A. TM ON--CMD 013 B. XMTR A SEL--CMD 012 XMTR B SEL--CMD 013 C. IF RCVR CG (CG-01) OPEN, NEXT 12 HR PULSE WILL RESET IT. NOTE-- IF PSE LEVELING IS IN PROGRESS, SEND PSE STBY SEL-- CMD 037.
	31-24	DATA DEMAND SIGNAL FROM DATA PROCESSOR FAILS HIGH		SELECT REDUNDANT PROCESSOR USING THE OTHER DECODER	CUE-- CVR IS STEADILY INDICATING AN ERRONEOUS PATTERN OTHER THAN ALL ZEROS (CVR LIGHT ON EVERY 0.0 SECONDS) AFTER A CMD HAS BEEN SENT. PROC '1A1' SEL--CMD 034 PROC '1A2' SEL--CMD 036
	31-36	RESERVED FOR TELEMETRY			
MISSION Rev DATE SECTION ORG. PAGE					
POLLO 11 A 10/19/68 ALSEP 1 TELEMETRY 31-9					

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 31 - ALSEP 1

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	31-31	FAILURE OF AUTOMATIC LEVELING MODE		PERFORM FORCED LEVELING BY GROUND COMMANDS	PSE ACTIVATION PRESETS LEVELING MODE TO AUTOMATIC; CMD 103 WILL SWITCH TO FORCED MODE; CMD 103 IS A TWO-STATE CMD; PSE LEVELING MODE AUTO/FORCED.
	31-32	PSE LEVELING MOTOR FAILS ON		ALTERNATELY BND CMD PSE TO STANDBY SELECT AND TO OPERATE SELECT	CUE-- LEVELING MOTOR WILL DRAW 3 WATTS FROM RESERVE POWER. PSE STAY SEL--CMD 097 PSE OPER. SEL--CMD 098
	31-33	PSE LEVELING MOTOR FAILS OFF		NO ACTION TO BE TAKEN	CUE-- NO DROP IN RESERVE POWER (NORMALLY 3 WATTS) WHEN REPEATED EFFORTS ARE MADE TO TURN MOTOR ON; AND NO ACTIVITY ON SHORT PERIOD Z-DATA CHANNEL.
	31-34	FAILURE OF MECHANICAL LEVEL DRIVE		SELECT LOW SPEED AND HIGH SPEED AND DIRECTION REVERSALS ALTERNATELY.	CUE-- NO MOTION OF THE PLATFORM CAN BE DETECTED ON THE LP HORIZONTAL OR LP-Z COMPONENT TIDAL OUTPUT. X-NTR ON/OFF--CMD 070 Y-NTR ON/OFF--CMD 071 Z-NTR ON/OFF--CMD 072 DIRECTION PLUS/MINUS--CMD 076 SPEED LOW/HIGH--CMD 079
	31-35	MISALIGNED COARSE SENSOR		A. COMMAND COARSE SENSOR OUT WHEN CORRESPONDING MOTOR IS IN LEVELING OPERATION. B. PERFORM FORCED LEVELING OF THE PSE BY GND CMD.	WHILE IN FINAL LEVELING PHASE (LOW STEPPING RATE); THE MOTOR REVERTS TO A HIGH STEPPING RATE. REPEATEDLY WITHOUT ACHIEVING CENTERING, COARSE LEVEL SENSOR AND SIGNAL WILL NEVER ALIGN, AND THE MOTOR WILL CONTINUE TO DRIVE BEYOND LEVEL. COARSE SENSOR OUT--CMD 102
	31-36	FAILURE OF COARSE LEVEL SENSOR		A. SELECT FORCED PSE LEVELING MODE. B. GROUND COMMAND COARSE LEVEL SENSOR OUT. C. PROCEED WITH FORCED LEVELING FOR COARSE LEVELING. D. USE AUTO MODE FOR FINE LEVELING.	CUE-- NO HIGH SPEED MOTOR OPERATION IS NOTICED DURING INITIAL LEVELING PHASE AND COMPONENT DOES NOT CENTER WITHIN EXPECTED TIME (40 MINUTES MAXIMUM IN AUTO MODE); USE HIGH SPEED LEVELING FOR COARSE LEVELING. CMD 103--PSE LEVELING MODE AUTO/FORCED. CMD 102--COARSE LEVEL SENSOR OUT
MISSION REV DATE SECTION GROUP PAGE 1					
POLLO 12 A 10/15/70 SECT 3 PSE 11-2					

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 31 - ALSEP 1

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
31-37	LONG PERIOD COMPONENT STICKS			<p>A. USE HIGH SPEED; FORCED LEVELING IN DIRECTION WHICH PULLS MASS AWAY FROM STOP.</p> <p>B. IF UNSUCCESSFUL; SELECT LOW SPEED AND HIGH SPEED AND DIRECTION REVERSALS ALTERNATELY.</p>	<p>CUE--- FAILURE TO CENTER WITHIN EXPECTED TIME 140 MINUTES MAXIMUM IN AUTO MODE; IF STEPS A AND B FAIL; LP COMPONENT IS DEFECTIVE.</p> <p>NOTE--- DO NOT EXCEED 5 MIN 30 SEC IN HIGH SPEED.</p> <p>X-MTR ON/OFF--CMD 870</p> <p>Y-MTR ON/OFF--CMD 871</p> <p>Z-MTR ON/OFF--CMD 872</p> <p>DIRECTION PLUS/MINUS--CMD 874</p> <p>SPEED HIGH/LOW--CMD 875</p>												
31-38	ELECTRICAL FAILURE OF LONG PERIOD COMPONENT			<p>TERMINATE LEVELING OF THE AFFECTED AXIS AFTER COARSE SENSOPHASE IS COMPLETED</p>	<p>CUE--- TIDAL OUTPUT IS WITHIN RANGE; BUT IS NOT AFFECTED BY LEVELING OR CENTERING DRIVE.</p>												
31-39	AUTOMATIC SWITCHOVER OF PBE TO STANDBY			<p>IF PBE HAS NOT BEEN TRIPPLED OFF; CMD PBE TO OPERATE SELECT</p>	<p>IF CIRCUIT BREAKER CB-04 HAS OPENED FROM OVERCURRENT (500 MA +/- 10 PERCENT) IN STANDBY MODE WILL BE SELECTED AND THE CO WILL BE RESET AUTOMATICALLY.</p> <p>PBE OPER SEL--CMD 896</p>												
31-40	FAILURE OF PBE UNCAGE SEQUENCE			<p>A. TO UNCAGE ARM--</p> <p>1. SEND UNCAGE ARM/FIRE.</p> <p>B. IF UNSUCCESSFUL; FIRST 15 HR TIMER PULSE WILL ARM ACTUATOR.</p> <p>C. IF UNSUCCESSFUL; 30 HR OR 45 HR PULSE FROM DELAYED CMD SEQUENCER WILL ARM ACTUATOR.</p> <p>D. TO UNCAGE FIRE (AFTER ACTUATOR HAS BEEN ARMED):</p> <p>1. SEND UNCAGE ARM/FIRE.</p> <p>2. IF UNSUCCESSFUL; SEND CMD 897; PBE STANDBY SEL.</p> <p>3. IF UNSUCCESSFUL; NEXT 15-HR TIMER PULSE WILL ARM AND FIRE THE ACTUATOR.</p>	<p>NORMAL UNCAGING IS ACCOMPLISHED BY SENDING CMD 892--UNCAGE ARM/FIRE--100; ONCE TO ARM AND ONCE TO FIRE THE ACTUATOR.</p> <p>NOTE--- UNCAGING MAY NOT BE POSSIBLE UNLESS AT 85 THERMAL PLATE 5 TEMP IS ABOVE +30 DEG F.</p> <p>NOTE--- SELECTING PBE STANDBY WILL RESET ARM LOGIC IF ACTUATOR IS NOT FIRED.</p> <p>NOTE--- 30 SEC IS REQUIRED BETWEEN ARM AND FIRE TO CHARGE CAPACITOR.</p>												
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>CASE</td> </tr> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/15/70</td> <td>ALSEP 1</td> <td>PBE</td> <td>31-3</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	CASE	APOLLO 12	A	10/15/70	ALSEP 1	PBE	31-3
MISSION	REV	DATE	SECTION	GROUP	CASE												
APOLLO 12	A	10/15/70	ALSEP 1	PBE	31-3												

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 31 - ALSEP 3

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	31-03	PSE GOES OFF WHILE IN STANDBY MODE		DURING NORMAL OPERATIONS, CMD PSE TO STBY SEL	CUE--- EXP 3 STBY DISCRETE EXTINGUISHES, AND RESERVE POWER INCREASES SINCE POWER IS REMOVED FROM THE HEATERS. IF FUSE (F-03) HAS BEEN BLOWN BY OVERCURRENT (900 MA), CAPABILITY TO SELECT PSE STBY MODE IS LOST. CMD 037--PSE STBY SEL CMD 037--PDR 3 ON		
	31-02	PSE TEMP LOW AND AUTO THERMAL CONTROL FAILS		COMMAND HEATER TO MANUAL ON	ASSUME AUTOMATIC THERMOSTAT CONTROL FAILED. CMD 070 IS A 4-STATE CMD, WHICH CAN SEQUENTIALLY STEP THRU THE FOLLOWING MODES TO CONTROL THE PSE SENSOR HEATER. 1. OFF 2. MANUAL HTR ON 3. OFF 4. AUTOMATIC THERMOSTAT CONTROL ENABLED DL-07 PSE INSTRUMENT TEMP LOW LIMIT IS 120 DEG F. MINIMUM OF 6 WATTS RESERVE POWER IS REQUIRED.		
	31-03	PSE TEMP HIGH AND AUTO THERMAL CONTROL FAILS		A. COMMAND HEATER OFF	A. CMD 076 IS 4-STATE CMD. 1. OFF 2. MANUAL HTR ON 3. OFF 4. AUTOMATIC THERMOSTAT CONTROL ENABLED. DL-07 PSE INSTRUMENT TEMP HIGH LIMITS IS +130 DEG F. B. IF UNSUCCESSFUL, CMD PSE TO STBY, THEN TO OPERATE		
	31-04	LOSS OF DOWNLINK DURING LEVELING MOTOR OPERATION		SEND PSE STBY SEL	NOTE--- PSE STBY SEL WILL STOP MOTORS.		
	31-05	HORIZONTAL DATA LESS THAN -20/ GREATER THAN +20 M RAD		LEVEL PSE X AND/OR Y AXIS	CUE--- DL-4 (X-AXIS) DL-5 (Y-AXIS)		
	31-06	VERTICAL DATA LESS THAN -3/ GREATER THAN +3 M GAL		LEVEL PSE Z-AXIS	CUE--- DL-6		
		31-07 TO 31-30 RESERVED FOR PSE					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 13	A	10/19/79	ALSEP 3	PSE	31-9

NASA - Manned Spacecraft Center

MISSION RULES

SECTION 31 - ALSOP 1

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULES	QUES/NOTES/COMMENTS
	31-31	LOSS OF LSM DATA		A. VERIFY NORMAL BIT RATE. B. CMD LSM OPER.	NORMAL BIT RATE SEL--CMD 106 LSM OPER--042 NOTE--- LSM DATA NOT USABLE IN LOW BIT RATE.
	31-32	MAINTAIN LSM TEMP 40 +/- 10 DEG C.		A. SELECT Y SENSOR THERMOSTAT. B. IF TEMP CONTINUES HIGH, TURN HTS OFF.	CMD 134 IS 3-STATE CMD--- 1. A SENSOR THERMOSTAT SEL (PRESET) 2. Y SENSOR THERMOSTAT SEL 3. ALL HTS OFF CUE--- OM-1 FOR X-AXIS OM-2 FOR Y-AXIS
	31-33	FAILURE OF FLIP/CAL TO STOP		CMD THE FOLLOWING SEQUENCE--- LSM STBY--043 LSM OPER--042	NOTE--- NORMAL FLIP/CAL SEQUENCE IS 390 SEC. NOTE--- DURING 12-HR NIGHTS, RETURN TO OPER WITHIN 12-HR AFTER STBY.
	31-34	FLIP/CAL SEQUENCE NOT INITIATED BY TIMER AT 12-HR INTERVALS		A. VERIFY FLIP/CAL INHIBIT OFF B. CMD FLIP/CAL GO. C. IF UNSUCCESSFUL, SEND FOLLOWING CMD SEQUENCE--- 1. 043--STBY SEL 2. 042--OPER ON 3. 127--FLIP/CAL INHIBIT OFF 4. 131--FLIP/CAL GO	A. CUE--- DM-23 IS A "10." CMD 127 B. CMD 131 C. REINITIALIZE LOGIC. NOTE--- AFTER 48 HRS OF NO FLIP/CALS--PRIORITY LOWERED TO 4.
		31-35 TO 31-60 RESERVED FOR LSM			

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 12	A	10/19/69	ALSOP 1	LSM	31-10

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MISSION RULES

SECTION 31 - ALSEP 1

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	31-61	UNABLE TO BREAK CCSE SEAL AND/OR UNABLE TO REMOVE SIDE DUST COVERS		WAIT FOR DELAYED TIMER TO INITIATE CMDS	PET 96 HRS 2 MIN--BREAK SEAL PET 96 HRS 3 MIN--EXECUTE PET 96 HRS 4 MIN--REMOVE DUST COVERS PET 96 HRS 8 MIN--EXECUTE												
	31-63	CMD REGISTER DOES NOT AGREE WITH UPLINK COMMAND		RESET LOAD REGISTER	CUE-- DI-64 RESET REGISTER BY UPLINKING CMDS 100, 109, 106, AND 107-- THEN EXECUTE WITH 310 EXCEPT AS NOTED IN GENERAL RULE 9A.												
	31-63	INTERNAL ARCING		CMD TO STBY	CUE-- DI-1 (FRAME COUNTER) ERRATIC CMD 053												
	31-64 TO 31-70	RESERVED FOR SIDE															
<table border="1"> <tr> <td>MISSION</td> <td>REV</td> <td>DATE</td> <td>SECTION</td> <td>GROUP</td> <td>PAGE</td> </tr> <tr> <td>APOLLO 12</td> <td>A</td> <td>10/13/69</td> <td>ALSEP 1</td> <td>SIDE</td> <td>31-11</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	A	10/13/69	ALSEP 1	SIDE	31-11
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 12	A	10/13/69	ALSEP 1	SIDE	31-11												

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MISSION RULES

SECTION 31 - ALSEP 1

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	31-71	INTERNAL ARCING		CHD TO STBY	CUE-- D-1 AND/OR D-2 (SEQUENCE COUNTER) ERRATIC CHD--046
	31-72	A. TEMP LESS THAN DEG C B. TEMP GREATER THAN DEG C		A. CHD TO STBY B. CHD TO OFF	A. CHD 046--TURN ON 4 WATTS OF HEAT. B. CHD 046 THEN CHD 050 WILL TURN OFF ALL HTRs. DURING OPERATE MODE, THERMISTAT CONTROL IS 20 +/- DEG C. CUE-- D-31, 12, 13 AND 14
		31-73 TO 31-80 RESERVED FOR SWS			



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APPENDICES

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A ACRONYMS AND  
SYMBOLS

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MISSION RULES

APPENDIX A - ACRONYMS AND SYMBOLS

REV	ITEM				
	PIPA	PULSE INTEGRATING PENDULOUS ACCELEROMETER	SOOB	SPACECRAFT OPERATIONAL DATA BOOK	
	PLSS	PORTABLE LIFE SUPPORT SYSTEM	SOL	SOLENOID	
	PO	POWER OUT	SOP	STANDARD OPERATING PROCEDURE	
	PO2	PARTIAL PRESSURE OXYGEN	SOV	SHUT-OFF VALVE	
	POS	POSITION	SPAN	SPACECRAFT PLANNING AND ANALYSIS	
	POS	PRIMARY OXYGEN SYSTEM	SPS	SERVICE PROPULSION SYSTEM	
	PPM	PARTS PER MILLION	SRO	SUPERINTENDENT RANGE OPERATIONS	
	PPQS	PROPELLANT QUANTITY GAGING SYSTEM	SSC	SPACE SUIT COMMUNICATOR	
	PRELN	PRELAUNCH	STBY	STANDBY	
	PRESS	PRESSURE	SV	SWITCH	
	PRI	PRIMARY	SET	SEXTANT	
	PROC	PROCEDURE			
	PROP	PROPELLANT	TB	TIME BASE	
	PSA	POWER SERVO AMPLIFIER	TBD	TO BE DETERMINED	
	PSI	POUNDS PER SQUARE INCH	TC	TEST CONDUCTOR	
	PSID	POUNDS PER SQUARE INCH DIFFERENCE	T/C	TELEMETRY AND COMMUNICATIONS	
	PSB	PAD SAFETY SUPERVISOR	TCE	CONDENSER EXHAUST TEMPERATURE	
	PTA	PLATE TORQUE ASSEMBLY	TCP	THRUST CHAMBER PRESSURE	
	PTP	PREFERRED TARGET POINT	TD&E	TRANSPORTATION, DOCKING AND EJECTION	
	PTY	PITCH THRUST VECTOR	TOP	TELEMETRY DATA PROCESSOR	
	PU	PROPELLANT UTILIZATION	TPLCOM	LM EECOM	
	PUGS	PROPELLANT UTILIZATION AND GAGING SYSTEM	TEMP	TEMPERATURE	
	PVT	PRESSURE-VOLUME-TEMPERATURE	IFF	TIME OF FREE FALL	
	PYRO	PYROTECHNICS	TMC	THRUST AND CONTROLLER	
			TIG	TIME OF IGNITION	
	QTY	QUANTITY	TIL	TRANSUNAR INJECTION	
			TM	TELEMETRY	
			TMG	THERMAL METEOROID GARMENT	
			TNK	TANK	
			TKO	THRUST OKAY	
	RAD	RADIATOR	TPF	TERMINAL PHASE FINALIZATION	
	RET	RETRACT	TPI	TERMINAL PHASE INITIATE	
	RCS	REACTION CONTROL SYSTEM	TRNS	TRANSFER	
	RCU	REMOTE CONTROL UNIT	TRUN	TRUNNION	
	RCVR	RECEIVER	TRC	TRANSLATION THRUST CONTROLLER	
	REF	REFERENCE	TVT	TELETYPE	
	REFSMAT	REFERENCE STABLE MEMBER MATRIX	TVC	THRUST VECTOR CONTROL	
	REQD	REQUIRED			
	RETRB	RETRO ELAPSED TIME TO REVERSE B	U/D	UP/DOWN	
	RETRO	RETROFIRE OFFICER	UDL	UPDATE LINK	
	REV	REVOLUTION	UHF	ULTRA HIGH FREQUENCY	
	RF	RADIO FREQUENCY	UNDCO	UNDOCKED	
	RFO	RETROFIRE OFFICER	USB	UNIFIED S-BAND	
	RGA	RATE GYRO ASSEMBLY			
	RHC	ROTATION HAND CONTROLLER	VC	VELOCITY COUNTER	
	RIP	RANGE OF IMPACT POINT	VEI	INERTIAL VELOCITY AT ENTRY	
	RL	ROLL LEFT	VGX	VELOCITY TO BE GAINED X-AXIS	
	RNDZ	RENDEZVOUS	VGY	VELOCITY TO BE GAINED Y-AXIS	
	RP-RT	DOWNRANGE ERROR	VGZ	VELOCITY TO BE GAINED Z-AXIS	
	RR	RENDEZVOUS RADAR	VHF	VERY HIGH FREQUENCY	
	RR	ROLL RIGHT	VLV	VALUE	
	RSI	ROLL STABILITY INDICATOR	VSM	VIDEO SWITCHING MATRIX	
	RSG	RANGE SAFETY OFFICER			
	RSVR	RESOLVER			
	RTACF	REAL-TIME AUXILIARY COMPUTING FACILITY	WBD	WIDE-BAND DATA	
	RTC	REAL-TIME COMMAND	WMS	WASTE MANAGEMENT SYSTEM	
	RTCC	REAL-TIME COMPUTER COMPLEX	WT	WEIGHT	
	S/C	SPACECRAFT	XFEED	CROSSFEED	
	SCE	SIGNAL CONDITIONING EQUIPMENT	XMIT	TRANSMIT	
	SCS	STABILIZATION AND CONTROL SYSTEM	XNTR	TRANSMITTER	
	SEC	SECONDARY			
	SEC	SECOND			
	SECO	SUSTAINER ENGINE CUTOFF S-IVBCUTOFF	Y	YAW OR Y-AXIS	
	SECS	SEQUENTIAL EVENTS CONTROL SYSTEM	YTV	YAW THRUST VECTOR	
	SHE	SUPER-CRITICAL HELIUM			
	SIG	SIGNAL			
	SLA	SPACECRAFT LM ADAPTER	Z	Z-AXIS	
	SLV	SATURN LAUNCH VEHICLE			
	SM	SERVICE MODU. I			
	SNJC	SERVICE MODULE JETTISON CONTROLLER			

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APPENDIX A - ACRONYMS AND SYMBOLS

REV	ITEM														
		SYMBOLS													
		<table border="0"> <tr> <td>M</td> <td>ALTIITUDE</td> </tr> <tr> <td>DELTA V<sub>IN</sub></td> <td>DELTA VELOCITY IN INSERTION</td> </tr> <tr> <td>DELTA T<sub>B</sub></td> <td>DELTA BURN TIME</td> </tr> <tr> <td>DELTA H</td> <td>DELTA ALTIITUDE</td> </tr> </table>						M	ALTIITUDE	DELTA V <sub>IN</sub>	DELTA VELOCITY IN INSERTION	DELTA T <sub>B</sub>	DELTA BURN TIME	DELTA H	DELTA ALTIITUDE
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DELTA T <sub>B</sub>	DELTA BURN TIME														
DELTA H	DELTA ALTIITUDE														
		MISSION	REV	DATE	SECTION	GROUP	PAGE								
		APOLLO 12	FNL	9/10/69	ACRONYMS AND SYMBOLS		A-4								

1

1

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LIST

1

1

1

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MISSION RULES  
APPENDIX B - DISTRIBUTION LIST

REV	ITEM												
	<p>-----            * DISTRIBUTION LIST *            -----</p>												
	<p><u>DIRECTOR OF FLIGHT OPERATIONS</u></p> <p>FA/KRAFT: Co. Co. JR. (13)            SJOBERG: S.A.            ROSE: R.S.            KOONS: W.E.</p>												
	<p><u>FLIGHT CONTROL DIVISION</u></p> <p>FC/KRANE: E.F.            LUNNEY: S.S.            CHARLESWORTH: C.E.            GRIFFIN: S.D.            WINDLER: M.L.            FRANK: M.P.            ROACH: J.W.            BROOKS: M.P.            MILLER: M.G.</p>												
	<p><u>FLIGHT CONTROL OPERATIONS BRANCH</u></p> <p>FC2/HARLAN: Co.S.            LEWIS: Co.R.            FENDEL: S.L. (13)            SAUCK: P.L. (13)            PLATT: V.E. (19)            MOCHNA: W.M.</p>												
	<p><u>CM SYSTEMS BRANCH</u></p> <p>FC3/ALDRICH: A.D.            MITCHINSON: N.B.            LOE: T.R. (20)            WILLOUGHBY: B.N. (18)            BLAIR: W.L. (2)</p>												
	<p><u>LM SYSTEMS BRANCH</u></p> <p>FC4/HANNIGAN: J.E. (4)            PUDDY: D.R. (20)            CARLTON: R.L. (20)            EDELIN: F. (4)</p>												
	<p><u>FLIGHT DYNAMICS BRANCH</u></p> <p>FC5/BOSTICK: J.C.            SHAFER: P.C.            LLEWELYN: J.S. (4)            PARKER: Co.S. (19)            PAVELKA: S.L. (15)</p>												
	<p><u>MISSION SIMULATIONS BRANCH</u></p> <p>FC6/SHELLEY: C.B. (28)</p>												
	<p>MISSION CONTROL REQUIREMENTS</p> <p>FC7/PETTIT: G.J. (2)</p>												
	<p><u>EXPERIMENTS SYSTEMS BRANCH</u></p> <p>FC8/SAULTZ: J.E. (12)            MILEY: R.R. (2)</p>												
	<table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 12</td> <td>B</td> <td>10/31/79</td> <td>APPENDIX B - DISTR LIST</td> <td></td> <td>B-1</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 12	B	10/31/79	APPENDIX B - DISTR LIST		B-1
MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	B	10/31/79	APPENDIX B - DISTR LIST		B-1								



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APPENDIX B - DISTRIBUTION LIST

REV	ITEM	MISSION	REV	DATE	SECTION	GROUP	PAGE
	<p><u>MSPC FLIGHT CONTROL OFFICE</u></p> <p>P-MO-F/HAMNER, R.S. 1201</p> <p><u>FLIGHT SUPPORT DIVISION</u></p> <p><u>SYSTEMS ENGINEERING BRANCH</u></p> <p>FS2/SATTERFIELD, J.M.</p> <p><u>SUPPORT SYSTEMS BRANCH</u></p> <p>FS6/SSEGOTA, P. 121</p> <p><u>OPERATIONS SUPPORT BRANCH</u></p> <p>FS4/FRERE, J.A. SANDORN, S.D. 1201 MONKVIC, J.A. 121</p> <p><u>FLIGHT SOFTWARE BRANCH</u></p> <p>FS3/STOKES, J.D. 121 GIBSON, P.F. JR. GARMAN, J.R. 121</p> <p><u>MISSION PLANNING AND ANALYSIS DIVISION</u></p> <p>FM/MAYER, J.P. 121 MUSSE, C. 121 SINDALL, M.W. OWEN, D.M.</p> <p><u>FLIGHT ANALYSIS BRANCH</u></p> <p>FM3/ALLEN, C.P. 121</p> <p><u>LANDING ANALYSIS BRANCH</u></p> <p>FM2/BENNETT, P.V. ALPHINE, J. DOLY, M.M. DUFFNER, E. DAVIES, C.A. HARPOLE, J.C. HANSBERRY, V.</p> <p><u>MAIN PHYSICS BRANCH</u></p> <p>FM1/MCPHERSON, J.C. 121</p> <p><u>MISSION ANALYSIS BRANCH</u></p> <p>FM3/BERRY, R. 121</p> <p><u>RESEARCH ANALYSIS BRANCH</u></p> <p>FM4/LINDBERT, S.C. 121 COWDY, M.L.</p>	APOLLO 12	B	10/21/70	APPENDIX B - DISTR LIST		B-2

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MISSION RULES

APPENDIX B - DISTRIBUTION LIST

REV	ITEM	MISSION	REV	DATE	SECTION	GROUP	PAGE
	<p><u>GUIDANCE AND PERFORMANCE BRANCH</u></p> <p>PH/CASSETTE M.D. 121</p> <p><u>APOLLO TRAJECTORY SUPPORT OFFICE</u></p> <p>FMIS/PARTEN: R. COLLINS: M. BENNETT: W.J.</p> <p><u>LANDING AND RECOVERY DIVISION</u></p> <p>FL/HANMACK: J.B. 181</p> <p><u>DIRECTOR OF FLIGHT CREW OPERATIONS</u></p> <p>CA/BLAYTON: D.R. 121</p> <p><u>ASTRONAUT OFFICE</u></p> <p>CO/SHEPARD: A.B. 1201 DUKE: C.P. 121</p> <p><u>FLIGHT CREW SUPPORT DIVISION</u></p> <p>CP/NORMY: W.J. GRIMM: D.P. BILLOREAU: J.W. DEMENT: M.E. 141 ALLEN: L.B. 141 KRAMER: P.C. 131 WARREN: D.K. 131 ANDERSON: W.M. WOODLING: C.M. RICHARD: L.G. (CP-1) 121 RICHMOND: M.A. 121 VAN BOCRELL: J.J. 121 O'NEILL: J.W. 110 FARMER: B. 121 MITCHELL: J. (CP-10) COLLINS: M.B. (CP-11) RBC MCCAFFERTY: R. (CP-6) CF/FRANKLIN: G.C.</p> <p><u>DIRECTOR OF MEDICAL RESEARCH AND OPERATIONS</u></p> <p>DA/BERRY: C.A. M.D. CATTERSON: A.D. M.D. DO/MEDICAL OPERATIONS 121</p> <p><u>PUBLIC AFFAIRS OFFICE</u></p> <p>AP/DUFF: B. AP/GREEN: G.J. 131</p> <p><u>APOLLO SPACEPART PROGRAM OFFICE</u></p> <p>PA/LAY: GEORGE M. PARSONS: DILLI: J.W. MORSE: G. SLEIGH: R.D. SIMPSON: G. PA/APOLLO FILES PO/ROB: C.A. J. DUNNITT: A. POB/ROBE: J. POY/KOMAR: R. SILVER: P. 1401 POB/CRAIG: J.</p>						
		APOLLO 12	B	10/21/70	APPENDIX B - DISTR LIST		B-3

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APPENDIX B - DISTRIBUTION LIST

REV	ITEM												
	<p>                     PC32/ZACCARO, J. (2)                      PP32/CLINTOCK, J.                      PP32/FASH, H. (2)                      RA/BLAND, W. (2)                      PT/RABIAN, D. (2)                      PTD/DATA LIBRARY (2)                      DMS MISSION DATA PACK (16)                      NAS/SEIGLER, J. (2)                 </p> <p><u>DIRECTOR OF ENGINEERING AND DEVELOPMENT</u></p> <p>                     EA/FAGET, M. (2)                      GARDNER, R. (2)                      CHAMBERLAIN, J. (2)                      BOND, A. (2)                      EAS/DEANS, P. (2)                      EB/KYLE, M.                      EC3/TRAVERS, D.                      STOKER, C.                      EC5/NEULIN, R.                      EC/SMYLER, B. (2)                      EC2/MC ALLISTER, P.                      GILLEN, B. (2)                      TUCKER, E. (2)                      EC4/STUBBS, M. (2)                      EC/SWIFT, R.                      SAUTER, B. (2)                      EC4/RICCI, D.                      JOHNSON, G.                      MUMFORD, R. (2)                      ROTRANEL, F.                      CAMPOS, A. (2)                      DIET, R. (2)                      FENNER, R. (2)                      WALTER, D. (2)                      GIBBECK, R. (2)                      FARRAR, J.                 </p> <p>                     E12/LUSE, M. (2)                      E13/TREHON, R.                      EDMISTON, C. (2)                      E22/MONTGOMERY, J.                      E23/COX, R. (2) (2)                      E23/MANAWAY, J.                      E21/WASSON, C.                      E24/WILSON, R. (2)                      E24/LEWIS, R. (2)                      BURTON, P. (2)                      SHELTON, D. (2)                      E21/STUBBS, M. (2)                      MUMFORD, R. (2)                      MAMMOCK, W. (2)                      E24/KARAKULOV, V.                      DEART, D.                      E25/BELL, D.                      OVERMAN, S.                      TROUT, D.                      BRADY, D.                      E23/TROWMAN, G.                      E22/SMITH, J.                      E12/OLYNE, P. (2)                      WEISS, S. (2)                      PAYLORE, J. (2)                      E2/SILVERIA, M.                      E21/REDD, D.                 </p> <p><u>FLIGHT ADAPT OFFICE</u></p> <p>                     MAC/BA FRENCH, J. (2)                      DF/GREENWELL, D.                      SAC/MT VANCE, R. (2)                 </p> <p><u>RELIABILITY AND CERTIFICATION OFFICE</u></p> <p>                     M2/WILLIAMS, H. (2)                 </p>												
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MISSION	REV	DATE	SECTION	GROUP	PAGE								
APOLLO 12	0	10/31/69	APPENDIX B - DISTR LIST		1-2								

NASA - Manned Spacecraft Center

MISSION RULES

APPENDIX B - DISTRIBUTION LIST

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APOLLO 10	0	10/21/79	APPENDIX B - DISTRIBUTION LIST		B-2								

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