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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

[FINAL
FLIGHT MISSION RULES,

APOLLO 11
(AS-506/107/LM-5)]

MAY 16, 1969

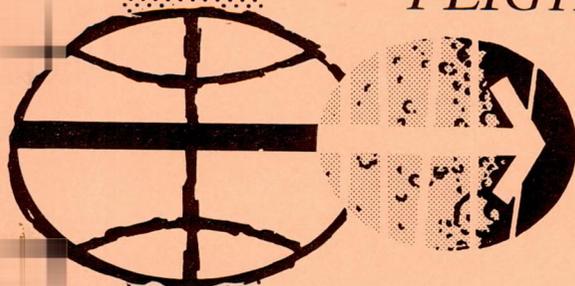
PREPARED BY
FLIGHT CONTROL DIVISION

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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APOLLO 11

FINAL FLIGHT MISSION RULES

REVISION B

PREFACE

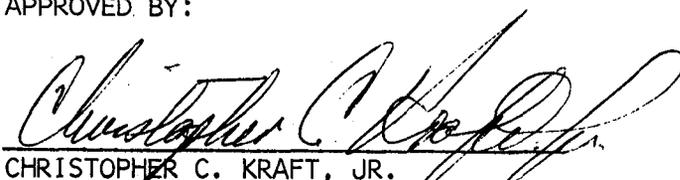
THIS DOCUMENT CONTAINS REVISION B TO THE FLIGHT MISSION RULES FOR APOLLO 11 AS OF JULY 3, 1969. REVISION B IS A PAGE CHANGE REVISION AND THE PAGES SHOULD BE INSERTED IN ACCORDANCE WITH THE REVISION INSTRUCTION SHEET WHICH FOLLOWS THIS PAGE. THIS AND ALL SUBSEQUENT REVISIONS TO THIS DOCUMENT WILL BE PRINTED ON DIFFERENT COLORED PAGES FOR EASY RECOGNITION.

IT IS REQUESTED THAT ANY ORGANIZATION HAVING COMMENTS, QUESTIONS, OR SUGGESTIONS CONCERNING THESE MISSION RULES CONTACT MR. LARRY W. KEYSER, FLIGHT CONTROL OPERATIONS BRANCH, BUILDING 45, ROOM 638, PHONE HU3-3838.

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:


CHRISTOPHER C. KRAFT, JR.
DIRECTOR OF FLIGHT OPERATIONS

APOLLO 11
FINAL FLIGHT MISSION RULES
REVISION B

REVISION INSTRUCTION SHEET

UPDATE THIS DOCUMENT IN ACCORDANCE WITH THE FOLLOWING INSTRUCTIONS:

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MISSION RULES

REV	ITEM	<p style="text-align: center;">----- ! INTRODUCTION & PURPOSE ! -----</p> <p>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 CONFIGURATION, 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.</p> <p>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---</p> <ul style="list-style-type: none"> 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. 					
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SECTION I - GENERAL GUIDELINES

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	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.					
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	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 INFLIGHT 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.												
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SECTION I - GENERAL GUIDELINES

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		<p>----- ' DEFINITIONS ' -----</p>					
I-36	REDLINE	<p>---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.</p>					
I-37	REDLINE FUNCTION	<p>---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.</p>					
I-38	PRIMARY OBJECTIVE	<p>---A STATEMENT OF THE PRIMARY PURPOSE OF FLIGHT. WHEN USED IN CENTER CONTROL DOCUMENTATION THE PRIMARY OBJECTIVE MAY BE AMPLIFIED BUT NOT MODIFIED. DETAILED TEST OBJECTIVES WILL BE GENERATED AND AMPLIFIED TO FULFILL EACH MISSION OBJECTIVE.</p>					
I-39	PRINCIPAL DETAILED TEST OBJECTIVE	<p>---A DETAILED TEST OBJECTIVE WHICH MUST BE ACCOMPLISHED PRIOR TO THE LUNAR LANDING MISSION. ANY PRINCIPAL DETAILED TEST OBJECTIVE NOT SATISFACTORILY COMPLETED ON THE ASSIGNED MISSION CAN BE ATTEMPTED ON A SUBSEQUENT MISSION WITHOUT MAJOR IMPACT.</p>					
I-40	MANDATORY DETAILED TEST OBJECTIVE	<p>---A PRINCIPAL DETAILED TEST OBJECTIVE WHICH MUST BE SATISFACTORILY COMPLETED ON THE ASSIGNED MISSION. FAILURE TO DO SO WOULD UNDULY COMPROMISE SUBSEQUENT FLIGHT SCHEDULES AND/OR REQUIRE SUBSEQUENT SPACE VEHICLE RECONFIGURATION.</p>					
I-41	SECONDARY DETAILED TEST OBJECTIVE	<p>---A DETAILED TEST OBJECTIVE WHICH WOULD PROVIDE SIGNIFICANT DATA OR EXPERIENCE BUT WHICH IS NOT A PREREQUISITE TO THE LUNAR LANDING MISSION.</p>					
I-42	MANDATORY (M)	<p>---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 MANDATORY DETAILED TEST OBJECTIVES.</p>					
I-43	HIGHLY DESIRABLE (HD)	<p>---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 TEST OBJECTIVES.</p>					
I-44	DESIRABLE (D)	<p>---A DESIRABLE ITEM IS A SPACE VEHICLE ELEMENT OR OPERATIONAL SUPPORT ELEMENT THAT IS NOT ESSENTIAL FOR THE ACCOMPLISHMENT OF THE PRIMARY MISSION.</p>					
I-45	PROCEED	<p>---CONTINUE IN ACCORDANCE WITH PRESCRIBED COUNTDOWN PROCEDURES.</p>					
I-46	HOLD	<p>---INTERRUPTION OF THE COUNTDOWN FOR UNFAVORABLE WEATHER, REPAIR OF HARDWARE, OR CORRECTION OF CONDITIONS UNSATISFACTORY FOR LAUNCH OR FLIGHT.</p>					
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SECTION I - GENERAL GUIDELINES

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	I-47	COUNTDOWN---THE PERIOD OF TIME STARTING WITH LAUNCH VEHICLE POWER UP FOR THE LAUNCH (OR SIMULATED LAUNCH) WHICH INCLUDES SERVICE STRUCTURE REMOVAL, LAUNCH VEHICLE CRYOGENIC TANKING, SPACECRAFT CLOSEOUT, AND TERMINAL COUNT.												
	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.												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">MISSION</th> <th style="width: 5%;">REV</th> <th style="width: 10%;">DATE</th> <th style="width: 20%;">SECTION</th> <th style="width: 15%;">GROUP</th> <th style="width: 10%;">PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 11</td> <td>B</td> <td>7/3/69</td> <td>GENERAL OMSF GUIDELINES</td> <td>GENERAL RULES</td> <td>I-6</td> </tr> </tbody> </table>			MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	B	7/3/69	GENERAL OMSF GUIDELINES	GENERAL RULES	I-6
MISSION	REV	DATE	SECTION	GROUP	PAGE									
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MISSION RULES

SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM						
		<p>----- GENERAL -----</p>					
	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 OR MANDATORY DETAILED TEST 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 I 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.					
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MISSION RULES

SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM							
	<p>1-10 MANDATORY SPACE VEHICLE INSTRUMENTATION FOR THE PURPOSES OF FLIGHT MISSION RULES MUST BE IN CONSONANCE WITH THE FOLLOWING CRITERIA--- (REFERENCE OMSF GENERAL RULE 1-42).</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> <p>1-11 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> <p>1-12 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> <p>1-13 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> <p>1-14 THE COMMAND PILOT MAY INITIATE SUCH INFLIGHT ACTION AS HE DEEMS ESSENTIAL FOR CREW SAFETY.</p> <p>1-15 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>							
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MISSION RULES

SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM						
		<p>----- ! DEFINITIONS ! -----</p>					
	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-IVB STAGE FROM THE S-II STAGE.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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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 (HP GREATER THAN OR EQUAL TO 75 NM) IN THE EVENT OF AN SLV FAILURE OCCURRING IMMEDIATELY PRIOR TO INSERTION, OR IN THE EVENT OF DEGRADED SLV PERFORMANCE.					
1-34	S-IVB DESTRUCT PACKAGE SAFING---THE EMERGENCY DESTRUCT PACKAGE IS SAFED 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 LOX, LH2, 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	<p>FLIGHT PHASE---THE INTERVAL FROM LIFTOFF THROUGH SPLASHDOWN. FOR MISSION RULE PURPOSES THE FLIGHT PHASE IS FURTHER SUBDIVIDED AS SHOWN BELOW---</p> <p>A. LAUNCH PHASE--- FROM LIFTOFF THROUGH INSERTION (TB1 THROUGH TB4).</p> <p>B. EARTH ORBIT PHASE---FROM INSERTION THROUGH S-IVB CUTOFF FOR TRANSLUNAR INJECTION (TLI).</p> <p>C. TD&E PHASE---FROM CSM/S-IVB SEPARATION THROUGH LM EJECTION FROM SLA.</p> <p>D. TRANSLUNAR COAST PHASE---FROM S-IVB CUTOFF FOR TLI THROUGH LO11 CUTOFF.</p> <p>E. DOCKED PHASE---THE TIME INTERVALS DURING WHICH THE LM AND CSM ARE DOCKED.</p> <p>F. LUNAR ORBIT PHASE---FROM LO11 CUTOFF TO UNDOCKING AND FROM REDOCKING TO TEI CUTOFF.</p> <p>G. UNDOCKED PHASE---THE TIME INTERVAL BETWEEN LM AND CSM UNDOCKING UNTIL THE LM DOI MANEUVER.</p> <p>H. DOI PHASE---THE TIME INTERVAL FROM THE DOI MANEUVER TO THE INITIATION OF THE PDI MANEUVER.</p> <p>I. POWERED DESCENT---THE TIME INTERVAL FROM THE INITIATION OF THE PDI MANEUVER TO TOUCH DOWN.</p> <p>1. PDI TO PDI +5---DURING THIS TIME PERIOD THE LM CAN ABORT THE POWERED DESCENT AND GET INTO ORBIT USING THE DPS ONLY AND RETAIN THE DESCENT STAGE AFTER INSERTION.</p> <p>2. PDI +5 TO LO GATE---LO GATE IS THE POINT AT WHICH THE CREW TAKES OVER AND MANUALLY FLIES THE DESCENT.</p> <p>3. LO GATE TO TOUCH DOWN---THE TIME INTERVAL FROM CREW TAKEOVER (APPROXIMATELY 500 FT ALTITUDE) TO LANDING.</p> <p>J. LUNAR STAY PHASE---THE TIME INTERVAL FROM TOUCHDOWN UNTIL LIFTOFF.</p> <p>EVA---THE TIME INTERVAL FROM LM DEPRESSURIZATION UNTIL LM REPRESSURIZATION.</p> <p>K. ASCENT PHASE---THE TIME INTERVAL FROM LIFTOFF TO LM INSERTION INTO LUNAR ORBIT.</p> <p>L. RENDEZVOUS---THE TIME INTERVAL FROM INSERTION INTO LUNAR ORBIT AFTER ASCENT OR AFTER AN ABORTED DESCENT UNTIL CSM/LM DOCKING. FOR AN ALTERNATE MISSION WHICH DOES NOT INCLUDE A LUNAR LANDING IT IS THE TIME FROM THE CSM PRE-DOI SEPARATION MANEUVER THROUGH CSM/LM DOCKING.</p> <p>M. TRANSEARTH COAST PHASE---FROM TEI CUTOFF TO CM/SM SEPARATION.</p> <p>N. ENTRY PHASE---FROM CM/SM SEPARATION TO SPLASHDOWN.</p>					
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SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM							
	1-43	<p>LUNAR ABORT MODES AFTER EARLY LOI1 SHUTOFF</p> <p>A. DPS</p> <ol style="list-style-type: none"> 1. MODE-I--- SHUTOFF OCCURS FROM LOI1 + 0 SEC TO <u>LOI1 + 104 SEC</u>. DIRECT RETURN BURN AT APPROXIMATELY LOI1 + 2 HRS. 2. MODE-II--- SHUTOFF OCCURS FROM <u>LOI1 + 104 SEC</u> TO <u>LOI1 + 170 SEC</u>. TWO IMPULSE WITH FIRST BURN AT APPROXIMATELY LOI1 + 2 HRS AND SECOND BURN AT NEXT PERICYNTHION. 3. MODE-III--- SHUTOFF OCCURS FROM LOI1 + 170 SEC TO NOMINAL LOI1 SHUTOFF. TEI AT APPROXIMATELY LOI1 + 15 HRS (NEXT PERICYNTHION). <p style="text-align: center;">NOTE</p> <p style="text-align: center;">THE SHUTOFF TIMES ARE BASED ON A NOMINAL TRAJECTORY UP TO SHUTOFF. HANDOVER BETWEEN MODES I, II, AND III IS A FUNCTION OF ACCUMULATED LOI1 DELTA VELOCITY.</p> <p>B. SPS (DOCKED)--- SHUTOFF OCCURS FROM LOI1 + 0 SEC TO LOI1 + 170 SEC. -RESTART AT LOI1 + 15 MINUTES FOR A DIRECT RETURN.</p> <p>RULE NUMBERS 1-44 THROUGH 1-47 ARE RESERVED.</p>						
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SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM							
		<p>----- ' PRELAUNCH RULES ' -----</p>						
	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	
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SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM																											
	1-74	<p>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.</p>																										
	1-75	<p>EMERGENCY ENGINE SHUTDOWN METHODS.</p> <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>CCW ON THC</td> <td>S-IC, S-II, S-IVB</td> <td>T + 30 SEC. TO S-IVB CUTOFF</td> </tr> <tr> <td>ASTRONAUT</td> <td>S-II/ S-IVB L/V STAGE SWITCH</td> <td>S-II, S-IVB</td> <td>T + 2-33 TO S-IVB CUTOFF</td> </tr> <tr> <td>RSO</td> <td>RF CMD (MFCO)</td> <td>S-IC, S-II, S-IVB</td> <td>T-0 TO S-IVB CUTOFF</td> </tr> <tr> <td>EDS</td> <td>2 OF 3 VOTING LOGIC</td> <td>S-IC</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-IC ENGINES WILL NOT BE SHUTDOWN</td> </tr> </tbody> </table>							INITIATOR	METHOD	STAGE	TIME FRAME	ASTRONAUT	CCW ON THC	S-IC, S-II, S-IVB	T + 30 SEC. TO S-IVB CUTOFF	ASTRONAUT	S-II/ S-IVB L/V STAGE SWITCH	S-II, S-IVB	T + 2-33 TO S-IVB CUTOFF	RSO	RF CMD (MFCO)	S-IC, S-II, S-IVB	T-0 TO S-IVB CUTOFF	EDS	2 OF 3 VOTING LOGIC	S-IC	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-IC ENGINES WILL NOT BE SHUTDOWN
INITIATOR	METHOD	STAGE	TIME FRAME																									
ASTRONAUT	CCW ON THC	S-IC, S-II, S-IVB	T + 30 SEC. TO S-IVB CUTOFF																									
ASTRONAUT	S-II/ S-IVB L/V STAGE SWITCH	S-II, S-IVB	T + 2-33 TO S-IVB CUTOFF																									
RSO	RF CMD (MFCO)	S-IC, S-II, S-IVB	T-0 TO S-IVB CUTOFF																									
EDS	2 OF 3 VOTING LOGIC	S-IC	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-IC ENGINES WILL NOT BE SHUTDOWN																									
	1-76	<p>THE AUTOMATIC EDS (TWO ENGINE OUT 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---</p> <p>THE EDS AUTO SWITCH WILL BE TURNED OFF WHENEVER ANY TWO CSM ENTRY BATTERIES ARE TIED TO THE SAME MAIN BUS OR FOR CONFIRMED LOSS OF ANY CSM ENTRY BATTERY.</p>																										

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SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM								
	1-77	<p>ABORT MODES---</p> <p>MODE I BOUNDARY OF APPLICATION</p> <p>1A LES ABORT ENABLE (APPROX. T-45 MIN) TO GET 42 SEC. (10 K FEET)</p> <p>1B GET 42 SEC TO 100K FEET ALTITUDE (GET APPROX. 1 + 50)</p> <p>1C 100K FEET ALTITUDE TO TOWER JETTISON (GET APPROX. 3 + 07)</p>							
	1-78	<p>MODE II BOUNDARY OF APPLICATION PROCEDURES</p> <p> TOWER JETTISON (GET APPROX. 3 + 07) UNTIL FULL LIFT SPLASHPOINT IS 3200 NM DOWNRANGE (GET APPROX. 10+13)</p> <p>A. MCC PROVIDES</p> <p> 1. GET OF 400K 2. PITCH AT .05G 3. GET DROGUE</p> <p>B. ENTRY IS FULL LIFT</p>							
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SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM						
	1-79	MODE III	<p align="center"><u>BOUNDARY OF APPLICATION</u></p> <p>BETWEEN FULL LIFT SPLASH POINT =3200 NM AND INSERTION.</p>			<p align="center"><u>PROCEDURES</u></p> <p>A. MCC PROVIDES---</p> <ol style="list-style-type: none"> 1. GETI AT S-IVB CUTOFF PLUS 2-05 2. DELTA V FOR 3250 NM SPLASH POINT 3. BURN DURATION 4. GET OF 400K 5. PITCH AT .05G 6. GET DROGUE <p>B. MANEUVER IS SCS AUTO.</p> <p>C. ENTRY IS ROLL LEFT 55 DEGREES.</p>	
			<p align="center">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 align="center"><u>BOUNDARY OF APPLICATION</u></p> <p>CONTINGENCY ORBIT INSERTION CAPABILITY TO INSERTION (BASED ON COI LINE ON GAMMA VS V PLOT FOR NEAR NOMINAL ALTITUDE)</p>			<p align="center"><u>PROCEDURES</u></p> <p>A. MCC PROVIDES---</p> <ol style="list-style-type: none"> 1. GETI AT S-IVB CUTOFF PLUS 2-05 2. DELTA V REQUIRED TO ACHIEVE PERIGEE GREATER THAN OR EQUAL TO 75 NM 3. BURN DURATION 4. PITCH AT GETI <p>B. MANEUVER IS SCS AUTO</p>	
	1-81	MODE	<p align="center"><u>BOUNDARY OF APPLICATION</u></p> <p>APOGEE KICK PRE-APOGEE CUTOFF, OUTSIDE THE COI BOUNDARY, CORRECTABLE TO SAFE ORBITAL CONDITIONS BY A MANEUVER AT APOGEE.</p>			<p align="center"><u>PROCEDURES</u></p> <p>A. MCC PROVIDES---</p> <ol style="list-style-type: none"> 1. GETI FOR BURN AT APOGEE 2. DELTA V REQUIRED TO ACHIEVE PERIGEE GREATER THAN OR EQUAL TO 75 NM 3. BURN DURATION 4. PITCH ATTITUDE <p>B. MANEUVER IS SCS AUTO</p>	
			<p>RULES 1-82 THROUGH 1-86 ARE RESERVED</p>				
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SECTION 1 GENERAL RULES AND SOP'S

REV	ITEM							
<p>----- CREW ABORT LIMITS -----</p>								
1-87	MAX Q REGION		PROCEDURES					
	<p>A. (00-50 TO 02-00) AOA GREATER THAN OR EQUAL TO 100 PCT AND ROLL, PITCH, OR YAW ERROR GREATER THAN OR EQUAL TO 5 DEGREES (NOT APPLICABLE TO ANY ENGINE OUT PRIOR TO 50 SEC.)</p>		<p>ABORT MODE I (ACTION ONLY AFTER BOTH HAVE REACHED THRESHOLD.)</p>					
1-88	RATES AND ATTITUDE		PROCEDURES					
	<p>A. PITCH AND YAW 1. L/O TO S-IC/S-II STAGING - 4 DEG/SEC 2. S-IC/S-II STAGING TO S-IVB CUTOFF - 9 DEG/SEC 3. YAW ERROR GREATER THAN 45 DEG.</p>		<p>ABORT MODE I ABORT MODE I, MODE II, MODE III, OR MODE IV</p>					
	<p>B. ROLL 1. L/O TO S-IVB CUTOFF - 20 DEG/SEC</p>		<p>ABORT MODE I, MODE II, MODE III, OR MODE IV</p>					
1-89	EDS AUTOMATIC ABORT LIMITS (UNTIL MANUAL DEACTIVATION OF TWO ENGINES OUT AUTO AND LV RATES AT 2-00 MIN)							
		BOUNDARY OF APPLICATION						
	<p>A. RATES PITCH AND YAW ROLL</p>	<p>4.0 +/- .5 DEG/SEC 20.0 +/- .5 DEG/SEC</p>						
	<p>B. ANY TWO ENGINES OUT</p>							
	<p>C. CM TO IU BREAKUP</p>							
1-90	S-IVB TANK PRESSURE LIMITS (S-II/S-IVB SEP TO CSM/LV SEP)							
	<p>A. BULKHEAD DELTA P FUEL GREATER THAN OXID = 26 PSID OXID GREATER THAN FUEL = 36 PSID</p>							
	<p>B. LOX TANK PRESS GREATER THAN OR EQUAL TO 50 PSIA</p>							
1-91	ENGINE FAILURES		PROCEDURES					
	<p>LOSS OF 3 OR MORE S-II ENGINES PRIOR TO S-IVB TO ORBIT CAPABILITY</p>		<p>ABORT MODE I, OR MODE II</p>					
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MISSION RULES

SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM	----- ' GENERAL ' -----					
	2-1	<p>PRELAUNCH</p> <p>A. LAUNCH AZIMUTH LIMITATIONS RESTRICT LAUNCHES TO OCCUR BETWEEN 72 DEG. AND 107 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 IP'S WILL BE APPLIED. THESE CONSTRAINTS (REF LMRD) 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 54 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	<p>LAUNCH</p> <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, COOLANT, AND ELECTRICAL ENERGY REMAIN FOR AT LEAST ONE REVOLUTION PLUS ENTRY.</p>					
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SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM						
	2-3	<p>EARTH ORBIT</p> <p>A. ENTRY WILL BE MADE AT THE NEXT BEST PTP 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 PTP, MAKING ALLOWANCES FOR SETUP AND ENTRY.</p> <p>C. THE DEORBIT CAPABILITIES REQUIRED FOR EARTH ORBIT ARE---</p> <ol style="list-style-type: none"> 1. TWO METHODS OF DEORBIT ARE REQUIRED. 2. IF A SUBSEQUENT SINGLE FAILURE WOULD PRECLUDE DEORBIT BY EITHER METHOD REMAINING, THE CSM WILL DEORBIT. 3. SPS IS THE PRIME METHOD OF DEORBIT AND SUFFICIENT DELTA V WILL BE RESERVED FOR THIS MANEUVER. 4. SM-RCS (4 QUAD) AND SM-CM/RCS HYBRID WILL BE CONSIDERED AS INDEPENDENT DEORBIT METHODS AS LONG AS INDIVIDUAL SM-RCS QUAD AND GNCS INTERGRITY IS MAINTAINED AND SUFFICIENT RCS PROPELLANT IS AVAILABLE. 5. THE LM PROPULSION SYSTEM (DPS OR RCS) MAY BE USED TO PLACE THE CSM IN AN ORBIT (HP GREATER THAN OR EQUAL TO 80 NM) FROM WHICH A SM-RCS OR SM-CM/RCS HYBRID DEORBIT CAN BE CONDUCTED. 6. UTILIZATION OF BACKUP DEORBIT METHODS WILL BE BASED ON THE FOLLOWING PRIORITIES--- <ol style="list-style-type: none"> (A) SM-RCS (B) LM PROP PLUS SM-RCS (C) SM-CM/RCS HYBRID (D) LM PROP PLUS SM-CM/RCS HYBRID <p style="text-align: center;">RULE NUMBERS 2-4 THROUGH 2-10 ARE RESERVED</p>					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
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SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM							
	2-11	<p>TRANSLUNAR INJECTION</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"> 1. THERE HAVE BEEN NO FAILURES IN THE LAUNCH VEHICLE WHICH RESULTS IN --- <ol style="list-style-type: none"> (A) A CATASTROPHIC HAZARD (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 PROPULSION PERFORMANCE IS AVAILABLE TO ASSURE A 95 PERCENT PROBABILITY OF ACHIEVING A CUTOFF ORBIT WITH 65,000 N.M. APOGEE ALTITUDE. 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. <p>B. THE TLI MANEUVER WILL BE DELAYED UNTIL THE SECOND OPPORTUNITY FOR SUSPECTED FAILURE OF A CRITICAL SYSTEM (PRIME OR BACKUP) (MANEUVER, LIFE SUPPORT, COOLING, POWER, SEQUENTIAL COMMUNICATIONS) WHICH REQUIRES TIME FOR EVALUATION.</p>						
	2-12	<p>TRANSPPOSITION, DOCKING AND EJECTION (TD&E)</p> <ol style="list-style-type: none"> 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. B. THE NORMAL MINIMUM CABIN PRESSURE REDLINE OF 4.0 PSIA FOR TUNNEL/LM PRESSURIZATION SEQUENCES MAY BE WAIVED DURING TD&E. FOR TUNNEL OR LM LEAKS WHICH PREVENT NORMAL PRESSURIZATION, THE CM WILL BE DEPRESSURIZED AS REQUIRED FOR HATCH REMOVAL AND UMBILICAL HOOKUP. C. IF NORMAL LM EJECTION IS NOT SUCCESSFUL, NO ATTEMPT WILL MADE TO MAN THE LM AND "STAGE" TO RECOVER THE ASCENT STAGE. 						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
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SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM							
	2-13	<p>TRANSLUNAR COAST</p> <ul style="list-style-type: none"> A. NO MCC WILL BE PERFORMED IF LOI CAN BE TARGETED WITHIN OPERATIONAL CONSTRAINTS. B. TRANSLUNAR COAST WILL BE TERMINATED IF ADEQUATE CONSUMABLES ARE NOT AVAILABLE FOR A FREE RETURN + 12 HRS. 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. D. A HYBRID TRAJECTORY WILL NOT BE FLOWN UNLESS THERE ARE ENOUGH CSM CONSUMABLES FOR A LUNAR ORBIT MISSION, AND THE CSM SYSTEM MEET THE LOI CRITERIA. 						
	2-14	<p>LUNAR ORBIT INSERTION</p> <p>LOI WILL BE INHIBITED AND A LUNAR FLYBY PERFORMED IF THE CSM DOES NOT SATISFY ANY OF THE FOLLOWING CONDITIONS---</p> <ul style="list-style-type: none"> A. FULL CRITICAL SYSTEMS REDUNDANCY. B. ADEQUATE CONSUMABLES FOR MINIMUM LUNAR ORBIT OPERATIONS WITH CAPABILITY TO SUSTAIN A TANK LOSS AT NOMINAL TEI-29 HRS AND RETURN TO EARTH WITH AN AVERAGE POWER LEVEL OF 50 AMPS. C. SPS PROPELLANT RESERVE CAPABILITY FOR TEI AND TRANSEARTH MCC'S. D. RCS PROPELLANT RESERVE TO ACCOMPLISH TEI CONTROL, TRANSEARTH MCC CONTROL, PTC, AND MINIMUM LUNAR ORBIT OPERATIONS. 						
	2-15	<p>LUNAR ORBIT</p> <ul style="list-style-type: none"> A. LOI DISPERSIONS <ul style="list-style-type: none"> 1. IF A STABLE ORBIT HAS NOT BEEN ACHIEVED, AN SPS OR DPS ABORT WILL BE EXECUTED. 2. IF A STABLE ORBIT HAS BEEN ACHIEVED, AN SPS OR DPS TEI WILL BE PERFORMED AT THE NEXT PERICYNTHION OR AN ALTERNATE MISSION WILL BE FLOWN. B. DESIGNED REDUNDANT CAPABILITY MUST BE MAINTAINED IN ALL CSM SYSTEMS CRITICAL FOR TEI AND LIFE SUPPORT. 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 50 AMPS FOR CONTINUATION TO THE NEXT MISSION PHASE. D. THE CSM MUST MAINTAIN AN SPS FUEL RESERVE CAPABILITY FOR THE TEI MANEUVERS AND TRANSEARTH MCC'S. E. THE CSM MUST MAINTAIN RCS PROPELLANT RESERVE TO ACCOMPLISH TEI CONTROL, TRANSEARTH MCC CONTROL, PTC, AND MINIMAL TRANSEARTH OPERATIONS. F. IF NORMAL MISSION OPERATIONS ARE INHIBITED, THE DPS WILL BE USED FOR TEI WHEN THERE IS A CHOICE BETWEEN THE DPS AND SPS. 						
	2-16	<p>INTRAVEHICULAR TRANSFER</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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SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM						
	2-17	<p>DOCKED LM OPERATION</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 (-FT).</p> <p>RULE NUMBERS 2-18 THROUGH 2-20 ARE RESERVED</p>					
	2-21	<p>CSM/LM UNDOCKING AND SEPERATION</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 WHILE IN THE UNDOCKED CONFIGURATION AND UNTIL CM INTEGRITY IS ESTABLISHED AFTER RENDEZVOUS AND DOCKING.</p>					
	2-22	<p>CSM LUNAR ORBIT UNDOCKED</p> <p>A. UNDOCKING TO PDI</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. PDI TO LANDING</p> <p>NO CSM FAILURES, EXCEPT FOR TIME-CRITICAL SPS FAILURES, 2 LIKE CRYO TANKS, 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>LM-DOI</p> <p>FOR DOI, THE LM MUST HAVE THE CAPABILITY TO RENDEZVOUS AND DOCK WITHOUT VIOLATING ANY SPECIFIC MISSION RULES OR REDLINES.</p>					
	2-24	<p>LM-PDI</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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SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM							
	2-25	<p>LM-POWERED DESCENT</p> <p>IF A SYSTEMS FAILURE OCCURS AND A CHOICE IS AVAILABLE---</p> <p>A. EARLY IN POWERED DESCENT WHEN DPS-TO-ORBIT CAPABILITY IS AVAILABLE, (UP TO PDI + 5 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.</p> <p>B. DURING THE REMAINDER OF POWER 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.</p>						
	2-26	<p>LM-LUNAR STAY</p> <p>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.</p> <p>B. LOSS OF REDUNDANT CAPABILITY IN CRITICAL LM SYSTEMS IS CAUSE FOR ABORT AT THE NEXT BEST OPPORTUNITY.</p>						
	2-27	<p>EVA</p> <p>A. FOR THE NOMINAL (TWO-MAN) EVA, TOTAL EMU LIFE SUPPORT SYSTEMS CAPABILITY, EVA TO EVA VOICE, EVA TO MSFN 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.</p> <p>B. TO INITIATE THE EVA PHASE, THE EMU MUST HAVE SUFFICIENT CONSUMABLES TO SUPPORT CHECKOUT, PLANNED EVA (2+40) AND A 30 MINUTE POST-EVA RESERVE.</p> <p>C. THE DUAL EVA WILL BE OPEN-ENDED TO 2+40.</p> <p>D. IN THE EVENT PLSS TELEMETRY IS MANDATORY FOR CRITICAL INSTRUMENTATION AND TV INHIBITS EITHER LM OR PLSS TRANSMISSION, THE ERECTABLE S-BAND ANTENNA WILL BE DEPLOYED.</p> <p>E. AN EARLY TERMINATION OF THE EVA WILL BE BASED ON THE ASTRONAUT'S CAPABILITY TO COMMUNICATE WITH EACH OTHER, THE CAPABILITY OF MSFN 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.</p> <p>F. CONSIDERATION WILL BE GIVEN, TIME PERMITTING, FOLLOWING AN EARLY TERMINATION OF A DUAL EVA TO REINITIATE A SINGLE EVA TO RETRIEVE LUNAR SAMPLES.</p> <p>G. 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.</p> <p>H. ANY EMU PROBLEM REQUIRING A LM REPRESSURIZATION, AN OPS PURGE IN EXCESS OF TBD MINUTES, OR INABILITY TO RECONFIGURE THE EMU TO A NORMAL PLSS OPERATION FOLLOWING A FINITE PURGE WILL RESULT IN A DUAL EVA TERMINATION.</p> <p>I. ALL EVA EXCURSIONS WILL BE LIMITED TO THAT VICINITY OF LM WHICH WILL ALLOW A SAFE (30 MINUTES) RETURN TO THE LM ECS WHILE OPERATING ON THE OPS.</p> <p>J. 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.</p>						
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SECTION 2 FLIGHT OPERATIONS RULES

REV	ITEM							
	2-28	<p>ASCENT</p> <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	<p>RENDEZVOUS</p> <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	<p>TRANSEARTH COAST</p> <ul style="list-style-type: none"> 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 G&N IS GO - THEN THE SHALLOW TARGET LINE WILL BE USED. 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. C. IF THE FLIGHTPATH ANGLE IS OUTSIDE THE ENTRY CORRIDOR, AN MCC WILL BE EXECUTED AS SOON AS PRACTICAL. D. MCC'S WILL BE ACCOMPLISHED BY THE SPS IF NECESSARY TO MAINTAIN RCS REDLINES. 						
	2-31	RESERVED						
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SECTION 3 MISSION RULE SUMMARY

REV	ITEM							
		<p>THIS SECTION IS A SUMMARY OF THE DATA PRIORITY GUIDELINES BY MISSION PHASE, SLV 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 'EVENT' COLUMNS ON THE GO/NO-GO CHARTS INDICATE WHAT IS REQUIRED TO DO THAT EVENT WITHOUT REGARD TO WHAT IS REQUIRED TO CONTINUE THE MISSION. THE 'NOMINAL MISSION' COLUMNS INDICATE WHAT IS REQUIRED TO PROCEED WITH THE LUNAR LANDING MISSION WITH A MINIMUM STAY TIME OF 2 HRS.</p> <p style="text-align: center;">----- ! LAUNCH PHASE ! -----</p>						
3-1		<p>THE LAUNCH WILL BE ABORTED FOR THE FOLLOWING REASONS---</p> <p>A. SLV</p> <p>S-II GIMBAL ACTUATOR HARDOVER INBOARD PRIOR TO S-IVB TO ORBIT CAPABILITY</p> <p>VIOLATION OF AUTO/MANUAL EDS LIMITS</p> <p>S-II ENGINE FAILURES (TIME DEPENDENT)</p> <p>FAILURE OF SECOND PLANE SEPARATION</p> <p>S-IVB LOSS OF HYDRAULIC FLUID (PRIOR TO S-IVB IGNITION)</p> <p>S-IVB LOSS OF THRUST (TIME DEPENDENT) (POSSIBLE COI CAPABILITY)</p> <p>S-IVB LOX TANK PRESS GREATER THAN 50 PSI BEFORE TWR JETT, AFTER TWR JETT PERFORM EARLY STAGING</p> <p>B. CSM</p> <p>1. ENVIRONMENTAL</p> <p>LOSS OF CABIN AND SUIT PRESSURE</p> <p>LOSS OF CABIN PRESSURE AND SUIT CIRCULATION</p> <p>FIRE/SMOKE IN CM</p> <p>LOSS OF CABIN PRESSURE AND O2 MANIFOLD LEAK</p> <p>2. ELECTRICAL</p> <p>LOSS OF 3 FUEL CELLS AND 1 BATTERY</p> <p>UNCONTROLLABLE SHORTED MAIN BUS</p> <p>LOSS OF BOTH AC BUSES DURING MODE I OR MODE II</p> <p>3. PROPULSION</p> <p>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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SECTION 3 MISSION RULE SUMMARY

REV	ITEM							
	3-2	<p>THE S-IVB EARLY STAGING WILL BE USED AFTER 'S-IVB TO COI' CAPABILITY FOR THE FOLLOWING ---</p> <p>S-II GIMBAL ACTUATOR INBOARD HARDOVER</p> <p>S-II ENGINE FAILURE (TIME DEPENDENT)</p>						
	3-3	<p>SWITCHOVER TO CSM GUIDANCE WILL BE PERFORMED FOR--</p> <p>SATURN GUIDANCE REFERENCE FAILURE</p>						
	3-4	<p>MODE II, MODE IV, APOGEE KICK, OR EPO RETROFIRE WILL BE COMPLETED BY MANUAL TAKEOVER FOR ATTITUDE EXCURSIONS OF GREATER THAN OR EQUAL TO 5 DEG.</p> <p>RULE NUMBERS 3-5 THROUGH 3-10 ARE RESERVED.</p>						
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SECTION 3 MISSION RULE SUMMARY

REV	ITEM													
		<p>----- ' EARTH ORBIT ' -----</p>												
	3-11	<p>CSM SEPARATION FROM THE S-IVB (WITHOUT LM EXTRACTION) WILL BE PERFORMED EARLY FOR THE FOLLOWING SLV CONDITIONS (CONSIDERATION WILL BE GIVEN TO EXTRACTING THE LM LATER IF THE CONDITION CAN BE CORRECTED)</p> <p>TIME BASE 5 FAILS TO INITIATE AT CUTOFF</p> <p>*S-IVB RANGE SAFETY PROPELLANT DISPERSAL SYSTEM ARMS INADVERTENTLY AFTER INSERTION AND PRIOR TO SAFING</p> <p>*S-IVB LOX TANK PRESS IS GREATER THAN 50 PSI</p> <p>LOSS OF ATTITUDE CONTROL DURING TB5</p> <p>*S-IVB COMMON BULKHEAD DELTA PRESSURE EXCEEDS LIMITS</p> <p>*START BOTTLE GREATER THAN 1800 PSIA</p> <p style="text-align: center;">*PERFORM SPS MANEUVER TO A SAFE DISTANCE</p>												
	3-12	<p>CSM SEPARATION FROM THE S-IVB (WITH LM EXTRACTION) WILL BE PERFORMED FOR---</p> <p>A. S-IVB NO-GO FOR TLI</p> <p>B. CSM NO-GO FOR TLI BUT GO FOR EARTH ORBIT MISSION</p>												
	3-13	<p>TLI WILL BE INHIBITED FOR---</p> <p>INSUFFICIENT PROPELLANT REMAINS FOR A 95 PERCENT PROBABILITY OF ACHIEVING A 65,000 NM APOGEE ELLIPSE</p> <p>S-IVB ENGINE MAIN LOX VALVE FAILS TO CLOSE AT CUTOFF</p> <p>LOSS OF ATTITUDE CONTROL</p> <p>CONTINUOUS VENT SYSTEM REGULATOR FAILS.</p> <p>LOSS OF ENGINE CONTROL BOTTLE PRESSURE</p> <p>CONFIRMED ACTUATOR HARDOVER</p> <p>LOSS OF ENGINE HYDRAULIC FLUID</p> <p>COLD HE SPHERE PRESS LOW</p> <p>LH2 ULLAGE PRESS LOW</p> <p>LOX ULLAGE PRESS LOW</p> <p>MISALIGNMENT RATE BETWEEN THE IU AND IMU IS OUTSIDE LIMITS</p> <p>UNACCEPTABLE DIFFERENCES BETWEEN CMC AND IU PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION</p> <p>UNACCEPTABLE DIFFERENCE BETWEEN MSFN AND IU ORBITAL DECISION PARAMETERS</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 11</td> <td>B</td> <td>7/3/69</td> <td>MISSION RULE SUMMARY</td> <td>EARTH ORBIT</td> <td>3-3</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	B	7/3/69	MISSION RULE SUMMARY	EARTH ORBIT	3-3
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SECTION 3 MISSION RULE SUMMARY

REV	ITEM							
	<p>3-14</p> <p>3-15</p>	<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 DIVIATIONS FROM NOMINAL PROFILES EXCEED 45 DEG.</p> <p>CSM TAKEOVER WILL BE PERFORMED FOR SATURN GUIDANCE REFERENCE FAILURE IN EARTH ORBIT OR DURING TLI.</p> <p>RULES 3-16 THROUGH 3-20 ARE RESERVED.</p>						
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SECTION 3 MISSION RULE SUMMARY

REV	ITEM						
		<p style="text-align: center;">----- ! TD&E ! -----</p> <p>3-21 TD&E WILL NOT BE PERFORMED FOR---</p> <p>A. PILOTS EVALUATION OF RATES AND ATTITUDES, AND SLA CONFIGURATION NOT ACCEPTABLE.</p> <p>B. THE SLV IS NO-GO FOR---</p> <ol style="list-style-type: none"> 1. VIOLATION OF S-IVB BULKHEAD DELTA P LIMITS 2. LOX TANK OVERPRESSURE GREATER THAN 50 PSI 3. TB7 FAILS TO INITIATE (DEPENDING ON FAILURE MODE, IT MAY BE SAFE TO PROCEED.) <p>RULE NUMBERS 3-22 THROUGH 3-29 ARE RESERVED.</p>					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	FNL	5/16/69	MISSION RULE SUMMARY	TD+E	3-5	

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MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM						
<p>----- ' TRANSLUNAR COAST ' -----</p>							
3-30		<p>THE RESIDUALS OF MCC3 WILL BE TRIMMED TO 0.5 FPS IN ALL AXES. IF MCC4 IS EXECUTED, THE X-AXIS RESIDUAL WILL BE TRIMMED TO WITHIN 1.0 FPS.</p>					
3-31		<p>DURING THE LOI BURN, THE FLIGHT CREW WILL TAKE THE FOLLOWING ACTION---</p> <p>A. IF ON FREE RETURN TRAJECTORY, TERMINATE LOI FOR THE FOLLOWING SPS PROBLEMS (PERFORM THE 15 MINUTE ABORT IF THE BURN IS TERMINATED IN THE MODE I OR MODE II REGIONS)---</p> <p>IF ON A HYBRID TRAJECTORY, TERMINATE LOI FOR THE FOLLOWING SPS PROBLEMS IN MODE I, THE FIRST HALF OF THE GAP, AND MODE III. (PERFORM THE 15 MINUTE ABORT IF THE BURN IS TERMINATED IN MODE I OR THE FIRST HALF OF THE GAP).---</p> <ol style="list-style-type: none"> 1. LOSS OF ONE GN2 BOTTLE (LESS THAN 400 PSI) AND DECAY IN OTHER. (IF CONFIRMED BY BALL VALVE CLOSURE, TERMINATE IN MODE I ONLY.) 2. PRESSURE DECAY IN EITHER SPS PROPELLANT TANK TO 160 PSI CONFIRMED BY DROP IN PC. *3. FUEL-OXIDIZER DELTA P GREATER THAN 20 PSI CONFIRMED BY DROP IN PC. *4. CHAMBER PRESSURE LESS THAN 80 PSI OR DECAY OF 10 PSI DURING BURN. 5. ANY BALL VALVE FAILS TO OPEN AFTER ITS RESPECTIVE BANK IS COMMANDED ON OR FAILS CLOSED. (TERMINATE LOI ONLY IN MODE I REGION.) VERIFY FAILURE BY SHUTTING DOWN GOOD BANK. <p>IF ON A HYBRID TRAJECTORY, TERMINATE LOI FOR THE FOLLOWING SPS PROBLEMS IN MODE II---</p> <ol style="list-style-type: none"> *1. PRESSURE DECAY IN EITHER SPS PROPELLANT TANK TO 115 PSI CONFIRMED BY DROP IN PC. 2. PHYSIOLOGICAL INDICATIONS OF ERRATIC PERFORMANCE (CHUGGING, EXCESSIVE VIBRATION). <p style="text-align: center;">* REFERENCE MALF. PROCEDURE--- SPS-1</p> <p>B. PERFORM MTVC TAKEOVER AND COMPLETE THE BURN FOR THE FOLLOWING CONTROL PROBLEMS---</p> <ol style="list-style-type: none"> 1. G6N NO-GO 2. ATTITUDE EXCURSION GREATER THAN 10 DEG EXCLUDING START TRANSIENTS 3. RATES GREATER THAN 10 DEG./SEC <p>C. RESTART THE BURN AND COMPLETE UNDER SCS CONTROL FOR AN SPS SHUTDOWN.</p> <p>RULES NUMBER 3-32 THROUGH 3-37 ARE RESERVED.</p>					
MISSION	REV	DATE	SECTION	GROUP	PAGE		
APOLLO 11	B	7/3/69	MISSION RULE SUMMARY	ALL PHASES COAST	3-6		

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MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM							
		<p>----- ' LUNAR ORBIT ' -----</p>						
3-38		<p>PRIOR TO UNDOCKING THE FOLLOWING TRAJECTORY CONDITIONS MUST BE SATISFIED---</p>						
		<p>A. THE MISS DISTANCE OVER THE LLS IS LESS THAN <u>0.5</u> DEG. OUT OF PLANE AND <u>+/-2</u> DEG. IN AZIMUTH</p>						
		<p>NOTE ADDITIONAL MANEUVERS WILL BE BE SCHEDULED, AS NEEDED, BETWEEN LO12 AND UNDOCKING TO CORRECT DISPERSIONS.</p>						
		<p>RULE NUMBERS 3-39 THROUGH 3-44 ARE RESERVED.</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	B	7/3/69	MISSION RULE SUMMARY	LUNAR ORBIT	3-7	

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MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM							
		----- ' DOI PHASE ' -----						
	3-45	DOI IGNITION						
		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.						
	3-46	DOI TERMINATION						
		THE FLIGHT CREW WILL TERMINATE DOI FOR THE FOLLOWING---						
		A. ATTITUDE DEVIATIONS GREATER THAN 5 DEG.						
		B. RATES GREATER THAN 5 DEG./SEC.						
		C. OVERBURN OF <u>2</u> SECONDS AND <u>2</u> FPS						
	3-47	DOI TO PDI						
		A. DOI RESIDUALS WILL BE NULLED ONLY ALONG THE X BODY AXIS						
		B. DIRECT RETURN TO THE CSM WILL BE PERFORMED FOR THE FOLLOWING REASON---						
		NOTE 1---CAPABILITY REMAINS TILL APPROXIMATELY DOI +10 MINUTES						
		1. LM CONDITIONS---						
		(A) ECS						
		(1) LOSS OF BOTH COOLANT LOOPS						
		(2) FIRE, SMOKE, OR FREE GLYCOL IN CABIN OR SUIT						
		(B) G6C						
		(1) PGNS FAIL						
		(2) PGNS, AGS POST-DOI RESIDUALS DIFFER BY GREATER THAN 2 FPS AND RR CONFIRMS AGS.						
		(3) AT DOI CUTOFF, PRIOR TO TRIMMING, PGNS RESIDUALS ARE GREATER THAN 5 FPS IN ANY AXIS						
		(C) CREW TERMINATES THE DOI MANEUVER						
		RULE 3-48 IS RESERVED						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	B	7/3/69	MISSION RULE SUMMARY	DOI PHASE	3-8	

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MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM													
		<p>----- POWERED DESCENT PHASE -----</p>												
3-49	PDI IGNITION	<p>THE FLIGHT CREW WILL NOT ATTEMPT TO BACK UP THE PDI 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 LGC COMPUTED TIG + 7.5 SEC. PDI MAY BE ATTEMPTED 1 REV LATER, DEPENDING ON AN ANALYSIS OF THE PROBLEM.</p>												
3-50	PDI TO LO GATE	<p>POWERED DESCENT WILL BE ABORTED FOR THE FOLLOWING---</p> <p>A. LR DATA IS REQUIRED FOR LANDING - NO LR DATA BY 10 K FT - ABORT.</p> <ol style="list-style-type: none"> 1. LR CONVERGENCE (ALTITUDE ONLY) - DATA NOT BEING ACCEPTED OR CONVERGING FOLLOWING LOCKON FOR 60 SECONDS - ABORT. 2. LR DATA ACCEPTED AND CONVERGED CONTINUOUS TO P-64 - CONTINUE MISSION IF LOSS OF LOCK OCCURS IN P-64. 3. LR DATA ACCEPTED AND CONVERGED WITH SUBSEQUENT DROPOUT - CONTINUE TO P-64. <ol style="list-style-type: none"> (A) LANDING RADAR REGAINED IN P-64. <ol style="list-style-type: none"> (1) DELTA H LESS THAN 1000 FT BETWEEN PGNS AND LR - CONTINUE MISSION. (2) DELTA H GREATER THAN 1000 FT BETWEEN PGNS AND LR - ABORT. (B) LR NOT REGAINED AT P-64 - ABORT. 4. LATE LR LOCKON WITH DATA BEING INCORPORATED AND CONVERGING - CONTINUE TO P-64. <ol style="list-style-type: none"> (A) DELTA H LESS THAN 1000 FT BETWEEN PGNS AND LR - CONTINUE MISSION. (B) DELTA H GREATER THAN 1000 FT BETWEEN PGNS AND LR - ABORT. <p>B. FAILURE TO ENTER P64 WHEN TG EQUALS 60 SEC.</p> <p>C. PGNS NAVIGATION ERRORS WHICH RESULT IN AGS-PGNS VELOCITY DIFFERENCES THAT VIOLATE THE PGNS FAILURE LIMITS.</p> <p>D. PGNS NAVIGATION ERRORS WHICH RESULT IN MSFN-PGNS VELOCITY DIFFERENCES THAT VIOLATE THE PGNS FAILURE LIMITS.</p> <p style="text-align: center;">NOTE</p> <p style="text-align: center;">ITEMS C AND D ARE VALID ONLY PRIOR TO LR INCORPORATION. FOR ITEM D, SWITCHOVER TO AGS WILL BE PERFORMED.</p> <p>E. INITIAL PERCENT COMMANDED THRUST NOT EQUAL TO <u>100</u> PERCENT +/- <u>10</u> PERCENT CONFIRMED BY A TRAJECTORY DEVIATION.</p> <p>F. COMMANDED THRUST INCREASING PRIOR TO THROTTLEDOWN OR P63 TGO = 80 SEC.</p> <p>G. NO LANDING SITE VISIBILITY BY P64 PLUS <u>60</u> SEC.</p> <p>H. NO THROTTLE RECOVERY BY P63/P64 PROGRAM SWITCH PLUS 15 SEC.</p> <p>I. VIOLATION OF THE TIME BIASED (20 SEC) DPS ABORT BOUNDARY.</p> <p>J. FAILURE TO ACHIEVE FTP BY NOMINAL TIG + 26 SEC.</p>												
3-51	LO GATE TO TD	<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" 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 11</td> <td>B</td> <td>7/3/69</td> <td>MISSION RULE SUMMARY</td> <td>POWERED DESCEN</td> <td>3-9</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	B	7/3/69	MISSION RULE SUMMARY	POWERED DESCEN	3-9
MISSION	REV	DATE	SECTION	GROUP	PAGE									
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MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM							
		<p>----- ASCENT -----</p>						
	3-61	<p>ASCENT</p> <p>A. GUIDANCE SWITCHOVER TO AGS WILL BE PERFORMED FOR ---</p> <p>1. ONBOARD RECOGNIZED PGNS FAILURES</p> <p>2. PGNS NAVIGATION ERRORS, DURING ASCENT OR FOLLOWING DESCENT ABORT, 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 + 40 NM</p> <p>(C) AGS PREDICTED WEDGE ANGLE AT INSERTION GREATER THAN 1.0 DEG.</p> <p>B. THE GROUND WILL NOT REQUEST SWITCHOVER AFTER TGO LESS THAN <u>30</u> SECONDS.</p> <p>RULE 3-62 THROUGH 3-79 ARE RESERVED.</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	B	7/3/69	MISSION RULE SUMMARY	ASCENT	3-10	

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MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM							
	3-80	<p>A NON-CRITICAL SPS MANEUVER WILL BE INHIBITED FOR---</p> <p>A. G&C</p> <ol style="list-style-type: none"> 1. LOSS OF TWO TVC SERVO LOOPS 2. LOSS OF THREE TVC CONTROL MODES (G&N, SCS AUTO, AND MTVC - RATE CMD IF UNDOCKED) 3. LOSS OF THREE TVC CONTROL MODES (G&N, SCS AUTO, AND MTVC - ACCEL CMD IF DOCKED) <p>B. SPS</p> <ol style="list-style-type: none"> 1. LOSS OF BOTH GN2 BOTTLES (LESS THAN 400 PSI) 2. FUEL OR OXIDIZER FEEDLINE TEMP LESS THAN 40 DEG. F. 3. FLANGE TEMP GREATER THAN 480 DEG. F. ON PREVIOUS BURN 4. CHAMBER PRESSURE LESS THAN 70 PSI ON PREVIOUS BURN 5. FUEL/OXIDIZER DELTA P GREATER THAN 20 PSI 6. LOSS OF ULLAGE CAPABILITY FOR FIRST BURN SUBSEQUENT TO DOCKED DPS BURN, OR AFTER STORAGE TANKS EMPTY 7. FIRST BURN SUBSEQUENT TO DOCKED DPS WAS LESS THAN 40 SEC, CONTINUOUS 8. PRESSURE IN EITHER FUEL OR OXIDIZER TANK LESS THAN 140 PSI 9. DELTA V REMAINING LESS THAN MANEUVER PLUS DEORBIT REQUIREMENT 						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 17	FNL	5/16/69	MISSION RULE SUMMARY	ALL PHASES	3-11	

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MISSION RULES

SECTION 3 MISSION RULE SUMMARY

REV	ITEM								
	<p>3-81</p> <p>LOI2, PLANE CHANGE, DOI, & MCC'S NOT REQUIRED FOR ENTRY CORRIDOR CONTROL WILL BE TERMINATED AFTER MANUAL TAKEOVER FOR---</p> <p>A. CSM, STAGED LM & DOCKED</p> <ol style="list-style-type: none"> 1. ATTITUDE EXCURSIONS GREATER THAN OR EQUAL TO <u>10</u> DEG 2. ATTITUDE RATES GREATER THAN OR EQUAL TO <u>10</u> DEG/SEC. 3. ATTITUDE ERRORS GREATER THAN OR EQUAL TO <u>10</u> DEG. <p>B. UNSTAGED LM</p> <ol style="list-style-type: none"> 1. ATTITUDE EXCURSIONS GREATER THAN OR EQUAL TO <u>5</u> DEG. 2. ATTITUDE RATES GREATER THAN OR EQUAL TO <u>5</u> DEG/SEC. 3. ATTITUDE ERRORS GREATER THAN OR EQUAL TO <u>5</u> DEG. 								
	<p>3-82</p>	<p>GENERALLY, THE FOLLOWING MANEUVER RESIDUAL TRIMMING CRITERIA WILL APPLY---</p> <p>A. DOCKED SPS - TRIMMED TO <u>1</u> FPS IN X-AXIS ONLY (MCC, MCC1, MCC2, AND LOI1 ARE NOT TRIMMED).</p> <p>B. DOCKED DPS WILL NOT BE TRIMMED.</p> <p>C. ALL UNDOCKED MANEUVERS (BY EITHER VEHICLE) WILL BE NULLED ALONG X-AXIS. Y AND Z-AXIS RESIDUALS WILL NOT BE TRIMMED.</p>							
	<p>3-83</p>	<p>THE FOLLOWING MANEUVERS WILL BE MANUALLY TERMINATED AFTER VIOLATION OF THESE OVERBURN CRITERIA---</p> <p>A. TLI - <u>6</u> SEC AND V (PNGS) GREATER THAN V(PAD).</p> <p>B. LOI1</p> <ol style="list-style-type: none"> 1. SPS - <u>10</u> SEC 2. DPS - <u>10</u> SEC AND DELTA V (AGS) GREATER THAN <u>10</u> FPS <p>C. LOI2 - <u>1</u> SEC</p> <p>D. DOI - <u>2</u> SEC AND DELTA V GREATER THAN <u>2</u> FPS</p> <p>E. TEI</p> <ol style="list-style-type: none"> 1. SPS - <u>2</u> SEC AND DELTA VC GREATER THAN <u>40</u> FPS 2. DPS - <u>10</u> SEC AND DELTA V (AGS) GREATER THAN <u>2</u> FPS <p>F. SPS MCC - <u>1</u> SEC</p>							
		MISSION	REV	DATE	SECTION	GROUP	PAGE		
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SECTION 3 MISSION RULE SUMMARY

REV	ITEM						
	3-84	<p>ALL MANEUVERS EXCEPT LOI2, PLANE CHANGE, DOI, AND MCC'S NOT REQUIRED FOR ENTRY CORRIDOR CONTROL WILL BE COMPLETED BY SCS (MTVC OR AUTO) OR AGS TAKEOVER FOR ANY OF THE FOLLOWING---</p> <p>A. CSM, STAGED LM 1 DOCKED</p> <ol style="list-style-type: none"> 1. ATTITUDE EXCURSIONS GREATER THAN OR EQUAL TO <u>10</u> DEG. 2. ATTITUDE RATES GREATER THAN OR EQUAL TO <u>10</u> DEG/SEC. 3. ATTITUDE ERRORS GREATER THAN OR EQUAL TO <u>10</u> DEG. <p>B. UNSTAGED LM</p> <ol style="list-style-type: none"> 1. ATTITUDE EXCURSIONS GREATER THAN OR EQUAL TO <u>5</u> DEG. 2. ATTITUDE RATES GREATER THAN OR EQUAL TO <u>5</u> DEG/SEC. 3. ATTITUDE ERRORS GREATER THAN OR EQUAL TO <u>5</u> DEG. 					
	3-85	<p>ALL RENDEZVOUS MANEUVERS WILL BE NULLED ALONG THE X-AXIS. Y AND Z RESIDUALS WILL NOT BE TRIMMED.</p> <p style="text-align: center;">NOTE THIS INCLUDES NOMINAL AND/OR RESCUE MANEUVERS. TEI & MCC'S WILL BE NULLED ALONG ALL AXES.</p> <p>RULES 3-86 THROUGH 3-89 ARE RESERVED.</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	B	7/3/69	MISSION RULE SUMMARY	ALL PHASES	3-13

CSM EECOM GO/NO-GO CRITERIA

GO/NO-GO ITEM	EARTH ORBIT		TLC		LUNAR ORBIT		UNDOCKING		DOI		POWERED DESCENT			LUNAR STAY				
	CONT BOOST	CONT E.O.	TLI	TD&E	CONT TLC	LOI	CONT L.O.	EVENT	NOMINAL MISSION	EVENT	NOMINAL MISSION	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
ECS																		
CABIN INTEGRITY	⑩ CABIN INTEGRITY																	← CABIN INTEGRITY →
NO FIRE OR SMOKE IN CABIN	← NO F OR S IN CAB →																	← NO FIRE/SMOKE IN CAB →
NO O ₂ MANIFOLD LEAKS	⑩* ← NO O ₂ LEAKS →																	
MAIN O ₂ REGULATORS	⑩* 1 OF 2	③ BOTH					1 OF 2											← 1 OF 2 →
ECS COOLANT LOOPS	1 OF 2 ⑤	BOTH																← 1 OF 2 →
ECS RADIATORS	1 OF 2 ⑤	BOTH						①	①-PRIMARY	①	①							
ECS GLYCOL EVAPS																		
SUIT INTEGRITY	S I ⑩*							S I										← NO GLYCOL LEAK →
NO GLYCOL LEAK	← NO LEAK →																	← NO EXC CAB HUM →
NO EXCESSIVE CABIN HUMIDITY	← NO HUMID →																	
POTABLE H ₂ O TANK	← POT →																	
WASTE H ₂ O TANK																		← 1 OF 2 →
SUIT COMPRESSORS	⑩* 1 OF 2	BOTH																← 1 OF 2 →
SUIT CIRCUIT	⑩* ← SUIT CIRCUIT →																	← SUIT CIRCUIT →
OVERBOARD DUMPS	← 1 OF 3 →																	
CRYU																		← BOTH →
O ₂ TANKS		1 OF 2	BOTH															← BOTH →
H ₂ TANKS		1 OF 2	BOTH															← BOTH →
EPS																		← ⑥ →
FUEL CELLS	2 0 + OR + 1 3	2 OF 3	ALL				⑥	⑥-ALL-⑥	2 OF 3	⑥	⑥-ALL ⑥	2 OF 3	⑥	⑥	⑥	⑥	⑥	← ⑥ →
ENTRY BATTERIES		2 OF 3	ALL				⑥	⑥-ALL-⑥	2 OF 3	⑥	⑥-ALL ⑥	⑥	⑥	⑥	⑥	⑥	⑥	← ⑥ →
MAIN BUSES	1 OF 2	← BOTH →																← BOTH →
BATTERY BUSES	1 OF 2	← BOTH →																← BOTH →
AC BUSES	1 OF 2 ⑨	← BOTH →																← BOTH →
BATT RELAY BUS		← BATT RELAY BUS →																← BATT RELAY BUS →
INVERTERS	1 OF 3 ⑨	← 2 OF 3 →																← 2 OF 3 →
AC φ A (1 AND 2)	1 OF 2 ⑨	← BOTH →																← BOTH →
DOCKING																		
DOCKING LATCHES							9 OF 12											← ⑧ →
GN ₂ BOTTLES																		← 2 OF 4 →
SEQ																		
SMJC NOT ACTIVATED			SMJC NOT ACT															← SMJC NOT ACTIVATED →
SEQUENTIAL SYSTEMS			← BOTH →				← BOTH →											

3-14

- BASED ON AMOUNT OF WATER AVAILABLE, CONSIDERATION WILL BE GIVEN TO CONTINUING MISSION WITH SECONDARY RADIATOR AND PRIMARY EVAPORATOR
- REQUIREMENT EXISTS ONLY IF DESCENT STAGE CAN BE RETAINED FOR TEI
- IF ONE MAIN REG HAS FAILED OPEN AND THE OTHER IS FUNCTIONING NORMALLY, TLI WILL BE PERFORMED
- (DELETED)
- MUST BE IN 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 GN₂ BOTTLE REMAINING IN AN OPERABLE SYSTEM
- MODE I AND II ONLY; 0 THEREAFTER
- MUST HAVE CABIN INTEGRITY OR VIABLE SUIT LOOP. ITEMS MARKED BY * ARE REQUIRED TO MAINTAIN VIABLE SUIT LOOP

LEGEND: NO REQUIREMENT

CSM GNC GO/NO-GO CRITERIA

GO/NO-GO ITEM	EARTH ORBIT		TLC			LUNAR ORBIT			UNDOCKING		DOI		POWERED DESCENT			LUNAR STAY				
	CONT BOOST	CONT E.O.	TLI	TD&E	CONT TLC	LOI	CONT LOI	CONT L.O.	EVENT	NOMINAL MISSION	EVENT	CONT DOI	NOMINAL MISSION	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
GNCS/SCS																				
DEORBIT CAPABILITY		SPS+8/U METHOD																		
AUTO ATTITUDE CONTROL				3 AXIS			N/A		3 AXIS				3 AXIS						2 AXIS	
RATE DAMPING				3 AXIS			N/A		3 AXIS				3 AXIS						2 AXIS	
DIRECT RCS				3 AXIS			N/A		3 AXIS				3 AXIS						2 AXIS	
BMAGS P,Y			1 OF 2			1 OF 2			1 OF 2				1 OF 2						1 OF 2	
BMAGS R			1 OF 2			1 OF 2														
FOAI			1 OF 2			1 OF 2			1 OF 2				1 OF 2							
THC			THC				N/A		THC											
RHC			1 OF 2			1 OF 2	N/A		1 OF 2				1 OF 2							
EMS																				
CMC			CMC			CMC			CMC				CMC						CMC	
ISS			ISS			ISS			ISS				ISS						ISS	
OSS			OSS			OSS	N/A		OSS				OSS						O-DAC	
OPTICS DAC			O-DAC			O-DAC			OPTICS DAC				OPTICS DAC						O-DAC	
NO SOLENOID DR GNL							N/A													
TVC SERVO LOOP		1 OF 2	BOTH			BOTH	1 OF 2		BOTH				BOTH						BOTH	
DSKY			1 OF 2			1 OF 2			1 OF 2				1 OF 2						1 OF 2	
SPS																				
FU/OX TANK (W/O LEAK)			FU/OX			FU/OX	>160		FU/OX TANK				FU/OX TANK						FU/OX TANK	
GN ₂ TANK (W/O LEAK)		1 OF 2 (CAN'T CONFIRM)				1 OF 2 C.C.	①		BOTH		1 OF 2 C.C.		1 OF 2 (CAN'T CONFIRM)						BOTH	
BALL VALVE BANK		1 OF 2	BOTH			BOTH	①		BOTH				BOTH						BOTH	
FEEDLINE TEMP >40° F			>40°			>40°	N/A		>40°				>40°						>40°	
FU/OX ΔP < 20 PSI			< 20			< 20			< 20				< 20						< 20	
FLANGE TEMP < 480°F		< 480°	N/A			< 480°			< 480°				N/A						N/A	
Pc > 70 PSI		> 70	N/A			> 70	> 80 OR OF CAV < 10		> 70				N/A						N/A	
ULLAGE CAPABILITY			BOTH			1 OF 2	N/A		1 OF 2				1 OF 2						1 OF 2	
HE TANK (W/O LEAK)			HE TNK			HE TNK			HE TNK				HE TNK						HE TNK	
SM RCS																				
HE TANK (W/O LEAK)		3 OF 4	ALL			ALL			3 OF 4				3 OF 4						3 OF 4	
NO LEAK BELOW ISO VLV		3 OF 4	ALL	3 OF 4		ALL			3 OF 4				3 OF 4						3 OF 4	
PKG TEMP > 55°		3 OF 4	ALL	3 OF 4		ALL			3 OF 4				3 OF 4						3 OF 4	
THRUSTERS		ALL ROT AXES	3 of 4 P.Y 6 of 8 R	②		3 of 4 P.Y 6 of 8 R	2 OF 8 R		6 OF 8 R				3 of 4 P.Y ALL R					3 of 4 P.Y 6 of 8 R		
CM RCS																				
HE TANK (W/O LEAK)	1 OF 2 MODE 1			BOTH					1 OF 2				1 OF 2						1 OF 2	
MANIFOLD (W/O LEAK)	1 OF 2 MODE 1			BOTH					1 OF 2				1 OF 2						1 OF 2	
NOT ARMED				NOT ARMED																

3-15

① MODE I = BOTH
MODE II OR III = 1 OF 2

② REQUIRES 3 AXIS ATTITUDE CONTROL AND TRANSLATION IN 3 AXES (ONE LATERAL AXIS MAY BE DEGRADED)

LEGEND:  NO REQUIREMENT

LM TELCOM GO/NO-GO CRITERIA

GO/NO-GO ITEM	UNDOCKING		DOI		POWERED DESCENT				LUNAR STAY			RENDEZVOUS LM ACTIVE		DOCKING	
	EVENT	NOMINAL MISSION	EVENT	CONT DOI	NOMINAL MISSION	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/CDH		TPI/TPF
PYRO															
1. PYRO SYSTEMS ****	1 OF 2	← BOTH →			← BOTH →						← BOTH →				
ELECTRICAL															
1. CDR AND LMP BUS ①		← BOTH →			← BOTH →									1 OF 2	
2. DC FEEDERS ②	DESCENT	← 1 OF 2 →			← 1 OF 2 →						← 1 OF 2 →				
	ASCENT	← BOTH →			← BOTH →									1 OF 2	
3. BATTERIES ⑦ ③ ****	DESCENT	4 OR 2	2 OF 4	4 OR 2		← 2 OF 4 →					← 2 OF 4 →				
	ASCENT	1 OR 2	2 OF 2	1 OR 2		← BOTH →					← BOTH →			1 OF 2	
4. INVERTERS		← 1 OF 2 →			← 1 OF 2 →										
5. AC BUSES		← BUS A →			← BUS A →										
ENVIRONMENTAL															
1. SUIT/CABIN INTEGRITY	← SUIT AND CABIN →				← SUIT AND CABIN →				SUIT	← SUIT AND CABIN →					
2. SUIT FANS ****	1 OF 2	BOTH	1 OF 2		← BOTH →		← 1 OF 2 →			← BOTH →					
3. O ₂ DEMAND REGS ****	← 1 OF 2 →				← 1 OF 2 →						1 OF 2 ④				
4. H ₂ O SEPARATORS AND LCG COOLANT LOOP ****	1 OF 2 H ₂ O SEP OR LCG	← BOTH H ₂ O SEPS OR 1 OF 2 H ₂ O SEPS + LCG →			← BOTH H ₂ O SEPARATORS OR 1 OF 2 H ₂ O SEPARATORS + LCG →					← BOTH H ₂ O SEPS OR 1 OF 2 H ₂ O SEPS + LCG →			← 1 OF 2 H ₂ O SEPS OR LCG →		
5. O ₂ TANKS ③ ****	DESCENT	← ANY →			← ANY →					← DESCENT →					
	ASCENT	1 OF 2	← 2 OF 3 →			← 2 OF 3 →				← 1 OF 2 →					
6. COOLANT LOOPS ****	PRIMARY	1 OF 2	← BOTH →		⑥	← BOTH →					← BOTH →			1 OF 2	
	SECONDARY														
7. H ₂ O FEED PATHS	PRI OR SEC	← PRIMARY →		⑥	← PRIMARY →					← PRIMARY →			← PRI OR SEC →		
8. H ₂ O TANKS ③ ****	DESCENT		DES	ANY				ANY		← DES →					
	ASCENT	1 OF 2	← BOTH →			← BOTH →		2 OF 3		← BOTH →			← 1 OF 2 →		
9. NO FIRE, SMOKE OR GLYCOL IN SUIT OR CABIN				⑥											

3-16

- 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 DESCENT FEEDER WILL ALWAYS BE REASON FOR ABORTING THE LANDING MISSION
- ③ FUNCTIONAL CAPABILITY ONLY - SEE REDLINES FOR CONSUMABLES REQUIREMENTS
- ④ ASSUMES CREWMAN IN LM OPERATING ON LM ECS
- ⑤ LIFTOFF WITHIN 11 MINUTES WITH LOSS OF PRIMARY
- ⑥ PERFORM DIRECT RETURN
- ⑦ THE TWO REMAINING DESCENT BATTERIES MUST FEED SEPARATE BUSES

LEGEND: **** RETAIN DESCENT STAGE ALAP
 NO REQUIREMENT

LM CONTROL GO/NO-GO CRITERIA

GO/NO-GO ITEM	UNDOCKING		DOI			POWERED DESCENT				LUNAR STAY			RENDEZVOUS LM ACTIVE		DOCKING
	EVENT	NOMINAL MISSION	EVENT	CONT DOI	NOMINAL MISSION	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/COH	TPI/TPF	
GNC															
1. PGNS					PGNS									PGNS	AGS OR PGNS
2. AGS		AGS			AGS		④								
3. 3 AXIS AUTO ATT CNTL AND HOLD		REDUNDANT			REDUNDANT		④							3 AXIS	
4. 3 AXIS CONTROL		REDUNDANT		3 AXIS	REDUNDANT									REDUNDANT	3 AXIS
5. ACA		1 ACA			1 ACA										1 ACA
6. 3 AXIS TRANSLATION		3 AXIS			3 AXIS	ULLAGE								1 AXIS	3 AXIS
7. TTCA		1 TTCA			1 TTCA			⑤							3 AXIS
8. FDAI - ATTITUDE/RATES/ERRORS		CREW OPTION			CREW OPTION										
9. THROTTLE RESPONSE IN 40 SEC															
10. VHF RNG/CSM OPT TRK		ONE			ONE										
11. RR/TRANSPONDER		RR			RR										
12. AOT		AOT-①													
13. LR		LR			LR	②									
14. REDUNDANT ASC ENG ON/OFF														REDUNDANT ASC ON/OFF	
15. PITCH AND ROLL GDA TRIMMED		PITCH AND ROLL GDA			W/IN IMPINGEMENT CONSTRAINTS										
16. MANUAL THROTTLE		MANUAL			MANUAL THROTTLE			⑤							
17. AUTO THROTTLE/CMD INDICATION		AUTO ③			AUTO THROTTLE	③									
DPS															
1. NO PROPELLANT LEAKS					NO PROP LEAKS										
2. FU, OX INLET/ULLAGE PRESS (PSI)	< 65%	> 60/> 60			> 120/> 123	> 60/> 60				> 120/> 123					
	> 65%	N/A			N/A					> 150/> 160					
3. FU, OX ΔP (FU HIGH/OX HIGH)	< FTP	N/A			N/A					SEE RULE 25-2 A.5.(A)					
	FTP														
4. PROPELLANT TEMP		> 50° AND < 75° OX < 86° FU			> 50° AND < 75° OX < 86° FU										
5. PROPELLANT ΔT		< 10°	< 25°		< 10°										
6. PROP QTY > LOW LEVEL/2%															
7. She AVAIL PRIOR 6:20															
8. VENT WITHIN 8 MIN															
APS															
1. NO PROPELLANT LEAKS					NO PROPELLANT LEAKS									NO PROP LEAKS IMMEDIATE LIFTOFF	
2. FU/OX INLET PRESS		> 62 AND < 220								> 62 AND < 220					APS NOT REQ FOR RNDZ
3. FU/OX ΔP (EITHER HIGH)		< 90								< 90 PSID					
4. PROPELLANT TEMP		> 50° AND < 90°								> 50° AND < 90°					
5. PROP ΔT < 10° F		< 10° F								< 10° F					
RCS															
1. NO PROPELLANT LEAKS															
2. FU/OX MANIF PRESS (> 100 PSI)		A AND B			A OR B					A AND B				A AND B	A OR B
3. PROP TEMP (> 40° F < 100° F)		A AND B			A AND B					A AND B				A AND B	A OR B
4. 3 AXIS ATT CNTL CAPABILITY		REDUNDANT			3 AXIS	REDUNDANT				3 AXIS	REDUNDANT			REDUNDANT	3 AXIS
5. 3 AXIS TRANSLATION		3 AXIS			3 AXIS									1 AXIS	3 AXIS
6. NO IMPINGEMENT LIMITS EXCEEDED		NO IMPINGEMENT			NO IMPINGEMENT										

3-17

1. AOT REQUIRED UNTIL FIRST P52 ALIGNMENT
2. LR/PGNS DELTA ALT MUST BE CONVERGED PRIOR TO 13,000 FT
3. MANUALLY FOLLOW CMD THRUST METER IF POSSIBLE
4. CONSIDERATION WILL BE GIVEN TO CONTINUING BASED UPON THE FAILURE MODE
5. CONSIDERATION WILL BE GIVEN TO CONTINUING BASED UPON NOMINAL TRAJECTORY AND GUIDANCE

LEGEND: NO REQUIREMENT

COMMUNICATIONS/INSTRUMENTATION GO/NO-GO CRITERIA

GO/NO-GO ITEM	EARTH ORBIT		TLC			LUNAR ORBIT			UNDOCKING		DOI		POWERED DESCENT				LUNAR STAY			RENDEZVOUS LM ACTIVE			
	CONT BOOST	CONT E.O.	TLI	TD&E	CONT TLC	LOI	CONT LOI	CONT L.O.	EVENT	NOMINAL MISSION	EVENT	CONT DOI	NOMINAL MISSION	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/CDH	TPI/TPF	
USB 2-WAY VOICE COMM		①	CSM			CSM		CSM OR LM	← CSM AND LM →				← CSM AND LM →		②-LM-②			CSM & LM ③	LM	LM			
VHF COMM LM/CSM									← SIMPLEX OR DUPLEX →				SIMP OR DUP							SIMP OR DUP	DUPLEX		
VHF COMM LM/EVA																				SIMP OR DUP	DUPLEX		
VHF COMM EVA/EVA																				DUPLEX			
MSFN/EVA VOICE																				EITHER CREWMAN			
CRITICAL INSTRUMENTATION		← CSM →				CSM		CSM	← LM AND CSM →				LM AND CSM		← LM →					← LM AND CSM →		← LM →	
LM TELEMETRY										HBR	HBR OR LBR				← HBR →	④	④			← HBR OR LBR →			
CSM TELEMETRY		← 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 HBR TO MAKE FINAL GO/NO GO TO CONTINUE POWERED DESCENT

LEGEND: - NO REQUIREMENT

3-18

EMU GO/NO-GO CRITERIA

GO/NO-GO ITEM	UNDOCKING		DOI			POWERED DESCENT				LUNAR STAY ②		
	EVENT	NOMINAL MISSION	EVENT	CONT DOI	NOMINAL MISSION	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 →	
LCG/LTL COOLING											2 OF 2	1 OF 2
PRIMARY O ₂ SUPPLY(S)	← ① →										2 OF 2	1 OF 2
PLSS O ₂ PRESSURE REG(S)											2 OF 2	1 OF 2
PLSS FAN(S)											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 ₂ BOTTLE(S)	← ① →										2 OF 2	1 OF 2
OPS PRESSURE REG(S)											2 OF 2	1 OF 2

3-19

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 3 - MISSION RULE SUMMARY - CONTINUED

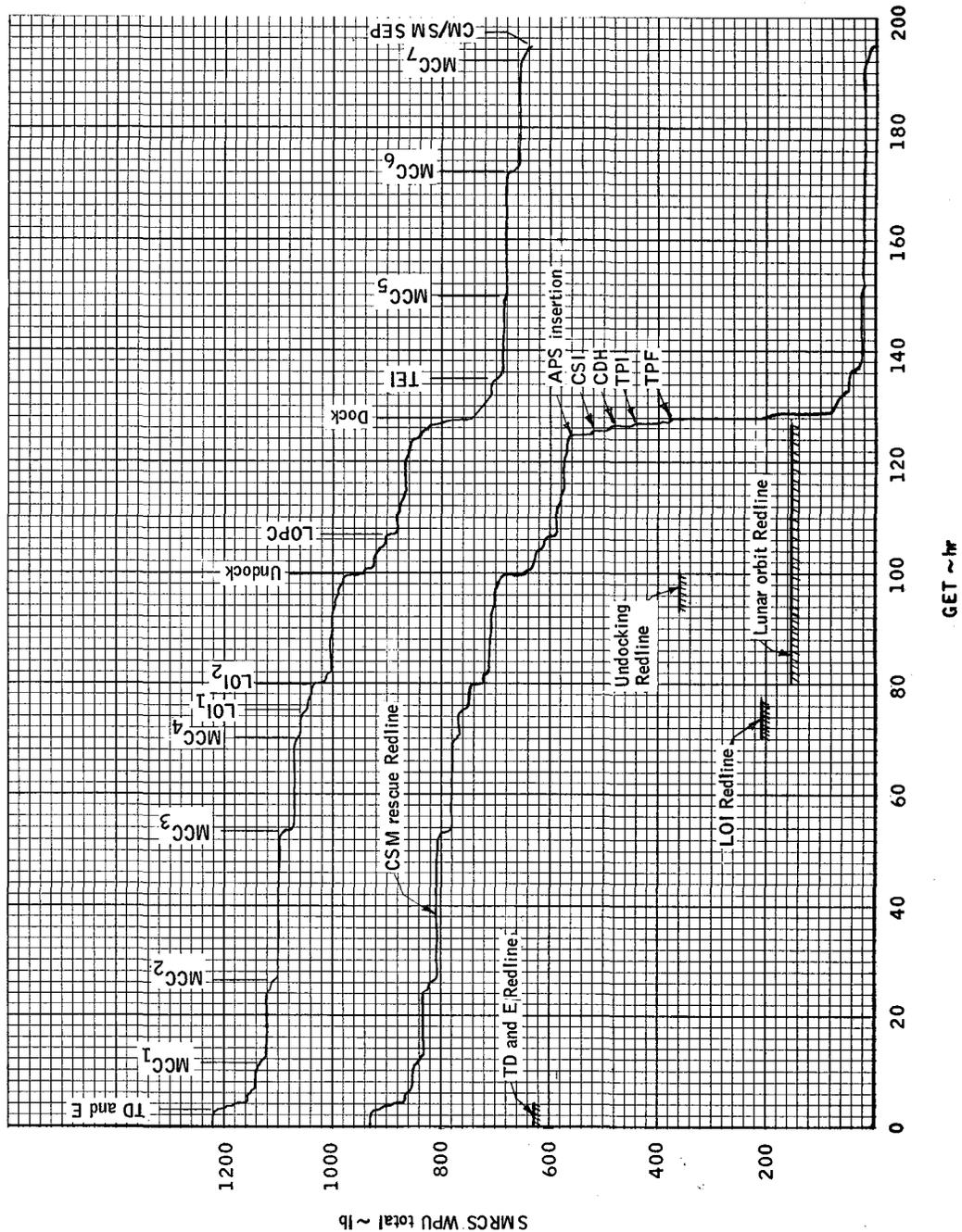
REV	ITEM						
<p>----- ' CONSUMABLES ' -----</p>							
3-90	SPS		A.	AFTER TD&E AND THE FIRST DOCKED SPS MCC, THE DELTA V REQUIRED TO CONTINUE WITH A LUNAR MISSION IS 5500 FPS (CSM UNDOCKED CAPABILITY).	B.	THE DELTA V REQUIRED FOR LOI GO IS LO11 (FUNCTION OF LAUNCH DAY AND LAUNCH AZ) +190 FPS (LOI2, DOCKED) +2960 FPS (TEI AND TEC MCC'S).	
		C.	THE DELTA V REQUIRED FOR GO FOR RENDEZVOUS IS 3520 FPS. THIS DELTA V INCLUDES---	560 FPS, LM RESCUE	2800 FPS, TEI (APPROXIMATELY 79 HR RETURN)	160 FPS, 30 MCC BASED ON SCS CONTROLLED TEI	
				-----	3520 FPS		
3-91	SM RCS		A.	THE REDLINE FOR TD&E IS 630 LBS AND IS CONSISTENT WITH A CSM ONLY LUNAR ORBIT MISSION (NOMINAL FIRST AND THIRD DAY OPERATIONS AND SPS DOI OPERATIONS).	B.	THE SM RCS PROPELLANT REQUIRED FOR LOI COMMITMENT IS 210 LBS. THIS CAPABILITY ALLOWS ONE DAY OF NOMINAL LUNAR ORBIT OPERATIONS WHILE DOCKED AND NOMINAL TEC OPERATIONS.	
		C.	IF THE LUNAR ORBIT REDLINE IS VIOLATED, TEI WILL BE PERFORMED ASAP. THIS REDLINE ALLOWS---	90 LBS-LM SEP, 2 REVS IN LUNAR ORBIT, TEI ULLAGE, NOMINAL TEC	65 LBS-MCC ALLOWANCE FOR TEMC		
		D.	THE SM RCS PROPELLANT REQUIRED TO ALLOW A GO FOR UNDOCKING IS 360 LBS. THIS CAPABILITY INCLUDES---	CSM SEP MANEUVER, ONE REV FOR THE MINI-FOOTBALL, BRAKING AND DOCKING, FOUR REVS POSTDOCKING, AND THE LUNAR ORBIT REDLINE.			
		E.	THE SM RCS PROPELLANT REQUIRED TO ALLOW A GO FOR RENDEZVOUS IS 670 LBS. THIS CAPABILITY INCLUDES---	395 LBS, RESCUE (INCLUDES FOUR JET 10 SEC ULLAGE FOR FOUR SPS MANEUVERS ONE RCS MANEUVER, AND ASSUMES THE CSM PERFORMS BRAKING)	90 LBS-LUNAR ORBIT REDLINE LESS MCC ALLOWANCE	225 LBS-NOMINAL LUNAR ORBIT USAGE	
				-----	670 LBS-TOTAL		
		F.	IF THE TEC REDLINE IS APPROACHED, ONLY RCS USAGE ESSENTIAL FOR CREW SAFETY WILL BE CONTINUED. THIS REDLINE ALLOWS A CM/SM SEP MANEUVER OF 3 FPS. THE TEC REDLINE, INCL. ALLOWANCE FOR TEI ULLAGE, IS 60 LBS.				
<p>RULE NUMBERS 3-92 AND 3-93 ARE ARE RESERVED.</p>							
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MISSION RULES

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MISSION RULES

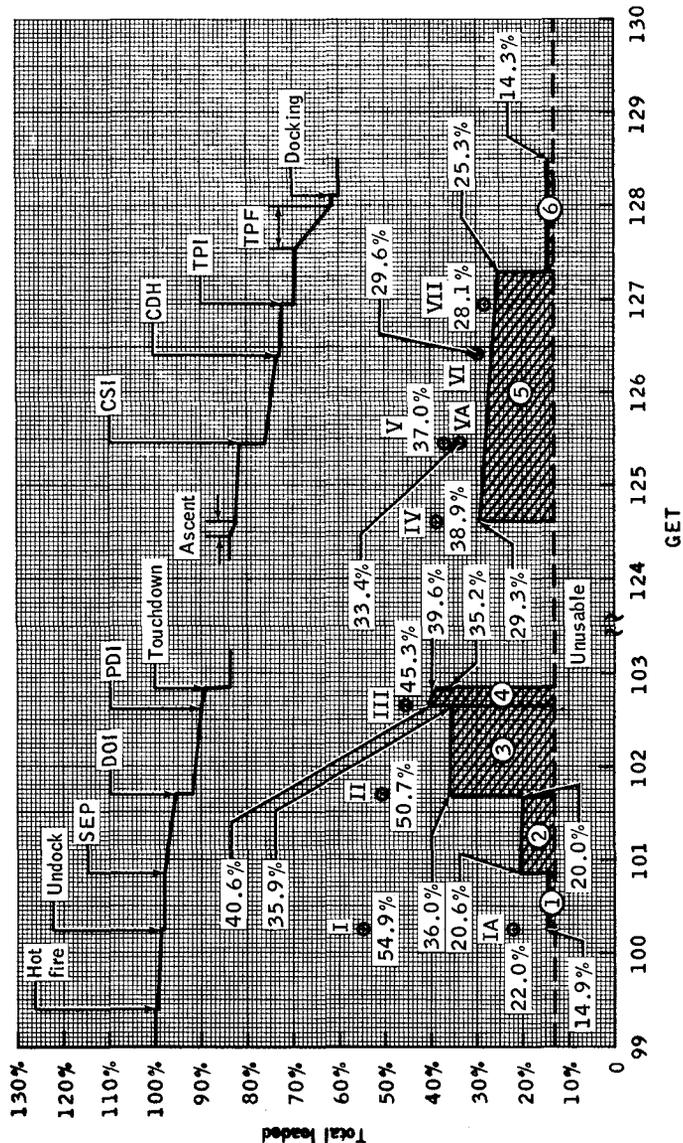
SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM																				
3-94	<p>CSM 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>TLI</th> <th>LOI</th> <th>UNDOCK*</th> </tr> </thead> <tbody> <tr> <td>BATT AMP-HOURS REMAINING **</td> <td>88.4</td> <td>81</td> <td>50 ***</td> <td>44 ***</td> </tr> <tr> <td>O2 (PERCENT EACH TANK)</td> <td>82.8</td> <td>82.0</td> <td>60.7</td> <td>53.4</td> </tr> <tr> <td>H2 (PERCENT EACH TANK)</td> <td>90.2</td> <td>89.3</td> <td>64.8</td> <td>55.8</td> </tr> </tbody> </table> <p>*UNDOCKING REDLINE IS THAT MINIMUM REQUIREMENT NECESSARY TO DO A LUNAR LANDING WITH ASCENT AFTER ONE CSM ORBIT.</p> <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 G&N 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 50 AMP AVERAGE POWER LEVEL AFTER LOSS OF ONE CRYO TANK AT NOMINAL TEI -29 HOURS (WORST CASE TIME FOR FAILURE).</p> <p>RULES 3-95 AND 3-96 ARE RESERVED.</p>		LAUNCH	TLI	LOI	UNDOCK*	BATT AMP-HOURS REMAINING **	88.4	81	50 ***	44 ***	O2 (PERCENT EACH TANK)	82.8	82.0	60.7	53.4	H2 (PERCENT EACH TANK)	90.2	89.3	64.8	55.8
	LAUNCH	TLI	LOI	UNDOCK*																	
BATT AMP-HOURS REMAINING **	88.4	81	50 ***	44 ***																	
O2 (PERCENT EACH TANK)	82.8	82.0	60.7	53.4																	
H2 (PERCENT EACH TANK)	90.2	89.3	64.8	55.8																	

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LM RCS propellant profile



MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM							
	3-97	<p>LM-RCS PROPELLANT GO/NO-GO'S AND REDLINES</p> <p>A. ASSUMPTIONS</p> <p>1. TOTAL LOADED 633 LBS EQUAL 100 PERCENT UNUSABLE</p> <table border="0"> <tr> <td>TRAPPED PROPELLANT</td> <td>7.3 PERCENT</td> </tr> <tr> <td>GROUND GAGING UNCERTAINTY</td> <td>6.0 PERCENT</td> </tr> <tr> <td>TOTAL UNUSABLE</td> <td>13.3 PERCENT</td> </tr> </table> <p>2. OPS RESERVE</p> <p>(A) PRIOR TO TPI — ONE REV LOS TRACKING OF CSM (STAGED) EQUAL 2.5 PERCENT</p> <p>(B) AFTER TPI — CSM ACTIVE DOCKING EQUAL 1.0 PERCENT</p> <p>B. GO/NO-GO'S</p> <p>1. UNDOCKING/SEPARATION---</p> <p>I. PROPELLANT REQUIRED FOR UNDOCKING, DOI, DESCENT, ASCENT AND RENDEZVOUS PLUS OPS RESERVE.</p> <p>I.A PROPELLANT REQUIRED FOR UNDOCKING MINI-FOOTBALL, AND DOCKING PLUS OPS RESERVE.</p> <p>2. DOI</p> <p>II. PROPELLANT REQUIRED FOR DOI, DESCENT, ASCENT AND RENDEZVOUS PLUS OPS RESERVE.</p> <p>3. PDI</p> <p>III. PROPELLANT REQUIRED FOR DESCENT, ASCENT AND RENDEZVOUS PLUS OPS RESERVE.</p> <p>4. IMMEDIATELY AFTER ASCENT</p> <p>IV. PROPELLANT REQUIRED FOR NOMINAL LM ACTIVE RNDZ PLUS OPS RESERVE.</p> <p>5. CSI</p> <p>V. PROPELLANT REQUIRED FOR REMAINDER OF RNDZ PLUS OPS RESERVE.</p> <p>V.A. PROPELLANT FOR CSI, LOS TO TPI, TPI, BRAKING, DOCKING PLUS OPS RESERVE.</p> <p>6. CDH</p> <p>VI. PROPELLANT REQUIRED FOR REMAINDER OF RNDZ PLUS OPS RESERVE.</p> <p>7. TPI</p> <p>VII. PROPELLANT REQUIRED FOR REMAINDER OF RENDZVOUS PLUS OPS RESERVE.</p>	TRAPPED PROPELLANT	7.3 PERCENT	GROUND GAGING UNCERTAINTY	6.0 PERCENT	TOTAL UNUSABLE	13.3 PERCENT
TRAPPED PROPELLANT	7.3 PERCENT							
GROUND GAGING UNCERTAINTY	6.0 PERCENT							
TOTAL UNUSABLE	13.3 PERCENT							

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MISSION RULES

SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM						
	3-97 CONT.	<p>C. REDLINES</p> <ol style="list-style-type: none"> 1. UNDOCKING TO SEP PROPELLANT REQUIRED FOR NOMINAL DOCKING 2. SEP TO DOI PROPELLANT REQUIRED FOR REMAINDER OF MINI FOOTBALL, DOCKING PLUS OPS RESERVE. 3. DOI TO PDI PROPELLANT REQUIRED FOR LOS IN LONGEST ABORT RNDZ WITH DPS ATTACHED UNTIL JUST BEFORE TPI (P-20 MAXIMUM DEADBAND), STAGING, BRAKING, DOCKING PLUS OPS RESERVE. 4. PDI TO TOUCHDOWN PROPELLANT REQUIRED FOR DESCENT, NOM ASCENT, LONGEST LOS FOR CSM RESCUE (P-20 MAXIMUM DEADBAND), BRAKING, DOCKING PLUS OPS RESERVE. 5. INSERTION TO TPI PROPELLANT REQUIRED FOR LOS TO TPF, BRAKING, DOCKING, PLUS OPS RESERVE. NOTE RCS REQUIRED DECREASES WITH LESS LOS UNTIL TPI. 6. TPI TO DOCKING PROPELLANT REQUIRED FOR OPS RESERVE. 					
	3-98	<p>LM DPS</p> <p>THE NOMINAL DPS PROPELLANT MARGIN IS APPROXIMATELY 925 LBS. THERE ARE NO REDLINES OR GO/NO-GO'S PLANNED.</p>					
	3-99	<p>LM APS</p> <p>THE NOMINAL APS PROPELLANT MARGIN AT INSERTION IS APPROXIMATELY 246 LBS. THERE ARE NO REDLINES OR GO/NO-GO'S PLANNED.</p> <p>RULE NUMBERS 3-100 AND 3-101 ARE RESERVED.</p>					
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SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM							
	3-102	<p>LM EPS, O2, H2O</p> <p>A. LM ECS AND EPS NOMINAL MISSION REDLINES ARE DEFINED IN TWO CATEGORIES---</p> <ol style="list-style-type: none"> 1. THOSE USABLE QUANTITIES REQUIRED (PLUS DISPERSIONS) AT ANY TIME TO COMPLETE THE NOMINAL MISSION THROUGH DOCKING. <ol style="list-style-type: none"> (A) FROM UNDOCKING TO TOUCHDOWN, THE NOMINAL MISSION REDLINES ARE BASED ON A TWO-HOUR LUNAR STAY. THESE REDLINES ARE DEFINED BY THE CONSUMABLES REQUIRED TO COMPLETE THE LANDING, A 2-HOUR STAY, ASCENT AND NOMINAL (4-HOUR) RENDEZVOUS. EACH ASCENT BATTERY AND ASCENT H2O TANK AND ONE ASCENT O2 TANK MUST CONTAIN CONSUMABLES REQUIRED FOR LIFTOFF AND NOMINAL RENDEZVOUS THROUGH CREW TRANSFER. IN ADDITION, THERE MUST BE SUFFICIENT ASCENT/DESCENT CONSUMABLES TO COMPLETE THE LANDING PLUS A 2-HOUR LUNAR STAY. HOWEVER, FOR THE FIRST REV AFTER TOUCHDOWN, THE REDLINES ARE DEFINED AS THE CONSUMABLES REQUIRED TO PROVIDE A T3 LIFTOFF, NOMINAL INSERTION, AND CSM RESCUE AS A MINIMUM. (B) FOR THE REMAINDER OF THE LUNAR STAY, THE DESCENT REDLINES ARE BASED ON THE CONSUMABLES REQUIRED TO REACH THE NEXT LAUNCH WINDOW (A CONSTANT 2 HOURS IS ASSUMED) PLUS A LUNAR SURFACE RESERVE OF 2 HOURS (EPS - SPLIT BUS CONFIGURATION). ASCENT REDLINES ARE BASED ON THE CONSUMABLES REQUIRED FOR LIFTOFF AND NOMINAL RENDEZVOUS THROUGH CREW TRANSFER AS DEFINED IN PARAGRAPH (A) ABOVE. (C) THE RENDEZVOUS REDLINE IS BASED ON THE CONSUMABLES REQUIRED TO COMPLETE A NOMINAL LM-ACTIVE RENDEZVOUS, COMPLETELY POWERED UP. WHEN THE REDLINE IS REACHED, LM WILL BE POWERED DOWN AND CSM BECOMES THE ACTIVE VEHICLE. HOWEVER, THE LM WILL BE POWERED UP TO PERFORM BRAKING. THE REDLINE ALLOWS FOR THIS CAPABILITY. 2. THOSE USABLE QUANTITIES REQUIRED (PLUS DISPERSIONS) TO COMPLETE THE REQUIRED ALTERNATE MISSION. <p>B. GO/NO GO'S FOR ECS AND EPS ARE DEFINED IN TWO CATEGORIES---</p> <ol style="list-style-type: none"> 1. THOSE USABLE QUANTITIES REQUIRED (PLUS DISPERSIONS AND OPERATIONAL RESERVES) AT SELECTED POINTS OF COMMITMENT TO COMPLETE THE NOMINAL MISSION THROUGH DOCKING. <ol style="list-style-type: none"> (A) THE GO/NO GO VALUES FOR UNDOCKING, DOI, PDI, AND A STAY/NO STAY FOR T1 & T2 ARE IDENTICAL TO THE NOMINAL MISSION REDLINES AT THOSE TIMES. SEE 3-102.A.1(A) FOR DETAILS. (B) THE DESCENT CONSUMABLES VALUES FOR THE GO/NO GO FOR A 10 OR 22-HOUR STAY ARE THOSE REQUIRED TO COMPLETE THE STAY WITH THE SCHEDULED ACTIVITIES PLUS A 2-HOUR SURFACE RESERVE. THE LAST 4 HOURS OF THIS CAPABILITY FOR EPS MUST BE SPLIT BUS OPERATION. THE ASCENT CONSUMABLE GO/NO GO VALUES ARE THE SAME AS THE REDLINES DISCUSSED IN 3-102.A.1(B) (C) THERE IS NO APPLICABLE GO/NO GO FOR THE LM-ACTIVE RENDEZVOUS. LM IS THE ACTIVE VEHICLE AS LONG AS THE REDLINES, DEFINED IN PARAGRAPH 3-102.A.1(C), ARE NOT VIOLATED. 2. THOSE USABLE QUANTITIES REQUIRED (PLUS DISPERSIONS AND OPERATIONAL RESERVES) AT SELECTED POINTS OF COMMITMENT TO COMPLETE THE REQUIRED ALTERNATE MISSION. 						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	A	6/20/69	MISSION RULE SUMMARY	CONSUMABLES	3-26	

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MISSION RULES

SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM																			
	3-102 CONT.																			
		GO/NO GO			STAY/NO STAY															
		UNDOCK	DOI	PDI	LUNAR STAY															
		ROM(1) WITH 2-HR STAY	ROM WITH 2-HR STAY	ROM WITH 2-HR STAY	T1 AND T2 (3)	ROM(2) WITH 8-HR STAY	ROM(2) 20-HR WITH EVA	ROM(2) 20-HR W/O EVA												
		ASC O2 (LBS EITHER TANKS)	1.6	1.6	1.6		1.6	1.6												
		PLUS																		
		ASC/DES O2 (LBS)	1.7	1.3	.9		4.1	20.6												
		ASC H2O (LBS EACH TANK)	29	29	29 (3)	29	29	29												
		PLUS																		
		ASC/DES H2O (LBS)	33	27	19 (3)	68	138	139												
		ASC AMP HRS (EACH BAT)	247	247	247 (3)	237	237	237												
		PLUS																		
		ASC/DES AMP HOURS	203	135	94 (3)	387	797	783												
		<p>(1) ROM = REMAINDER OF MISSION</p> <p>(2) APPLIED AT T3-20 MIN, I.E. TOTAL SURFACE STAY TIMES ARE 10 AND 22 HOURS.</p> <p>(3) LM IS "STAY" IF SUFFICIENT ASCENT/DESCENT H2O AND ELECTRICAL POWER ARE AVAILABLE TO PROVIDE A T3 LIFTOFF, NOMINAL INSERTION & CSM RESCUE CAPABILITY AS A MINIMUM. LM IS "STAY" EVEN IF ALL TANKED O2 IS LOST.</p> <p>GENERAL NOTE</p> <p>VALUES IN TABLE ARE THE REQUIRED USABLE AMOUNTS. UNUSABLES ARE---</p> <table border="1"> <thead> <tr> <th></th> <th>O2</th> <th>H2O</th> <th>A-H</th> </tr> </thead> <tbody> <tr> <td>ASC</td> <td>37</td> <td>2.08</td> <td>7</td> </tr> <tr> <td>DES</td> <td>3.39</td> <td>16.4</td> <td>15</td> </tr> </tbody> </table> <p>(PER TANK OR BATTERY)</p>								O2	H2O	A-H	ASC	37	2.08	7	DES	3.39	16.4	15
	O2	H2O	A-H																	
ASC	37	2.08	7																	
DES	3.39	16.4	15																	
		MISSION	REV	DATE	SECTION	GROUP	PAGE													
		APOLLO 11	B	7/3/69	MISSION RULE SUMMARY	CONSUMABLES	3-27													

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MISSION RULES

SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM								
	3-103 EMU	<p>PLSS AMP HRS, O2 & H2O REDLINES</p> <p>A. NOMINAL EVA-THE PLSS AMP-HRS, O2 AND H2O REDLINES FOR THE NOMINAL EVA ARE DEFINED IN THREE CATAGORIES---</p> <ol style="list-style-type: none"> 1. THOSE VALUES REQUIRED FOR DUAL TERMINATION AND SAFE RETURN TO A PRESSURIZED LM CABIN PLUS THE VALUES REQUIRED FOR 30 MIMUTES OF POST-EVA RESERVE. 2. THOSE VALUES REQUIRED FOR DUAL TERMINATION, TRANSFER OF ONE SRC, AND SAFE RETURN TO A PRESSURIZED LM CABIN PLUS 30 MINUTES OF POST-EVA RESERVE. 3. THOSE VALUES REQUIRED FOR DUAL TERMINATION, TRANSFER OF BOTH SRC'S AND SAFE RETURN TO A PRESSURIZED LM CABIN PLUS 30 MINUTES OF POST-EVA RESERVE. <p>B. ALTERNATE EVA- THE PLSS AMP-HOURS, O2 AND H2O REDLINES FOR THE ALTERNATE EVA'S ARE DEFINED IN TWO CATAGORIES---</p> <ol style="list-style-type: none"> 1. THOSE VALUES REQUIRED FOR SINGLE EVA TERMINATION AND SAFE RETURN TO A PRESSURIZED LM CABIN PLUS THE VALUES REQUIRED FOR 30 MINUTES OF POST-EVA RESERVE. 2. THOSE VALUES REQUIRED FOR SINGLE EVA TERMINATION, TRANSFER OF ONE SRC, AND SAFE RETURN TO A PRESSURIZED LM CABIN PLUS 30 MINUTES OF POST-EVA RESERVE. 							
		MISSION	REV	DATE	SECTION	GROUP	PAGE		
		APOLLO 11	A	6/20/69	MISSION RULE SUMMARY	CONSUMABLES	3-28		

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MISSION RULES

SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM																																											
	3-103 CONT.	<p>C. PLSS AMP-HR, O2 AND H2O 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="4">GO/NO-GO'S</th> </tr> <tr> <th></th> <th>NOMINAL EVA 2HR 40 MIN</th> <th>ALTERNATE 1-MAN, 2-HR EVA</th> <th>ALTERNATE 1-MAN, 50-MIN EVA</th> </tr> </thead> <tbody> <tr> <td>CDR POS (PSIA)</td> <td>919</td> <td>757</td> <td>506</td> </tr> <tr> <td>H2O (LBS)</td> <td>7.34</td> <td>5.96</td> <td>3.40</td> </tr> <tr> <td>AMP-HRS</td> <td>12.0</td> <td>10.0</td> <td>6.5</td> </tr> <tr> <td>LMP</td> <td></td> <td></td> <td></td> </tr> <tr> <td>POS (PSIA)</td> <td>884</td> <td>757</td> <td>506</td> </tr> <tr> <td>H2O (LBS)</td> <td>6.97</td> <td>5.96</td> <td>3.40</td> </tr> <tr> <td>AMP-HRS</td> <td>12.0</td> <td>10.0</td> <td>6.5</td> </tr> </tbody> </table> <p>(1) THESE REQUIREMENTS ARE VALID ONLY IF THE CDR'S PLSS FAILS TO SATISFY ITS GO/NO-GO CRITERIA.</p>							GO/NO-GO'S					NOMINAL EVA 2HR 40 MIN	ALTERNATE 1-MAN, 2-HR EVA	ALTERNATE 1-MAN, 50-MIN EVA	CDR POS (PSIA)	919	757	506	H2O (LBS)	7.34	5.96	3.40	AMP-HRS	12.0	10.0	6.5	LMP				POS (PSIA)	884	757	506	H2O (LBS)	6.97	5.96	3.40	AMP-HRS	12.0	10.0	6.5
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	MISSION	REV	DATE	SECTION	GROUP	PAGE																																						
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MISSION RULES

SECTION 3 - MISSION RULE SUMMARY - CONTINUED

REV	ITEM													
	<p>3-103 CONT.</p> <p>D. OPS O2, PLSS O2, H2O AND AMP-HRS GO/NO-GO'S ARE DEFINED AS THOSE VALUES REQUIRED TO COMPLETE A 30-MINUTE CEVA.</p> <div style="border: 1px dashed black; padding: 10px; margin: 20px auto; width: fit-content;"> <p style="text-align: center;">CEVA GO/NO-GO TABLE</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td rowspan="2" style="text-align: center; vertical-align: middle;">OPS</td> <td style="text-align: center;">ACTIVATED</td> <td style="text-align: center;">4600 PSIA/4.8 LBS</td> </tr> <tr> <td style="text-align: center;">UNACTIVATED</td> <td style="text-align: center;">5380 PSIA/5.6 LBS</td> </tr> <tr> <td></td> <td style="text-align: center;">POS</td> <td style="text-align: center;">422 PSIA/0.5 LBS</td> </tr> <tr> <td rowspan="2" style="text-align: center; vertical-align: middle;">PLSS</td> <td style="text-align: center;">H2O</td> <td style="text-align: center;">1.7 LBS</td> </tr> <tr> <td style="text-align: center;">BAT</td> <td style="text-align: center;">4.8 AMP-HRS</td> </tr> </tbody> </table> </div>	OPS	ACTIVATED	4600 PSIA/4.8 LBS	UNACTIVATED	5380 PSIA/5.6 LBS		POS	422 PSIA/0.5 LBS	PLSS	H2O	1.7 LBS	BAT	4.8 AMP-HRS
OPS	ACTIVATED		4600 PSIA/4.8 LBS											
	UNACTIVATED	5380 PSIA/5.6 LBS												
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PLSS	H2O	1.7 LBS												
	BAT	4.8 AMP-HRS												

MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM								
	4-1	<p>GENERAL</p> <p>A. THE FOLLOWING PRELAUNCH REQUIREMENTS DEFINE THE MCC/MSFN 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>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>							
		MISSION	REV	DATE	SECTION	GROUP	PAGE		
		APOLLO 11	FNL	5/16/69	GROUND INSTR. REQUIREMENTS	GENERAL	4-1		

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SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
4-5	COMMUNICATIONS	A. MOCR---			
		FD LOOP	PRELAUNCH	1 OF 2 MANDATORY	FOR MISSION CONTROL
		AFD CONF LOOP			
		MOCR SYS 1 & 2			
		MOCR DYN	PRELAUNCH	ALL HIGHLY DESIRABLE	
		A/G 1 LOOP			
		A/G 2 LOOP			
		B. MCC/LAUNCH COMPLEX---			
		121 CLTC	PRELAUNCH	1 OF 3 MANDATORY	FOR TERMINAL COUNT COORDINATION OF MCC-PAD ACTIVITIES
		111 CVTS			
212 MSTC					
C. MCC/RSO---					
FD LINE TO RSO	PRELAUNCH	1 OF 3 MANDATORY	FOR TRAJECTORY VERIFICATION AND BOOSTER SAFING		
RSO PRIVATE LINE					
CAPE 111 RSO LOOP					
D. MISCELLANEOUS---					
BSE TM MONITOR LOOP	PRELAUNCH	DESIRABLE	USED FOR MONITORING SPACE VEHICLES SUBSYSTEM CHECKOUT		
CIF/USB LOOP					
E. MCC/REMOTED SITES---					
ONE A/G PATH VIA GSFC	PRELAUNCH	MANDATORY	USED FOR COMMUNICATION WITH CREW		
4-6	COMPUTER	A. MOC (IBM 360/75)	PRELAUNCH	MANDATORY	TO PROCESS MANDATORY S/V PARAMETERS AND TRAJECTORY DATA
		B. DSC (IBM 360/75)	PRELAUNCH	HIGHLY DESIRABLE	AN SSC (IBM 360/75) IS AVAILABLE AS BACKUP TO THE MOC OR DSC.
		C. CCATS (UNIVAC 494) - ONLINE	PRELAUNCH	1 MANDATORY AND 1 HIGHLY DESIRABLE	TO THROUGH PROCESS MANDATORY S/V PARAMETERS TO MOC
		D. CCATS (UNIVAC 494) - STANDBY	PRELAUNCH	1 HIGHLY DESIRABLE	PRELAUNCH IP PREDICTIONS FOR MODE 1 ABORTS.
		E. RTACF - 2	PRELAUNCH	1 HIGHLY DESIRABLE	
			PRELAUNCH	1 MANDATORY	MCC TIMING STANDARD TO SUPPORT MANDATORY RTCC/CCATS COMPUTERS
4-7	TIMING MITE (2)		PRELAUNCH	1 MANDATORY	

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SECTION 4 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	MANDATORY	20 SECONDS INTERRUPTABLE POWER FOR THE FOLLOWING HIGHLY DESIRABLE ITEMS--- - FLT DYN SSR CONSOLES AND PLOTBOARDS - RTCC CONSOLES (EXCEPT COMP SUP) - RTACF - PDSDD - CMCC - TTY			
		D. BUS B2	PRELAUNCH	MANDATORY	20 SECONDS INTERRUPTABLE POWER FOR MOCR AND SSR CONSOLES			
	4-9	DISPLAY						
		A. MOCR D/TV CHANNELS	PRELAUNCH	10 OF 36 MANDATORY	FOR DISPLAY OF MANDATORY S/V PARAMETERS			
			POSITION	NO. OF CHANNELS				
			RETRO	1				
			FIDO	1				
		GUIDO	1					
		EECOM	1					
		GNC	1					
	RTCC	1						
	BOOSTER	4						
	B. TRAJECTORY DISPLAY							
	1. FDO LAUNCH DIGITALS	PRELAUNCH	MANDATORY ON D/TV	FOR CONTINGENCY ORBIT INSERTION MANEUVER DATA AND TFF 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	FROM SELECTED TRACKING DATA SOURCE.				
	3. RFO LAUNCH DIGITALS	PRELAUNCH	MANDATORY ON D/TV	MONITOR FOR MODES III AND IB MANEUVER DATA.				
	4. GAMMA(EI) VS V(EI)	PRELAUNCH	MANDATORY ON 1 OF 2--- (A) D/TV (B) SSR PLOTBOARD	MONITOR FOR G-LIMIT VIOLATION.				
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
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SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	CONT 4-9							
		5. PHI VS LAMBDA	PRELAUNCH	HIGHLY DESIRABLE ON 1 OF 2--- (A) RTCC PLOTBOARD (B) SSR PLOTBOARD	MONITOR FOR CROSS-RANGE LIMITS			
		6. T(FF) VS R(IP)	PRELAUNCH	HIGHLY DESIRABLE ON 1 OF 2--- (A) D/TV (B) SRR PLOTBOARD	MONITOR FOR ABORT MODES II, III, AND IB.			
		7. H VS D	PRELAUNCH	HIGHLY DESIRABLE ON 10 X 20 SCRIBER PLOTTER				
		8. GAMMA(I) VS V(I) (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. INSERTION/INJECTION DIGITALS	PRELAUNCH	MANDATORY ON D/TV	FOR G&N GO/NO-GO			
		C. ADEG CHANNELS 90-93	PRELAUNCH	HIGHLY DESIRABLE	FOR DSC DISPLAYS			
		D. VSM	PRELAUNCH	MANDATORY	FOR D/TV			
		E. AUX VSM	PRELAUNCH	HIGHLY DESIRABLE				
		F. EIDOPHORS (3)	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	
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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. WBD (50.0 KBPS) LINES (2) BETWEEN MCC AND GSFC	PRELAUNCH	1 MANDATORY	B. EITHER LINE CAN BE SWITCHED TO EITHER UNIVAC - 494.		
		C. TTY CIRCUITS BETWEEN MCC AND GSFC			C. VFTG PROVIDES TWO REDUNDANT 16 CIRCUIT TTY CHANNELS.		
		1. OUTGOING	PRELAUNCH	1 OF 32 CIRCUITS HIGHLY DESIRABLE	1. FOR ACQ MSG, LS CMD		
		2. INCOMING (JJ)	PRELAUNCH	1 OF 32 CIRCUITS MANDATORY	2. FOR RECEPTION OF LOWSPEED RADAR DATA.		
	4-11	KSC					
		TELEMETRY---					
		A. VHF TM FROM THE FOLLOWING FOR S-II, S-IVB, AND IU---			A. THESE ANTENNAS CAN BE SWITCHED TO MILA OR CIF FACILITIES		
		1. CIF 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. CIF USB					
		COMMAND---					
		THIS CAPABILITY IS DEFINED UNDER GSFC/KSC/MSFN COMMAND RULE 4-12 FOR LAUNCH COVERAGE.					
		TRACKING---					
		THAT CAPABILITY REQUIRED TO SATISFY RULE 4-4 (TRAJECTORY) IS MANDATORY.					
		VOICE COMMUNICATIONS---					
		THIS KSC CAPABILITY IS DEFINED UNDER MCC RULE 4-5 (COMMUNICATIONS).					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	B	7/3/69	GROUND INSTR. REQUIREMENTS	GSFC/KSC/MSFN	4-6

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SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	4-12	LAUNCH COVERAGE					
		<p>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 4-16 AND FIGURES 4-1 THROUGH 4-5) TO DETERMINE CAPABILITY.</p>					
		A. CMD					
		USB CCS	PRELAUNCH	HIGHLY DESIRABLE			
		B. TELEMETRY					
		S-IC (VHF)	PRELAUNCH	HIGHLY DESIRABLE	S-IC DATA IS ONLY HIGHLY DESIRABLE SINCE THE MCC IS NOT PRIME FOR REQUESTING AN ABORT FOR S-IC MALFUNCTIONS.		
		S-II (VHF)	PRELAUNCH	HIGHLY DESIRABLE FROM LIFTOFF TO S-II CUTOFF (APPROX. 8 + 36 SEC)	FOR ABORT CUES FROM MCC		
		S-IVB VHF (CP-1)	PRELAUNCH	HIGHLY DESIRABLE			
		IU CCS (DP-1B)	PRELAUNCH	MANDATORY	FOR BULKHEAD DELTA P AFTER S/C SEP		
		IU VHF (DP-1)	PRELAUNCH	HIGHLY DESIRABLE			
		CSM (USB)	PRELAUNCH	MANDATORY FROM LIFTOFF THROUGH S-IVB CUTOFF PLUS 60 SEC.	FOR ABORT CUES FROM MCC		
		C. TRACKING					
		<p>THAT CAPABILITY REQUIRED TO SATISFY RULE 4-4 (TRAJECTORY) IS MANDATORY</p>					
		D. A/G COMMUNICATIONS					
		1. MILA					
		VHF	PRELAUNCH	HIGHLY DESIRABLE			
		USB	PRELAUNCH	MANDATORY			
		2. MSFN					
		VHF	PRELAUNCH	1 OF 2 MANDATORY			
		USB					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	GROUND INSTR. REQUIREMENTS	GSFC/KSC/MSFN	4-7

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SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM							
4-16	<p>INTRODUCTION TO SITE FAILURE DECISION MATRICES (FIGURES 4-1 THROUGH 4-5)</p> <p>FOR PRELAUNCH FAILURES OF LAUNCH PHASE SITE CAPABILITY, THE FOLLOWING DECISION MATRICES APPLY THE LAUNCH PHASE GROUND INSTRUMENTATION REQUIREMENTS TO THE RESULTING DEGRADED COVERAGE.</p> <p>THESE MATRICES POINT 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 MATRICES WILL BE USED TO DETERMINE WHETHER MANDATORY CONTINUOUS COVERAGE HAS BEEN LOST.</p> <p>TO USE THE MATRIX</p> <ul style="list-style-type: none"> A. LOOK FOR AN X UNDER THE COLUMN FOR SITE WHERE THE FAILURE OCCURRED. B. GO ACROSS TO THE COLUMN FOR THE CAPABILITY THAT WAS LOST AND READ THE DECISION. C. THE COVERAGE THAT WAS LOST IS IN THE COLUMN LABELED 'MANDATORY COVERAGE LOST.' D. MORE THAN ONE X IN A ROW SPECIFIES A FAILURE OF THE SAME CAPABILITY AT MORE THAN ONE SITE. 							
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	B	7/3/69	GROUND INSTR. REQUIREMENTS	GSFC/KSC/MSFN	4-9	

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SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	SITES FAILED					CAPABILITY LOST				
		ALDS TM	MIL/CAPE	GBM	BDA	VAN	MANDATORY COVERAGE	TELEMETRY	CMD	TRACK	A/G
		00-00 08-49	00-00 08-49	01-07 09-13	04-11 12-42	09-30 15-32	LOST	USB OR VHF		BOTH S AND C BAND	
	S I N G L E	X					NONE SEE NOTE 4	GO	N/A	N/A	N/A
	F A I L U R E		X				00-00 TO 01-02	GO	GO	NO-GO	NO-GO
				X			S-IC/S-II SEP SEE NOTE 1	GO	GO	GO	GO
					X		NONE	GO	GO	GO	GO
						X	NONE	GO	GO	GO	GO
		X	X				00-00 TO 01-02	NO-GO	GO	NO-GO	NO-GO
	M U L T I P L E		X	X			00-00	GO	GO	NO-GO	NO-GO
		X	X	X			03-56	NO-GO	GO	NO-GO	NO-GO
			X		X		00-00 TO 01-02	GO	GO	NO-GO	NO-GO
		X	X		X			NO-GO	GO	NO-GO	NO-GO
			X			X	00-00 TO	GO	GO	NO-GO	NO-GO
	F A I L U R E S	X	X			X	01-02	NO-GO	GO	NO-GO	NO-GO
				X	X		08-51 TO 08-58 SEE NOTES 1 AND 3	GO	GO	GO	GO
				X		X	S-IC/S-II SEP	GO	GO	GO	GO
					X	X	9-14 TO INSR + 60	NO-GO	GO	NO-GO	GO *

NOTES---

- FLAME ATTENUATION WILL CAUSE LOSS OF USB LOCK AT MIL DURING S-IC/S-II SEPARATION.
- INSR + 60 SECONDS IS APPROXIMATELY 12-21.
- LOSS OF COVERAGE IS NOT SEVERE ENOUGH FOR A NO-GO CONDITION.
- LOSS OF ALDS RESULTS IN LOSS OF S-IC TM; HOWEVER, IT IS NOT MANDATORY FOR LAUNCH.

* GO FOR USB--- NO GO FOR USB AND VHF

FIGURE 4-1. - 72 DEG. LAUNCH AZIMUTH SITE FAILURE DECISION MATRIX.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	GROUND INSTR. REQUIREMENTS	GSFC/KSC/MSFN	4-10

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SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	SITES FAILED					MANDATORY COVERAGE	CAPABILITY LOST			
		ALDS TM	MIL/CAPE	GBM	BDA	VAN		TELEMETRY	CMD	TRACK	A/G
		00-00 08-49	00-00 08-49	01-07 09-20	04-12 12-33	09-11 16-12	LOST	USB OR VHF		BOTH S AND C BAND	
	SINGLE	X					NONE SEE NOTE 4	GO	N/A	N/A	N/A
	FAILURE		X				00-00 TO 01-02	GO	GO	NO-GO	NO-GO
	FAILURE			X			S-IC/S-II SEP SEE NOTE 2	GO	GO	GO	GO
	FAILURE				X		NONE	GO	GO	GO	GO
	FAILURE					X	NONE	GO	GO	GO	GO
	MULTIPLE	X	X				00-00 TO 01-02	NO-GO	GO	NO-GO	NO-GO
	MULTIPLE		X	X			00-00 TO	GO	GO	NO-GO	NO-GO
	MULTIPLE	X	X	X			03-57	NO-GO	GO	NO-GO	NO-GO
	MULTIPLE		X		X		00-00 TO	GO	GO	NO-GO	NO-GO
	MULTIPLE	X	X		X		01-02	NO-GO	GO	NO-GO	NO-GO
	MULTIPLE		X			X	00-00 TO	GO	GO	NO-GO	NO-GO
	MULTIPLE	X	X			X	01-02	NO-GO	GO	NO-GO	NO-GO
	MULTIPLE			X	X		S-IC/S-II SEP	GO	GO	GO	GO
	MULTIPLE			X		X	S-IC/S-II SEP	GO	GO	GO	GO
	MULTIPLE				X	X	09-21 TO INSR + 60	NO-GO	GO	NO-GO	GO *

NOTES---

1. ANG HAS ACQUISITION FROM 07-48 TO 11-20 HOWEVER, MAXIMUM ELEVATION IS 1.6 DEGREES.
2. FLAME ATTENUATION WILL CAUSE LOSS OF USB LOCK AT MIL DURING S-IC/S-II SEPARATION.
3. INSR + 60 SECONDS IS APPROXIMATELY 12-21.
4. LOSS OF ALDS RESULTS IN LOSS OF S-IC TM HOWEVER, IT IS NOT MANDATORY FOR LAUNCH.

* GO FOR USB--- NO GO FOR USB AND VHF

FIGURE 4-2.- 81 DEG. LAUNCH AZIMUTH SITE FAILURE DECISION MATRIX.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	GROUND INSTR. REQUIREMENTS	GSFC/KSC/MSFN	4-11

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SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	SITES FAILED					MANDATORY COVERAGE LOST	CAPABILITY LOST			
		ALDS TM 00-00 08-48	MIL/CAPE 00-00 08-48	GBM 01-06 09-26	BDA 04-15 12-13	ANG 07-23 12-48	VAN 09-07 16-19	TELEMETRY USB OR VHF	CMD	TRACK BOTH S AND C BAND	A/G
	SINGLE FAILURE	X					NONE SEE NOTE 4	GO	N/A	N/A	N/A
	FAILURE		X				00-00 TO 01-02	GO	GO	NO-GO	NO-GO
	FAILURE			X			S-IC/S-II SEP SEE NOTE 2	GO	GO	GO	GO
	FAILURE				X		NONE	GO	GO	GO	GO
	FAILURE					X	NONE	GO	GO	GO	GO
	MULTIPLE	X	X				00-00 TO 01-02	NO-GO	GO	NO-GO	NO-GO
	MULTIPLE		X	X			00-00 TO	GO	GO	NO-GO	NO-GO
	MULTIPLE	X	X	X			03-59	NO-GO	GO	NO-GO	NO-GO
	MULTIPLE		X		X		00-00 TO	GO	GO	NO-GO	NO-GO
	MULTIPLE	X	X		X		01-02	NO-GO	GO	NO-GO	NO-GO
	FAILURE		X			X	00-00 TO	GO	GO	NO-GO	NO-GO
	FAILURE	X	X			X	01-02	NO-GO	GO	NO-GO	NO-GO
	FAILURE			X	X		S-IC/S-II SEP	GO	GO	GO	GO
	FAILURE			X		X	S-IC/S-II SEP	GO	GO	GO	GO
	FAILURE				X	X	NONE	GO	GO	GO	GO
	FAILURE					X	12-11 TO INSR + 60	NO GO	GO	NO-GO	GO *

NOTES---

1. ANG HAS MAXIMUM ELEVATION OF 5 DEGREES.
 2. FLAME ATTENUATION WILL CAUSE LOSS OF USB LOCK AT MIL DURING S-IC/S-II SEPARATION.
 3. INSR + 60 SECONDS IS APPROXIMATELY 12-21.
 4. LOSS OF ALDS RESULTS IN LOSS OF S-IC TM HOWEVER, IT IS NOT MANDATORY FOR LAUNCH.
- * GO FOR USB--- NO GO FOR USB AND VHF

FIGURE 4-3.- 90 DEG. LAUNCH AZIMUTH SITE FAILURE DECISION MATRIX.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	GROUND INSTR. REQUIREMENTS	GSFC/KSC/MSFN	4-12

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SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	SITES FAILED						MANDATORY COVERAGE	CAPABILITY LOST			
		ALDS TM	MIL/CAPE	GBM	BDA	ANG	VAN	LOST	TELEMETRY	CMD	TRACK	A/G
		00-00 08-48	00-00 08-48	01-06 09-31	04-21 11-43	07-00 13-40	09-16 15-57		USB OR VHF		BOTH S AND C BAND	
	SINGLES	X						NONE SEE NOTE 3	GO	N/A	N/A	N/A
	FAILURES		X					00-00 TO 01-02	GO	GO	NO-GO	NO-GO
	FAILURES			X				S-IC/S-II SEP SEE NOTE 1	GO	GO	GO	GO
	FAILURES				X			NONE	GO	GO	GO	GO
	FAILURES					X		NONE	GO	GO	GO	GO
	FAILURES						X	NONE	GO	GO	GO	GO
	MULTIPLE	X	X					00-00 TO 01-02	NO-GO	GO	NO-GO	NO-GO
	MULTIPLE		X	X				00-00 TO	GO	GO	NO-GO	NO-GO
	MULTIPLE	X	X	X				04-04	NO-GO	GO	NO-GO	NO-GO
	MULTIPLE		X		X			00-00 TO	GO	GO	NO-GO	NO-GO
	MULTIPLE	X	X		X			01-02	NO-GO	GO	NO-GO	NO-GO
	MULTIPLE		X				X	00-00 TO	GO	GO	NO-GO	NO-GO
	MULTIPLE	X	X				X	01-02	NO-GO	GO	NO-GO	NO-GO
	FAILURES			X	X			S-IC/S-II SEP	GO	GO	GO	GO
	FAILURES			X			X	S-IC/S-II SEP	GO	GO	GO	GO
	FAILURES				X		X	NONE	GO	GO	GO	GO
	FAILURES				X	X		NONE	GO	GO	GO	GO
	FAILURES					X	X	11-41 TO INSR + 60	NO-GO	GO	GO	GO *
	FAILURES		X			X		00-00 TO	GO	GO	NO-GO	NO-GO
	FAILURES	X	X			X		01-02	NO-GO	GO	NO-GO	GO *

NOTES---

- FLAME ATTENUATION WILL CAUSE LOSS OF USB LOCK AT MIL DURING S-IC/S-II SEPARATION.
 - INSR + 60 SECONDS IS APPROXIMATELY 12-21.
 - LOSS OF ALDS RESULTS IN LOSS OF S-IC TM HOWEVER, IT IS NOT MANDATORY FOR LAUNCH.
- * GO FOR USB--- NO GO FOR USB AND VHF

FIGURE 4-4.- 99 DEG. LAUNCH AZIMUTH SITE FAILURE DECISION MATRIX.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	GROUND INSTR. REQUIREMENTS	GSFC/KSC/MSFN	4-13

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SECTION 4 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	SITES FAILED						CAPABILITY LOST				
		ALDS TM	MIL/CAPE	GBM	BDA	ANG	VAN	MANDATORY COVERAGE LOST	TELEMETRY	CMD	TRACK	A/G
		00-00 08-48	00-00 08-48	01-06 09-35	04-29 11-03	06-48 14-10	09-42 14-59		USB OR VHF		BOTH S AND C BAND	USB
	SINGLES	X						NOTE SEE NOTE 3	GO	N/A	N/A	N/A
	FAILURE		X					00-00 TO 01-02	GO	GO	NO-GO	NO-GO
	FAILURE			X				S-IC/S-II SEP SEE NOTE 1	GO	GO	GO	GO
	FAILURE				X			NONE	GO	GO	GO	GO
	FAILURE					X		NONE	GO	GO	GO	GO
	FAILURE						X	NONE	GO	GO	GO	GO
	MULTI	X	X					00-00 TO 01-02	NO-GO	GO	NO-GO	NO-GO
	MULTI		X	X				00-00 TO	GO	GO	NO-GO	NO-GO
	MULTI	X	X	X				04-11	NO-GO	GO	NO-GO	NO-GO
	PLE		X					00-00 TO	GO	GO	NO-GO	NO-GO
	PLE	X	X			X		01-02	NO-GO	GO	NO-GO	NO-GO
	PLE		X				X	00-00 TO	GO	GO	NO-GO	NO-GO
	PLE	X	X				X	01-02	NO-GO	GO	NO-GO	NO-GO
	FAILURE			X		X		S-IC/S-II SEP	GO	GO	GO	GO
	FAILURE			X			X	S-IC/S-II SEP	GO	GO	GO	GO
	S					X	X	11-01 TO INSR + 60	NO-GO	GO	GO	GO *
					X	X		NONE	GO	GO	GO	GO

NOTES---

1. FLAME ATTENUATION WILL CAUSE LOSS OF USB LOCK AT MIL DURING S-IC/S-II SEPARATION.
2. INSR + 60 SECONDS IS APPROXIMATELY 12-21.
3. LOSS OF ALDS RESULTS IN LOSS OF S-IC TM HOWEVER, IT IS NOT MANDATORY FOR LAUNCH.
- * GO FOR USB--- NO GO FOR USB AND VHF

FIGURE 4-5.- 108 DEG. LAUNCH AZIMUTH SITE FAILURE DECISION MATRIX.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	GROUND INSTR. REQUIREMENTS	GSFC/KSC/MSFN	4-14

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MISSION RULES

SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM								
5-1		<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 1 + 40 AND DECREASING AFTER TOWER JETTISON.</p> <p>C. VIOLATION OF ENTRY 'G' LIMIT.</p> <p>D. VS INCREASING.</p> <p>E. OVERSPEED CONDITIONS AT INSERTION.</p> <p>F. VIOLATION OF EXIT HEATING LINE.</p>							
5-2		<p>THE LES WILL NOT BE JETTISONED UNTIL MODE II CAPABILITY IS ESTABLISHED BY TFF IS GREATER THAN OR EQUAL TO 1 + 20 AND INCREASING.</p>							
5-3		<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 MANEUVERS.</p> <p>B. MANEUVERS WILL BE INTERRUPTED WHEN TFF = 1 + 40 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 LIFT OF AVOID LAND. UNAVOIDABLE LAND LANDING USE RL 90 DEG.</p> <p>E. MAXIMUM NUMBER OF SPS START ATTEMPTS IS TWO.</p> <p>F. IF NO SLA SEP OR IF SPS FAILS---</p> <ol style="list-style-type: none"> 1. HP IS LESS THAN 40 - EXECUTE CM/SM SEP BY TFF = 1 + 40. 2. HP IS BETWEEN 40 AND 75 - GROUND WILL DECIDE TO USE SM RCS ASAP OR AT APOGEE TO REDUCE HP TO 40 NM. 							
5-4		<p>MODE III ABORTS.</p> <p>A. PREDICTED TFF AFTER SPS C/O IS LESS THAN 1 + 40.</p> <ol style="list-style-type: none"> 1. FULL LIFT IP ON WATER - DO NOT BURN. 2. G&N GO AND FULL LIFT IP ON LAND - BURN TO TFF = 1 + 40, RL 90 DEG. 3. G&N NO-GO AND FULL LIFT IP ON LAND - BURN A REDUCED DELTA V TO MAINTAIN TFF AFTER C/O AND RL 90 DEG. <p>B. IF DELTA TB IS LESS THAN OR EQUAL TO 2 SEC, DO NOT BURN.</p> <p>C. IF IGNITION OCCURS AFTER GETI +10 SEC, BURN UNTIL G&N DELTA R = 0, RL 55 DEG. (IF UNABLE TO BURN DELTA R = 0, RL 90 DEG.)</p>							
		MISSION	REV	DATE	SECTION	GROUP	PAGE		
		APOLLO 11	A	6/20/69	TRAJECTORY AND GUIDANCE	LAUNCH	5-1		

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SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM							
	5-5	<p>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"> A. CMC PROGRAM FAILURE. B. RTCC AND CMC TFF DIFFERENCE OF GREATER THAN 40 SEC. C. CONFIRMED ERROR IN S/C PLATFORM VELOCITY COMPONENTS OF GREATER THAN 50 FPS IN X OR 100 FPS IN Z. D. CMC TRAJECTORY SOURCE INDICATES 'GO' OR 'NO-GO' INCONSISTENT WITH BEST TRAJECTORY SOURCE(S) INDICATION. 						
	5-6	<p>THE ORBIT IS 'GO' IF HP IS GREATER THAN OR EQUAL TO 75 NM.</p>						
		<p>RULES 5-7 THROUGH 5-19 ARE RESERVED.</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	A	6/20/69	TRAJECTORY AND GUIDANCE	LAUNCH	5-2	

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SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM						
	5-26	IF A G&N FAILURE IS DETECTED PRIOR TO RETROFIRE, CREW USES SCS DELTA V MODE WITH AN EMS ENTRY.					
	5-27	<p>IF SPS FAILS AFTER EPO RETROFIRE IGNITION OR NO SLA SEP---</p> <p>A. HP IS GREATER THAN 75 NM - RETARGET FOR NEXT BEST PTP USING RCS.</p> <p>B. 40 IS LESS THAN HP IS LESS THAN 75 - PITCH UP TO LOCAL HORIZONTAL ATTITUDE AND BURN SM RCS USING FOLLOWING PRIORITIES---</p> <ol style="list-style-type: none"> 1. BURN HP TO PAD VALUE 2. BURN MAXIMUM SM RCS DELTA V AVAILABLE 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 40 NM TERMINATE ALL THRUSTING AT TFF = <u>7</u> MIN. <p>C. HP IS LESS THAN 40 NM - REMAIN IN RETRO ATTITUDE AND BURN SM RCS USING THE FOLLOWING PRIORITY---</p> <ol style="list-style-type: none"> 1. BURN DELTA V RESIDUALS. 2. BURN MAXIMUM SM DELTA V AVAILABLE. <p style="text-align: center;">NOTE</p> <p style="text-align: center;">THE S-IVB LOX 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 11	FNL	5/16/69	TRAJECTORY AND GUIDANCE	EARTH ORBIT AND TLI	5-4	

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SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM													
	5-28	<p>THE G&N IS NO-GO FOR ENTRY IF---</p> <p>A. THE CMC VALUE OF DOWNRANGE ERROR (RP - RT) AT .2G DIFFERS GREATER THAN +/- 100 NM FROM GROUND VALUE OR IS GRATER THAN +/- 130 NM FROM BACKUP CHART VALUE. CREW FAILOVER TO EMS ENTRY AS FIRST PRIORITY OR GROUND BANK ANGLE AND RETRB AS SECOND PRIORITY.</p> <p>B. V AND GAMMA AT 400K ARE OUTSIDE THE CORRIDOR. GROUND WILL PROVIDE ENTRY PROFILE.</p>												
	5-29	<p>BOOSTER NAVIGATION AND TARGET UPDATES FOR TLI---</p> <p>A. THERE WILL BE NO IU TARGET UPDATES FOR EITHER TLI OPPORTUNITY.</p> <p>B. AN IU NAVIGATION UPDATE WILL BE PERFORMED FOR EITHER TLI OPPORTUNITY WHERE AN S-IVB GUID REF FAIL OR AN S-IVB ACCELEROMETER FAIL OCCURED PRIOR TO EARTH-ORBIT INSERTION. THE UPDATE WILL BE TIMETAGGED PRIOR TO GET = 2 HR 14 MIN FOR THE FIRST OPPORTUNITY OR GET = 3 HR 42 MIN FOR THE SECOND OPPORTUNITY.</p>												
	5-30	<p>THE CMC STATE VECTOR WILL BE UPDATED PRIOR TO TLI WITH THE BEST MSFN VECTOR.</p>												
	5-31	<p>A PROPERLY OPERATING SPACECRAFT G&N (CMC, IMU AND OSS) SYSTEM IS MANDATORY FOR TLI. FOR SATURN GUIDANCE REFERENCE FAILURES THE TLI WILL BE PERFORMED USING MANUAL BACKUP TECHNIQUES. FOR SATURN ACCELEROMETER FAILURES THE IU WILL BE CONSIDERED GO WITH A 95 PERCENT PROBABILITY OF ACHIEVING A 65,000 NM APOGEE ELLIPSE AT TLI CUTOFF. FOR SATURN ACCELEROMETER FAILURES THE TLI WILL BE CONTROLLED BY THE IU COMPUTER AND MANUALLY TERMINATED (FOR OVERSPEEDS) BASED ON GROUND UPDATED TOTAL INERTIAL CUTOFF VELOCITY AS OBSERVED ON THE DSKY.</p>												
	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 TD&E AND DOCKED SPS MIDCOURSE---</p> <p>A. GREATER THAN 5500 FPS - CONTINUE MISSION</p> <p>B. LESS THAN 5500 FPS - EXECUTE EARTH ORBIT ALTERNATE</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> </tr> </thead> <tbody> <tr> <td>APOLLO 11</td> <td>B</td> <td>7/3/69</td> <td>TRAJECTORY AND GUIDANCE</td> <td>EARTH ORBIT AND TLI</td> <td>5-5</td> </tr> </tbody> </table>			MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	B	7/3/69	TRAJECTORY AND GUIDANCE	EARTH ORBIT AND TLI	5-5
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SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM												
5-35	<p>DIFFERENCE IN CMC AND IU 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 38 FPS</p> <p>DELTA YDOT IS GREATER THAN 73 FPS</p> <p>DELTA ZDOT IS GREATER THAN 87 FPS</p> <p>DELTA VT 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 7.5 AND 38 FPS</p> <p>DELTA YDOT IS BETWEEN 41 AND 73 FPS</p> <p>DELTA ZDOT IS BETWEEN 28 AND 87 FPS</p> <p>DELTA VT 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 5-36 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 IU VERSUS MSFN.</p> <p>SEMI-MAJOR AXIS IS GREATER THAN 19,900 FT</p> <p>CROSSRANGE VELOCITY IS GREATER THAN 32 FPS</p>												
5-36	<p>DIFFERENCE IN MSFN AND IU DOWNRANGE POSITION (DELTA RV) IS GREATER THAN 105,100 FT AT GET = 56 MIN MEANS TLI IS NO-GO.</p>												
5-37	<p>WITH AN S-IVB GUID REF FAIL OR AN S-IVB 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 535,900 FEET AT GET = 56 MIN.</p> <p>B. DIFFERENCE IN SEMIMAJOR 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 5-38 THROUGH 5-45 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>B</td> <td>7/3/69</td> <td>TRAJECTORY AND GUIDANCE</td> <td>EARTH ORBIT AND TLI</td> <td>5-6</td> </tr> </tbody> </table>		MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	B	7/3/69	TRAJECTORY AND GUIDANCE	EARTH ORBIT AND TLI	5-6
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	5-46	<p>THE CMC OR LGC WILL BE TEMPORARILY NO-GO FOR MANEUVER CONTROL FOR ANY OF THE FOLLOWING---</p> <p>A. COMPUTER PROGRAM FAILURE.</p> <p>B. CMC/IMU ALIGNMENT DISCREPANCY (FOR MANEUVER EXECUTION, MONITORING, AND ORBIT DETERMINATION).</p> <p>1. SEXTANT STAR CHECK--- AUTO OPTICS POSITIONING DOES NOT PLACE SELECTED STAR IN FIELD OF VISION OF SXT.</p> <p>2. HORIZON CHECK ERROR IS GREATER THAN 4 DEG FOR RETROFIRE FROM EPO.</p> <p>C. LGC/IMU 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> <p>1. PHI IS GREATER THAN .02 DEG.</p> <p>2. LAMBDA IS GREATER THAN .02 DEG.</p> <p>3. H IS GREATER THAN .2 NM.</p>																																													
	5-47	<p>SPACECRAFT TIMING MUST BE MAINTAINED WITHIN THE LIMITS---</p> <table border="1"> <thead> <tr> <th></th> <th>CMC</th> <th>LGC</th> <th>AGS</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. TLI</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. TEI</td> <td>2</td> <td>2</td> <td>---</td> </tr> <tr> <td>G. DESCENT</td> <td>.9</td> <td>.9</td> <td>.3</td> </tr> <tr> <td>H. ASCENT</td> <td>.5</td> <td>.3</td> <td>.3</td> </tr> <tr> <td>I. RENDEZVOUS</td> <td>.5</td> <td>.5</td> <td>.5</td> </tr> </tbody> </table> <p>RULES 5-48 THRU 5-55 ARE RESERVED.</p>							CMC	LGC	AGS	A. RETROFIRE	2	---	---	B. ENTRY	2	---	---	C. TLI	2	---	---	D. MCC'S	2	---	---	E. LOI	2	2	---	F. TEI	2	2	---	G. DESCENT	.9	.9	.3	H. ASCENT	.5	.3	.3	I. RENDEZVOUS	.5	.5	.5
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	5-56	<p>MIDCOURSE CORRECTION NOMINAL EXECUTION POINTS WILL BE AT THE FOLLOWING---</p> <p>A. TLI C/O +9 HRS (EARLIEST PLANNED MCC AT TLI C/O +4 HRS).</p> <p>B. TLI C/O +25 HRS.</p> <p>C. LOI -22 HRS.</p> <p>D. LOI1 -5 HRS.</p>					
	5-57	<p>TRANSLUNAR MCC EXECUTION CRITERIA</p> <p>A. SPS MCC'S SHOULD BE GREATER THAN 3 SEC.</p> <p>B. MCC 2 AND 4 ARE PREFERRED EXECUTION POINTS.</p> <p>C. CONSIDERING THE ABOVE, FIRST MIDCOURSE WILL BE DELAYED UNTIL MCC 2 IF COST IS NOT PROHIBITIVE.</p> <p>D. A NON-FREE MCC 2 OF 3 SEC SPS WILL BE EXECUTED TO AVOID MCC 3 WHEN FEASIBLE.</p>					
	5-58	<p>THE G&N WILL BE THE PRIMARY MODE OF EXECUTING TRANSLUNAR MCC.</p>					
		<p>RULE 5-59 IS RESERVED.</p>					
	5-60	<p>LOI SHALL BE TARGETED WITHIN THESE CONSTRAINTS---</p> <p>A. HP IS BETWEEN 50 AND 60 (LUNAR PARKING ORBIT).</p> <p>B. THE PERICYNTHION OF THE APPROACH HYPERBOLA WILL BE MAINTAINED WITHIN 50 AND 70 N.M.</p> <p>C. THE ALTITUDE OF THE NODE (BETWEEN THE APPROACH HYPERBOLA AND THE DESIRED LPO) WILL BE MAINTAINED BETWEEN 50 AND 75 N.M.</p>					
	5-61	<p>A "GO" FOR LOI REQUIRES THE FOLLOWING---</p> <p>A. COMMITMENT TO LEAST 4 HRS IN LPO - (PROVIDES ONE REV OF TRACK AFTER LOI1 FOR CALCULATION OF TEI).</p> <p>B. ADEQUATE FUEL REMAINING FOR SUBSEQUENT LUNAR ORBIT OPERATIONS (MINIMUM WOULD BE LOI2 AND TEI).</p> <p>C. THE APPROACH HYPERBOLA HP GREATER THAN 50 NM.</p>					
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REV	ITEM						
	5-62	<p>PREMATURE LOI SHUTDOWN (SPS PROBLEMS)</p> <p>A. FREE RETURN TRAJECTORY.</p> <ol style="list-style-type: none"> 1. SHUTDOWN IN MODE I REGION (LOI IGN. TO LOI IGN. + 1+50) - EXECUTE AN SPS 15 MIN. DIRECT ABORT OR A DPS 2-HR. DIRECT ABORT. 2. SHUTDOWN IN MODE II REGION (LOI IGN. + 1+50 TO LOI IGN. + 3+00) - EXECUTE AN SPS 15-MIN. DIRECT ABORT OR A DPS TWO IMPULSE CIRCULUNAR ABORT. 3. SHUTDOWN IN MODE III REGION (LOI IGN. + 3+00 TO C/O) - EXECUTE TEI (SPS OR DPS) AT NEXT PERICYNTIAN OR INITIATE AN ALTERNATE MISSION. <p>B. HYBRID TRAJECTORIES.</p> <ol style="list-style-type: none"> 1. NOMINAL ABORT REGIONS. <ul style="list-style-type: none"> (A) MODE I = LOI IGN. TO LOI IGN. + 1+10. (B) GAP = LOI IGN. + 1+10 TO LOI + 1+58. (C) MODE II = LOI IGN. + 1+58 TO LOI IGN. + 2+44. (C) MODE II = LOI IGN. + 1+58 TO LOI IGN. + 2+44. (D) MODE III = LOI IGN. + 2+44 TO C/O. 3. NO MANUAL SHUTDOWNS SHOULD BE ATTEMPTED DURING GAP. 2. SHUTDOWN IN MODE I - EXECUTE AN SPS 15-MIN. DIRECT ABORT OR A DPS 2-HR. DIRECT ABORT. 4. SHUTDOWN IN FIRST HALF OF GAP - EXECUTE AN SPS 15-MIN. DIRECT ABORT. 5. SHUTDOWN IN SECOND HALF OF GAP - RESTART SPS IN ATTEMPT TO ACHIEVE STABLE LUNAR ORBIT. 6. SHUTDOWN IN MODE II - RESTART SPS IN ATTEMPT TO ACHIEVE STABLE LUNAR ORBIT OR EXECUTE A DPS 2-IMPULSE CIRCULUNAR ABORT. 7. SHUTDOWN IN MODE III - EXECUTE TEI (SPS OR DPS) AT NEXT PERICYNTIAN OR INITIATE AN ALTERNATE MISSION. 					
	5-63	<p>IF THE SPS FAILS AT IGNITION---</p> <p>A. MCC - RESCHEDULE MCC FOR FLYBY TRAJECTORY WITH DPS/SM-RCS EXECUTION.</p> <p>B. LOI1 - EXECUTE MCC5 ABORT MANEUVER WITH DPS/SM-RCS.</p> <p>C. LOI2 - EXECUTE GROUND COMPUTED TEI WITH DPS AS SOON AS PRACTICAL.</p> <p>RULES 5-64 THROUGH 5-75 ARE RESERVED.</p>					
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REV	ITEM							
5-76		THE LOI2 MANEUVER WILL BE TARGETED TO MINIMIZE THE LLS MISS DISTANCE AND TO ACHIEVE A 60 NM CIRCULAR ORBIT AT RENDEZVOUS.						
5-77		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 TEI.)						
		RULES 5-78 THROUGH 5-80 ARE RESERVED.						
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5-88		DOI WILL BE SLIPPED ONE REV FOR FAILURE TO IGNITE THE DPS BY DOI TIG + 2 MINS.					
5-89		LR DATA IS REQUIRED FOR LANDING--NO LR DATA BY 10K FT -ABORT.					
	A.	LR CONVERGENCE (ALTITUDE ONLY) - DATA NOT BEING ACCEPTED OR CONVERGING FOLLOWING LOCKON FOR 60 SECONDS -ABORT					
	B.	LR DATA ACCEPTED AND CONVERGED CONTINUOUS TO P-64 - CONTINUE MISSION IF LOSS OF LOCK OCCURS IN P-64.					
	C.	LR DATA ACCEPTED AND CONVERGED WITH SUBSEQUENT DROPOUT - CONTINUE TO P-64.					
	1.	LANDING RADAR REGAINED IN P-64.					
		(A) DELTA H LESS THAN 1000FT BETWEEN PGNS AND LR - CONTINUE MISSION.					
		(B) DELTA H GREATER THAN 1000 FT BETWEEN PGNS AND LR - ABORT.					
	2.	LR NOT REGAINED AT P-64 - ABORT.					
	D.	LATE LR LOCKON WITH DATA BEING INCORPORATED AND CONVERGING - CONTINUE TO P-64.					
	1.	DELTA H LESS THAN 1000 FT BETWEEN PGNS AND LR - CONTINUE MISSION.					
	2.	DELTA H GREATER THAN 1000 FT BETWEEN PGNS AND LR - ABORT.					
5-90		POWERED DESCENT WILL BE TERMINATED FOR---					
	A.	FAILURE TO ENTER P64 WHEN TG EQUALS 60 SEC.					
	B.	PGNS NAVIGATION ERRORS WHICH RESULT IN AGS-PGNS VELOCITY DIFFERENCES THAT VIOLATE THE PGNS FAILURE LIMITS.					
	C.	PGNS NAVIGATION ERRORS WHICH RESULT IN MSFN-PGNS VELOCITY DIFFERENCES THAT VIOLATE THE PGNS FAILURE LIMITS.					
		<p style="text-align: center;">NOTE RULES B AND C ARE VALID ONLY PRIOR TO LANDING RADAR VELOCITY INCORPORATIONS. FOR RULE B, SWITCHOVER TO AGS WILL BE PERFORMED.</p>					
	D.	INITIAL PERCENT COMMANDED THRUST NOT EQUAL TO <u>160</u> PERCENT +/- <u>10</u> PERCENT CONFIRMED BY A TRAJECTORY DEVIATION.					
	E.	COMMANDED THRUST INCREASING PRIOR TO THROTTLE DOWN OR P63 TGO = 80 SEC.					
	F.	NO LANDING SITE VISIBILITY BY P64 PLUS <u>60</u> SEC.					
	G.	NO THROTTLE RECOVERY BY P63/P64 PROGRAM SWITCH PLUS 15 SEC.					
	H.	VIOLATION OF THE TIME BIASED (20 SEC) DPS ABORT BOUNDARY.					
	I.	FAILURE TO ACHIEVE FTP BY NOMINAL TIG + 26 SEC.					
5-91		THERE ARE NO TRAJECTORY OR GUIDANCE CONSTRAINTS WHICH ARE CAUSE FOR ABORT AFTER CREW TAKEOVER OF POWERED DESCENT.					
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	5-92	THE FOLLOWING RENDEZVOUS OPTIONS/RESCUE MODES WILL BE UTILIZED AS NECESSARY FOR FAILURES REQUIRING TERMINATION OF THE LUNAR LANDING---					
		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.)					
		NOTE					
		FOLLOWING DOI, THE PGNS AND AGS WILL BE COMPARED. IN CASE OF DISAGREEMENT, THE RR WILL BE USED FOR SYSTEM VALIDATION.					
		PNGS FAIL - DIRECT RETURN.					
		RR FAIL - FIVE IMPULSE RENDEZVOUS.					
		B. FOR FAILURES FROM DOI +10 TO PDI, EXECUTE THE NO PDI +12 ABORT SEQUENCE. DOCKING IN ABOUT 3-1/4 HOURS.					
		C. ABORTS DURING POWERED DESCENT FROM PDI TO PDI +10 MINUTES WILL INSERT INTO LUNAR ORBIT USING THE ONBOARD VARIABLE TARGETING. THE LM WILL EXECUTE THE RENDEZVOUS USING THE CFP SEQUENCE. DOCKING WILL BE IN ABOUT 3-1/4 HOURS FROM INSERTION.					
		D. ABORTS DURING POWERED DESCENT FROM PDI +10 MINUTES TO TO THE FIRST LUNAR SURFACE GO/NO-GO (APPROXIMATELY 4 MINUTES AFTER TOUCHDOWN) WILL INSERT INTO LUNAR ORBIT USING THE ONBOARD VARIABLE TARGETS. RENDEZVOUS WILL BE ACCOMPLISHED BY A LM ACTIVE FIVE IMPULSE SEQUENCE. DOCKING WILL BE IN ABOUT 5-1/4 HOURS FROM INSERTION.					
		E. FOR COMPLETE LM FAILURES PRIOR TO PDI, THE CSM WILL EXECUTE A FIVE IMPULSE RESCUE WITH DOCKING ABOUT 7-1/4 HOURS FROM PDI.					
		RULES 5-93 THROUGH 5-100 ARE RESERVED.					
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	5-111	<p>THE PGNCIS IS PRIME FOR CSI, CDH, AND TPI MANEUVER COMPUTATION/EXECUTION WITH THE AGS AS BACKUP UTILIZING THE ACCEPTED SOLUTION---</p> <p>A. THE AVAILABLE SOLUTIONS FOR CSI IN ORDER OF PRIORITY ARE--- PGNCIS, CHARTS, CMC, AGS, AND GROUND. THE HIGHEST PRIORITY SOLUTION WHICH AGREES WITH THE CMC XDOT TO WITHIN <u>3</u> FPS WILL BE EXECUTED.</p> <p>B. THE AVAILABLE SOLUTIONS FOR CDH ARE--- PGNCIS, CHARTS, CMC. THE ORDER OF PRIORITY WILL BE---</p> <ol style="list-style-type: none"> 1. COMPARE PGNCIS AND CMC. IF NO MORE DIFFERENT THAN 2 FPS IN XDOT AND 6 FPS IN ZDOT, USE PGNCIS SOLUTION. 2. IF ''1'' ABOVE IS VIOLATED, COMPARE PGNCIS AND CHARTS WITH SAME CRITERIA. IF COMPARISON PASSES, USE PGNCIS SOLUTION. 3. IF ''1'' AND ''2'' ABOVE ARE VIOLATED, COMPARE CHARTS AND CMC USING THE SAME CRITERIA. IF COMPARISON PASSES, USE CHART SOLUTION. 4. IF ''1'', ''2'', AND ''3'' ABOVE ARE VIOLATED, USE THE CMC SOLUTION. <p>C. THE AVAILABLE SOLUTIONS FOR TPI ARE--- PGNCIS, CHARTS, AND CMC. THE ORDER OF PRIORITY WILL BE---</p> <ol style="list-style-type: none"> 1. COMPARE PGNCIS AND CMC. IF NO MORE DIFFERENT THAN 2 FPS IN XDOT, 5 FPS IN YDOT, OR 6 FPS IN ZDOT, USE THE PGNCIS SOLUTION. 2. IF ''1'' FAILS, COMPARE THE PGNCIS AND CHARTS, WITH SAME CRITERIA. IF COMPARISON PASSES, USE THE PGNCIS SOLUTION. 3. IF ''1'' AND ''2'' FAIL, COMPARE THE CHARTS AND THE CMC SOLUTIONS, USING THE SAME CRITERIA. IF COMPARISON PASSES, USE THE CHART SOLUTION. 4. IF ''1'', ''2'', AND ''3'' FAIL, USE THE CMC SOLUTION. 							
	5-112	<p>RENDEZVOUS PLANS SHALL, WHERE POSSIBLE, SATISFY THE FOLLOWING CONSTRAINTS---</p> <p>A. RENDEZVOUS MANEUVERS MUST BE AT LEAST 30 MIN APART.</p> <p>B. THE NOMINAL DELTA H FOR TPI WILL BE 15 NM ABOVE OR BELOW.</p> <p>C. THE REQUIRED ELEVATION ANGLE OF <u>26.6</u> DEG (BELOW) OR <u>28.3</u> DEG (ABOVE) WILL BE TARGETED TO OCCUR 23 MINUTES PRIOR TO SUNRISE.</p> <p>D. ARRIVAL AT THE TPI ELEVATION ANGLE CANNOT BE MOVED EARLIER THAN <u>31</u> MINUTES PRIOR TO SUNRISE.</p> <p>RULES 5-113 THROUGH 5-120 ARE RESERVED.</p>							
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	5-121	<p>TRANSEARTH MCC WILL BE TARGETED TO ACHIEVE ENTRY CONDITIONS AS FOLLOWS---</p> <p>A. IF VEI GREATER THAN 31000 FPS USE STEEP TARGET LINE.</p> <p>B. IF VEI LESS THAN 31000 FPS AND G&N GO, USE SHALLOW TARGET LINE.</p> <p>C. TRANSEARTH MIDCOURSE CORRECTION NOMINAL EXECUTION POINTS WILL BE AT THE FOLLOWING---</p> <ol style="list-style-type: none"> 1. TEI +17 HRS. 2. EI - 22 HRS. 3. EI - 3 HRS. 												
	5-122	<p>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---MCC5).</p> <p>C. THE LAST MCC WILL BE SCHEDULED NO LATER THAN EI-3 HOURS.</p> <p>D. THE G&N 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>F. THE RESIDUALS FOR MCC'S WILL BE TRIMMED TO WITHIN 0.2 FPS IN EACH AXIS.</p>												
	5-123	<p>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>												
	5-124	<p>ENTRY CONDITIONS WILL BE CONTROLLED TO AVOID HEAT SHIELD LIMITATIONS.</p>												
	5-125	<p>BACKUP ENTRY IS CONSTRAINED AS FOLLOWS---</p> <p>A. THE CONSTANT G ENTRY MUST FALL BETWEEN 3 AND 5 G'S.</p> <p>B. EMS RANGING WILL NOT BE ATTEMPTED UNTIL V IS LESS THAN 25500 FPS.</p>												
	5-126	<p>WEATHER AVOIDANCE WITH AERODYNAMIC LIFT WILL NOT BE ATTEMPTED UNLESS THE G&N IS OPERATIONAL, OR EMS-INDICATED VELOCITY IS LESS THAN 25500 FPS.</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 11</td> <td>A</td> <td>6/20/69</td> <td>TRAJECTORY AND GUIDANCE</td> <td>TRANSEARTH ENTRY</td> <td>5-16</td> </tr> </tbody> </table>			MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	A	6/20/69	TRAJECTORY AND GUIDANCE	TRANSEARTH ENTRY	5-16
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	5-127	<p>PREDICTED ENTRY CORRIDOR VIOLATION AFTER THE LAST MCC OPPORTUNITY---</p> <p>A. UNDERSHOOT LINE EXCEEDED--- GROUND ADVISE CREW TO FLY FULL LIFT UNTIL PEAK G IS PASSED, THEN FLY G6N.</p> <p>B. OVERSHOOT LINE EXCEEDED---GROUND ADVISE CREW TO FLY NEGATIVE LIFT TO 2 G'S FOLLOWED BY 4 G CONSTANT ENTRY.</p>					
	5-128	<p>IF THE EMS INDICATES A SKIP CONDITION, NEGATIVE LIFT SHOULD BE ACHIEVED PRIOR TO VERIFYING THE EMS WITH CROSS CHECKS.</p>					
	5-129	<p>IF THE EMS INDICATES AN UNDERSHOOT CONDITION EXISTS, FULL LIFT SHOULD BE ACHIEVED PRIOR TO VERIFYING THE EMS WITH CROSS CHECKS.</p>					
	5-130	<p>THE G6N 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. CAUSES TRAJECTORY TO VIOLATE THE OFFSET LIMITS (SKIP) ON EMS SCROLL.</p> <p>D. CAUSES TRAJECTORY TO VIOLATE THE ONSET LIMITS (G) ON EMS SCROLL.</p> <p>E. IF THE G6N TRIM ATTITUDES AT CM/SM SEP DIFFER FROM THE HORIZON MONITOR ATTITUDE BY GREATER THAN <u>5</u> DEG.</p> <p>F. IF THE G6N TRIM ATTITUDES AT .05 G DIFFERS FROM THE GROUND VALUES BY GREATER THAN 5 DEG.</p> <p>G. IF THE CMC FAILS TO SEQUENCE FROM P63 TO P64 AT RET .05 G +/- <u>5</u> SEC.</p>					
		<p>RULES 5-131 THRU 5-139 ARE RESERVED.</p>					
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SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM	<div style="border: 1px dashed black; padding: 5px; margin: 0 auto; width: 80%;"> RANGE SAFETY RULES AND AGREEMENTS ----- GENERAL ----- </div>					
5-140		RANGE SAFETY POLICIES AND CRITERIA ARE SPECIFIED IN AFETR MANUAL (AFETRM) 127-1 DATED 1 JANUARY 1969. THE FOLLOWING MISSION RULES CONCERNING SPECIFIC AFETR/NASA INTERFACE SUPPLEMENT AFETRM 127-1.					
5-141		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 LIFTOFF INDICATION.					
5-142		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.					
5-143		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.					
5-144		THE FD WILL INFORM THE RSO WHEN THE S-1C NO. 3 OR NO. 4 ENGINE HAS SHUT DOWN BY STATING 'RSO, 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.					
5-145		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.					
5-146		IF AN ESTABLISHED IMPACT PREDICTION (IP) POINT IS ON THE CAPE KENNEDY LAND AREA, 'DESTRUCT/PD' WILL BE TRANSMITTED.					
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SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM	
		<p>----- ' TRACKING SOURCES ' -----</p>
	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 INFLIGHT 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 FPQ-6, AND GRAND TURK TPQ-18.
	5-157	PRESENT POSITION AND IP PLOTS AT BERMUDA (BDA) USING INPUTS FROM EITHER THE BDA FPS-16 OR BDA FPQ-6 RADAR ARE HIGHLY DESIRABLE FOR LAUNCH.

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SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM	<div style="border: 1px dashed black; padding: 5px; display: inline-block;">AIRBORNE SYSTEMS</div>							
5-	158	TWO (2) OPERATIONAL RANGE SAFETY COMMAND RECEIVERS ON EACH LAUNCH VEHICLE STAGE (S-IC, S-II, AND S-IVB) ARE MANDATORY TO L/O. THE RANGE SAFETY SUPERVISOR (CRSS) AT THE LAUNCH CONTROL CENTER WILL DETERMINE IF THE RECEIVERS ARE OPERATING PROPERLY.							
		5-	159	IU C-BAND BEACON NO. 1 OR NO. 2 IS HIGHLY DESIRABLE FOR LAUNCH.					
				MISSION	REV	DATE	SECTION	GROUP	PAGE
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SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM	
		----- '' COMMAND/CONTROL '' -----
	5-160	NASA BERMUDA DRS COMMAND/CONTROL CAPABILITY IS MANDATORY TO L/O FOR FLIGHT AZIMUTHS LESS THAN 90 DEGREES.
	5-161	A 4 SECOND TIME DELAY BETWEEN ''ARM/MFCO'' AND ''DESTRUCT/PD'' WILL BE PROVIDED BY TIMERS IN THE RSO CONSOLE IN THE RCC.

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REV	ITEM	
		<p>----- ' COMMUNICATIONS ' -----</p>
	5-162	ONE (1) OF TWO (2) PRIVATE, INDEPENDENT, GEOGRAPHICALLY DIVERSIFIED COMMUNICATIONS LINKS BETWEEN THE RSO AND BRSO IS MANDATORY AND THE OTHER IS HIGHLY DESIRABLE.
	5-163	ONE (1) OF THE FOLLOWING THREE (3) COMMUNICATIONS LINKS IS MANDATORY BETWEEN THE RSO AND FD/FIDO AND THE OTHERS ARE HIGHLY DESIRABLE. (1) RSO LOOP (CAPE 111) (2) RSO PRIVATE LINE (3) FLIGHT DIRECTOR LOOP
	5-164	A COMMUNICATIONS LINK BETWEEN THE RSO AND THE RANGE SAFETY SUPERVISOR (CRSS) AT THE LAUNCH CONTROL CENTER IS MANDATORY FOR T-40 MINUTE DESTRUCT CHECKS.
	5-165	A DIRECT LINE COMMUNICATIONS LINK BETWEEN THE RSO AND THE LAUNCH VEHICLE TEST CONDUCTOR (CLTC) IS HIGHLY DESIRABLE.

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SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM							
		----- ! TELEMETRY ! -----						
	5-166	IU TELEMETRY DATA (ONBOARD GUIDANCE PARAMETERS) TO THE RTCS ARE HIGHLY DESIRABLE UNTIL S-IVB CUTOFF FOR IP COMPUTATION AND RSO DISPLAY.						
	5-167	TELEMETRY REQUIREMENTS TO BE DISPLAYED FOR THE RSO AND THE BRSO ARE HIGHLY DESIRABLE.						
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SECTION 5 TRAJECTORY AND GUIDANCE

REV	ITEM						
		----- ! RANGE SAFETY WEATHER RESTRICTIONS ! -----					
	5-168	WIND RESTRICTIONS---					
		AN ANNUAL PROFILE WIND RESTRICTION OF	SIGMA)	WILL BE IN EFFECT FOR LAUNCH.			
	5-169	CEILING AND VISIBILITY RESTRICTIONS---					
		NO CEILING OR VISIBILITY RESTRICTIONS WILL BE IMPOSED PROVIDING CNV FPS-16 AND MILA TPQ-18 RADARS AND BEACON NO. 1 ARE OPERATIONAL.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 6 - SLV - TBI THROUGH TB4/TB4A

REV	ITEM						
		SUMMARY OF LAUNCH PHASE RULES					
	6-1	S-IC LOSS OF THRUST					
	6-2	LOSS OF ATTITUDE CONTROL					
	6-3	INERTIAL PLATFORM FAILURE - ACCELEROMETER					
	6-4	SLV INERTIAL PLATFORM FAILURE					
	6-7	S-II LOSS OF THRUST					
	6-8	S-II GIMBAL SYSTEM FAILURE					
	6-9	S-II SECOND PLANE SEPERATION FAILS					
	6-10	S-IVB LOSS OF HYDRAULIC FLUID					
	6-11	S-IVB LOSS OF THRUST					
		THE FOLLOWING MISSION RULES ALSO APPLY TO THIS SECTION---					
		NONE					
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MISSION RULES

SECTION 6 - SLV - TBI THROUGH TB4/TB4A

REV	ITEM							
		<p>A. BSE GENERALIZED SWITCH SELECTOR COMMAND CAPABILITY EXISTS---</p> <ol style="list-style-type: none"> 1. WHEN CREW ENABLES IU COMMAND SYSTEM (EXCEPT AS NOTED BELOW IN ITEM D) 2. AFTER TB7 + 20 MIN. <p>B. BSE MANEUVER UPDATE AND INHIBIT CAPABILITY FOR TB7 MANEUVERS ONLY.</p> <p>C. BSE HAS NAVIGATION UPDATE CAPABILITY.</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 7000 FT.</p> <p>F. BSE WILL RECOMMEND NO S-IVB RESTART FOR ANY CONFIRMED MALFUNCTION IN THE LAUNCH VEHICLE WHICH RESULTS IN---</p> <ol style="list-style-type: none"> 1. A CATASTROPHIC HAZARD 2. 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 PROPULSION PERFORMANCE IS AVAILABLE TO ASSURE A 95 PERCENT PROBABILITY OF ACHIEVING A CUTOFF ORBIT WITH 65,000 N.M. APOGEE ALTITUDE. <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> <ol style="list-style-type: none"> 6-1 S-IC LOSS OF THRUST 6-2 LOSS OF ATTITUDE CONTROL **6-7 S-II LOSS OF THRUST **6-8 S-II GIMBAL SYSTEM FAILURE ANY SINGLE ACTUATOR HARDOVER 6-9 S-II SECOND PLANE SEPARATION FAILS TO OCCUR AT TB3 + 31 SEC 6-10 S-IVB LOSS OF ENGINE HYDRAULIC FLUID PRIOR TO FIRST S-IVB BURN 6-11 S-IVB STAGE LOSS OF THRUST <p>I. SPACECRAFT GUIDANCE TAKEOVER WILL BE RECOMMENDED FOR THE FOLLOWING---</p> <ol style="list-style-type: none"> 6-4 LAUNCH VEHICLE INERTIAL PLATFORM FAILURE-ATTITUDE REFERENCE 7-8 LOSS OF ATTITUDE CONTROL (DURING COAST PERIOD) TB5, TB7 <p>J. S-II/S-IVB EARLY STAGING WILL BE RECOMMENDED FOR THE FOLLOWING---</p> <ol style="list-style-type: none"> **6-7 S-II LOSS OF THRUST **6-8 GIMBAL SYSTEM FAILURE ANY SINGLE ACTUATOR HARDOVER <p style="text-align: center;">** TIME DEPENDENT</p>						
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MISSION RULES

SECTION 6 - SLV - TBI THROUGH TB4/TB4A

REV	ITEM							
		<p>K. TLI INHIBIT OR SPACECRAFT SEPARATION WILL BE RECOMMENDED FOR THE FOLLOWING---</p> <ul style="list-style-type: none"> 7-1 INSUFFICIENT PROPELLANTS REMAIN FOR ACHIEVEMENT OF TLI GUIDANCE CUTOFF 7-4 J-2 ENGINE MAIN OXIDIZER VALVE FAILS TO CLOSE AT S-IVB CUTOFF 7-5 FAILURE OF RANGE SAFETY SYSTEM AFTER INSERTION 7-8 LOSS OF ATTITUDE CONTROL *7-11 TIME BASE 5 OR TIME BASE 7 FAILS TO INITIATE AT S-IVB CUTOFF 7-16 S-IVB ENGINE CONTROL BOTTLE PRESSURE LOW 7-22 S-IVB LOSS OF ENGINE HYDRAULIC FLUID 8-1 INERTIAL PLATFORM FAILURE - ACCELEROMETER 8-5 S-IVB LH2 TANK ULLAGE PRESSURE LOW PRIOR TO SECOND BURN 8-6 S-IVB ACTUATOR CONFIRMED HARDOVER PRIOR TO TB6 + 9 MIN 10 SEC 8-8 LOSS OF ATTITUDE CONTROL DURING S-IVB SECOND BURN <p style="text-align: center;">*EMERGENCY SEPARATION REQUIRED</p> <p>L. SPACECRAFT SEPARATION OR TLI INHIBIT WILL BE RECOMMENDED UNLESS COMMAND ACTION IS SUCCESSFUL FOR THE FOLLOWING---</p> <ul style="list-style-type: none"> 7-3 J-2 ENGINE MAIN FUEL VALVE FAILS TO CLOSE AT SIVB CUTOFF *7-6 S-IVB COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE 7-9 CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO OPEN IN TB5 *7-14 S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS +36 OR -26 PSID 7-18 LOW COLD HELIUM SPHERE PRESSURE 7-19 LOW LOX TANK ULLAGE PRESSURE 7-20 J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS 8-7 S-IVB CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO CLOSE DURING RESTART SEQUENCE <p style="text-align: center;">* EMERGENCY SEPARATION REQUIRED</p> <p>M. SPACECRAFT GUIDANCE TAKEOVER TLI BURN WILL BE RECOMMENDED FOR THE FOLLOWING---</p> <ul style="list-style-type: none"> 6-4 LAUNCH VEHICLE INERTIAL PLATFORM FAILURE-ATTITUDE REFERENCE <p>N. FOR EARLY SPACECRAFT SEPARATION THE CREW SHOULD ENABLE THE IU COMMAND SYSTEM AND THE BSE SHOULD GROUND COMMAND TO LOCK OPEN THE IU COMMAND SYSTEM, PRIOR TO SPACECRAFT SEPARATION IF AT ALL POSSIBLE.</p> <p>O. BSE WILL INHIBIT TB6 IN THE EVENT A TLI NO-GO DECISION IS MADE IN TB5.</p>						
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MISSION RULES

SECTION 6 - SLV - TBI THROUGH TB4/TB4A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	6-1	<p>S-IC STAGE LOSS OF THRUST</p> <p>A. ANY SINGLE ENGINE PRIOR TO TB3</p> <p>B. ANY TWO OR MORE ENGINES</p> <p>1. PRIOR TO DEACTIVATION OF TWO ENGINES AUTO ABORT</p> <p>2. AFTER DEACTIVATION OF TWO ENGINES AUTO ABORT</p> <p>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)</p> <p>1. VOICE COMM WITH RSO</p> <p>2. NO VOICE COMM WITH RSO</p>	<p>LAUNCH</p> <p>LAUNCH</p>	<p>A. CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND FIDO.</p> <p>B. CONTINUE MISSION</p> <p>BSE INFORM FLIGHT.</p> <p>1. ABORT</p> <p>BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST.</p> <p>2. CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF POTENTIAL OVERRATE CONDITION.</p> <p>C. CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND FIDO.</p> <p>FLIGHT INFORM RSO.</p> <p>1.(A) FLIGHT CONFIRM ENGINE 3 OR 4 OUT VIA RSO PRIVATE LINE.</p> <p>(B) FLIGHT CONFIRM NO OTHER KNOWN ANOMALIES BY LITE ACTIVATION AND VOICE REPORT.</p> <p>2. FLIGHT CONFIRM ENGINE 3 OR 4 OUT AND NO OTHER KNOWN ANOMALIES BY LITE ACTIVATION.</p>	<p>A&B. CUES---</p> <p>1. THRUST OK SWITCHES - OFF (K33-115 THROUGH K47-115)</p> <p>2. THRUST CHAMBER PRESSURE LESS THAN 500 PSIA (D8-101 THROUGH D8-105).</p> <p>3. LONGITUDINAL ACCELERATION - ZERO (A2-603).</p> <p>4. FINAL THRUST OK CUTOFF - ON (K52-115 THROUGH K56-115).</p> <p>A&B. NOTE---</p> <p>CREW MAY DEACTIVATE AUTOMATIC ABORT AFTER TBI + 120 SEC.</p> <p>C. CUES---</p> <p>1. THRUST CHAMBER PRESSURE LESS THAN 500 PSIA (D8-103, D8-104).</p> <p>2. ENGINE 3 OR ENGINE 4 THRUST OK SWITCHES OFF (K39-115, THROUGH K44-115).</p> <p>3. ENGINE 3 OR 4 FINAL THRUST OK CUTOFF (K54-115, K55-115).</p> <p>C. NOTES---</p> <p>1. RSO LOOP 111 OR FD LOOP BACKUP TO PL.</p> <p>2. CONFIRMATION OF NO OTHER KNOWN ANOMALIES WILL BE BASED ON ENGINE CHAMBER PRESSURE NOT DECREASING AND TOK SWITCHES ON.</p>		
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MISSION RULES

SECTION 6 - SLV - TBI THROUGH TB4/TB4A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	6-2	<p>LOSS OF ATTITUDE CONTROL</p> <p>A. S-IC BURN</p>	LAUNCH	<p>A. LAUNCH VEHICLE ABORT BSE INFORM FLIGHT AND FIDO. CAPCOM INFORM CREW OF LOSS OF ATTITUDE CONTROL.</p> <p>CREW WILL ABORT ON LIMITS (NOTE A. 1).</p>	<p>A. CUES---</p> <p>1. ANGULAR RATES - PITCH (R4-602, R13-602) OR YAW (R5-602, R8-602) GREATER THAN 2 DEG/ SEC AND NOT DECREASING. ROLL (R6-602, R12-602) GREATER THAN 5 DEG/SEC AND NOT DECREASING.</p> <p>2. PLATFORM GIMBAL ANGLES - PITCH, YAW, OR ROLL (H60-603) CHANGING AT THE RATES GIVEN IN CUE A.1.</p> <p>3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE A.2).</p> <p>A. NOTES---</p> <p>1. CREW ABORT LIMITS---</p> <p>(A) PITCH AND YAW RATE PLUS OR MINUS 4 DEG/SEC</p> <p>(B) ROLL RATE PLUS OR MINUS 20 DEG/SEC</p> <p>(C) PITCH, YAW, OR ROLL ERROR PLUS OR MINUS 5 DEG AND Q-BALL DELTA P PLUS OR MINUS 3.2 PSID</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 GREATER THAN PLUS OR MINUS 5 DEG.</p> <p>(C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE</p> <p>(D) S-IC ENGINE ACTUATOR HARD-OVER GREATER THAN PLUS OR MINUS 5 DEG.</p>		
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MISSION RULES

SECTION 6 - SLV - TBI THROUGH TB4/TB4A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	6-2 CONT	B. S-II BURN	LAUNCH	B. LAUNCH VEHICLE ABORT BSE INFORM FLIGHT AND FIDO. CAPCOM INFORM CREW OF LOSS OF ATTITUDE CONTROL. CREW WILL ABORT ON LIMITS (NOTE B.1).	B. CUES--- 1. ANGULAR RATES - PITCH (R4-602, R13-602), YAW (R5-602, R8-602), OR ROLL (R6-602, R12-602) GREATER THAN 5 DEG/SEC AND NOT DECREASING. 2. PLATFORM GIMBAL ANGLES - PITCH, YAW OR ROLL (M60-603) CHANGING AT THE RATES GIVEN IN CUE B.1. 3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE B.2). B. NOTES--- 1. CREW ABORT LIMITS--- (A) PITCH AND YAW RATE PLUS OR MINUS 10 DEG/SEC (B) ROLL RATE PLUS OR MINUS 20 DEG/SEC 2. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOW- ING CONDITIONS--- (A) LVDC/LVDA COMPUTATIONAL FAILURE (B) ATTITUDE ERROR SIGNALS GREATER THAN PLUS OR MINUS 5 DEG (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE (D) S-IVB ENGINE ACTUATOR HARDOVER GREATER THAN PLUS OR MINUS 5 DEG		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 6 - SLV - TBI THROUGH TB4/TB4A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
6-2 CONT	C. S-IVB BURN	LAUNCH	C. LAUNCH VEHICLE ABORT BSE INFORM FLIGHT AND FIDO. CAPCOM INFORM CREW OF LOSS OF ATTITUDE CONTROL. CREW WILL ABORT ON LIMITS (NOTE C.1).	C. CUES--- 1. ANGULAR RATES - PITCH (R4-602, R13-602), YAW (R5-602, R8-602), OR ROLL (R6-602, R12-602) GREATER THAN 5 DEG/SEC AND NOT DECREASING. 2. PLATFORM GIMBAL ANGLES - PITCH, YAW, OR ROLL (H60-603) CHANGING AT THE RATES GIVEN IN CUE C.1. 3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE C.2). C. NOTES--- 1. CREW ABORT LIMITS--- (A) PITCH AND YAW RATE PLUS OR MINUS 10 DEG/SEC (B) ROLL RATE PLUS OR MINUS 20 DEG/SEC 2. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS--- (A) LVDC/LVDA COMPUTATIONAL FAILURE (B) ATTITUDE ERROR SIGNALS ROLL GREATER THAN PLUS OR MINUS 3.5 DEG, PITCH AND YAW GREATER THAN PLUS OR MINUS 5 DEG. (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE (D) FAILURE OF S-IVB ENGINE HYDRAULICS	
6-3	INERTIAL PLATFORM FAILURE - ACCELEROMETER	LAUNCH	CONTINUE MISSION BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF PROBABLE DEGRADED ORBIT.	CUES--- 1. GUIDANCE STATUS WORD (MODE CODE 24Q (H60-503) BITS D26 AND D25 FOR Z ACCEL SET TO 'ONE' BITS D24 AND D23 FOR X ACCEL SET TO 'ONE' BITS D22 AND D21 FOR Y ACCEL SET TO 'ONE' 2. ACCELEROMETER PICKOFFS (X, Y, OR Z) INDICATE IN EXCESS OF 3 DEG AND NOT DECREASING. (H10-603, H11-603, H12-603) NOTES--- 1. NO EFFECT ON VEHICLE TRAJECTORY DURING S-IC STAGE BURN. 2. LVDC SWITCHES TO A BACKUP MODE AND UTILIZES A PRECOMPUTED F/M PROFILE FOR FAILED AXIS DURING THE S-IC, S-II, AND S-IVB BURNS.	

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MISSION RULES

SECTION 6 - SLV - TB1 THROUGH TB4/TB4A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	6-4	LAUNCH VEHICLE INERTIAL PLATFORM FAILURE - ATTITUDE REFERENCE			CUES---		
		A. PRIOR TO TB 1 + 50 SEC	LAUNCH	A. CONTINUE MISSION/ABORT	A. 1. GUIDANCE REFERENCE FAILURE (D04 OR D06 MODE CODE 26 BIT D8 SET TO 'ONE' (H60-603)		
		1. ALL S-IC ENGINES THRUSTING		1. CONTINUE MISSION- BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT GUIDANCE TAKEOVER	2. GUIDANCE STATUS WORD-(MODE CODE 24) (H60-603)		
		2. LOSS OF THRUST - ANY S-IC		2. ABORT- BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST	BITS D20 AND D19 FOR Z GIMBAL SET TO 'ONE'		
					BITS D18 AND D17 FOR X GIMBAL SET TO 'ONE'		
					BITS D16 AND D15 FOR Y GIMBAL SET TO 'ONE'		
					3. LADDER OUTPUTS CONSTANT FOR FAILED AXES (H54-603, H55-603, H56-603)		
					4. ATTITUDE ERROR CONSTANT FOR FAILED AXES (H69-602, H70-602, H71-602)		
					5. THRUST OK SWITCHES OFF (K33-115 THRU K47-115)		
					6. THRUST CHAMBER PRESSURE LESS THAN 500 PSIA (D8-101 THRU D8-105)		
					7. FINAL THRUST OK CUTOFF ON (K52-115 THRU K56-115)		
		B. AFTER TB1 + 50 SEC AND PRIOR TO ORBITAL INSERTION	LAUNCH	B. CONTINUE MISSION- BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT GUIDANCE TAKEOVER	B. SAME AS CUES A.1. THRU A.4.		
		C. DURING TB5 OR TB6	EARTH ORBIT	C. CONTINUE MISSION- BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT GUIDANCE TAKEOVER	C. SAME AS CUES A.1. THRU A.4.		
					NOTES---		
					1. CUE 1 AND EITHER CUE 2,3, OR 4 ARE NECESSARY TO CALL A PLATFORM FAILURE		
					2. IU STATE VECTOR AT INSERTION MAY BE NO-GO AND A NAVIGATION UPDATE MAY BE REQUIRED FOR PROPER INITIATION OF TB6		
		RULE NUMBERS 6-5 THROUGH 6-6 ARE RESERVED.					
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MISSION RULES

SECTION 6 - SLV - TBI THROUGH TB4/TB4A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	6-7	S-II LOSS OF THRUST	LAUNCH				
		A. ANY SINGLE ENGINE FAILURE TO ATTAIN THRUST OR LOSS OF THRUST PRIOR TO NOMINAL S-II CUTOFF		A. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO.	A. CUES--- 1. THRUST OK SWITCHES-OFF (K285-201 THROUGH 205, K286-201 THROUGH 205). 2. THRUST CHAMBER PRESSURE- ZERO (D13-201 THROUGH 205). 3. LONGITUDINAL ACCELERATION (A2-603).		
		B. ANY TWO ENGINES- FAILURE TO ATTAIN THRUST OR LOSS OF THRUST---		B. CONTINUE MISSION/ABORT	B. CUES---		
		1. VEHICLE CONTROLLING		1. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO.	1. TWO ENGINES OUT (CUES A.1, A.2, A.3)		
		2. IF THE DIFFERENCE IN COMMANDED ANGLES AND GIMBAL ANGLES EXCEEDS 40 DEG IN PITCH OR YAW		2. ABORT BSE INFORM FLIGHT AND FIDO AND TRANSMIT ABORT REQUEST	2. COMMANDED ANGLES AND GIMBAL ANGLES (H60-603) B.1. NOTE--- CREW WOULD ABORT ON OVERRATE CONDITION.		
		C. THREE OR MORE ENGINES OUT		C. ABORT/EARLY STAGE/ CONTINUE MISSION	C. CUES---		
		1. PRIOR TO S-IVB TO ORBIT CAPABILITY		1. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST.	1. THREE OR MORE ENGINES OUR (CUES A.1, A.2, A.3) C. NOTE---		
		2. AFTER S-IVB TO ORBIT CAPABILITY BUT PRIOR TO LOW LEVEL SENSE ARM		2. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING.	AFTER PROGRAMMED S-II CENTER ENGINE CUTOFF, ENGINES OUT REFERS ONLY TO CONTROL ENGINES.		
		3. AFTER LOW LEVEL SENSE ARM		3. EARLY STAGE/ CONTINUE MISSION - BSE INFORM FLIGHT AND FIDO			
		(A) 3 CONTROL ENGINES OUT		(A) EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGE.			
		(B) ALL ENGINES OUT		(B) CONTINUE MISSION BSE INFORM FLIGHT			
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 6 - SLV - TB1 THROUGH TB4/TB4A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	6-8	S-II STAGE GIMBAL SYSTEM FAILURE	LAUNCH		CUES---			
		A. ANY SINGLE ACTUATOR HARDOVER OUTBOARD BETWEEN TB3 + 0 SEC AND TB3 + 20 SEC		A. ABORT- BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST	A. 1. YAW ACTUATOR POSITION EXCEEDS -5 DEG +G8-201 THRU 204, G30-201 THRU 204) 2. PITCH ACTUATOR POSITION EXCEEDS -5 DEG (G9-201 THRU 204, G31-201 THRU 204) 3. ADJACENT CONTROL ENGINE ACTUATOR IN SAME PLANE MOVES 4 1/2 DEG OUTBOARD (SAME MEASUREMENTS AS CUES 1 AND 2)			
		B. ANY SINGLE ACTUATOR HARDOVER INBOARD		B. ABORT/EARLY STAGE	B. (1 AND 2)			
		1. PRIOR TO S-IVB TO ORBIT CAPABILITY		1. ABORT- BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST	1. YAW ACTUATOR POSITION EXCEEDS +6 DEG (G8-201 THRU 204, G30-201 THRU 204) 2. PITCH ACTUATOR POSITION EXCEEDS +6 DEG (G9-201 THRU 204, G31-201 THRU 204)			
		2. BETWEEN S-IVB TO ORBIT CAPABILITY AND 30 SEC PRIOR TO S-II CUTOFF		2. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING	3. ADJACENT CONTROL ENGINE ACTUATOR IN SAME PLANE MOVES 4 1/2 DEG INBOARD (SAME MEASUREMENTS AS CUES 1 AND 2)			
		3. AFTER S-II CUTOFF MINUS 30 SEC		3. CONTINUE MISSION- BSE INFORM FLIGHT	NOTES--- 1. THE CREW SHOULD ABORT OR EARLY STAGE AS SOON AS POSSIBLE AFTER MALFUNCTION OCCURS TO PRECLUDE EXCESSIVE THERMAL PROBLEM IN AFT INTERSTAGE.			
	6-9	S-II SECOND PLANE SEPARATION FAILS TO OCCUR AT TB3 + 31 SEC	LAUNCH	ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST. CREW ABORT PRIOR TO TB3 + 66 SEC.	CUES---			
					1. SECOND PLANE SEPARATION INDICATION SHOWS NO SEPARATION (M86-206, M87-206) 2. GUIDANCE MODE WORD 1 MODE CODE 25 BIT D15 REMAINS ZERO (H60-603). 3. IGNITION BUS VOLTAGE REMAINS AT APPROXIMATELY 28 VOLTS (M125-207). 4. RECIRCULATION BUS VOLTAGE REMAINS AT APPROXIMATELY 56 VOLTS (M111-207)			
					NOTES--- THE CREW SHOULD ABORT AS SOON AS POSSIBLE AFTER MALFUNCTION OCCURS TO PRECLUDE EXCESSIVE THERMAL PROBLEMS IN AFT INTERSTAGE.			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
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MISSION RULES

SECTION 6 - SLV - TBI THROUGH TB4/TB4A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	6-10	S-IVB LOSS OF ENGINE HYDRAULIC FLUID PRIOR TO S-IVB BURN	LAUNCH	SPACECRAFT SEPARATION BSE INFORM FLIGHT AND FIDO AND RECOMMEND NO S-IVB START. FIDO WILL ADVISE CREW OF COI CAPABILITY	CUES--- 1. HYDRAULIC RESERVOIR OIL LEVEL APPROX ZERO PERCENT (L7-403). 2. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (D41-403). 3. HYDRAULIC RESERVOIR PRESSURE APPROX ZERO PSIA (D42-403). NOTES--- 1. L7-403 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-II CUTOFF		
	6-11	S-IVB 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 TLI	A. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND FIDO FIDO WILL ADVISE CREW OF COI CAPABILITY B. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO. THE SPACECRAFT SHOULD REMAIN ATTACHED TO THE S-IVB/IU AND MONITOR LH2 AND LOX TANK ULLAGE PRESSURES. IF SEPARATION IS REQUIRED, THE SPACECRAFT SHOULD IMMEDIATELY GO TO A SAFE DISTANCE (7000 FT) FROM THE S-IVB/IU.	CUES--- 1. THRUST CHAMBER PRESSURE - ZERO (D1-401). 2. THRUST OK SWITCHES - OFF (K14-401, K157-401). 3. LONGITUDINAL ACCELERATION - ZERO (A2-603). 4. TB5 IS INITIATED. MODE CODE 25, BIT D2 SET TO ONE (H60-603). 5. TB7 IS INITIATED. MODE CODE 26, BIT D20 SET TO ONE (H60-603). NOTE--- SEPARATION WILL BE REQUIRED FOR VIOLATION OF FMR 7-6 OR FMR 7-14.		
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MISSION RULES

SECTION 6 - SLV - TBI THROUGH TB4/TB4A

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-12	S-IVB COLD HELIUM SHUTOFF VALVE(S) FAILS OPEN	LAUNCH		CUES---
		A. PRIOR TO LAUNCH ESCAPE TOWER JETTISON		A. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST IF LOX TANK ULLAGE PRESSURE IS 50 PSIA OR SATURATED AT UPPER LEVEL	A. 1. LOX TANK ULLAGE PRESSURE (D179-406) 2. LOX TANK ULLAGE PRESSURE (D180-406)
		B. AFTER LAUNCH ESCAPE TOWER JETTISON AND PRIOR TO TB 3 +5 MIN 32 SEC		B. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING IMMEDIATELY	B,C,&D 1. COLD HELIUM REG DISCHARGE PRESSURE REMAINS GREATER THAN 200 PSIA FOR A MINIMUM OF 20 SECONDS (D105-403)
		C. AFTER TB 3 + 5 MIN 32 SEC AND S-II CUTOFF IS EXPECTED TO BE EARLIER THAN TB 3 + 6 MIN 38 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 TB3 + 5 MIN 32 SEC AND S-II CUTOFF MINUS 50 SEC - FOR PREMATURE S-II ENGINE(S) CUTOFF ONLY		D. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING	3. COLD HE BOTTLE PRESSURE DECAYING (D261-403, D263-403)

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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM						
		SUMMARY OF COAST PHASE RULES					
	7-1	INSUFFICIENT PROPELLANT					
	7-2	RESERVED					
	7-3	MAIN FUEL VALVE FAILS TO CLOSE					
	7-4	MAIN OXIDIZER VALVE FAILS TO CLOSE					
	7-5	RANGE SAFETY SYSTEM NOT SAFED AFTER INSERTION					
	7-6	COLD HELIUM SHUTOFF VALVE FAILS OPEN					
	7-7	AUXILIARY HYDRAULIC PUMP FAILS					
	7-8	LOSS OF ATTITUDE CONTROL					
	7-9	CONTINUOUS VENT REGULATOR FAILS TO OPEN					
	7-10	APS ULLAGE ENGINE FAILS ON					
	7-11	TB5 OR TB7 FAILS TO INITIATE					
	7-12	RESERVED					
	7-13	IU ENVIRONMENTAL CONTROL SYSTEM FAILS					
	7-14	COMMON BULKHEAD DELTA P					
	7-15	LOSS OF S-IVB STAGE PNEUMATICS					
	7-16	LOSS OF ENGINE CONTROL BOTTLE PRESSURE					
	7-17	LH2 TANK VENT FAILURE OR LEAK					
	7-18	LOW COLD HELIUM SUPPLY					
	7-19	LOX TANK ULLAGE PRESSURE IS LESS THAN 31 PSIA					
	7-20	J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS					
	7-21	PU VALVE FAILURE					
	7-22	S-IVB LOSS OF HYDRAULIC FLUID					
	7-23	RESERVED					
	7-24	RESERVED					
	7-25	LOX NON-PROPULSIVE VENT FAILS TO OPEN					
	7-26	LH2 LATCHING VENT VALVE FAILS TO OPEN					
	7-27	GH2 START BOTTLE DUMP FAILS TO OCCUR					
	7-28	COLD HELIUM DUMP FAILS TO OCCUR					
	7-29	RESERVED					
	7-30	RESERVED					
		THE FOLLOWING MISSION RULES ALSO APPLY TO THIS SECTION---					
	6-4	LAUNCH VEHICLE INERTIAL PLATFORM FAILURE-ATTITUDE REFERENCE					
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	7-4	J-2 ENGINE MAIN OXIDIZER VALVE (MOV) FAILS TO CLOSE AT---			CUES---		
	A.	FIRST S-IVB CUTOFF	EARTH ORBIT	A. NO S-IVB RESTART BSE INFORM FLIGHT AND COMMAND (ASAP)--- 1. PREVALVES AND RECIRC SHUTOFF VALVES CLOSED 2. ATTEMPT TO CLOSE MOV BSE RECOMMEND NO S-IVB RESTART	1. MAIN OXIDIZER VALVE POSITION (G3-401). 2. MAIN OXIDIZER VALVE OPEN (K120-401). 3. LOX FLOWMETER FLOWRATE (F1-401).		
	B.	SECOND BURN CUTOFF	TLC	B. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. PREVALVES AND RECIRC SHUTOFF VALVES CLOSED 2. ATTEMPT TO CLOSE MOV AT INITIATION OF LOX DUMP, BSE COMMAND--- 3. PREVALVES AND RECIRC SHUTOFF VALVES OPEN			
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-5	RANGE SAFETY SYSTEM NOT SAFED AFTER INSERTION	EO		CUES---	
	A.	PROPELLANT DISPERSION SYSTEM NOT ARMED		A. CONTINUE MISSION BSE INFORM FLIGHT AND RECOMMEND RSO SEND SAFE COMMAND	1. FIRING UNIT 1 RS EBW GREATER THAN OR EQUAL TO 1.6 VOLTS (M30-411). 2. FIRING UNIT 2 RS EBW GREATER THAN OR EQUAL TO 1.6 VOLTS (M31-411).	
	B.	PROPELLANT DISPERSION SYSTEM ARMED AND RSO HAS NOT SENT MFCO		B. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND	3. RANGE SAFETY RECEIVER NO. 1 ENABLE (N57-411) BETWEEN 2.4 AND 4.5 VOLTS. 4. RANGE SAFETY RECEIVER NO. 2 ENABLE (N62-411) BETWEEN 2.4 AND 4.5 VOLTS. 5. RSO DISPLAY AND COMMAND SYSTEM STATUS.	
				1. RECOMMEND SPACECRAFT SEPARATION TO A SAFE DISTANCE (7000 FT). 2. WHEN SPACECRAFT HAS REACHED A SAFE DISTANCE, RECOMMEND RSO SEND SAFE COMMAND.	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 THIS RULE.	
	7-6	S-IVB STAGE COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE AT---			CUES---	
	A.	TB5 + 1.4 SEC	EARTH ORBIT	A. CONTINUE MISSION NO S-IVB RESTART BSE INFORM FLIGHT AND COMMAND---	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).	
				1. LOX NPV VALVE OPEN 2. ATTEMPT TO CLOSE STAGE COLD HELIUM SHUTOFF VALVES IF 2 SUCCESSFUL, BSE COMMAND IMMEDIATELY---	NOTES--- 1. FAILURE TO CLOSE THE SHUTOFF VALVES WILL RESULT IN THE DEPLETION OF THE COLD HELIUM. 2. ACTION REQUIRED TO AVOID EXCEEDING LOX TANK OVERPRESSURE OR BULKHEAD POSITIVE DELTA PRESSURE LIMITS (FMR 7-14). 3. SEE FMR 7-18 FOR RESTART CRITERIA FOR OFF-NOMINAL COLD HELIUM PRESSURE.	
				3. LOX NPV VALVE CLOSE IF 2 IS UNSUCCESSFUL, BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT SEP IF LOX ULLAGE PRESSURE AT 90 PSIA OR SATURATED.		
	B.	TB7 + 1.1 SEC	TLC	B. CONTINUE MISSION AFTER TB7 + 2 MIN 30 SEC, BSE INFORM FLIGHT AND COMMAND---		
				1. LOX NPV VALVE OPEN AT TB7 + 15 MIN BSE SEND---		
				2. LOX NPV VALVE CLOSE		
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	7-7	S-IVB 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 ABOVE 1700 PSIA (D41-403). 2. RESERVOIR LEVEL BELOW 50 PERCENT (L7-403). 3. AFT BUS NO. 2 CURRENT ABOVE 20 AMPS (M22-404). 4. HYDRAULIC RESERVOIR OIL PRESSURE GREATER THAN 137 PSIA (D42-403). NOTES--- FAILURE TO TURN OFF HYDRAULIC PUMP DEPLETES AFT NO. 2 BATTERY IN APPROXIMATELY 90 MIN AND OVERHEATS HYDRAULIC SYSTEM IN APPROXIMATELY 70 MIN			
		B. TO TURN ON 1. AS SEQUENCED AND THE HYDRAULIC FLUID TEMP IS BELOW OR PREDICTED TO DROP BELOW 10 DEG F BEFORE NEXT STATION AOS 2. AT TB6 + 3 MIN 39 SEC	TLI	B. CONTINUE MISSION 1. BSE INFORM FLIGHT AND ATTEMPT TO TURN ON AUXILIARY HYDRAULIC PUMP 2. BSE INFORM FLIGHT AND COMMAND AUXILIARY HYDRAULIC PUMP OFF	CUES--- B.1. SYSTEM PRESSURE BELOW 1700 PSIA (D41-403). 2. RESERVOIR OIL LEVEL ABOVE 50 PERCENT (L7-403). 3. AFTER BUS NO. 2 CURRENT AT ZERO AMPS (M22-404). 4. RESERVOIR PRESSURE LESS THAN 89 PSI (D42-403). 5. HYDRAULIC PUMP INLET OIL TEMP (C50-401). 6. RESERVOIR OIL TEMP (C51-403).			
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	7-8	LOSS OF ATTITUDE CONTROL DURING			CUES---		
	A.	TB5 AND TB7 TO TB7 + 15 MIN	EARTH ORBIT/ TLC	A. SPACECRAFT GUIDANCE TAKEOVER BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT GUIDANCE TAKEOVER IF UNSUCCESSFUL, BSE RECOMMEND SPACECRAFT SEPARATION	A. 1. ANGULAR RATES - PITCH (R4-602, R13-602) OR YAW (R5-602, R8-602), GREATER THAN 0.3 DEG/SEC AND NOT DECREASING, AND ROLL (R6-602, R12-602), GREATER THAN 0.5 DEG/SEC AND NOT DECREASING 2. PLATFORM GIMBAL ANGLES - PITCH, YAW, OR ROLL (H60-603) CHANGING AT RATES CORRESPONDING TO THOSE IN CUE 1 3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE 2)		
	B.	TB6 TO TB6 + 9 MIN 10 SEC	TLI	B. TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	B. 1. ANGULAR RATES - PITCH (R4-602, R13-602) OR YAW (R5-602, R8-602), GREATER THAN 0.5 DEG/SEC AND NOT DECREASING, AND ROLL (R6-602, R12-602) GREATER THAN 0.5 DEG/SEC AND NOT DECREASING 2. SAME AS CUE A.2 3. SAME AS CUE A.3		
	C.	AFTER TB7 + 15	TLC	C. CREW DISCRETION BSE INFORM FLIGHT AND FIDO	C. 1. ANGULAR RATES PITCH (R4-602, R13-602), YAW (R5-602, R8-602), AND ROLL (R6-602, R12-602) GREATER THAN 1.0 DEG/SEC AND NOT DECREASING 2. SAME AS CUE A.2 3. SAME AS CUE A.1		
	D.	AFTER TB8 INITIATE	TLC	D. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO AND TERMINATE--- 1. PROPELLANT DUMP 2. ULLAGE ENGINE BURNS	D. SAME AS CUES C.1, C.2, AND C.3 NOTES--- 1. AFTER S-IVB CUTOFF AND DURING PROGRAMMED MANEUVERS THE ABOVE RATE LIMITS ARE NOT APPLICABLE 2. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS--- (A) LVDC/LVDA COMPUTATIONAL FAILURE (B) ABNORMAL ATTITUDE ERROR SIGNALS (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE (D) ATTITUDE REFERENCE FAILURE		
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	7-9	CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO OPEN IN TB5 (TB5 + 59 SEC)	EARTH ORBIT	CONTINUE MISSION/NO S-IVB RESTART BSE INFORM FLIGHT AND 1. ATTEMPT TO OPEN CVS RELIEF OVERRIDE SHUTOFF VALVE IF UNSUCCESSFUL, BSE--- 2. VENT THE LH2 TANK PRIOR TO TB6 + 8 MIN 40 SEC TO A VALUE BELOW THE PRESSURE REQUIRED FOR S-IVB RESTART. IF THE LH2 BLOWDOWN IS COMPLETED WITHIN 30 MINUTES PRIOR TO TB6 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(S) 1 NOR 2 IS SUCCESSFUL, BSE RECOMMEND NO S-IVB RESTART.	CUES--- 1. CVS NOZZLE PRESSURE (D181-409, D182-409). 2. CVS REGULATOR CLOSED (K154-411). 3. LH2 ULLAGE PRESSURE (D177-408, D178-408). NOTES--- 1. IF THE CVS REGULATOR FAILS TO OPEN, THE LH2 SATURATION TEMPERATURE WILL INCREASE ABOVE RESTART LIMITS. 2. COMMAND ACTION WILL REQUIRE EVALUATION OF LH2 RESIDUALS TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF. APPROXIMATELY 150 POUNDS OF LH2 WILL BE LOST FOR EACH PSI THE LH2 TANK IS VENTED BELOW 19.5 PSIA.			
	7-10	APS ULLAGE ENGINE(S) THRUST FAILS TO TERMINATE AT SEQUENCED TIMES	EARTH ORBIT/ TLI/TLC	CONTINUE MISSION BSE INFORM FLIGHT AND ATTEMPT TO TERMINATE ULLAGE ENGINE THRUST IF UNSUCCESSFUL, BSE INFORM FLIGHT OF IMPENDING LOSS OF ATTITUDE CONTROL.	CUES--- 1. ULLAGE ENGINE THRUST CHAMBER PRESSURE (D220-414, D221-415). 2. APS HELIUM SPHERE PRESSURE DECREASING (D35-414, D36-415, D250-414, D251-415).			
	7-11	TIME BASE 5 OR TIME BASE 7 FAILS TO INITIATE AT S-IVB CUTOFF	EARTH ORBIT TLC	SPACECRAFT SEPARATION BSE INFORM FLIGHT AND RECOMMEND IMMEDIATE SEPARATION TO A SAFE DISTANCE	CUES--- LVDC FAILURE NOTE--- THIS CONDITION WILL RESULT IN LOSS OF SEQUENCING AND PITCH AND YAW ATTITUDE CONTROL.			
		RULE NUMBER 7-12 IS RESERVED.						
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-13	IU ECS WATER VALVE FAILS TO CYCLE OPEN AND CLOSED	ALL	A. CONTINUE MISSION	CUES---
		A. WATER VALVE CLOSED AND COOLANT INLET CONTROL TEMPERATURE IS 64 DEG. F OR HIGHER, AND		BSE INFORM FLIGHT AND SEND---	1. WATER VALVE CLOSED/OPEN (G5-601, G6-601).
		THE INERTIAL GIMBAL TEMPERATURE IS PREDICTED TO BE EQUAL TO OR GREATER THAN 115 DEG.F BEFORE THE NEXT SITE AOS OR,		1. ECS LOGIC INHIBIT COMMAND	2. ME/H2O TEMP (C15-601).
		THE LVDC MEMORY TEMPERATURE IS PREDICTED TO BE EQUAL TO OR GREATER THAN 124 DEG.F BEFORE THE NEXT SITE AOS		2. WATER VALVE OPEN	3. GMW MODE CODE 27 BIT D8 SET TO ZERO (H60-603).
		B. WATER VALVE OPEN AND COOLANT INLET CONTROL TEMP IS 55 DEG. F OR LESS, AND		B. CONTINUE MISSION	4. ST-124 INERTIAL GIMBAL TEMP (C34-603).
		THE INERTIAL GIMBAL TEMPERATURE IS PREDICTED TO BE 104 DEG. F OR LESS BEFORE THE NEXT SITE AOS, OR		BSE INFORM FLIGHT AND SEND---	5. SUBLIMATOR INLET TEMP (C11-601).
		THE LVDC MEMORY TEMPERATURE IS PREDICTED TO BE 32 DEG.F OR LESS BEFORE THE NEXT SITE AOS.		1. ECS LOGIC INHIBIT COMMAND	6. LVDC MEMORY TEMP (C54-603).
				2. WATER VALVE CLOSED	7. LVDA TEMP NO. 1 (C55-603).
					8. LVDA TEMP NO. 2 (C56-603).

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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	7-14	S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS---	EARTH ORBIT TLC				
		A. MINUS 20 PSID OR PLUS 30 PSID		A. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND---	<p>CUES---</p> <p>1. LH2 TANK ULLAGE PRESSURE (K177-408, D178-408).</p> <p>2. LOX TANK ULLAGE PRESSURE (D180-406,</p> <p>3. LH2 PUMP INLET PRESSURE (D2-403).</p> <p>4. LOX PUMP INLET PRESSURE (D3-403).</p>		
		B. MINUS 26 PSID OR PLUS 36 PSID		B. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND FIDO AND RECOMMEND SPACECRAFT SEPARATION TO A SAFE DISTANCE	<p>NOTES---</p> <p>1. MINUS DELTA PRESSURE IS DEFINED AS A FUEL TANK ULLAGE PRESSURE GREATER THAN THE LOX TANK ULLAGE PRESSURE.</p> <p>2. PLUS DELTA PRESSURE IS DEFINED AS A LOX TANK ULLAGE PRESSURE GREATER THAN THE FUEL TANK ULLAGE PRESSURE.</p> <p>3. THE MINIMUM RECOMMENDED DISTANCE BETWEEN THE S-IVB AND THE SPACECRAFT IS 7,000 FT.</p> <p>4. THE BULKHEAD WILL STRUCTURALLY FAIL AT THE ULTIMATE LIMITS OF MINUS 32.5 PSID OR PLUS 42.0 PSID.</p>		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
7-17	LH2 TANK VENT FAILURE OR LEAK DURING ORBITAL COAST	EARTH ORBIT	CONTINUE MISSION	<p>IF LH2 ULLAGE PRESSURE DROPS BELOW 17 PSIA, BSE COMMAND---</p> <p>1. BOOST LH2 VENT VALVES CLOSED AND CVS REGULATOR CLOSED (ORIFICE OPEN)</p> <p>IF THE SITUATION CANNOT BE CORRECTED, AFTER INITIATION OF BURNER REPRESS, BSE COMMAND---</p> <p>2. SECOND BURN RELAY OFF</p>	<p>CUES---</p> <p>1. LH2 ULLAGE PRESSURE (D177-408, D178-408).</p> <p>2. LH2 PUMP INLET PRESSURE (D2-403).</p> <p>3. LH2VENT 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 LH2 TANK.</p> <p>2. EXISTENCE OF A SERIOUS LEAK WILL BE VERIFIED BY LITTLE OR NO PRESSURE RISE DURING BURNER REPRESS.</p> <p>3. REPRESS REQUIREMENTS ARE BASED ON LH2 TANK ULLAGE PRESSURE OF 21 PSIA AT INITIATION OF RESTART SEQUENCE.</p> <p>4. IF LH2 TANK ULLAGE PRESSURE DROPS BELOW 19.5 PSIA DURING TB5, RESULTING PROPELLANT LOSSES SHOULD BE INCLUDED IN THE EVALUATION OF CAPABILITY TO ACHIEVE TLI GUIDANCE CUTOFF PER FMR 7-1.</p>		
7-18	LOW COLD HELIUM SUPPLY PRESSURE				CUE---		
	A. LESS THAN 1000 PSIA DURING TB5	EARTH ORBIT	A. CONTINUE MISSION	<p>BSE INFORM FLIGHT AND COMMAND FROM LAST STATION PRIOR TO TB6--</p> <p>BURNER LOX SHUTDOWN VALVE CLOSE ON</p>	<p>COLD HELIUM SPHERE PRESSURE (D261-403, D263-403).</p>		
	B. LESS THAN 450 PSIA DURING BURNER REPRESSURIZATION	TLI	B. CONTINUE MISSION	<p>BSE INFORM FLIGHT AND COMMAND---</p> <p>1. BURNER LOX SHUTDOWN VALVE CLOSE ON</p> <p>2. BURNER LOX SHUTDOWN VALVE CLOSE OFF</p>			
	C. LESS THAN 350 PSIA PRIOR TO RESTART	EARTH ORBIT/TLI	C. NO S-IVB RESTART (TB5)/TLI INHIBIT (TB6)	<p>BSE INFORM FLIGHT AND RECOMMEND NO S-IVB RESTART.</p>			
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	7-19	LOW LOX TANK ULLAGE PRESSURE A. LOX ULLAGE PRESSURE LESS THAN 31 PSIA IN TB5 B. THE AMBIENT REPRESS SYSTEM DOES NOT INCREASE THE ULLAGE PRESSURE TO AT LEAST 20 PSIA FOR FIRST OPPORTUNITY RESTART OR 23 PSIA FOR SECOND OPPORTUNITY RESTART BY TB6 + 9 MIN 10 SEC	EARTH ORBIT	A. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. BURNER LOX SHUTDOWN VALVE CLOSE 2. LOX VENT VALVES BOOST CLOSE AS CLOSE AS POSSIBLE TO TB6 + 7 MIN 30 SEC, BSE COMMAND--- 3. LOX REPRESS ON B. TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	CUES--- 1. LOX ULLAGE PRESSURES (D179-406, D180-406). 2. LOX PUMP INLET PRESSURE (D3-403).			
	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 1800 PSIA PRIOR TO RESTART	EARTH ORBIT	A. CONTINUE MISSION BSE INFORM FLIGHT AND SEND--- 1. START BOTTLE VENT OPEN FOR 3 SEC 2. REPEAT COMMAND AS NECESSARY TO INSURE 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 FIDO AND RECOMMEND SPACECRAFT SEPARATION	CUES--- 1. START BOTTLE PRESSURE (D17-401, D241-401)			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	7-21	PU VALVE FAILS TO A MIXTURE RATIO GREATER THAN 5.0 TO 1 ANY TIME PRIOR TO RESTART	EARTH ORBIT/ TLI	CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND---	CUES--- 1. PU VALVE POSITION (G10-401). 2. PU FEEDBACK VOLTAGE (M61-411) NOTES--- 1. THIS FAILURE WILL REQUIRE EVALUATION OF RESIDUALS TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF (REF FMR 7-1). 2. PU FEEDBACK VOLTAGE M61, IS ONLY VALID WHEN PU SYSTEM POWER IS ON		
	7-22	S-IVB LOSS OF ENGINE HYDRAULIC FLUID	EARTH ORBIT/ TLI	NO S-IVB RESTART (TB5)/TLI INHIBIT (TB6) BSE INFORM FLIGHT AND RECOMMEND NO S-IVB RESTART	CUES--- 1. HYDRAULIC RESERVOIR OIL LEVEL APPROX ZERO PERCENT (L7-403). 2. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (D41-403). 3. HYDRAULIC RESERVOIR PRESSURE APPROXIMATELY ZERO PSIA (D42-403). NOTES--- 1. L7-403 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.					
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	7-25	S-IVB STAGE LOX NONPROPULSIVE VENT (NPV) FAILS TO OPEN AT----			CUES---			
		A. TB7 + 0.7 SEC	TLC	A. CONTINUE MISSION BSE INFORM FLIGHT AND VENT THE LOX TANK TO 18-20 PSIA PRIOR TO TB7 + 15 MIN.	1. LOX NPV NOZZLE PRESSURES (D243-404, D244-404). 2. LOX TANK ULLAGE PRESSURE (D179-406, D180-406). 3. LOX NPV OPEN DISCRETE (K198-424, K199-424).			
		B. TO LATCH OPEN AT TB8 + 17 MIN 3 SEC	TLC	B. CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO LATCH OPEN THE LOX LATCHING VENT VALVE IF UNSUCCESSFUL, BSE COMMAND---				
				2. LOX NPV OPEN IF B2 UNSUCCESSFUL, BSE COMMAND---				
				3. LOX VENT OPEN				
	7-26	LH2 LATCHING VENT VALVE FAILS TO LATCH OPEN AS PROGRAMMED	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO LATCH OPEN THE LH2 VENT IF UNSUCCESSFUL, BSE COMMAND---	CUES---			
				2. LH2 LATCHING VENT VALVE CLOSED	1. LH2 NPV NOZZLE PRESSURE (D183-409, D184-409). 2. LH2 ULLAGE PRESSURE (D177-408, D178-408). 3. LH2 LATCHING VENT VALVE DISCRETES (K210-410, K211-410).			
				3. LH2 VENT VALVE OPEN AT TB7 + 15 MIN OR TB7 + 1 HR 15 MIN COMMAND---				
				4. LH2 VENT VALVE CLOSE				
	7-27	ENGINE START BOTTLE DUMP FAILS TO INITIATE	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND ATTEMPT TO OPEN THE START BOTTLE VENT VALVE	CUES---			
					1. GH2 START BOTTLE PRESSURE (D17-401, D241-401).			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
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MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	7-28	S-IVB STAGE COLD HELIUM DUMP FAILS TO INITIATE	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO INITIATE THE COLD HELIUM DUMP THROUGH THE BURNER. IF UNSUCCESSFUL, BSE INFORM FLIGHT AND AT TB8 + 17 MIN 30 SEC SEND--- 2. LOX PRESSURIZATION SHUTOFF VALVES OPEN	CUES--- 1. COLD HELIUM BOTTLE PRESSURE (D261-403, D263-403).		
		RULE NUMBERS 7-29 AND 7-30 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 8 - SLV - TB6

REV	ITEM						
		SUMMARY OF RESTART PHASE RULES					
	8-1	ACCELEROMETER FAILURE					
	8-2	O2/H2 BURNER LH2 VALVE FAILS					
	8-3	LH2 CHILLDOWN SYSTEM FAILS					
	8-4	LOX CHILLDOWN SYSTEM FAILS					
	8-5	LH2 TANK ULLAGE PRESSURE LOW					
	8-6	S-IVB 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---					
	6-4	LAUNCH VEHICLE INERTIAL PLATFORM FAILURE ATTITUDE REFERENCE					
	6-11	S-IVB STAGE LOSS OF THRUST					
	7-7	S-IVB AUXILIARY HYDRAULIC PUMP FAILS					
	7-8	LOSS OF ATTITUDE CONTROL DURING TB5 AND TB7 TO SPACECRAFT SEPARATION; TB6 TO TB6 + 9 MIN 10 SEC					
	7-9	CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO OPEN IN TB5 (TB5 + 59 SEC)					
	7-13	IU ECS WATER 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					
	7-16	S-IVB ENGINE CONTROL BOTTLE PRESSURE LESS THAN 400 PSIA					
	7-17	LH2 TANK VENT FAILURE OR LEAK DURING ORBITAL COAST					
	7-18	LOW COLD HELIUM SUPPLY PRESSURE					
	7-19	LOX TANK ULLAGE PRESSURE LESS THAN 31 PSIA IN TB5					
	7-21	PU VALVE FAILS TO A MIXTURE RATIO GREATER THAN 5.0 TO 1 ANY TIME PRIOR TO RESTART					
	7-22	S-IVB LOSS OF ENGINE HYDRAULIC FLUID					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 8 - SLV - TB6

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS				
	8-1	INERTIAL PLATFORM FAILURE-ACCELEROMETER A. AFTER TB6 INITIATED BUT PRIOR TO TB6 + 9 MIN 10 SEC B. AFTER TB6 + 9 MIN 10 SEC	TLI	A. TLI INHIBIT BSE INFORM FLIGHT AND FIDO AND RECOMMEND TLI INHIBIT PRIOR TO TB6 + 9 MIN 10 SEC. B. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO.	CUES--- 1. GUIDANCE STATUS WORD (MODE CODE 24) (H60-603) BITS D26 AND D25 FOR Z ACCEL SET TO 'ONE' BITS D24 AND D23 FOR X ACCEL SET TO 'ONE' BITS D22 AND D21 FOR Y ACCEL SET TO 'ONE' 2. ACCELEROMETER PICKOFFS (X, Y, OR Z) INDICATE IN EXCESS OF 3.0 DEG AND NOT DECREASING (H10-603, H11-603, H12-603). NOTES--- 1. LVDC SWITCHES TO A BACKUP MODE AND UTILIZES A PRECOMPUTED F/M PROFILE FOR FAILED AXIS DURING S-IVB BURN. 2. ACCELEROMETER FAILURE OCCURRING DURING TB5 MAY NOT BE RECOGNIZED UNTIL SECOND BURN IGNITION.				
	8-2	S-IVB STAGE O2/H2 BURNER FUEL PROPELLANT VALVE FAILS CLOSED	TLI	CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. BURNER SHUTDOWN 2. CONTINUOUS VENT SYSTEM DRIFICE OPEN 3. REPRESSURIZATION OFF	CUES--- 1. BURNER CHAMBER DOME TEMPERATURE INDICATES 460 DEG. OR LESS (C2094-403, C382-403). 2. BURNER PROPELLANT VALVE POSITIONS (K180-404, K192-403, K181-404). 3. AMBIENT REPRESSURIZATION MODE SELECT (K195-404). NOTE--- THE O2/H2 BURNER VOTING CIRCUIT WILL NOT DETECT FAILURE OF THE BURNER TO IGNITE OR BURNER FLAME-OUT IN THE EVENT THE FUEL PROPELLANT VALVE FAILS CLOSED.				
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MISSION RULES

SECTION 8 - SLV - TB6

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	8-3	LH2 CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS	TLI	<p>CONTINUE MISSION</p> <p>A. BSE INFORM FLIGHT AND---</p> <p>1. ATTEMPT TO CORRECT SITUATION SPECIFIED IN NOTE 1.A, 1.B, 1.D</p> <p>IF UNSUCCESSFUL, BSE INFORM FLIGHT</p>	<p>CUES---</p> <p>1. LH2 PUMP INLET TEMP (C3-403)</p> <p>2. LH2 RECIRC FLOW (F5-404)</p> <p>3. LH2 PUMP INLET PRESS (D2-403)</p> <p>4. LH2 PREVALVE DISCRETES (K111-404, K112-404)</p> <p>5. LH2 BLEED VALVE CLOSE (K127-401)</p> <p>6. LH2 RECIRC VALVE CLOSE (K136-409)</p> <p>7. LH2 ULLAGE PRESS (D177-408, D178-408).</p> <p>NOTES---</p> <p>1. LH2 CHILLDOWN WILL NOT BE SATISFACTORY IF---</p> <p>(A) PREVALVE IS OPEN</p> <p>(B) RECIRCULATION VALVE IS CLOSED</p> <p>(C) BLEED VALVE IS CLOSED</p> <p>(D) CHILLDOWN PUMP IS NOT ON</p>			
	8-4	S-IVB STAGE LOX CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS	TLI	<p>CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND---</p> <p>1. ATTEMPT TO CORRECT SITUATION SPECIFIED IN NOTE 1.A, 1.B, 1.D</p> <p>IF 1 IS UNSUCCESSFUL, BSE INFORM FLIGHT AND COMMAND AT TB6 + 7 MIN 42 SEC (SEE NOTE 2)</p> <p>2. LOX LEAD FOR 8 SEC THRU THE PREVALVES</p> <p>3. IMMEDIATELY AFTER LOX LEAD, COMMAND LOX DOME PURGE FOR 8 TO 10 SEC</p> <p>IF 1 OR 2 IS UNSUCCESSFUL, BSE INFORM FLIGHT AND CONTINUE MISSION</p> <p>IF 2 IS NOT TERMINATED BY GROUND COMMAND AFTER 8 SEC, BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT</p>	<p>CUES---</p> <p>1. LOX PUMP INLET TEMPERATURE (C4-403)</p> <p>2. LOX CHILLDOWN FLOW RATE (F4-424).</p> <p>3. LOX PUMP INLET PRESSURE (D3-403) AND LOX TANK ULLAGE PRESSURE (D179-406, D180-406)</p> <p>4. LOX PREVALVE DISCRETES (K109-403, K110-403)</p> <p>5. LOX BLEED VALVE CLOSED (K126-401)</p> <p>6. LOX RECIRCULATION VALVE CLOSED (K139-424)</p> <p>NOTES---</p> <p>1. LOX CHILLDOWN WILL NOT BE SATISFACTORY IF---</p> <p>(A) PREVALVE IS OPEN</p> <p>(B) RECIRCULATION VALVE IS CLOSED</p> <p>(C) BLEED VALVE IS CLOSED</p> <p>(D) CHILLDOWN PUMP IS NOT ON</p> <p>2. THE 8-SEC LOX LEAD SHOULD BE COMMANDED AS NEAR AS POSSIBLE TO TB6 + 7 MIN 42 SEC BUT CAN BE COMMANDED AS LATE AS TB6 + 8 MIN 22 SEC.</p>			
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MISSION RULES

SECTION 8 - SLV - TB6

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	8-5	LOW LH2 TANK ULLAGE PRESSURE AT TB6 + 9 MIN 10 SEC	TLI	TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT.	CUES--- 1. LH2 TANK ULLAGE PRESSURE (D177-408, D178-408). 2. LH2 PUMP INLET PRESSURE (D2-403). NOTES--- 1. THIS RULE IS NOT VALID WITH ANY INDICATION OF AN LH2 VENT VALVE PROBLEM (I.E., LEAKAGE OR FAILURE TO CLOSE) (SEE FMR'S 7-17 AND 8-7) 2. AT TB6 + 9 MIN 10 SEC, THE LH2 TANK ULLAGE PRESSURE SHOULD BE 4 PSIA HIGHER THAN ULLAGE PRESSURE DURING ORBITAL COAST TO MEET RESTART REQUIREMENTS.		
	8-6	S-IVB ACTUATOR CONFIRMED HARDOVER (GREATER THAN OR EQUAL TO +/- 5 DEG.) PRIOR TO TB6 + 9 MIN 10 SEC	TLI	TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	CUE--- 1. ACTUATOR POSITIONS +/- 5 DEG OR GREATER (G1-400, G1-403, G2-400, G2-403). NOTE--- BOTH INDIVIDUAL ACTUATOR POSITIONS MUST CONFIRM MALFUNCTION PRIOR TO RECOMMENDING TLI INHIBIT.		
	8-7	S-IVB STAGE CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO CLOSE DURING RESTART SEQUENCE	TLI	CONTINUE MISSION/TLI INHIBIT BSE INFORM FLIGHT AND COMMAND--- 1. SECOND BURN RELAY OFF 2. ATTEMPT TO CLOSE THE CVS REGULATOR 3. IF 2 IS UNSUCCESSFUL BSE COMMAND BURNER SHUTDOWN.	CUES--- 1. CVS NOZZLE PRESSURE REMAINS GREATER THAN 3 PSIA (D181-409, D182-409). 2. CVS REGULATOR CLOSED (K154-411). 3. LH2 TANK ULLAGE PRESSURE (D177-408, D178-408).		
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MISSION RULES

SECTION 9 - SLV TB8

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	LH2 DUMP FAILS						
9-5	LOSS OF APS FOR DUMP						
		THE FOLLOWING REFERENCED FLIGHT MISSION RULES ARE ALSO APPLICABLE DURING TIME BASE EIGHT (TB8)					
7-3	J-2 ENGINE MAIN FUEL VALVE (MFV) 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 TB5 AND TB7 TO SPACECRAFT SEPARATION, TB6 TO TB6 + 9 MIN 20 SEC AFTER SPACECRAFT SEPARATION, AFTER TB8 INITIATE						
7-13	IU 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.						
7-25	S-IVB STAGE LOX NON-PROPULSIVE VENT (NPV) FAILS TO OPEN AT TB7 + 0.7 SEC, TO LATCH OPEN AT TB 8 + 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						
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MISSION RULES

SECTION 9 - SLV TB8

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	9-1	S-IVB STAGE PNEUMATIC DUMP FAILS TO INITIATE	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO OPEN THE ENGINE PUMP PURGE CONTROL VALVE	CUES--- 1. ENGINE PUMP PURGE PRESSURE (D50-403). 2. AMBIENT HELIUM SUPPLY PRESSURE (D236-403, D256-403).		
	9-2	S-IVB LOX DUMP FAILS TO INITIATE AT TB8 + 12 MIN 0.2 SEC	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO INITIATE LOX DUMP BY OPENING THE MAIN OXIDIZER VALVE	CUES--- 1. MAIN OXIDIZER VALVE POSITION (G3-401). 2. MAIN OXIDIZER VALVE OPEN DISCRETE (K120-401). 3. LOX PUMP INLET TEMPERATURE (C4-403). 4. LOX FLOW RATE (F1-401).		
	9-3	ENGINE CONTROL BOTTLE DUMP FAILS TO INITIATE	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO OPEN THE ENGINE HELIUM CONTROL VALVE	CUE--- 1. ENGINE CONTROL REG. PRESS (D18-401). 2. ENGINE CONTROL HELIUM SPHERE PRESSURE (D19-401, D242-401).		
		RULE 9-4 IS RESERVED					
	9-5	LOSS OF EITHER OR BOTH APS MODULES PRIOR TO OR DURING PROPELLANT DUMP	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. S-IVB BURN MODE ON	CUES--- 1. MANIFOLD PRESSURE MOD 1 LESS THAN 160 PSIA (FUEL-OXID) (D70-414, D71-414). 2. MANIFOLD PRESSURE MOD 2 LESS THAN 160 PSIA (FUEL-OXID) (D72-415, D73-415). 3. HELIUM SUPPLY PRESSURE MODE 1 APPROXIMATELY 1100 PSIA (D35-414, D250-414). 4. HELIUM SUPPLY PRESSURE MODE 2 APPROXIMATELY 1100 PSIA (D36-415, D251-415).		
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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM						
	10-1	<p style="text-align: center;">----- ' GENERAL ' -----</p> <p>LAUNCH</p> <p>LAUNCH WILL BE CONTINUED AS LONG AS THE SUIT CIRCUIT AND O2 SUPPLY WILL SUPPORT FLIGHT CREW DEMANDS FOR AT LEAST ONE REV AND ENTRY INTO 2-1. THERE ARE NO COOLANT FAILURES FOR WHICH LAUNCH/INSERTION PHASE WILL BE TERMINATED.</p> <p>TLC & TEC</p> <p>WATER EVAPORATION WILL BE LIMITED TO COMPONENT TESTING.</p> <p>POWERED DESCENT</p> <p>THERE ARE NO CSM ENVIRONMENTAL CONTROL SYSTEMS FAILURES FOR WHICH POWERED DESCENT WILL BE TERMINATED.</p> <p>ALL PHASES</p> <ul style="list-style-type: none"> A. BACKUP SYSTEMS AND BACKUP COMPONENTS WILL NORMALLY BE USED FOR THE MOST RAPID PRACTICAL RETURN TO EARTH, NOT FOR MISSION CONTINUATION. 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. C. TO CONTINUE, WATER QUANTITY PREDICTIONS MUST REFLECT ADEQUATE QUANTITIES TO MEET NORMAL MISSION REQUIREMENTS. 					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	FNL	5/16/69	CSM ENVIRONMENT CONTROL	GENERAL	10-1	

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM							
	10-2	<p>DEFINITIONS</p> <p>LOSS OF CABIN INTEGRITY---</p> <p style="padding-left: 40px;">CM PRESSURE VESSEL LEAKAGE SUCH THAT CABIN PRESSURE CANNOT BE MAINTAINED GREATER THAN, OR EQUAL TO 4.5 PSIA BY CABIN PRESSURE REGULATORS (1.2 LB/HR TOTAL).</p> <p>LOSS OF SUIT INTEGRITY---</p> <p style="padding-left: 40px;">TOTAL PGA AND SUIT LOOP LEAKAGE IS GREATER THAN 0.5 PSI/MIN (1.5 LB/HR) DURING PGA SUIT LOOP PRESSURE CHECK.</p> <p>LOSS OF SUIT CIRCUIT---</p> <p style="padding-left: 40px;">INABILITY OF THE SUIT CIRCUIT TO MAINTAIN ADEQUATE CREW COMFORT AND/OR CO2 REMOVAL WITHOUT USING DIRECT O2.</p> <p>LOSS OF O2 MANIFOLD---</p> <p style="padding-left: 40px;">AN O2 MANIFOLD OR REGULATOR FAILURE WITH WHICH THE SUIT CIRCUIT O2 DEMANDS CANNOT BE SUPPLIED FOR ENTRY.</p> <p>LOSS OF PRIMARY LOOP COOLING---</p> <p style="padding-left: 40px;">LOSS OF ALL FLOW, A LEAK WHICH CANNOT BE ISOLATED, OR COMBINED FAILURES SUCH THAT RADIATORS AND EVAPORATOR PROVIDE NO COOLING.</p> <p>LOSS OF SECONDARY LOOP COOLING---</p> <p style="padding-left: 40px;">LOSS OF ALL FLOW, A LEAK WHICH CANNOT BE ISOLATED, OR COMBINED FAILURES SUCH THAT RADIATORS AND EVAPORATOR PROVIDE NO COOLING.</p> <p>LOSS OF COOLANT LOOP RADIATORS---</p> <p style="padding-left: 40px;">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>LOSS OF ALL COOLING---</p> <p style="padding-left: 40px;">LOSS OF PRIMARY AND SECONDARY LOOP COOLING.</p> <p>LOSS OF SURGE TANK AND/OR REPRESS PACK---</p> <p style="padding-left: 40px;">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 11	FNL	5/16/69	CSM ENVIRONMENT CONTROL	GENERAL	10-2	

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM							
		<p>----- ' SYSTEMS MANAGEMENT ' -----</p>						
	10-10	O2 SYSTEM						
		<p>A. SUIT FLOW RELIEF VALVE WILL REMAIN CLOSED FOR DURATION OF FLIGHT.</p> <p>B. NORMAL CM REPRESSURIZATION WITH LM MANNED WILL UTILIZE THE REPRESS PACK.</p> <p>C. SURGE TANK WILL BE ON LINE EXCEPT DURING LM PRESSURIZATION OR CM PRESSURIZATION WITH THE LM MANNED, WHEN IT WILL BE ISOLATED TO MAINTAIN QUANTITY GREATER THAN 500 PSIA.</p> <p>D. THE PLSS VALVE WILL BE IN OFF POSITION FOR ALL PHASES EXCEPT LAUNCH, ENTRY, AND TUNNEL/LM PRESSURIZATION AND RECHARGE</p> <p>E. THE SUIT CIRCUIT MUST BE PURGED OF ACCUMULATED H2 ONCE EVERY 6 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 <u>4.0</u> PSIA DURING NORMAL LM PRESSURIZATION EXCEPT DURING TD&E.</p> <p>H. THE CM ECS WILL NORMALLY SUPPLY ALL O2 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"> 1. INABILITY TO MAINTAIN CABIN PRESSURE ABOVE 4.5 PSIA. 2. ALL UNDOCKED OPERATIONS. 3. TD&E. 4. GLYCOL LEAKS IN COMMAND MODULE. 5. FIRE, SMOKE, CONTAMINATION IN CABIN. <p>J. THE FLIGHT CREW WILL DOFF SUITS (TIME AND CONDITIONS PERMITTING) FOR THE FOLLOWING---</p> <ol style="list-style-type: none"> 1. LOSS OF SUIT CIRCUIT. 2. CONFIRMED LEAK OF GLYCOL IN SUIT CIRCUIT. 						
		COOLANT MANAGEMENT						
		<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>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	A	6/20/69	CSM ENVIRONMENT CONTROL	MANAGEMENT	10-3	

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM								
	10-10 (CONT)	<p>WATER SYSTEM</p> <p>A. WASTE WATER WILL BE 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"> 1. AT LO1, THE WASTE TANK WILL CONTAIN GREATER THAN 75 PERC 2. AT CM-SM SEPARATION, THE POTABLE TANK WILL BE FULL AND THE WASTE TANK WILL BE 90 PERCENT FULL. <p>C. GENERAL DUMPING CONSIDERATIONS TO REDUCE TRAJECTORY CALCULATION PERTURBATIONS---</p> <ol style="list-style-type: none"> 1. DUMPS WILL BE PERFORMED (IF REQUIRED) WITHIN 2 HOURS PRECEDING MCC MANEUVERS. 2. IF DUMPS ARE REQUIRED IN LUNAR ORBIT THE OPTIMUM DUMP TIME IS IMMEDIATELY PRECEDING SLEEP PERIODS. <p>SYSTEM BACKUP</p> <p>LM SYSTEMS WILL BE USED AS REQUIRED FOR CSM SYSTEMS BACKUP. DESCENT STAGE WILL BE RETAINED IF POSSIBLE.</p> <p>RULE NUMBERS 10-11 THROUGH 10-19 ARE RESERVED.</p>							
		MISSION	REV	DATE	SECTION	GROUP	PAGE		
		APOLLO 11	FNL	5/16/69	CSM ENVIRONMENT CONTROL	MANAGEMENT	10-4		

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
				----- SPECIFIC -----			
	10-20	CABIN PRESSURE CANNOT BE RELIEVED	LAUNCH	CONTINUE MISSION	NORMAL RELIEF STARTS AT <u>50</u> SECONDS		
	10-21	CABIN PRESSURE DECREASING AND/OR LESS THAN 4.5 PSIA AND---			CREW OPTION TO USE LM ENVIRONMENT FOR EARTH RETURN IN LIEU OF SUITED RETURN.		
		A. SUIT PRESSURE GREATER THAN 3.5 PSIA	LAUNCH	A.1. CONTINUE MISSION			
			DOI	2. ENTER NEXT BEST PTP- NO GO FOR PDI. RETAIN DESCENT STAGE FOR TEI.			
			POWERED DESCENT	3. CONTINUE MISSION- NO GO FOR LUNAR STAY			
			ALL	4. ENTER NEXT BEST PTP IF CABIN PRESS NOT RESTORED GREATER THAN 4.5 PSIA.			
		B. SUIT PRESSURE LESS THAN 3.5 PSIA	LAUNCH	B.1. ABORT ASAP			
			ALL	2. ENTER ASAP			
		C. LOSS OF SUIT CIRCULATION	LAUNCH	C.1. ABORT ASAP OPEN DIRECT O2 45 DEG FROM LAUNCH SETTING.	C.1. CORRESPONDS TO 12.6 LB/HR (APPROX 3 CFM/CREWMAN)		
			ALL	2. ENTER ASAP			
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM ENVIRONMENT CONTROL SYSTEM	SUIT/CABIN	10-5

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-22	LOSS OF SUIT CIRCUIT, CABIN STABLE AND GREATER THAN 4.5 PSIA	LAUNCH	A. CONTINUE MISSION OPEN DIRECT O2 VALVE 45 DEG FROM LAUNCH SETTING.	LM SYSTEMS (IF AVAILABLE) WILL BE USED FOR CO2 AND H2O REMOVAL. A. CORRESPONDS TO 12.6 LB/HR (APPROX 3 CFM/CREWMAN)
			EO	B. ENTER NEXT BEST PTP 1. DOFF SUITS. 2. OPEN WASTE OVERBOARD DRAIN VALVE TO OBTAIN CABIN BLEED FLOW. 3. DON FACE MASKS AFTER 1 HOUR	B.2. WASTE OVERBOARD BLEED = 0.67 LB O2/HR 3. TIME REQUIRED FOR CM CO2 PARTIAL PRESSURE TO INCREASE TO 7.6 MM HG 1 CREWMAN--- 4 HR. 3 CREWMAN--- 80 MIN.
			DOI	C. ENTER NEXT BEST PTP- NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI.	
			POWERED DESCENT	D. CONTINUE MISSION- NO GO FOR LUNAR STAY	
			ALL	E. ENTER NEXT BEST PTP	

MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 10 - CSM 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 PLSS VALVE TO FILL.			
	10-24	LOSS OF SURGE TANK AND REPRESS PACK	LAUNCH ALL TEC	A. CONTINUE MISSION B. CONTINUE MISSION PLAN TO RESTORE ENTRY O2 BY STORING OPS IN CM AT FINAL LM EGRESS. C. CONTINUE MISSION DOFF SUITS FOR ENTRY.	B. OPS O2 QTY--- 2 TANKS -2 LB/TANK			
	10-25	FIRE OR SMOKE IN COMMAND MODULE	LAUNCH DOI POWERED DESCENT ALL	A. ABORT 1. DECOMPRESS CABIN 2. TROUBLESHOOT ELECTRICAL SYSTEM PER FLIGHT CREW CHECKLIST BOOST FIRE PROCEDURES. B. ENTER NEXT BEST PTP- NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI C. CONTINUE MISSION- NO GO FOR LUNAR STAY D.1. TROUBLESHOOT/COMBAT FIRE PER FLIGHT CREW CHECKLIST EMERGENCY PROCEDURES. 2. ASSESS DAMAGE AND REMOVE POWER FROM AFFECTED SYSTEMS 3. ENTER NEXT BEST PTP				
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	CSM ENVIRONMENT CONTROL SYSTEM	SUIT/CABIN	10-7	

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-26	CONTAMINATION IN CABIN	ALL	CREW MAY ELECT TO DECOMPRESS	IF UNABLE TO CLEAR CONTAMINATION, MISSION MAY BE TERMINATED EARLY.
	10-27	LOSS OF SUIT INTEGRITY	LAUNCH ALL	A. CONTINUE MISSION B. CONTINUE MISSION NO-GO FOR UNDOCK	
	10-28	LOSS OF O2 MANIFOLD A. O2 MANIFOLD LEAKS GREATER THAN 4 LB/HR AND CABIN PRESSURE GREATER THAN 4.5 PSIA B. O2 MANIFOLD LEAKS GREATER THAN 4 LB/HR AND CABIN PRESSURE LESS THAN 4.5 PSIA	LAUNCH UNDOCKED DOI/ POWERED DESCENT/ LUNAR STAY ALL LAUNCH ALL	A.1. CONTINUE MISSION 2. CONTINUE MISSION- 3. ENTER NEXT BEST PTP (A) VERIFY SURGE TANK AND REPRESS PACK ISOLATED UNTIL ENTRY. (B) RETRIEVE OPS FROM LM. B.1. ABORT ASAP 2. ENTER ASAP USE OPS IN SUITED MODE FOR ENTRY	A.3. APPROXIMATELY 5 HOURS ARE REQUIRED TO DEplete CABIN O2 FROM 4.8 TO 3.5 PSIA, WITH 0.456 LB/HR USAGE RATE (CREW + CABIN LEAK + TANK PRESS BLEED) A.3.(B) CREW OPTION TO USE LM ENVIRONMENT FOR EARTH RETURN IN LIEU OF MANUAL CABIN PRESSURE REGULATION. LM O2 (IF AVAILABLE) MAY BE USED TO SUPPLEMENT CSM SUPPLY.
	10-29	LOSS OF ONE MAIN REGULATOR A. FAILED CLOSED B. FAILED OPEN	LAUNCH EO ALL ALL	A.1. CONTINUE MISSION- 2. CONTINUE MISSION- NO GO FOR TLI 3. CONTINUE MISSION B. CONTINUE MISSION	

MISSION	REV	DATE	SECTION	GROUP	PAGE
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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	A. CONTINUE MISSION	LM SYSTEMS (IF AVAILABLE) MAY BE USED IN LIEU OF CSM SYSTEMS		
			UNDOCKED/ DOI/ POWERED DESCENT/ LUNAR STAY	B. CONTINUE MISSION			
			ALL	C. ENTER NEXT BEST PTP			
	10-31	LOSS OF ONE SUIT COMPRESSOR	LAUNCH	A. CONTINUE MISSION			
			EO	B. CONTINUE MISSION- NO GO FOR TLI			
			ALL	C. CONTINUE MISSION			
	10-32	LOSS OF TWO SUIT COMPRESSORS	LAUNCH	A. CONTINUE MISSION- OPEN DIRECT O2 45 DEG FROM LAUNCH SETTING			
			DOI	B. ENTER NEXT BEST PTP- RETAIN LM DESCENT STATE FOR TEI			
			POWERED DESCENT	C. CONTINUE MISSION- NO GO FOR LUNAR STAY			
			ALL	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	A	6/20/69	CSM ENVIRONMENT CONTROL SYSTEM	SUIT/CABIN	10-9

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MISSION RULES
SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	10-40	PRIMARY COOLANT LOOP MALFUNCTIONS															
		A. LOSS OF EVAPORATOR	LAUNCH	A.1. CONTINUE MISSION	A.1. REF MALF PROC---												
			ALL	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	2.(A) MAINTAIN PRI RAD OUT TEMP GREATER THAN -20 DEG. F. (B) 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	B.1. CONTINUE MISSION	B.1. REF MALF PROC---												
			EO	2. NO-GO FOR TLI (A) ACTIVATE SECONDARY LOOP (B) USE PRIMARY LOOP IN ADDITION TO SECONDARY LOOP FOR G&N OPERATIONS.	2. ALTERNATE MISSION MAY BE PERFORMED												
			TLC	3. ENTER NEXT BEST PTP NO-GO FOR LOI													
			LUNAR ORBIT UNDOCKED	4. BASED ON WATER AVAILABLE FOR EVAPORATIVE COOLING, CONSIDERATION WILL BE GIVEN TO CONTINUING MISSION USING SECONDARY RADIATORS SUPPLEMENTED BY PRIMARY LOOP EVAPORATOR.													
			DOI/ POWERED DESCENT	5. CONTINUE MISSION													
			LUNAR STAY	6. CONTINUE MISSION. ACTIVATE SECONDARY LOOP.													
		C. TOTAL LOSS OF LOOP	LAUNCH	C.1. CONTINUE MISSION ACTIVATE SECONDARY LOOP													
			EO	2. CONTINUE MISSION NO-GO FOR TLI ACTIVATE SECONDARY LOOP	C.2. ALTERNATE MISSION MAY BE PERFORMED.												
			DOI/ POWERED DESCENT/ LUNAR STAY	3. CONTINUE MISSION- ACTIVATE SECONDARY LOOP.													
			ALL	4. ENTER NEXT BEST PTP ACTIVATE SECONDARY LOOP													
<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>A</td> <td>6/20/69</td> <td>CSM ENVIRONMENT CONTROL SYSTEM</td> <td>COOLANT</td> <td>10-10</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	A	6/20/69	CSM ENVIRONMENT CONTROL SYSTEM	COOLANT	10-10
MISSION	REV	DATE	SECTION	GROUP	PAGE												
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SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	10-41	SECONDARY LOOP MALFUNCTIONS					
		A. LOSS OF EVAPORATOR	ALL	A. CONTINUE MISSION	A. MALF ECS		
		B. LOSS OF RADIATORS	EO	B.1. NO-GO FOR TLI LOOP IS STILL OPERATIONAL IN EVAPORATIVE MODE.	B.1. MALF ECS		
			TLC	2. ENTER NEXT BEST PTP			
			LUNAR ORBIT	3. CONTINUE MISSION			
		C. TOTAL LOSS OF LOOP	EO	C.1. NO-GO FOR TLI	C.1. MALF ECS		
			TLC	2. ENTER NEXT BEST PTP			
			LUNAR ORBIT	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 MAXIMUM ORBIT TIME--- 4 HOURS EMERGENCY POWER DOWN FOLLOWED BY 1.5 HOURS OF POWER UP FOR ENTRY.			
			POWERED DESCENT	C. CONTINUE MISSION-			
			ALL	D. ENTER ASAP			
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	B	7/3/69	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 GYLCOL COOLANT			LM ENVIRONMENT (IF AVAILABLE) MAY BE USED FOR EARTH RETURN IN LIEU OF CSM.			
	A. IN COMMAND MODULE		LAUNCH	A.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	B.1. CONTINUE MISSION				
			EO	2. ENTER NEXT BEST PTP DOFF SUITS AND USE FACE MASKS IF REQUIRED.				
			DOI	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	B	7/3/69	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
10-50	LOSS OF OVERBOARD DUMPS	A. NORMAL OVERBOARD DUMPS FROZEN OR BLOCKED	ALL	A. 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. LOSS OF ALL OVERBOARD DUMP CAPABILITY	EO TLC LUNAR ORBIT	B.1. ENTER NEXT BEST PTP	B.1.(A) IF POTABLE AND WASTE TANKS (OR WASTE TANKS ALONE) BECOME FULL, 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.
			UNDOCKED/ DOI/ POWERED DESCENT/ LUNAR STAY	2. CONTINUE MISSION	2. UNDOCKING MAY BE PERFORMED.
10-51	UNCONTROLABLE HIGH HUMIDITY		LAUNCH	A. CONTINUE MISSION	LM SYSTEMS MAY BE USED FOR HUMIDITY CONTROL.
			DOI	B. ENTER NEXT BEST PTP- NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI	
			POWERED DESCENT	C. CONTINUE MISSION- NO GO FOR LUNAR STAY	
			ALL	D. ENTER NEXT BEST PTP	
10-52	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 FULL, FUEL CELL WATER WILL BE DUMPED THROUGH OVERBOARD PRESSURE RELIEF VALVES

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MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	10-53	CONFIRMED LEAK IN POTABLE WATER TANK OR UNABLE TO TRANSFER FUEL CELL WATER TO POTABLE TANK.	LAUNCH EO TLC ALL	A. CONTINUE MISSION B. CONTINUE MISSION GO FOR TLI. ENTER NEXT BEST PTP AFTER TANK DEPLETION IF TLI NOT PERFORMED AND UNABLE TO EXTRACT LM C. CONTINUE MISSION- USE LM WATER FOR CREW CONSUMPTION. IF UNABLE TO DO TD&E ENTER NEXT BEST PTP. D. CONTINUE MISSION	LM SYSTEMS (IF AVAILABLE) MAY BE USED TO SUPPLEMENT CSM.		
		RULE NUMBERS 10-54 THROUGH 10-59 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM ENVIRONMENT CONTROL SYSTEM	WATER & WASTE MANAGEMENT	10-14

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SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM - CONCLUDED

REV	ITEM	----- INSTRUMENTATION REQUIREMENTS -----					REFERENCE
	10-60	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCER	CATEGORY	
		CABIN PRES	CF0001P	METER	COMMON	1 OF	10-20
		SUIT PRES	CF0012P	METER	COMMON	3 M	
		TANK BLADDER PRES	CF0120P	-----	-----		
		SUIT PRESS (CUFF GAGES)	-----	-----	-----	MANDATORY (EACH CREWMAN)	10-21
		SURGE TANK PRESS	CF0006P	METER	COMMON	1 OF	10-28
		OXYGEN REPRESS PRESS	-----	METER	-----	2 M	
		PRIM ACCUM QTY	CF0019Q	METER	COMMON	1 OF	10-40,
		PRIM PUMP OUT PRESS	CF0016P	METER	COMMON	2 M	10-44
		POTABLE H2O QTY	CF0010Q	METER	COMMON	HD	10-53,
		WASTE H2O QTY	CF0009Q	METER	COMMON	HD	10-52
		SEC STEAM PRESS	CF0073P	METER	COMMON	1 OF	10-41
		SEC EVAP OUT TEMP	CF0071T	METER	COMMON	2 M	
		SEC ACCUM QTY	CF0072P	METER	COMMON	HD	
		SEC PUMP OUT PRESS	CF0070P	METER	COMMON	HD	
		PRIM EVAP OUT TEMP	CF0018T	METER	COMMON	HD	
		PRIM STEAM PRESS	CF0034	METER	COMMON	HD	
		ECS O2 FLOW	CF0035R	METER	COMMON	HD	
		O2 MANIFOLD PRESS	CF0036P	-----	-----	HD	
		SUIT COMP PRESS	CF0015P	METER	COMMON	HD	
		PRIM RAD OUT TEMP	CF0020T	METER	COMMON	HD	
		PRIM EVAP INLET TEMP	CF0181T	-----	-----	HD	
		STEAM DUCT TEMP	CF0017T	-----	-----	HD	
		SEC RAD OUT TEMP	SF0236T	METER	-----	HD	

	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	FNL	5/16/69	CSM ENVIRONMENT CONTROL SYSTEM	INSTR REQUIREMENTS	10-15	

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MISSION RULES

SECTION 11 - CSM CRYOGENICS

REV	ITEM							
		<p>----- ' SYSTEMS MANAGEMENT ' -----</p>						
	11-10	<p>CRYO MANAGEMENT</p> <p>A. MANUAL PRESSURE CONTROL WILL NORMALLY BE USED AS REQUIRED TO MAINTAIN---</p> <p>1. TANK PRESSURES GREATER THAN <u>750</u> PSIA O2 AND <u>200</u> PSIA FOR H2.</p> <p>2. QUANTITY BALANCE WITHIN <u>4</u> PERCENT O2 AND <u>3</u> PERCENT FOR H2.</p> <p>B. ONE FUEL CELL MAY BE PURGED OR THE SPACECRAFT ELECTRICAL LOADS MAY BE INCREASED TO PRECLUDE CRYO TANK VENTING.</p> <p>C. O2 TANK FANS AND H2 TANK FANS WILL NOT BE OPERATED IN THE AUTO MODE.</p>						
	11-11	<p>CRYO GAGING</p> <p>A. ONBOARD CRYOGENIC QUANTITY GAGING IS PRIME. ACCURACY IS +/-2.65 PERCENT (+/-8.48 LB O2, +/-0.72 LB H2) PER TANK.</p> <p>B. MCC CALCULATED QUANTITY USING PRESSURE VERSUS TEMPERATURE IS BACKUP.</p> <p>RULE NUMBERS 11-12 THROUGH 11-19 ARE RESERVED.</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	A	6/20/69	CSM CRYOGENICS	MANAGEMENT	11-2	

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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 150 O2, LESS THAN 100 H2, RESPECTIVELY).	LAUNCH EO POWERED DESCENT ALL	A. CONTINUE MISSION B. CONTINUE MISSION NO-GO FOR TLI C. CONTINUE MISSION NO GO FOR LUNAR STAY D. ENTER NEXT BEST PTP	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 150 O2, LESS THAN 100 H2, RESPECTIVELY)	LAUNCH POWERED DESCENT EO	A. CONTINUE MISSION ISOLATE SURGE TANK PRIOR TO 800 PSIA B.1. PDI TO LO GATE - ENTER NEXT BEST PTP RETAIN LM DESCENT STAGE FOR TEI IF POSSIBLE. 2. LO GATE TO TD - CONTINUE MISSION. NO GO FOR LUNAR STAY. C. ENTER NEXT BEST ATP OR PTP 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 11	A	6/20/69	CSM CRYOGENICS	SPECIFIC	11-3

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MISSION RULES

SECTION 11 - CSM CRYOGENICS - CONCLUDED

REV	ITEM	----- INSTRUMENTATION REQUIREMENTS -----					MISSION RULE REFERENCE
11-50	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY		
	O2 TANK 1 QTY	SC0032Q	METER	COMMON	1 OF 2	11-20	
	O2 TANK 2 QTY	SC0033Q	METER	COMMON	MANDATORY		
	O2 TANK 1 TEMP	SC0041T	-----	-----	HIGHLY	11-20	
	O2 TANK 2 TEMP	SC0042T	-----	-----	DESIRABLE		
	H2 TANK 1 QTY	SC0030Q	METER	COMMON	1 OF 2	11-20	
	H2 TANK 2 QTY	SC0031Q	METER	COMMON	MANDATORY		
	H2 TANK 1 TEMP	SC0043T	-----	-----	HIGHLY	11-20	
	H2 TANK 2 TEMP	SC0044T	-----	-----	DESIRABLE		
	O2 TANK 1 PRESS	SC0037P	METER	COMMON	1 OF 2	11-20	
	O2 TANK 2 PRESS	SC0038P	METER	COMMON	MANDATORY	11-20	
	H2 TANK 1 PRESS	SC0039P	METER	COMMON	1 OF 2	11-20	
	H2 TANK 2 PRESS	SC0040P	METER	COMMON	MANDATORY	11-20	

	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	FNL	5/16/69	CSM CRYOGENICS	INSTR REQ	11-4	

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MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	12-32	LOSS OF THREE FUEL CELLS A. OUTPUT LESS THAN 10 AMPS EACH	LAUNCH POWERED DESCENT ALL	A. CONTINUE MISSION 1. AFTER 2 + 00 EDS AUTO/OFF TO OFF. 2. TIE BAT C TO BOTH MAIN BUSES. 3. POWER DOWN AT INSERTION ENTER 2-1 IF FUEL CELLS CANNOT BE RESTORED. B.1. PDI TO LO GATE - ENTER NEXT BEST PTP. RETAIN LM DESCENT STAGE FOR TEI IF POSSIBLE. 2. LO GATE TO TD - CONTINUE MISSION NO GO FOR LUNAR STAY. C. ENTER NEXT BEST PTP	LM SYSTEMS (IF AVAILABLE) MAY BE USED TO SUPPLEMENT FUEL CELL POWER. A.1. IF TOTAL OUTPUT CAPABILITY LESS THAN 8 AMPS AT 22 VDC, SMJC WILL BE INOPERATIVE FOR CM/SM SEP. A.3. 4.75 HOURS LEFT IN ORBIT BEFORE DEORBIT MANEUVER.		
	12-33	LOSS OF THREE FUEL CELLS PLUS ONE BATTERY CURRENT LESS THAN 50 PERCENT OF LOAD ON EITHER REMAINING BATTERY	LAUNCH EO POWERED DESCENT ALL	A. ABORT B. ENTER NEXT BEST ATP OR PTP PERFORM EMERGENCY POWER DOWN C.1. PDI TO LO GATE - ENTER NEXT BEST PTP. RETAIN LM DESCENT STAGE FOR TEI. 2. LO GATE TO TD - CONTINUE MISSION. NO GO FOR LUNAR STAY. D. ENTER NEXT BEST PTP PERFORM EMERGENCY POWER DOWN	USE LM SYSTEMS (IF AVAILABLE). RESERVE ENTRY BATTERIES FOR ENTRY. A. ASSUMES ALL THREE FUEL CELL CURRENTS LESS THAN OR EQUAL TO 5 AMPS AND BATTERY C TIED TO BOTH MAINS. B. 2.4 HOURS LEFT IN ORBIT BEFORE SPS IGNITION		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM ELECTRICAL POWER SYSTEM	FUEL CELLS	12-5

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MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
<p>-----</p> <p style="border: 1px dashed black; padding: 2px;">SPECIFIC MISSION RULES</p> <p>-----</p>								
	12-30	LOSS OF ONE FUEL CELL (OUTPUT LESS THAN 5 AMPS)	LAUNCH EO TLC LUNAR ORBIT LUNAR STAY DOI ALL	A. CONTINUE MISSION B. NO-GO FOR TLI 1. OPEN CIRCUIT FUEL CELL. 2. RECONFIGURE REMAINING TWO FUEL CELLS TO ONE FUEL CELL ONLY PER MAIN BUS. 3. IF FUEL CELL CANNOT BE RESTORED, PERFORM SHUTDOWN. C. BASED ON THE FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING WITH NOMINAL MISSION D. CONTINUE MISSION- E. CONTINUE MISSION	B.1. REF MALF PROC EPS 5.			
	12-31	LOSS OF TWO FUEL CELLS (OUTPUT LESS THAN 5 AMPS EACH)	LAUNCH POWERED DESCENT ALL	A. CONTINUE MISSION AFTER 2 + 00 GET PERFORM--- 1. EDS AUTO/OFF TO OFF. 2. IF LOSS OF FC 1 AND 2, TIE BAT C TO MAIN A. 3. IF LOSS OF FC 2 AND 3, TIE BAT C TO MAIN B. 4. IF LOSS OF FC 1 AND 3, TIE BAT C TO BOTH MAIN BUSES. B. CONTINUE MISSION- NO GO FOR LUNAR STAY C. ENTER NEXT BEST PTP 1. CONNECT REMAINING FUEL CELL TO BOTH MAIN BUSES. 2. PERFORM "LOSS OF TWO FC POWER DOWN."	LM SYSTEMS MAY BE USED TO SUPPLEMENT CSM POWER. C. ONE ENTRY BATTERY MAY BE USED TO SUPPLEMENT REMAINING FC FOR G&N ALIGNMENT PRIOR TO DEORBIT.			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	CSM ELECTRICAL POWER SYSTEM	FUEL CELLS	12-4	

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MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM							
	12-22	<p>FUEL CELL MANAGEMENT</p> <p>A. FUEL CELL WILL BE 'SHUTDOWN' FOR THE FOLLOWING---</p> <ol style="list-style-type: none"> 1. SUSTAINED CURRENT OUTPUT LESS THAN 5 AMPS. 2. FUEL CELL H2 LOOP IS CONTAMINATED WITH KOH. 3. REACTANT LEAKAGE JEOPARDIZING MISSION DURATION. <p>B. FUEL CELL MAY BE 'OPEN CIRCUITED' FOR THE FOLLOWING---</p> <ol style="list-style-type: none"> 1. SKIN TEMP GREATER THAN 475 DEG. F. 2. TCE TEMP GREATER THAN 225 DEG. F. 3. FAILURE OF H2 PUMP OR GLYCOL PUMP. 4. VOLTAGE MANAGEMENT. 5. FUEL CELL CANNOT BE PURGED AND TIME TO GO IS GREATER THAN PREDICTED FUEL CELL LIFETIME. <p>C. FUEL CELL O2 PURGES WILL BE DONE AT 12 HOUR INTERVALS. FUEL CELL H2 PURGES WILL BE DONE AT 48 HOUR INTERVALS.</p> <p>D. ADDITIONAL PURGES 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 H2 PURGE WILL NORMALLY BE PRECEDED BY 20 MINUTES OF H2 VENT HEATER OPERATION.</p> <p>G. FC INLINE 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>INVERTER MANAGEMENT</p> <p>INVERTERS MAY BE REMOVED FROM LINE FOR ANY OF THE FOLLOWING REASONS---</p> <p>A. INVERTER TEMP GREATER THAN 190 DEG. F.</p> <p>B. SPACECRAFT LOAD MANAGEMENT</p>						
		<p>RULE NUMBERS 12-24 THROUGH 12-29 ARE RESERVED</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	B	7/3/69	CSM ELECTRICAL	MANAGEMENT	12-3	

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MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM						
		<p>----- ' SYSTEMS MANAGEMENT ' -----</p>					
	12-20	BUS MANAGEMENT					
		<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 1 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 CHARGE 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 COMPATABLE WITH ONLINE OPERATION EQUIPMENT.</p>					
		1.	SPS	<u>24.5</u>			
		2.	PGNS	<u>25.0</u>			
		3.	AUTO SM-RCS	<u>22.0</u>			
		4.	AUTO CM-RCS	<u>21.0</u>			
		5.	DIRECT SM-RCS	<u>21.0</u>			
		6.	DIRECT CM-RCS	<u>17.0</u>			
		7.	INVERTERS	<u>19.0</u>			
	12-21	BATTERY MANAGEMENT					
		<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>					
		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.				
		D. THREE BATTERIES WILL BE TIED TO THE MAIN BUSES FOR DEORBIT MANEUVER AND ENTRY.					
		E. BATTERIES ARE CONSIDERED TO HAVE 40 AMP-HR CAPABILITY INFLIGHT AND 45 AMP-HR CAPABILITY FOR POSTLANDING.					
		F. A SINGLE BATTERY THAT CANNOT BE RECHARGED WILL NOT BE USED EXCEPT DURING DEORBIT, ENTRY AND POSTLANDING.					
		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.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	CSM ELECTRICAL POWER SYSTEM	MANAGEMENT	12-2

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MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	12-42	LOSS OF BATTERY CHARGER	EO	A. CONTINUE MISSION ROTATE BATTERY C FOR BURNS TO MAINTAIN BALANCED BATTERIES	REF MALF PROC EPS-5		
			TLC	B. NO-GO FOR LOI IF SUM OF TWO LOWEST ENTRY BATTERIES LESS THAN 50 AMP HRS.			
			LO	C. NO-GO FOR UNDOCK IF SUM OF TWO LOWEST ENTRY BATTERIES LESS THAN 44 AMP HR.			
		RULE NUMBERS 12-43 THROUGH 12-49 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	B	7/3/69	CSM ELECTRICAL POWER SYSTEM	BATTERIES/ CHARGER	12-7

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MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	12-50	MAIN BUS TIE MOTOR SWITCH FAILURES					
		A. ONE MOTOR SWITCH FAILS OPEN	LAUNCH	A.1. CONTINUE MISSION (A) IF MOTOR SW A/C TIE BAT C TO MAIN BUS A. (B) IF MOTOR SW B/C TIE BAT C TO MAIN BUS B.			
			ALL	2. CONTINUE MISSION CLOSE ALTERNATE MOTOR SW AND USE MAIN BUS TIE CB'S AS MOTOR SWITCHES.	A.2. BATTERIES MUST BE CHARGED THROUGH OPEN MOTOR SW. LEAVE BATTERY CB CLOSED FOR CHARGING.		
		B. ONE OR BOTH MOTOR SW FAILED CLOSED	ALL	B. CONTINUE MISSION USE CB'S AS MOTOR SWITCHES.	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 2 DISCONNECTS FROM MAIN A	LAUNCH	A.1. CONTINUE MISSION (A) PLACE EDS AUTO/OFF TO OFF. (B) F/C 2 TO BUS A ONLY. (C) TIE BAT C TO MAIN A. (D) INVERTER 3 TO AC BUS 2, MAIN A. (E) POWER DOWN MAIN BUS B.	A.1. GREATER THAN 85 AMPS SHORT ON MAIN B WILL CAUSE REVERSE DISCONNECT DURING LAUNCH MALF EPS-3.		
			DOI	A.2. ENTER NEXT BEST PTP- NO GO FOR PDI			
			POWERED DESCENT	A.3. CONTINUE MISSION- NO GO FOR LUNAR STAY			
			ALL	A.4. ENTER NEXT BEST PTP IF BUS NOT RESTORED POWER DOWN MAIN BUS B.	A.4. REF MALF PROC EPS 5SR-1		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM ELECTRICAL POWER SYSTEM	DC DISTRIBUTION	12-8

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MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	12-51 CONT	B. FUEL CELL 2 DISCONNECTS FROM MAIN B	LAUNCH	B.1. CONTINUE MISSION (A) PLACE EDS AUTO/OFF TO OFF. (B) FC 2 TO BUS B ONLY. (C) TIE BAT C TO MAIN BUS B. (D) INVERTER 3 TO AC BUS 1, MAIN B. (E) POWER DOWN MAIN BUS A. (F) TVC GIMBAL DRIVE (P,Y)-2. (G) GIMBAL MOTOR CONTROL (YAW 2, PITCH 2) BAT B OPEN FOLLOWING GIMBAL MOTOR TURN ON.	B.1. GREATER THAN 79 AMPS SHORT ON MAIN A WILL CAUSE REVERSE DISCONNECT DURING LAUNCH		
			DOI	B.2. ENTER NEXT BEST PTP- NO GO FOR PDI			
			POWERED DESCENT	B.3. CONTINUE MISSION- NO GO FOR LUNAR STAY			
			ALL	B.4. ENTER NEXT BEST PTP IF BUS NOT RESTORED. POWER DOWN MAIN BUS A			
		C. MAIN BUS SHORTED GREATER THAN 25 AMPS AND FUEL CELLS CANNOT BE DISCONNECTED FROM SHORTED BUS.	LAUNCH	C.1. ABORT	C.1. FAILURE OF MOTOR SWITCH TO DISCONNECT FROM SHORTED BUS INDICATED BY FC SHORTED BUS T/B GRAY.		
			DOI	2. ENTER NEXT BEST PTP IF MN BUS NOT RESTORED- NO GO FOR PDI, RETAIN LM DESCENT STAGE FOR TEI			
			POWERED DESCENT	3. CONTINUE MISSION- NO GO FOR LUNAR STAY IF MN BUS NOT RESTORED.			
			ALL	4. ENTER NEXT BEST PTP IF MAIN BUS NOT RESTORED.	C.4. IF FUEL CELL FEED CIRCUITRY SHORTED, CLOSE FC REACTANT VALVES.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM ELECTRICAL POWER SYSTEM	DC DISTRIBUTION	12-9

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MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
12-52	A. BATTERY BUS SHORTED IS GREATER THAN 5 AMPS		LAUNCH	A.1. CONTINUE MISSION (A) PLACE EDS 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 22 AMPS WILL CAUSE BATTERY BUS VOLTAGE TO BE GREATER THAN OR EQUAL TO MAIN BUS VOLTAGE.
			DOI POWERED DESCENT ALL	2. ENTER NEXT BEST PTP- NO GO FOR PDI RETAIN LM DESCENT STAGE FOR TEI 3. CONTINUE MISSION- NO GO FOR LUNAR STAY 4. ENTER NEXT BEST PTP 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	B. CONTINUE MISSION REMOVE POWER FROM BUS EXCEPT FOR MANEUVERS AND ENTRY	
12-53	BATTERY RELAY BUS SHORTED A. SHORT GREATER THAN 2.0 AMPS		LAUNCH	A.1. CONTINUE MISSION	
			UNDOCKED/ DOI/ POWERED DESCENT ALL	2. CONTINUE MISSION. NO GO FOR LUNAR STAY 3. ENTER NEXT BEST PTP OPEN BATTERY BUS TO BATTERY RELAY BUS CB'S.	A.2. UNDOCKING MAY BE PERFORMED. A.3. REF MALF PROC EPS-SSR-2
	B. SHORT LESS THAN 2.0 AMPS		ALL	B. CONTINUE MISSION	B. PLACE BATTERY A ONLY TO BAT RELAY BUS AND CHARGE BAT B CONTINUOUSLY WITH BAT B POWER ENTRY AND POST LANDING CB OPEN. CONSIDER BATTERY CHARGER LOST FOR MISSION PLANNING. MALF EPS SSR-2

MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	12-54	A. LOSS OF ONE BATTERY BUS, MAIN BUS, (UNABLE TO POWER BUS)	LAUNCH DOI POWERED DESCENT ALL	A.1. CONTINUE MISSION 2. ENTER NEXT BEST PTP- NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI. 3. CONTINUE MISSION- NO GO FOR LUNAR STAY 4. ENTER NEXT BEST PTP				
		B. LOSS OF BATTERY RELAY BUS (UNABLE TO POWER BUS)	LAUNCH UNDOCKED/ DOI/ POWERED DESCENT ALL	B.1. CONTINUE MISSION 2. CONTINUE MISSION NO GO FOR LUNAR STAY 3. ENTER NEXT BEST PTP.	B.2. UNDOCKING MAY BE PERFORMED .			
		RULE NUMBERS 12-55 THROUGH 12-59 ARE						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	A	6/20/69	CSM ELECTRICAL	DC DISTRIBUTION	12-11	

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MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	12-60	LOSS OF TWO INVERTERS	LAUNCH DOI POWERED DESCENT ALL	A. CONTINUE MISSION B. ENTER NEXT BEST PTP- NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI C. CONTINUE MISSION- NO GO FOR LUNAR STAY D. ENTER NEXT BEST PTP	A. REF MALF PROC PLACE REMAINING INVERTER ON BOTH AC BUSES. D. CONSIDERATION WILL BE GIVEN TO RETAINING LM FOR SYSTEM BACKUP.		
	12-61	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 PDI. RETAIN LM DESCENT STAGE FOR TEI C. CONTINUE MISSION- NO GO FOR LUNAR STAY D. ENTER NEXT BEST PTP	D. REF MALF PROC EPS-1		
	12-62	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 MR--- A.2. INITIATE CONTINUOUS FC H2 PURGE FOR COOLING. C.1. USE LM SYSTEMS (IF AVAILABLE) FOR AC POWERED FUNCTIONS TO ENTRY. 2. FOR CSM ONLY, ENTER WITHIN 1-1/2 HOURS. INITIATE CONTINUOUS FC H2 PURGE FOR COOLING.		
		RULE NUMBERS 12-63 THROUGH 12-69 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM ELECTRICAL POWER SYSTEM	AC DISTRIBUTION	12-12

MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM - CONCLUDED

REV	ITEM	----- ' INSTRUMENTATION REQUIREMENTS ' -----					
	12-70	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
		AC BUS 1 PHASE A VAC	CC0200V	METER	SEPARATE	HIGHLY DESIRABLE	12-5,6,61
		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	CC0203V	METER	SEPARATE	HIGHLY DESIRABLE	12-5,6,61
		AC BUS 2 PHASE B VAC	-----	METER	-----	HIGHLY DESIRABLE	
		AC BUS 2 PHASE C VAC	-----	METER	-----	HIGHLY DESIRABLE	
		MAIN BUS A VDC	CC0206V	METER	SEPARATE	1 OF 2	12-32,52,20C
		MAIN BUS B VDC	CC0207V	METER	SEPARATE	MANDATORY	12-22
		BAT BUS A VDC	CC0210V	METER	SEPARATE	HIGHLY DESIRABLE	
		BAT BUS B VDC	CC0211V	METER	SEPARATE	HIGHLY DESIRABLE	
		BAT RELAY BUS VDC	CC0232V	METER	SEPARATE	HIGHLY DESIRABLE	
		BAT A CURRENT	CC0222C	METER	COMMON	2 OF 3 MANDATORY	12-4,33,40,41
		BAT B CURRENT	CC0223C	METER	COMMON		
		BAT C CURRENT	CC0224C	METER	COMMON		
		FC 1 CURRENT	SC2113C	METER	COMMON	1 OF 3 MANDATORY	12-7,31,32,33, 22A
		FC 1 O2 FLO	SC2141R	METER	COMMON		
		FC 1 H2 FLO	SC2139R	METER	COMMON		
		FC 2 CURRENT	SC2114C	METER	COMMON	1 OF 3 MANDATORY	12-7,31,32,33, 22A
		FC 2 O2 FLO	SC2142R	METER	COMMON		
		FC 2 H2 FLO	SC2140R	METER	COMMON		
		FC 3 CURRENT	SC2115C	METER	COMMON	1 OF 3 MANDATORY	12-7,31,32,33, 22A
		FC 3 O2 FLO	SC2144R	METER	COMMON		
		FC 3 H2 FLO	SC2141R	METER	COMMON		
		BAT CHARGER CURRENT	SC0215C	METER	COMMON	HIGHLY DESIRABLE	
		FC 1 SKIN TEMP	SC2084T	METER	COMMON	HIGHLY DESIRABLE	12-22B
		FC 2 SKIN TEMP	SC2085T	METER	COMMON	HIGHLY DESIRABLE	
		FC 3 SKIN TEMP	SC2086T	METER	COMMON	HIGHLY DESIRABLE	
		FC 1 COND TEMP	SC2081T	METER	COMMON	HIGHLY DESIRABLE	12-22B
		FC 2 COND TEMP	SC2082T	METER	COMMON	HIGHLY DESIRABLE	
		FC 3 COND TEMP	SC2083T	METER	COMMON	HIGHLY DESIRABLE	
		FC 1 RAD OUT TEMP	SC2087T	METER	COMMON	HIGHLY DESIRABLE	12-22I
		FC 2 RAD OUT TEMP	SC2088T	METER	COMMON	HIGHLY DESIRABLE	
		FC 3 RAD OUT TEMP	SC2089T	METER	COMMON	HIGHLY DESIRABLE	
		BAT MANIFOLD PRESS	-----	METER	-----	HIGHLY DESIRABLE	-----
		INV 1 TEMP	CC0175T	MCWS	COMMON	HIGHLY DESIRABLE	-----
		INV 2 TEMP	CC0176T	MCWS	COMMON	HIGHLY DESIRABLE	-----
		INV 3 TEMP	CC0177T	MCWS	COMMON	HIGHLY DESIRABLE	-----
		FC 1 PH	SC2160X	TALKBACK	COMMON	HIGHLY DESIRABLE	12-22E
		FC 2 PH	SC2161X	TALKBACK	COMMON	HIGHLY DESIRABLE	
		FC 3 PH	SC2162X	TALKBACK	COMMON	HIGHLY DESIRABLE	
NOTE--- USE BAT C IN LIEU OF BATTERY WITH LOST INST							

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	CSM ELECTRICAL POWER SYSTEM	INSTR REQ	12-13

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MISSION RULES

SECTION 13 - DOCKING AND UMBILICAL

REV	ITEM						
		----- ' GENERAL ' -----					
13-1	THREE GOOD DOCKING RING LATCHES 120 DEG. APART ARE REQUIRED FOR AN IVT.						
	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 FOWARD 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 POLE, TD&E 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						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	B	7/3/69	DOCKING AND UMBILICAL	MANAGEMENT	13-1

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MISSION RULES

SECTION 13 - DOCKING AND UMBILICAL

REV	ITEM							
		<div style="border: 1px dashed black; padding: 2px; display: inline-block;">MANAGEMENT</div>						
13-11	FOR MISFIRE OF A DOCKING RETRACT SQUIB, THE REMAINING SQUIB 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 MODE, CONSIDERATION WILL BE GIVEN TO UNDOCKING WITH ONE NITROGEN BOTTLE REMAINING IN AN OPERABLE SYSTEM.							
13-12	THE CM FORWARD AND LM UPPER HATCH NORMALLY WILL BE INSTALLED FOR ANY TYPE OF MANEUVER OR DOCKING.							
13-13	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---							
	TUNNEL PRESSURE PSIA	COMBINED CM/LM ACTIVE THRUSTERS						
	GREATER THAN 1.5 PSIA	INHIBIT ALL CSM ROLL AND LM YAW CONTROL						
	BETWEEN 0 AND 1.5 PSIA	NO MORE THAN 2 JETTS						
	0 PSIA	NO MORE THAN 4 JETTS						
13-14	LOW PROBE TEMPERATURE WILL NOT INHIBIT DOCKING ATTEMPTS. RULE NUMBERS 13-15 THROUGH 13-19 ARE RESERVED.							
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	B	7/3/69	DOCKING AND UMBILICAL	MANAGEMENT	13-2	

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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 HATCH.	DOCKED	CONTINUE MISSION PERFORM EVT IF LM MANNED	SPS AND SM RCS MANEUVERS MAY BE PERFORMED
	13-26	FAILURE TO RELEASE CAPTURE LATCHES	DOCKED	REDOCK	
	13-27	PRIMARY FORWARD HATCH LOCK/UNLOCK MECHANISM INOPERATIVE	ALL	CONTINUE MISSION	
	13-28	FAILURE TO REINSTALL CSM FORWARD HATCH	TD&E DOCKED	CONTINUE MISSION ENTER IN SUITS	REF BACKUP PROCEDURES
	13-29	FAILURE TO REINSTALL PROBE AND/OR DROGUE OR FAILURE TO CLOSE LM UPPER HATCH	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 GN2 BOTTLE REMAINING IN AN OPERABLE SYSTEM.	

	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	A	6/20/69	DOCKING AND UMBILICAL	SPECIFIC	13-4	

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MISSION RULES

SECTION 14 - CSM SEQUENTIAL

REV	ITEM						
		<div style="border: 1px dashed black; padding: 5px; 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 CD0123X 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					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM SEQUENTIAL	GENERAL	14-1

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MISSION RULES

SECTION 14 - CSM SEQUENTIAL

REV	ITEM							
		<p>----- ' MANAGEMENT ' -----</p>						
	14-10	<p>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.</p>						
		<p>RULE NUMBERS 14-11 THROUGH 14-19 ARE RESERVED</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	CSM SEQUENTIAL	MANAGEMENT	14-2	

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MISSION RULES

SECTION 14 - CSM 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 RCS ENABLE AND/OR SLA SEP RELAYS	LAUNCH EO TLC LUNAR ORBIT/ LUNAR STAY	A. CONTINUE MISSION ENTER 3-1 IF BUS NOT RESTORED B. TERMINATE OPERATIONS ENTER NEXT BEST PTP IF BUS NOT RESTORED C. CONTINUE MISSION	CD0170X AND/OR CD0123X SYSTEM A, CD0171X AND/OR CD0124X SYSTEM B			
	14-21	PYRO BUS A OR B LESS THAN OR EQUAL TO 35 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 35 VDC	LAUNCH EO TLC LUNAR ORBIT/ LUNAR STAY ALL LAUNCH ALL	A.1. CONTINUE MISSION 2. TERMINATE OPERATIONS ENTER NEXT BEST PTP 3. CONTINUE MISSION B. CONTINUE MISSION C.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 BUS B. USE BATTERY TIE FOR PYRO POWER TO AFFECTED BUS C.2. ASSUME PYRO BAT VERIFIED GREATER THAN 35 VDC PRIOR TO ARMING. IF ENTRY BAT USED IN LIEU OF PYRO BAT, VOLTAGE SHOULD BE APPROXIMATELY = TO BAT BUS VOLTAGE.			
			MISSION	REV	DATE	SECTION	GROUP	PAGE
			APOLLO 11	FNL	5/16/69	CSM SEQUENTIAL	SPECIFIC	14-3

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MISSION RULES

SECTION 14 - CSM SEQUENTIAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	14-22	TELEMETRY INDICATES 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 CD0132X, CD0135X, AND CD0134X 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	DOI 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 (FOR BOTH INDICATIONS PERFORM SLA SEP WITH SECS ARM CB'S OPEN.) B. AT CM RCS PRESS---ARM RESPECTIVE PYRO BUS	CD0173X AND/OR CD0174X			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
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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 A. PRIOR TO SLA SEP---DO NOT ARM RESPECTIVE PYRO BUS B. FOR SLA SEP---ARM RESPECTIVE PYRO BUS FIRST	CD0123X AND/OR CD0124X			
	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	ALL	CONTINUE MISSION DO NOT ARM AFFECTED SYSTEM UNTIL SEQ GO/NO-GO PRIOR TO ENTRY UNLESS OTHER PYRO SYSTEM FAILS.	ARMING SYSTEM WITH VOLTAGE GREATER THAN 18 VDC MAY RESULT IN PERMANENT LOSS OF THAT PAM TRAIN.			
		RULE NUMBERS 14-29 THROUGH 14-39 ARE RESERVED.						
	14-40	ACTIVATED APEX JETTISON LOGIC RELAYS	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 (CD0230X AND CD023X)			
	14-41	ACTIVATED DROGUE CHUTE DEPLOY LOGIC RELAYS	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.	MAY BE DETECTED AT ANY TIME (CE0001X AND/OR CE0002X)			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
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MISSION RULES

SECTION 14 - CSM SEQUENTIAL - CONCLUDED

REV	ITEM	----- INSTRUMENTATION REQUIREMENTS -----					
		MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RUL REFERENCE
	14-50	PYRO BUS A VOLTS	CD0005V	----	-----	1 OF	14-21
		PYRO BUS B VOLTS	CD0006V	----	-----	2 M	14-21
		SEQ LOGIC BUS A VOLTS	CD0200V	----	-----	HD	14-20
		SEQ LOGIC BUS B VOLTS	CD0201V	----	-----	HD	14-20
		APEX JET A	CD0230X	----	-----	HD	14-40
		APEX JET B	CD0231X	----	-----	HD	14-40
		DROGUE DEPLOY A	CE0001X	----	-----	HD	14-41
		DROGUE DEPLOY B	CE0002X	----	-----	HD	14-41
		PILOT CHUTE DEPLOY A	CE0003X	----	-----	HD	14-42
		PILOT CHUTE DEPLOY B	CE0004X	----	-----	HD	14-42
		SLA SEP RELAY A	CD0123X	----	-----	HD	14-26
		RCS/SCS ACTIVATE A	CD0170X	----	-----	HD	-----
		SLA SEP RELAY B	CD0124X	----	-----	HD	14-26
		RCS/SCS ACTIVATE B	CD0171X	----	-----	HD	-----
		CM RCS PRESS SIG A	CD0173X	----	-----	HD	14-25
		CM RCS PRESS SIG B	CD0174X	----	-----	HD	14-25
		CM-SM SEP RELAY A	CD0023X	----	-----	HD	-----
		CM-SM SEP RELAY B	CD0024X	----	-----	HD	-----
		CREW ABORT A	CD0130X	----	-----	HD	-----
		CREW ABORT B	CD0131X	----	-----	HD	-----
		EDS ABORT VOTE 1	CD0132X	----	-----	HD	14-22
		EDS ABORT VOTE 2	CD0133X	----	-----	HD	14-22
		EDS ABORT VOTE 3	CD0134X	----	-----	HD	14-22
		EDS ABORT A	CD0135X	----	-----	HD	-----
		EDS ABORT B	CD0136X	----	-----	HD	-----
		MAIN CHUTE DISC A	CE0321X	----	-----	HD	-----
		MAIN CHUTE DISC B	CD0322X	----	-----	HD	-----
		EDS ABORT REQ A	BS0080X	----	-----	HD	-----
		EDS ABORT REQ B	BS0081X	----	-----	HD	-----
		DOCKING PROBE TEMP	CS0220T	----	-----	HD	-----
		CSM-LM LOCK RING	CD1154X	----	-----	HD	19-23
		SEP RELAY A					
		CSM-LM LOCK RING	CD1155X	----	-----	HD	19-23
		SEP RELAY B					
		LM CURRENT	SC2962C	METER	COMMON	HD	-----

MISSION	REV	DATE	SECTION	GROUP	PAGE	
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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM													
1	15-4	<p>LOI, LUNAR ORBIT</p> <p>A. LOI WILL BE INHIBITED OR LUNAR ORBIT TERMINATED EARLY IF EITHER REDUNDANT ATTITUDE CONTROL, REDUNDANT SPS CONTROL OR NON-CRITICAL SPS 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"> 1. ATTITUDE CONTROL---DIRECT RCS AND RATE DAMPING IN EACH AXIS. 2. TVC---BOTH SERVO LOOPS AND TWO TVC CONTROL MODES (ACCEL CMD EXCLUDED). 3. G&N---THE G&N MUST BE FULLY OPERATIONAL WITH THE EXCEPTION OF OPTICS AND NAV DSKY. OPTICS MUST BE CAPABLE OF ALIGNING PLATFORM. 4. RCS TRANSLATION---X-AXIS VIA AUTO COILS OR DIRECT ULLAGE PUSHBUTTON. <p>B. IN ORDER TO PERFORM A NON-CRITICAL BURN THE G&C SYSTEMS MUST PROVIDE THE CAPABILITY TO EXECUTE AN ULLAGE MANEUVER BY EITHER CMC AUTO (RCS DAP), SCS AUTO, OR DIRECT ULLAGE.</p>												
	15-5	<p>UNDOCKED</p> <p>THE UNDOCKED PHASE WILL BE DELETED OR TERMINATED IF THE G&C SYSTEMS CANNOT PROVIDE REDOCKING OR LM RESCUE CAPABILITY. THE G&C 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"> - OPERATIONAL OPTICS SUBSYSTEM - ONE DSKY - TRANSLATION CAPABILITY IN EACH AXIS - RATE DAMPING IN ALL THREE AXES - OPERATIONAL IMU AND CMC - ONE OPERATIONAL RMC - ONE OPERATIONAL FDAI - DIRECT RCS - NON CRITICAL SPS BURN CAPABILITY 												
	15-6	<p>ASCENT, DESCENT---THERE ARE NO GUIDANCE AND CONTROL SYSTEM FAILURES THAT AFFECT THE ASCENT OR DESCENT PHASES.</p>												
	15-7	<p>LUNAR STAY PHASE</p> <p>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 TEI.</p> <ol style="list-style-type: none"> 1. ATTITUDE CONTROL - DIRECT RCS IN TWO AXES AND RATE DAMPING IN TWO AXES. 2. TVC - BOTH SERVO LOOPS AND TWO TVC CONTROL MODES (ACCEL CMD EXCLUDED). 3. G&N - THE G&N MUST BE FULLY OPERATIONAL WITH THE EXCEPTION OF OPTICS AND NAV DSKY. 												
		<p>RULES 15-8 AND 15-9 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>A</td> <td>6/20/69</td> <td>GUIDANCE AND CONTROL</td> <td>GENERAL</td> <td>15-2</td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	A	6/20/69	GUIDANCE AND CONTROL	GENERAL	15-2
MISSION	REV	DATE	SECTION	GROUP	PAGE									
APOLLO 11	A	6/20/69	GUIDANCE AND CONTROL	GENERAL	15-2									

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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM						
		----- ' SYSTEMS MANAGEMENT ' -----					
15-10	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.						
15-11	PIPA AND IRIG BIAS WILL BE UPDATED WHEN ACTUAL BIASES DIFFER FROM VALUES IN CMC ERASABLE BY 0.007 FT/SEC2 AND 0.075 DEG/HR RESPECTIVELY.						
15-12	DELTA V COUNTER DRIFT 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 EMS WILL BE CONSIDERED FAILED.						
15-13	DAP INITIALIZATION GIMBAL TRIMS---WILL BE UPDATED FOR EVERY SPS 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 GEN 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. 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.						
		RULE NUMBERS 15-14 THROUGH 15-19 RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	GUIDANCE AND CONTROL	SYSTEMS MANAGEMENT	15-3

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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
----- <div style="border: 1px dashed black; padding: 5px; display: inline-block;"> SPECIFIC MISSION RULES </div> -----							
	15-20	LOSS OF EITHER BMAG 1 OR 2 IN EITHER PITCH OR YAW CHANNEL	ALL	CONTINUE MISSION	A. REF MALF PROC--- G&C-1,3,4+8 SCS-1,3,3A,+6 B. NO SCS AUTO TVC C. IF IN YAW CHANNEL, AFTER .05G, RSI IS USABLE IF REMAINING GYRO IS SELECTED FOR RATE. RSI MUST BE REALIGNED IN ADDITION TO THE ABOVE, FOR YAW FAILURE AFTER .05G.		
	15-21	LOSS OF BOTH BMAG 1 AND 2 IN EITHER PITCH OR YAW CHANNEL	LAUNCH TLC DESCENT ALL OTHERS ENTRY	A. CONTINUE MISSION B. NO-GO FOR LOI C. CONTINUE MISSION D. TERMINATE PHASE AND ENTER NEXT BEST PTP E. CONTINUE MISSION	A. MTVC ACCEL CMD IS ONLY MODE III OR MODE IV SPS CONTROL MODE. D.1. IN LUNAR ORBIT DO DPS TEI. 2. IF STAGED, RETAIN LM ASCENT STAGE FOR TEI. 3. IN EARTH ORBIT, LOSS OF PITCH CHANNEL RESULTS IN ALL THREE DEORBIT METHODS BEING SUBJECTED TO SINGLE FAILURES IN THE G&N SYSTEM. THE YAW LOSS PRECLUDES HYBRID DEORBIT AND SUBJECTS BOTH REMAINING DEORBIT METHODS TO SINGLE FAILURES IN THE G&N SYSTEM E. RSI AND SCS FDAI ROLL UNUSABLE WITH YAW CHANNEL FAILURES.		
	15-22	LOSS OF ROLL BMAG A. NUMBER ONE B. NUMBER TWO	ALL ALL	A. CONTINUE MISSION B. CONTINUE MISSION	A.1. MANUAL ROLL ATTITUDE CONTROL REQUIRED IN ALL SCS MODES. 2. NO SCS FDAI ROLL. RSI VALID. B.1. USE OF ATT 1/RATE 2 AND LIM CYCLE MAY PROVIDE RATE DAMPED ATTITUDE HOLD WHEN RCS DAP IS NOT USED. GYRO PACKAGE 2 MUST BE POWERED DOWN TO EFFECT ATTITUDE HOLD IF FAILURE IS HARDOVER. 2. SELECTION OF RATE 1 WILL PROVIDE BOTH RSI AND SCS FDAI ROLL FOR ENTRY. RSI MUST BE REALIGNED FOR ROLL FAILURE AFTER .05G.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	GUIDANCE AND CONTROL	SCS	15-4

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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-23	LOSS OF BOTH ROLL BMAG'S	LAUNCH EO TLC ALL OTHERS	A. CONTINUE MISSION B.1. NO GO FOR TLI 2. ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE C. NO-GO FOR LOI D. CONTINUE MISSION	C. NO SCS FDAI ROLL OR RSI AVAILABLE FOR ENTRY.
	15-24	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 GIMBAL DRIVE SWITCH IN APPROPRIATE AXIS B. NO-GO FOR LOI C. CONTINUE MISSION D. TERMINATE PHASE AND ENTER NEXT BEST PTP	- MAINTAIN 20 LBS/QUAD/AXIS FOR HARDOVER RECOVERY FOR UNDOCKED AND --- LBS/QUAD/ AXIS FOR HARDOVER RECOVERY FOR DOCKED SPS MANEUVERS. D. IN LUNAR ORBIT DO DPS TEI.
	15-25	LOSS OF BOTH TVC SERVO LOOPS	LAUNCH EO TLC DESCENT ALL OTHERS	A. CONTINUE MISSION B. ENTER NEXT BEST PTP RCS DEORBIT C. NO-GO FOR LOI D. CONTINUE MISSION E. TERMINATE PHASE AND ENTER NEXT BEST PTP	A.1. REF MALF PROC G6C-1, G6N-4, SCS-A1 2. NO MODE III OR IV CAPABILITY. LIMITED LANDING POINT CONTROL IN MODE III OR IV WITH SM-RCS. E. IN LUNAR ORBIT DO DPS TEI.
	15-26	LOSS OF PROPORTIONAL CONTROL FROM--- A. EITHER RHC B. BOTH RHC'S	ALL ALL	A. CONTINUE MISSION USE REMAINING RHC B. CONTINUE MISSION USE DIRECT RCS OR ACCEL CMD FOR MANUAL MANEUVERS	B. NO MTVC RATE OR MTVC ACCEL CMD CAPABILITY

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	GUIDANCE AND CONTROL	SCS	15-5

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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-27	LOSS OF DIRECT RCS CONTROL FROM---			• REF MALF PROC SCS 5
		A. EITHER RHC, ANY OR ALL AXES	ALL	A. CONTINUE MISSION	
		B. BOTH RHC'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 REQUIREMENT.
		C. BOTH RHC'S, TWO AXES	LUNAR STAY	C. TERMINATE PHASE AND ENTER NEXT BEST PTP.	
	15-28	COMPLETE LOSS OF AUTO ATTITUDE CONTROL IN PITCH AND YAW CHANNELS.			• REF MALF PROC SCS 1 SUSPECTED FAILURE WOULD BE AUTO INHIBIT CIRCUITRY.
		A. CONTROL IS REGAINED BY OPENING EMS CB'S	ALL	A. CONTINUE MISSION AFTER SM 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 ULLAGE AND DIRECT RCS.	C.2. FAILURE VIOLATES RATE DAMPING REQUIREMENTS.
	15-29	LOSS OF FLIGHT DIRECTOR ATTITUDE INDICATORS			• REF MALF PROC G6C-1,2,3,4,5+6
		A. ONE	ALL	A. CONTINUE MISSION	
		B. BOTH	LAUNCH	B.1. CONTINUE MISSION	
			TLC	2. NO-GO FOR LOI	
			DESCENT	3. CONTINUE MISSION	
			LUNAR STAY	4. CONTINUE MISSION	
			ALL OTHERS	5. TERMINATE PHASE AND ENTER NEXT BEST PTP	5. IN LUNAR ORBIT, DO DPS TEI. DO NOT STAGE LM. IF STAGED, RETAIN LM ASCENT STAGE FOR TEI. USE WINDOW REF.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	A	6/20/69	GUIDANCE AND CONTROL	SCS	15-6

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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-30	LOSS OF AC1 PHASE A			<p>- LOSS OF AC1 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. FDAI 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&Y DRIVE NO. 1.</p> <p>• IN EARTH ORBIT, LOSS OF AC1 PRECLUDES HYBRID DEORBIT AND SUBJECTS BOTH REMAINING DEORBIT METHODS TO A SINGLE FAILURE (AC2 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 PTP	D. IN LUNAR ORBIT DO DPS TEI.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	GUIDANCE AND CONTROL	SCS	15-7

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MISSION RULES

SECTION 15-GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	15-31	LOSS OF AC2 PHASE A	LAUNCH TLC DESCENT ALL OTHERS	A. CONTINUE MISSION B. NO-GO FOR LOI C. CONTINUE MISSION D. TERMINATE PHASE AND ENTER NEXT BEST PTP	- LOSS OF AC2 PHASE A RESULTS IN THE LOSS OF--- A. REDUNDANT SERVO LOOP POWER B. ALL PROPORTIONAL CONTROL C. FDAI 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. RSI H. GPI P&Y DRIVE NO. 2 • IN EARTH ORBIT, LOSS OF AC2 RESULTS IN ALL THREE DEORBIT METHODS BEING SUBJECTED TO A SINGLE FAILURE (AC1 PHASE A). D. IN LUNAR ORBIT DO DPS TEI.			
	15-32	LOSS OF ORBIT RATE DISPLAY (ORDEAL) EARTH AND LUNAR	ALL	CONTINUE MISSION	REF MALF PROC G6C-4+5			
	15-33	LOSS OF ENTRY MONITOR SYSTEM	ALL	CONTINUE MISSION	REF MALF PROC EMS-1			
	15-34	GROUND AT EITHER SPS SOL DRIVER OUTPUT AND UNABLE TO REMOVE	ALL	CONTINUE MISSION- OPEN SPS PILOT VALVE CB'S	• REF MALF PROC G6C-1			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	B	7/3/69	GUIDANCE AND CONTROL	SCS	15-8	

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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	15-35	LOSS OF TRANSLATION HAND CONTROLLER	LAUNCH EARTH ORBIT TLC LO UNDOCKED ALL 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 SM AND HYBRID DEORBIT MINIMUM REQUIREMENTS. D. VIOLATES LM RESCUE MINIMUM REQUIREMENTS.		
		RULE NUMBERS 15-36 THROUGH 15-49 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	GUIDANCE AND CONTROL	SCS	15-9

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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	15-54	LOSS OF OPTICS SYBSYSTEM COUPLING DATA UNIT DIGITAL TO ANALOG CONVERTER	LAUNCH EO TLC LO UNDOCKED DESCENT ALL OTHERS	A. CONTINUE MISSION B. CONTINUE ALTERNATE EO MISSION IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE C. NO-GO FOR LOI D. ENTER NEXT BEST PTP E. DOCK F. CONTINUE MISSION G. TERMINATE PHASE AND NEXT BEST PTP	REF MALF PROC G6C-1 CONSTITUTES LOSS OF TVC DAP		
		RULE NUMBERS 15-55 THROUGH 15-59 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	GUIDANCE AND CONTROL	G&N	15-12

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MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL - CONCLUDED

REV	ITEM	----- INSTRUMENTATION REQUIREMENTS -----					
15-60	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE	
	CMC DIGITAL DATA	CG0001V	-	-	MANDATORY	15-50	
	SPS SOL DRIVER 1	CH3604X	EMS-SPS-ON	SEPARATE	HIGHLY DESIRABLE	15-34	
	SPS SOL DRIVER 2	CH3605X	EMS-SPS-ON	SEPARATE	HIGHLY DESIRABLE	15-34	
	PITCH GIMBAL POS 1 & 2	CH3517H	GPI	COMMON	1 OF 2 MANDATORY -OB/HD-PCM	15-24/25	
	YAW GIMBAL POS 1 & 2	CH3518H	GPI	COMMON	1 OF 2 MANDATORY -OB/HD-PCM	15-24/25	
	TM BIAS 2.5 VDC	CG1110V	-	-	HIGHLY DESIRABLE	15-52/53/54	
	PIPA TEMP	CG2300T	-	-	HIGHLY DESIRABLE	15-52	
	IMU HTR +28 VDC	CH1513X	-	-	HIGHLY DESIRABLE	15-52	
	CMC OPERATE +28 VDC	CG1523X	-	-	HIGHLY DESIRABLE	15-50	
	OPTX OPERATE +28 VAC	CG1533X	-	-	HIGHLY DESIRABLE	15-54	
	IG 1X RSVR OUT SIN	CG2112V	FDAI	COMMON	HIGHLY DESIRABLE	15-52	
	IG 1X RSVR OUT COS	CG2113V	FDAI	COMMON	HIGHLY DESIRABLE	15-52	
	MG 1X RSVR OUT SIN	CG2142V	FDAI	COMMON	HIGHLY DESIRABLE	15-52	
	MG 1X RSVR OUT COS	CG2143V	FDAI	COMMON	HIGHLY DESIRABLE	15-52	
	OG 1X RSVR OUT SIN	CG2172V	FDAI	COMMON	HIGHLY DESIRABLE	15-52	
	OG 1X RSVR OUT COS	CG2173V	FDAI	COMMON	HIGHLY DESIRABLE	15-52	
	SHAFT CDU DAC OUT	CG3721V	-	-	HIGHLY DESIRABLE	15-54	
	TRUNNION CDU DAC OUT	CG3722V	-	-	HIGHLY DESIRABLE	15-54	
	CMC WARNING	CG5040X	C&W	COMMON	HIGHLY DESIRABLE	15-50	
	PITCH ATT ERROR	CH3500H	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23	
	YAW ATT ERROR	CH3501H	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23	
	ROLL ATT ERROR	CH3502H	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23	
	SCS PITCH BODY RATE	CH3503R	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23	
	SCS YAW BODY RATE	CH3504R	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23	
	SCS ROLL BODY RATE	CH3505R	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23	
	SCS TVC PITCH AUTO CMD	CH3582V	-	-	HIGHLY DESIRABLE	15-24/25	
	SCS TVC YAW AUTO CMD	CH3583V	-	-	HIGHLY DESIRABLE	15-24/25	
	MTVC PITCH CMD	CH3585H	-	-	HIGHLY DESIRABLE	15-24/25	
	MTVC YAW CMD	CH3586H	-	-	HIGHLY DESIRABLE	15-24/25	
	FDAI ERROR 5, RATE 5	CH3592X	-	-	HIGHLY DESIRABLE	15-20/21/22/23	
	FDAI ERROR 50/15, RATE 50/10	CH3593X	-	-	HIGHLY DESIRABLE	15-20/21/22/23	
	PITCH DIFF CLUTCH CUR	CH3666C	-	-	HIGHLY DESIRABLE	15-24/25	
	YAW DIFF CLUTCH CUR	CH3667C	-	-	HIGHLY DESIRABLE	15-24/25	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	GUIDANCE AND CONTROL	INSTR REQ REQ	15-13

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MISSION RULES

SECTION 16 - CSM SPS

REV	ITEM							
		----- ' GENERAL ' -----						
	16-1	LAUNCH PHASE THERE ARE NO SPS FAILURES THAT ARE CONSIDERED CAUSE FOR ABORT DURING THE LAUNCH PHASE.						
	16-2	REMAINING MISSION PHASES A. FAILURES AFFECTING THE SPS FALL INTO ONE OF THREE CATEGORIES--- 1. FAILURES WHICH CAUSE THE SPS TO BE UNSAFE. FAILURES IN THIS CATEGORY CAUSE THE MISSION TO BE TERMINATED BY ENTRY INTO THE NEXT BEST PTP. 2. FAILURES WHICH CAUSE THE SPS TO BE INOPERABLE OR UNSAFE TO OPERATE. FAILURES IN THIS CATEGORY CAUSE THE MISSION TO BE TERMINATED OR ALTERED SUCH THAT SUBSEQUENT SPS MANEUVERS ARE NOT NECESSARY. 3. FAILURES WHICH DEGRADE THE CAPABILITY OF THE SPS TO A DEGREE THAT REQUIRES THAT ALL PLANNED BURNS EXCEPT CRITICAL BURNS BE INHIBITED. FAILURES IN THIS CATEGORY CAUSE THE MISSION TO BE ALTERED SUCH THAT SUBSEQUENT SPS MANEUVERS ARE NOT NECESSARY, IF POSSIBLE. B. WITH STORAGE TANKS EMPTY, EITHER A TWO-JET OR FOUR-JET ULLAGE MANEUVER IS REQUIRED PRIOR TO ALL NON-CRITICAL BURNS. LACK OF CAPABILITY TO PERFORM AN ULLAGE MANEUVER WILL NOT BE CAUSE FOR INHIBITING A CRITICAL BURN. C. SPS ANOMALIES OR DEGRADATIONS ARE NOT CAUSE FOR TERMINATING A CRITICAL BURN. NON-CRITICAL BURNS WILL BE TERMINATED FOR SPS ANOMALIES OR DEGRADATIONS WHICH CAUSE OR COULD LEAD TO UNSAFE CONDITIONS.						
	16-3	EARTH ORBIT PHASE A. CRITICAL BURNS IN THIS PHASE ARE MODE IV, 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 SMRCS OR HYBRID TECHNIQUES. B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL BURNS, TLI WILL BE INHIBITED AND A SUITABLE EARTH ORBIT ALTERNATE MISSION WILL BE IMPLEMENTED. THE SPS MAY BE USED FOR DEORBIT ONLY. 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.						
	16-4	TRANSLUNAR COAST PHASE 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. B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL MANEUVERS, FURTHER NON-CRITICAL BURNS AND LOI WILL BE INHIBITED. 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.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	CSM SPS	GENERAL	16-1	

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MISSION RULES
SECTION 16 - CSM SPS

REV	ITEM							
16-5	LUNAR ORBIT PHASE	<p>A. TEI IS THE ONLY CRITICAL BURN IN THIS PHASE.</p> <p>B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL BURNS, FURTHER NON-CRITICAL BURNS WILL BE INHIBITED.</p> <p>C. LM DPS MAY BE USED FOR TEI IF THE CAPABILITY EXISTS.</p>						
16-6	DESCENT PHASE	<p>THE LM POWERED DESCENT WILL BE ABORTED FOR SPS PROPELLANT LEAKS BECAUSE THE CAPABILITY TO PERFORM TEI IS DECREASING WITH TIME.</p>						
16-7	UNDOCKED AND LUNAR STAY PHASES	<p>A. THE LUNAR ORBIT PLANE CHANGE IS A CRITICAL BURN IF OUTSIDE TOTAL LM CAPABILITY.</p> <p>B. THESE PHASES WILL BE TERMINATED FOR CONFIRMED LOSS OF SPS REDUNDANCY.</p>						
16-8	ASCENT PHASE	<p>LM RESCUE BURNS MAY BE REQUIRED, AND THEY ARE CRITICAL.</p>						
16-9	TRANSEARTH COAST PHASE	<p>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.</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	CSM SPS	GENERAL	16-2	

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MISSION RULES
SECTION 16 - CSM SPS

REV	ITEM	MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	B	7/3/69	CSM SPS	MANAGEMENT	16-3
		<p>----- ' SYSTEMS MANAGEMENT ' -----</p>					
	16-10	<p>PROPELLANT GAGING</p> <p>A. PRIME METHOD---ONBOARD GAGING SYSTEM(1 PERCENT).</p> <p>B. BACKUP METHOD---FLOW RATE X BURN TIME (3 PERCENT).</p>					
	16-11	<p>PROPELLANT UTILIZATION VALVE</p> <p>THE PU VALVE WILL BE USED TO CONTROL THE O/F MIXTURE RATIO TO MAINTAIN OXIDIZER UNBALANCE WITHIN +- 100 POUNDS. (THE UNBALANCE METER SHOULD BE DISREGARDED UNTIL 25 SECONDS AFTER IGNITION.)</p>					
	16-12	<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>					
	16-13	<p>PROPELLANT MANAGEMENT</p> <p>A. THE SPS PROPELLANT REDLINE PRE LOI TO PROVIDE CAPABILITY FOR LOI, CIRCULARIZATION, LOPC TEI AND TEMC FOR THE NOMINAL MISSION IS 89.5 PERCENT INDICATED PROPELLANT REMAINING.</p> <p>B. THE SPS PROPELLANT REDLINE PREUNDOCKING TO PROVIDE CAPABILITY FOR LM RESCUE, TEI AND TEMC FOR THE NOMINAL MISSION IS 29.5 PERCENT INDICATED PROPELLANT REMAINING.</p>					
	16-14	<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>					
	16-15	<p>ULLAGE MANAGEMENT</p> <p>IN GENERAL, SPS BURNS REQUIRING ULLAGE WILL BE PRECEDED BY A TWO -JET ULLAGE.</p> <p>RULE NUMBERS 16-16 THROUGH 16-19 ARE RESERVED.</p>					

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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: 2px;"> SPECIFIC MISSION RULES </div>				
	16-20	SUSTAINED PRESSURE DECAY IN EITHER THE FUEL OR OXIDIZER TANK (COULD BE HELIUM OR FUEL OR OXIDIZER)	LAUNCH	CONTINUE MISSION	<ul style="list-style-type: none"> MALF PROC--- SPS 1B MANUAL PRESSURIZATION OF THE TANKS SHOULD BE CONSIDERED PRIOR TO ANY REQUIRED SPS BURN. 			
			EO	ENTER NEXT BEST PTP RCS DEORBIT				
			TLC	NO-GO FOR LOI INHIBIT NON-CRITICAL SPS BURNS				
			LO	PLAN TEI ASAP USE LM DPS IF CAPABILITY EXISTS				
			UNDOCKED	DOCK ASAP	DO NOT STAGE LM			
			DESCENT	ABORT, RETURN TO CSM				
			LUNAR STAY	RETURN TO CSM ASAP				
			TEC	CONTINUE MISSION INHIBIT NON-CRITICAL BURNS				
		A. DURING NON-CRITICAL BURN	ALL	A. TERMINATE BURN				
		B. DURING CRITICAL BURN	ALL	B. CONTINUE BURN				
	16-21	LOSS OF ONE GN2 TANK PRESSURE (LESS THAN 400 PSIA)	UNDOCKED LUNAR STAY	A.1. REDOCK 2. PERFORM MANEUVER ON SUSPECTED SYSTEM. REF FMR 16-22	<ul style="list-style-type: none"> MALF PROC--- SPS 9 TRANSDUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION. 			
			ALL OTHERS	B. CONTINUE MISSION				
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	CSM SPS	SPECIFIC	16-4	

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MISSION RULES

SECTION 16 - CSM SPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/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	MALF PROC SPS-9			
	16-23	LOSS OF BOTH GN2 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	<ul style="list-style-type: none"> MALF PROC--- SPS 9 TRANSUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION. DO NOT STAGE LM 			
	16-24	FUEL FEEDLINE AND/OR OXIDIZER FEEDLINE TEMP LESS THAN 40 DEG F. 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	<ul style="list-style-type: none"> MALF PROC--- SPS 11 LIMITATION FOR CRITICAL BURNS IS 25 DEG F. DO NOT STAGE LM 			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	CSM SPS	SPECIFIC	16-5	

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MISSION RULES

SECTION 16 - CSM SPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	16-25	ENGINE FLANGE TEMP GOES HIGHER THAN 480 DEG F DURING AN SPS BURN.			• MALF PROC--- SPS 5
			LAUNCH	NOT APPLICABLE	
			EO	ENTER NEXT BEST PTP RCS DEORBIT	
			LO	ENTER NEXT BEST PTP, USE DPS 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	
	16-26	THRUST CHAMBER PRESSURE LESS THAN 70 PSI CONFIRMED BY OTHER INSTRUMENTATION			• MALF PROC--- SPS 6
			LAUNCH	NOT APPLICABLE	
			EO	ENTER NEXT BEST PTP - RCS DEORBIT	• CONFIRMING INSTRUMENTATION INCLUDES ONBOARD PC METER, CREW, DEGRADED THRUST, FU AND OX INTERFACE PRESSURES, F/O VALVE POSITIONS, FU AND OX TANK PRESSURES.
			LO	ENTER NEXT BEST PTP, USE LM DPS 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	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	CSM SPS	SPECIFIC	16-6

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MISSION RULES

SECTION 16 - CSM SPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	16-27	LACK OF ULLAGE CAPABILITY	LAUNCH	A. NOT APPLICABLE	MALF PROC--- SM RCS ---			
			EO	B. NO-GO FOR TLI CONTINUE MISSION IN EO WITH SUITABLE ALTERNATE				
			TLC	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	MALF PROC--- SPS 1C			
			EO	ENTER NEXT BEST PTP RCS DEORBIT				
			TLC	NO-GO FOR LOI				
			LO	PLAN TEI ASAP WITH LM DPS				
			UNDOCKED	DO NOT STAGE LM DOCK ASAP				
			ALL	RETURN TO CSM OR ATTEMPT CSM RESCUE CONTINUE MISSION				
		A. DURING NON-CRITICAL BURN	OTHERS	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 11	FNL	5/16/69	CSM SPS	SPECIFIC	16-7	

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MISSION RULES
SECTION 16 - CSM SPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	16-29	LEAK OR COMPLETE LOSS OF HELIUM SUPPLY PRESSURE OR BOTH HELIUM VALVES FAIL CLOSED.	LAUNCH EO TLC LO UNDOCKED ALL OTHERS	A. CONTINUE MISSION B. NO-GO FOR TLI CONTINUE MISSION IN EO IF SUFFICIENT ULLAGE BLOWDOWN DELTA V CAPABILITY EXISTS C. NO-GO FOR LOI D. NO-GO FOR UNDOCKING E. DOCK ASAP F. CONTINUE MISSION	<ul style="list-style-type: none"> BLOWDOWN DELTA V REMAINING IS A FUNCTION OF ULLAGE VOLUME AT TIME OF FAILURE. <p>MALF PROC--- SPS 7&8</p> <p>E. NORMAL MISSION PRECLUDES LM RESCUE</p>		
		RULE NUMBERS 16-30 THROUGH 16-49 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM SPS	SPECIFIC	16-8

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MISSION RULES

SECTION 16 - CSM SPS - CONCLUDED

REV	ITEM	----- INSTRUMENTATION REQUIREMENTS -----					
	16-50	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
		OX TK PRESS	SP0003P	METER/C&W	COMMON	M O/B	16-20, 28
		OX SM/ENG INTERFACE P	SP0931P	-	-	HD	16-20,29
		FU TK PRESS	SP0006P	METER/C&W	COMMON	M O/B	16-20, 28
		FU SM/ENG INTERFACE P	SP0930P	-	-	HD	16-20, 28
		SPS VLV ACT PRESS-PRI	SP0600P	METER	COMMON		16-21, 22
		SPS VLV ACT PRESS-SEC	SP0601P	METER	COMMON	-1 OF 2 M O/B	16-21, 22
		SPS FU FEEDLINE TEMP	SP0048T	METER	COMMON		16-24
		SPS OX FEEDLINE TEMP	SP0049T	SYS TEST	COMMON	-1 OF 2 M	
		SPS INJ FLANGE TEMP 1	SP0061T	C&W	COMMON		16-25
		SPS INJ FLANGE TEMP 2	SP0062T	C&W	COMMON	-1 OF 2 M O/B	
		ENG CHAMBER PRESS	SP0661P	METER	COMMON	M O/B	16-26
		HE TK PRESS	SP0001P	METER	SEPARATE	HD	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	SP0655Q	DISPLAY	COMMON	HD	16-10, 11, 13
		OX TK 2 QTY	SP0656Q	DISPLAY	COMMON	HD	16-10, 11, 13
		FU TK 1 QTY - TOTAL AUX	SP0657Q	DISPLAY	COMMON	HD	16-10, 11, 13
		FU TK 2 QTY	SP0658Q	DISPLAY	COMMON	HD	16-10, 11, 13

	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	FNL	5/16/69	CSM SPS	INSTR REQ	16-9	

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MISSION RULES

SECTION 17 - CSM SM-RCS

REV	ITEM						
		----- ' SYSTEMS MANAGEMENT ' -----					
	17-15	PROPELLANT GAGING A. PRIME METHOD---RTCC EQUATION (6 PERCENT). B. BACKUP METHOD---HELIUM PRESSURE/TEMPERATURE (11 PERCENT) (ONBOARD)					
	17-16	QUAD PROPELLANT BALANCE PROP ISOLATION VALVES WILL NOT BE USED FOR QUAD PROPELLANT BALANCE. PROPELLANT BALANCE WILL BE ACCOMPLISHED BY SELECTING TWO-JET +X AND -X TRANSLATIONS WITH EITHER THE PITCH OR YAW QUAD AND BY CHOOSING SUITABLE JETS FOR ATTITUDE CONTROL. PROPELLANT DIFFERENCES BETWEEN QUADS WILL BE MAINTAINED WITHIN +- 50 POUNDS.					
	17-17	SECONDARY PROPELLANT FUEL PRESSURE VALVE THE RCS SECONDARY FUEL PRESSURIZATION VALVE WILL BE OPENED WHEN THE PRIMARY FUEL MANIFOLD PRESSURE REACHES 150 PSIA. RULE NUMBERS 17-18 THROUGH 17-19 ARE RESERVED.					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	FNL	5/16/69	CSM SM-RCS	MANAGEMENT	17-2	

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MISSION RULES

SECTION 17 - CSM SM-RCS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	17-21	SUSTAINED LEAK BELOW HE ISOLATION VALVE (COULD BE HELIUM OR FUEL OR OXIDIZER)			• MALF PROC--- RCS 1C • QUAD WILL REMAIN USABLE UNTIL HE MANIFOLD PRESSURE REACHES 75 PSI.		
		A. ONE OR MORE QUADS	LAUNCH	A. CONTINUE MISSION			
		B. ONE QUAD (ALL OTHER QUADS NORMAL)	EO	B.1. NO-GO FOR TLI			
			TLC	2.(A) NO GO FOR LOI (B) ENTER NEXT BEST PTP IF LM NOT AVAILABLE			
			LO	3. NO GO FOR UNDOCKING			
			UNDOCKED	4. DOCK ASAP			
			DESCENT	5. CONTINUE MISSION			
			LUNAR STAY	6. CONTINUE MISSION			
		C. MORE THAN ONE	DESCENT	C.1. CONTINUE MISSION			
		ALL OTHER		2. TERMINATE PHASE AND ENTER NEXT BEST PTP.	C.2.(A) IN LUNAR ORBIT DO DPS TEI. (B) RETAIN LM ASCENT STAGE FOR TEI DEPENDING UPON LM APS/ RCS PROPELLANT REMAINING.		
	17-22	PACKAGE TEMP LESS THAN 55 DEG F. AND UNABLE TO INCREASE	LAUNCH	NOT APPLICABLE	• MALF PROC--- RCS 1A		
		A. ONE QUAD (ALL OTHER QUADS NORMAL)	EO	A.1. NO-GO FOR TLI			
			TLC	2.(A) NO GO FOR LOI (B) ENTER NEXT BEST PTP IF LM NOT AVAILABLE			
			LO	3. NO GO FOR UNDOCKING			
			UNDOCKED	4. DOCK ASAP			
			DESCENT	5. CONTINUE MISSION			
			LUNAR STAY	6. CONTINUE MISSION			
		B. MORE THAN ONE QUAD	DESCENT	B.1. CONTINUE MISSION			
		ALL OTHER		2. TERMINATE PHASE AND ENTER NEXT BEST PTP.	B.2.(A) IN LUNAR ORBIT DO DPS TEI (B) RETAIN LM ASCENT STAGE FOR TEI DEPENDING UPON LM APS/ RCS PROPELLANT.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	CSM SM-RCS	SPECIFIC	17-4

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MISSION RULES

SECTION 17 - CSM SM-RCS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	17-23	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. LOSS OF FOLLOWING THRUSTER COMBINATIONS---	EO	B.1. CONTINUE ALTERNATE EO MISSION	
		TWO PITCH OR TWO YAW,		IF BOTH SPS AND SM RCS DEORBIT CAPABILITY AND ALL AXIS ATTITUDE CONTROL AVAILABLE	
		ONE PITCH AND ONE YAW,			
		PITCH AND TWO ROLL IN SAME DIRECTION,	TLC	2. NO-GO FOR LOI 3. PLAN TEI FOR NEXT OPPORTUNITY	
		ONE YAW AND TWO ROLL IN SAME	TLC UNDOCKED	4. DOCK ASAP	
		THREE ROLL IN SAME DIRECTION	DESCENT LUNAR STAY	5. CONTINUE MISSION 6. ENTER NEXT BEST PTP	
		C. LOSS OF +X THRUSTERS ON ADJACENT QUADS.	ALL	C. INHIBIT NON-CRITICAL SPS BURNS	B.5. RETAIN LM ASCENT STAGE FOR TEI IF LOSS OF ALL THRUSTERS IN ONE DIRECTION IN SAME AXIS C. REF SPS RULE 16-27, LACK OF ULLAGE CAPABILITY
		RULE 17-24 THROUGH 17-49 ARE RESERVED.			

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	CSM SM-RCS	SPECIFIC	17-5

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MISSION RULES

SECTION 17 - CSM SM-RCS - CONCLUDED

REV	ITEM	INSTRUMENTATION REQUIREMENTS					
17-50	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE	
	SM HE TK A PRESS	SR5001P	METER	COMMON		17-20, 21	
	QTY SM-RCS PROP SYS A	SR5025Q	METER	COMMON	-1 OF 2 M	17-20, 21	
	SM HE TK B PRESS	SR5002P	METER	COMMON		17-20, 21	
	QTY SM-RCS PROP SYS B	SR5026Q	METER	COMMON	-1 OF 2 M	17-20, 21	
	SM HE TK C PRESS	SR5003P	METER	COMMON		17-20, 21	
	QTY SM-RCS PROP SYS C	SR5027Q	METER	COMMON	-1 OF 2 M	17-20, 21	
	SM HE TK D PRESS	SR5004P	METER	COMMON		17-20, 21	
	QTY SM-RCS PROP SYS D	SR5028Q	METER	COMMON	-1 OF 2 M	17-20, 21	
	SM ENG PKG A TEMP	SR5065T	METER/C&W	COMMON	HD	17-22	
	SM ENG PKG B TEMP	SR5066T	METER/C&W	COMMON	HD	17-22	
	SM ENG PKG C TEMP	SR5067T	METER/C&W	COMMON	HD	17-22	
	SM ENG PKG D TEMP	SR5068T	METER/C&W	COMMON	HD	17-22	
	SM HE TK A TEMP	SR5013T	METER	COMMON	HD	17-20, 21	
	SM HE TK B TEMP	SR5014T	METER	COMMON	HD	17-20, 21	
	SM HE TK C TEMP	SR5015T	METER	COMMON	HD	17-20, 21	
	SM HE TK D TEMP	SR5016T	METER	COMMON	HD	17-20, 21	
	SM HE MAN A PRESS	SR5729P	-----	-----	HD	17-20, 21	
	SM HE MAN B PRESS	SR5776P	-----	-----	HD	17-20, 21	
	SM HE MAN C PRESS	SR5817P	-----	-----	HD	17-20, 21	
	SM HE MAN D PRESS	SR5830P	-----	-----	HD	17-20, 21	
	SM FU MAN A PRESS	SR5737P	METER/C&W	COMMON	HD	17-12, 21	
	SM FU MAN B PRESS	SR5784P	METER/C&W	COMMON	HD	17-12, 21	
	SM FU MAN C PRESS	SR5822P	METER/C&W	COMMON	HD	17-12, 21	
	SM FU MAN D PRESS	SR5823P	METER/C&W	COMMON	HD	17-12, 21	
	SM OX MAN A PRESS	SR5733P	-----	-----	HD	17-21	
	SM OX MAN B PRESS	SR5780P	-----	-----	HD	17-21	
	SM OX MAN C PRESS	SR5820P	-----	-----	HD	17-21	
	SM OX MAN D PRESS	SR5821P	-----	-----	HD	17-21	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	CSM SM-RCS	INSTR REQ	17-6

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MISSION RULES

SECTION 18 - CSM CM-RCS

REV	ITEM						
		----- ' GENERAL ' -----					
18-1	LAUNCH	<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 ATTITUDE CONTROL. THIS FAILURE WILL REQUIRE ENTRY INTO PTP 6-4 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 TOWER JETTISON IS JUSTIFICATION FOR A MODE I ABORT. AFTER TOWER 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 SM 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	LUNAR ORBIT, LUNAR STAY PHASES	<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	LM DESCENT PHASE	<p>THERE ARE NO CSM RCS FAILURES THAT ARE CAUSE FOR TERMINATING THE DESCENT PHASE.</p>					
18-4	ALL OTHER PHASES	<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 ATTITUDE CONTROL SYSTEM AND REDUCES THE DELTA V AVAILABLE FOR HYBRID DEORBIT. LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE IN BOTH CM RCS RINGS DELETES ALL ENTRY ATTITUDE CONTROL CAPABILITY REQUIRING CONTINGENCY SM 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>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM CM-RCS	GENERAL	18-1

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MISSION RULES

SECTION 18 - CSM CM-RCS

REV	ITEM						
		----- ' SYSTEMS MANAGEMENT ' -----					
	18-10	THRUSTER TEMP CONTROL	CM RCS THRUSTERS WILL BE HEATED PRIOR TO ENTRY FOR 20 MINUTES OR UNTIL THE LOWEST INDICATED TEMPERATURE IS 28 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. MALF PROC RCS 5.				
	18-11	HELIUM INTERCONNECT	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. MALF PROC RCS 4. RULE NUMBERS 18-12 THROUGH 18-19 ARE RESERVED.				
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM CM-RCS	MANAGEMENT	18-2

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MISSION RULES

SECTION 18 - CSM CM-RCS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	18-22	CM RCS IS ARMED FOR ANY REASON	LO/ DESCENT/ LUNAR STAY ALL OTHERS	CONTINUE MISSION TERMINATE PHASE AND ENTER NEXT BEST PTP			
		RULE NUMBERS 18-23 THROUGH 18-49 ARE RESERVED.					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	FNL	5/16/69	CSM CM-RCS	SPECIFIC	18-4	

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MISSION RULES

SECTION 18 - CSM CM-RCS - CONCLUDED

REV	ITEM	----- ' INSTRUMENTATION REQUIREMENTS ' -----					
18-50	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE	
	CM HE TK A PRESS	CR0001P	METER	COMMON	M	18-20	
	CM HE TK B PRESS	CR0002P	METER	COMMON	M	18-20	
	CM TK A TEMP	CR0003P	METER	COMMON	HD	18-20	
	CM TK B TEMP	CR0004P	METER	COMMON	HD	18-20	
	CM HE MNFLD A PRESS	CR0035P	METER/C&W	SEPARATE	M	18-21	
	CM HE MNFLD B PRESS	CR0036P	METER/C&W	SEPARATE	M	18-21	
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	CSM CM-RCS	INSTR REQ	18-5

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MISSION RULES

SECTION 19 - EMU/EVA -

REV	ITEM															
		<p>----- ! GENERAL ! -----</p>														
	19-1	<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/RNDZ</p> <p>ANY COMBINATION OF TWO OPS AND/OR PLSS UNITS SATISFYING THE FOLLOWING---</p> <ol style="list-style-type: none"> 1. OPS SOURCE PRESSURE 2. SUFFICIENT O2 CONSUMABLES (PLSS H2O, LIOH AND BATTERY ARE NOT CHECKED PRIOR TO UNDOCKING) TO SUPPORT A 30 MINUTE CONTINGENCY EVA (CEVA) <p>B. EVA</p> <ol style="list-style-type: none"> 1. CRITICAL INSTRUMENTATION 2. LCG/LTL COOLING 3. EMU PRESSURE INTEGRITY 4. PLSS O2 PRESSURE REGULATOR 5. PLSS FAN 6. PLSS BATTERY 7. OPS O2 PRESSURE REGULATOR 8. SUFFICIENT PLSS CONSUMABLES TO SUPPORT CHECKOUT, PLANNED EVA (2+40) AND A 30 MINUTE POST-EVA RESERVE. 9. SUFFICIENT OPS CONSUMABLES TO SUPPORT 30 MINUTE PURGE OPERATIONS. 														
	19-2	<p>DEFINITIONS</p> <p>LOSS OF EMU PRESSURE INTEGRITY</p> <ol style="list-style-type: none"> 1. UNABLE TO MEET 0.3 PSI/MIN PRESSURE DECAY CRITERIA DURING EMU PRESSURE INTEGRITY CHECK. 2. EMU REGULATED PRESSURE LESS THAN 3.75 PSID (TM) AND DECREASING ON LUNAR SURFACE WHICH REPRESENTS AN O2 USAGE RATE GREATER THAN 0.7 LBS/HR <p>LOSS OF PRIMARY OXYGEN SUB-SYSTEM (POS) OXYGEN SUPPLY</p> <ol style="list-style-type: none"> 1. SOURCE PRESSURE LESS THAN 152 PSIA 2. UNABLE TO SUPPLY OXYGEN TO OXYGEN VENTILATION LOOP <p>LOSS OF PLSS BATTERY</p> <ol style="list-style-type: none"> 1. PLSS BATTERY VOLTAGE LESS THAN 16.0 VDC AND DECREASING 2. PLSS BATTERY CURRENT DRAIN GREATER THAN 3.5 AMPS AND INCREASING (DOES NOT INCLUDE CHECKOUT) <p>LOSS OF LIQUID COOLING GARMENT/LIQUID TRANSPORT LOOP (LCG/LTL) THERMAL CONTROL</p> <ol style="list-style-type: none"> 1. LOSS OF LCG/LTL CIRCULATION (FLOW RATE LESS THAN 3.5 LBS/MIN AND DECREASING) 2. LCG H2O INLET TEMPERATURE OF 50 DEG F AND INCREASING AND LCG H2O DELTA T LESS THAN 5 DEG F AND DECREASING WITH DIVERTER VALVE IN 'MAX' POSITION (THIS CONSTITUTES A FAILED SUBLIMATOR) 														
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">MISSION</th> <th style="width: 5%;">REV</th> <th style="width: 10%;">DATE</th> <th style="width: 20%;">SECTION</th> <th style="width: 15%;">GROUP</th> <th style="width: 10%;">PAGE</th> <th style="width: 15%;"></th> </tr> </thead> <tbody> <tr> <td>APOLLO 11</td> <td>B</td> <td>7/3/69</td> <td>EMU/EVA</td> <td>GENERAL/ MANAGEMENT</td> <td>19-1</td> <td></td> </tr> </tbody> </table>	MISSION	REV	DATE	SECTION	GROUP	PAGE		APOLLO 11	B	7/3/69	EMU/EVA	GENERAL/ MANAGEMENT	19-1	
MISSION	REV	DATE	SECTION	GROUP	PAGE											
APOLLO 11	B	7/3/69	EMU/EVA	GENERAL/ MANAGEMENT	19-1											

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MISSION RULES

SECTION 19 - EMU/EVA -

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
				<div style="border: 1px dashed black; padding: 2px;"> SPECIFIC </div>				
	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 DEHUMIDIFICATION 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 THRU 19-29 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	EMU/EVA	SPECIFIC	19-3	

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MISSION RULES

SECTION 19 - EMU/EVA -

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	19-30	LOSS OF LCG/LTL	EVA	TERMINATE EVA IMMEDIATELY 1. IF ADDITIONAL COOLING IS REQUIRED, ACTIVATE OPS AND OPEN PGA PURGE VALVE	REF MALF EMU		
	19-31	FEED H2O PRESSURE LESS THAN 2.5 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 PLSS 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 THRU 19-40 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	EMU/EVA	SPECIFIC	19-4

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MISSION RULES

SECTION 19 - EMU/EVA - CONCLUDED

REV	ITEM	----- ' INSTRUMENTATION REQUIREMENTS ' -----						
19-41	MEAS DESCRIPTION	PAM FM/FM	ONBOARD	TRANSDUCERS	CATAGORY	MISSION RULE REFERENCE		
	FEED H2O PRESS	GT8110P/GT8210P		COMMON	HD			
	LOW FEED H2O PRESS		FLAG ANNUNCIATOR		M			
	PLSS EKG	GT8124J/GT8224J			*			
	PLSS BAT CUR	GT8140C/GT8240C			HD			
	PLSS BAT VOLT	GT8141V/GT8241V			HD			
	LCG H2O TEMP	GT8154T/GT8254T			HD			
	PGA PRESS	GT8168P/GT8268P			HD			
	PGA PRESS GAGE		METER		M			
	LOW PGA PRESS		FLAG ANNUNCIATOR		M			
	SUBL O2 OUT TEMP	GT8170T/GT8270T			HD			
	PLSS O2 PRESS	GT8182P/GT8282P		COMMON	HD			
	PLSS O2 QTY IND		METER		M			
	HIGH O2 FLOW		FLAG ANNUNCIATOR		M			
	LOW VENT FLOW		FLAG ANNUNCIATOR		M			
	LCG H2O DELTA T	GT8196T/GT8296T			HD			
	OPS PRESS GAGE		METER		M			
	OPS REG PRESS GAGE		METER		**M			
	EVC SYNC	GT8100X/GT8200X			M			
	EVC CAL 0 VDC	GT8101V/GT8201V			HD			
	EVC CAL 5 VDC	GT8102V/GT8202V			HD			
	* AEROMEDICAL PARAMETER REFERENCE SECTION 31.							
	**1 OF 2 OPS REG PRESS GAGES IS MANDATORY.							
19-42	CRITICAL INSTRUMENTATION							
	MEAS DESCRIPTION	PAM FM/FM	ONBOARD	TRANSDUCER				
	PLSS O2 PRESS/PLSSO2 QTY IND	GT8182P/ GT8282P	METER	COMMON				
	PGA PRESS GAGE/LOW PGA PRESS FLAG ANNUNCIATOR/PGA PRESS	GT8168P/ GT8268P	METER/TONE- FLAG					
	LOW VENT FLOW FLAG ANNUNCIATOR		TONE-FLAG					
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	A	6/20/69	EMU/EVA	PRELAUNCH INSTR	19-5	

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM							
		----- ' GENERAL ' -----						
20-1		A. BASELINE REQUIREMENTS (ALL PHASES EXCEPT LAUNCH) 1. TWO-WAY VOICE COMM BETWEEN SPACECRAFT. 2. TWO-WAY VOICE COMM BETWEEN CSM OR LM AND MSFN DURING ALL DOCKED ACTIVITIES AND BETWEEN BOTH SPACECRAFT AND MSFN DURING UNDOCKED ACTIVITIES. B. LAUNCH THERE ARE NO COMMUNICATIONS FAILURES FOR WHICH THE LAUNCH/ INSERTION PHASE WILL BE TERMINATED. C. POWERED DESCENT ADDITIONAL REQUIREMENTS. LM VOICE REQUIRED TILL LO GATE. THERE ARE NO CSM COMMUNICATIONS SYSTEMS FAILURES FOR WHICH LM POWERED DESCENT WILL BE TERMINATED. D. LUNAR STAY ADDITIONAL REQUIREMENTS. 1. FOR TWO-MAN EVA---VOICE COMM BETWEEN MSFN AND ONE EVA. 2. FOR ONE-MAN EVA---VOICE COMM BETWEEN MSFN AND LM OR EVA PLUS DUPLEX VOICE BETWEEN THE LM AND EVA CREWMAN. 3. DUPLEX VOICE COMM BETWEEN BOTH EVA CREWMEN.						
20-2		VHF EVA COMMUNICATIONS PRIORITIES ARE--- A. TWO-MAN EVA 1. PRIME---EVA-1 AR/EVA-2 AR (RELAY MODE-ALLOWS DUPLEX VOICE BETWEEN EVA'S PLUS THE TRANSMISSION OF VOICE AND DATA FROM BOTH EVA'S TO LM, PLUS THE RECEPTION OF LM VOICE BY BOTH EVA'S) 2. BACKUP---EVA-1 AR/EVA-2B OR EVA-1 A/EVA-2B OR EVA-1 B/EVA-2A (EITHER MODE COMBINATION ALLOWS DUPLEX VOICE BETWEEN EVA'S PLUS THE TRANSMISSION OF VOICE FROM BOTH THE EVA'S TO THE LM PLUS THE TRANSMISSION OF DATA FROM ONE EVA TO THE LM AND THE RECEIVING OF LM VOICE BY ONE EVA.) B. ONE-MAN EVA 1. PRIME---EVA-1A OR EVA-2A (ALLOW DUPLEX VOICE BETWEEN EVA AND THE LM PLUS THE TRANSMISSION OF DATA FROM EVA TO LM) 2. BACKUP---EVA-1B OR EVA-2B (ALLOWS DUPLEX VOICE BETWEEN EVA AND LM)						
		RULES 20-3 THROUGH 20-6 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	COMM & INST	FUNCTIONAL COMM-GENERAL	20-1	

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
				----- SPECIFIC -----			
	20-13	LOSS OF TWO-WAY VHF VOICE COMM BETWEEN SPACECRAFT	DOCKED UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY	DO NOT UNDOCK DOCK ASAP NO GO FOR DOI CONTINUE MISSION CONTINUE MISSION CONTINUE MISSION NO GO FOR EVA IF DUPLEX OR SIMPLEX VOICE BETWEEN LM/EVA NOT AVAILABLE.	REF MAL PROC COMM--- 3 LOSS OF VHF VOICE COMM WITH CSM		
	20-14	LOSS OF TWO-WAY VOICE COMM WITH MSFN A. CSM ONLY B. LM ONLY	LAUNCH EARTH ORBIT TLC DOI/POWERED DESCENT LUNAR STAY DOCKED UNDOCKED DESCENT ORBIT 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 IF VHF RELAY THROUGH LM STILL AVAILABLE OTHERWISE ENTER NEXT BEST PTP B.1. CONTINUE MISSION NO GO FOR DOI 2. RETURN TO VICINITY OF CSM NO GO FOR PDI 3.A.PDI TO LO GATE RETURN TO VICINITY OF CSM ASAP B.LO GATE TO TOUCHDOWN CONTINUE MISSION. 5. LM LIFTOFF NEXT ASCENT OPPORTUNITY.	B.3 ENTER LM EARLY TO USE LM S-BAND FOR VOICE COMM WITH MSFN. 6. REF MAL PROC COMM-- 4 LOSS OF S-BAND VOICE COMM 5 S-BAND RECOVER CANNOT ACQUIRE PHASE LOCK. B.3. CSM RELAY ACCEPTABLE		
	20-15	LOSS OF TWO CSM AUDIO CENTERS	EPO ALL	CONTINUE MISSION NO GO FOR TLI CONTINUE MISSION			
	20-16	LOSS OF VOICE FROM EVA-2 TO EVA-1	DUAL EVA	CONTINUE MISSION EVA-2 GO TO POSITION 'B'	EVA-1 HAS EVC-1 EVA-2 HAS EVC-2		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	COMM & INST	FUNCTIONAL COMM-SPECIFIC	20-3

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	----- ' MANAGEMENT ' -----					
	20-7	<p>VOICE CONFIGURATION</p> <p>A. LM/CSM/MSFN</p> <ol style="list-style-type: none"> VHF DUPLEX B AND USB WILL BE TRANSMITTED/RECEIVED SIMULTANEOUSLY FOR LAUNCH THROUGH CYI, REV 1. VHF SIMPLEX A AND USB WILL BE TRANSMITTED/RECEIVED SIMULTANEOUSLY FOR EARTH ORBIT AFTER CYI, REV 1 LOS. 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. VHF B SIMPLEX 259.7 MHZ IS BACKUP TO VHF A SIMPLEX 296.8 MHZ. USB IS PRIME VOICE COMM BETWEEN MSFN AND CSM OR LM. USB/VHF RELAY IS VOICE COMM BACKUP TO USB BETWEEN MSFN AND MALFUNCTIONED S/C. NORMAL VOICE COMM WILL USE SIMULTANEOUS MSFN UPLINK TO BOTH VEHICLES. HOWEVER, IF REQUIREMENT SHOULD EXIST, SIMULTANEOUS INDLPENDENT MSFN/CSM AND MSFN/LM COMM MODES WILL BE INITIATED. 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 MSFN RELAY WITH EACH S/C MONITORING THE VHF A FREQUENCY. THE CSM AND LM WILL TRANSMIT SIMULTANEOUSLY ON VHF AND USB DURING ALL LM POWERED UP PHASES IN LUNAR ORBIT. IN THE EVENT OF A COMPLETE LOSS OF CSM S-BAND COMMUNICATIONS WITH MSFN, THE LM WILL BE CONFIGURED FOR LM TWO-WAY RELAY AND RETAINED FOR TEI AND TEC. <p>B. LM/CSM/EVA/MSFN</p> <ol style="list-style-type: none"> LM TWO-WAY 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, MSFN CONFIGURED FOR USB RELAY. 					
	20-8	<p>CSM VHF/USB MANAGEMENT</p> <p>A. FOR CREW REST PERIODS, CSM S-BAND ANTENNAS WILL BE SELECTED BY GROUND COMMANDS.</p> <p>B. NORMAL CONTROL OF THE S-BAND MODES WILL BE BY GROUND COMMAND. CSM COMMUNICATIONS SWITCH POSITION WILL REFLECT OUT-OF-SITE CONTACT CONFIGURATION.</p>					
	20-9	<p>LM STEERABLE ANTENNA MANAGEMENT</p> <p>A. CSM THRUSTERS B3 AND C4 MUST BE DISABLED WHEN THE LM STEERABLE ANTENNA IS UNSTOWED DURING DOCKED PHASES</p> <p>B. DURING ALL PHASES THE STEERABLE ANTENNA TEMPERATURE SHOULD BE MAINTAINED BETWEEN -65 DEG. F AND 185 DEG. F.</p> <p>RULES 20-10 THROUGH 20-12 ARE RESERVED.</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	COMM & INST	FUNCTIONAL COMM-MNG.	20-2

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	20-17	LOSS OF VOICE FROM EVA-1 TO EVA-2	DUAL EVA	CONTINUE MISSION 1. EVA-2 GO TO POSITION 'A' 2. EVA-1 GO TO POSITION 'B'			
	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 'A' EVA-1 GO TO POSITION 'B' 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 11	A	6/20/69	COMM & INST	FUNCTIONAL COMM-SPECIFIC	20-4

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM						
		<div style="border: 1px dashed black; padding: 5px; display: inline-block;">MANAGEMENT</div>					
	20-30	<p>DSE MANAGEMENT</p> <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 AND WILL BE 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"> 1. LAUNCH 2. S-IVB/CSM SEPARATION 3. ALL SPS MANEUVERS 4. CM/LM SEPARATION AND ENTRY 5. DTO REQUIREMENTS (TBD) 6. LM FINAL SEP <p>C. DURING SLEEP PERIODS</p> <ol style="list-style-type: none"> 1. USING HIGH GAIN ANTENNAS, DSE RECORDING AND DUMPING WILL BE MANAGED PER (A) ABOVE. 2. USING OMNI'S, 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 HGA WILL BE ACTIVATED FOR THE DUMP. 					
	20-31	<p>CTE MANAGEMENT</p> <p>A. CTE WILL BE CONFIGURED TO CLOCK IN GET FOR FLIGHT; HOWEVER, IF A HOLD OCCURS AFTER T-20 MINUTES, CTE WILL NOT BE CORRECTED UNTIL COMPLETION OF POWERED FLIGHT.</p> <p>B. CTE 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 11	FNL	5/16/69	COMM & INSTR	CSM INST - MANAGEMENT	20-6

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
				----- SPECIFIC -----				
	20-35	LOSS OF CSM TM						
		A. HBR OR LBR	ALL	A. CONTINUE MISSION				
		B. ALL TM	LAUNCH	B.1. CONTINUE MISSION				
			ORBIT	2. ENTER NEXT BEST PTP				
			POWERED DESCENT	3. CONTINUE MISSION				
			LUNAR STAY	4. LM LIFTOFF AT THE NEXT ASCENT OPPORTUNITY.				
	20-36	LOSS OF CRITICAL INSTRUMENTATION	LAUNCH	CONTINUE MISSION				
			EO	ENTER NEXT BEST PTP NO GO FOR TLI				
			TLC	CONTINUE MISSION NO GO LOI				
			DOI	CONTINUE MISSION NO GO FOR LUNAR STAY				
	20-37	LOSS OF ONE CSM PMP POWER SUPPLY	ALL	CONTINUE MISSION				
	20-38	LOSS OF BOTH CSM POWER AMPLIFIERS	EPO	NO GO FOR TLI				
			ALL	CONTINUE MISSION				
	20-39	LOSS OF THE SCE	EPO	CONTINUE MISSION NO GO FOR TLI				
			TLC	CONTINUE MISSION NO GO FOR LOI				
			LUNAR ORBIT	CONTINUE MISSION				
			LUNAR STAY	CONTINUE MISSION				
		RULES 20-40 THROUGH 20-44 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	COMM & INSTR	CSM INST - SPECIFIC	20-7	

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM							
		----- ' GENERAL ' -----						
	20-45	A. BASELINE REQUIREMENT 1. CRITICAL INSTRUMENTATION (CRITICAL INSTRUMENTATION IS THAT INSTRUMENTATION, ONBOARD OR TM DURING MSFN AOS, OR ONBOARD ONLY DURING MFSN LOS REQUIRED TO VERIFY MISSION GO/NO-GO CRITERIA) B. POWERED DESCENT ADDITIONAL REQUIREMENTS LM HBR TELEMETRY C. LUNAR STAY ADDITIONAL REQUIREMENTS 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.						
	20-46	THE MISSION WILL BE CONTINUED WITH THE LOSS OF THE--- A. LM UPDATA LINK B. LM CAUTION AND WARNING SYSTEM C. LM DSEA D. EVA TELEMETRY E. LM FM DOWNLINK F. LM USB RANGING G. VHF RANGING RULES 20-47 THROUGH 20-49 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	B	7/3/69	COMM & INST	LM INST - GENERAL	20-8	

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	<p style="text-align: center;">----- ' MANAGEMENT ' -----</p> <p>20-50 LM USB/TM MANAGEMENT</p> <p>A. FOR NORMAL LM POWERED UP PHASES, THE LM STEERABLE ANTENNA WITH THE POWER AMPLIFIER WILL BE USED. DURING LUNAR STAY, IF THE ERECTABLE ANTENNA IS USED, THE POWER AMPLIFIER MAY BE TURNED OFF IF HBR TM AND VOICE CIRCUIT MARGINS ARE ADEQUATE.</p> <p>B. DURING PERIODS OF LM OUT-OF-STATION CONTACT (LUNAR FAR SIDE), THE TM BIT RATE WILL BE SWITCHED FROM HBR TO LBR AND TRANSMITTED TO THE CSM OVER VHF B EXCEPT DURING VHF RANGING AND PERIODS OF CRITICAL VOICE COMMUNICATIONS.</p> <p>C. FOR ALL LUNAR STAY OPERATIONS, HBR TM WILL BE USED.</p> <p>SYSTEM MONITORING</p> <p>DURING SLEEP PERIODS TBD CREWMEN WILL SLEEP WITH HEADSETS TO MONITOR FOR MASTER ALARMS OR GROUND COMMUNICATIONS.</p> <p>RULES 20-51 THROUGH 20-54 ARE RESERVED.</p>					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	FNL	5/16/69	COMM & INST	LM INST - MANAGEMENT	20-9	

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
				<div style="border: 1px dashed black; padding: 2px;"> SPECIFIC </div>				
	20-55	LOSS OF LM TM			REF MAL PROC			
		A. LOSS OF LBR ONLY	ALL	A. CONTINUE MISSION	COMM 6			
		B. LOSS OF HBR ONLY	DOCKED	B.1. CONTINUE MISSION	MFSN REPORTS			
			UNDOCKED	2. RETURN TO VICINITY OF CSM NO GO FOR DOI	LOSS OF PCM			
			DESCENT ORBIT	3. RETURN TO VICINITY OF CSM NO GO FOR PDI				
			POWERED DESCENT	4. (A) PDI TO LO GATE - ABORT RETURN TO VICINITY OF CSM				
				(B) LO GATE TO TD - CONTINUE MISSION				
			LUNAR STAY	5. CONTINUE MISSION				
		C. LOSS OF ALL TM	DOCKED	C.1. CONTINUE MISSION				
			ALL	2. RETURN TO VICINITY OF CSM NO GO FOR TD				
			POWERED DESCENT	3. (A) PDI TO LO GATE - ABORT-DOCK ASAP				
				(B) LO GATE TO TD - CONTINUE MISSION				
			LUNAR STAY	4. LM LIFTOFF NEXT LAUNCH OPPORTUNITY				
	20-56	LOSS OF CRITICAL INSTRUMENTATION	DOCKED	DO NOT UNDOCK				
			UNDOCKED	DOCK ASAP				
		RULES 20-57 THROUGH 20-59 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	COMM & INST	LM INST - SPECIFIC	20-10	

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MISSION RULES

SECTION 20 - COMMUNICATIONS AND INSTRUMENTATION CONCLUDED

REV	ITEM	----- ' CSM- INSTRUMENTATION REQUIREMENTS ' -----					
		MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REF
20-60		UDL VALIDITY SIGNAL	CT0262V	-	-	HD	13-10B,10E,11C
		USB RECEIVER AGC	CT0620E	METER	COMMON	HD	13-10B
		USB RECEIVER AGC	METER	-	-	HD	13-10B
		USB RECEIVER ERROR	CT0604F	-	-	HD	
		DSE TAPE MOTION	CT0012X	TB	-	HD	13-11
		CTE TIME	CT0145F	-	-	HD	13-11
		SCE 10 VDC	CT0018V	-	-	HD	
		SCE 5 VDC	CT0017V	-	-	HD	
		SCE 20 VDC	CT0015V	-	-	HD	
		SCE -20 VDC	CT0016V	-	-	HD	
		PCM HI REF 85 PERCENT	CT0125V	-	-	HD	
		PCM HI REF 15 PERCENT	CT0126V	-	-	HD	
		----- ' LM- INSTRUMENTATION REQUIREMENTS ' -----					
		MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REF
20-61		PCM OSC FAIL 2	GL0422V	-	-	1 OF 2	
		PCM OSC FAIL 3	GL0423V	-	-	HD	
		CAL 85 PCT	GL0401V	-	-	HD	
		CAL 15 PCT	GL0402V	-	-	HD	
		MET	GL0501W	-	-	HD	
		C&W PWR FAIL	GL4054X	CAUTION	-	HD	20-24
		MASTER ALARM	GL4069X	MASTER ALARM	-	HD	20-24
		DUA STATUS	GT0441X	-	-	HD	
		S-BND ST PH ERR	GT0992B	-	-	HD	20-21
		S-BND RCVR SIG	GT0994V	METER	-	HD	20-21
		STEERABLE ANT TEMP	GT0454	METER	-	HD	
		XMTR PO	GT0993	-----	-	HD	20-21
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	COMMUNICATIONS AND INSTR	PRELAUNCH REQ TS	20-11

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MISSION RULES

SECTION 21 - LM SEQUENTIAL AND PYROTECHNIC

REV	ITEM						
		<p>----- MANAGEMENT -----</p>					
	21-10	<p>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.</p>					
	21-11	<p>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.</p>					
	21-12	<p>UNDOCKED STAGING WITH ONE PYRO SYSTEM WILL BE PERFORMED ONLY IF ABSOLUTELY NECESSARY TO MAINTAIN CREW SAFETY.</p>					
	21-13	<p>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.</p>					
	21-14	<p>AN ARMED PYRO SYSTEM(S) THAT CANNOT BE DEARMED IS CONSIDERED UNSAFE FOR THE VIBRATION/SHOCK ENVIRONMENT ASSOCIATED WITH LUNAR TOUCHDOWN.</p>					
		<p>RULE NUMBERS 21-15 THROUGH 21-19 ARE RESERVED.</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	LM SEQUENTIAL AND PYROTECHNIC	GENERAL MANAGEMENT	21-2

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MISSION RULES

SECTION 21 - LM SEQUENTIAL AND PYROTECHNIC - CONCLUDED

REV	ITEM	----- PRELAUNCH INSTRUMENTATION -----						
	21-50	MEAS DESCRIPTION	PCM	ONBOARD	COMMON CAUTION LIGHT	CATEGORY	MISSION RULE	REFERENCE
		ED RLY A K1-K6	GY0201X	SYS A STAGING LIGHT		M	21-1, 2, 3, 13, 20, 21,	
		ED RLY B K1-K6	GY0202X	SYS B STAGING LIGHT		M	21-1, 2, 3, 13, 20, 21,	
		ED RLY A K7-K15	GY0231X	-----		M	21-1, 3, 22	
		ED RLY B K7-K15	GY0232X	-----		M	21-1, 3, 22	
		SELECTED ED BAT VOLT	-----	METER		M	21-1, 2, 20	

	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	FNL	5/16/69	LM SEQUENTIAL AND PYROTECHNIC	PRELAUNCH INSTR	21-5	

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MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM							
		<p>----- ' GENERAL ' -----</p>						
	22-1	<p>TO INITIATE THE FOLLOWING MISSION PHASES, THE ELECTRICAL POWER SYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES---</p>						
		<p>NOTE -----</p>						
		<p>LM ACTIVE RENDEZVOUS/CONTINGENCY RETURN ASSUMED</p>						
		<p>A. DOCKED WITH HATCH OPEN AND TUNNEL CLEAR</p>						
		<p>1. CDR OR LMP BUS</p>						
		<p>2. TWO DESCENT BATTERIES WITH ASSOCIATED FEEDER OR ONE ASCENT BATTERY WITH ASSOCIATED FEEDER.</p>						
		<p>3. SUFFICIENT AVAILABLE ASCENT OR DESCENT ELECTRICAL ENERGY TO COMPLETE THE PLANNED ACTIVITY PERIOD.</p>						
		<p>B. DOCKED WITH HATCH CLOSED</p>						
		<p>1. CDR AND LMP BUSES</p>						
		<p>2. TWO DESCENT BATTERIES PLUS ONE ASCENT BATTERY OR BOTH ASCENT BATTERIES.</p>						
		<p>3. BOTH ASCENT FEEDERS</p>						
		<p>4. SUFFICIENT AVAILABLE ASCENT OR DESCENT ELECTRICAL ENERGY TO COMPLETE THE PLANNED ACTIVITY PERIOD PLUS A RESERVE OF 1 HOUR.</p>						
		<p>C. UNDOCKED/SEPARATION</p>						
		<p>1. CDR AND LMP BUSES</p>						
		<p>2. TWO DESCENT BATTERIES PLUS TWO ASCENT BATTERIES OR FOUR DESCENT BATTERIES PLUS ONE ASCENT BATTERY.</p>						
		<p>3. BOTH ASCENT FEEDERS PLUS ONE DESCENT FEEDER. A SHORTED DESCENT FEEDER RESULTS IN LOSS OF ALL DESCENT BATTERIES.</p>						
		<p>4. SUFFICIENT AVAILABLE ELECTRICAL POWER---</p>						
		<p>(A) TO COMPLETE THE PLANNED ACTIVITY PLUS A RESERVE OF 2 HOURS.</p>						
		<p>(B) IN EACH ASCENT BATTERY TO PROVIDE A 2-HOUR CONTINGENCY RETURN CAPABILITY.</p>						
		<p>NOTE</p>						
		<p>TO CONTINUE LANDING MISSION, SEE POWERED DESCENT CONSUMABLE REQUIREMENTS.</p>						
		<p>D. DESCENT ORBIT</p>						
		<p>1. CDR AND LMP BUSES</p>						
		<p>2. TWO DESCENT BATTERIES PLUS BOTH ASCENT BATTERIES OR FOUR DESCENT BATTERIES PLUS ONE ASCENT BATTERY</p>						
		<p>3. BOTH ASCENT FEEDERS PLUS ONE DESCENT FEEDER.</p>						
		<p>4. ONE INVERTER AND AC BUS A</p>						
		<p>5. SUFFICIENT AVAILABLE ELECTRICAL POWER---</p>						
		<p>(A) TO COMPLETE THE PLANNED ACTIVITY PLUS A RESERVE OF 2 HOURS.</p>						
		<p>(B) IN EACH ASCENT BATTERY TO PROVIDE A 5-HOUR CONTINGENCY RETURN CAPABILITY</p>						
		<p>NOTE</p>						
		<p>TO CONTINUE LANDING MISSION, SEE POWERED DESCENT CONSUMABLE REQUIREMENTS.</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	LM ELECTRICAL POWER	GENERAL	22-1	

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MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM							
	22-1 (CONT)	<p>E. POWERED DESCENT</p> <ol style="list-style-type: none"> 1. CDR AND LMP BUSES 2. TWO DESCENT BATTERIES PLUS BOTH ASCENT BATTERIES 3. BOTH ASCENT FEEDERS PLUS ONE DESCENT FEEDER 4. ONE INVERTER AND AC BUS A. 5. SUFFICIENT ELECTRICAL POWER COMBINED IN ALL AVAILABLE BATTERIES TO ACCOMPLISH LANDING AND A LUNAR STAY OF 2 HOURS PLUS SUFFICIENT ELECTRICAL POWER IN EACH ASCENT BATTERY TO ACCOMPLISH LIFTOFF THRU CREW TRANSFER. <p>F. LUNAR STAY</p> <ol style="list-style-type: none"> 1. CDR AND LMP BUSES 2. ONE DESCENT BATTERY ON EACH BUS PLUS BOTH ASCENT BATTERIES 3. BOTH ASCENT FEEDERS AND BOTH DESCENT FEEDERS 4. SUFFICIENT ELECTRICAL POWER COMBINED IN ALL AVAILABLE BATTERIES TO COMPLETE THE DESIRED LUNAR STAY AND A 2 HOUR LUNAR STAY RESERVE, PLUS SUFFICIENT ELECTRICAL POWER IN EACH ASCENT BATTERY TO ACCOMPLISH LIFTOFF THRU CREW TRANSFER. <p style="text-align: center;">NOTE---</p> <p style="text-align: center;">LM IS STAY AT T1 OR T2 IF SUFFICIENT ELECTRICAL POWER IS AVAILABLE TO PROVIDE A T3 LIFTOFF, NOMINAL INSERTION, AND CSM RESCUE CAPABILITY.</p> <p>G. LM ACTIVE RENDEZVOUS</p> <ol style="list-style-type: none"> 1. EITHER CDR OR LMP BUS 2. ONE ASCENT BATTERY WITH ASSOCIATED FEEDER 3. SUFFICIENT AVAILABLE CONSUMABLES TO COMPLETE RENDEZVOUS/DOCKING/CREW TRANSFER PLUS A RESERVE OF 2 HOURS. 						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	A	6/20/69	LM ELECTRICAL POWER	GENERAL	22-2	

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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"> A. INABILITY TO MAINTAIN BUS VOLTAGE GREATER THAN 26.5 VDC B. A BUS CURRENT GREATER THAN OR EQUAL TO 90 AMPS <p>LOSS OF AN EPS BATTERY</p> <ul style="list-style-type: none"> A. BATTERY OUTPUT LESS THAN OR EQUAL TO 2 AMPS WHEN CONNECTED TO A BUS B. TEMPERATURE GREATER THAN OR EQUAL TO 145 DEG F WITH VOLTAGE EQUAL (UNSTAGED CONFIGURATION) OR LESS THAN NOMINAL (STAGED CONFIGURATION), AND CURRENT LESS THAN NOMINAL C. INABILITY TO MEET VOLTAGE REGULATION AT REQUIRED LOAD D. INABILITY TO BE CONNECTED TO A FEEDER DUE TO A MALFUNCTIONED ECA E. BATTERY OPEN CIRCUIT VOLTAGE BELOW 31.8 VDC STEADY STATE <p>LOSS OF A DC BUS FEEDER</p> <ul style="list-style-type: none"> A. DESCENT - INABILITY TO USE AS A POWER PATH THE ELECTRICAL CONNECTIONS FROM THE OUTPUT TERMINALS OF THE DESCENT ECA'S TO THE DFR 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 <p>LOSS OF OVERCURRENT PROTECTION</p> <ul style="list-style-type: none"> A. DEFINITE LOSS IF--- <ul style="list-style-type: none"> (1) BOTH CIRCUIT BREAKERS POWERING THE ECA'S FAIL OPEN (ALL DESCENT OR ALL ASCENT BATTERIES, DEPENDENT ON WHICH PAIR OF CIRCUIT BREAKERS FAILED) (2) FAILURE OF AN ASCENT BATTERY NORMAL FEED CONTACTOR B. PROBABLE LOSS IF--- <ul style="list-style-type: none"> (1) UNABLE TO MEASURE A BATTERY CURRENT BOTH ONBOARD AND ON TELEMETRY (2) UNABLE TO TAKE THE BATTERY OFF LINE <p>LOSS OF AN INVERTER AND/OR ASSOCIATED AC DISTRIBUTION</p> <ul style="list-style-type: none"> A. AC BUS VOLTAGE LESS THAN OR EQUAL TO 110.5 OR GREATER THAN OR EQUAL TO 120 VAC B. AC BUS FREQUENCY LESS THAN OR EQUAL TO 390 OR GREATER THAN OR EQUAL TO 410 HZ C. POWER CANNOT BE SUPPLIED TO AN AC BUS 					
	22-3	<p>ANY SPECIFIC EPS 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"> A. A DESCENT BATTERY MALFUNCTION REQUIRING THE BATTERY TO BE TAKEN OFF LINE. B. AN INVERTER MALFUNCTION IF THE STEERABLE ANTENNA IS AFFECTED (ASSUMES THE ERECTABLE ANTENNA IS NOT DEPLOYED). <p>RULE NUMBERS 22-4 THROUGH 22-9 ARE RESERVED.</p>					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	B	7/3/69	LM ELECTRICAL	GENERAL	22-3	

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MISSION RULES

SECTION 22 - LM ELECTRICAL POWER

REV	ITEM						
		----- ' MANAGEMENT ' -----					
22-10	<p>THE MISSION WILL BE CONTINUED AFTER LIFTOFF WITH THE LOSS OF OVERCURRENT PROTECTION. IF THIS PROTECTION IS LOST PRIOR TO LIFTOFF, 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 IF REQUIRED.</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 EACH BATTERY IMMEDIATELY PRIOR TO PDI + 5.</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 PRIOR TO LUNAR LIFTOFF.</p> <p>C. ONE ASCENT BATTERY/TWO BUS OPERATION BY REMOVING 5 AMP HOURS IMMEDIATELY PRIOR TO REMOVING THE LAST DESCENT BATTERY.</p>						
22-12	<p>THE BAL LOAD CROSSTIES (30A) WILL BE OPEN FOR MAIN PROPULSION BURNS, STAGING, AND WHENEVER AGS IS IN THE OPERATE MODE. THE BUS CROSSTIES (100A) WILL NOMINALLY NEVER BE CLOSED.</p>						
22-13	<p>FOR TIME CRITICAL SITUATIONS WHERE A REQUIREMENT EXISTS TO DETERMINE THE LOCATION OF A SHORT (BUS OR ASCENT/DESCENT FEEDER), PROCEDURES WILL ALLOW TAKING THE RISK OF INTENTIONALLY FEEDING THE SHORT. IF TIME PERMITS, STANDARD MALFUNCTION PROCEDURES WILL BE FOLLOWED. THE BUSES WILL NEVER BE CROSSTIED TO DETECT THE LOCATION OF A 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 402 OR LESS THAN OR EQUAL TO 398 HZ.</p>						
22-15	<p>BATTERIES WILL BE MANAGED DURING LUNAR STAY TO MAINTAIN EQUAL DISSIPATION OF AVAILABLE ENERGY WITHIN TBD AMP-HOURS BETWEEN ALL BATTERIES ON LINE.</p>						
22-16	<p>FOR A SHORTED DESCENT FEEDER, 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.</p>						
22-17	<p>WITH THE LOSS OF ONE ASCENT BATTERY, THE REMAINING ASCENT BATTERY WILL BE PLACED ON ITS BACKUP FEEDPATH WITH THE BUS CROSSTIES (100A) 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.</p> <p>RULE NUMBERS 22-18 THROUGH 22-19 ARE RESERVED.</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	B	7/3/69	LM ELECTRICAL	MANAGEMENT	22-4

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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) A. LOSS OF ONE INVERTER B. LOSS OF BOTH INVERTERS	ALL DOCKED UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY	A. 1. CONTINUE MISSION B. 1. CONTINUE MISSION NO GO DOI 2. DO NOT PERFORM PDI 3.(A) PDI TO LO GATE - ABORT (B) LO GATE TO TD - CONTINUE MISSION 4. CONTINUE MISSION	REF MALF PROC EPS--- 8 INVERTER • LOSS OF AC POWER RESULTS IN LOSS OF DPS GIMBALS, RR, S-BND STEERABLE ANT (HBR TM), BOTH FDAI SPHERES, • HBR TM CAN BE TRANSMITTED AND RECEIVED BY MSFN FROM THE OMNI'S.		
	22-25	LOSS OF AC BUSES A. LOSS OF BUS A B. LOSS OF BUS B	DOCKED UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY ALL	A. 1. CONTINUE MISSION NO GO FOR DOI 2. DO NOT PERFORM PDI 3.(A) PDI TO LO GATE - ABORT (B) LO GATE TO TD - CONTINUE MISSION 4. CONTINUE MISSION B. CONTINUE MISSION	REF MALF PROC EPS--- 8 INVERTER LOSS OF AC BUS A RESULTS IN LOSS OF DPS GIMBAL CONTROL, RENDZ RADAR, AND INTEGRAL LIGHTING LOSS OF AC BUS B RESULTS IN LOSS OF S-BAND STEERABLE ANTENNA (HBR TM) AND NUMERIC LIGHTING, HBR TM IS AVAILABLE FROM AN OMNI ANTENNA AND A 210 FT MSFN SITE. LOSS OF BOTH AC BUSES RESULTS IN THE ABOVE PLUS LOSS OF BOTH FDAI SPHERES AND THE AOT		
		RULE NUMBERS 22-26 THROUGH 22-49 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	LM ELECTRICAL POWER	SPECIFIC	22-7

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MISSION RULES

SECTION 22 - LM ELECTRICAL POWER - CONCLUDED

REV	ITEM	----- ' INSTRUMENTATION REQUIREMENTS ' -----					
	22-50	MEAS DESCRIPTION	PCM	ONBOARD	CATEGORY	MISSION RULE REFERENCE	
		AC BUS FREQ	GC0155F	CAUTION	} COMMON LIGHT	} 22-2,5,24,25	
		AC BUS VOLTS	GC0071V	METER/CAUTION			
		BAT 1 VOLTS	GC0201V	METER	} COMMON METER	} 22-2,10,14 20,21,24	
		BAT 2 VOLTS	GC0202V	METER			
		BAT 3 VOLTS	GC0203V	METER			
		BAT 4 VOLTS	GC0204V	METER			
		BAT 5 VOLTS	GC0205V	METER			
		BAT 6 VOLTS	GC0206V	METER			
		CDR BUS VOLTS	GC0301V	METER/WARNING	} COMMON LIGHT	} 22-2,10,14 21,22,23	
		LMP BUS VOLTS	GC0302V	METER/WARNING			
		BAT 1 CUR	GC1201C	METER	} COMMON METER	} 22-2,10,14 20,21,22,23	
		BAT 2 CUR	GC1202C	METER			
		BAT 3 CUR	GC1203C	METER			
		BAT 4 CUR	GC1204C	METER			
		BAT 5 CUR	GC1205C	METER			
		BAT 6 CUR	GC1206C	METER			
		BAT 1 MAL	GC9961U	CAUTION/COMP	} COMMON LIGHTS	} 22-2,10,14,20,21,23 22-2,10,20,21,22	
		BAT 2 MAL	GC9962U	CAUTION/COMP			
		BAT 3 MAL	GC9963U	CAUTION/COMP			
		BAT 4 MAL	GC9964U	CAUTION/COMP			
		BAT 5 MAL	GC9965U	CAUTION/COMP			
		BAT 6 MAL	GC9966U	CAUTION/COMP			
		BATTERY MAL	GL4047X		HD	22-2,10,20,21,22,23	
		BAT 1 LOW TAP	GC4362X	FLAG	HD	} 22-2,10,20,21,23	
		BAT 2 LOW TAP	GC4364X	FLAG	HD		
		BAT 3 LOW TAP	GC4366X	FLAG	HD		
		BAT 4 LOW TAP	GC4368X	FLAG	HD		
		BAT 5 B/U CDR	GC4369X	FLAG	HD	} 22-2,10,17,20 21,22	
		BAT 6 NORM CDR	GC4370X	FLAG	HD		
		BAT 5 NORM LMP	GC4371X	FLAG	HD		
		BAT 6 B/U LMP	GC4372X	FLAG	HD		

MISSION	REV	DATE	SECTION	GROUP	PAGE	
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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM						
		<p>----- ' GENERAL ' -----</p>					
	23-1	<p>TO INITIATE THE FOLLOWING MISSION 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"> 1. COMBINED VEHICLE PRESSURE INTEGRITY 2. ONE LM COOLANT LOOP <p>B. DOCKED WITH HATCH CLOSED</p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT LOOP INTEGRITY 3. ONE SUIT FAN 4. ONE DEMAND REGULATOR 5. ONE COOLANT LOOP 6. SUFFICIENT O2, H2O, AND LIOH CONSUMABLES TO COMPLETE THE PLANNED ACTIVITY PERIOD PLUS A RESERVE OF 1 HOUR <p>C. UNDOCKED/SEPARATION</p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT LOOP INTEGRITY 3. ONE SUIT FAN 4. ONE DEMAND REGULATOR 5. ONE COOLANT LOOP 6. 1 OF 2 H2O SEPARATORS OR LCG 7. SUFFICIENT O2, H2O AND LIOH <ul style="list-style-type: none"> (A) TO COMPLETE THE PLANNED ACTIVITY PLUS A RESERVE OF 2 HOURS (B) IN EACH ASCENT H2O TANK TO PROVIDE A 2-HOUR CONTINGENCY RETURN CAPABILITY (C) IN BOTH ASCENT O2 TANKS TO PROVIDE A 2-HOUR CONTINGENCY RETURN CAPABILITY <p style="text-align: center;">NOTE</p> <p style="text-align: center;">TO CONTINUE LANDING MISSION, SEE POWERED DESCENT CONSUMABLE REQUIREMENTS.</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	LM ENVIRONMENTAL CONTROL	GENERAL	23-1

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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM							
	23-1 CONT	<p>D. DESCENT ORBIT</p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT LOOP INTEGRITY 3. ONE SUIT FAN 4. ONE DEMAND REGULATOR 5. BOTH COOLANT LOOPS 6. PRIMARY H2O FEEDPATH CAPABILITY 7. BOTH H2O SEPARATORS OR 1 OF 2 H2O SEPARATORS PLUS THE LCG LOOP 8. SUFFICIENT O2, H2O, AND LIOH <ul style="list-style-type: none"> (A) TO COMPLETE THE PLANNED ACTIVITY PLUS A RESERVE OF 2 HOURS. (B) IN EACH ASCENT H2O TANK TO PROVIDE A 5-HOUR CONTINGENCY RETURN CAPABILITY (C) IN BOTH ASCENT O2 TANKS TO PROVIDE A 5-HOUR CONTINGENCY RETURN CAPABILITY <p style="text-align: center;">NOTE</p> <p style="text-align: center;">TO CONTINUE MISSION, SEE POWERED DESCENT CONSUMABLE REQUIREMENTS.</p> <p>E. POWERED DESCENT</p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT LOOP INTEGRITY 3. BOTH SUIT FANS 4. ONE DEMAND REGULATOR 5. BOTH COOLANT LOOPS 6. PRIMARY H2O FEEDPATH CAPABILITY 7. BOTH H2O SEPARATORS OR 1 OF 2 H2O SEPARATORS PLUS THE LGC LOOP 8. SUFFICIENT O2 COMBINED IN ALL AVAILABLE O2 TANKS TO ACCOMPLISH LANDING AND A LUNAR STAY OF 2 HOURS PLUS SUFFICIENT O2 IN EITHER ASCENT TANK TO ACCOMPLISH LIFTOFF THRU CREW TRANSFER. 9. SUFFICIENT H2O COMBINED IN ALL AVAILABLE H2O TANKS TO ACCOMPLISH LANDING AND A LUNAR STAY OF 2 HOURS PLUS SUFFICIENT H2O IN EACH ASCENT H2O TANK TO ACCOMPLISH LIFTOFF THRU CREW TRANSFER. 10. SUFFICIENT AVAILABLE LIOH IN EACH INSTALLED CARTRIDGE FOR 6 HOURS OF CO2 REMOVAL. 						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	A	6/20/69	LM ENVIRONMENTAL CONTROL	GENERAL	23-2	

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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM							
	23-1 CONT	<p>F. LUNAR STAY</p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT LOOP INTEGRITY 3. BOTH SUIT FANS 4. BOTH COOLANT LOOPS 5. PRIMARY H2O FEEDPATH 6. BOTH H2O SEPARATORS OR 1 OF 2 H2O SEPARATORS PLUS THE LCG LOOP 7. SUFFICIENT O2 COMBINED IN ALL AVAILABLE O2 TANKS TO COMPLETE THE DESIRED LUNAR STAY AND A 2-HOUR LUNAR STAY RESERVE PLUS SUFFICIENT O2 IN EITHER ASCENT TANK TO ACCOMPLISH LIFTOFF THRU CREW TRANSFER. 8. SUFFICIENT H2O COMBINED IN ALL AVAILABLE H2O TANKS TO COMPLETE THE DESIRED LUNAR STAY AND A 2-HOUR LUNAR STAY RESERVE PLUS SUFFICIENT H2O IN EACH ASCENT TANK TO ACCOMPLISH LIFTOFF THRU CREW TRANSFER. 9. SUFFICIENT LIOH FOR DESIRED LUNAR STAY, LIFTOFF THRU CREW TRANSFER, PLUS A RESERVE OF 4 HOURS. <p style="text-align: center;">NOTE---</p> <p style="text-align: center;">LM IS "STAY" AT T1 OR T2 REGARDLESS OF REMAINING LM O2 OR LIOH, IF SUFFICIENT H2O IS AVAILABLE TO PROVIDE A T3 LIFTOFF, NOMINAL INSERTION, AND A CSM RESCUE CAPABILITY.</p> <ol style="list-style-type: none"> G. LM-ACTIVE RENDEZVOUS/DOCKING 1. ONE COOLANT LOOP 2. ONE H2O FEEDPATH 3. ONE H2O SEPARATOR OR THE LCG LOOP 4. ONE ASCENT H2O TANK 5. SUFFICIENT H2O TO ACCOMPLISH RENDEZVOUS/DOCKING 						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	A	6/20/69	LM ENVIRONMENTAL CONTROL	GENERAL	23-3	

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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 6 LBS/HR.</p> <p>LOSS OF SUIT LOOP INTEGRITY</p> <p>TOTAL PGA/SUIT LOOP LEAKAGE GREATER THAN OR EQUAL TO 0.3 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 50 DEGREE F AND RISING EXCEPT DURING COOLANT LOOP STARTUP AND DRYOUT (SUBLIMATOR LOST)</p> <p>B. GLYCOL PUMP DELTA P LESS THAN OR EQUAL TO 6 PSID (CIRCULATION LOST) 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 MSFN CONFIRMATION OF INADEQUATE DESCENT TANK PRESSURE WITH O₂ MANIFOLD PRESSURE.</p> <p>LOSS OF ASCENT O₂ TANK</p> <p>A. MSFN 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 35 PERCENT, CREW MAY CONFIRM LOSS BY BALANCING ONE TANK AGAINST THE OTHER, WITH MSFN COVERAGE--- OR</p> <p>C. IF STAGED OR IF DESCENT O₂ LESS THAN 35 PERCENT, LOSS OF ONBOARD AND MSFN READOUT.</p> <p>LOSS OF DESCENT H₂O TANK</p> <p>INABILITY TO SUPPLY H₂O TO W/B RESULTING IN RISING GLYCOL AND SUIT LOOP TEMPERATURE (CREW AND MSFN) AND DROP IN H₂O DELTA P (MSFN 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>					
	23-3	IF A SUBLIMATOR IS LOST DUE TO BREAKTHROUGH, NO RESTART ATTEMPT WILL BE MADE.					
	23-4	OXYGEN PURGE SYSTEM AND PLSS CONSUMABLES WILL BE RESERVED FOR POSSIBLE EVT AND WILL NOT BE CONSIDERED FOR LM GO/NO-GO'S OR REDLINES.					
	23-5	TWO POUNDS OF OXYGEN CONTAINED IN THE LM CABIN WILL BE CONSIDERED AVAILABLE IN CALCULATING GO/NO-GO'S OR REDLINES. THE CABIN CAN BE CONSIDERED, WHEN DISCUSSING FUNCTIONAL PRESSURE VESSEL REQUIREMENTS, AS A BACKUP TO THE ASCENT O ₂ TANKS.					
	23-6	<p>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>					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	B	7/3/69	LM ENVIRONMENTAL CONTROL	GENERAL	23-4	

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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM							
		----- ' SYSTEMS MANAGEMENT ' -----						
	23-10	PRIMARY GLYCOL LOOP CIRCULATION WILL BE DISCONTINUED DURING STARTUP OF THE SECONDARY LOOP BUT MAY BE REINITIATED FOLLOWING SECONDARY LOOP STABILIZATION IF DEEMED NECESSARY.						
	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 MSFN 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 11	FNL	5/16/69	LM ENVIRONMENTAL CONTROL	MANAGEMENT	23-5	

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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 MALF 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) PDI TO PDI +5 ABORT DELAY STAGING ALAP	
				(B) PDI +5 TO TD CONTINUE MISSION	
			LUNAR STAY	4. LIFTOFF NEXT BEST OPPORTUNITY	
			RNDZ	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	• IF DESCENT O2 PURGE COOLING IS NOT AVAILABLE, CREW SHOULD DON PLSSSES AND DUMP CABIN.
			POWERED DESCENT	3.(A) PDI TO PDI +5 ABORT DELAY STAGING ALAP	
				(B) PDI +5 TO TD CONTINUE MISSION	
			LUNAR STAY	4. LIFTOFF NEXT BEST OPPORTUNITY	
			RNDZ	5. INITIATE CSM RESCUE	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	LM ENVIRONMENTAL CONTROL	SPECIFIC	23-10

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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-25	LOSS OF O2 TANK(S)			
		A. ONE ASCENT TANK	ALL	A. CONTINUE MISSION	
		B. TWO ASCENT TANKS	DOCKED	B.1. DO NOT UNDOCK	
			UNDOCKED	2. DOCK ASAP DELAY STAGING ALAP	
			DESCENT ORBIT		
			POWERED DESCENT	3.(A) PDI TO PDI + 5 - ABORT DELAY STAGING ALAP	
				(B) PDI + 5 TO TOUCHDOWN- ABORT	
			LUNAR STAY	4. LIFT OFF AT NEXT BEST OPPORTUNITY	
			RNDZ	5. CONTINUE MISSION	
		C. DESCENT TANK	ALL	C.1. CONTINUE MISSION	
			LUNAR STAY	2. LIFTOFF NEXT BEST OPPORTUNITY	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	LM ENVIRONMENTAL CONTROL	SPECIFIC	23-11

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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-28	LOSS OF H2O TANK(S)			
		A. ONE ASCENT TANK	DOCKED UNDOCKED	A.1. CONTINUE MISSION	
			DESCENT ORBIT	2. RETURN TO VICINITY OF CSM ASAP DELAY STAGING ALAP NO GO PDI	
			POWERED DESCENT	3.(A) PDI TO PDI + 5- ABORT DELAY STAGING ALAP	DURING POWERED DESCENT, IT IS IMPOSSIBLE TO CONFIRM THE LOSS OF AN ASCENT TANK
				(B) PDI + 5 TO TOUCHDOWN CONTINUE MISSION	
			LUNAR STAY	4. LIFT OFF NEXT BEST OPPORTUNITY	
			RNDZ	5. CONTINUE MISSION	
		B. TWO ASCENT TANKS	DOCKED UNDOCKED	B.1. CONTINUE MISSION	
			DESCENT ORBIT	2. RETURN TO VICINITY OF CSM ASAP DO NOT STAGE NO GO PDI	
			POWERED DESCENT	3.(A) PDI TO PDI + 5- ABORT DO NOT STAGE	DURING POWERED DESCENT, IT IS IMPOSSIBLE TO CONFIRM THE LOSS OF AN ASCENT TANK
				(B) PDI + 5 TO LO-GATE ABORT	
				(C) PDI + 5 TO TOUCHDOWN CONTINUE MISSION	
			LUNAR STAY	4. LIFTOFF NEXT BEST OPPORTUNITY	
			RNDZ	5. INITIATE CSM RESCUE	POWER DOWN LM

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	LM ENVIRONMENTAL CONTROL	SPECIFIC	23-13

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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
		C. DESCENT TANK	ALL DOCKED LUNAR	C.1. CONTINUE MISSION 2. CONTINUE MISSION NO GO DOI 3. LIFTOFF NEXT BEST OPPORTUNITY			
23-29	FIRE OR SMOKE IN CABIN OR SUIT	ALL		TROUBLESHOOT/COMBAT FIRE ASSESS DAMAGE AND TRANSFER TO CSM IF NECESSARY	REF AOH PROC 5.3.2		
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 A. CABIN B. SUIT	ALL ALL ALL		TRANSFER TO CSM A. PURGE SUIT WITH DIRECT O2 B. DISCONNECT FROM SUIT LOOP	REF HALF PROC ECS--- 8 GLYCOL		
	RULE NUMBERS 23-32 THROUGH 23-49 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	LM ENVIRONMENTAL CONTROL	SPECIFIC	23-14

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MISSION RULES

SECTION 23 - LM ENVIRONMENTAL CONTROL - CONCLUDED

REV	ITEM	INSTRUMENTATION REQUIREMENTS			
23-50	MEAS DESCRIPTION	PCM	ONBOARD	CATEGORY	
	SUIT PRESS	GF1301P	METER	MANDATORY	
	CABIN PRESS	GF3571P	WARNING METER	MANDATORY	
	REPR ELEC OPEN	GF3572X	WARNING METER	MANDATORY	
	CO2 PART PRESS	GF1521P	METER, CAUTION COMP	HIGHLY DESIRABLE	
	H2O SEP RATE	GF9999U	CAUTION, COMP	HIGHLY DESIRABLE	
	DES O2 PRESS	GF3584P	METER, CAUTION	MANDATORY	
	ASC 1 O2 PRESS	GF3582P	METER, CAUTION	1 OF 2	
	ASC 2 O2 PRESS	GF3583P	METER, CAUTION	MANDATORY	
	O2 MANIFOLD PRESS	GF3589P	-----	MANDATORY	
	GLYCOL PUMP DELTA P	GF2021P	-----	MANDATORY	
	GLYCOL PUMP SW/O	GF2936X	COMP	HIGHLY DESIRABLE	
	SEC GLY PUMP PRESS	GF2921P	-----	MANDATORY	
	GLYCOL PUMP P	GF9997U	METER	MANDATORY	
	SEL. GLY LVL LOW	GF9986U	CAUTION	MANDATORY	
	GLYCOL TEMP	GF9998U	METER, CAUTION	MANDATORY PCM	
	DES H2O QTY	GF4581Q	METER, CAUTION	MANDATORY	
	ASC 1 H2O QTY	GF4582Q	METER, CAUTION	PCM ONE TANK AND METER OTHER TANK OR PCM AND CAUTION BOTH TANKS	
	ASC 2 H2O QTY	GF4583Q	METER, CAUTION 1 OF 2 M		
	PRI H2O REG DELTA P	GF4101P	-----	MANDATORY	
	SUIT DIV EGRESS	GF1221X	-----	HIGHLY DESIRABLE	
	SUIT TEMP	GF1281T	METER	HIGHLY DESIRABLE	
	CABIN TEMP	GF1651T	METER	HIGHLY DESIRABLE	

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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM						
		----- ' GENERAL ' -----					
	24-1	<p>TO INITIATE THE FOLLOWING PHASES, THE LM GUIDANCE SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES----</p> <p>A. DOCKED/UNDOCKED, DESCENT ORBIT</p> <ol style="list-style-type: none"> 1. OPERATIONAL PGNS AND AGS <ol style="list-style-type: none"> (A) OPERATIONAL PGNS REQUIRES LGC, ISS, AND DSKY. (B) OPERATIONAL AGS REQUIRES AEA, ASA, AND DEDA. 2. REDUNDANT 3-AXIS AUTO ATTITUDE CONTROL AND HOLD CAPABILITY VIA BOTH PGNS AND AGS. 3. REDUNDANT 3-AXIS CONTROL. 4. ONE HAND CONTROLLER (ACA). 5. 3-AXIS TRANSLATION CAPABILITY, WHICH REQUIRES--- <ol style="list-style-type: none"> (A) ONE TTCA (B) PGNS OR AGS 3-AXIS TRANSLATION CAPABILITY 6. ONE THRUST TRANSLATION CONTROLLER ASSEMBLY (TTCA) 7. ONE FDAI INCLUDING 2 OUT OF 3 OF THE FOLLOWING--- <ol style="list-style-type: none"> (A) ATTITUDE REFERENCE (B) RATE NEEDLES (C) ERROR NEEDLES 8. AN OPERATIONAL AOT NO AOT FAILURE THAT WOULD PREVENT ITS USE IN REALIGNING THE LM PLATFORM. <p style="text-align: center;">NOTE</p> <p style="text-align: center;">AFTER SUCCESSFUL PLATFORM FINE ALIGNMENT THE AOT IS NOT REQUIRED.</p> <ol style="list-style-type: none"> 9. OPERATIONAL RENDEZVOUS RADAR (RR) AND RR TRANSPONDER <ol style="list-style-type: none"> (A) PRIOR TO UNDOCKING IDENTIFIED BY ABILITY TO ACTIVATE, AND ANTENNA TEMPERATURE WITHIN LIMITS. (B) AFTER UNDOCKING REQUIRES ABILITY TO LOCK ON THE TRANSPONDER, LGC INTERFACE, AND ANTENNA TEMPERATURE WITHIN LIMITS. 10. OPERATIONAL LANDING RADAR (LR) DURING THIS PHASE MAY BE CONFIRMED ONLY BY THE ABILITY TO ACTIVATE AND THE ANTENNA TEMPERATURE WITHIN LIMITS. 11. REDUNDANT ASC ENGINE ON/OFF CAPABILITY BOTH AUTO AND MANUAL ASC ENGINE ON/OFF CAPABILITY. 12. OPEATIONAL PITCH AND ROLL GDA, WHICH REQUIRES--- <ol style="list-style-type: none"> (A) NO GDA FAILURE (B) NO CES DC POWER FAILURE (C) AC BUS A POWER 13. OPERATIONAL MANUAL THROTTLE CAPABILITY, WHICH REQUIRES ONE TTCA AND NO CES/DESCENT ENGINE FAILURES WHICH WOULD INHIBIT THROTTLE CONTROL. 14. OPERATIONAL AUTO THROTTLE CAPABILITY, WHICH REQUIRES NO CES/DESCENT ENGINE FAILURES WHICH WOULD INHIBIT THROTTLE CONTROL. 					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	LM GUIDANCE AND CONTROL	GENERAL	24-1

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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM								
	24-1 CONT	<p>15. OPERATIONAL VHF RANGING OR OPTICAL TRACKING</p> <p>B. POWERED DESCENT</p> <p>1. REQUIREMENTS TO INITATE PDI ARE IDENTICAL TO DESCENT ORBIT EXCEPT DELETE THE FOLLOWING CAPABILITIES WHICH ARE NOT REQUIRED---</p> <p>(A) 3-AXIS TRANSLATION (ONLY ULLAGE IS REQUIRED)</p> <p>(B) VHF RANGING AND TRACKING</p> <p>(C) AOT</p> <p>(D) RR</p> <p>2. PDI TO LOW GATE</p> <p>(A) OPERATIONAL PGNS AND AGS (AGS TO HIGH-GATE)</p> <p>(B) REDUNDANT 3-AXIS AUTO ATTITUDE CONTROL AND HOLD CAPABILITY (REDUNDANT TO HIGH-GATE)</p> <p>(C) 3-AXIS CONTROL (REDUNDANT TO HIGH-GATE)</p> <p>(D) ONE ACA</p> <p>(E) ONE TTCA (CONSIDERATION WILL BE GIVEN TO CONTINUING BASED UPON NOMINAL TRAJECTORY AND GUIDANCE.)</p> <p>(F) ONE FDAI (2 OUT OF 3 FUNCTIONS OPERATIONAL)</p> <p>(G) OPERATIONAL LANDING RADAR</p> <p>(1) NOT REQUIRED AFTER ADEQUATE ALTITUDE UPDATING OF LM STATE VECTORS.</p> <p>(2) OPERATIONAL LR REQUIRES---</p> <p>VALID ALTITUDE LOCK ON</p> <p>VALID ALTITUDE READOUT</p> <p>ANTENNA TEMPERATURE WITHIN LIMITS</p> <p>(H) ASCENT ENG ON/OFF (REDUNDANT TO PDI + 5)</p> <p>(I) OPERATIONAL PITCH AND ROLL GDA (TO PDI + 7)</p> <p>(J) OPERATIONAL AUTO AND MANUAL THROTTLE (MANUAL THROTTLE TO THROTTLEDOWN -25 SEC , IF ON NORMAL TRAJECTORY AND GUIDANCE IS OK.) (AUTO THROTTLE CMD INDICATOR FOR A SPECIAL FAILURE.)</p> <p>3. LOW GATE TO TOUCHDOWN (TD)</p> <p>(A) ONE ACA</p> <p>(B) ONE TTCA (CONSIDERATION WILL BE GIVEN TO CONTINUING BASED UPON NOMINAL TRAJECTORY AND GUIDANCE.)</p> <p>(C) OPERATIONAL MANUAL THROTTLE (CONSIDERATION WILL BE GIVEN TO CONTINUING BASED UPON NOMINAL TRAJECTORY AND GUIDANCE.)</p> <p>C. LUNAR STAY</p> <p>1. THE ASCENT MANEUVER TO LIFTOFF THE LUNAR SURFACE AT THE NEXT BEST OPPORTUNITY WILL BE PERFORMED IF ANY OF THE FOLLOWING G6C SYSTEM CAPABILITES ARE LOST---</p> <p>(A) OPERATIONAL PGNS</p> <p>(B) 3-AXIS AUTO ATTITUDE CONTROL AND HOLD CAPABILITY</p> <p>(C) REDUNDANT 3- AXIS CONTROL</p> <p>(D) REDUNDANT ASC ENGINE ON/OFF CAPABILITY</p>							
		MISSION	REV	DATE	SECTION	GROUP	PAGE		
		APOLLO 11	A	6/20/69	LM GUIDANCE AND CONTROL	GENERAL	24-2		

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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM							
	24-1 CONT	<p>D. RENDEZVOUS</p> <p>1. CSI AND CDH</p> <p>IN ORDER FOR THE LM TO BE ACTIVE VEHICLE IN PERFORMING THE CSI AND CDH RENDEZVOUS MANEUVERS, THE G&C SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES----</p> <p>(A) OPERATIONAL PGNS OR AGS</p> <p>(B) 3-AXIS AUTO ATTITUDE CONTROL AND HOLD CAPABILITY</p> <p>(C) 3-AXIS CONTROL</p> <p>(D) 1-AXIS TRANSLATION CAPABILITY</p> <p>2. TPI AND TPF</p> <p>IN ORDER FOR THE LM TO BE THE ACTIVE VEHICLE FOR THE TERMINAL RENDEZVOUS MANEUVERS, THE G&C SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES----</p> <p>(A) OPERATIONAL PGNS OR AGS</p> <p>(B) 3-AXIS AUTO ATTITUDE CONTROL AND HOLD CAPABILITY</p> <p>(C) 3-AXIS CONTROL</p> <p>(D) 3-AXIS TRANSLATION CAPABILITY</p> <p>(E) ONE TTCA</p> <p>3. DOCKING</p> <p>IN ORDER FOR THE LM TO BE THE ACTIVE VEHICLE FOR DOCKING THE G&C SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES----</p> <p>(A) 3-AXIS CONTROL</p> <p>(B) ONE ACA</p> <p>(C) 3-AXIS TRANSLATION CAPABILITY</p> <p>(D) ONE TTCA</p>						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	FNL	5/16/69	LM GUIDANCE AND CONTROL	GENERAL	24-3	

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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM						
	24-2	<p>DEFINITIONS</p> <p>3-AXIS AUTO ATTITUDE CONTROL AND HOLD CAPABILITY</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>3-AXIS CONTROL</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>OPERATIONAL PGNS</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, CDU, 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>OPERATIONAL AGS</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 AN/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>3-AXIS TRANSLATION</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 TTCA AND AN OPERATIONAL PGNS OR OPERATIONAL CES CIRCUITRY.</p>					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	FNL	5/16/69	LM GUIDANCE AND CONTROL	GENERAL	24-4	

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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM		MISSION	REV	DATE	SECTION	GROUP	PAGE
		----- ' MANAGEMENT ' -----						
	24-3	IMU						
		A. THE IRIG BIAS WILL BE UPDATED WHENEVER THE GYRO DRIFT IS GREATER THAN OR EQUAL TO <u>+/-0.09</u> DEG/HR (6 MERU).						
		B. THE PGNS 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 +/-1.93 DEG/HR (128 MERU).						
		C. AFTER AN INITIAL INFLIGHT PIPA BIAS UPDATE, SUBSEQUENT UPDATES WILL BE MADE WHENEVER THE DELTA BIAS (LGC VALUE OF BIAS - MEASURED BIAS) IS GREATER THAN OR EQUAL TO +/-0.100 CM/SEC2 (.0033 FT/SEC2).						
		D. THE PGNS WILL BE CONSIDERED NO-GO IF THE PIPA BIAS EXCEEDS <u>+/-3.125</u> CM/SEC2; THE MAXIMUM ALLOWABLE VALUE WITHIN THE LGC.						
	24-4	LGC						
		A. FOR LUNAR ASCENT AND DESCENT A MASS UPDATE IS REQUIRED IF THE DIFFERENCE BETWEEN THE GROUND CALCULATION AND LGC VALUE DIFFER BY MORE THAN 18 LBS. FOR THE RNDZ PHASE AN UPDATE IS REQUIRED FOR AN ERROR OF +/- 100 LBS.						
		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.						
		C. ULLAGE FOR ALL APS BURNS MAY BE 4 JET OR 2 JET SYSTEM A OR B.						
		D. ALL +/- (U-V) JETS WILL BE INHIBITED VIA V65 DURING DOCKED DPS BURNS.						
		E. DURING DOCKED MANEUVERS, ALL DPS GIMBAL TRIMMING MUST BE DONE AT GREATER THAN 35 PERCENT THROTTLE IN THE AUTO THROTTLE MODE. THE RECOMMENDED SETTING IS 40 PERCENT THROTTLE.						
	24-5	RENDEZVOUS RADAR						
		A. THE RR MUST NOT BE OPERATED UNTIL 2 1/2 HOURS AFTER OPERATE HEATER ACTIVATION AND THE ANTENNA TEMPERATURE (HPM) 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.						
		B. THE RR SHOULD NOT BE OPERATED AT AN ANTENNA TEMPERATURE GREATER THAN OR EQUAL TO <u>145 DEG F</u> AND/OR A GYRO PACKAGE TEMP (ESTIMATED) OF GREATER THAN OR EQUAL TO 200 DEG F.						
		C. IF IT IS ESTIMATED THAT THE RR GYRO PACKAGE WILL EXCEED 200 DEG F (HPM APPROX. <u>125 DEG F</u>) PRIOR TO COMPLETION OF THE BRAKING PHASE, THE RR SHOULD BE TURNED OFF UNTIL REQUIRED FOR TPI AND BRAKING.						
		D. IF THE ESTIMATED GYRO PACKAGE TEMP SHOULD EXCEED 200 DEG F (HPM APPROX. <u>125 DEG F</u>) ANYTIME DURING THE BRAKING PHASE, THE AC POWER TO THE RR SHOULD NOT BE TURNED OFF.						
		E. IF THE RR ANTENNA TEMP (HPM) EXCEEDS THE NOMINAL TEMP PROFILE BY <u>180</u> DEG F, THE RR SHOULD BE TURNED OFF IF IT IS NOT NEEDED.						
		F. IF THE RR OVEN HEATERS ARE TURNED OFF (BOTH THE PGNS--- RNDZ RDR AND HEATERS---RNDZ 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.						
			APOLLO 11	A	6/20/69	LM GUIDANCE AND CONTROL	MANAGEMENT	24-5

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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 + 50 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 PDI + 4 MIN IF THE LR TEMP IS GREATER THAN 110 DEF F. AT NOMINAL TIG -1.5 MIN (LR ACTIVATION).</p> <p>C. PDI WILL BE DELAYED ONE REV IF THE LR TEMP IS GREATER THAN TBD 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 AN ASA TEMPERATURE OF LESS THAN + 90 DEG F OR GREATER THAN + 150 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 7 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 DPS BURN.</p>					
<p>RULE NUMBERS 24-8 THROUGH 24-19 ARE RESERVED.</p>							
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
				----- SPECIFIC -----				
	24-20	LOSS OF OPERATIONAL PGNS	DOCKED/ UNDOCKED DESCENT/ ORBIT POWERED DESCENT LUNAR STAY RNDZ	1. RETURN TO CSM ASAP 2. NO-GO FOR DOI 1. STOP BURN IF BURNING 2. RETURN TO CSM ASAP 3. NO-GO FOR PDI 1. PRIOR TO LOW GATE (A) NO-GO FOR LANDING (B) ABORT 2. AFTER LOW GATE (A) LAND MANUALLY (B) NO-GO FOR EXTENDED LUNAR STAY ASCENT AT NEXT BEST OPPORTUNITY 1. SWITCH TO AGS 2. CONTINUE MISSION	• REF MALF PROC PGNS--- 2 ISS WARN 2 LGC WARN 3 TEMP CAUTION 4 GIMBAL LOCK			
	24-21	LOSS OF FDAI FUNCTIONS (ATT, RATES, ERRORS) A. ALL FUNCTIONS ON ONE FDAI B. ALL FUNCTIONS ON ONE FDAI AND 2 OF 3 ON THE OTHER	ALL DOCKED/ UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY/RNDZ	A. CONTINUE MISSION B.1.(A) RETURN TO CSM ASAP (B) NO-GO FOR DOI 2.(A) RETURN TO CSM ASAP (B) NO-GO FOR PDI 3.(A) PRIOR TO LOW GATE--- (1) NO-GO FOR LANDING (2) ABORT (B) AFTER LOW GATE--- CONTINUE MISSION 4. CONTINUE MISSION	• REF MALF PROC DISPLAY--- 1 FDAI ATT ERROR ABNORMAL 2 FDAI TOTAL ATT ABNORMAL 3 FDAI RATE DISPLAY ABNORMAL			
	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	
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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	24-23	LOSS OF RENDEZVOUS RADAR AND/OR TRANSPONDER	DOCKED/ UNDOCKED ALL OTHERS	1. RETURN TO CSM ASAP 2. NO-GO FOR DOI CONTINUE MISSION	• REF MALF PROC PGNS--- 5 TRACKER 8 RNDZ RADAR CAUTION 8A NO TRACK REF MALF PROC HTRS--- 1C RR TEMP ABNORMAL
	24-24	LOSS OF LANDING RADAR	DOCKED/ UNDOCKED DESCENT ORBIT POWERED DESCENT	1. RETURN TO CSM ASAP 2. NO-GO FOR DOI 1. RETURN TO CSM ASAP 2. NO-GO FOR PDI 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 MALF PROC PGNS--- 6 ALT LT 7 VEL LT REF MALF PROC HTRS--- 2 LR TEMP ABNORMAL
	24-25	VHF RANGING/OPTICAL TRACKING A. LOSS OF EITHER B. LOSS OF BOTH RULE 24-26 IS RESERVED.	ALL DOCKED/ UNDOCKED ALL OTHERS	A. CONTINUE MISSION B.1.(A) RETURN TO CSM ASAP (B) NO GO FOR DOI 2. CONTINUE MISSION	CSM OPTICAL TRACKING CAPABILITY REQUIRES THE LM TRACKING LIGHT AND THE ABILITY TO VISUALY TRACK.

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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	24-27	LOSS OF AUTOMATIC 3-AXIS ATTITUDE CONTROL AND HOLD CAPABILITY---			<ul style="list-style-type: none"> • REF MALF PROC CES--- 1 ABNORMAL VEHICLE DYNAMICS 2 LM DRIFTS
		A. LOSS OF AGS CAPABILITY	DOCKED/ UNDOCKED	A.1. RETURN TO CSM- NO GO FOR DOI	NOTE---
			DESCENT ORBIT	2. RETURN TO CSM ASAP- NO GO FOR PDI	CONSIDERATION WILL BE GIVEN TO CONTINUING BASED ON AGS FAILURE MODE
			POWERED DESCENT	3.(A) PRIOR TO HI-GATE- ABORT	
				(B) AFTER HI-GATE- CONTINUE MISSION	
			LUNAR STAY	4. CONTINUE MISSION	
		B. LOSS OF PGNS CAPABILITY	DOCKED/ UNDOCKED	B.1.(A) RETURN TO CSM (B) NO-GO FOR DOI	
			DESCENT ORBIT	2.(2) STOP BURN, IF BURNING	
				(B) NO-GO FOR PDI	
				(C) RETURN TO CSM ASAP	
			POWERED DESCENT	3.(A) PRIOR TO LOW GATE ABORT	
				(B) AFTER LOW GATE	
				(1) LAND MANUALLY	
				(2) NO-GO FOR EXTENDED LUNAR STAY	
			LUNAR STAY	4. ASCENT AT THE NEXT BEST OPPORTUNITY	

MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	24-28	LOSS OF 3-AXIS CONTROL			
		A. REDUNDANT	DOCKED/ UNDOCKED	A.1.(A) RETURN TO CSM ASAP (B) NO-GO FOR DOI	
			DESCENT ORBIT	2.(A) RETURN TO CSM ASAP (B) NO-GO FOR PDI	
			POWERED DESCENT/	3.(A) PRIOR TO HI GATE - ABORT (B) AFTER HI GATE - CONTINUE MISSION	
			LUNAR STAY	4. ASCENT AT NEXT BEST OPPORTUNITY	
			RNDZ	5. CONTINUE MISSION	
		B. ANY AXIS	POWERED DESCENT	B.1.(A) PDI TO LOW GATE ABORT (B) 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	
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MISSION RULES

SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
	24-30	LOSS OF PITCH OR ROLL GDA	DOCKED/ UNDOCKED DESCENT ORBIT POWERED DESCENT	DOCKING 1. RETURN TO CSM ASAP 2. NO-GO FOR DOI 1. RETURN TO CSM ASAP 2. NO-GO FOR PDI CONTINUE MISSION UNLESS RCS IMPINGEMENT CONSTRAINTS ARE VIOLATED.	RCS IMPINGEMENT CONSTRAINTS MAY BE VIOLATED BECAUSE OF RCS OPPOSING THRUST VECTOR OFFSET. REF MALF PROC CES--- 5 GDA CAUTION LIGHT ON			
	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 PDI 1. BACKUP PDI WITH DES ENG CMD OVRD SW 2. PDI TO PDI + 5; ABORT ONLY IF FAILURE AFFECTS ASCENT ENGINE. 3. AFTER PDI + 5, CONTINUE THROUGH LANDING. 4. NO-GO FOR EXTENDED LUNAR STAY IF FAILURE AFFECTS ASCENT ENGINE. ASCENT AT NEXT BEST OPPORTUNITY VIA MANUAL START CAPABILITY	REF MALF 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 PDI 2. RETURN TO CSM ASAP	REF MALF 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/ RNDZ	A. RETURN TO CSM ASAP - NO GO FOR DOI B. RETURN TO CSM ASAP - NO GO FOR PDI C. (1) PRIOR TO HI GATE - ABORT (2) AFTER HI GATE - CONTINUE MISSION D. CONTINUE MISSION	REF MALF PROC AGS--- 1 AGS WARNING LIGHT 2 DEDA RESPONSE IS ABNORMAL NOTE--- CONSIDERATION WILL BE GIVEN TO CONTINUING BASED UPON AGS FAILURE MODE.			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
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SECTION 24 - LM 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	• REF MALF PROC CES--- 11 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 PDI	11 CMD THR DOES NOT RESPOND TO TTCA OR DOES NOT FOLLOW TIMELINE.			
			POWERED DESCENT	1. PRIOR TO LOW GATE (A) IF CMDED 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 LOW GATE (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	NO LONGER THAN 25 SEC IN NON-THROTTLEABLE RANGE CAN BE ACCUMULATED.			
			DESCENT ORBIT	1. RETURN TO CSM ASAP 2. IF BURNING, CONTINUE BURN 3. NO-GO FOR PDI	• REF MALF PROC CES--- 11 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) IF THROTTLE REGAINED WITHIN 25 SEC - CONTINUE MISSION (B) IF THROTTLE OPERATED FOR MORE THAN 25 SEC IN NON-THROTTLEABLE REGION - ABORT 3. AFTER THROTTLE DOWN, THROTTLE REQUIREMENT MAY BE DELETED BASED ON NOMINAL TRAJECTORY AND GUIDANCE.	11 CMD THR DOES NOT RESPOND TO TTCA OR DOES NOT FOLLOW TIMELINE			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
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SECTION 24 - LM GUIDANCE AND CONTROL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	24-36	LOSS OF ACA A. ONE B. BOTH	ALL DOCKED/ UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY RNDZ	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 PDI 3.(A) ABORT USING DPS. ABORT STAGE 20 SEC AFTER LOW LEVEL 4.(A) CONTINUE MISSION (B) CSM ACTIVE VEHICLE FOR DOCKING	• REF MALF PROCES 2 LM DRIFTS OUT OF DEADBAND 5 PROP CMDS ABNORMAL
	24-37	LOSS OF TTCA A. ONE B. BOTH	ALL DOCKED/ UNDOCKED DESCENT ORBIT POWERED DESCENT LUNAR STAY RNDZ	A. CONTINUE MISSION B.1.(A) RETURN TO CSM ASAP (B) NO-GO FOR DOI 2.(A) RETURN TO CSM ASAP (B) NO-GO FOR PDI, CDH, CSI, DOCKING 3.(A) DO NOT SWITCH TO MANUAL THROTTLE (B) ABORT USING DPS. ABORT STAGE AFTER 'X' SEC IN NON THROTTABLE RANGE (C) AFTER THROTTLE DOWN MANUAL THROTTLE 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	• REF MALF PROCES--- 1 ABNORMAL VEHICLE DYNAMICS 14 ABSENCE OF NORMAL RESPONSE VIA TTCA 3.(B) 'X' SEC IS DEFINED IN RULE 25-15.
	24-38	LOSS OF LUNAR CONTACT LIGHTS RULE NUMBER 24-39 IS RESERVED.	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	GG0001U	-	-	M	24-20
		PLS TORO REF	GG1040V	-	-	HD	24-20
		2.5 VDC TM BIAS	GG1110V	-	-	HD	24-20
		IMU 28 VAC 800	GG1201V	-	-	HD	24-20
		IRIG SUSP 3.2 KC	GG1331V	-	-	HD	24-20
		IMU STBY	GG1513X	-	-	HD	24-20
		LGC OPR	GG1523X	-	-	HD	24-20
		X PIPA OUT IN PHASE	GG2001V	-	-	HD	24-20
		Y PIPA OUT IN PHASE	GG2021V	-	-	HD	24-20
		Z PIPA OUT IN PHASE	GG2041V	-	-	HD	24-20
		IG SVO ERR IN PHASE	GG2107V	-	-	HD	24-20
		IG IX RSVR OUT SIN	GG2112V	FDAI	COMMON	M-PCM	24-20
		IG IX RXVR OUT COS	GG2113V	FDAI	COMMON	M-PCM	24-20
		MG SVO ERR IN PHASE	GG2137V	-	-	HD	24-20
		MG IX RSVR OUT SIN	GG2142V	FDAI	COMMON	M-PCM	24-20
		MG IX RSVR OUT COS	GG2143V	FDAI	COMMON	M-PCM	24-20
		OG SVO ERR IN PHASE	GG2167V	-	-	HD	24-20
		OG RSVR OUT SIN	GG2172V	FDAI	COMMON	M-PCM	24-20
		OG RSVR OUT COS	GG2173V	FDAI	COMMON	M-PCM	24-20
		PITCH ATT ERR	GG2219V	FDAI	COMMON	HD - PCM	24-20
		YAW ATT ERR	GG2249V	FDAI	COMMON	HD - PCM	24-20
		ROLL ATT ERR	GG2279V	FDAI	COMMON	HD - PCM	24-20
		PIPA TEMP	GG2300T	C&W	SEPARATE	M-PCM	24-20
		RR SHFT SIN	GG3304V	FDAI	COMMON	HD - PCM	24-23
		RR SHFT COS	GG3305V	FDAI	COMMON	HD - PCM	24-23
		RR TRUN SIN	GG3324V	FDAI	COMMON	HD - PCM	24-23
		RR TRUN COS	GG3325V	FDAI	COMMON	HD - PCM	24-23
		LGC WARNING	GG9001X	C&W	COMMON	HD - PCM	24-20
		ISS WARNING	GG9002X	C&W	COMMON	HD - PCM	24-20
		LR ANT TEMP	GN7563T	TEMP MONITOR	COMMON	M - PCM	
		RR NO TRACK	GN7621X	C&W	COMMON	HD - PCM	24-23
		RR ANT TEMP	GN7723T	TEMP MONITOR	COMMON	M-PCM	24-23
		YAW ERR CMD	GH1247V	-	-	M	24-28
		PITCH ERR CMD	GH1248V	-	-	M	24-28
		ROLL ERR CMD	GH1249V	-	-	M	24-28
		JD A4D OUTPUT	GH1419V	-	-	HD	24-27
		RCS TCP A4D	GR5032X	-	-	HD	24-27
		JD B3D OUTPUT	GH1423V	-	-	HD	24-27
		RCS TCP B3D	GR5036X	-	-	HD	24-27
		JD A2D OUTPUT	GH1427V	-	-	HD	24-27
		RCS TCP A2D	GR5040X	-	-	HD	24-27
		JD B1D OUTPUT	GH1431V	-	-	HD	24-27
		RCS TCP B1D	GR5044X	-	-	HD	24-27
		JD B4U OUTPUT	GH1418V	-	-	HD	24-27
		JD B4F OUTPUT	GH1420V	-	-	HD	24-27
		JD A4R OUTPUT	GH1421V	-	-	HD	24-27
		JD A3U OUTPUT	GH1422V	-	-	HD	24-27
		JD B3A OUTPUT	GH1424V	-	-	HD	24-27
		JD A3R OUTPUT	GH1425V	-	-	HD	24-27
		JD B2U OUTPUT	GH1426V	-	-	HD	24-27
		JD A2A OUTPUT	GH1428V	-	-	HD	24-27
		JD B2L OUTPUT	GH1429V	-	-	HD	24-27
		JD A1U OUTPUT	GH1430V	-	-	HD	24-27
		JD A1F OUTPUT	GH1432V	-	-	HD	24-27
		JD B1L OUTPUT	GH1433V	-	-	HD	24-27
		RCS TCP B4U	GR5031X	-	-	HD	24-27
		RCS TCP B4F	GR5033X	-	-	HD	24-27
		RCS TCO A4R	GR5034X	-	-	HD	24-27
		RCS TCP A3U	GR5035X	-	-	HD	24-27
		RCS TCP B3A	GR5037X	-	-	HD	24-27
		RCS TCP A3R	GR5038X	-	-	HD	24-27
		RCS TCP B2U	GR5039X	-	-	HD	24-27
		RCS TCP A2A	GR5041X	-	-	HD	24-27
		RCS TCP B2L	GR5042X	-	-	HD	24-27
		RCS TCP A1U	GR5043X	-	-	HD	24-27
		RCS TCP A1F	GR5045X	-	-	HD	24-27
		RCS TCP B1L	GR5046X	-	-	HD	24-27
		YAW ATT ERR	GH1455V	FDAI	COMMON	HD	24-28
		PITCH ATT ERR	GH1456V	FDAI	COMMON	HD	24-28
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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SECTION 24 - M GUIDANCE AND CONTROL - CONTINUED

REV	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
	24-40 CONT	ROLL ATT ERR	GH1457V	FDAI	COMMON	HD	24-28
		RGA YAW RATE	GH1461V	FDAI	COMMON	M ON BOAR	24-28
		RGA PITCH RATE	GH1462V	FDAI	COMMON	M PCM/HD	24-28
		RGA ROLL RATE	GH1463V	FDAI	COMMON	M	24-28
		AGS SEL	GH1621X	-	-	HD	24-33
		ROLL PLSD/DIR	GH1628X	-	-	HD	24-33
		PITCH PLSD/DIR	GH1629X	-	-	HD	24-33
		YAW PLSD/DIR	GH1630X	-	-	HD	24-33
		AUTO ON	GH1214X	-	-	M	24-31
		APS ARM	GH1230X	-	-	M	24-31
		ENG FIRE OVRD	GH1286X	-	-	M	24-31
		MAN THRUST CMD	GH1311V	METER	SEPARATE	M	24-34,24-35
		PITCH GDA POS	GH1313V	-	-	M	24-30
		ROLL GDA POS	GH1314V	-	-	M	24-30
		P TRM FAIL	GH1323X	C&W	COMMON	M	24-30
		R TRM FAIL	GH1330X	C&W	COMMON	M	24-30
		AUTO THRUST CMD	GH1331V	METER	SEPARATE	HD	24-34
		DPS ARM	GH1348X	-	-	M	24-32,24-31
		VAR INJ ACT POS	GQ6806H	-	-	M	24-34,24-35
		CES AC PWR FAIL	GL4026X	C&W	COMMON	M	24-30
		CES DC PWR FAIL	GL4027X	C&W	COMMON	M	24-30
		AGS DOWNLINK DATA	GI0001X	-	-	HD	24-33
		ASA TEMP	GI3301T	-	-	HD	24-33
		ASA PWR/AEA FAIL	GL4028X	C&W	COMMON	HD	24-33
		AUTO OFF	GH1217X	-	-	HD	24-32,24-31
		AGS AUTO	GH1641X	-	-	HD	24-27
		AGS ATT HOLD	GH1642X	-	-	HD	24-27
		PGNS AUTO	GH1643X	-	-	HD	24-27
		PGNS ATT HOLD	GH1644X	-	-	HD	24-27
		LR RNG DATA NO GOOD	GN7521X	C&W	COMMON	HD	
		LR VEL DATA NO GOOD	GN7557X	C&W	COMMON	HD	

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MISSION RULES

SECTION 25 - LM PROPULSION - DPS

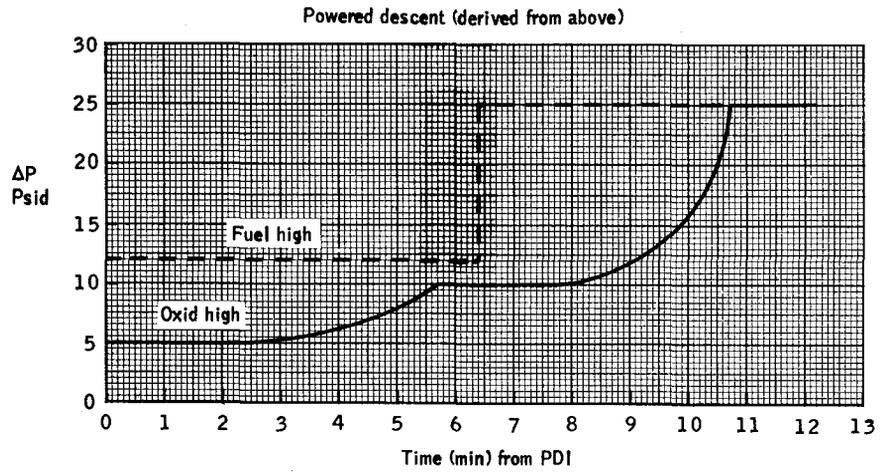
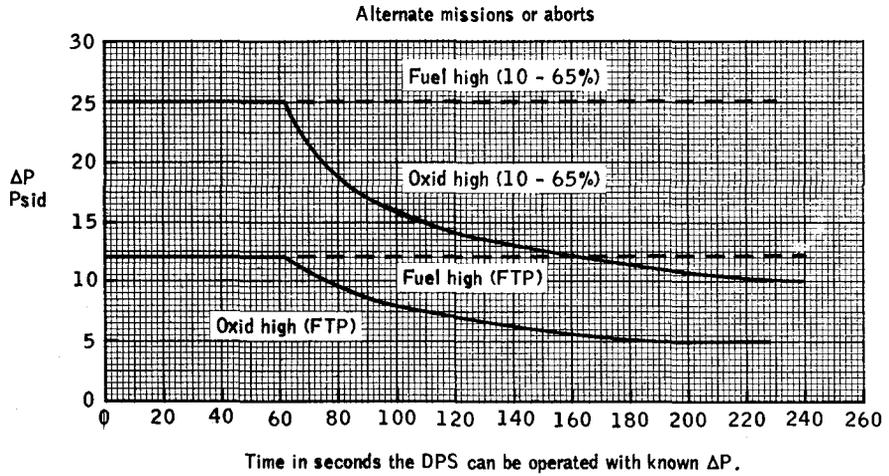
REV	ITEM							
		----- ' GENERAL ' -----						
25-1		IN ORDER TO INITIATE AND CONTINUE THE FOLLOWING MISSION PHASES THE DPS SUBSYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES.						
		A. DOCKED/UNDOCKED						
		NO DPS PROPELLANT LEAKS						
		B. DESCENT ORBIT, POWERED DESCENT						
		1. NO DPS PROPELLANT LEAKS						
		2. AN OPERATIONAL DPS						
		3. LOW LEVEL CONFIRMS SUFFICIENT PROPELLANT TO LAND, OR IF LOW LEVEL INVALID-GREATER THAN 2 PERCENT QUANTITY REMAINING.						
25-2		DEFINITIONS						
		A. AN OPERATIONAL DPS IS DEFINED AS FOLLOWS---						
		1. FUEL AND/OR OXID ENGINE INLET PRESSURE GREATER THAN 60 PSIA AT DOI INITIATION.						
		2. FUEL AND/OR OXID ENGINE INLET PRESSURES GREATER THAN 120 PSIA (ULLAGE PRESSURES GREATER THAN 123 PSIA.) DURING A BURN WITH THROTTLE LESS THAN 65 PERCENT OR GREATER THAN 150 PSIA (ULLAGE PRESSURES GREATER THAN 160 PSIA.) WITH THROTTLE GREATER THAN 65 PERCENT.						
		3. DPS PROPELLANT TEMPS GREATER THAN 50 DEG F, AND OXID TEMP LESS THAN 75 DEG F AND FUEL TEMP LESS THAN 86 DEG F OTHER THAN DURING A BURN.						
		4. DELTA TEMP BETWEEN FUEL AND OXID LESS THAN 25 DEG F FOR BURNS LESS THAN 400 SEC, AND LESS THAN 10 DEG F FOR BURNS GREATER THAN 400 SEC ONLY TO INITIATE A BURN.						
		5. (A) DELTA PRESSURE BETWEEN FUEL AND OXID ENGINE INLET PRESSURES BELOW CURVE (NEXT PAGE) PRIOR TO LOW GATE---						
		(B) DELTA PRESSURE (FUEL HIGH) LESS THAN 50 PSID AT START OF ANY BURN.						
		6. SUPERCRITICAL HELIUM ADEQUATE TO COMPLETE MISSION.						
		B. THE LOW THROTTLE POINT IS DEFINED AS THE MINIMUM POSITION THAT THE THROTTLE ACTUATOR WILL ASSUME WITH MINIMUM MANUAL THROTTLE COMMAND VOLTAGE (12.4 FOR LM-5).						
		RULES 25-3 THROUGH 25-10 ARE RESERVED.						
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	B	7/3/69	LM PROPULSION -DPS	GENERAL - DPS	25-1	

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MISSION RULES

SECTION 25 - LM PROPULSION - DPS

REV	ITEM



MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	A	6/20/69	LM PROPULSION -DPS	GENERAL - DPS	25-2

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MISSION RULES

SECTION 25 - LM PROPULSION - DPS

REV	ITEM						
		<p>----- ! SYSTEMS MANAGEMENT ! -----</p>					
		RULE 25-11 IS RESERVED.					
	25-12	THE TOTAL CONTINUOUS BURN TIME OF THE DESCENT ENGINE SHALL NOT EXCEED 910 SECONDS OF OPERATION INDEPENDENT OF THRUST LEVEL (BASED UPON A LUNAR MISSION DUTY CYCLE).					
	25-13	THE DPS ENGINE WILL NOT NORMALLY BE OPERATED FOR LESS THAN 3.5 SEC. A 2 SEC COAST BEFORE RESTART AT 12.4 PERCENT AND A 30 MINUTE COAST BEFORE RESTARTS GREATER THAN 12.4 PERCENT IS REQUIRED.					
	25-14	ALL DPS STARTS WILL BE NOMINALLY PLANNED AT THE LOW THROTTLE POINT.					
	25-15	THE DPS ENGINE WILL NOT BE OPERATED IN THE NON-THROTTLING RANGE (65 PERCENT TO FTP) FOR MORE THAN 25 SEC DURING THE NORMAL LUNAR MISSION PROFILE OR FOR WHATEVER TIME 0.2 PERCENT/SEC NON-THROTTLEABLE EROSION RATE WILL ALLOW SUCH THAT THE TOTAL THROAT AREA INCREASE WILL NOT EXCEED 25 PERCENT.					
	25-16	FROM A SAFETY STANDPOINT SUPERCRITICAL HELIUM BURST DISC RUPTURE DURING MANNED OPERATION IS AN ALLOWABLE EVENT.					
	25-17	WITH A NORMAL SHE PRESSURE RISE RATE THERE IS NO MINIMUM PRESSURE AT WHICH DPS PROPELLANTS CAN NOT BE DEPLETED.					
	25-18	IF POSSIBLE THE DPS WILL NOT BE BURNED TO PROPELLANT DEPLETION; WHERE EVER POSSIBLE THE ABORT STAGE SEQUENCE WILL BE INITIATED AT LOW LEVEL PLUS 20 SECONDS DURING AN ABORT FROM POWERED DESCENT; HOWEVER, AT CREW OPTION ABORT STAGE SEQUENCE MAY BE INITIATED AT LOW LEVEL IF A SAFE ABORT STAGE CAPABILITY EXISTS.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	B	7/3/69	LM PROPULSION -DPS	MANAGEMENT	25-3

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MISSION RULES

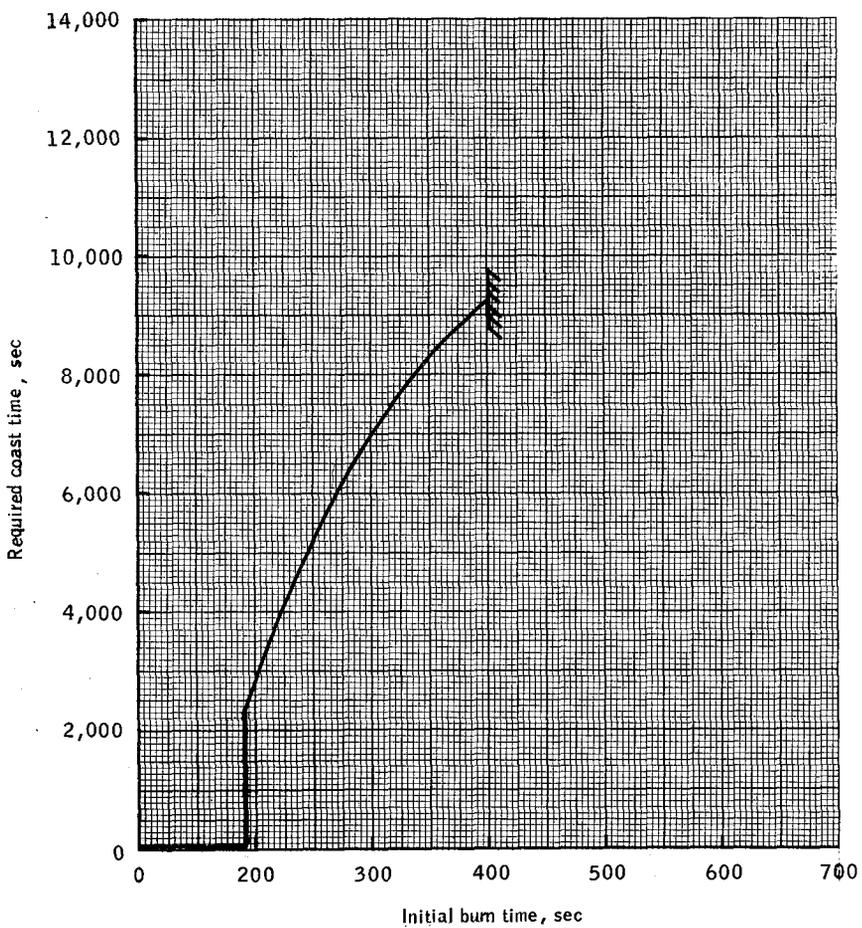
SECTION 25 - LM PROPULSION - DPS

REV	ITEM
25-19	DPS ENGINE RESTARTS CAN BE MADE WITH THE FOLLOWING CONSTRAINTS (REF 25-20) ---

INITIAL BURN	REQUIRED COAST TIME	MAXIMUM RESTART BURN TIME
A. 3.5 SEC TO 40 SEC	2 SECONDS(SINGLE RESTART ONLY)	NO CONSTRAINT
B. 40 SEC TO 190 SEC	2 SECONDS(SINGLE RESTART ONLY)	400 SECS
C. 190 SECS TO 400 SECS	SEE FIGURE BELOW	100 SECS*
D. GREATER THAN 400 SECS	NO RESTART	---

THESE CONSTRAINTS ARE BASED ON ENGINE THRUST CHAMBER HEATING AND SOAK BACK LIMITS. TERMINATE THE BURN IF THE MAXIMUM RESTART BURN TIME IS EXCEEDED.

*THERE SHALL BE NO MORE THAN 4 RESTARTS (60 SEC MAX DURATION EACH) AFTER THE INITIAL BURN.



LMDE required coast time vs initial burn time for engine chamber heating limitations.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	A	6/20/69	LM PROPULSION -DPS	MANAGEMENT	25-4

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MISSION RULES

SECTION 25 - LM PROPULSION - DPS

REV	ITEM						
	25-20	<p>ONLY PERMISSION APPROVED ALTERNATE DPS/MULTIBURN PROFILES WILL BE EXECUTED, SINCE NO DATA EXISTS TO ALLOW REAL-TIME SUPPORT FOR EXAMINING DPS FREEZING, CHARRING, BACKWALL TEMPERATURE CONSTRAINTS FOR MULTIBURN PROFILES.</p>					
	25-21	<p>PROPELLANT GAGING</p> <p>A. PRIME METHOD--- PQGS (TM, ONBOARD) (1.3 PERCENT)</p> <p>B. BACKUP METHOD--- GROUND MASS CALCULATION (0.8 PERCENT)</p>					
	25-22	<p>IF POWERED DESCENT IS ABORTED PRIOR TO PDI + 5 OR IF A DOCKED DPS CONTINGENCY IS REQUIRED, THE DES HE REG 1 AND REG 2 SWITCHES SHOULD BE CLOSED AT IGNITION + 6 MINUTES AND 10 SECONDS TO INSURE A LOW ENOUGH TANK PRESSURE TO PREVENT A VIOLATION OF FRACTURE MECHANICS LIMITS FROM HEAT SOAK BACK.</p> <p>RULE NUMBERS 25-23 THROUGH 25-29 ARE RESERVED.</p>					
	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	A	6/20/69	LM PROPULSION -DPS	MANAGEMENT	25-5	

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MISSION RULES

SECTION 25 - LM PROPULSION - DPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
----- SPECIFIC MISSION RULES -----							
	25-30	LOSS OF OPERATIONAL DPS (PRIOR TO LOW GATE REF MR 25-2 FOR DEFINITION. AFTER LOW GATE ONLY LOW INLET PRESSURES LESS THAN 120 PSIA)	DOCKED/ UNDOCKED DESCENT ORBIT POWERED DESCENT	A. INHIBIT DPS BURNS B. STOP DOI IF IN PROGRESS 1. INHIBIT PDI 2. RNDZ WITH APS C. ABORT STAGE	REF MAL PROC DPS--- 1 DES REG 1A FUEL/OXID PRESS ABNORMAL 2 FUEL/OXID TEMP ABNORMAL 3 HE PRESS ABNORMAL		
	25-31	START TANK LEAK PRIOR TO PRESSURIZATION A. FUEL AND/OR OXID ENGINE INLET P GREATER THAN 60 PSIA. B. FUEL AND/OR OXID ENGINE INLET P LESS THAN 60 PSIA.	ALL	A. CONTINUE MISSION INHIBIT FIRING DPS START TANK SQUIB B. CONTINUE MISSION 1. FIRE SQUIB TO START TANK 2. INHIBIT DPS BURNS IF INLET PRESSURES DO NOT COME UP GREATER THAN OR EQUAL TO 60 PSIA.	REF MAL PROC DPS--- 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	DPS FAILS TO PRESSURIZE A. VIA START TANK 1. INLET PRESS GREATER THAN OR EQUAL TO 60 PSIA. 2. INLET PRESS LESS THAN 60 PSIA. B. VIA SUPERCRITICAL HELIUM	ALL DESCENT ORBIT	A. 1. CONTINUE MISSION 2. INHIBIT ALL DPS BURNS B. CUT OFF DOI ON INLET PRESSURES IF NECESSARY 1. IF DOI ACCOMPLISHED (A) ARM PYRO PRIOR TO PDI. (B) SWITCH DES HE REGS AT PDI IGNITION. 2. IF DOI SHUTDOWN (A) NO GO FOR PDI. (B) RNDZ WITH APS.	REF MAL PROC DPS--- 1 DES REG 3 HE PRESS ABNORMAL		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	LM PROPULSION -DPS	SPECIFIC-DPS	25-6

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MISSION RULES

SECTION 25 - LM PROPULSION - 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 HE PRESS ABNORMAL
		A. PRIOR TO PDI + 6 MIN. 20 SECS.	POWERED DESCENT	A. ABORT ABORT STAGE PRIOR TO INLET PRESSURES LESS THAN OR EQUAL TO 150 PSIA. (ULLAGE PRESSURE LESS THAN 160 PSIA.)	
		B. AFTER PDI + 6 MIN. 20 SECS.		B. CONTINUE MISSION	REF RULE 25-2.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	A	6/20/69	LM PROPULSION -DPS	SPECIFIC-DPS	25-7

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MISSION RULES

SECTION 25 - LM PROPULSION - DPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	25-34	LEAK BETWEEN HE REG SHUTOFF AND QUAD CHECK VALVES DETECTED--- A. PRIOR TO BLOWING AMB TANK SQUIB	ALL	A. PRESSURIZE DPS WITH AMB 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 AT PDI IGNITION.	REF MAL PROC DPS 1 DES REG 3 HE PRESS ABNORMAL		
		B. AFTER AMB PRESSURIZATION BUT PRIOR TO DOI.	ALL	B. IF LEAK RATE LESS THAN 20 PSI/SEC 1. CLOSE DES HE REG 1 2. 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. (A) CLOSE DES HE REG 1 (B) OPEN DES HE REG 1 AT IGNITION OF SUBSEQUENT BURNS. (C) CLOSE DES HE REG 1 AT SHUTDOWN OF SUBSEQUENT BURNS. 2. IF SHE RISE RATE IS LESS THAN 150 PSI/HR CONTINUE MISSION (A) CLOSE DES HE REG 1 (B) OPEN DES HE REG 1 AT PDI IGNITION	SHE CAPABILITY MUST BE OBTAINED REAL TIME FROM ACF SHE PROGRAM TO IDENTIFY REMAINING CAPABILITIES.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	LM PROPULSION -DPS	SPECIFIC-DPS	25-8

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MISSION RULES

SECTION 25 - LM PROPULSION - DPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	25-35	LEAK BETWEEN SHE SQUIB AND DES HE REG 1 AND 2 SHUTOFF VALVES.	DOCKED/ UNDOCKED DESCENT ORBIT	A. PRIOR TO DOI DO NOT BLOW SHE SQUIB AT DOI 1. DO NOT ARM PYRO PRIOR TO DOI 2. ARM PYRO PRIOR TO PDI B.1. SHE PRESS RISE GREATER THAN 150 PSI/HR (A) INHIBIT FURTHER DPS BURNS 2. SHE PRESS RISE LESS THAN 150 PSI/HR (A) CONTINUE MISSION	REF MAL PROC DPS 1 DES REG 3 HE PRESS ABNORMAL		
	25-36	DPS PROPELLANT/VAPOR LEAK DOWNSTREAM OF QUAD CHECK VALVES	DOCKED/ UNDOCKED DESCENT ORBIT POWERED DESCENT	STAGE ASAP STAGE ASAP APS RNDZ A. PDI TO LOW GATE ABORT STAGE B. LOW GATE TO TD CONTINUE MISSION	REF MAL PROC DPS 1 DES REG 1A FUEL/OXID PRESS ABNORMAL 3 HE PRESS ABNORMAL 7 PQGS IND ABNORMAL		
	25-37	LOW LEVEL CONFIRMS INSUFFICIENT PROPELLANT TO LAND.	POWERED DESCENT	A. ABORT B. ABORT STAGE 20 SECONDS AFTER LOW LEVEL	REF MAL PROC DPS 6 DES QTY		
	25-38	PQGS READING 2 PERCENT (EITHER FUEL OR OXID) AND NO VALID TIME ESTIMATE FROM LOW LEVEL	POWERED DESCENT	ABORT ABORT STAGE AT DPS DEPLETION	REF MAL PROC DPS 7 PQGS IND ABNORMAL		
	25-39	EXCESSIVE PROPELLANT USAGE (MARGIN AT TOUCHDOWN LESS THAN 0 PERCENT).	POWERED DESCENT	A. PRIOR TO P64 - CONTINUE MISSION B. AFTER P64 BUT PRIOR TO LO GATE. 1. ABORT 2. ABORT STAGE 20 SECONDS AFTER LOW LEVEL.	NOTE---THROTTLEDOWN TIME, THRUST LEVEL, AND SYSTEM PRESSURES ARE SECONDARY CUES WHICH INDICATE OFF NOMINAL DPS PERFORMANCE.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	LM PROPULSION -DPS	SPECIFIC-DPS	25-9

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MISSION RULES

SECTION 25 - LM PROPULSION - DPS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	25-40	UNABLE TO VENT DPS AFTER LANDING	LUNAR STAY	ASCEND ASAP	
		RULES 25-41 THROUGH 25-49 ARE RESERVED.			

	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	A	6/20/69	LM PROPULSION -DPS	SPECIFIC-DPS	25-10	

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MISSION RULES

SECTION 25 - LM DPS - CONCLUDED

REV	ITEM	----- ' DPS - PRELAUNCH INSTRUMENTATION ' -----					MISSION RULE REFERENCE
	25-50	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCER	CATEGORY	
		START TNK PRESS	GQ3015P	HE MON	COMMON	M	25-31,32,35
		HE REG PRESS	GQ3018P	C&W	COMMON	HD 1 OF 2	25-34,30,35
		HE REG PRESS	GQ3025P			HD M-PCM	25-34,30,35
		HE PRESS	GQ3435P			HD 1 OF 2	25-33,30,32
		HE PRESS	GQ3436P	PRESS		HD M	25-33,30,32
		FU TNK 1 QTY	GQ3603Q	QTY	COMMON	HD 1 OF 2	25-37,38,39
		FU TNK 2 QTY	GQ3604Q	QTY	COMMON	HD M	25-37,38,39
		OX TNK 1 QTY	GQ4103Q	QTY	COMMON	HD 1 OF 2	25-37,38,39
		OX TNK 2 QTY	GQ4104Q	QTY	COMMON	HD M	25-37,38,39
		FU 1 TEMP	GQ3718T	TEMP MON	COMMON	HD 1 OF 2	25-30
		FU 2 TEMP	GQ3719T	TEMP MON	COMMON	HD M	25-30
		OX 1 TEMP	GQ4218T	TEMP MON	COMMON	HD 1 OF 2	25-30
		OX 2 TEMP	GQ4219T	TEMP MON	COMMON	HD M	25-30
		FU PRESS	GQ3611P			M	25-30,31,32,33, 35
		OX PRESS	GQ4111P			M	25-30,31,32,33, 35
		TCP	GQ6510P	THRUST	COMMON	M-PCM	25-30
		LOW LEVEL	GQ4455X	DPS LOW	COMMON	M	25-36

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	A	6/20/69	LM DPS	PRELAUNCH INSTR	25-11

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MISSION RULES

SECTION 26 - LM PROPULSION - APS

REV	ITEM								
		<p>----- ! GENERAL ! -----</p>							
26-1		<p>IN ORDER TO INITIATE AND CONTINUE THE FOLLOWING MISSION PHASES THE APS SUBSYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES---</p> <p>A. DOCKED</p> <p>NO PROPELLANT LEAK</p> <p>B. UNDOCKED, DESCENT ORBIT, POWERED DESCENT, LUNAR STAY</p> <ol style="list-style-type: none"> 1. NO APS PROPELLANT LEAKS 2. AN OPERATIONAL APS <p>C. RENDEZVOUS</p> <ol style="list-style-type: none"> 1. OPERATIONAL APS IF APS REQUIRED 							
26-2		<p>DEFINITIONS---</p> <p>A. AN OPERATIONAL APS (PREPRESSURIZATION) IS DEFINED AS FOLLOWS---</p> <ol style="list-style-type: none"> 1. DELTA PRESS BETWEEN APS FUEL AND OXID ENGINE INLET PRESSURES LESS THAN 90 PSID. 2. DELTA TEMP BETWEEN APS FUEL AND OXID LESS THAN 10 DEG F. 3. APS FUEL AND/OR OXID TEMP GREATER THAN 50 DEG F AND LESS THAN 90 DEG F. 4. APS FUEL OR OXID INLET PRESSURE GREATER THAN 62 PSIA AND LESS THAN 220 PSIA. 5. NO HELIUM TANK OR HELIUM LINE LEAKS. <p>B. AN OPERATIONAL APS (POST-PRESSURIZATION) IS DEFINED AS FOLLOWS---</p> <ol style="list-style-type: none"> 1. ADEQUATE SOURCE PRESSURE FOR DELTA V REQUIRED. 2. DELTA TEMP BETWEEN APS FUEL AND OXID LESS THAN 60 DEG F FOR BURNS LESS THAN 100 SECONDS AND 10 DEG F FOR BURNS GREATER THAN 100 SECONDS. 3. APS FUEL AND/OR OXID TEMP GREATER THAN 50 DEG F AND LESS THAN 120 DEG F FOR BURNS LESS 100 SECONDS AND GREATER THAN 50 DEG F AND LESS THAN 90 DEG F FOR BURNS GREATER THAN 100 SECONDS. 4. APS FUEL AND/OR OXID INLET PRESSURES GREATER THAN 115 PSIA. (ULLAGE PRESSURE GREATER THAN 125 PSIA) 5. DELTA PRESSURE BETWEEN FUEL AND OXID INLET PRESSURES LESS THAN OR EQUAL TO 15 PSID. <p>RULES 26-3 THROUGH 26-9 ARE RESERVED</p>							
		MISSION	REV	DATE	SECTION	GROUP	PAGE		
		APOLLO 11	B	7/3/69	LM PROPULSION - APS	GENERAL	26-1		

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MISSION RULES

SECTION 26 - LM PROPULSION - APS

REV	ITEM						
		<p>----- ' SYSTEMS MANAGEMENT ' -----</p>					
	26-10	<p>APS MANNED ENGINE STARTS WILL NOMINALLY BE PRECEDED BY A PROPELLANT SETTling MANEUVER USING TWO JET ULLAGE WITH THE EXCEPTION THAT NO ULLAGE IS REQUIRED FOR AN ABORT STAGE OR FROM INITIATION OF ASCENT FROM THE LUNAR SURFACE.</p>					
	26-11	<p>THE APS CANNOT REMAIN ACTIVATED (COMPATIBILITY SQUIB VALVES FIRED) LONGER THAN 24 HOURS BEFORE ITS USAGE IS COMPLETED NOMINALLY. IN CASE OF A CONTINGENCY, THE TIME CAN BE EXTENDED TO 3-1/2 DAYS.</p> <p>RULE 26-12 IS RESERVED.</p>					
	26-13	<p>THE MINIMUM IMPULSE OF THE APS ENGINE IS 1257 PLUS OR MINUS 104 LBS - SEC, WHICH CORRESPONDS TO AN ELECTRICAL ON/OFF TIME OF 0.5 SEC.</p>					
	26-14	<p>ONLY PREMISSION 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.</p>					
	26-15	<p>PROPELLANT GAGING (NO ONBOARD READOUT)---</p> <p>A. PRIME METHOD--- APS QTY FROM LGC MASS CALCULATION (ONE PERCENT)</p> <p>B. BACKUP METHOD--- FLOW RATE X TIME (5 PERCENT)</p> <p>RULES 26-16 THROUGH 26-19 ARE RESERVED.</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	B	7/3/69	LM PROPULSION - APS	MANAGEMENT	26-2

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MISSION RULES

SECTION 26 - LM PROPULSION - APS

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	26-24	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
	26-25	APS FU AND/OR OXID LOW LEVEL	ASCENT	A. CONTINUE MISSION 1. OPEN RCS MAINS 2. CLOSE ASC FEED	APS MAL PROC APS 4 ASC QTY
		RULES 26-26 THROUGH 26-29 ARE RESERVED.			

	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	A	6/20/69	LM PROPULSION - APS	SPECIFIC	26-5	

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MISSION RULES

SECTION 26 - LM APS - CONCLUDED

REV	ITEM	----- ' APS - PRELAUNCH INSTRUMENTATION ' -----					MISSION RULE REFERENCE
		MEAS DESCRIPTION	PCM	ONBOARD TRANSDUCER	CATEGORY		
26-30		APS HE 1 PRESS	GP0001P	HEL MON C&W COMMON	M - PCM	26-20,21,22	
		APS HE 2 PRESS	GP0002P	HEL MON C&W COMMON	M - PCM	26-20,21,22	
		APS HE REG PRESS	GP0018P		HD 1 OF 2	26-20,22	
		APS HE REG PRESS	GP0025P	C&W COMMON	HD M - PCM	26-20,22	
		APS HE 1 TEMP	GP0201T	HEL MON COMMON	HD - PCM	26-21	
		APS HE 2 TEMP	GP0202T	HEL MON COMMON	HD - PCM	26-21	
		APS FUEL TEMP	GP0718T	TEMP COMMON	M - PCM	26-20	
		APS FUEL LOW	GP0908X	C&W COMMON	HD	26-25	
		APS OXID TEMP	GP1218T	TEMP COMMON	M - PCM	26-20	
		APS OXID LOW	GP1408X	C&W COMMON	HD	26-25	
		APS FUEL PRESS	GP1501P	C&W COMMON	M - PCM	26-20,21,22,23	
		APS OXID PRESS	GP1503P	C&W COMMON	M - PCM	26-20,21,22,23	
		VLVS A DELTA POS	GP2997U		HD	26-24	
		VLVS B DELTA POS	GP2998U		HD	26-25	
		APS TCP	GP2010P		HD		

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 11	FNL	5/16/69	LM APS	PRELAUNCH INSTR	26-6

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MISSION RULES

SECTION 27 - LM REACTION CONTROL SYSTEM

REV	ITEM								
		----- ! GENERAL ! -----							
27-1		<p>IN ORDER TO INITIATE AND CONTINUE THE FOLLOWING MISSION PHASES, THE RCS SUBSYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES---</p> <p>A. DOCKED</p> <p style="padding-left: 40px;">NO PROPELLANT LEAKS</p> <p>B. UNDOCKED, DESCENT ORBIT</p> <p style="padding-left: 40px;">1. OPERATIONAL RCS SYSTEMS A AND B</p> <p>C. POWERED DESCENT</p> <p style="padding-left: 40px;">1. PRIOR TO PDI + 5</p> <p style="padding-left: 80px;">(A) OPERATIONAL RCS SYSTEMS A AND B</p> <p style="padding-left: 80px;">(B) NO PROPELLANT LEAKS</p> <p style="padding-left: 40px;">2. AFTER PDI + 5</p> <p style="padding-left: 80px;">(A) OPERATIONAL RCS SYSTEM A OR B, OR A COMBINATION OF SYSTEMS A AND B WHICH WOULD PROVIDE 3-AXIS ATTITUDE CONTROL</p> <p>D. LUNAR STAY</p> <p style="padding-left: 40px;">1. OPERATIONAL RCS SYSTEMS A AND B</p> <p style="padding-left: 40px;">2. NO PROPELLANT LEAKS</p> <p>E. RENDEZVOUS</p> <p style="padding-left: 40px;">1. OPERATIONAL RCS SYSTEM A OR B, OR A COMBINATION OF A AND B WHICH WOULD PROVIDE 3-AXIS ATTITUDE CONTROL AND ONE AXIS TRANSLATION CAPABILITY PRIOR TO TPI AND 3-AXIS TRANSLATION CAPABILITY FROM TPI THROUGH DOCKING.</p>							
27-2		<p>DEFINITIONS</p> <p>A. RCS SYSTEM</p> <p style="padding-left: 40px;">AN RCS SYSTEM CONTAINS EIGHT OPERATIONAL THRUSTERS SUPPLIED BY ITS OWN PRESSURIZATION AND PROPELLANT FEED SYSTEM INDEPENDENT OF ASCENT FEED AND CROSSFEED.*</p> <p style="padding-left: 40px;">*INDIVIDUAL THRUSTERS REQUIRED FOR DIFFERENT MISSION PHASES WILL BE COVERED SEPARATELY.</p> <p>B. OPERATIONAL RCS SYSTEM</p> <p style="padding-left: 40px;">1. FUEL AND/OR OXID MANIFOLD PRESSURES GREATER THAN OR EQUAL TO 100 PSI.</p> <p style="padding-left: 40px;">2. FUEL TEMP GREATER THAN OR EQUAL TO 40 DEG F AND LESS THAN OR EQUAL TO 100 DEG F.</p> <p>RULE NUMBERS 27-3 THROUGH 27-9 ARE RESERVED.</p>							
		MISSION	REV	DATE	SECTION	GROUP	PAGE		
		APOLLO 11	B	7/3/69	LM REACTION CONTROL SYSTEM	GENERAL - RCS	27-1		

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MISSION RULES

SECTION 27 - LM REACTION CONTROL SYSTEM

REV	ITEM	----- ! SYSTEMS MANAGEMENT ! -----																													
27-10	THRUSTER TEMP	THE RCS QUAD TEMP MUST BE BROUGHT UP TO OPERATING TEMPERATURE VIA THE RCS HEATERS PRIOR TO ANY RCS FIRINGS. THRUSTER QUAD TEMPERATURES MUST BE ABOVE 119 DEG F FOR 25 MINUTES PRIOR TO ANY PULSE FIRINGS.																													
27-11	USABLE RCS PROPELLANT IS 548.9 LBS OR 86.7 PERCENT OF TOTAL LOADED	<table border="0"> <tr> <td>TOTAL LOADED</td> <td>633.0 LBS</td> <td>100.0 PERCENT</td> <td colspan="3"></td> </tr> <tr> <td>TRAPPED AND LOADING ERROR</td> <td>-46.2 LBS</td> <td>- 7.3 PERCENT</td> <td colspan="3"></td> </tr> <tr> <td>TM ERROR*</td> <td>-37.9 LBS</td> <td>- 6.0 PERCENT</td> <td colspan="3"></td> </tr> <tr> <td>USABLE</td> <td>548.9 LBS</td> <td>86.7 PERCENT</td> <td colspan="3"></td> </tr> </table> <p>*BASED ON A GROUND COMPUTATIONAL ACCURACY OF 6 PERCENT.</p>						TOTAL LOADED	633.0 LBS	100.0 PERCENT				TRAPPED AND LOADING ERROR	-46.2 LBS	- 7.3 PERCENT				TM ERROR*	-37.9 LBS	- 6.0 PERCENT				USABLE	548.9 LBS	86.7 PERCENT			
TOTAL LOADED	633.0 LBS	100.0 PERCENT																													
TRAPPED AND LOADING ERROR	-46.2 LBS	- 7.3 PERCENT																													
TM ERROR*	-37.9 LBS	- 6.0 PERCENT																													
USABLE	548.9 LBS	86.7 PERCENT																													
27-12	PROPELLANT GAGING	<p>A. PRIME METHOD ---</p> <p>GROUND RCS PROGRAM (6.0 PERCENT)</p> <p>B. BACKUP METHOD---</p> <p>PQMD (ONBOARD READOUT 13.0 PERCENT, GROUND READOUT 10.0 PERCENT)</p>																													
27-13	CROSSFEED	<p>THE RCS SYSTEMS SHOULD BE CROSSFED WHEN NECESSARY TO INSURE THAT NEITHER SYSTEM EXCEEDS ITS RCS CONSUMABLE REDLINE.</p> <p>RULE NUMBERS 27-14 THROUGH 27-19 ARE RESERVED.</p>																													
		MISSION	REV	DATE	SECTION	GROUP	PAGE																								
		APOLLO 11	A	6/20/69	LM REACTION CONTROL SYSTEM	MANAGEMENT	27-2																								

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MISSION RULES

SECTION 27 - LM REACTION CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	27-21	RCS THRUSTER PAIR			REF MAL PROC RCS
		A. ONE PAIR ISOLATED	DOCKED	A. 1. DO NOT UNDOCK	4 RCS TCA
			UNDOCKED	2. DOCK ASAP NO-GO FOR DOI	
			DESCENT	3. RETURN TO CSM ASAP	
			ORBIT	NO-GO FOR PDI	
			POWERED DESCENT	4. (A) PRIOR TO PDI + 5 - ABORT (B) AFTER PDI + 5 - CONTINUE MISSION NO GO FOR LUNAR STAY	
			LUNAR STAY	5. ASCENT ASAP	
			RNDZ	6. CONTINUE MISSION	
		B. COMBINATION ISOLATED RESULTING IN LOSS OF ATTITUDE CONTROL	DOCKED	B. 1. DO NOT UNDOCK	
			UNDOCKED	2. CSM ACTIVE DOCKING NO-GO FOR DOI	
			DESCENT	3. CSM RESCUE	
			ORBIT	NO-GO FOR PDI. CSM ACTIVE DOCKING	
			POWERED DESCENT	4. OPEN WHATEVER ISOLATION PAIRS REQUIRED TO MAINTAIN ATTITUDE CONTROL. (A) PRIOR TO LOW GATE - (1) ABORT (2) ABORT STAGE AT DPS DEPLETION (B) LOW GATE TO TOUCHDOWN CONTINUE MISSION	
			LUNAR STAY/ RNDZ	5. OPEN WHATEVER ISOLATION PAIRS REQUIRED TO ACHIEVE SAFE ASCENT. CSM RESERVE AND ACTIVE DOCKING	

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MISSION RULES

SECTION 27 - LM REACTION CONTROL SYSTEM

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS												
	27-22	DECREASING OR LOSS OF RCS HE PRESSURE	ALL	A. 1. CONTINUE USING BOTH SYSTEMS UNTIL MFLD PRESS IN BAD SYSTEM LESSER THAN 100 PSI, THEN CLOSE MAINS OF BAD SYSTEM 2. CROSSFEED FROM GOOD SYSTEM	REF MAL PROC RCS 1 RCS 1A HE PRESS LOW OR DECR. 1B PQMD ABNORMAL WHEN MFLD PRESS DROPS BELOW 100 PSI, THE SYSTEM IS CONSIDERED NON-OPERATIONAL REF RULE 27-2												
			DOCKED	B. DO NOT UNDOCK UNLESS SUFFICIENT PROPELLANT TO REDOCK EXISTS IN BLOWDOWN													
			UNDOCKED	C. RETURN TO CSM AND DOCK ASAP NO-GO FOR DOI													
			DESCENT ORBIT	D. RETURN TO CSM AND DOCK ASAP NO-GO FOR PDI													
			POWERED DESCENT/RNDZ	E. CONTINUE MISSION													
			LUNAR STAY	F. 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 ASAP	F. REQUIRES 50 LBS (15.8 PERCENT OF TOTAL LOADED IN ONE SYSTEM.)												
	27-23	RCS PROPELLANT LEAK	DOCKED	A. EGRESS TO CSM ASAP. UNDOCK AND STATIONKEEP	REF MAL PROC RCS 1 RCS												
			UNDOCKED	B. DOCK ASAP NO-GO FOR DOI	1A HE PRESS LOW OR DECR. 1B PQMD ABNORMAL												
			DESCENT ORBIT	C. DOCK ASAP 1. NO-GO FOR PDI													
			POWERED DESCENT	D. 1. PDI TO PDI + 5 - ABORT 2. PDI + 5 TO TD - CONTINUE MISSION													
			LUNAR STAY	E. ASCEND NEXT BEST OPPORTUNITY													
			RNDZ	F. 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 11</td> <td>B</td> <td>7/3/69</td> <td>LM REACTION CONTROL SYSTEM</td> <td>SPECIFIC - RCS</td> <td>27-5</td> </tr> </table>						MISSION	REV	DATE	SECTION	GROUP	PAGE	APOLLO 11	B	7/3/69	LM REACTION CONTROL SYSTEM	SPECIFIC - RCS	27-5
MISSION	REV	DATE	SECTION	GROUP	PAGE												
APOLLO 11	B	7/3/69	LM REACTION CONTROL SYSTEM	SPECIFIC - RCS	27-5												

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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 27-21)	REF MAL PROC HTR. 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. 1. PDI TO LOW GATE ABORT STAGE 2. LOW GATE TO TD CONTINUE MISSION D. CONTINUE MISSION	REF MAL PROC RCS 1B PQMD ABNORMAL		
		RULES 27-26 THROUGH 27-29 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	LM REACTION CONTROL SYSTEM	SPECIFIC - RCS	27-6

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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	GR1085Q	QUANTITY	COMMON	M	27-23,22,20
		RCS 'B' PROP QTY	GR1095Q	QUANTITY	COMMON	M	27-23,22,20
		RCS 'A' REG PRESS	GR1201P	PRESS MON C&W	COMMON	M-PCM	27-20,22,23
		RCS 'B' REG PRESS	GR1202P	PRESS MON C&W	COMMON	M-PCM	27-20,22,23
		RCS 'A' HE PRESS	GR1101P	PRESS MON C&W	COMMON	M-PCM	27-23,20
		RCS 'B' HE PRESS	GR1102P	PRESS MON C&W	COMMON	M-PCM	27-23,20
		RCS 'A' FUEL TEMP	GR2121T	TEMP MON	COMMON	M-PCM	27-20
		RCS 'B' FUEL TEMP	GR2122T	TEMP MON	COMMON	M-PCM	27-20
		RCS MAIN 'A' CLSD	GR9609U	MAIN SOV	COMMON	HD	
		RCS MAIN 'B' CLSD	GR9610U	MAIN SOV	COMMON	HD	
		RCS 'A' FUEL MFLD PRESS	GR2201P	PRESS MON	COMMON	M	27-20,23
		RCS 'B' FUEL MFLD PRESS	GR2202P	PRESS MON	COMMON	M	27-20,23
		RCS 'A' OX MFLD PRESS	GR3201P	PRESS MON	COMMON	M	27-20,23
		RCS 'B' OX MFLD PRESS	GR3202P	PRESS MON	COMMON	M	27-20,23
		A/B XFEED OPEN	GR9613U	CRSFD	COMMON	HD	
		QUAD 1 'A' TCA ISOL VLV	GR9667U	SYS A QUAD 1	COMMON	HD	27-21
		QUAD 2 'A' TCA ISOL VLV	GR9665U	SYS A QUAD 2	COMMON	HD	27-21
		QUAD 3 'A' TCA ISOL VLV	GR9663U	SYS A QUAD 3	COMMON	HD	27-21
		QUAD 4 'A' TCA ISOL VLV	GR9661U	SYS A QUAD 4	COMMON	HD	27-21
		QUAD 1 'B' TCA ISOL VLV	GR9668U	SYS B QUAD 1	COMMON	HD	27-21
		QUAD 2 'B' TCA ISOL VLV	GR9666U	SYS B QUAD 2	COMMON	HD	27-21
		QUAD 3 'B' TCA ISOL VLV	GR9664U	SYS B QUAD 3	COMMON	HD	27-21
		QUAD 4 'B' TCA ISOL VLV	GR9662U	SYS B QUAD 4	COMMON	HD	27-21
		QUAD 1 TEMP	GR6004T	TEMP MON C&W	COMMON	M	27-24
		QUAD 2 TEMP	GR6003T	TEMP MON C&W	COMMON	M	27-24
		QUAD 3 TEMP	GR6002T	TEMP MON C&W	COMMON	M	27-24
		QUAD 4 TEMP	GR6001T	TEMP MON C&W	COMMON	M	27-24
		ASC FEED OXID 'A' OPEN	GR9641U	SYS A ASC OXID ASC FUEL	COMMON	HD	
		ASC FEED FUEL 'A' OPEN	GR9631U	SYS A ASC OXID ASC FUEL	COMMON	HD	
		ASC FEED FUEL 'B' OPEN	GR9632U	SYS B ASC OXID ASC FUEL	COMMON	HD	
		ASC FEED OXID 'B' OPEN	GR9642U	SYS B ASC OXID ASC FUEL	COMMON	HD	

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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 (VABD)					
		(2) PERSONAL RADIATION DOSIMETER (PRD)					
		(3) NUCLEAR PARTICLE DETECTION SYSTEM (NPDS)					
		(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) RIOMETERS					
		2. EPO					
		(A) JAEIC					
		(B) RIOMETERS					
		(C) PRD					
		3. EARTH ORBITAL MISSION					
		(A) PRD					
		(B) JAEIC					
		(C) RIOMETERS					
		(D) SAAP					
		RULE NUMBERS 28-5 THROUGH 28-9 ARE RESERVED.					

	MISSION	REV	DATE	SECTION	GROUP	PAGE	
	APOLLO 11	A	6/20/69	SPACE ENVIRONMENT	MANAGEMENT	28-2	

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MISSION RULES

SECTION 28 - SPACE ENVIRONMENT

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS			
				----- SPECIFIC MISSION RULES -----				
	28-10	ANY SOURCE REPORTS A POSSIBLE ARTIFICIAL EVENT	ALL	PROCEED UNTIL VERIFICATION FROM ALL OTHER SOURCES.				
	28-11	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 TLI 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 PRD 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 DOSIMETER READOUTS PER SOP 2-8			
	28-12	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.			
	28-13	MAJOR SOLAR FLARE PREDICTED	ALL	CONTINUE MISSION.				
				ALL OTHER	C. CONTINUE MISSION.			
		MISSION	REV	DATE	SECTION	GROUP	PAGE	
		APOLLO 11	B	7/3/69	SPACE ENVIRONMENT	SPECIFIC	28-3	

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MISSION RULES

SECTION 28 - SPACE ENVIRONMENT

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	28-14	MAJOR SOLAR FLARE HAS OCCURRED					
		A. UNCONFIRMED PARTICLE EVENT	ALL	A. CONTINUE MISSION.			
		B. CONFIRMED PARTICLE EVENT AND SOLAR PARTICLE ALERT NETWORK/RTACF 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, TLI IS NO-GO.			
			ALL OTHERS	3. CONTINUE MISSION. CONSIDERATION WILL BE GIVEN TO EARLY (OR EXTENDED) TEI AND INHIBITING 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 NEXT BEST PTP IF THE TOTAL DOSE CAN BE REDUCED WITHOUT INCREASING THE TOTAL RISK TO THE CREW.	C.1. CREW SHOULD BEGIN PERSONAL DOSIMETER AND RADIATION SURVEY METER READOUTS PER SOP 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.(A) HATCH-DOWN ATTITUDE MAY BE USED TO REDUCE THE TOTAL DOSE. 2.(B) 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
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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
			VABD				
		RADIATION DOSIMETER 2 (CM SKIN DOSE RATE)	CK1052K	-	-	HD	28-12
		DOSIMETER RATE CHANGE	CK1059R	-	-	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	ST0841T	-	-	HD	28-14
		PERSONAL RADIATION DOSIMETER (PRD) - 3 - ONBOARD				MANDATORY TO BE ONBOARD	28-14
		RATE SURVEY METER (RSM) - 1 - ONBOARD				MANDATORY TO BE ONBOARD	28-14

MISSION	REV	DATE	SECTION	GROUP	PAGE	
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MISSION RULES

SECTION 29 - RECOVERY

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	29-6	AN ELLIPSE 163 NM UPRANGE, 152 NM DOWNRANGE AND 50 NM TO EITHER SIDE OF 55 DEG/55DEG TARGET POINT-- AND AN ELLIPSE 105 NM UPRANGE AND DOWNRANGE AND 40 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 MANEUVER FOOTPRINT AND AN ELLIPSE 109 NM UPRANGE AND DOWNRANGE AND 40 NM TO EITHER SIDE OF 90 DEG/90DEG TARGET POINT-- AND ELIPSE 105 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	AN ELLIPSE 5 NM UPRANGE, 5 NM DOWNRANGE AND 3 NM TO EITHER SIDE OF THE GNCS TARGET POINT--AND AN ELLIPSE 18 NM UPRANGE 18 NM DOWNRANGE AND 45 NM TO EITHER SIDE OF THE EMS TARGET POINT WILL BE CLEAR OF ALL LAND	POST-TLI	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 'G' TARGET POINT WILL BE CLEAR OF LARGE LAND MASSES	POST-TLI	HIGHLY DESIRABLE			
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	RECOVERY	SPECIFIC	29-2

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MISSION RULES

SECTION 30 - AEROMEDICAL

REV	ITEM						
		----- ' GENERAL ' -----					
	30-1	PRELAUNCH PRIOR TO COMMITTING TO LAUNCH, THE FOLLOWING CONDITIONS MUST BE MET--- A. SATISFACTORY FLIGHT CREW PHYSIOLOGICAL STATUS. B. THE MINIMUM CABIN OXYGEN CONCENTRATION FOR LAUNCH IS 60 PERCENT. C. THE MINIMUM SUIT OXYGEN CONCENTRATION FOR LAUNCH IS 95 PERCENT.					
	30-2	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.					
	30-3	THE POTABLE WATER PH MUST BE WITHIN 6.0 TO 8.0 AT SERVICING AND FINAL SAMPLING.					
	30-4	THE MAXIMUM ALLOWABLE CONCENTRATION OF PCO2 IS 5MM OF HG.					
	30-5	LAUNCH THERE ARE NO MEDICAL REASONS FOR ABORTING DURING THE LAUNCH PHASE OTHER THAN THOSE CONDITIONS INTOLERABLE TO THE CREW.					
	30-6	EARTH ORBIT AND DEEP SPACE OPERATIONS. EARLY MISSION TERMINATION FOR MEDICAL FALL INTO TWO CATEGORIES--- A. ONSET OF CONDITIONS WHICH ADVERSELY AFFECT CREW SAFETY HEALTH, OR FUNCTION AND PERFORMANCE. B. FAILURE OF SPACECRAFT SYSTEMS TO MAINTAIN A PHYSIOLOGICALLY SATISFACTORY ENVIRONMENT.					
	30-7	WATER PALATABILITY CREW EVALUATION OF THE DRINKING WATER TASTE WILL BE THE BASIS FOR DETERMINING WATER PALATABILITY, EVEN FOR KOH CONTAMINATION.					
		RULE NUMBERS 30-8 THROUGH 30-14 ARE RESERVED					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	AEROMEDICAL	GENERAL	30-1

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MISSION RULES
SECTION 30 - AEROMEDICAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/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 11	A	6/20/69	AEROMEDICAL	SPECIFIC PHYSIOLOGICAL	30-2

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MISSION RULES

SECTION 30 - AEROMEDICAL

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	30-19	DYSBARISM IN ANY CREWMAN	LAUNCH	A. CONTINUE MISSION CREW MAY ELECT TO ABORT IF CONDITION IS INTOLERABLE	A.1. CHECK SUIT INTEGRITY. 2. IF CONDITIONS PERMIT CREW MAY ELECT TO OVER- PRESSURIZE. (A) ALL THREE SUITS CONNECTED TO SUIT CIRCUIT. (B) SUIT DEMAND REG TO PRESS POSITION (C) MONITOR SUIT PRESS (SHOULD REACH 4 PSID IN 75 SEC). (D) SELECT SUIT DEMAND REG INLET SEL VALVE TO OFF WHEN SUIT PRESS REACHES 4.0 PSID. (E) MAINTAIN SUIT OVERPRESSURE BY OPENING INLET SELECTOR VALVE AS NECESSARY. NOTE--- RELIEF FUNCTION OF DEMAND REGULATOR IS ISOLATED WHEN USING THIS PROCEDURE.		
			ALL	B. TERMINATE PHASE ENTER NEXT BEST PTP	B. MCC SURGEON WILL EVALUATE AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS NOT EFFECTIVE.		
	30-20	ORAL TEMP EXCEEDS 101 DEG F. DESPITE CORECTIVE ACTION.			MCC SURGEON MAY RECOMMEND EARLY MISSION TERMINATION IF TREATMENT IS UNSUCCESSFUL.		
		A. IF DUE TO ILLNESS	LAUNCH	A.1. NOT APPLICABLE			
			ALL	2. TERMINATE PHASE ENTER NEXT BEST PTP			
		B. IF RESULTANT FROM THERMAL OVERLOAD	LAUNCH	B.1. NOT APPLICABLE			
			ALL	2. TERMINATE PHASE ENTER NEXT BEST PTP			
	30-21	PLSS METABOLIC OVERLOAD.	EVA	A. IF AMBER LINE IS EXCEEDED--- DECREASE ACTIVITY.	A. AMBER LINE LIMIT IS WORK SUSTAINED AT A RATE GREATER THAN 2500 BTU/HR FOR A PERIOD LONGER THAN 5 MINUTES, AS DETERMINED BY PREFLIGHT ERGOMETRY CALIBRATIONS. THE MCC SURGEON WILL EVALUATE AND MAY RECOMMEND DECREASED CREW ACTIVITY.		
				B. IF RED LINE IS EXCEEDED--- STOP ACTIVITY AND REST.	B. 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 ERGOMETRY CALIBRATIONS. MCC SURGEON WILL EVALUATE AND MAY RECOMMEND THAT THE CREW STOP ACTIVITY AND REST.		
		RULE NUMBERS 30-22 THROUGH 30-24 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	AEROMEDICAL	SPECIFIC PHYSIOLOGICAL	30-3

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MISSION RULES

SECTION 30 - AEROMEDICAL - CONCLUDED

REV	ITEM	----- ' INSTRUMENTATION REQUIREMENTS ' -----					
		CSM					
30-35		MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
		ELECTROCARDIOGRAM	CJ0060J	NOT DISPLAYED		M*	30-15/16
		ELECTROCARDIOGRAM	CJ0061J	NOT DISPLAYED		M*	30-15/16
		ELECTROCARDIOGRAM	CJ0062J	NOT DISPLAYED		M*	30-15/16
		CO2 PARTIAL PRESSURE	CF0005P	METER	COMMON	HD	30-2/27/28
		SUIT CABIN DELTA PRESS	CF0003P	NOT DISPLAYED		HD	30-3/19
		ORAL TEMPERATURE		CLINICAL THERMOMETER		M*	30-20
		PNEUMOGRAM	CJ0200R	NOT DISPLAYED		HD	30-17
		PNEUMOGRAM	CJ0201R	NOT DISPLAYED		HD	30-17
		PNEUMOGRAM	CJ0202R	NOT DISPLAYED		HD	30-17
		LM					
		CO2 PARTIAL PRESSURE	GF1521P	METER		HD	
		ELECTROCARDIOGRAM	GT9999	NOT DISPLAYED		M*	30-15/16
		PNEUMOGRAM		NOT DISPLAYED		HD	30-17
		PLSS					
		PLSS ELECTROCARDIOGRAM	GT8124J			M*	30-15/16
		*MANDATORY TO CABIN CLOSEOUT					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	A	6/20/69	AEROMEDICAL	INSTR REQ	30-5

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MISSION RULES

SECTION 31 - EASEP

REV	ITEM						
		<p>B. PSE</p> <ol style="list-style-type: none"> 1. THE PSE WILL BE UNCAGED AS SOON AS POSSIBLE AFTER THE PSE IS COMMANDED ON. THE TEMPERATURE OF THE PSE ELECTRONICS IN THE CENTRAL STATION, MONITORED ON AT-5 THERMAL PLATE 3 TEMP., MUST BE ABOVE +25 DEG F BEFORE THE PSE CAN BE UNCAGED- HOWEVER, PSE UNCAGING WILL BE ATTEMPTED AT ANY TEMP. 2. THE PSE LEVELING MOTORS WILL NOT BE ACTIVATED PRIOR TO UNCAGING OF THE PSE. 3. AFTER PSE LEVELING OF THE HORIZONTAL COMPONENTS (LPX AND LPY) HAS BEEN COMPLETED, THE COARSE LEVEL SENSORS WILL BE GROUND COMMANDED OUT (VIA CMD 102 LEVEL SENSOR IN/OUT). 4. FOR PROPER OPERATION OF THE PSE, THE FEEDBACK FILTER MUST BE IN THE FOLLOWING MODES (THE FILTER IS GROUND COMMANDED IN AND OUT OF THE FEEDBACK LOOP BY CMD 101 PSE FILTER IN/OUT)--- <ol style="list-style-type: none"> A. LEVELING MOTOR MODE OF ANY KIND - FILTER OUT B. LONG PERIOD CALIBRATION - FILTER IN C. NORMAL OPERATIONAL MODE - FILTER IN 5. THE X-AXIS AND Y-AXIS MASSES OF THE PSE MUST BE LEVELED BEFORE THE Z-AXIS MASS. 6. REFER TO STANDARD OPERATING PROCEDURE FOR PSE LEVELING PROCEDURES. 7. THE PSE SENSOR HEATERS MUST BE OFF DURING OPERATION OF THE PSE LEVELING MOTORS. 8. PSE WILL BE PLACED IN STBY-SELECT CONDITION, BY GROUND COMMAND, APPROXIMATELY ONE (1) HOUR BEFORE LUNAR SUNSET. <p>RULES 31-2 THRU 31-9 ARE RESERVED</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	EASEP	GENERAL	31-2

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MISSION RULES

SECTION 31 - EASEP

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	31-10	FAILURE OF PCU		A. IF PCU 1 IS ACTIVE, SELECT PCU 2. B. IF PCU 2 IS ACTIVE--- 1. VERIFY THAT SCIENTIFIC DATA IS BEING LOST. 2. VERIFY THAT TOTAL FAILURE OF PCU 2 IS INEVITABLE. 3. IF ABOVE CONDITIONS ARE MET, SELECT PCU 1.	CUE--- PCU OUTPUT VOLTAGES ARE OFF NOMINAL AND SCIENTIFIC DATA IS BEING LOST. AUTOMATIC SWITCHOVER FROM PCU 1 TO PCU 2 SHOULD OCCUR WHEN THE +12 VDC BUS VARIES +1 VDC. CMD 062, PCU 2 SELECT. CMD 060, PCU 1 SELECT.		
		RULES 31-11 THRU 31-19 ARE RESERVED					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	EASEP	ELECTRICAL	21-3

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MISSION RULES

SECTION 31 - EASEP

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	31-20	ANY THERMAL PLATE TEMP. EXCEEDS DEG F.		REFER TO GRAPH OF CENTRAL STATION INTERNAL POWER DISSIPATION VS. SHUNT CURRENT TO DETERMINE THE PROPER COMBINATION OF THE FOLLOWING ALTERNATIVES TO BE EXERCISED--- 1. PDR NO. 1 ON OR OFF 2. PDR NO. 2 ON OR OFF 3. PSE OFF 4. TRANSMITTER OFF	SELECT THE ADJUSTMENT WHICH REDUCES HEAT GENERATION (E.G., BY REDUCING INTERNAL POWER DISSIPATION) AND MINIMIZES THE RISK OF EXCEEDING PCU HIGH AND LOW LOAD LIMITS (ALSO, SHUNT CURRENT HIGH AND LOW LIMITS). GRAPH OF INTERNAL POWER DISSIPATION VS. PCU LOAD COULD BE USED IF AVAILABLE. THERMAL PLATE TEMP. MEASUREMENTS ARE AT-3, AT-4, AT-5, AT-6, AND AT-7. PDR NO. 1 DISSIPATES 5 WATTS. PDR NO. 2 DISSIPATES 10 WATTS.		
		RULES 31-21 THRU 31-29 ARE RESERVED.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	EASEP	THERMAL	31-4

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MISSION RULES

SECTION 31 - EASEP

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	31-30	EASEP FAILS TO RESPOND TO A CMD.		A. REINITIATE THE CMD. B. IF UNSECCESFUL, SELECT OTHER DECODER (ALSEP 2A OR 2B) AND REINITIATE THE CMD. C. IF UNSECCESFUL, SEND A 'SPARE' CMD. D. IF UNSECCESFUL, SWITCH TO OTHER DATA PROCESSOR.	CUE--- NO FUNCTIONAL VERIFICATION AND NO CMD VERIFICATION WORD (CVW) VERIFY THAT THE RECEIVER CB HAS NOT OPENED. 'SPARE' CMD SHOULD YIELD CVW BUT NO FUNCTION. CMD 150, 153, 154, AND 155 ARE SPARE CMDS. CMD 034 PROCESSOR 'X' SELECT. CMD 035 PROCESSOR 'Y' SELECT.		
		RULES 31-31 THRU 31-39 ARE RESERVED.					
MISSION	APOLLO 11	REV	FNL	DATE 5/16/69	SECTION EASEP	GROUP UPLINK	PAGE 31-5

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MISSION RULES

SECTION 31 - EASEP

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	31-40	LOSS OF DOWNLINK CARRIER.		A. SELECT OTHER TLM TRANSMITTER. B. IF NO EFFECT--- SEND TRANSMITTER ON CMD.	GROUND STATION VERIFIES THAT LOSS OF TLM CARRIER IS NOT FAILURE IN GROUND SYSTEMS. SELECTION OF ALTERNATE TRANSMITTER WILL RESET CIRCUIT BREAKERS TO THE TRANSMITTERS (CB-02, CB-03, CB-04, AND CB-05). CMD 012 TRANSMITTER 'A' SELECT. CMD 015 TRANSMITTER 'B' SELECT. CMD 013 TRANSMITTER ON.		
	31-41	LOSS OF DOWNLINK MODULATION.		A. SELECT OTHER DATA PROCESSOR. B. IF NO EFFECT--- SELECT OTHER TLM TRANSMITTER.	GROUND STATION VERIFIES LOSS OF MODULATION ON TLM CARRIER. CMD 034, PROCESSOR 'X' SELECT. CMD 035, PROCESSOR 'Y' SELECT. CMD 012, TRANSMITTER 'A' SELECT. CMD 015, TRANSMITTER 'B' SELECT.		
	31-42	UNABLE TO RETAIN NORMAL BIT RATE.		A. SEND NORMAL BIT RATE CMD. B. IF UNSUCCESSFUL, SEND NORMAL BIT RATE RESET CMD. C. IF UNSUCCESSFUL, SELECT OTHER DATA PROCESSOR. D. IF UNSUCCESSFUL, REPEAT STEP A AND/OR STEP B.	LSM DATA IS MEANINGLESS IN LOW BIT RATE. CMD 006, NORMAL BIT RATE CMD 011, NORMAL BIT RATE RESET CMD 034, PROCESSOR 'X' SELECT CMD 035, PROCESSOR 'Y' SELECT		
	31-43	ONE OR MORE SYNC LOSSES EVERY TEN (10) SECONDS.		A. SWITCH TO REDUNDANT TRANSMITTER. B. IF UNSUCCESSFUL--- SWITCH TO REDUNDANT DATA PROCESSOR. C. IF UNSUCCESSFUL--- SELECT LOW BIT RATE.	THIS RATE OF SYNC LOSSES EXCEEDS BIT ERROR RATE. INDICATION OF MALFUNCTION WILL BE EVENT LIGHT. THIS ACTION ASSUMES NO GROUND STATION MALFUNCTION. LOW BIT RATE IS 530 BPS RATE. NOTE THAT LSM DATA WILL BECOME MEANINGLESS. CMD 012, TRANSMITTER 'A' SELECT CMD 015, TRANSMITTER 'B' SELECT CMD 034, PROCESSOR 'X' SELECT CMD 035, PROCESSOR 'Y' SELECT CMD 007, LOW BIT RATE SELECT		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	EASEP	DOWNLINK	31-6

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MISSION RULES

SECTION 31 - EASEP

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	31-50	FAILURE OF AUTOMATIC PSE LEVELING MODE		REFERENCE PROCEDURE FOR MANUAL LEVELING OF THE PSE BY GROUND COMMANDS.	PSE ACTIVATION PRESETS LEVELING MODE TO AUTOMATIC. CMD 103 WILL SWITCH TO THE MANUAL MODE. CMD 103 IS A 2-STATE CMD, PSE LEVELING MODE AUTO/MANUAL.		
	31-51	PSE LEVELING MOTOR FAILS ON		ALTERNATELY GND CMD PSE TO STANDBY SELECT AND TO OPERATE SELECT.	UNABLE TO COMMAND PSE LEVELING MOTOR OFF. CUES--- LEVELING MOTOR WILL DRAW 3 WATTS FROM RESERVE POWER. CMD 037, EXP 1 (PSE) STANDBY SELECT. CMD 036, EXP 1 (PSE) OPERATE SELECT.		
	31-52	FAILURE OF PSE LEVELING MOTOR - OFF		NO ACTION CAN BE TAKEN.	CUES--- NO DROP IN RESERVE POWER (NORMALLY 3 WATTS) WHEN ATTEMPT IS MADE TO TURN MOTOR ON, AND NO ACTIVITY ON SHORT PERIOD Z-DATA CHANNEL.		
	31-53	FAILURE OF MECHANICAL LEVEL DRIVE		SELECT LOW SPEED AND HIGH SPEED AND DIRECTION REVERSALS ALTERNATELY.	CUES--- NO MOTION OF THE PLATFORM CAN BE DETECTED ON THE OTHER LP HORIZONTAL OR LPZ COMPONENT TIDAL OUTPUT. X-MOTOR ON/OFF - CMD 070 Y-MOTOR ON/OFF - CMD 071 Z-MOTOR ON/OFF - CMD 072 DIRECTION PLUS/MINUS - CMD 074 SPEED LOW/HIGH - CMD 075		
	31-54	MISALIGNED COARSE SENSOR		A. COMMAND COARSE SENSOR OUT WHEN CORRESPONDING MOTOR IS IN LEVELING OPERATION. B. REFERENCE PROCEDURE FOR MANUAL LEVELING OF THE PSE BY GROUND COMMANDS.	WHILE IN FINAL LEVELING PHASE (LOW STEPPING RATE), THE MOTOR REVERTS TO A HIGH STEPPING RATE REPEATEDLY WITHOUT ACHIEVING CENTERING. COARSE LEVEL SENSOR AND GIMBAL WILL NEVER ALIGN, AND THE MOTOR WILL CONTINUE TO DRIVE BEYOND LEVEL. CMD 102, COARSE SENSOR OUT.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	EASEP	PSE	31-8

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MISSION RULES

SECTION 31 - EASEP

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	31-55	FAILURE OF COARSE LEVEL SENSOR		<p>A. SELECT MANUAL PSE LEVELING MODE.</p> <p>B. GROUND COMMAND COARSE LEVEL SENSOR OUT.</p> <p>C. PROCEED WITH MANUAL LEVELING FOR COARSE LEVELING. PROCEDURE .</p> <p>D. USE AUTO MODE FOR FINE LEVELING. PROCEDURE .</p>	<p>CUES--- NO HIGH SPEED MOTOR OPERATION IS MOTICED DURING INITIAL LEVELING PHASE AND COMPONENT DOES NOT CENTER WITHIN EXPECTED TIME. (40 MINUTES MAXIMUM IN AUTO MODE.)</p> <p>USE HIGH SPEED MANUAL LEVELING FOR COARSE LEVELING.</p> <p>CMD 103, PSE LEVELING MODE AUTO/MANUAL.</p> <p>CMD 102, COARSE LEVEL SENSOR OUT.</p>		
	31-56	LONG PERIOD COMPONENTS STICK		<p>A. USE HIGH SPEED, MANUAL 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 (40 MINUTES MAXIMUM IN AUTO MODE).</p> <p>IF STEPS A AND B FAIL, LP COMPONENT IS DEFECTIVE.</p> <p>NOTE--- DO NOT EXCEED LEVELING LIMITS.</p> <p>X-MOTOR ON/OFF - CMD 070</p> <p>Y-MOTOR ON/OFF - CMD 071</p> <p>Z-MOTOR ON/OFF - CMD 072</p> <p>DIRECTION PLUS/MINUS - CMD 074</p> <p>SPEED LOW/HIGH - CMD 075</p>		
	31-57	ELECTRICAL FAILURE OF LONG PERIOD COMPONENT		TERMINATE LEVELING OF THE AFFECTED AXIS AFTER COARSE SENSOR PHASE IS COMPLETED.	CUE--- TIDAL OUTPUT IS WITHIN RANGE, BUT IS NOT AFFECTED BY LEVELING OR CENTERING DRIVE.		
	31-58	FAILURE TO UNCAGE PSE		<p>A. TO UNCAGE ARM---</p> <ol style="list-style-type: none"> 1. SEND UNCAGE ARM/FIRE. 2. IF UNSUCCESSFUL, FIRST 12-HOUR TIMER PULSE WILL ARM ACTUATOR. 3. IF UNSUCCESSFUL, 96 HOURS +2 MINUTES PULSE FROM DELAYED CMD SEQUENCER WILL ARM ACTUATOR. <p>B. TO UNCAGE FIRE (AFTER THE ACTUATOR HAS BEEN ARMED)---</p> <ol style="list-style-type: none"> 1. SEND UNCAGE ARM/FIRE. 2. IF UNSUCCESSFUL, NEXT 12-HOUR TIMER PULSE WILL FIRE THE ACTUATOR. 3. IF UNSUCCESSFUL, SEND CMD 037 EXPR 1 (PSE) STANDBY SELECT. 	<p>NORMAL UNCAGING OF PSE ACCOMPLISHED BY SENDING CMD 073 UNCAGE ARM/FIRE TWICE, ONCE TO ARM AND ONCE TO FIRE THE ACTUATOR CIRCUIT WHICH UNCAGES ALL SPRING MASSES.</p> <p>NOTE--- ATOS THERMAL PLATE 3 TEMP. PSE ELECTRONICS IN CENTRAL STATION MUST BE ABOVE +25 DEG F BEFORE UNCAGING IS POSSIBLE.</p>		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	EASEP	PSE	31-9

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MISSION RULES

SECTION 31 - EASEP

REV	ITEM	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS		
	31-59	AUTOMATIC SWITCHOVER OF PSE TO STANDBY		IF PSE HAS NOT BEEN RIPPLED OFF, COMMAND EXPR. 1 (PSE) TO OPERATE SELECT.	IF CIRCUIT BREAKER CB-06 HAS OPENED FROM OVERCURRENT (500 MA +/- 10 PERCENT), STANDBY MODE WILL BE SELECTED AND THE CIRCUIT BREAKER WILL BE RESET AUTOMATICALLY. CMD 036, EXPR. 1 OPERATE SELECT.		
	31-60	PSE GOES OFF WHILE IN STANDBY MODE		COMMAND EXPR. 1 (PSE) TO OPERATE SELECT.	CUE--- EXP. 1 STDBY DISCRETE EXTINGUISHES, AND RESERVE POWER INCREASES SINCE POWER IS REMOVED FROM THE HEATERS. FUSE (F-03) HAS PROBABLY BEEN BLOWN BY OVERCURRENT (500 MA). CAPABILITY TO SELECT PSE STANDBY MODE IS LOST. CMD 036, EXPR. 1 OPERATE SELECT.		
	31-61	PSE INSTRUMENT TEMP BELOW 123 DEG F		COMMAND HEATER TO MANUAL ON.	ASSUME AUTOMATIC THERMOSTAT CONTROL FAILED. CMD 076 IS A 4-STATE CMD, WHICH CAN SEQUENTIALLY STEP THROUGH THE FOLLOWING MODES TO CONTROL THE PSE SENSOR HEATER--- 1. OFF 2. MANUAL HEATER ON 3. OFF 4. AUTOMATIC THERMOSTAT CONTROL ENABLED. DL-07 PSE INSTRUMENT TEMP.		
	31-62	PSE INSTRUMENT TEMP EXCEEDS 127 DEG F		A. COMMAND HEATER OFF. B. IF UNSUCCESSFUL, COMMAND PSE TO STANDBY, THEN TO OPERATE.	A. CMD 076 IS A 4-STATE CMD WHICH CAN SEQUENTIALLY STEP THROUGH THE FOLLOWING MODES TO CONTROL THE PSE SENSOR HEATER--- 1. OFF 2. MANUAL HEATER ON 3. OFF 4. AUTOMATIC THERMOSTAT CONTROL ENABLED. DL-07 PSE INSTRUMENT TEMP. B. SELECTING PSE TO STANDBY WILL REINITIALIZE TO AUTOMATIC THERMOSTAT CONTROL.		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	EASEP	PSE	31-10

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MISSION RULES

APPENDIX A - ACRONYMS AND SYMBOLS

REV	ITEM						
		<p>SYMBOLS</p> <p>H ALTITUDE</p> <p>DELTA VIN DELTA VELOCITY IN INSERTION</p> <p>DELTA TB DELTA BURN TIME</p> <p>DELTA H DELTA ALTITUDE</p>					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 11	FNL	5/16/69	ACRONYMS AND SYMBOLS		A-4

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MISSION RULES

RELV	ITEM	DISTRIBUTION LIST			
		<u>DIRECTOR OF FLIGHT OPERATIONS</u>		<u>OPERATIONS SUPPORT BRANCH</u>	
		FA/KRAFT, C.C., JR. (2) SJOBERG, S.A. ROSE, R.G. KOONS, W.E.		FS4/FREIRE, J.A. SANBORN, S.D. (20) MONKVIC, J.A. (2)	
		<u>FLIGHT CONTROL DIVISION</u>		<u>FLIGHT SOFTWARE BRANCH</u>	
		FC/KRANZ, E.F. LUNNEY, G.S. CHARLESWORTH, C.E. GRIFFIN, G.D. WINDLER, M.L. FRANK, M.P. ROACH, J.W. BROOKS, M.F. MILLER, H.G.		FS5/STOKES, J.D. (3) GIBSON, T.F., JR. GARMAN, J.R. (2)	
		<u>FLIGHT CONTROL OPERATIONS BRANCH</u>		<u>MISSION PLANNING AND ANALYSIS DIVISION</u>	
		FC2/HARLAN, C.S. LEWIS, C.R. FENDELL, E.I. (13) EALICK, P.L. (3) PLATT, W.E. (9) MOLNAR, W.M.		FM/MAYER, J.P. (2) HUSS, C. (1) TINDALL, H.W. OWEN, D.H.	
		<u>CSM SYSTEMS BRANCH</u>		<u>FLIGHT ANALYSIS BRANCH</u>	
		FC3/ALDRICH, A.D. HUTCHINSON, N.B. LOE, T.R. (20) WILLOUGHBY, B.N. (18) BLAIR, W.L. (2)		FM3/ALLEN, C.F. (14)	
		<u>LM SYSTEMS BRANCH</u>		<u>LANDING ANALYSIS BRANCH</u>	
		FC4/HANNIGAN, J.E. (4) PUDDY, D.R. (20) CARLTON, R.L. (20) EDELIN, F. (4)		FM2/BENNETT, F.V. BOLT, W.M. GRAVES, C.A. HARPOLD, J.C. ALPHIN, J. DUPNICK, E. HANSEN, V.	
		<u>FLIGHT DYNAMICS BRANCH</u>		<u>MATH PHYSICS BRANCH</u>	
		FC5/BOSTICK, J.C. SHAFFER, P.C. LLEWELYN, J.S. (4) PARKER, C.B. (5) PAVELKA, E.L. (4)		FM4/MCPHERSON, J.C. (2)	
		<u>MISSION SIMULATIONS BRANCH</u>		<u>MISSION ANALYSIS BRANCH</u>	
		FC6/SHELLEY, C.B. (28)		FM5/BERRY, R. (5)	
		<u>MISSION CONTROL REQUIREMENTS</u>		<u>RENDEZVOUS ANALYSIS BRANCH</u>	
		FC7/PETTITT, G.I. (2)		FM6/LINEBERRY, E.C. (2) CONWAY, H.L.	
		<u>EXPERIMENTS SYSTEMS BRANCH</u>		<u>GUIDANCE AND PERFORMANCE BRANCH</u>	
		FC9/SAULTZ, J.E. (12) MILEY, R.R. (2)		FM7/CASSETI, M.D. (2)	
		<u>MSFC FLIGHT CONTROL OFFICE</u>		<u>APOLLO TRAJECTORY SUPPORT OFFICE</u>	
		P-MO-F/HAMNER, R.S. (20)		FM13/PARTEN, R. COLLINS, M. BENNET, W.J.	
		<u>FLIGHT SUPPORT DIVISION</u>		<u>LANDING AND RECOVERY DIVISION</u>	
		<u>SYSTEMS ENGINEERING BRANCH</u>		FL/HAMMACK, J.B. (8)	
		FS2/SATTERFIELD, J.M.		<u>DIRECTOR OF FLIGHT CREW OPERATIONS</u>	
		<u>SUPPORT SYSTEMS BRANCH</u>		CA/SLAYTON, D.K. (2)	
		PS/63SEGOTA, P. (3)		<u>ASTRONAUT OFFICE</u>	
				CB/SHEPARD, A.B. (20) DUKE, C.P. (2)	
				<u>FLIGHT CREW SUPPORT DIVISION</u>	
				CF/NORTH, W.J. GRIMM, D.F. BILODEAU, J.W.	
				<u>FLIGHT CREW SUPPORT DIVISION (CONTINUED)</u>	
				DEMENT, M.E. (4) ALLEN, L.D. (4) KRAMER, P.C. (5) WARREN, D.K. (3) ANDERSON, W.M. WOODLING, C.H.	
				KUEHNEL, H.A. (4) RICHARD, L.G. (2) VAN BOCKEL, J.J. (2) O'NEILL, J.W. (5) FABER, S. (3) MITCHELL, J. (CFK-10) COLLINS, H.G. (CFK-15) KSC MCCAFFERTY, R. (CFK-6) CF/FRANKLIN, G.C.	
				<u>DIRECTOR OF MEDICAL RESEARCH AND OPERATIONS</u>	
				DA/BERRY, C.A., M.D. CATTERSON, A.D., M.D. DD/MEDICAL OPERATIONS (12)	
				<u>PUBLIC AFFAIRS OFFICE</u>	
				AP/DUFF, B. AP3/GREEN, D.J. (5)	
				<u>APOLLO SPACECRAFT PROGRAM OFFICE</u>	
				PA/LOW, G.M. BOLENDER, C.H., BRIG. GEN. PA2/APOLLO FILES PD/BATTEY, R.V. DENNETT, A.	
				PD5/GOREE, J. PD7/KOHR, R. SILVER, M. (40)	
				PD9/CRAIG, J. PD12/PERRINE, C.H. SEVIER, J.R. WARD, R.J. (2) PD14/BYINGTON, H.W. PP/MCLINTOCK, J. PP32/TASH, H.L. (2) NA/BLAND, W.M. (2) PT/ARABIAN, D.O. PT3/GOLDENBEUM, D. (10) PT4/LOBB, J. (3) BM86 MISSION DATA PACK (15) PD13/WESTMORELAND, P. NA3/SEIGLER, J.P. (2)	
				<u>DIRECTOR OF ENGINEERING AND DEVELOPMENT</u>	
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		<p><u>GODDARD SPACE FLIGHT CENTER</u></p> <p>KNOX, C.B. (9) CODE 821.1 MANNED FLIGHT OPERATIONS DIVISION, REQUIREMENTS SECTION</p> <p><u>JOHN F. KENNEDY SPACE CENTER NASA - MSOB</u></p> <p>KENNEDY SPACE CENTER, FLORIDA ATTEN: HO/ASTRO OFF (6) CD/DE BUS, K., DR. AS-SAT/BARNETT, V. (2) AP-SCO/BEDDINGFIELD, S. AP-OPN/BLACKWOOD, H. (2) LO/PETRONI, R.A. KAPYRAN, W.J. LO-OPN/DONNELLY, P. LP-PLN-2/KNIGHT, G.W. (2) LV/GRUENE, H. LV-ENG/RIGELL, I.A. LV-TOM-1/HART, J.J. LV-TOM-4/YOUMANS, R.E. LV-GDC/LEALMAN, R.E. LV-INS/EDWARDS, M.D. LV-MEC/FANNIN, L.E. LS/WILLIAMS, J.J. LS-ENG-1/GASKINS, R.B. (4) MARS, C.B. (4) TBC, 3L15/PARK, J.E. (2) NAR, 2M16/WEAVER, R.A. (2) MDC, 27B12/SHAFFER, J.R. (2) IBM, 3N1/GROVIER, P.M. (2) TS/CLARK, R.L. (5) AP-SYM/MOORE, A.H. (6) IN/SENDER, K. (5) SO/GORMAN, R. (3) IS-TSM2/CLARK, B. BEASON, W.P. PSK/MORSE, A.E. KSC MISSION DIRECTOR'S OFFICE, R3121 NSO BLDG GAEC/LOPRESTI, R. (10); R1047 MSOB</p> <p><u>MARSHALL SPACE FLIGHT CENTER</u></p> <p>MSFC/P-MO-MGR, MISSION OPERATIONS OFFICE (30)</p> <p><u>OFFICE MANNED SPACEFLIGHT</u></p> <p>MUELLER, G.E., DR. PHILLIPS, S.C., MAJ. GEN. HAGE, G.H. ALLER, R.O. (18) STOUT, F.E. (2) DRAPER, C.N., TC (5) SCHULHERR, R.M. MOP</p> <p><u>DOD MSF SUPPORT OFFICE PAFB, FLA</u></p> <p>OLSON, R.G., COL. (5) FRESE, F.J., JR., COL. MC (2) DDMS-N/DEARMAN, J., CAPT. ETOOP-2 PAFB FLA, 32925 (6) DOMS-H, COLOPY, R.E., CDR</p> <p><u>MIT LABORATORIES BOSTON, MASS.</u></p> <p>NEVINS, J. (12) COPPS, E. (2) SPARS, N.</p>			
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	<p><u>NORTH AMERICAN ROCKWELL, DOWNEY, CALIF.</u></p> <p>POTTS, J.R. CODE AB70 (1)</p> <p><u>GRUMMAN AIRCRAFT ENGINEERING CORP., BETHPAGE, NEW YORK</u></p> <p>PRATT, R. (35)</p> <p><u>BOEING, HOUSTON, TEXAS</u></p> <p>BOEING DATA MANAGEMENT, M/S HA-04 (2)</p> <p><u>BOEING COMPANY SPACE DIVISION (955 L "ENFANT PLAZA," N, SW, WASHINGTON, D.C. 20024)</u></p> <p>CAMPBELL, R.L. (3)</p> <p><u>NASA, DAYTONA BEACH OPER, P.O. BOX 2500, DAYTONA BEACH, FLA. 32015</u></p> <p>CAHALAN, P.F. MA-2D</p> <p><u>GENERAL ELECTRIC, 1830 NASA BLVD, HOUSTON, TEXAS, 77058</u></p> <p>HORNSBY, J. CODE 753</p>				
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APPENDIX C - CHANGE CONTROL

REV	ITEM	<p style="text-align: center;">----- CHANGE CONTROL -----</p> <p>1.0 INTRODUCTION</p> <p>1.1 PURPOSE</p> <p style="padding-left: 40px;">THE PURPOSE OF THIS APPENDIX IS TO DELINEATE CHANGE CONTROL PROCEDURES FOR THE AS-505/106/LM-4</p> <p style="padding-left: 40px;">MISSION RULES. THIS WILL INSURE THE PROPER COORDINATION OF CHANGES, PROVIDE A RECORD OF PROPOSED CHANGES (INCLUDING THE RATIONALE FOR MAKING THEM), AND WILL PROVIDE A MEANS FOR PROMULGATING INDIVIDUAL RULE UPDATES BETWEEN REVISIONS (INTERIM CHANGES).</p> <p>1.2 EFFECTIVITY</p> <p style="padding-left: 40px;">APRIL 14, 1969</p> <p>2.0 CHANGE PROCEDURES</p> <p>2.1 SUBMISSION OF CHANGES</p> <p style="padding-left: 40px;">PROPOSED CHANGES ARE SOLICITED FROM ANY INDIVIDUAL OR ORGANIZATION HAVING A VALID INPUT. CHANGES ORIGINATING OUTSIDE THE FLIGHT CONTROL TEAM WILL BE SUBMITTED DIRECTLY TO THE ASSISTANT FLIGHT DIRECTOR (AFD). CHANGES ORIGINATING WITHIN THE FLIGHT CONTROL TEAM WILL BE SUBMITTED TO THE AFD VIA PRIME MISSION OPERATIONS CONTROL ROOM (MOCR) POSITION CONCERNED.</p> <p>2.1.1 FORMAT</p> <p style="padding-left: 40px;">PERSONS DESIRING TO SUBMIT A PROPOSED CHANGE WILL COMPLETE ALL ITEMS ON THE FORM SHOWN IN FIGURE C-1 (FORM MUST BE TYPED). ADDITIONAL PAGES MAY BE USED IF THE SPACE PROVIDED IS NOT ADEQUATE. THE COMPLETED ORIGINAL FORM AND ONE COPY WILL THEN BE FORWARDED TO THE AFD.</p> <p style="padding-left: 40px;">THE AFD WILL REVIEW THE FORM FOR COMPLETENESS AND PROPER MISSION RULE FORMAT, AND MAKE CORRECTIONS AS REQUIRED. THE ORIGINATOR WILL BE ADVISED OF ANY SUCH CHANGES.</p> <p>2.2 APPROVAL</p> <p>2.2.1 COORDINATION</p> <p style="padding-left: 40px;">THE ORIGINATOR OF THE CHANGE MAY OBTAIN PRELIMINARY CONCURRENCES. THE AFD WILL, HOWEVER, OBTAIN FORMAL CONCURRENCES OR DISAPPROVALS (VERBALLY OR BY INITIATING) FROM THE NECESSARY PERSONNEL. VERBAL CONCURRENCES WILL BE INDICATED IN THE APPROPRIATE SIGNATURE BOX.</p> <p>2.2.2 SIGNOFF/DISAPPROVAL</p> <p style="padding-left: 40px;">UPON OBTAINING THE REQUIRED CONCURRENCES OR NEGATIVE COMMENTS, THE AFD WILL PRESENT THE PROPOSED CHANGE TO THE FLIGHT DIRECTOR FOR FINAL APPROVAL OR DISAPPROVAL. THE AFD MAY SIGN OFF OR DISAPPROVE PROPOSED CHANGES IN THE ABSENCE OF THE FLIGHT DIRECTOR.</p> <p>2.2.3 DISAPPROVED CHANGES</p> <p style="padding-left: 40px;">IF A CHANGE IS DISAPPROVED THE AFD WILL RETURN THE COPY TO THE ORIGINATOR. A COPY OF THE REQUESTED CHANGE WILL BE RETAINED FOR FUTURE REFERENCE.</p> <p>2.3 PUBLICATION AND DISTRIBUTION OF INTERIM CHANGES</p> <p style="padding-left: 40px;">INTERIM CHANGES WILL BE DISTRIBUTED VIA AN ABBREVIATED DISTRIBUTION LIST CONSISTING OF THE MISSION CONTROL TEAM, PERTINENT NASA ORGANIZATIONS, AND THE APPROPRIATE VEHICLE CONTRACTOR(S).</p> <p>3.0 REVISIONS</p> <p>3.1 DEVELOPMENT</p> <p style="padding-left: 40px;">THE AFD WILL COMPILE THE EFFECTIVE INTERIM CHANGES AND CORRECTIONS OF MINOR TYPOGRAPHICAL ERRORS INTO COMPLETE PAGE CHANGES TO THE BASIC DOCUMENT. ('PEN AND INK' CHANGES MAY BE USED TO CORRECT TYPOGRAPHICAL ERRORS IF THERE ARE NO OTHER CHANGES IN THE PAGE CONCERNED.)</p>						
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		<p>3.2 APPROVAL</p> <p style="margin-left: 40px;">SINCE ALL INTERIM CHANGES WILL HAVE RECEIVED PRIOR CONCURRENCES AND APPROVAL, ONLY THE FLIGHT DIRECTOR (OR THE AFD IN THE FLIGHT DIRECTOR'S ABSENCE) WILL BE REQUIRED TO APPROVE REVISIONS.</p> <p>3.3 PUBLICATION</p> <p>3.3.1 SCHEDULE</p> <p style="margin-left: 40px;">REVISIONS WILL BE MADE ON AN 'AS REQUIRED' BASIS.</p> <p>3.3.2 DISTRIBUTION</p> <p style="margin-left: 40px;">REVISIONS WILL BE PRINTED AND DISTRIBUTED THROUGH THE NORMAL ADMINISTRATIVE CHANNELS.</p>					
		NASA-MANNED SPACECRAFT CENTER MISSION RULE REQUEST/REVISION				DATE _____	
REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	NOTES/COMMENTS		
RATIONALE: <input type="checkbox"/> NEW TECHNICAL DATA <input type="checkbox"/> CLARIFICATION <input type="checkbox"/> TYPOGRAPHICAL ERROR							
ORIGINATOR:		NAME _____ ORGANIZATION _____ EXT _____			APPROVED: _____		APPROVED: _____
					COGNIZANT BRANCH CHIEF		FLIGHT DIRECTOR
AFD: _____	BSE: _____	FIDO: _____	GUIDO: _____	RETR: _____	GAC: _____	EECOM: _____	OTHER: _____
NSC FORM 1155 (JAN 58)							
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FIGURE C-1.- MISSION RULE CHANGE REQUEST FORM.

APOLLO

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**APOLLO 11
(AS-506 /
107/LM-5)**



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