



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

*FINAL
FLIGHT MISSION RULES*

*APOLLO 10
(AS-505/106/LM-4)*

APRIL 15, 1969

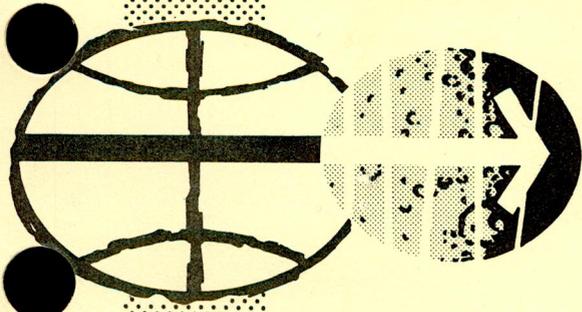
*PREPARED BY
FLIGHT CONTROL DIVISION*

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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FINAL FLIGHT MISSION RULES

REVISION A

PREFACE

THIS DOCUMENT CONTAINS REVISION A TO THE FLIGHT MISSION RULES FOR APOLLO 10 AS OF APRIL 23, 1969. REVISION A IS A PAGE CHANGE REVISION AND THE PAGES SHOULD BE INSERTED IN ACCORDANCE WITH THE REVISION INSTRUCTION SHEET WHICH FOLLOWS THIS PAGE. THIS AND ALL SUBSEQUENT REVISIONS TO THIS DOCUMENT WILL BE PRINTED ON DIFFERENT COLORED PAGES FOR EASY RECOGNITION.

IT IS REQUESTED THAT ANY ORGANIZATION HAVING COMMENTS, QUESTIONS, OR SUGGESTIONS CONCERNING THESE MISSION RULES CONTACT MR. JOHN H. TEMPLE, FLIGHT CONTROL OPERATIONS BRANCH, BUILDING 45, ROOM 635, PHONE HU3-2267.

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

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MISSION RULES

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CSM - APOLLO 10 FINAL MISSION RULES	ABORT LAUNCH FOR LOSS OF:	INHIBIT TEI FOR LOSS OF:	CONSIDER TEI ABORT FOR LOSS OF:	INHIBIT L/O FOR LOSS OF: *(See foot note)	DO EARLY TEI FOR LOSS OF: *(See foot note)	DO NOT UNDOCK OR RNDZ FOR LOSS OF:	SAVE DPS/APS FOR LOSS OF:
CABIN INTEGRITY FIRE/SMOKE/CONT SUIT INTEGRITY SUIT CIRCULATION O ₂ MFLD SURGE/REPRESS MAIN REGULATORS CYCLIC ACCUM PRI LOOP RAD EVAP SEC LOOP RAD EVAP POT TANK WASTE TANK O/B DUMP	ANY COMD X (BOTH) (>#/HR)	X X X (1 of 2) X X (1 of 2) X (BOTH) X X (BOTH) X X X X X X X X X	X X X (BOTH) X X (1 of 2) X X X X X X X X X X X	X X X (BOTH) X X (BOTH) X X X X X X X X X X X X	X X X (1 of 2)* X X (BOTH) X X X X X X X X X X X X	X X X (1 of 2)* X X (BOTH) X X X X X X X X X X X X X	X X X (BOTH) X X X X X X X X X X X X X X
O ₂ H ₂		X X	X X		X X	X X	X X
FUEL CELLS ENTRY BATS BUS-MAIN-BATT-BATT RELAY AC BUS INVERTERS BTRY CHGR	B FC + 1 BAT X (BOTH WHILE MODE 1 OR 2)	X (1 of 3) X (1 of 3) X (ANY 1) X (1 of 2) X X (2 of 3)	X (2 of 3) X (2 of 3) X (ANY 1) X (1 of 2) X X (2 of 3)	*X (1 of 3) *X (1 of 3) X (ANY 1) X (1 of 2) X X (+ SUM OF 2 BATT)	X (1 of 3)* X (1 of 3)* X (ANY 1) X (1 of 2) X X (+ SUM OF 2 BATT)	X (1 of 3)* X (1 of 3)* X (ANY 1) X (1 of 2) X X (+ SUM OF 2 BATT)	X (2 of 3) X (1 of 2) X X (2 of 3)
SEQ LOGIC PYRO SMJC ACT RELAYS ACT		X X X	X X X	X X X	X X X	X X X	
HBR LBR SBAND VOICE VHF VOICE CMD CRITICAL ONBOARD SCE		(BOTH) X (ALL VOICE) X X	(BOTH) X (ALL VOICE) X	(BOTH) X (ALL VOICE) X X	(BOTH) X (ALL VOICE) X X	(BOTH) X (ALL VOICE) X X	X (CSM SBAND)
IMU CMC OPTICS DISKY (CMC WNG RELAY) FDAI TVC SERVO LOOPS DIRECT RCS AUTO, RATE RCS TRANSLATION CAP EMAGS RHC GROUND AT SPS-SOLND VHF RANGING		X X X X (BOTH) X (1 of 2) X (BOTH RHC) X (P + Y) X (BOTH IN ANY AXIS) X	X X X X (BOTH RHC) X (P + Y) X (BOTH IN ANY AXIS) X	X X X X (NAVDISKY) X (BOTH) X (1 of 2) X (BOTH RHC) X (P + Y) X (ULLAGE) X (BOTH IN ANY AXIS) X (1 of 2) X	X X X X (NAVDISKY) X (BOTH) X (1 of 2) X (BOTH RHC) X (P + Y) X (ULLAGE) X (BOTH IN ANY AXIS) X X	X X X X (NAVDISKY)* X (BOTH) X (1 of 2) X (BOTH RHC) X (P + Y) X (ANY AXIS) X (BOTH IN ANY AXIS) X X	X (1 of 2)
SOURCE HELIUM TANK PRESS TANK ΔP FEEDLINE TEMPS BALL VALVES GN ₂ TANKS PREVIOUS PERF		X X X X X (BOTH)	X X X X X	X X X X (1 of 2) X (BOTH) X	X X X X (1 of 2) X (BOTH) X	X X X X X (1 of 2) X (BOTH) X	X X X X X (1 of 2) X (BOTH)
SOURCE HELIUM THRUSTERS		X (1 of 4) X (1P, 1Y or 2R)	X (1 of 4)	X (1 of 4) X (2P or 2Y, 1P or 1Y + 2R, 3R)	X (1 of 4) X (1P + 1Y, 1P or 1Y + 2R, 3R)	X (1 of 4) X (ANY 1)	X (2 of 4)
DOCKING LATCHES DOCKING MECH N ₂ BOTTLES				X (4 of 12)		X (9 of 12) X (BOTH) X (3 SQUIBS)	
SOURCE HELIUM MFLD PRESS ARMED	X (BOTH RINGS) X (WHILE MODE 1)	X (1 of 2) X (1 of 2) X	X (1 of 2) X (1 of 2) X	X (1 of 2) X (1 of 2) X	X (1 of 2)* X (1 of 2)* X	X (1 of 2)* X (1 of 2)* X	

○ - STILL UNDER DISCUSSION

* - DEPENDS UPON REALTIME UNDERSTANDING OF FAILURE MODE

• - FOR THESE ITEMS, EARLY TEI WILL BE DELAYED A REASONABLE TIME PENDING COMPLETION OF VARIOUS L/O ACTIVITY.

LM - APOLLO 10 FINAL MISSION RULES	DO NOT UNDOCK FOR LOSS OF:	DO NOT PERFORM NOM RNDZ FOR LOSS OF:	(PRE DOI) DO PDI ABORT SEQUENCE FOR LOSS OF:	(POST DOI) DO PDI ABORT SEQUENCE FOR LOSS OF:	DO DIRECT RETURN ABORT FOR LOSS OF:	INHIBIT STAGING FOR LOSS OF:	INHIBIT STAGING OR DELAY UNTIL IF OTHER CONSIDERATIONS JUSTIFY STAGING:	DO NOT DO UNMANNED APS BURN FOR LOSS OF:
CABIN INTEGRITY	X	X		X	X		X	
FIRE/SMOKE/CONT	X	X			X			
SUIT INTEGRITY	X	X		X			X	
SUIT CIRCULATION	X (BOTH)	X (BOTH)		X (BOTH)			X (BOTH)	
DESCENT O ₂	← ANY 2of3	← ANY 2of3		← ANY 2of3			INSUFFICIENT	
ASCENT O ₂ (2)							X (1 of 2)	
DEMAND REGULATORS	X (BOTH)	X (BOTH)		X (BOTH)			X (BOTH)	
H ₂ O SEPARATORS		X (BOTH)		X (BOTH)			X (BOTH)	
PRI LOOP	← BOTH	← (1 of 2)		X	X		← BOTH LOOPS	
PRI H ₂ O FEEDPATH		X		X				
SEC LOOP								
DESC H ₂ O	← ALL 3	← ANY 2of3		← ANY 2of3			INSUFFICIENT	
ASC H ₂ O							X (BOTH)	
EVA EQPT (OPS, PLSS)	X (2 of 3)							
DESCENT BATS	← RREQ 2 DHS	← RREQ 2D+2A		← RREQ 2D+2A			X (BOTH)	
ASCENT BATS	← 1 ASC	← OR 4D+1A		← OR 4D+1A			X (1 of 2)	
DESCENT FEEDERS	X (BOTH)	X (BOTH OR 1 TO HARD SHUT)	X (BOTH OR 1 TO HARD SHUT)	X (1 of 2)		X (BOTH)	X (1 of 2)	
ASCENT FEEDERS	X (1 of 2)	X (1 of 2)					X	
ECA PROTECTION :							X	
CDR BUS	X	X		X			X	X
LMP BUS	X	X		X			X	X
AC BUS		X (1 of 2)						
INVERTERS		X (BOTH)						
PYRO SYSTEMS	X (BOTH)					X (BOTH)	X (1 of 2)	
EDS RELAYS								
HBR		⊗						← BOTH
LBR								
SBAND VOICE		X						
VHF VOICE	X	X						X
OMD								
CRIT ONBOARD DISP	X	X		X				
IMU		X		X	X			← BOTH
LGC		X		⊗	X			PNGS
OPTICS		X (AOT+COAS)	X					AGS
DSKY		X		X	X			
FDAI		X (BOTH)						
G IMBAL DRIVE CAP		⊗ (+RCS IMP)	⊗ (+RCS IMP)					
RNDZ 3 AXIS ATT CNTL	X	X				LOSS OF CNTL		LOSS OF CNTL
3 AXIS TRANS CAP	X (ANY-AXIS) +X ONLY	X (ANY-AXIS) +X ONLY				X (ANY-AXIS) +X ONLY		
AGS								
RATE gyro PKG ACA	X	X (BOTH)						
THROTTLE CAP								
RNDZ RADAR		X						
FLASHING LITE		⊗						
SH _e TANK		⊗	⊗	○				
START TANK								
TANK PRESS (LEAKS)	X	X	X					
TANK ΔP		X	X					
PROP TEMPS		X	X					
PROP AT		X	X					
SOURCE HELIUM								
TANK PRESSURE (LEAKS)	X					X	X	X
TANK ΔP							X	X
PROP TEMPS							X	
PROP AT							X	
RCS SYSTEMS	X (1 of 2)	X		X		X (BOTH)		
THRUSTER PAIRISOL	X	X						

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		<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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MISSION RULES

OMSF GENERAL RULES

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I-1	MISSION RULES ARE EFFECTIVE DURING THE LAUNCH COUNTDOWN, FLIGHT AND RECOVERY OPERATIONS, AND DURING PRELAUNCH TESTS WHEN APPLICABLE. THEY ARE BASED ON PRIMARY OBJECTIVES AS STATED IN THE APOLLO FLIGHT MISSION ASSIGNMENTS DOCUMENT M-D MA 500-11. PROPOSED CHANGES TO THE PRIMARY OBJECTIVES STATED IN THE MISSION ASSIGNMENTS DOCUMENT SHALL REQUIRE AA/MSF APPROVAL.				
I-2	THE DIRECTOR OF FLIGHT OPERATIONS AND THE DIRECTOR OF LAUNCH OPERATIONS OR THEIR DESIGNATED REPRESENTATIVE WILL INSURE COORDINATION OF THEIR RESPECTIVE MISSION RULE CHANGES WITH THE MISSION DIRECTOR AND OTHER APPROPRIATE ORGANIZATIONS.				
I-3	FOLLOWING THE CDDT OR FRT, WHICHEVER OCCURS FIRST, MISSION DIRECTOR APPROVAL AND CONCURRENCE WILL BE REQUIRED ON ALL RULES CHANGES AFFECTING SAFETY, ACCOMPLISHMENT OF TEST OBJECTIVES, DEVIATIONS FROM THE NOMINAL MISSION AND PRELAUNCH CONSTRAINTS. CONCURRENCE MAY BE OBTAINED VERBALLY IF TIME CONSIDERATIONS SO DICTATE.				
I-4	DURING THE CONDUCT OF THE MISSION, THE MISSION DIRECTOR WILL BE ADVISED OF ALL RECOMMENDATIONS THAT INVOLVE CHANGES TO: MISSION OBJECTIVES, MISSION RULES, FLIGHT PLAN CONTENT, OR LAUNCH/FLIGHT SAFETY.				
I-5	WITHIN THEIR RESPECTIVE AREAS OF RESPONSIBILITY, THE COMMAND PILOT, THE LAUNCH DIRECTOR, FLIGHT DIRECTOR, DOD MANAGER FOR MSF SUPPORT OPERATIONS, AND THE MISSION DIRECTOR MAY TAKE OR RECOMMEND ANY ACTION REQUIRED FOR OPTIMUM CONDUCT OF THE MISSION.				
I-6	THE COMMAND PILOT, SPACECRAFT TEST CONDUCTOR, LAUNCH VEHICLE TEST CONDUCTOR, SPACE VEHICLE TEST SUPERVISOR, LAUNCH OPERATIONS MANAGER, LAUNCH DIRECTOR, FLIGHT DIRECTOR, DOD MANAGER FOR MANNED SPACE FLIGHT SUPPORT OPERATIONS, OR THE MISSION DIRECTOR MAY REQUEST A HOLD FOR CONDITIONS WITHIN THEIR RESPECTIVE AREAS OF RESPONSIBILITY.				
I-7	DURING THE COUNTDOWN, THE LAUNCH VEHICLE AND SPACECRAFT PROGRAM MANAGERS AND RESPECTIVE CENTER OPERATIONS MANAGERS SHALL PROVIDE TECHNICAL ADVICE AND SUPPORT DIRECTLY TO THE LAUNCH OPERATIONS MANAGER AND LAUNCH DIRECTOR. THE LATTER TWO WILL KEEP THE MISSION DIRECTOR FULLY INFORMED OF PROBLEMS AND PROPOSED SOLUTIONS. DURING THE FLIGHT PHASE OF OPERATIONS, SIMILAR SUPPORT AS REQUIRED WILL BE PROVIDED TO THE FLIGHT DIRECTOR AND THE MSC DIRECTOR OF FLIGHT OPERATIONS. THE MISSION DIRECTOR WILL BE KEPT FULLY INFORMED BY THESE INDIVIDUALS OF PROBLEMS AND PROPOSED SOLUTIONS DURING THE APPLICABLE PHASES OF THE MISSION.				
I-8	WHEN TIME PERMITS, THE FAILURE OF A MANDATORY OR HIGHLY DESIRABLE ITEM WILL BE REPORTED TO THE MISSION DIRECTOR BY THE LAUNCH DIRECTOR OR THE FLIGHT DIRECTOR. THE INITIAL REPORT WILL INCLUDE THE POSITION OR FACILITY THAT DETECTED THE MALFUNCTION. SUBSEQUENTLY, THE MISSION DIRECTOR WILL BE INFORMED OF ESTIMATED TIME TO REPAIR AND RECOMMENDED PROCEED, HOLD, RECYCLE, OR SCRUB ACTION AS IT DEVELOPS.				
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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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MISSION RULES

REV	ITEM				
	I-18	FROM LIFTOFF TO TOWER CLEAR, THE LAUNCH DIRECTOR AND FLIGHT DIRECTOR WILL HAVE CONCURRENT RESPONSIBILITY FOR SENDING AN ABORT REQUEST. THE CRITERIA FOR SENDING AN ABORT REQUEST DURING THIS PERIOD WILL BE ESTABLISHED IN THE LAUNCH AND FLIGHT RULES RESPECTIVELY.			
	I-19	THE LAUNCH OPERATIONS MANAGER WILL INFORM MCC WHEN THE SPACE VEHICLE CLEARS THE UMBILICAL TOWER BY SAYING "CLEAR TOWER" OVER ONE OF THE LOOPS FROM KSC TO MCC.			
	I-20	IN THE EVENT OF NON-CATASTROPHIC SPACE VEHICLE COLLISION WITH THE UMBILICAL TOWER OR OTHER CONTINGENCIES WHICH DO NOT REQUIRE IMMEDIATE ACTION, THE LAUNCH OPERATIONS MANAGER WILL CONTINUE TO EVALUATE THE EXTENT OF THE DAMAGE AND PROVIDE INFORMATION TO THE FLIGHT DIRECTOR FOR ANY ACTION NECESSARY AFTER UMBILICAL TOWER CLEARANCE.			
	I-21	COMPLETE GROUND CONTROL OF THE SPACE VEHICLE PASSES TO THE FLIGHT DIRECTOR WHEN THE SPACE VEHICLE REACHES SUFFICIENT ALTITUDE TO CLEAR THE TOP OF THE UMBILICAL TOWER.			
	I-22	IN THE MCC, THE FLIGHT DIRECTOR, FLIGHT DYNAMICS OFFICER AND BOOSTER SYSTEMS ENGINEER WILL HAVE THE CAPABILITY TO SEND AN ABORT REQUEST SIGNAL. THE CRITERIA FOR SENDING AN ABORT REQUEST WILL BE ESTABLISHED IN THE FLIGHT RULES.			
	I-23	THE COMMAND PILOT MAY INITIATE SUCH 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.			
		RULE NUMBERS 1-28 THROUGH 1-35 ARE RESERVED			
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REV	ITEM	DEFINITIONS			
I-36		<u>REDLINE</u> : A REDLINE VALUE IS A MAXIMUM AND/OR MINIMUM LIMIT OF A CRITICAL PARAMETER NECESSARY TO IDENTIFY VEHICLE, SYSTEM, AND COMPONENT PERFORMANCE AND OPERATION. REDLINE VALUES WILL BE ESTABLISHED SUCH THAT FURTHER DEGRADATIONS OF THE SYSTEM OR COMPONENT COULD LEAD TO A FAILURE TO ACCOMPLISH THE PRIMARY MISSION.			
I-37		<u>REDLINE FUNCTION</u> : A REDLINE FUNCTION IS A PARAMETER THAT HAS BEEN IDENTIFIED TO MONITOR THE FUNCTIONING OF A UNIT TO INSURE THE OPERATIONAL PERFORMANCE OF THAT UNIT IS ACCEPTABLE TO MEET THE PRIMARY MISSION. REDLINE FUNCTIONS ARE MANDATORY.			
I-38		<u>PRIMARY OBJECTIVE</u> : 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.			
I-39		<u>PRINCIPAL DETAILED TEST OBJECTIVE</u> : 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.			
I-40		<u>MANDATORY DETAILED TEST OBJECTIVE</u> : 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.			
I-41		<u>SECONDARY DETAILED TEST OBJECTIVE</u> : A DETAILED TEST OBJECTIVE WHICH WOULD PROVIDE SIGNIFICANT DATA OR EXPERIENCE BUT WHICH IS NOT A PREREQUISITE TO THE LUNAR LANDING MISSION.			
I-42		<u>MANDATORY (M)</u> : 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.			
I-43		<u>HIGHLY DESIRABLE (HD)</u> : 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.			
I-44		<u>DESIRABLE (D)</u> : A DESIRABLE ITEM IS A SPACE VEHICLE ELEMENT OR OPERATIONAL SUPPORT ELEMENT THAT IS NOT ESSENTIAL FOR THE ACCOMPLISHMENT OF THE PRIMARY MISSION.			
I-45		<u>PROCEED</u> : CONTINUE IN ACCORDANCE WITH PRESCRIBED COUNTDOWN PROCEDURES.			
I-46		<u>HOLD</u> : INTERRUPTION OF THE COUNTDOWN FOR UNFAVORABLE WEATHER, REPAIR OF HARDWARE, OR CORRECTION OF CONDITIONS UNSATISFACTORY FOR LAUNCH OR FLIGHT.			
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MISSION RULES

REV	ITEM				
	I-47	<u>COUNTDOWN</u> : 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 THE TERMINAL COUNT.			
	I-48	<u>HOLD-POINT</u> : A PREDETERMINED POINT WHERE THE COUNTDOWN MAY BE CONVENIENTLY INTERRUPTED.			
	I-49	<u>RECYCLE</u> : THE COUNTDOWN IS STOPPED AND RETURNED TO A DESIGNATED POINT OR AS SPECIFIED IN THE LAUNCH MISSION RULES.			
	I-50	<u>SCRUB</u> : THE LAUNCH IS POSTPONED.			
	I-51	<u>CUTOFF</u> : THE AUTOMATIC OR MANUAL COMMAND TO STOP THE LAUNCH SEQUENCE AFTER INITIATION OF THE "AUTOMATIC LAUNCH SEQUENCE START."			
	I-52	<u>LIFTOFF</u> : THE EVENT DETERMINED BY THE INSTRUMENTATION UNIT UMBILICAL DISCONNECT SIGNAL AND IS THE POINT IN TIME WHEN PLUS TIME COMMENCES.			
	I-53	<u>ABORT</u> : MISSION TERMINATION BY UNSCHEDULED INTENTIONAL SEPARATION OF THE SPACECRAFT FROM THE LAUNCH VEHICLE PRIOR TO ORBITAL INSERTION.			
	I-54	<u>EARLY MISSION TERMINATION</u> : UNSCHEDULED INTENTIONAL MISSION TERMINATION AT OR AFTER ORBITAL INSERTION.			
	I-55	<u>MEASUREMENT</u> : A MEASUREMENT IS A SPECIFIC DATA CHANNEL OF INSTRUMENTATION MONITORING A SINGLE FUNCTION.			
	I-56	<u>INSTRUMENTATION</u> : INSTRUMENTATION IS THE EQUIPMENT THAT ACQUIRES, TRANSMITS AND MONITORS DATA FOR PERFORMANCE EVALUATION OF SPACE VEHICLE AND OPERATIONAL SUPPORT ITEMS.			
A	I-57	<u>SEMI-SYNCHRONOUS</u> : AN ORBIT WITH A PERIOD OF 12 HOURS. THE PERIGEE POSITIONS ARE FIXED RELATIVE TO EARTH AND 180° APART IN LONGITUDE.			
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PART II
1 GENERAL RULES
AND SOP'S

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MISSION RULES

REV	ITEM				
		GENERAL			
	1-1	THE FLIGHT MISSION RULES OUTLINE PREPLANNED DECISIONS DESIGNED TO MINIMIZE THE AMOUNT OF REAL-TIME RATIONALIZATION REQUIRED WHEN NON-NOMINAL SITUATIONS OCCUR DURING THE TERMINAL COUNTDOWN, THE FLIGHT PHASE, AND RECOVERY OPERATIONS.			
	1-2	WHENEVER POSSIBLE, THE CREW AND GROUND WILL VERIFY ALL MALFUNCTIONS. WHENEVER THERE IS A CONFLICT BETWEEN SPACECRAFT AND GROUND TELEMETRY READOUTS, THE SPACECRAFT READOUTS ARE PRIME (ASSUMING THE SPACECRAFT HAS ADEQUATE INSTRUMENTATION AND THAT APPLICABLE SPACECRAFT COCKPIT READOUTS ARE OPERATIONAL).			
	1-3	IF AN ALTERNATE MISSION IS REQUIRED, MISSION OBJECTIVES WILL BE DELETED IN ACCORDANCE WITH THE PRIORITY OF OBJECTIVES STATED IN THE FLIGHT OPERATIONS RULES. LOWER ORDER OBJECTIVES WILL NOT BE ATTEMPTED IF DOING SO MAY COMPROMISE THE ACCOMPLISHMENT OF OBJECTIVES OF A HIGHER PRIORITY.			
	1-4	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.			
	1-5	WHEN A CONFLICT OF FLIGHT PLAN ACTIVITIES OCCURS, THE FLIGHT DIRECTOR WILL DETERMINE THE PRIORITY OF ACTIVITIES.			
	1-6	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.			
	1-7	THE FLIGHT DIRECTOR MAY, AFTER ANALYSIS OF THE FLIGHT, CHOOSE TO TAKE ANY NECESSARY ACTION REQUIRED FOR THE SUCCESSFUL COMPLETION OF THE MISSION.			
	1-8	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.			
	1-9	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.			
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MISSION RULES

REV	ITEM				
	1-10	UNLESS STATED OTHERWISE, MANDATORY AND HIGHLY DESIRABLE INSTRUMENTATION REQUIREMENTS ARE SATISFIED BY EITHER ONBOARD OR PCM CAPABILITY.			
	1-11	<p>MANDATORY SPACE VEHICLE INSTRUMENTATION FOR THE PURPOSES OF FLIGHT MISSION RULES MUST BE IN CONSONANCE WITH THE FOLLOWING CRITERIA: (REFERENCE OMSF GENERAL RULE I-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>			
	1-12	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.			
	1-13	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.			
	1-14	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.			
	1-15	THE COMMAND PILOT MAY INITIATE SUCH INFLIGHT ACTION AS HE DEEMS ESSENTIAL FOR CREW SAFETY.			
	1-16	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.			
		RULE NUMBERS 1-17 THROUGH 1-23 ARE RESERVED.			
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MISSION RULES

REV	ITEM	DEFINITIONS			
	1-24	<u>ASAP</u> : AS SOON AS PRACTICABLE (I.E., AS SOON AS POSSIBLE AND REASONABLE).			
	1-25	<u>PTP</u> : 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	<u>ATP</u> : AN "ALTERNATE TARGET POINT" IS A STRATEGICALLY LOCATED SET OF COORDINATES CHOSEN TO PROVIDE A SPACECRAFT TARGET POINT MIDWAY BETWEEN PTP'S.			
	1-27	<u>NEXT BEST PTP</u> : 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	<u>REENTER ASAP</u> : REENTER AS SOON AS PRACTICABLE (I.E., AS SOON AS POSSIBLE AND REASONABLE).			
	1-29	<u>TERMINATE ASAP</u> : REENTER WITH THE MINIMUM TRIP TIME TO AN UNSPECIFIED LANDING AREA.			
	1-30	<u>CRITICAL MANEUVERS</u> : 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 LOI AND MCC'S NOT REQUIRED FOR ENTRY CORRIDOR CONTROL.			
	1-31	<u>NON-CRITICAL BURN</u> : A BURN WHICH NEED NOT BE ACCOMPLISHED TO MAINTAIN AN ACCEPTABLE LEVEL OF CREW SAFETY.			
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REV	ITEM				
	1-32	<u>EARLY STAGING</u> : UNSCHEDULED INTENTIONAL SEPARATION OF THE S-IVB STAGE FROM THE S-II STAGE.			
	1-33	<u>CONTINGENCY ORBIT INSERTION (COI)</u> : AN SPS PROPULSIVE MANEUVER WHICH WILL PROVIDE CSM INSERTION INTO A SAFE ORBIT ($H_p \geq 75NM$) IN THE EVENT OF AN SLV FAILURE OCCURRING IMMEDIATELY PRIOR TO INSERTION, OR IN THE EVENT OF DEGRADED SLV PERFORMANCE.			
	1-34	<u>S-IVB DESTRUCT PACKAGE SAFING</u> : THE EMERGENCY DESTRUCT PACKAGE IS SAFED BY THE RSO TRANSMITTING A COMMAND WHICH PERMANENTLY REMOVES POWER FROM THE RANGE SAFETY RECEIVERS.			
	1-35	<u>S-IVB SAFING</u> : A PASSIVATION SEQUENCE IN WHICH S-IVB LOX, LH ₂ , AND HIGH PRESSURE SPHERES ARE DEPLETED.			
	1-36	<u>PRELAUNCH PHASE (PRELN)</u> : THE TIME INTERVAL FROM THE COMPLETION OF THE FLIGHT READINESS REVIEW TO LIFTOFF.			
A	1-37	<p><u>FLIGHT PHASE</u>: THE INTERVAL FROM LIFTOFF THROUGH SPLASHDOWN. FOR MISSION RULE PURPOSES THE FLIGHT PHASE IS FURTHER SUBDIVIDED AS SHOWN BELOW:</p> <p>A. <u>LAUNCH PHASE</u>: FROM LIFTOFF THROUGH INSERTION (TBI THROUGH TB4).</p> <p>B. <u>EARTH ORBIT PHASE</u>: FROM INSERTION THROUGH S-IVB CUTOFF FOR TRANSLUNAR INJECTION (TLI).</p> <p>C. <u>TD&E PHASE</u>: FROM CSM/S-IVB SEPARATION THROUGH LM EJECTION FROM SLA.</p> <p>D. <u>TRANSLUNAR COAST PHASE</u>: FROM S-IVB CUTOFF FOR TLI THROUGH LOI₁ CUTOFF.</p> <p>E. <u>DOCKED PHASE</u>: THE TIME INTERVALS DURING WHICH THE LM AND CSM ARE DOCKED.</p> <p>F. <u>LUNAR ORBIT PHASE</u>: FROM LOI₁ CUTOFF TO UNDOCKING AND FROM FINAL LM ACTIVITIES TO TEI CUTOFF.</p> <p>G. <u>UNDOCKED PHASE</u>: THE TIME INTERVAL DURING WHICH A MANNED LM IS SEPARATED FROM THE CSM FOR STATION KEEPING (MAXIMUM SEPARATION DISTANCE OF $\approx 500FT.$).</p> <p>H. <u>RENDEZVOUS PHASE</u>: FROM THE CSM PRE-DOI SEPARATION MANEUVER THROUGH CSM/LM DOCKING AT END OF RENDEZVOUS.</p> <p>I. <u>UNMANNED PHASE</u>: FROM FINAL CSM/LM SEPARATION TO COMPLETION OF LM ACTIVITIES (INCLUDING LM APS BURN TO DEPLETION).</p> <p>J. <u>TRANSEARTH COAST PHASE</u>: FROM TEI CUTOFF TO CM/SM SEPARATION.</p> <p>K. <u>ENTRY PHASE</u>: FROM CM/SM SEPARATION TO SPLASHDOWN.</p>			
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MISSION RULES

REV	ITEM				
	1-38	<u>RECOVERY PHASE:</u> THE TIME INTERVAL FROM SPLASHDOWN TO DELIVERY OF THE FLIGHT CREW AND SPACECRAFT TO DESIGNATED LANDBASED INSTALLATIONS.			
	1-39	<p><u>REENTRY DEFINITIONS:</u></p> <p>A. AUTOMATIC - REENTRY CONTROLLED BY CMC WHICH OUTPUTS BANK ANGLE COMMAND TO THE RCS.</p> <p>B. CLOSED LOOP - REENTRY CONTROLLED BY THE CREW MANUALLY FLYING BANK ANGLE MODULATION USING CMC ENTRY PROGRAM OUTPUTS.</p> <p>C. OPEN LOOP REENTRY - REENTRY CONTROLLED BY THE CREW USING SPACECRAFT DISPLAYS AND FLYING:</p> <ol style="list-style-type: none"> 1. BANK ANGLE (RR 0-90) AND RETRB (RL 0-90). 2. CONSTANT BANK ANGLE - CREW ESTABLISHES AND MAINTAINS A CONSTANT BANK ANGLE. (CONSTANT BANK ANGLES >90 DEGREES WILL NOT BE FLOWN EXCEPT WHEN SKIPOUT RULE IS VIOLATED.) 3. ROLLING REENTRY - MAINTAIN CONSTANT 18 DEGREES PER SECOND ROLL RATE. 4. EMS RANGING - CONSTANT BANK ANGLE IS HELD TO 1G; THEN THE RANGE TO GO DISPLAY AND THE RANGE POTENTIAL LINES ARE COMPARED TO MODULATE THE BANK ANGLE. AT RETRB THE PRESENT BANK ANGLE IS RESERVED. <p>D. CONSTANT G ENTRY: CREW CONTROLS THE BANK ANGLE TO MAINTAIN A SPECIFIED G LEVEL.</p> <p>E. EMS REENTRY: CREW CONTROLS THE BANK ANGLE TO MAINTAIN A CONSTANT G UNTIL VELOCITY <25,500 FPS. THE EMS IS THEN USED TO CONTROL RANGE BY NULLING THE DIFFERENCE BETWEEN THE RANGE TO GO COUNTER AND THE RANGE POTENTIAL GUIDELINES. ALL MANEUVERS ARE OVERRIDDEN AS NECESSARY TO PREVENT AN ONSET OR OFFSET VIOLATION.</p>			
	1-40	<u>ALTERNATE MISSION:</u> ANY DEVIATION FROM THE NOMINAL MISSION TIMELINE WHERE FURTHER MISSION OBJECTIVES ARE CONSIDERED BEFORE THE END OF THE MISSION.			
	1-41	<u>CONTINUE MISSION:</u> THE CONTINUE MISSION RULING FOR MALFUNCTIONS INDICATES THAT THE MISSION WILL BE CONTINUED IN ACCORDANCE WITH PRESENT PLANS UNLESS OVERRIDING FACTORS ARE PRESENT WHICH WOULD CAUSE SELECTION OF AN ALTERNATE CHOICE.			
	1-42	<u>SLINGSHOT MANEUVER:</u> USE OF RESIDUAL S-IVB PROPELLANTS TO PLACE THE SPENT STAGE IN A SOLAR OR NON-LUNAR IMPACTING TRAJECTORY.			
	1-43	<p><u>LUNAR ABORT MODES AFTER DISPERSED LOI₁</u></p> <p>A. SPS ABORT 15 MIN ABORT - SPS RESTART FOR DIRECT RETURN. (DOCKED SPS ABORT MAY BE EXECUTED IN MODES I OR II)</p> <p>B. DPS ABORT</p> <ol style="list-style-type: none"> 1. MODE I - DIRECT RETURN USING DPS, BURN AT APPROXIMATELY LOI + 2 HRS. 2. MODE II - TWO IMPULSE DPS ABORT FOR EARTH RETURN, FIRST BURN AT APPROXIMATELY LOI + 2 HRS, SECOND BURN AT NEXT PERICYNTHION. 3. MODE III - DPS TEI, BURN AT APPROXIMATELY LOI + 15 HRS. <p>NOTE: HANDOVER BETWEEN MODES I, II, AND III IS FUNCTION OF ACCUMULATED LOI₁ ΔV (REF RULE 5-62)</p>			
		RULE NUMBERS 1-44 THROUGH 1-47 ARE RESERVED.			
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MISSION RULES

REV	ITEM	CRITERIA FOR TARGET POINT SELECTION																				
A	1-48	<p>THE CRITERIA LISTED BELOW WILL BE USED WHEN CHOOSING BETWEEN TWO OR MORE TARGET POINTS. THE CRITICALITY OF THE MISSION SITUATION WILL AFFECT THE APPLICATION OF THESE CRITERIA.</p> <p style="text-align: right;"><u>PRIORITY</u></p> <table> <tr> <td>ACCEPTABLE LAND MASS CLEARANCE</td> <td style="text-align: right;">1</td> </tr> <tr> <td>ACCEPTABLE WEATHER CONDITIONS FOR RECOVERY OPERATIONS AND CM STRUCTURAL INTEGRITY</td> <td style="text-align: right;">2</td> </tr> <tr> <td>CAPABILITY OF RECOVERY FORCES</td> <td style="text-align: right;">3</td> </tr> <tr> <td>COMMUNICATION WITH THE SPACECRAFT FROM A GROUND STATION AT LEAST 40 MINUTES PRIOR TO DEORBIT BURN*</td> <td style="text-align: right;">4</td> </tr> <tr> <td>SUFFICIENT DAYLIGHT FOR RECOVERY OPERATIONS</td> <td style="text-align: right;">5</td> </tr> <tr> <td>A GROUND STATION FOR POST-DEORBIT BURN* TRACKING</td> <td style="text-align: right;">6</td> </tr> <tr> <td>VOICE CONTACT PRIOR TO AND DURING DEORBIT BURN*</td> <td style="text-align: right;">7</td> </tr> <tr> <td>POST-BLACKOUT TRACKING DATA AVAILABLE FOR REENTRY (ASSUMES PRE-BLACKOUT ACQUISITION)</td> <td style="text-align: right;">8</td> </tr> <tr> <td>GROUND STATIONS AVAILABLE TO OBTAIN DELTA V_C READOUTS AND TO PASS CREW BACKUP GUIDANCE QUANTITIES</td> <td style="text-align: right;">9</td> </tr> </table> <p>*OR FINAL MCC MANEUVER</p>			ACCEPTABLE LAND MASS CLEARANCE	1	ACCEPTABLE WEATHER CONDITIONS FOR RECOVERY OPERATIONS AND CM STRUCTURAL INTEGRITY	2	CAPABILITY OF RECOVERY FORCES	3	COMMUNICATION WITH THE SPACECRAFT FROM A GROUND STATION AT LEAST 40 MINUTES PRIOR TO DEORBIT BURN*	4	SUFFICIENT DAYLIGHT FOR RECOVERY OPERATIONS	5	A GROUND STATION FOR POST-DEORBIT BURN* TRACKING	6	VOICE CONTACT PRIOR TO AND DURING DEORBIT BURN*	7	POST-BLACKOUT TRACKING DATA AVAILABLE FOR REENTRY (ASSUMES PRE-BLACKOUT ACQUISITION)	8	GROUND STATIONS AVAILABLE TO OBTAIN DELTA V_C READOUTS AND TO PASS CREW BACKUP GUIDANCE QUANTITIES	9
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GROUND STATIONS AVAILABLE TO OBTAIN DELTA V_C READOUTS AND TO PASS CREW BACKUP GUIDANCE QUANTITIES	9																					
	1-49	<p><u>LUNAR RETURN ENTRY RANGE PRIORITY:</u> THE RELATIVE ENTRY RANGE (400,000 FEET TO SPLASH) PRIORITY IS AS FOLLOWS:</p> <p>A. 1200 - 1400 NM (NOMINAL)</p> <p>B. 1400 - 1800 NM (USED TO AVOID WEATHER VIOLATIONS IN PRIORITY A.)</p> <p>C. 1800 - 2500 NM (USED TO AVOID EXTREME WEATHER VIOLATIONS IN PRIORITY A AND B.)</p>																				
		<p>RULE NUMBERS 1-50 THROUGH 1-55 ARE RESERVED</p>																				
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MISSION RULES

REV	ITEM	PRELAUNCH RULES			
A	1-56	<p><u>MANDATORY</u> - 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 <u>MANDATORY TO L/O</u>. REFERENCE THE LAUNCH MISSION RULES DOCUMENT FOR SPECIFIC PROCEDURES.</p>			
	1-57	<p><u>HIGHLY DESIRABLE</u> - 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><u>DESIRABLE</u> - 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>			
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MISSION RULES

REV	ITEM	LAUNCH ABORTS					
	1-66	ABORT REQUEST COMMANDS ARE COMMANDS TRANSMITTED FROM THE MCC OR LCC WHICH ILLUMINATE THE ABORT REQUEST LIGHT ON THE COMMAND PILOT'S PANEL. THE "ABORT LIGHT" AND A VOICE REPORT "ABORT" OVER A/G ARE CONSIDERED TWO CUES FOR THE CREW TO TAKE THE NECESSARY ACTION TO ABORT THE MISSION. THE GROUND WILL USE TWO INDEPENDENT CUES PRIOR TO TRANSMITTING "ABORT REQUEST." ADDITIONAL CUES FOR THE CREW WILL COME FROM ONBOARD INDICATIONS.					
	1-67	ABORT ACTION CAN BE INITIATED ONLY BY THE CREW OR THE EDS.					
	1-68	WHENEVER POSSIBLE, ALL ABORTS AND EARLY MISSION TERMINATIONS WILL BE TIMED FOR A WATER LANDING.					
	1-69	THE FLIGHT DIRECTOR WILL INITIATE THE ABORT REQUEST FOR SPACECRAFT SYSTEM MALFUNCTIONS.					
	1-70	THE FLIGHT DYNAMICS OFFICER WILL INITIATE THE ABORT REQUEST COMMAND DURING THE FLIGHT PHASE IF THE SPACE VEHICLE EXCEEDS THE FLIGHT DYNAMICS ENVELOPE.					
	1-71	THE BOOSTER SYSTEMS ENGINEER WILL INITIATE THE ABORT REQUEST COMMAND BASED UPON LAUNCH VEHICLE TIME-CRITICAL SYSTEMS MALFUNCTIONS THAT WOULD NOT ALLOW A SAFE INSERTION OR CONTINUATION TO A FLIGHT DYNAMICS LIMIT LINE.					
A	1-72	<p>THE ONLY KSC POSITION THAT WILL HAVE ABORT REQUEST CAPABILITY IS THE LAUNCH OPERATIONS MANAGER. THE LAUNCH OPERATIONS MANAGER MAY SEND AN ABORT REQUEST FROM THE TIME THE LAUNCH ESCAPE SYSTEM IS ARMED UNTIL THE SPACE VEHICLE REACHES SUFFICIENT ALTITUDE TO CLEAR THE TOP OF THE UMBILICAL TOWER. PRIOR TO TRANSFER OF CONTROL TO THE FLIGHT DIRECTOR, THE LAUNCH OPERATIONS MANAGER WILL INITIATE THE ABORT REQUEST COMMAND FROM KSC BASED ON THE CRITERIA DEFINED IN THE LMRD. THESE INCLUDE:</p> <ul style="list-style-type: none"> A. UNCONTROLLABLE FIRE B. SLV EXPLOSION C. SLV STRUCTURAL FAILURE D. SLV TIPOVER E. SLV FALLBACK 					
	1-73	THE RSO CAN SHUTDOWN THE SLV BY TRANSMITTING THE MFCO COMMAND WHICH ALSO LIGHTS THE ABORT REQUEST LIGHT IN THE SPACECRAFT. THE MFCO WILL INITIATE AN AUTO-ABORT IF TRANSMITTED PRIOR TO EDS DISABLE. THE MFCO COMMAND INITIATES A 4.1 SEC TIMER ON THE GROUND WHICH IN TURN ENABLES DESTRUCT CAPABILITY IF TRANSMITTED. THE RSO DESTRUCT COMMAND CAN THEN DESTROY THE SLV. THE RSO WILL ALWAYS SAFE THE S-IVB AFTER TRANSMITTING MFCO UPON VERIFICATION OF CUTOFF IF THE DESTRUCT COMMAND IS NOT TO BE TRANSMITTED.					
	1-74	THE RSO WILL SAFE THE S-IVB DESTRUCT SYSTEM AFTER CONFIRMATION OF S-IVB C/O FROM THE FLIGHT DYNAMICS OFFICER. IF COMMUNICATIONS ARE LOST WITH THE FIDO, THE S-IVB DESTRUCT SYSTEM WILL BE SAFED BASED ON THE RSO'S VERIFICATION OF S-IVB CUTOFF. ONCE SAFED, THE S-IVB DESTRUCT SYSTEM CANNOT BE REINITIATED. IF THE RSO INITIATES MFCO, THE RSO WILL INITIATE SAFING AFTER VERIFICATION OF S-IVB CUTOFF.					
		MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

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

REV	ITEM				
A	2-1	<u>MISSION GO/NO-GO</u>	<div style="border: 1px solid black; padding: 5px; text-align: center; margin-bottom: 10px;">FLIGHT OPERATIONS RULES</div> <p>A. GO/NO-GO DECISIONS WILL BE MADE BY THE FLIGHT CREW AND THE MCC PRIOR TO PROCEEDING BEYOND THE NEXT BEST DEORBIT OR DIRECT ABORT OPPORTUNITY, PRIOR TO ENTERING ANY CRITICAL MISSION SEQUENCE, AND PRIOR TO EXECUTING ANY PROPULSIVE MANEUVER. FORMAL GO/NO-GO POINTS ARE SUMMARIZED IN SECTION 3.</p> <p>B. FAILURE TO SATISFY THE GO/NO-GO CRITERIA IS SUFFICIENT CAUSE TO ALTER THE NOMINAL MISSION ACTIVITIES. THE COURSE OF ACTION REQUIRED WILL BE BASED UPON THE SPECIFIC CRITERIA NOT SATISFIED AND ASSOCIATED SPECIFIC MISSION RULES.</p> <p>C. THE LIFETIME REQUIREMENTS AND CONSUMABLES ESTABLISHED FOR THE GO/NO-GO CRITERIA MUST ACCOUNT FOR THE NOMINAL ACTIVITIES PLANNED FOR COMPLETION, SUFFICIENT TIME AND CONSUMABLES TO PREPARE AND CONDUCT A CSM LM RESCUE, TEI, AND ENTRY FROM ANY POINT IN THE NOMINAL ACTIVITIES PLUS 12 HRS.</p>		
A	2-2	<u>PRELAUNCH</u>	<p>A. LAUNCH AZIMUTH LIMITATIONS RESTRICT LAUNCHES TO OCCUR BETWEEN 72° AND 107°.</p> <p>B. THE FLIGHT DIRECTOR WILL EVALUATE WIND SIMULATIONS ALONG THE MODE I (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 TM AND TRACKING COVERAGE IS REQUIRED FROM THE SLV FROM LIFTOFF THROUGH INSERTION PLUS 60 SEC. COMMAND IS HIGHLY DESIRABLE.</p>		
	2-3	<u>LAUNCH</u>	<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>		
	2-4	<u>EARLY STAGING</u>	<p>IF REQUIRED, EARLY S-IVB STAGING MAY BE INITIATED BY THE FLIGHT CREW ONLY AFTER S-IVB-TO-ORBIT CAPABILITY IS OBTAINED OR S-IVB LOX TANK PRESS LIMITS EXCEEDED AFTER TOWER JETTISON.</p>		
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MISSION RULES

REV	ITEM				
A	2-5	<u>EARTH ORBIT</u>	<p>A. ENTRY WILL BE MADE 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 PLUS 12 HRS.</p> <p>C. THE DEORBIT CAPABILITIES REQUIREMENTS FOR EARTH ORBIT ARE:</p> <ol style="list-style-type: none"> 1. TWO METHODS OF DEORBIT ARE REQUIRED (SPS PLUS ONE OTHER); 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 ΔV 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 INTEGRITY 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 ($h_p > 80$ 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 		
A	2-6	<u>EARLY CSM/S-IVB SEPARATION (NO LM EXTRACTION), EARTH ORBIT</u>	<p>A. AN S-IVB FAILURE OR SYSTEMS TREND THAT WILL RESULT IN A HAZARDOUS SITUATION FOR THE FLIGHT CREW IS CAUSE FOR AN IMMEDIATE CSM/S-IVB SEPARATION. THE FLIGHT CREW WILL PERFORM A SEPARATION MANEUVER ASAP. MINIMUM SAFE DISTANCE IS CONSIDERED TO BE 7,000 FT.</p> <p>B. LOSS OF ATTITUDE CONTROL DURING TB5.</p>		
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MISSION RULES

REV	ITEM				
A	2-7	<u>TRANSLUNAR INJECTION</u>	<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 ARE ADEQUATE S-IVB CONSUMABLES TO PROVIDE A ONE SIGMA PROBABILITY OF A GUIDED CUTOFF. 2. THERE HAVE BEEN NO FAILURES IN THE LAUNCH VEHICLE WHICH WOULD RESULT IN A CATASTROPHIC HAZARD. 3. THERE HAS BEEN NO MALFUNCTION IN THE LAUNCH VEHICLE WHICH RESULTS IN ANY CONDITION FOR WHICH A GUIDED CUTOFF WILL DEFINITELY NOT BE ACHIEVED. 4. 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. (REF RULE 3-138) <p>B. THE TLI MANEUVER WILL BE DELAYED UNTIL THE SECOND OPPORTUNITY FOR SUSPECTED FAILURE OF A CRITICAL SYSTEMS (PRIME OR BACKUP) (MANEUVER, LIFE SUPPORT, COOLING, POWER, SEQUENTIAL, COMMUNICATIONS) WHICH REQUIRES TIME FOR EVALUATION.</p>		
A	2-8	<u>TRANSPOSITION, DOCKING, AND EJECTION (TD&E)</u>	<p>A. IN THE EVENT OF ADVERSE LIGHTING, ATTITUDES, RATES, OR MECHANICAL ANOMALIES, THE FLIGHT CREW WILL MAKE THE FINAL DECISION TO ATTEMPT DOCKING AND EXTRACTION.</p> <p>B. THE NORMAL MINIMUM CABIN PRESSURE REDLINE OF 4.0 PSIA FOR TUNNEL/LM PRESSURIZATION SEQUENCES WILL 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.</p> <p>C. IF NORMAL LM EJECTION IS NOT SUCCESSFUL, NO ATTEMPT WILL BE MADE TO MAN THE LM AND "STAGE" TO RECOVER THE ASCENT STAGE.</p> <p>D. <u>THREE LATCHES LOCATED 120° APART ARE REQUIRED TO PERFORM TD&E.</u></p>		
A	2-9	<u>TRANSLUNAR COAST</u>	<p>A. AN SPS BURN OF APPROXIMATELY 20 FPS IS PLANNED AFTER TLI TO PROVIDE A SEPARATION DISTANCE FROM THE S-IVB AND TO ESTABLISH A NOMINAL FREE RETURN.</p> <p>B. NO MCC WILL BE PERFORMED IF LOI CAN BE TARGETED WITHIN OPERATIONAL CONSTRAINTS.</p> <p>C. TRANSLUNAR COAST WILL BE TERMINATED IF ADEQUATE CONSUMABLES DO NOT EXIST FOR A FREE RETURN +12 HRS.</p> <p>D. THE CREW WILL USE THEIR DISCRETION TO MAN THE LM FOR BACKUP COMMUNICATIONS IF CSM COMMUNICATIONS ARE LOST WITH THE MSFN.</p> <p>E. LM PROPULSION CAPABILITY CANNOT BE CONSIDERED AS ACCEPTABLE BACKUP TO CSM SYSTEMS UNTIL AFTER IVT AND LM SYSTEMS CHECKOUT.</p>		
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MISSION RULES

REV	ITEM				
A	2-10	<u>LUNAR ORBIT INSERTION</u>	<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 PLUS 12 HOURS. 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. E. MINIMUM OF 9 DOCKING RING LATCHES. 		
	2-11	<u>LUNAR ORBIT</u>	<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 PERICYNTHIAN OR AN ALTERNATE MISSION WILL BE FLOWN. B. DESIGNED REDUNDANT CAPABILITY MUST BE MAINTAINED IN ALL CRITICAL CSM SYSTEMS. C. SUFFICIENT CONSUMABLES MUST REMAIN TO COMPLETE THE NEXT MISSION PHASE AND EARTH RETURN +12 HRS 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 RENDEZVOUS OPERATIONS ARE INHIBITED, THE DPS WILL BE USED FOR TEI WHEN THERE IS A CHOICE BETWEEN THE DPS AND SPS. 		
	2-12	<u>INTRAVEHICULAR TRANSFER</u>	<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> <p>IF THE PROBLEM CANNOT BE CORRECTED, THE LM SYSTEMS WILL BE ACTIVATED AND THE LM WILL BE STAGED AND SET UP FOR THE UNMANNED OPERATION.</p>		
	2-13	<u>DOCKED LM OPERATION</u>	<ul style="list-style-type: none"> A. LIMITED EVALUATION OF LM SYSTEMS PERFORMANCE, UTILIZING ONE LM CREWMAN, WILL CONTINUE AS LONG AS LIFE SUPPORT CAN BE PROVIDED TO THREE SUITED CREWMEN AND AS LONG AS LM/CSM VOICE COMMUNICATIONS ARE AVAILABLE AND NO HAZARDOUS, CREW SAFETY SITUATIONS EXIST. B. FOR AN IMPENDING HAZARDOUS SITUATION RESULTING FROM A DESCENT STAGE PROBLEM, THE STAGE WILL BE JETTISONED AND ASC STAGE OPERATIONS WILL CONTINUE AFTER THE VEHICLE HAS MOVED TO A SAFE DISTANCE (____FT). C. BEFORE CSM/LM UNDOCKING, LIFE SUPPORT CAPABILITY FOR CONTINGENCY EVT MUST BE VERIFIED. 		
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MISSION RULES

REV	ITEM				
	2-14	<u>CSM/LM UNDOCKING AND SEPARATION</u>			<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.</p> <p>B. VHF VOICE COMMUNICATIONS BETWEEN THE LM AND CSM ARE MANDATORY FOR UNDOCKING.</p> <p>C. CM AND LM SUIT LOOP INTEGRITY 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> <p>E. THE CAPABILITY TO REDOCK WITH THE ASCENT STAGE ONLY MUST BE ESTABLISHED BEFORE UNDOCKING WILL BE PERFORMED.</p>
	2-15	<u>RENDEZVOUS</u>			<p>A. FOR SYSTEM FAILURES IN EITHER SPACECRAFT THAT WOULD RESULT IN EARLY TERMINATION, THE TOTAL LM CAPABILITY (WITHIN ESTABLISHED REDLINES AND NO VIOLATION OF DETAILED SYSTEMS RULES) WILL BE DEDICATED TO COMPLETION OF THE RENDEZVOUS IN PROGRESS. FOR LM CONDITIONS REQUIRING MANUAL CONTROL OF AN APS/DPS TRANSLATION MANEUVER. IT IS PREFERRED TO RETAIN THE DPS FOR EASE OF CONTROL AND STAGE CONSUMABLES.</p> <p>B. BOTH VEHICLES MUST HAVE INDEPENDENT CAPABILITY TO COMPLETE RENDEZVOUS AND DOCKING.</p> <p>C. LM STAGING MAY BE DELAYED, POSSIBLY UNTIL AFTER DOCKING, IF NECESSARY TO MAINTAIN SUFFICIENT ELECTRICAL POWER, LIFE SUPPORT AND/OR PROPULSION CAPABILITY FOR COMPLETION OF THE RENDEZVOUS IN PROGRESS AND DOCKING.</p> <p>D. FIFTH STAGING FROM EITHER AN INACTIVE DPS OR AN ACTIVE DPS WILL NOT BE PERFORMED, EXCEPT FOR IMPENDING CATASTROPHIC FAILURE OF THE DESCENT STAGE.</p> <p>E. FOR CONDITIONS INHIBITING LM STAGING, THE CSM WILL EXECUTE THE MCC AND BRAKING MANEUVERS.</p>
	2-16	<u>UNMANNED PHASE</u>			<p>A. THE APS BURN TO DEPLETION WILL BE ACCOMPLISHED UNLESS LOSS OF ATTITUDE CONTROL OR TLM. IF IGNITION WOULD RESULT IN STAGE DESTRUCTION IN LUNAR ORBIT, THE MANEUVER WILL BE INHIBITED.</p> <p>B. IF TEI IS ACCOMPLISHED WITH THE DPS AND THE ASCENT STAGE IS NOT REQUIRED FOR CSM PROBLEMS, THE APS UNMANNED BURN TO DEPLETION WILL BE PERFORMED DURING THE TEC PHASE.</p>
	2-17	<u>TRANSEARTH COAST</u>			<p>A. THE STEEP TARGET LINE WILL BE USED FOR MCC'S UNLESS THE VELOCITY AT ENTRY INTERFACE IS LESS THAN 30,000 FPS AND THE G&N IS GO; THEN THE SHALLOW TARGET LINE WILL BE USED.</p> <p>B. MCC'S MAY BE USED FOR LANDING AREA CONTROL PRIOR TO ENTRY INTERFACE MINUS 24 HOURS FOR RECOVERY ACCESS VIOLATIONS, UNACCEPTABLE WEATHER, OR LAND MASSES IN ANY PART OF THE OPERATIONAL FOOTPRINT.</p> <p>C. IF THE FLIGHT PATH ANGLE IS OUTSIDE THE ENTRY CORRIDOR, AN MCC WILL BE EXECUTED AS SOON AS PRACTICAL.</p> <p>D. MCC'S WILL BE ACCOMPLISHED BY THE SPS IF NECESSARY TO MAINTAIN RCS REDLINES.</p>
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	FLIGHT OPERATIONS RULES	GENERAL	2-5

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MISSION RULES

REV	ITEM				
A	2-18	<u>ALTERNATE MISSIONS</u>	<p>A. ALTERNATE MISSION GUIDELINES</p> <ol style="list-style-type: none"> 1. THE LM RENDEZVOUS WILL HAVE FIRST PRIORITY IN ALTERNATE MISSIONS, AND TLI WILL BE INHIBITED IF A FAILURE SHOULD OCCUR WHICH WOULD INHIBIT LOI. LM SYSTEMS EVALUATION WILL HAVE SECOND PRIORITY. 2. THE LM WILL BE UNDOCKED IN LUNAR OR LOW EARTH ORBIT ($H_a < 400$ NM) ONLY. 3. WHENEVER POSSIBLE, THE SPS WILL BE USED TO RETURN TO LOW EARTH ORBIT ($H_a < 400$ NM) FROM DISPERSED TLI CUTOFFS. WHEN THIS IS NOT POSSIBLE, THE CSM/LM WILL BE PLACED IN A SEMI-SYNCHRONOUS ORBIT AND DOCKED LM SYSTEMS EVALUATIONS CONDUCTED. 4. SHOULD SPS PROBLEMS OCCUR IN ANY MISSION PHASE, CONSIDERATION WILL BE GIVEN TO USING THE DPS ENGINE. 5. SHOULD CSM FAILURES OCCUR IN ANY MISSION PHASE, CONSIDERATION WILL BE GIVEN TO USING THE LM SYSTEMS. 6. THE DPS WILL BE USED TO EXECUTE TEI WHENEVER AVAILABLE. <p>B. ALTERNATE MISSION DESCRIPTIONS</p> <p>THE FOLLOWING CLASSES OF ALTERNATE MISSIONS ARE AVAILABLE, AND ARE NOT LISTED IN ORDER OF PRIORITY. SEE REFERENCE 2-18A FOR ALTERNATE MISSION GUIDELINES.</p> <p>(RULE 2-18 CONTINUED ON FOLLOWING PAGE.)</p>		
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	FLIGHT OPERATIONS RULES	ALTERNATE MISSIONS	2-6

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MISSION RULES

REV	ITEM				
A	2-18 (CONT'D)	ALTERNATE MISSIONS		<p>B.1. EARTH ORBIT MISSIONS</p> <p><u>CONTINGENCY/FAILURE</u></p> <p>(A) NO LM EXTRACTION AFTER PARTIAL TLI ($H_a < 25,000$ NM) OR SPS COI</p> <p>(B) NO LM EXTRACTION AFTER PARTIAL TLI ($H_a > 25,000$ NM)</p> <p>(C) LM EXTRACTION AFTER NO TLI OR PARTIAL TLI ($H_a < 4000$ NM)</p> <p>(D) LM EXTRACTION AFTER PARTIAL TLI ($4000 < H_a < 10,000$ NM)</p> <p>(E) LM EXTRACTION AFTER PARTIAL TLI ($10,000 < H_a < 50,000$ NM)</p> <p style="text-align: center;"><u>NOTE</u></p> <p>THE LM ACTIVE RENDEZVOUS FOR THESE ALTERNATES WILL BE:</p> <ol style="list-style-type: none"> SEP - CSM ACTIVE - $\Delta V = 5$ FPS PHASING - LM ACTIVE - $\Delta V = 178$ FPS CSI - $\Delta V = 0$ FPS CDH - $\Delta V = 103$ FPS ($\Delta h = 11$ NM) TPI - $\Delta V = 24$ FPS TPF - $\Delta V = 32$ FPS <p>(RULE 2-18 CONTINUED ON FOLLOWING PAGE)</p>	<p><u>ACTION/MISSION</u></p> <ol style="list-style-type: none"> SPS PHASING BURN SPS "LOI" TO ACHIEVE 400 X 100 NM ORBIT SPS "MCC" TO ACHIEVE 240 X 100 NM ORBIT 10 DAY MISSION <ol style="list-style-type: none"> SPS PHASING BURN SPS "LOI" TO ACHIEVE SEMI-SYNCHRONOUS ORBIT (PARTIALLY OUT OF PLANE) SPS PHASING TO ACHIEVE LONGITUDE_p = 165 W <ol style="list-style-type: none"> SPS FOR APOGEE RAISE (IF NECESSARY) SPS "LOI" TO ACHIEVE APOGEE = 400 NM (PARTIALLY OUT OF PLANE) DPS "DOI" (DOCKED) DPS POWERED DESCENT (DOCKED) SPS CIRCULARIZATION AT 140 NM LM ACTIVE RENDEZVOUS APS BTD - AGS (UNMANNED) SPS TO ACHIEVE 240 X 90 NM ORBIT 10 DAY MISSION <ol style="list-style-type: none"> SPS PHASING DPS "DOI" (DOCKED) DPS "PD" (DOCKED) TO ACHIEVE APOGEE = 4000 NM (PARTIALLY OUT OF PLANE) SPS PHASING SPS "LOI" TO ACHIEVE APOGEE = 400 NM SPS CIRCULARIZATION AT 150 NM LM ACTIVE RENDEZVOUS APS BTD - AGS (UNMANNED) SPS TO 240 X 90 ORBIT 10 DAY MISSION <ol style="list-style-type: none"> SPS PHASING SPS "LOI" TO SEMI-SYNC (PARTIALLY OUT OF PLANE) SPS PHASING DPS "DOI" (DOCKED) DPS "PD" (DOCKED) SPS PHASING SPS BURN TO ACHIEVE LONGITUDE_p = 165 W 10 DAY MISSION
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	FLIGHT OPERATIONS RULES	ALTERNATE MISSIONS	2-7

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MISSION RULES

REV	ITEM				
A	2-18 (CONT'D)	<u>ALTERNATE MISSIONS</u>		<p>B.2. LUNAR MISSIONS</p> <p><u>CONTINGENCY/FAILURE</u></p> <p>(A)(1) LM EXTRACTION AFTER NON-NOMINAL TLI WHERE EOMFR AFTER BAP MCC, LOI₁, LOI₂, AND TEI <500 FPS (NOTE: SPS DOCKED ΔV = 2400 IS MANDATORY)</p> <p>(2) LM EXTRACTION AFTER NON-NOMINAL TLI WHERE (1) IS NOT PERFORMED</p> <p>(3) LM EXTRACTION AFTER NON-NOMINAL TLI WHERE (1) AND (2) ARE NOT PERFORMED</p> <p>(B) NO LM EXTRACTION AFTER NOMINAL TLI OR AFTER NON-NOMINAL TLI WHERE EOMFR AFTER SPS BAP MCC, LOI₁, LOI₂, AND TEI >500 FPS (NOTE: FAILURE OF THIS TEST DICTATES LUNAR FLYBY MCC WITH POSSIBLE SPS FOR FASTER RETURN POST-PERICYTHON)</p> <p>(C)(1) ANY SITUATION WHICH WARRANTS A DPS TEI (REFERENCE MISSION RULES)</p> <p>(2) LM NO-GO FOR RENDEZVOUS AND TEI</p> <p>(D) ANY SITUATION WHICH WARRANTS THE RETENTION OF THE ASCENT STAGE ON TEC</p> <p>3. RENDEZVOUS ALTERNATES</p> <p><u>CONTINGENCY/FAILURE</u></p> <p>(A) ANY SITUATION WHICH DICTATES NO LM STAGING (REFERENCE MISSION RULES)</p> <p>(B) APS ONLY PROFILE (DPS NOT AVAILABLE FOR DOI)</p>	<p><u>ACTION/MISSION</u></p> <p>1. DPS LOI (DOCKED) WHERE APOCYNTHION = 2000 NM</p> <p>2. SPS LOI₂</p> <p>3. NOMINAL MISSION</p> <p>1. LM CHECKOUT</p> <p>2. APS BTD (UNMANNED)</p> <p>3. CSM-ONLY LUNAR ORBIT MISSION (SEE ALT B.2.(B)1)</p> <p>1. LM CHECKOUT</p> <p>2. DPS FLYBY MCC</p> <p>3. APS BTD (UNMANNED)</p> <p>4. SPS FOR FASTER RETURN (IF DESIRED)</p> <p>1. CSM-ONLY LUNAR MISSION WITH SPS DOI AND SUBSEQUENT CIRCULARIZATION</p> <p>1. DPS TEI</p> <p>2. APS BTD (UNMANNED) (IF POSSIBLE)</p> <p>3. SPS FOR FASTER RETURN (IF DESIRED)</p> <p>1. EXTENDED LM CHECKOUT</p> <p>2. APS BTD (UNMANNED)</p> <p>1. SPS TEI WITH THE ASCENT STAGE RETAINED</p> <p><u>ACTION/MISSION</u></p> <p>1. NOMINAL RENDEZVOUS WITHOUT STAGING (NOTE: DPS MAY BE STAGED 7 MINUTES PRIOR TO TPI IN SOME INSTANCES)</p> <p>1. APS DOI</p> <p>2. PDI ABORT PROFILE</p>
		<p>RULE NUMBERS 2-19 THROUGH 2-30 ARE RESERVED.</p>			
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**3 MISSION RULE
SUMMARY**

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MISSION RULES

REV	ITEM	LAUNCH PHASE			
A	3-1	<p>THE LAUNCH WILL BE ABORTED FOR THE FOLLOWING REASONS:</p> <p><u>CONDITION</u> <u>RULES</u></p> <p>A. SLV</p> <p>S-II GIMBAL ACTUATOR HARDOVER INBOARD (TIME DEPENDENT) VIOLATION OF AUTO/MANUAL EDS LIMITS S-II ENGINE FAILURES (TIME DEPENDENT) FAILURE OF SECOND PLANE SEPARATION S-IVB LOSS OF HYDRAULIC FLUID (PRIOR TO S-IVB IGNITION), POSSIBLE COI CONDITION S-IVB LOSS OF THRUST (TIME DEPENDENT), POSSIBLE COI CONDITION S-IVB LOX TANK PRESSURE >50 PSI (THROUGH TWR JETT)</p> <p>B. CSM</p> <p>1. ENVIRONMENTAL</p> <p>LOSS OF CABIN PRESSURE AND SUIT PRESSURE LOSS OF CABIN PRESSURE AND SUIT CIRCULATION FIRE/SMOKE IN CM LOSS OF CABIN PRESSURE AND O₂ MANIFOLD LEAK</p> <p>2. ELECTRICAL</p> <p>LOSS OF 3 FUEL CELLS AND 1 BATTERY UNCONTROLLABLE SHORTED MAIN BUS LOSS OF BOTH AC BUSES DURING MODE 1 OR MODE II</p> <p>3. PROPULSION</p> <p>SUSTAINED LEAK OR LOSS OF He PRESSURE 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>			
	3-2	<p>THE S-IVB EARLY STAGING WILL BE USED AFTER "S-IVB TO-ORBIT" CAPABILITY FOR THE FOLLOWING REASONS:</p> <p><u>CONDITIONS</u> <u>RULES</u></p> <p>S-II GIMBAL ACTUATOR INBOARD HARDOVER S-II ENGINE FAILURES (TIME DEPENDENT) S-IVB LOX TANK PRESS >50 PSI (UPSTAGE AFTER TWR JETT)</p>			
A	3-3	<p>SWITCHOVER TO CSM GUIDANCE WILL BE PERFORMED FOR:</p> <p>SATURN GUIDANCE REFERENCE FAILURE</p> <p>RULE NUMBERS 3-4 THROUGH 3-9 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	MISSION RULE SUMMARY	LAUNCH PHASE	3-1

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MISSION RULES

REV	ITEM	EARTH ORBIT			
A	3-10	<p>THE CSM WILL BE NO-GO FOR CONTINUING THE MISSION IF ANY OF THE FOLLOWING CONDITIONS EXIST:</p> <p>A. ECS <u>RULES</u></p> <p>LOSS OF CABIN INTEGRITY LOSS OF SUIT CIRCUIT LOSS OF O₂ MANIFOLD LOSS OF SURGE TANK AND REPRESS PACK LOSS OF CYCLIC ACCUMULATOR OPERATION POTABLE WATER TANK QUANTITY PLUS FUEL CELL PRODUCTION TO THE NEXT PTP WILL TOTAL 20 LB LOSS OF URINE DUMP CAPABILITY FOR PTP'S SUBSEQUENT TO LM JETTISON LOSS OF PRIMARY COOLING CONFIRMED LEAK OF GLYCOL IN EITHER COMMAND MODULE OR SUIT CIRCUIT</p> <p>B. CRYO</p> <p>INSUFFICIENT O₂ AND H₂ TO SUPPLY FUEL CELL AND ECS DEMANDS TO THE NEXT GO/NO-GO PTP PLUS THREE HOURS (DRIFTING FLIGHT PLUS GUIDED ENTRY MANEUVER)</p> <p>C. EPS</p> <p>LOSS OF TWO FUEL CELLS LOSS OF TWO ENTRY BATTERIES LOSS OF ONE MAIN BUS, ONE AC BUS, OR THE BATTERY RELAY BUS LOSS OF TWO INVERTERS LOSS OF BATT CHARGER AND TOTAL BATT AMP-HRS ≤ 73 (REF. RULE 12-42)</p> <p>D. COMM/INSTRUMENTATION</p> <p>LOSS OF INSTRUMENTATION (TM OR ONBOARD) SUCH THAT IT IS NOT POSSIBLE TO VERIFY GO/NO-GO CRITERIA EITHER IN S/C OR ON GROUND LOSS OF TWO-WAY VOICE COMMUNICATION AFTER LM JETTISON (CSM/MSFN)</p> <p>E. SEQUENTIAL</p> <p>LOSS OF ONE SEQUENTIAL SYSTEM</p> <p>F. G&C</p> <p>LOSS OF DIRECT RCS (ANY AXIS) LOSS OF RATE DAMPING (ANY AXIS) LOSS OF TWO DEORBIT METHODS</p> <p>G. SPS</p> <p>LOSS OF CAPABILITY TO PERFORM CRITICAL MANEUVERS ΔV REMAINING LESS THAN SPS DEORBIT REQUIREMENTS</p> <p>H. SM-RCS</p> <p>LOSS OF TWO QUADS LOSS OF ATTITUDE CONTROL IN ONE OR MORE AXES PROPELLANT REMAINING LESS THAN HYBRID DEORBIT REQUIREMENT, IF HYBRID AND SPS DEORBIT AVAILABLE. OTHERWISE PROPELLANT REMAINING LESS THAN SM DEORBIT REQUIREMENT.</p> <p>I. CM-RCS</p> <p>LOSS OF SOURCE PRESSURE - ONE RING LOSS OF MANIFOLD PRESSURE - ONE RING CM-RCS ARMED</p> <p>J. UNSATISFACTORY CREW CONDITION</p> <p>K. TWO SATISFACTORY METHODS OF DEORBIT ARE NOT AVAILABLE (SPS AND ONE ALTERNATE)</p> <p>L. A SUBSEQUENT SINGLE FAILURE WOULD REQUIRE ENTRY IN ONE REV OR LESS</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	MISSION RULE SUMMARY	EARTH ORBIT	3-2

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MISSION RULES

REV	ITEM				
	3-11	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):			
		<u>NOTE</u> THOSE CONDITIONS MARKED BY AN ASTERISK REQUIRE AN SPS SEPARATION MANEUVER.			
		<u>CONDITION</u>			<u>RULES</u>
		TIME BASE 5 FAILS TO INITIATE AT CUTOFF *S-IVB RANGE SAFETY PROPELLANT DISPERSAL SYSTEM ARMS INADVERTENTLY AFTER INSERTION AND PRIOR TO SAFING *S-IVB LOX TANK PRESS >50 PSI LOSS OF ATTITUDE CONTROL DURING TB5 *S-IVB COMMON BULKHEAD DELTA PRESSURE EXCEEDS LIMITS *START BOTTLE ABOVE 1800 PSIA			
	3-12	CSM SEPARATION FROM THE S-IVB (WITH LM EXTRACTION) WILL BE PERFORMED EARLY FOR:			
		<u>CONDITION</u>			<u>RULES</u>
		A. S-IVB NO-GO FOR TLI B. CSM NO-GO FOR TLI BUT GO FOR EARTH ORBIT MISSION			
A	3-13	TLI WILL BE INHIBITED FOR:			
		<u>CONDITION</u>			<u>RULES</u>
		A. SLV INSUFFICIENT PROPELLANT FOR TLI GUIDANCE CUTOFF S-IVB ENGINE MAIN LOX VALVE FAILS TO CLOSE AT CUTOFF LOSS OF ATTITUDE CONTROL CONTINUOUS VENT SYSTEM REGULATOR FAILS LOSS OF ENGINE CONTROL BOTTLE PRESSURE CONFIRMED ACTUATOR HARDOVER LOSS OF ENGINE HYDRAULIC FLUID COLD He SPHERE PRESS LOW LH ₂ ULLAGE PRESS LOW LOX ULLAGE PRESS LOW MISALIGNMENT RATE BETWEEN THE IU AND IMU IS OUTSIDE LIMITS UNACCEPTABLE DIFFERENCES BETWEEN CMC AND IU PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION UNACCEPTABLE DIFFERENCE BETWEEN MSFN AND IU ORBITAL DECISION PARAMETERS IU PLATFORM ACCELEROMETER FAILURE B. CSM 1. ECS LOSS OF CABIN INTEGRITY LOSS OF SUIT CIRCULATION FIRE OR SMOKE IN THE CABIN O ₂ MANIFOLD LEAK LOSS OF ONE MAIN O ₂ REGULATOR LOSS OF ONE SUIT COMPRESSOR LOSS OF PRIMARY RADIATOR LOSS OF PRIMARY COOLANT LOOP			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	MISSION RULE SUMMARY	EARTH ORBIT	3-3

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MISSION RULES

REV	ITEM				
A	3-13 (CONT'D)	<p>LOSS OF SECONDARY RADIATOR</p> <p>LOSS OF SECONDARY LOOP</p> <p>LEAK OF GLYCOL COOLANT</p> <p>FAILURE OF BOTH H₂O ACCUMULATORS</p> <p>LOSS OF POTABLE OR WASTE H₂O TANK</p> <p>LOSS OF BOTH H₂O EVAPORATORS (BECAUSE NO-GO FOR LUNAR RNDZ)</p> <p>LOSS OF ALL OVERBOARD DUMP CAPABILITY</p> <p>2. CRYO</p> <p>LOSS OF ANY CRYO TANK</p> <p>3. EPS</p> <p>LOSS OF ONE FUEL CELL</p> <p>LOSS OF ONE ENTRY BATTERY</p> <p>LOSS OF ONE BATTERY, MAIN OR BATTERY RELAY BUS</p> <p>LOSS OF TWO INVERTERS</p> <p>LOSS OF ONE A/C BUS</p> <p>LOSS OF AC1 PHASE A</p> <p>LOSS OF AC2 PHASE A</p> <p>4. COMM/INSTRUMENTATION</p> <p>LOSS OF BOTH POWER AMPLIFIERS</p> <p>LOSS OF THE SCE</p> <p>LOSS OF TWO AUDIO CENTERS</p> <p>LOSS OF CRITICAL INSTRUMENTATION (REQUIRED FOR GO/NO-GO DECISION)</p> <p>5. SEQUENTIAL</p> <p>SMJC ACTIVATED</p> <p>LOSS OF ONE SEQUENTIAL SYSTEM</p> <p>6. G&C</p> <p>LOSS OF BOTH BMAGS IN PITCH, YAW, OR ROLL</p> <p>LOSS OF BOTH FDAI'S</p> <p>GROUND AT EITHER SPS SOL DRIVER OUTPUT</p> <p>LOSS OF CMC</p> <p>LOSS OF NAV DSKY (CMC WARNING RELAY)</p> <p>LOSS OF BOTH DSKY'S</p> <p>LOSS OF ISS</p> <p>LOSS OF OPTICS SUBSYSTEM</p> <p>LOSS OF OPTICS CDU DAC</p> <p>LOSS OF EITHER TVC SERVO LOOP</p> <p>7. SPS</p> <p>SUSTAINED PRESSURE DECAY IN SPS FUEL OR OX TANK</p> <p>LOSS OF BOTH GN₂ TANK PRESSURES</p> <p>FUEL FEEDLINE AND/OR OXID FEEDLINE TEMP 40°F AND UNABLE TO INCREASE</p> <p>FUEL/OXIDIZER ΔP GREATER THAN 20 PSI</p> <p>LOSS OF He SOURCE PRESSURE</p> <p>8. SM RCS</p> <p>HELIUM TANK LEAK IN ONE QUAD</p> <p>LEAK DOWNSTREAM OF He ISOLATION VALVE</p> <p>PACKAGE TEMP <70°F AND UNABLE TO INCREASE</p> <p>LOSS OF FOLLOWING THRUSTER COMBINATIONS:</p> <p>2P OR 2Y</p> <p>1P AND 1Y</p> <p>1P OR 1Y AND 2 ROLL IN SAME DIRECTION</p> <p>3 ROLL IN SAME DIRECTION</p> <p>9. CM RCS</p> <p>LOSS OF HELIUM SOURCE PRESS - ONE RING</p> <p>CM-RCS ARMED</p> <p>LOSS OF He MANIFOLD PRESS ONE RING</p>		<u>RULES</u>	
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	MISSION RULE SUMMARY	EARTH ORBIT	3-4

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MISSION RULES

REV	ITEM				
	3-13 (CONT'D)	10. INTERFACE CONDITIONS LOSS OF TWO-WAY S-BAND VOICE LOSS OF ALL TM			
	3-14	TLI WILL BE TERMINATED FOR:		<u>RULES</u>	
		A. PITCH OR YAW BODY RATES GREATER THAN 10°/SEC			
		B. PITCH OR YAW ATTITUDE DEVIATIONS FROM NOMINAL PROFILES EXCEED 45°			
		C. ROLL BODY RATE GREATER THAN 20°/SEC			
A	3-15	SWITCHOVER TO CSM GUIDANCE DURING THE TLI BURN WILL BE PERFORMED FOR: SATURN GUIDANCE REFERENCE FAILURE			
A		RULE NUMBERS 3-16 THROUGH 3-20 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	MISSION RULE SUMMARY	EARTH ORBIT	3-5

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MISSION RULES

REV	ITEM	TD & E			
A	3-21	<p>TD&E WILL BE PERFORMED IF NO IMMEDIATE ABORT RETURNS (CSM CONDITIONS) EXIST. TD&E WILL NOT BE PERFORMED FOR:</p> <p>A. PILOT'S EVALUATION OF RATES AND ATTITUDES, AND SLA CONFIGURATION NOT ACCEPTABLE.</p> <p>B. LESS THAN THREE GOOD DOCKING RING LATCHES LESS THAN 120° APART.</p> <p>C. THE SLV WILL BE NO-GO FOR:</p> <ol style="list-style-type: none"> 1. VIOLATION OF S-IVB BULKHEAD ΔP LIMITS 2. LOX TANK OVERPRESSURE >50 PSI 3. TB7 FAILS TO INITIATE <p>D. THE CSM WILL BE NO-GO FOR:</p> <ol style="list-style-type: none"> 1. <u>LOSS OF SUIT INTEGRITY</u> 2. LOSS OF TRANSLATION HAND CONTROLLER 			<u>RULES</u>
		<p>RULE NUMBERS 3-22 THROUGH 3-27 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	MISSION RULE SUMMARY	TD&E	3-6

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MISSION RULES

REV	ITEM	TRANSLUNAR COAST			
	3-28	<p>TRANSLUNAR COAST WILL BE TERMINATED AND ENTRY INTO THE NEXT BEST PTP ACCOMPLISHED FOR THE LISTED CSM FAILURES. THE NEXT BEST PTP COULD INCLUDE A CIRCULUNAR FLIGHT DEPENDENT ON INFLIGHT ANALYSIS AND EVALUATION OF THE FOLLOWING TRADEOFFS:</p> <p>A. FLIGHT TIME REMAINING</p> <p>B. ABORT MANEUVER REQUIRED</p> <p>C. SYSTEMS REDUNDANCY REMAINING</p> <p>(NOTE: FOR CSM PROBLEMS, CONSIDERATION WILL BE GIVEN TO EARLY TRANSFER TO THE LM TO ALLEVIATE THE CONDITION.)</p> <p><u>CSM CONDITION</u> <u>RULES</u></p> <p>A. ECS</p> <p>LOSS OF CABIN INTEGRITY FIRE OR SMOKE IN THE CABIN O₂ MANIFOLD LEAK LOSS OF ONE MAIN O₂ REGULATOR LOSS OF PRIMARY RADIATOR LOSS OF PRIMARY COOLANT LOOP LOSS OF SECONDARY RADIATOR LOSS OF SECONDARY LOOP LEAK OF GLYCOL COOLANT EXCESSIVE CABIN HUMIDITY LOSS OF POTABLE OR WASTE H₂O TANK LOSS OF SUIT CIRCULATION LOSS OF ALL OVERBOARD DUMP CAPABILITY</p> <p>B. CRYO</p> <p>LOSS OF ANY CRYO TANK</p> <p>C. EPS</p> <p>LOSS OF TWO FUEL CELLS LOSS OF ONE BATTERY, MAIN, OR BATTERY RELAY BUS LOSS OF TWO INVERTERS LOSS OF ONE A/C BUS LOSS OF TWO ENTRY BATTERIES</p> <p>D. COMM/INSTRUMENTATION</p> <p>LOSS OF SCE</p> <p>E. SEQUENTIAL</p> <p>LOSS OF ONE SEQUENTIAL SYSTEM SMJC ACTIVATED PREMATURELY</p> <p>F. G&C</p> <p>LOSS OF DIRECT RCS CONTROL, BOTH RHC'S (CHECK ONCE POST TLI) LOSS OF AUTO ATTITUDE CONTROL PITCH AND YAW</p> <p>G. SPS</p> <p>NONE</p> <p>H. SM-RCS</p> <p>LOSS OF ONE QUAD LEAK DOWNSTREAM OF HELIUM ISOLATION VALVE</p> <p>I. CM-RCS</p> <p>LOSS OF HELIUM SOURCE PRESSURE - ONE RING CM-RCS ARMED LOSS OF HELIUM MANIFOLD PRESSURE - ONE RING</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	MISSION RULE SUMMARY	TRANSLUNAR COAST	3-7

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MISSION RULES

REV	ITEM				
A	3-28 (CONT'D)	<p>J. INTERFACE CONDITION</p> <p>LOSS OF ALL TWO-WAY VOICE CSM OR LM/MSFN (CREW NOT UPDATED WITH FLYBY PAD)</p>			
A	3-29	<p>LOI WILL BE INHIBITED AND A CIRCULUNAR FLIGHT ACCOMPLISHED FOR ANY CONSUMABLE PROBLEM PREVENTING MINIMUM LUNAR ORBIT OPERATIONS OR ANY CONDITION REQUIRING TERMINATION OF TLC. THE FOLLOWING CSM CONDITIONS WILL ALSO CAUSE LOI TO BE INHIBITED:</p> <p>A. <u>CSM CONDITION</u> <u>RULES</u></p> <p>1. ECS</p> <p>LOSS OF PRIMARY AND SECONDARY EVAPORATORS</p> <p>2. EPS</p> <p>LOSS OF ONE ENTRY BATTERY (BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING WITH LOI)</p> <p>LOSS OF ONE FUEL CELL (BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING WITH LOI)</p> <p>LOSS OF AC 1 PHASE A</p> <p>LOSS OF AC 2 PHASE A</p> <p>LOSS OF BATT CHARGER (IF SUM OF TWO LOWEST ENTRY BATT \leq 56 AMP HRS)</p> <p>3. COMM/INSTRUMENTATION</p> <p>LOSS OF CRITICAL INSTRUMENTATION (REQUIRED FOR GO/NO-GO DECISION)</p> <p>4. G&C</p> <p>LOSS OF BOTH BMAGS IN ROLL</p> <p>LOSS OF BOTH BMAGS IN PITCH OR YAW AXIS</p> <p>LOSS OF BOTH FDAI'S</p> <p>LOSS OF CMC</p> <p>LOSS OF NAV DSKY (CMC WARNING RELAY)</p> <p>LOSS OF ISS</p> <p>LOSS OF OPTICS SUBSYSTEM</p> <p>LOSS OF OPTICS CDU D/A (CHECK PRE-SPS BURN)</p> <p>GROUND AT EITHER SPS SOL DRIVER OUTPUT AND UNABLE TO REMOVE</p> <p>LOSS OF EITHER TVC SERVO LOOP DURING A PREVIOUS BURN</p> <p>5. SPS</p> <p>SUSTAINED PRESSURE DECAY IN SPS FUEL OR OX TANK</p> <p>LOSS OF ONE BANK OF BALL VALVES</p> <p>FUEL FEEDLINE TEMP 40°F AND UNABLE TO INCREASE</p> <p>ENGINE FLANGE OVERTEMP DURING A PREVIOUS BURN</p> <p>THRUST CHAMBER PRESSURE BELOW 70 PSI DURING A PREVIOUS BURN</p> <p>FUEL/OXIDIZER ΔP GREATER THAN 20 PSI</p> <p>LOSS OF HELIUM SOURCE PRESSURE (SPS)</p> <p>LOSS OF BOTH GN₂ TANKS</p> <p>6. SM-RCS</p> <p>LOSS OF ULLAGE CAPABILITY</p> <p>LOSS OF FOLLOWING THRUSTER COMBINATIONS:</p> <p>2P OR 2Y</p> <p>1P AND 1Y</p> <p>1P OR 1Y AND 2 ROLL IN SAME DIRECTION</p> <p>3 ROLL IN SAME DIRECTION</p> <p>7. CM-RCS</p> <p>LOSS OF HELIUM SOURCE PRESSURE - ONE RING</p> <p>CM-RCS ARMED</p> <p>LOSS OF HELIUM MANIFOLD PRESSURE - ONE RING</p>			
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MISSION RULES

REV	ITEM				
	3-29 (CONT'D)	<p>B. INTERFACE CONDITION:</p> <ol style="list-style-type: none"> 1. DOCKING LOSS OF 4 DOCKING LATCHES 2. COMMUNICATIONS LOSS OF ALL TM LOSS OF ALL TWO-WAY VOICE CSM/MSFN 			
A	3-30	<p>DURING THE LOI BURN, THE FLIGHT CREW WILL TAKE THE FOLLOWING ACTION:</p> <p>A. TERMINATE LOI FOR THE FOLLOWING SPS PROBLEMS (PERFORM THE 15 MINUTE ABORT IF THE BURN IS TERMINATED IN THE MODE I OR MODE II REGION):</p> <p style="padding-left: 40px;">**SEE MALFUNCTION PROCEDURE #1</p> <ol style="list-style-type: none"> 1. LOSS ONE GN₂ BOTTLE (<400 PSI) AND DECAY IN OTHER (TERMINATE ONLY WHILE IN THE MODE I OR MODE II REGION) 2. PRESSURE DECAY IN EITHER SPS PROPELLANT TANK TO 140 PSI (AFTER MANUAL REPRESS ATTEMPT) **3. FUEL - OXIDIZER ΔP>20 PSI **4. CHAMBER PRESSURE <80 PSI OR DECAY OF 10 PSI DURING BURN 5. ANY BALL VALVE(S) FAILS TO OPEN AFTER ITS RESPECTIVE BANK IS COMMANDED ON OR FAILS CLOSED (TERMINATE ONLY WHILE IN THE MODE I OR MODE II REGION) 6. FLANGE TEMPERATURE LIGHT <p>B. PERFORM MTVC TAKEOVER AND COMPLETE THE BURN FOR THE FOLLOWING CONTROL PROBLEMS:</p> <ol style="list-style-type: none"> 1. G&N NO-GO 2. ATTITUDE EXCURSION >10° 3. RATES >10°/SEC <p>C. RESTART THE BURN AND COMPLETE UNDER SCS CONTROL FOR AN SPS SHUTDOWN.</p>			
		<p>RULE NUMBERS 3-31 THROUGH 3-36 ARE RESERVED.</p>			
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REV	ITEM	LUNAR ORBIT			
	3-37	<p>DEPENDING ON THE ANALYSIS OF A NON-NOMINAL LOI BURN, THE FOLLOWING COURSES OF ACTION ARE AVAILABLE:</p> <p>A. UNLESS A STABLE ORBIT HAS BEEN ACHIEVED, DIRECT (SPS OR DPS) ABORTS OR DPS TWO IMPULSE CIRCUMLUNAR ABORTS WILL BE EXECUTED.</p> <p>B. IF STABLE ORBIT HAS BEEN ACHIEVED, TEI (DPS OR SPS) WILL BE EXECUTED AT NEXT PERICYNTHION OR AN ALTERNATE MISSION WILL BE INITIATED.</p>			
A	3-38	<p>TEI WILL BE PERFORMED AT THE NEXT BEST OPPORTUNITY FOR THE FOLLOWING CSM CONDITIONS:</p> <p style="text-align: center;"><u>NOTE 1</u></p> <p>FOR CSM PROBLEMS, CONSIDERATION WILL BE GIVEN TO RETAINING THE LM FOR THE TRANSEARTH PHASE TO ALLEVIATE THE CONDITION AND/OR PROVIDE A BACKUP CAPABILITY.</p> <p style="text-align: center;"><u>NOTE 2</u></p> <p>FOR THOSE CONDITIONS MARKED BY AN ASTERISK, EARLY TEI WILL BE EXECUTED ONLY AFTER MISSION CRITICAL LUNAR ORBIT OPERATIONS HAVE BEEN COMPLETED (I.E., LM CHECKOUT, RNDZ, LANDMARK TRACKING).</p> <p><u>CONDITION</u> <u>RULES</u></p> <p>A. ECS</p> <p>O₂ MANIFOLD LEAK LOSS OF PRIMARY RADIATOR LOSS OF PRIMARY COOLANT LOOP CONFIRMED LEAK OF GLYCOL COOLANT LOSS OF POTABLE OR WASTE H₂O TANK EXCESSIVE CABIN HUMIDITY LOSS OF CABIN INTEGRITY LOSS OF SUIT CIRCULATION LOSS OF BOTH EVAPORATORS LOSS OF SECONDARY LOOP LOSS OF BOTH MAIN REGULATORS *LOSS OF SECONDARY RADIATOR *LOSS OF ALL OVERBOARD DUMP CAPABILITY *LOSS OF ONE SUIT COMPRESSOR *LOSS OF ONE MAIN REGULATOR</p> <p>B. CRYO</p> <p>LOSS OF ANY CRYO TANK</p> <p>C. EPS</p> <p>*LOSS OF BATT CHARGER AND SUM OF TWO LOWEST ENTRY BATT =52 AMP-HR LOSS OF TWO INVERTERS LOSS OF AC 1, PHASE A LOSS OF AC 2, PHASE A LOSS OF ONE MAIN OR BATTERY BUS LOSS OF BATTERY RELAY BUS LOSS OF 1 AC BUS *LOSS OF ONE BATTERY (BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING WITH THE NOMINAL MISSION) *LOSS OF ONE FUEL CELL (BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING WITH THE NOMINAL MISSION)</p> <p>D. COMM/INSTRUMENTATION</p> <p>*LOSS OF SCE LOSS OF CRITICAL INSTRUMENTATION (REQUIRED FOR GO/NO-GO DECISION)</p>			
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MISSION RULES

REV	ITEM				
A	3-38 (CONT'D)	<p>E. SEQUENTIAL</p> <p>*LOSS OF ONE SEQUENTIAL SYSTEM *SMJC ACTIVATED PREMATURELY</p> <p>F. G&C</p> <p>LOSS OF BOTH BMAGS IN PITCH OR YAW *LOSS OF BOTH ROLL BMAGS LOSS OF EITHER TVC LOOP IN EITHER PITCH OR YAW (CHECKED PRE-SPS BURNS) LOSS OF DIRECT RCS CONTROL BOTH RHC COMPLETE LOSS OF AUTO ATTITUDE CONTROL IN PITCH AND YAW LOSS OF BOTH FDAI'S GROUND AT EITHER SPS SOL DRIVER OUTPUT AND ENABLE TO REMOVE</p> <p>*LOSS OF CMC *LOSS OF NAV DSKY (CMC WARNING RELAY) *LOSS OF INERTIAL SUBSYSTEM *LOSS OF OPTICS CDU D/A (CHECKED PRE-SPS BURNS)</p> <p>G. SPS</p> <p>SUSTAINED PRESSURE DECAY IN SPS FUEL OR OX TANK LOSS OF ONE BANK OF BALL VALVES LEAK OR LOSS OF SPS He SUPPLY PRESSURE (DEPENDENT ON ULLAGE BLOWDOWN CAPABILITY) FUEL FEEDLINE AND/OR OXIDIZER FEEDLINE TEMP 40°F AND UNABLE TO INCREASE FUEL-OXIDIZER ΔP >20 PSI CHAMBER PRESSURE <70 PSI FLANGE TEMPERATURE LIGHT LOSS OF BOTH GN₂ TANK PRESS UNABLE TO IGNITE THE SPS LOSS OF ULLAGE CAPABILITY</p> <p>H. SM-RCS</p> <p>LOSS OF ONE SM-RCS QUAD SM-RCS PACKAGE TEMP LOW AND UNABLE TO INCREASE LOSS OF FOLLOWING THRUSTER COMBINATIONS:</p> <p>2P OR 2Y 1P AND 1Y 1P OR 1Y AND 2 ROLL IN SAME DIRECTION 3 ROLL IN SAME DIRECTION</p> <p>I. CM-RCS</p> <p>*LEAK IN OR LOSS OF SOURCE PRESS IN ONE CM-RCS RING *ARMING OF CM-RCS *LOSS OF He MANIFOLD PRESS ONE RING</p> <p>J. INTERFACE CONDITIONS</p> <p>1. COMMUNICATIONS</p> <p>LOSS OF TWO-WAY VOICE CSM/MSFN LOSS OF ALL TM</p>			
A	3-39	<p>IVT (CSM TO LM) WILL BE INHIBITED FOR ANY OF THE FOLLOWING:</p> <p>A. DOCKING SYSTEM</p> <p>LESS THAN <u>THREE</u> GOOD DOCKING RING LATCHES LESS THAN <u>120°</u> APART</p>			
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REV	ITEM				
	3-40	THE LM WILL BE JETTISONED EARLY FOR:			
		A. APS PROPELLANT LEAKS			
		B. RCS PROPELLANT LEAKS			
	3-41	THE ASCENT STAGE WILL BE RETAINED FOR TEC FOR THE FOLLOWING CSM CONDITIONS:			
		A. ECS			
		LOSS OF SUIT CIRCULATION UNCONTROLLABLE HIGH HUMIDITY			
		B. SM-RCS			
		LOSS OF 2 QUADS			
		C. INTERFACE CONDITIONS			
		LOSS OF TWO-WAY VOICE WITH MSFN			
A	3-42	A DPS TEI WILL BE PERFORMED FOR:			
		A. BEFORE UNDOCKING			
		ALL CONDITIONS INHIBITING UNDOCKING OR REASONS FOR EARLY TEI (REF. RULE 3-49/3-38; DELETE REFERENCE TO EMU REQUIREMENTS)			
		B. AFTER DOCKING			
		ALL CSM CONDITIONS WHERE STAGING IS INHIBITED IN ORDER TO RETAIN THE DESCENT STAGE FOR TEI AND/OR TEC (REF. RULE 3-59)			
		RULE NUMBERS 3-43 THROUGH 3-48 ARE RESERVED.			
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MISSION RULES

REV	ITEM				
A	3-49	<p>UNDOCKING OF THE LM WILL BE INHIBITED FOR:</p> <p>A. CSM CONDITIONS</p> <p>CSM CONDITIONS CAUSING A DECISION TO PERFORM AN EARLY TEI (3-38) OR IF THE CSM OPERATIONS DEPEND ON THE LM SYSTEMS. UNDOCKING ALSO REQUIRES FULL SUIT CIRCUIT INTEGRITY, A THC, ALL SM RCS THRUSTERS OPERATIONAL, AND TWO-WAY VOICE COMMUNICATIONS WITH LM AND MSFN.</p> <p>B. LM CONDITIONS:</p> <p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">THE CAPABILITY IS MAINTAINED TO STAGE THE LM IF REQUIRED.</p> <p>1. SEQUENTIAL AND PYROTECHNICS</p> <p>LOSS OF BOTH PYRO SYSTEMS</p> <p>2. EPS</p> <p>REQUIRE ONE ASCENT AND AT LEAST TWO DESCENT BATT LOSS OF EITHER ASCENT FEEDER LOSS OF EITHER CDR OR LMP BUS INSUFFICIENT ELECTRICAL ENERGY TO COMPLETE THE UNDOCKED OPERATIONS PLUS 2 HRS LOSS OF TWO DESCENT FEEDERS</p> <p>3. ECS</p> <p>LOSS OF CABIN PRESSURE INTEGRITY LOSS OF SUIT CIRCUIT INTEGRITY LOSS OF BOTH SUIT FANS LOSS OF BOTH DEMAND REGULATORS LOSS OF BOTH PRIMARY AND SECONDARY COOLANT LOOP LOSS OF ALL H₂O TANKS LOSS OF TWO OR MORE O₂ TANKS INSUFFICIENT CONSUMABLES (O₂, H₂O, OR LiOH) TO COMPLETE THE UNDOCKED OPERATIONS PLUS 2 HRS</p> <p>4. COMM/INSTRUMENTATION</p> <p>LOSS OF ONBOARD CRITICAL DISPLAYS</p> <p>5. G&C</p> <p>LOSS OF REDUNDANT 3-AXIS ATTITUDE CONTROL LOSS OF 3-AXIS TRANSLATION CAPABILITY</p> <p>6. DPS</p> <p>PROPELLANT LEAK (JETTISON DPS AT BEST OPPORTUNITY BEFORE CONSIDERING UNDOCKING)</p> <p>7. APS</p> <p>PROPELLANT LEAK (JETTISON LM AT BEST OPPORTUNITY)</p> <p>8. RCS</p> <p>LOSS OF RCS SYS A OR B PROPELLANT LEAK (JETTISON LM AT BEST OPPORTUNITY) ONE RCS THRUSTER PAIR ISOLATED</p> <p>C. INTERFACE CONDITIONS</p> <p>1. DOCKING SYSTEM</p> <p>THREE DOCKING RETRACT SQUIBS HAVE FIRED OR MISFIRED FAILURE TO REINSTALL OR CLOSE DOCKING PROBE, DROGUE, OR LM UPPER HATCH FAILURE OF CSM FORWARD HATCH PRIMARY AND SECONDARY LOCK/UNLOCK MECHANISM</p> <p>2. COMMUNICATIONS</p> <p>LOSS OF TWO-WAY VHF VOICE BETWEEN CSM AND LM</p> <p>D. EMU</p> <p>LOSS OF 2 OF 3 (2 OPS, 1 PLSS)</p>			
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MISSION RULES

REV	ITEM	RENDEZVOUS PHASE			
A	3-50	INITIATION OF NOMINAL RENDEZVOUS (TRAJECTORY PROFILE) WILL BE INHIBITED FOR:			
		<u>NOTE</u>			
		THE SEP MANEUVER AND MINI-FOOTBALL WILL BE PERFORMED FOR ALL CONDITIONS ALLOWING UNDOCKING. REFERENCE RULE 3-49.			
		A.	CSM CONDITIONS REQUIRING TEI AT THE NEXT BEST OPPORTUNITY (3-38). RENDEZVOUS ALSO REQUIRES FULL SUIT CIRCUIT INTEGRITY, THC, SEXTANT TRACKING CAPABILITY, RR TRANSPONDER, AND TM.		
		B.	<u>LM CONDITIONS</u>	<u>RULES</u>	
		1.	SEQUENTIAL AND PYROTECHNICS LOSS OF BOTH PYRO SYSTEMS		
		2.	EPS NEED TWO ASCENT AND TWO DESCENT OR FOUR DESCENT AND ONE ASCENT BATT LOSS OF EITHER CDR OR LMP BUS LOSS OF BOTH INVERTERS LOSS OF EITHER AC BUS A OR B LOSS OF EITHER ASCENT FEEDER INSUFFICIENT ELECTRICAL ENERGY TO COMPLETE THE NOMINAL RNDZ PLUS 2 HRS LOSS OF BOTH DESCENT FEEDERS OR LOSS OF ONE DESCENT FEEDER DUE TO HARD SHORT		
		3.	ECS LOSS OF CABIN PRESSURE INTEGRITY LOSS OF SUIT LOOP INTEGRITY LOSS OF BOTH SUIT FANS LOSS OF BOTH H ₂ O SEPARATORS LOSS OF BOTH DEMAND REGULATORS LOSS OF EITHER COOLANT LOOP LOSS OF PRIMARY H ₂ O FEEDPATH CAPABILITY INSUFFICIENT CONSUMABLES (O ₂ , H ₂ O, OR LiOH) TO PERFORM NOMINAL RNDZ PLUS 2 HRS LOSS OF TWO O ₂ TANKS LOSS OF TWO H ₂ O TANKS		
		4.	COMM/INSTRUMENTATION LOSS OF CRITICAL ONBOARD DISPLAYS		
		5.	G&C LOSS OF REDUNDANT 3-AXIS ATTITUDE CONTROL CAPABILITY LOSS OF PGNS LOSS OF 3-AXIS TRANSLATION CAPABILITY LOSS OF RR LOSS OF BOTH FDAI'S LOSS OF DSKY LOSS OF DPS ENG ON/OFF CAPABILITY LOSS OF AOT AND COAS LOSS OF GDA WHERE RCS IMPINGEMENT CONSTRAINTS WILL BE VIOLATED LOSS OF BOTH TTCA LOSS OF BOTH HAND CONTROLLERS		
		6.	DPS PROPELLANT LEAKS LOSS OF OPERATIONAL DPS		
		7.	APS PROPELLANT LEAKS LOSS OF OPERATIONAL APS		
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MISSION RULES

REV	ITEM				
A	3-50 (CONT'D)	<p>8. RCS</p> <p>REDUNDANT 3-AXIS ATTITUDE CONTROL 3-AXIS TRANSLATION CONTROL LOSS OF SYSTEMS A OR B ONE THRUSTER PAIR ISOLATED PROPELLANT LEAK</p> <p>C. THE RENDEZVOUS WILL BE <u>NO-GO</u> IF ANY OF THE FOLLOWING INTERFACE CONDITIONS EXIST:</p> <p>1. COMMUNICATIONS</p> <p>LOSS OF TWO-WAY VOICE COMMUNICATION BETWEEN VEHICLES LOSS OF TWO-WAY VOICE COMMUNICATION BETWEEN MSFN AND LM LOSS OF ALL TELEMETRY (NEED BLOCK OF HBR FOR E-MEMORY DUMP BEFORE GO)</p>			
A	3-51	<p>THE FLIGHT CREW WILL TERMINATE DOI FOR: <u>RULES</u></p> <p>ATTITUDE DEVIATIONS $>5^{\circ}$ RATES $>5/\text{SEC}$ DPS TANK PRESS <120 PSI OVERBURN IMU OR LGC FAIL DELTA PRESSURE BETWEEN FUEL AND OXIDIZER $>\text{TBD}$ PSI (AFTER STEADY STATE ACHIEVED)</p>			
A	3-52	<p>THE FLIGHT CREW WILL PERFORM THE DIRECT RETURN TO THE CSM FOR THE FOLLOWING REASONS (CAPABILITY REMAINS TILL APPROXIMATELY DOI + 10 MIN):</p> <p><u>LM CONDITIONS</u></p> <p>A. ECS</p> <p>LOSS OF BOTH COOLANT LOOPS FIRE OR SMOKE IN CABIN LOSS OF CABIN PRESSURE</p> <p>B. G&C</p> <p>PGNS FAIL ACCURACY TEST (COMPARISON WITH AGS AND RR) LOSS OF IMU LOSS OF LGC</p> <p>C. TRAJECTORY</p> <p>DOI OVERBURN >12 FPS</p>			
A	3-53	<p>DPS PHASING BURN OPERATION</p> <p>A. THE DPS PHASING BURN WILL BE TERMINATED FOR THE FOLLOWING LM CONDITIONS:</p> <p>1. G&C</p> <p>LOSS OF ALL ATTITUDE CONTROL, ATTITUDE EXCURSION $>5^{\circ}$, RATE EXCURSION $>5^{\circ}/\text{SEC}$ LOSS OF ALL THRUST VECTOR CONTROL AND RCS PLUME IMPINGEMENT CONSTRAINT EXCEEDED</p> <p>2. DPS</p> <p>INLET PRESSURE <120 PSI WHEN <65 PERCENT THROTTLE, <150 PSI WHEN >65 PERCENT THROTTLE DELTA PRESSURE BETWEEN FUEL AND OXIDIZER $>\text{TBD}$ PSI (AFTER STEADY STATE ACHIEVED)</p>			
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REV	ITEM				
A	3-53 (CONT'D)	<p>B. AFTER PREMATURE DPS CUTOFF, THE FOLLOWING ACTION WILL BE TAKEN:</p> <ol style="list-style-type: none"> 1. ATTEMPT RESTART WITH "START" BUTTON 2. ATTEMPT RESTART WITH "DES ENG CMD OVRD" SWITCH 3. (A) $V_G < 5$ FPS - TRIM WITH +X (B) $5 < V_G < 25$ FPS - STAGE AND COMPLETE BURN VIA RCS (C) $V_G \geq 25$ FPS - STAGE AND COMPLETE BURN VIA APS WITH AGS CONTROL 4. ACHIEVE $\Delta V_M \geq 40$ FPS VIA RCS IF DPS AND APS FAIL TO ALLOW RNDZ PHASING ONE REV LATER THAN NOMINAL 			
A	3-54	<p>APS INSERTION BURN OPERATION</p> <p>A. THE APS INSERTION BURN WILL BE TERMINATED FOR:</p> <ol style="list-style-type: none"> 1. G&C LOSS OF ALL ATTITUDE CONTROL, ATTITUDE EXCURSION $>10^\circ$, RATE EXCURSION $>10^\circ/\text{SEC}$ 2. APS INLET PRESSURE <115 PSI OR >250 PSI DELTA PRESSURE BETWEEN FUEL AND OXIDIZER >12 PSI <p>B. AFTER PREMATURE CUTOFF, THE FOLLOWING ACTION WILL BE TAKEN:</p> <ol style="list-style-type: none"> 1. ATTEMPT RESTART AND COMPLETE BURN IF: <ol style="list-style-type: none"> (A) 10 SEC $>$ COAST TIME $>$ 200 SEC, PROP TEMP $<$ 65°F (B) 10 SEC $>$ COAST TIME $>$ 90 SEC, PROP TEMP $>$ 65°F 2. IF $V_M < 45$ FPS, TRIM BACK TO ZERO WITH RCS MINUS X 3. IF $V_G < 80$ FPS, COMPLETE MANEUVER WITH RCS PLUS X <p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">FOR ALL CASES BETWEEN $V_M > 45$ FPS AND $V_G > 80$ FPS, A CSM RESCUE WILL BE PERFORMED. DOCKING WILL OCCUR TWO HOURS LATER THAN NOMINAL.</p>			
A	3-55	<p>AGS TAKE-OVER WILL BE PERFORMED FOR THE FOLLOWING LM CONDITIONS EXCEPT DOI:</p> <p>G&C</p> <p>LOSS OF LGC LOSS OF ISS LOSS OF ATTITUDE CONTROL, ATTITUDE EXCURSION $>10^\circ$ FOR STAGED VEHICLE, $>5^\circ/\text{SEC}$ FOR UNSTAGED VEHICLE LOSS OF RATE CONTROL, RATE EXCURSION $>10^\circ/\text{SEC}$ FOR STAGED VEHICLE, $>5^\circ/\text{SEC}$ FOR UNSTAGED VEHICLE</p>			
A	3-56	<p>THE FIVE-IMPULSE LM ACTIVE RNDZ (WITH DOCKING 2 HOURS EARLIER THAN NOMINAL) CAN BE SELECTED AS LATE AS 5 MIN BEFORE THE PC AFTER DOI. FAILURE TO MEET THE FOLLOWING CRITERIA IN RULE 3-50 FOR THE NOMINAL RNDZ WILL BE CAUSE FOR PERFORMING THE FIVE-IMPULSE RNDZ.</p> <p>A. LM CONDITIONS (IF THE PROBLEM OCCURS PRIOR TO DOI):</p> <ol style="list-style-type: none"> 1. EPS LOSS OF EITHER DESCENT FEEDER DUE TO A HARD SHORT INSUFFICIENT ELECTRICAL ENERGY TO COMPLETE THE NOMINAL PLUS 2 HRS BUT SUFFICIENT TO COMPLETE THE FIVE-IMPULSE PLUS 2 HRS 			
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A	3-56 (CONT'D)	2. ECS	INSUFFICIENT CONSUMABLES (O ₂ , H ₂ O, LiOH) TO PERFORM NOMINAL RNDZ PLUS 2 HRS BUT SUFFICIENT TO COMPLETE FIVE-IMPULSE PLUS 2 HRS		
		3. G&C	LOSS OF AOT AND COAS (IF A FINE ALIGN HAS BEEN ACCOMPLISHED BEFORE THE FAILURE) <u>LOSS OF GDA WHERE RCS IMPINGEMENT CONSTRAINTS WILL BE VIOLATED</u>		
		4. DPS	LOSS OF OPERATIONAL DPS PROPELLANT LEAKS LOSS OF DPS ENG ON/OFF CAPABILITY		
		B. LM CONDITIONS (IF FAILURE IS RECOGNIZED AFTER DOI) FOR FIVE-IMPULSE:			
		1. EPS	LOSS OF ANY TWO BAT LOSS OF EITHER DC BUS LOSS OF EITHER ASCENT FEEDER INSUFFICIENT ELECTRICAL ENERGY TO COMPLETE THE NOMINAL TIMELINE PLUS 2 HRS		
		2. ECS	LOSS OF CABIN PRESSURE INTEGRITY LOSS OF SUIT LOOP INTEGRITY LOSS OF BOTH SUIT FANS LOSS OF BOTH H ₂ O SEPARATORS LOSS OF BOTH DEMAND REGULATORS LOSS OF PRIMARY COOLANT LOOP LOSS OF TWO O ₂ TANKS LOSS OF TWO H ₂ O TANKS INSUFFICIENT CONSUMABLES (O ₂ , H ₂ O, LiOH) TO PERFORM NOMINAL TIMELINE		
		3. COMM/INSTRUMENTATION	LOSS OF CRITICAL DISPLAYS		
		4. G&C	LOSS OF PGNS LOSS OF DSKY		
		5. RCS	LOSS OF SYSTEM A OR B		
		C. TRAJECTORY	DOI UNDERBURN >5 FPS		
A	3-57		LM STAGING WILL BE PERFORMED EARLY FOR THE FOLLOWING LM CONDITIONS:		
		A. G&C	LOSS OF GDA WHERE RCS PLUME IMPINGEMENT CONSTRAINT WILL BE VIOLATED		
		B. DPS	LOSS OF OPERATIONAL DPS PROPELLANT LEAK		
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A	3-58	LM STAGING WILL BE DELAYED FOR ANY CSM RESCUE (REFERENCE RULE 3-60) AND THE FOLLOWING LM CONDITIONS:			
		<p><u>NOTE</u></p> <p>DELAYED STAGING WILL OCCUR AT TPI AT THE EARLIEST. IT IS PREFERABLE TO INHIBIT STAGING IF CIRCUMSTANCES WILL PERMIT.</p>			
		A. SEQUENTIAL AND PYRO			
		LOSS OF EITHER PYRO SYSTEM			
		B. EPS			
		LOSS OF EITHER BUS			
		LOSS OF EITHER ASCENT BATTERY			
		INSUFFICIENT ASCENT ELECTRICAL ENERGY TO COMPLETE NOMINAL OPERATIONS PLUS 2 HRS			
		CONFIRMED LOSS OF ASCENT BATTERY OVERCURRENT PROTECTION			
		C. ECS			
		LOSS OF CABIN PRESS INTEGRITY			
		LOSS OF SUIT LOOP INTEGRITY			
		LOSS OF BOTH SUIT FANS			
		LOSS OF EITHER SUIT FANS			
		LOSS OF BOTH DEMAND REGULATORS			
		LOSS OF EITHER ASCENT O ₂ TANK			
		LOSS OF EITHER ASCENT H ₂ O TANKS			
		INSUFFICIENT ASCENT O ₂ , H ₂ O, OR LiOH TO COMPLETE NOMINAL OPERATIONS PLUS 2 HRS			
		LOSS OF BOTH COOLANT LOOPS			
		D. APS			
		NON OPERATIONAL			
		DELTA V < <u>TBD</u>			
		E. RCS			
		LOSS OF SYSTEM A OR B			
	3-59	LM STAGING WILL BE INHIBITED WHILE IN THE UNDOCKED CONFIGURATION FOR THE FOLLOWING CONDITIONS:			
		<p><u>NOTE</u></p> <p>FOR THESE CONDITIONS, THE CSM WILL PERFORM THE MCC AND BRAKING MANEUVERS.</p>			
		A. <u>CSM CONDITIONS</u>			
		1. ECS			
		LOSS OF CABIN INTEGRITY			
		FIRE OR SMOKE			
		LOSS OF O ₂ MANIFOLD			
		2. CRYO			
		LOSS OF ANY CRYO TANK			
		3. EPS			
		LOSS OF TWO FUEL CELLS			
		LOSS OF TWO INVERTERS			
		LOSS OF ONE AC BUS			
		LOSS OF AC 1 ϕ A OR AC 2 ϕ A			
		4. G&C			
		LOSS OF EITHER TVC LOOP			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	MISSION RULE SUMMARY	RENDEZVOUS	3-18

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MISSION RULES

REV	ITEM				
A	3-59 (CONT'D)	<p>5. SPS</p> <p>SUSTAINED PRESSURE DECAY IN FUEL OR OX LOSS OF BOTH GN₂ TANK PRESSURES FUEL/OX FEEDLINE <40°F AND UNABLE TO INCREASE DELTA PRESSURE BETWEEN FUEL/OX >20 PSI LEAK OR LOSS OF SPS He SUPPLY PRESSURE</p> <p>B. <u>LM CONDITIONS</u></p> <p>1. SEQUENTIAL AND PYRO LOSS OF BOTH PYRO SYSTEMS</p> <p>2. EPS LOSS OF BOTH ASCENT BATTERIES LOSS OF BOTH ASCENT FEEDERS INSUFFICIENT ASCENT ELECTRICAL ENERGY TO COMPLETE TERMINAL PHASE PLUS 2 HRS</p> <p>3. ECS INSUFFICIENT ASCENT O₂ OR H₂O TO COMPLETE TERMINAL PHASE PLUS 2 HRS</p> <p>4. G&C LOSS OF RCS TRANSLATION CAPABILITY LOSS OF ATTITUDE CONTROL</p> <p>5. APS PROPELLANT LEAK</p> <p>6. RCS PROPELLANT LEAK</p>			
	3-60	CSM MCC AND BRAKING MANEUVERS WILL BE PERFORMED FOR ANY CASE WHERE THE DPS ENGINE IS REQUIRED FOR TEI, OR THE DESCENT STAGE CONSUMABLES ARE REQUIRED FOR TEC. (REFERENCE CSM CONDITIONS IN RULE 3-59.) A CSM RESCUE (MULTIPLE BURN CONDITION) WILL BE PERFORMED FOR CONDITIONS PROHIBITING A LM ACTIVE RNDZ.			
	3-61	AN EVT WILL BE PERFORMED FOR THE FOLLOWING CONDITIONS: INABILITY TO DOCK INABILITY TO PERFORM TUNNEL TRANSFER			
		RULE NUMBERS 3-62 THROUGH 3-66 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	MISSION RULE SUMMARY	RENDEZVOUS	3-19

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MISSION RULES

REV	ITEM			
		UNMANNED PHASE		
A	3-67	<p>THE UNMANNED APS BURN WILL BE INHIBITED FOR CONDITIONS REQUIRING ASCENT STAGE SYSTEMS FOR LIFE SUPPORT OR COMMUNICATIONS AS A RESULT OF CSM PROBLEMS (REFERENCE RULE 3-41) AND THE FOLLOWING LM CONDITIONS:</p> <p>A. EPS</p> <p style="padding-left: 40px;">LOSS OF EITHER BUS LOSS OF BOTH ASCENT BATTERIES</p> <p>B. GUIDANCE AND CONTROL</p> <p style="padding-left: 40px;">LOSS OF PGNC'S AND AGS LOSS OF APS ARM-DEARM/ON-OFF CONTROL LOSS OF 3-AXIS ATTITUDE CONTROL</p> <p>C. INTERFACE CONDITIONS</p> <p style="padding-left: 20px;">1. COMMUNICATIONS</p> <p style="padding-left: 40px;">LOSS OF ALL TM LOSS OF CMD UPLINK</p>	<u>RULES</u>	
↑		<p>RULE NUMBERS 3-68 THROUGH 3-75 ARE RESERVED.</p>		
MISSION	REV	DATE	SECTION	PAGE
APOLLO 10	A	4/23/69	MISSION RULE SUMMARY	3-20
			UNMANNED PHASE	

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MISSION RULES

REV	ITEM	ALL MANEUVERS			RULES
	3-76	A CRITICAL SPS MANEUVER WILL BE INHIBITED FOR THE FOLLOWING CSM PROBLEMS (OTHER PROPULSION SYSTEMS WILL BE USED IF AVAILABLE):			
		A. G&C			
		LOSS OF TWO TVC SERVO LOOPS LOSS OF THREE TVC CONTROL MODES (G&N, SCS AUTO, AND MTVC)			
		B. SPS			
		PRESSURE IN EITHER FUEL OR OXIDIZER TANK <115 PSI LOSS OF BOTH GN ₂ BOTTLES (<400 PSI) FUEL OR OXIDIZER FEEDLINE TEMP <27°F FLANGE TEMP >480°F ON PREVIOUS BURN CHAMBER PRESSURE <70 PSI ON PREVIOUS BURN FUEL/OXIDIZER P >20 PSI FIRST BURN SUBSEQUENT TO DOCKED DPS WAS <40 SEC, CONTINUOUS			
		C. DOCKING SYSTEM			
		FOR DOCKED BURNS LESS THAN NINE GOOD DOCKING RING LATCHES			
A	3-77	A DPS MANEUVER WILL BE INHIBITED FOR THE FOLLOWING LM PROBLEMS:			
		A. EPS			
		LOSS OF EITHER BUS			
		B. G&C			
		LOSS OF ULLAGE NO GDA CONTROL AND GIMBAL FAILED HARDOVER			
		C. DPS			
		PROPELLANT TEMP NOT WITHIN 40 TO 75°F LIMITS DELTA PRESS BETWEEN FUEL AND OXIDIZER >180 PSID AT FTP FUEL INLET PRESS <120 PSI FOR <65 PERCENT THROTTLE AND <150 PSI FOR >65 PERCENT THROTTLE LOSS OF SUPERCRITICAL He OR INSUFFICIENT He PRESS TO GAIN 310 FPS ΔV PROPELLANT LEAKS MORE THAN 100 SEC WILL BE ACCUMULATED IN DPS NON-THROTTABLE RANGE			
		D. DOCKING SYSTEM			
		FOR DOCKED BURNS LESS THAN NINE GOOD DOCKING RING LATCHES			
A	3-78	AN APS MANEUVER WILL BE INHIBITED FOR THE FOLLOWING LM PROBLEMS:			
		A. G&C			
		LOSS OF ULLAGE LOSS OF 3-AXIS ATTITUDE CONTROL LOSS OF PGNS AND AGS			
		B. APS			
		DELTA PRESS BETWEEN FUEL AND OXIDIZER >20 PSIA DELTA TEMP BETWEEN FUEL AND OXIDIZER >10°F PROPELLANT TEMP NOT WITHIN 40 TO 100°F LIMITS INLET PRESS <115 PSI PROPELLANT LEAKS			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	MISSION RULE SUMMARY	ALL MANEUVERS	3-21

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MISSION RULES

REV	ITEM				
	3-79	LM RCS MANEUVERS WILL BE INHIBITED FOR THE FOLLOWING LM PROBLEMS:	<u>RULES</u>		
		A. G&C			
		LOSS OF PGNS AND AGS			
		LOSS OF 3-AXIS ATTITUDE CONTROL			
		LOSS OF BOTH ACA'S			
		LOSS OF 3-AXIS TRANSLATION			
		B. RCS			
		PROPELLANT TEMP NOT WITHIN 40 TO 100°F LIMITS			
		DELTA PRESS BETWEEN FUEL AND OXIDIZER >80 PSID			
		MANIFOLD PRESSURE <100 PSI			
		PROPELLANT LEAKS			
		QUAD TEMPS <119°F			
		C. DOCKING SYSTEM			
		THREE GOOD DOCKING RING LATCHES 120° APART ARE REQUIRED			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	MISSION RULE SUMMARY	ALL MANEUVERS	3-22

**4 GROUND
INSTRUMENTATION
REQUIREMENTS**

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MISSION RULES

REV	ITEM				
A	4-1	<p><u>GENERAL</u></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;"><u>NOTE</u></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> <p>C. COMMAND TO THE LAUNCH VEHICLE IS MANDATORY FROM S-IVB CUTOFF TO S-IVB CUTOFF + 60 SEC AND POST S/C SEPARATION.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	GROUND INSTRUMENTATION REQUIREMENTS	GENERAL	4-1

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	4-2	<u>TELEMETRY</u> A. CONSOLE DISPLAY (D/TV, EVENTS, ANALOGS) B. PCM GROUND STATIONS (4) C. RECORDING AND PLAYBACK ALDS MSFN D. FM - GROUND STATION	PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH	MANDATORY 1 OF 4 MANDATORY , 1 HIGHLY DESIRABLE BOTH DESIRABLE 1 OF 2 MANDATORY	A. FOR DISPLAY OF MANDATORY S/V PARAMETERS. B. FOR DISPLAY OF MANDATORY S/V EVENTS AND ANALOGS. D. TO PROVIDE MANDATORY DISPLAY DATA FOR THE MCC SURGEON.	
A	4-3	<u>COMMAND</u> A. MOCR TOGGLE SWITCHES (BOTH A AND B) 1. BSE ABORT REQUEST 2. FIDO ABORT REQUEST 3. FD ABORT REQUEST B. COMMAND PANELS: EECOM, GUIDO, BSE, TELCOM, CONTROL, CCATS C. MOCR CONSOLE/SITE SELECT CAPABILITY 1. RTC CONSOLE (CCATS) 2. CCATS CMD CONSOLE MED D. FC/M&O SWITCHING CAPABILITY 1. FLIGHT DIRECTOR 2. CCATS CMD MED	PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH	HIGHLY DESIRABLE HIGHLY DESIRABLE HIGHLY DESIRABLE 1 OF 6 MANDATORY 1 OF 2 MANDATORY 1 OF 2 MANDATORY	A. FOR LAUNCH PHASE ABORT REQUEST B. FOR BULKHEAD ΔP AFTER S/C INSERTION AND SEP C. FOR BULKHEAD ΔP AFTER S/C INSERTION AND SEP D. FOR BULKHEAD ΔP AFTER S/C INSERTION AND SEP	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	GROUND INSTRUMENTATION REQUIREMENTS		MCC	4-2

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	4-4	<u>TRAJECTORY</u> A. TRAJECTORY DATA PROCESSING 1. AVAILABILITY OF ONE INDEPENDENT TRACKING SOURCE (IP, USB) FROM LIFTOFF TO T + 10 MINUTES. 2. IU AND CMC TM VECTORS FROM LIFTOFF TO INSERTION PLUS 60 SECONDS. B. RTCC - DATA SELECT CAPABILITY	PRELAUNCH PRELAUNCH PRELAUNCH	1 MANDATORY BOTH MANDATORY MANDATORY	A. THE TRAJECTORY DATA SOURCES ARE UTILIZED AS FOLLOWS: 1.(A) INDEPENDENT VERIFICATION OF L/V NAVIGATION. (B) PROTECTION AGAINST VIOLATION OF LAUNCH ENVELOPE. A.2. REQUIRED FOR ORBIT GO/NO-GO B. TO SELECT BEST AVAILABLE DATA SOURCE.	
	4-5	<u>COMMUNICATIONS</u> A. MOCR: FD LOOP } AFD CONF LOOP } MOCR SYS 1 & 2 } MOCR DYN } A/G 1 LOOP } A/G 2 LOOP } B. MCC/LAUNCH COMPLEX: 121 CLTC } 111 CVTS } 212 MSTC } C. MCC/RSO: FD LINE TO RSO } RSO PRIVATE LINE } CAPE 111 RSO LOOP } D. MISCELLANEOUS: BSE TM MONITOR LOOP } CIF/USB LOOP } E. MCC/REMOVED SITES: ONE A/G PATH VIA GSFC	PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH	1 OF 2 MANDATORY ALL HIGHLY DESIRABLE 1 OF 3 MANDATORY 1 OF 3 MANDATORY DESIRABLE MANDATORY	FOR MISSION CONTROL FOR TERMINAL COUNT COORDINATION OF MCC-PAD ACTIVITIES FOR TRAJECTORY VERIFICATION AND BOOSTER SAFING USED FOR MONITORING SPACE VEHICLES SUBSYSTEM CHECKOUT USED FOR COMMUNICATION WITH CREW	
MISSION	REV	DATE	SECTION		GROUP	PAGE
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	4-6	<u>COMPUTER</u> A. MOC (IBM 360/75) B. DSC (IBM 360/75) C. CCATS (UNIVAC 494) - ONLINE D. CCATS (UNIVAC 494) - STANDBY E. RTACF - 2	PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH	MANDATORY HIGHLY DESIRABLE 1 MANDATORY AND 1 HIGHLY DESIRABLE 1 HIGHLY DESIRABLE	TO PROCESS MANDATORY S/V PARAMETERS AND TRAJECTORY DATA. AN SSC (IBM 360/75) IS AVAIL- ABLE AS BACKUP TO THE MOC OR DSC. TO THROUGH PROCESS TO MOC MANDATORY S/V PARAMETERS PRELAUNCH IP PREDICTIONS FOR MODE 1 ABORTS.	
	4-7	<u>TIMING</u> MITE (2)	PRELAUNCH	1 MANDATORY	MCC TIMING STANDARD TO SUPPORT MANDATORY RTCC/CCATS COMPUTERS	
	4-8	<u>MCC POWER</u> A. BUS A ₁ B. BUS A ₂ C. BUS B ₁ D. BUS B ₂	PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH	MANDATORY MANDATORY MANDATORY MANDATORY	UNINTERRUPTABLE POWER FOR WIDE BAND CROSS BAR SWITCH UNINTERRUPTABLE POWER FOR D/TV DATA DISTRIBUTORS 20 SECONDS INTERRUPTABLE POWER FOR PLOTBOARDS (POWER) 20 SECONDS INTERRUPTABLE POWER FOR VSM	
MISSION	REV	DATE	SECTION		GROUP	PAGE
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS																
	4-9	<u>DISPLAY</u>																			
		A. <u>MOCR D/TV CHANNELS</u>	PRELAUNCH	10 OF 36 MANDATORY																	
		<table border="0"> <tr> <td><u>POSITION</u></td> <td><u>NO. OF CHANNELS</u></td> </tr> <tr> <td>RETRO</td> <td>1</td> </tr> <tr> <td>FIDO</td> <td>1</td> </tr> <tr> <td>GUIDO</td> <td>1</td> </tr> <tr> <td>EECOM</td> <td>1</td> </tr> <tr> <td>GNC</td> <td>1</td> </tr> <tr> <td>RTCC</td> <td>1</td> </tr> <tr> <td>BOOSTER</td> <td>4</td> </tr> </table>	<u>POSITION</u>	<u>NO. OF CHANNELS</u>	RETRO	1	FIDO	1	GUIDO	1	EECOM	1	GNC	1	RTCC	1	BOOSTER	4			
<u>POSITION</u>	<u>NO. OF CHANNELS</u>																				
RETRO	1																				
FIDO	1																				
GUIDO	1																				
EECOM	1																				
GNC	1																				
RTCC	1																				
BOOSTER	4																				
		B. <u>TRAJECTORY DISPLAY</u>																			
		1. FDO LAUNCH DIGITALS	PRELAUNCH	MANDATORY ON D/TV	FOR CONTINGENCY ORBIT INSERTION MANEUVER DATA AND T_{FF} LIMITS.																
		2. γ 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. γ_{EI} VS V_{EI}	PRELAUNCH	MANDATORY ON 1 OF 2: (A) D/TV (B) SSR PLOTBOARD	MONITOR FOR G-LIMIT VIOLATION.																
		5. ϕ VS λ	PRELAUNCH	H/D 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) SSR PLOTBOARD	MONITOR FOR ABORT MODES II, III, AND IB.																
		7. h VS d	PRELAUNCH	H/D ON 10 X 20 SCRIBER PLOTTER																	
		8. γ_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 TV																	
		11. INSERTION/ INJECTION DIGITALS	PRELAUNCH	MANDATORY ON D/TV	FOR G&N GO/NO-GO																
		C. <u>ADEG CHANNELS 90-93</u>	PRELAUNCH	HIGHLY DESIRABLE	FOR DSC DISPLAYS																
		D. <u>VSM</u>	PRELAUNCH	MANDATORY	FOR D/TV																
		E. <u>AUX VSM</u>	PRELAUNCH	HIGHLY DESIRABLE																	
		F. <u>EIDOPHORS (3)</u>	PRELAUNCH	2 HIGHLY DESIRABLE																	
		NOTE: INDIVIDUAL FLIGHT CONTROLLERS WILL BE RESPONSIBLE FOR REPORTING LOSS OF DISPLAY CAPABILITY OF MANDATORY PARAMETERS TO THE FLIGHT DIRECTOR.																			
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	4-10	<u>GSFC</u> A. GSFC UNIVAC - 494 (2) COMMUNICATIONS PROCESSOR B. WBD (50.0 KBPS) LINES (2) BETWEEN MCC AND GSFC C. TTY CIRCUITS BETWEEN MCC AND GSFC 1. VOICE FREQUENCY TTY GROUP LINES (2) 2. LOW-SPEED TTY CIRCUITS (2)	PRELAUNCH PRELAUNCH PRELAUNCH	1 MANDATORY 1 MANDATORY 1 OF 4 MANDATORY	A. ONE UNIVAC - 494 CAN PERFORM ALL NECESSARY FUNCTIONS, THE SECOND ONE IS BACKUP. B. EITHER LINE CAN BE SWITCHED TO EITHER UNIVAC - 494. C. ONE CIRCUIT IS (M) TO REC LOW SPEED RADAR DATA. ONE CIRCUIT IS (HD) TO SEND ACQ MESSAGES.	
	4-11	<u>KSC</u> <u>TELEMETRY:</u> A. VHF TM FROM THE FOLLOWING FOR S-II, S-IVB, AND IU: 1. CIF ANTENNA 2. MILA VHF ANTENNA B. USB TM FROM THE FOLLOWING: 1. MILA USB 2. CIF USB <u>COMMAND:</u> THIS CAPABILITY IS DEFINED UNDER GSFC/KSC/MSFN COMMAND RULE 4-12 FOR LAUNCH COVERAGE. <u>TRACKING:</u> THAT CAPABILITY REQUIRED TO SATISFY RULE 4-4 (TRAJECTORY) IS MANDATORY. <u>VOICE COMMUNICATIONS:</u> THIS KSC CAPABILITY IS DEFINED UNDER MCC RULE 4-5 (COMMUNICATIONS).	PRELAUNCH PRELAUNCH	1 MANDATORY 1 MANDATORY	A. THESE ANTENNAS CAN BE SWITCHED TO MILA OR CIF FACILITIES. B. USB IS THE CSM'S ONLY SOURCE OF DATA.	
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	4-12	<u>LAUNCH COVERAGE</u> 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.				
		A. <u>CMD</u>				
		CCS	PRELAUNCH	MANDATORY FROM S-IVB C/O TO S-IVB C/O + 60 SECS.		
		USB CSM	PRELAUNCH	HIGHLY DESIRABLE		
		B. <u>TELEMETRY</u>				
		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) } IU VHF (DP-1) }	PRELAUNCH	1 OF 2 MANDATORY FROM LIFTOFF TO S-IVB CUTOFF PLUS 60 SEC	FOR ABORT CUES FROM MCC	
		CSM (USB)	PRELAUNCH	MANDATORY FROM LIFTOFF THROUGH S-IVB CUTOFF PLUS 60 SEC.	FOR ABORT CUES FROM MCC	
		C. <u>TRACKING</u>				
		THAT CAPABILITY REQUIRED TO SATISFY RULE 4-4 (TRAJECTORY) IS MANDATORY				
		D. <u>A/G COMMUNICATIONS</u>				
		1. MILA				
		VHF	PRELAUNCH	HIGHLY DESIRABLE		
		USB	PRELAUNCH	MANDATORY		
		2. MSFN				
		VHF } USB }	PRELAUNCH	1 OF 2 MANDATORY		
A	4-13	<u>GENERAL ORBITAL COVERAGE</u> (FROM S-IVB C/O + 60 SEC TO TLI C/O) IT IS REQUIRED THE MSFN HAVE THE CAPABILITY OF PROVIDING THE MCC THE MINIMUM MISSION CONTROL SUPPORT LISTED BELOW OF TWO MSFN USB SITES PER REVOLUTION THROUGH REVOLUTION 3.				
		A. <u>CMD</u>				
		CCS	PRELAUNCH	HIGHLY DESIRABLE		
		CSM USB	PRELAUNCH	HIGHLY DESIRABLE		
		B. <u>TELEMETRY</u>				
		S-IVB VHF (CP-1)	PRELAUNCH	HIGHLY DESIRABLE		
		IU CCS (DP-1B) } IU VHF (DP-1) }	PRELAUNCH	1 OF 2 MANDATORY	DOWNLINKS REQUIRED TO RECOVER S-IVB DATA.	
		CSM USB	PRELAUNCH	MANDATORY		
		C. <u>TRACK</u>				
		C-BAND	PRELAUNCH	HIGHLY DESIRABLE		
		USB	PRELAUNCH	MANDATORY		
		D. <u>A/G COMMUNICATIONS</u>				
		VHF	PRELAUNCH	HIGHLY DESIRABLE		
		USB	PRELAUNCH	MANDATORY		
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A 1	4-14	<u>POST S/C SEPARATION</u> IT IS MANDATORY THAT 1 SITE A. TLM - CCS B. CMD - CCS	PRELAUNCH PRELAUNCH	MANDATORY MANDATORY	A. TO PROVIDE TM FOR DETERMINING S-IVB STATUS BEYOND VHF RANGE. B. TO PROVIDE CORRECTIVE COMMAND CAPABILITY FOR S-IVB BULKHEAD DELTA PROBLEMS. C. BOTH OF THE ABOVE ARE REQUIRED TO INSURE CREW SAFETY AND LM EXTRACTION.	
A 1	4-15	<u>HSK, GDS, MAD</u> IT IS MANDATORY 2 OF 3 OF THESE SITES A. <u>TM</u> USB B. <u>TRACK</u> USB C. <u>VOICE</u> USB D. <u>CMD</u> USB	PRELAUNCH PRELAUNCH PRELAUNCH PRELAUNCH	MANDATORY MANDATORY MANDATORY HIGHLY DESIRABLE	A. TO COVER TRANSLUNAR COAST AND LPO.	
A 1	4-16	<u>RIOMETER NETWORK SITES</u> A. LIMA B. CRO } CYI }	PRELAUNCH	HIGHLY DESIRABLE 1 OF 2 HIGHLY DESIRABLE		
MISSION	REV	DATE	SECTION		GROUP	PAGE
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MISSION RULES

REV	ITEM				
	4-16	<p><u>INTRODUCTION TO SITE FAILURE DECISION MATRICES</u> (FIGURES 4-1 THROUGH 4-5)</p> <p>THESE DECISION MATRICES APPLY THE GROUND INSTRUMENTATION REQUIREMENTS TO THE POSSIBLE FAILURES OF SITE CAPABILITIES DURING LAUNCH PHASE.</p> <p>THESE MATRICES POINT OUT TIMES DURING LAUNCH WHEN A FAILURE WILL CAUSE A LOSS OF CONTINUOUS COVERAGE BETWEEN LIFTOFF AND INSERTION PLUS 60 SECONDS.</p> <p>TO USE THE MATRIX</p> <p>A. LOOK FOR AN X UNDER THE COLUMN FOR THE SITE WHERE THE FAILURE OCCURRED.</p> <p>B. GO ACROSS TO THE COLUMN FOR THE CAPABILITY THAT WAS LOST AND READ THE DECISION.</p> <p>C. THE COVERAGE THAT WAS LOST IS IN THE COLUMN LABELED "MANDATORY COVERAGE LOST."</p> <p>D. MORE THAN ONE X IN A ROW SPECIFIES A FAILURE OF THE <u>SAME CAPABILITY</u> AT MORE THAN ONE SITE.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	GROUND INSTRUMENTATION REQUIREMENTS	GSFC/KSC/MSFN	4-9

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MISSION RULES

REV	ITEM	SITES FAILED					MANDATORY COVERAGE LOST	CAPABILITY LOST				
		ALDS TM 0:00 8:49	MIL/CAPE 0:08 8:49	GBM 1:07 9:13	BDA 4:11 12:42	VAN 9:30 15:32		TELEMETRY USB OR VHF	CMD	TRACK BOTH S AND C BAND	A/G USB	A/G USB AND VHF
A	S I N G L E F A I L U R E	X					NONE SEE NOTE 4	GO	N/A	N/A	N/A	N/A
			X				00:00 TO 01:07	GO	GO	NO-GO	NO-GO	NO-GO
				X			S-IC/S-II SEP SEE NOTE 1	GO	GO	GO	GO	GO
					X		NONE	GO	GO	GO	GO	GO
						X	NONE	GO	GO	GO	GO	GO
	M U L T I P L E F A I L U R E S	X	X				00:00 TO 01:07	NO-GO	GO	NO-GO	NO-GO	NO-GO
			X	X			00:00 04:11	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
			X		X		00:00 TO 01:07	GO	GO	NO-GO	NO-GO	NO-GO
		X	X		X		9:13 TO 9:30	NO-GO	GO	NO-GO	NO-GO	NO-GO
			X			X	00:00 TO 01:07	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
		X	X				08:49 TO 9:30 SEE NOTES 1 AND 3	GO	GO	GO	GO	GO
				X		X	S-IC/S-II SEP	GO	GO	GO	GO	GO
					X	X	9:13 TO INSR + 60	NO-GO	NO-GO	NO-GO	GO	NO-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 COVERAGE IS NOT SEVERE ENOUGH FOR A NO-GO CONDITION.
4. LOSS OF ALDS RESULTS IN LOSS OF S-IC TM; HOWEVER, IT IS NOT MANDATORY FOR LAUNCH.

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

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	GROUND INSTRUMENTATION REQUIREMENTS	GSFC/KSC/MSFN	4-10

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MISSION RULES

REV	ITEM	SITES FAILED					MANDATORY COVERAGE LOST	CAPABILITY LOST				
		ALDS TM	MIL/CAPE	GBM	BDA	VAN		TELEMETRY	CMD	TRACK	A/G	A/G
		0:00 8:49	0:00 8:49	1:07 9:20	4:12 12:33	9:11 16:12		USB OR VHF		BOTH S AND C BAND	USB	USB AND VHF
A	S I N G L E	X					NONE SEE NOTE 4	GO	N/A	N/A	N/A	N/A
			X				00:00 TO 01:07	GO	GO	NO-GO	NO-GO	NO-GO
				X			S-IC/S-II SEP SEE NOTE 2	GO	GO	GO	GO	GO
	F A I L U R E				X		NONE	GO	GO	GO	GO	GO
						X	NONE	GO	GO	GO	GO	GO
		X	X				00:00 TO 01:07	NO-GO	GO	NO-GO	NO-GO	NO-GO
	M U L T I P L E		X	X			00:00 TO 4:12	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
		X	X		X		00:00 TO 01:07	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
		X	X		X		00:00 TO 01:07	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
	F A I L U R E S		X			X	00:00 TO 01:07	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
		X	X			X	00:00 TO 01:07	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
				X	X		S-IC/S-II SEP	GO	GO	GO	GO	GO
			X		X	S-IC/S-II SEP	GO	GO	GO	GO	GO	
			X	X	09:20 TO INSR + 60	NO-GO	NO-GO	NO-GO	GO	NO-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.

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

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	GROUND INSTRUMENTATION REQUIREMENTS	GSFC/KSC/MSFN	4-11

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MISSION RULES

REV	ITEM	SITES FAILED						MANDATORY COVERAGE LOST	CAPABILITY LOST				
		ALDS TM 0:00 8:48	MIL/CAPE 0:00 8:48	GBM 1:06 9:26	BDA 4:15 12:13	ANG 7:23 12:48	VAN 9:07 16:19		TELEMETRY USB OR VHF	CMD	TRACK BOTH S AND C BAND	A/G USB	A/G USB AND VHF
A	S I N G L E F A I L U R E	X						NONE SEE NOTE 4	GO	N/A	N/A	N/A	N/A
			X					00:00 TO 01:06	GO	GO	NO-GO	NO-GO	NO-GO
				X				S-IC/S-II SEP SEE NOTE 2	GO	GO	GO	GO	GO
					X			NONE	GO	GO	GO	GO	GO
						X		NONE	GO	GO	GO	GO	GO
							X	NONE	GO	GO	GO	GO	GO
	M U L T I P L E F A I L U R E S	X	X					00:00 TO 01:06	NO-GO	GO	NO-GO	NO-GO	NO-GO
			X	X				00:00 TO 04:15	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
		X	X		X			00:00 TO 01:06	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
			X				X	00:00 TO 01:06	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
		X	X				X	00:00 TO 01:06	GO NO-GO	GO GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
				X	X			S-IC/S-II SEP	GO	GO	GO	GO	GO
			X			X	S-IC/S-II SEP	GO	GO	GO	GO	GO	
				X		X	NONE	GO	GO	GO	GO	GO	
				X	X	12:13 TO INSR + 60	NO-GO	NO-GO	NO-GO	GO	NO-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.

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

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	GROUND INSTRUMENTATION REQUIREMENTS	GSFC/KSC/MSFN	4-12

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MISSION RULES

REV	ITEM	SITES FAILED						MANDATORY COVERAGE LOST	CAPABILITY LOST				
		ALDS TM	MIL/CAPE	GBM	BDA	ANG	VAN		TELEMETRY	CMD	TRACK	A/G	A/G
		0:00 8:48	0:00 8:48	1:06 9:31	4:21 11:43	7:00 13:40	9:16 15:57		USB OR VHF		BOTH C AND S BAND	USB	USB AND VHF
A	S I N G L E F A I L U R E	X						NONE SEE NOTE 3	GO	N/A	N/A	N/A	N/A
			X					00:00 TO 01:06	GO	GO	NO-GO	NO-GO	NO-GO
				X				S-IC/S-II SEP SEE NOTE 1	GO	GO	GO	GO	GO
					X			NONE	GO	GO	GO	GO	GO
						X		NONE	GO	GO	GO	GO	GO
							X	NONE	GO	GO	GO	GO	GO
	M U L T I P L E F A I L U R E S	X	X					00:00 TO 01:06	NO-GO	GO	NO-GO	NO-GO	NO-GO
			X	X				00:00 TO 04:21	GO NO-GO	GO	NO-GO	NO-GO	NO-GO
		X	X	X				00:00 TO 01:06	NO-GO	GO	NO-GO	NO-GO	NO-GO
			X		X			00:00 TO 01:06	GO NO-GO	GO	NO-GO	NO-GO	NO-GO
		X	X				X	00:00 TO 01:06	GO NO-GO	GO	NO-GO	NO-GO	NO-GO
				X	X			S-IC/S-II SEP	GO	GO	GO	GO	GO
				X			X	S-IC/S-II SEP	GO	GO	GO	GO	GO
					X		X	NONE	GO	GO	GO	GO	GO
				X	X		NONE	GO	GO	GO	GO	GO	
					X	X	11:43 TO INSR + 60	NO-GO	NO-GO	GO	GO	NO-GO	
X	X			X		00:00 TO 01:06	GO NO-GO	GO	NO-GO	NO-GO	NO-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.

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

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	GROUND INSTRUMENTATION REQUIREMENTS	GSFC/KSC/MSFN	4-13

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MISSION RULES

REV	ITEM	SITES FAILED						MANDATORY COVERAGE LOST	CAPABILITY LOST					
		ALDS TM 0:00 8:48	MIL/CAPE 0:00 8:48	GBM 1:06 9:35	BDA 4:29 11:03	ANG 6:48 14:10	VAN 9:42 14:59		TELEMETRY USB OR VHF	CMD	TRACK BOTH C AND S BAND	A/G USB	A/G USB AND VHF	
A	S I N G L E F A I L U R E	X						NOTE SEE NOTE 3	GO	N/A	N/A	N/A	N/A	
			X					00:00 TO 01:02	GO	GO	NO-GO	NO-GO	NO-GO	
				X					S-IC/S-II SEP SEE NOTE 1	GO	GO	GO	GO	GO
					X				NONE	GO	GO	GO	GO	GO
						X			NONE	GO	GO	GO	GO	GO
							X		NONE	GO	GO	GO	GO	GO
	M U L T I P L E F A I L U R E S	X	X						00:00 TO 01:02	NO-GO	GO	NO-GO	NO-GO	NO-GO
			X	X					00:00 TO 04:11	GO NO-GO	GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
		X	X	X					00:00 TO 01:02	GO NO-GO	GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
			X			X			00:00 TO 01:02	GO NO-GO	GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
		X	X				X		00:00 TO 01:02	GO NO-GO	GO	NO-GO NO-GO	NO-GO NO-GO	NO-GO NO-GO
				X		X			S-IC/S-II SEP	GO	GO	GO	GO	GO
				X			X		S-IC/S-II SEP	GO	GO	GO	GO	GO
						X	X		11:01 TO INSR + 60	NO-GO	NO-GO	GO	GO	NO-GO
			X	X			NONE	GO	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.

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

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	GROUND INSTRUMENTATION REQUIREMENTS	GSFC/KSC/MSFN	4-14

5 TRAJECTORY AND
GUIDANCE

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MISSION RULES

REV	ITEM				
	5-5	THE S/C CMC WILL BE NO-GO FOR ABORT MANEUVER DETERMINATION AND MONITORING FOR ANY OF THE FOLLOWING: A. CMC PROGRAM FAILURE. B. RTCC AND CMC T_{FF} DIFFERENCE OF >40 SEC. C. CONFIRMED ERROR IN S/C PLATFORM VELOCITY COMPONENTS OF > <u>50</u> FPS IN X OR <u>100</u> FPS IN Z. D. CMC TRAJECTORY SOURCE INDICATES "GO" OR "NO-GO" INCONSISTENT WITH BEST TRAJECTORY SOURCE(S) INDICATION.			
A	5-6	THE ORBIT IS "GO" IF $h_p \geq 75$ NM.			
		RULES 5-7 THROUGH 5-19 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	LAUNCH	5-2

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MISSION RULES

REV	ITEM					
	5-20	EARTH ORBITAL ALTITUDE CONSTRAINTS:				
		A. REAL-TIME MISSION PLANNING				
		PERIGEE - 85 NM MINIMUM. MAXIMUM, h_p IS DETERMINED BY SM RCS AVAILABLE FOR HYBRID DEORBIT.				
		B. CONTINGENCY				
		PERIGEE - 75 NM MINIMUM (VIOLATIONS WILL BE CORRECTED ASAP)				
		IF $h_p < 75$ NM AND MANEUVER TO RAISE h_p IS NOT POSSIBLE:				
		1. $40 < h_p < 75$ - EXECUTE SPS RETROGRADE ASAP UNTIL $h_p < 40$. IF NO SPS, USE SM-RCS.				
		2. $h_p < 40$ - CM/SM SEP - RETRO WILL RECOMMEND ENTRY PROFILE.				
A	5-21	THE CONTINGENCY SEPARATION MANEUVERS FOR THE CSM ARE:				
		A. IMPENDING S-IVB OR UNMANNED LM EXPLOSION - <u>55</u> FPS SPS ASAP (<u>7000</u> FT SEPARATION REQUIRED IN <u>200</u> SEC).				
		B. S-IVB ATTITUDE RATES ≥ 5 DEG/SEC - <u>5</u> FPS RCS ASAP.				
		C. S-IVB YAW ATTITUDE > 45 DEG - <u>5</u> FPS RCS ASAP.				
		D. CSM RETROFIRE REQUIRED WHILE ATTACHED TO THE S-IVB OR LM - SEPARATION 20 MINUTES PRIOR TO RETRO, 5 FPS RCS RETROGRADE WITH LINE ON HORIZON.				
A	5-22	S/C COMPUTER TIMING UPDATES ARE REQUIRED FOR SET ERRORS AS FOLLOWS:				
		A. CMC OR LGC $> .5$ SEC.				
		B. AGS > 2 SEC.				
		C. S/C L/O TIME (GRR) WILL BE UPDATED WITH SRO L/O TIME IF THE TWO ARE DIFFERENT BY 10 SEC.				
A	5-23	TIME BETWEEN EPO RETROFIRE GETI AND 400K MUST BE > 9 MIN. IF NOT, RETARGET FOR NEXT PTP.				
A	5-24	IF SPS RETROFIRE $\Delta T_B < 7$ SEC, USE SCS AUTO TVC.				
	5-25	PLANNED G&N AND SCS RETROFIRE MANEUVERS WILL BE UPDATED IF:				
		A. THE COMPUTED RETROFIRE POSITION CHANGES BY > 0.5 DEG LONGITUDE PRIOR TO GETI -30 MIN.				
		B. THE COMPUTED RETROFIRE POSITION CHANGES BY > 2 DEG LONGITUDE AFTER GETI -30 MIN.				
	5-26	IF A G&N FAILURE IS DETECTED PRIOR TO RETROFIRE, CREW USES SCS ΔV MODE WITH AN EMS ENTRY.				
MISSION		REV	DATE	SECTION	GROUP	PAGE
APOLLO 10		A	4/23/69	TRAJECTORY AND GUIDANCE	EARTH ORBIT AND TLI	5-3

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MISSION RULES

REV	ITEM				
A	5-27	<p>IF SPS FAILS AFTER EPO RETROFIRE IGNITION OR NO SLA SEP:</p> <p>A. $h_p > 75$ NM - RETARGET FOR NEXT BEST PTP USING RCS.</p> <p>B. $40 < h_p < 75$ - PITCH UP TO LOCAL HORIZONTAL ATTITUDE AND BURN SM RCS USING FOLLOWING PRIORITIES:</p> <ol style="list-style-type: none"> 1. BURN h_p TO PAD VALUE 2. BURN MAXIMUM SM RCS ΔV AVAILABLE 3. BURN CM RCS TO $h_p = 40$ NM IF SM RCS ΔV NOT SUFFICIENT TO OBTAIN $h_p = 40$ NM IF $h_p \leq 40$ NM TERMINATE ALL THRUSTING AT $T_{FF} = 7$ MIN. <p>C. $h_p < 40$ NM - REMAIN IN RETRO ATTITUDE AND BURN SM RCS USING THE FOLLOWING PRIORITY:</p> <ol style="list-style-type: none"> 1. BURN ΔV RESIDUALS. 2. BURN MAXIMUM SM ΔV AVAILABLE. <p style="text-align: center;"><u>NOTE</u></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 ΔV.</p>			
	5-28	<p>THE G&N IS NO-GO FOR ENTRY IF:</p> <p>A. THE CMC VALUE OF DOWNRANGE ERROR ($R_p - R_r$) AT .2G DIFFERS $> \pm 100$ NM FROM GROUND VALUE OR $> \pm 130$ 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 γ AT 400K ARE OUTSIDE THE CORRIDOR. GROUND WILL PROVIDE ENTRY PROFILE.</p>			
A	5-29	<p>IU TARGET AND NAVIGATION UPDATES:</p> <p>A. THERE WILL BE NO IU TARGET UPDATE FOR EITHER TLI OPPORTUNITY.</p> <p>B. AN IU NAVIGATION UPDATE WILL BE PERFORMED FOR TLI OPPORTUNITIES WHEN S-IVB GUIDANCE REFERENCE FAILURE OCCURRED PRIOR TO EARTH ORBIT INSERTION.</p>			
	5-30	THE CMC STATE VECTOR WILL BE UPDATED PRIOR TO TLI WITH THE BEST MSFN VECTOR.			
A	5-31	A PROPERLY OPERATING G&N (CMC + ISS + OSS) IS MANDATORY FOR TLI.			
	5-32	THE MAXIMUM ALLOWABLE MISALIGNMENT RATES BETWEEN THE IU AND IMU ARE <u>0.6</u> DEG/HR (IU) AND <u>1.5</u> DEG/HR (IMU).			
	5-33	THE S/C L/O RESFMAT WILL BE USED FOR BOTH TLI OPPORTUNITIES.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	EARTH ORBIT AND TLI	5-4

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MISSION RULES

REV	ITEM				
A 1 1 1 1	5-34	DISPERSED TLI C/O:			
		<p>A. PREDICTED END OF MISSION FUEL RESERVES (EOMFR) >500 FPS - CONTINUE MISSION AND EXECUTE MCC CONSISTENT WITH LUNAR ORBIT MISSION. (EOMFR INCLUDES T&D, BAP MCC₁, LOI₁, LOI₂, RENDEZVOUS RESCUE, AND TEI.)</p> <p>B. PREDICTED EOMFR <500 FPS AND:</p> <ol style="list-style-type: none"> 1. PREDICTED FUEL RESERVES AFTER T&D, BAP MCC₁, LOI₁, LOI₂, AND TEI (NO RENDEZVOUS RESCUE) >500 FPS - CONTINUE MISSION, EXECUTE MCC CONSISTENT WITH LUNAR ORBIT MISSION. (DPS LOI MAY BE CONSIDERED TO IMPROVE SPS ΔV CAPABILITY.) 2. PREDICTED FUEL RESERVES AFTER T&D, BAP MCC₁, LOI₁ (DPS), LOI₂, AND TEI (NO RENDEZVOUS RESCUE) <500 FPS, AND: <ul style="list-style-type: none"> (A) EOMFR AFTER LUNAR FLYBY (CSM AND LM) >5500 FPS (CSM ONLY), EXECUTE MCC FOR FLYBY MISSION. (B) EOMFR AFTER LUNAR FLYBY <5500 FPS, EXECUTE ALTERNATE MISSION CONSISTENT WITH FINAL MISSION PLANNING. 			
	5-35	DIFFERENCE IN CMC AND IU PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION:			
		<p>A. VIOLATION OF ANY OF THE FOLLOWING MEANS TLI IS NO-GO:</p> <p style="margin-left: 20px;">$\Delta V_{\dot{X}} > \underline{35}$ FPS</p> <p style="margin-left: 20px;">$\Delta V_{\dot{Y}} > \underline{66}$ FPS</p> <p style="margin-left: 20px;">$\Delta V_{\dot{Z}} > \underline{87}$ FPS</p> <p style="margin-left: 20px;">$\Delta V_T > \underline{33}$ FPS</p> <p>B. VIOLATION OF ANY OF THE FOLLOWING MEANS TLI IS TEMPORARILY NO-GO:</p> <p style="margin-left: 20px;">$7.4 < \Delta \dot{X} < \underline{35}$ FPS</p> <p style="margin-left: 20px;">$45 < \Delta \dot{Y} < \underline{66}$ FPS</p> <p style="margin-left: 20px;">$27 < \Delta \dot{Z} < \underline{87}$ FPS</p> <p style="margin-left: 20px;">$13 < \Delta T < \underline{33}$ FPS</p> <p style="margin-left: 40px;">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 style="margin-left: 20px;">$\Delta \alpha > \underline{19,300}$ FT</p> <p style="margin-left: 20px;">$\Delta \omega_{MAX} > \underline{32}$ FPS</p>			
A 1	5-36	DIFFERENCE IN MSFN AND IU DOWNRANGE POSITION (ΔR_V) >105,000 FT AT GET = 56 MIN MEANS TLI IS NO-GO.			
		RULES 5-37 THROUGH 5-45 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	EARTH ORBIT AND TLI	5-5

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MISSION RULES

REV	ITEM				
	5-46	THE CMC OR LGC WILL BE TEMPORARILY NO-GO FOR MANEUVER CONTROL FOR ANY OF THE FOLLOWING:			
		A. COMPUTER PROGRAM FAILURE.			
		B. CMC/IMU ALIGNMENT DISCREPANCY (FOR MANEUVER EXECUTION, MONITORING, AND ORBIT DETERMINATION).			
		1. SEXTANT STAR CHECK: AUTO OPTICS POSITIONING DOES NOT PLACE SELECTED STAR IN FIELD OF VISION OF SXT.			
		2. HORIZON CHECK ERROR $> \frac{1}{2}$ DEG FOR RETROFIRE FROM EPO.			
		C. LGC/IMU ALIGNMENT DISCREPANCY INDICATE BY > 2 DEG FROM PREDICTED COAS COORDINATES.			
		D. DIFFERENCE BETWEEN CMC/LGC GROUND NAV CHECK AFTER A NAV UPDATE FROM GROUND IS:			
		1. $\phi > .02$ DEG.			
		2. $\lambda > .02$ DEG.			
		3. $h > .2$ NM.			
A	5-47	MODE III, APOGEE KICK OR EPO RETROFIRE WILL BE COMPLETED BY MANUAL TAKEOVER FOR ATTITUDE EXCURSIONS OF ≥ 5 DEG.			
A	5-48	CRITICAL MANEUVERS WILL BE COMPLETED BY SCS (MTVC OR AUTO) OR AGS TAKEOVER FOR ANY OF THE FOLLOWING:			
		A. CSM OR STAGED LM			
		1. ATTITUDE EXCURSION ≥ 10 DEGREES			
		2. ATTITUDE RATES $\geq 10^\circ/\text{SEC}$			
		3. ATTITUDE ERRORS ≥ 10 DEGREES			
		B. UNSTAGED LM			
		1. ATTITUDE EXCURSIONS > 5 DEGREES			
		2. ATTITUDE RATES $\geq 5^\circ/\text{SEC}$			
		3. ATTITUDE ERRORS ≥ 5 DEGREES			
	5-49	NON-CRITICAL MANEUVERS WILL BE TERMINATED AFTER MANUAL TAKEOVER FOR:			
		A. ATTITUDE EXCURSIONS ≥ 10 DEG.			
		B. ATTITUDE RATES ≥ 10 DEG/SEC.			
		C. ATTITUDE ERRORS ≥ 10 DEG.			
A	5-50	GENERALLY, THE FOLLOWING MANEUVER RESIDUAL TRIMMING CRITERIA WILL APPLY:			
		A. DOCKED SPS - TRIMMED TO $\frac{1}{2}$ FPS IN X-AXIS ONLY (MCC ₁ , MCC ₂ , AND LOI ₁ ARE NOT TRIMMED).			
		B. DOCKED DPS WILL NOT BE TRIMMED.			
		C. ALL UNDOCKED MANEUVERS (BY EITHER VEHICLE) WILL BE TRIMMED TO WITHIN 0.2 FPS IN X-AXIS. Y AND Z-AXIS RESIDUALS WILL NOT BE TRIMMED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	MANEUVERS	5-6

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MISSION RULES

REV	ITEM				
A	5-51	<p>THE FOLLOWING MANEUVERS WILL BE MANUALLY TERMINATED AFTER VIOLATION OF THESE OVERBURN CRITERIA:</p> <p>A. TLI - <u>6</u> SEC</p> <p>B.1. LOI₁ - <u>10</u> SEC (SPS)</p> <p>2. LOI₁ - <u>TBD</u> SEC (DPS)</p> <p>C. LOI₂ - 1 SEC</p> <p>D. DOI - 2 SEC AND $\Delta V_{AGS} = 2$ FPS</p> <p>E.1. TEI - 2 SEC AND $\Delta V_C > 40$ FPS OVERBURN (SPS)</p> <p>2. TEI - 10 SEC AND $\Delta V_{AGS} > 10$ FPS OVERBURN (DPS)</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	MANEUVERS	5-7

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MISSION RULES

REV	ITEM					
	5-56	MIDCOURSE CORRECTION NOMINAL EXECUTION POINTS WILL BE AT THE FOLLOWING: A. TLI C/O +9 HRS (EARLIEST PLANNED MCC AT TLI C/O +4 HRS). B. TLI C/O +25 HRS. C. LOI -22 HRS. D. LOI ₁ -5 HRS.				
	5-57	TRANSLUNAR MCC EXECUTION CRITERIA A. MCC ₁ AND MCC ₂ WILL NOT BE EXECUTED AS LONG AS MCC ₃ REMAINS LESS THAN <u>25</u> EPS. NOTE: MCC ₃ ΔV >3 EPS ENABLES UTILIZATION OF SPS. B. MCC ₃ WILL BE EXECUTED ONLY IF LOI ₁ CANNOT BE TARGETED (WITHIN ALTITUDE AND APSIDAL SHIFT CONSTRAINTS) TO CORRECT THE TLC DISPERSIONS. C. MCC ₄ WILL BE EXECUTED ONLY IF LOI ₁ CANNOT BE TARGETED (WITHIN ALTITUDE CONSTRAINTS) TO CORRECT TLI DISPERSIONS.				
	5-58	THE G&N WILL BE THE PRIMARY MODE OF EXECUTING TRANSLUNAR MCC.				
	5-59	THE RESIDUALS OF MCC ₃ WILL BE TRIMMED TO 0.5 FPS IN ALL AXES. IF MCC ₄ IS EXECUTED, THE X-AXIS RESIDUAL WILL BE TRIMMED TO WITHIN 1.0 FPS.				
A	5-60	LOI SHALL BE TARGETED WITHIN THESE CONSTRAINTS: A. $60 > h_p > 50$ (LUNAR PARKING ORBIT). B. THE PERICYNTION OF THE APPROACH HYPERBOLA WILL BE MAINTAINED WITHIN 50 AND 70 NM. C. THE ALTITUDE OF THE NODE (BETWEEN THE APPROACH HYPERBOLA AND THE DESIRED LPO) WILL BE MAINTAINED BETWEEN 50 AND 75 NM.				
A	5-61	A "GO" FOR LOI REQUIRES THE FOLLOWING: A. COMMITMENT TO AT LEAST 4 HRS IN LPO - (PROVIDES ONE REV OF TRACK AFTER LOI ₁ FOR CALCULATION OF TEI). B. ADEQUATE FUEL REMAINING FOR SUBSEQUENT LUNAR ORBIT OPERATIONS (MINIMUM WOULD BE LOI ₂ AND TEI). C. $h_p > 50$ NM.				
A	5-62	PREMATURE LOI SHUTDOWN A. $\Delta V_M < 735$ FPS (100 SEC) - EXECUTE AN SPS 15 MIN DIRECT ABORT OR A DPS 2 HR DIRECT ABORT. B. $735 < \Delta V_M < 1280$ (100 TO 170 SEC) - EXECUTE AN SPS 15 MIN DIRECT ABORT OR A DPS TWO-IMPULSE CIRCUM-LUNAR ABORT. C. $\Delta V_M > 1280$ FPS (>170 SEC TO END OF BURN) - EXECUTE TEI (SPS OR DPS) AT NEXT PERICYNTION OR INITIATE AN ALTERNATE MISSION.				
	MISSION	REV	DATE	SECTION	GROUP	PAGE
	APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	TRANSLUNAR COAST	5-8

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MISSION RULES

REV	ITEM				
A 1	5-63	THE MAX ALLOWABLE MISS DISTANCE OVER THE LLS IS .5 OUT-OF-PLANE AND .5 DEG IN AZIMUTH. (NOTE: THE ALLOWABLE MISS DISTANCE IS AZIMUTH IS A FUNCTION OF THE LLS AND LAUNCH DAY.)			
	5-64	IF THE SPS FAILS AT IGNITION: A. MCC - RESCHEDULE MCC FOR FLYBY TRAJECTORY WITH DPS/SM-RCS EXECUTION. B. LOI ₁ - EXECUTE MCC ₅ ABORT MANEUVER WITH DPS/SM-RCS. C. LOI ₂ - EXECUTE GROUND COMPUTED TEI WITH DPS AS SOON AS PRACTICAL.			
		RULES 5-65 THROUGH 5-75 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	TRANSLUNAR COAST	5-9

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MISSION RULES

REV	ITEM				
	5-76	THE LOI ₂ MANEUVER WILL BE TARGETED TO MINIMIZE THE LLS MISS DISTANCE.			
	5-77	A "GO" FOR LOI ₂ REQUIRES COMMITMENT TO AT LEAST 4 HRS IN LUNAR ORBIT. (NOTE: THIS PROVIDES ONE FULL REV OF TRACK AFTER LOI ₂ FOR CALCULATION OF TEI.)			
A 1	5-78	ALL LUNAR ORBIT OPERATIONS WILL PRESERVE h_p NO LESS THAN 8 NM. VIOLATIONS WILL BE CORRECTED ASAP.			
		RULES 5-79 THROUGH 5-85 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	LUNAR ORBIT	5-10

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MISSION RULES

REV	ITEM					
A	5-86	<p>THE PGNC'S IS PRIME FOR CSI, CDH, AND TPI MANEUVER COMPUTATION/EXECUTION WITH THE AGS AS BACKUP UTILIZING THE ACCEPTED SOLUTION (EXCEPTION: CDH IS AGS CONTROLLED):</p> <p>A. THE AVAILABLE SOLUTIONS FOR CSI ARE: PGNC'S, CHARTS, AND GROUND. THE ORDER OF PRIORITY WILL BE:</p> <ol style="list-style-type: none"> 1. USE LARGEST SOLUTION (ΔV) IF NO GREATER THAN 2 FPS DIFFERENT FROM MIDDLE SOLUTION. 2. IF "1" ABOVE IS VIOLATED, USE MIDDLE SOLUTION +2 FPS. <p>B. THE AVAILABLE SOLUTIONS FOR CDH ARE: PGNC'S, CHARTS, CMC. THE ORDER OF PRIORITY WILL BE:</p> <ol style="list-style-type: none"> 1. COMPARE PGNC'S AND CMC. IF NO DIFFERENT THAN 2 FPS IN \dot{X} AND 6 FPS IN \dot{Z}, USE PGNC'S SOLUTION. 2. IF "1" ABOVE IS VIOLATED, COMPARE PGNC'S AND CHARTS WITH SAME CRITERIA. IF COMPARISON PASSES, USE PGNC'S 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: PGNC'S, CHARTS, AND CMC. THE ORDER OF PRIORITY WILL BE:</p> <ol style="list-style-type: none"> 1. COMPARE PGNC'S AND CMC. IF NO DIFFERENT THAN 2 FPS IN \dot{X}, 5 FPS IN \dot{Y}, OR 6 FPS IN \dot{Z}, USE THE PGNC'S SOLUTION. 2. IF "1" FAILS, COMPARE THE PGNC'S AND CHARTS, WITH SAME CRITERIA. IF COMPARISON PASSES, USE THE PGNC'S 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. 				
	5-87	<p>THE ORDER OF PRIORITY FOR THE TPI SOLUTION IS PGNC'S, LM ONBOARD CHARTS, CSM, AND GROUND. THE ONBOARD SOLUTION WILL NOT BE USED IF DIFFERENT FROM THE CSM BY:</p> <table border="0"> <tr> <td>A. $\Delta V_{GX} > 2$ FPS</td> <td>C. $\Delta V_{GZ} > 6$ FPS</td> </tr> <tr> <td>B. $\Delta V_{GY} > 5$ FPS</td> <td>D. $\Delta TIG \text{ TPI} > 2$ MIN</td> </tr> </table>	A. $\Delta V_{GX} > 2$ FPS	C. $\Delta V_{GZ} > 6$ FPS	B. $\Delta V_{GY} > 5$ FPS	D. $\Delta TIG \text{ TPI} > 2$ MIN
A. $\Delta V_{GX} > 2$ FPS	C. $\Delta V_{GZ} > 6$ FPS					
B. $\Delta V_{GY} > 5$ FPS	D. $\Delta TIG \text{ TPI} > 2$ MIN					
	5-88	<p>RENDEZVOUS PLANS SHALL, WHERE POSSIBLE, SATISFY THE FOLLOWING CONSTRAINTS:</p> <p>A. RENDEZVOUS MANEUVERS MUST BE AT LEAST <u>25</u> MIN APART.</p> <p>B. THE ALLOWABLE SLIP TIME FOR TPI IS <u>± 15</u> MIN FROM MPD.</p> <p>C. THE ΔH FOR TPI WILL BE <u>15 ± 5</u> NM.</p>				
	5-89	<p>THE GROUND WILL BE RESPONSIBLE FOR ALL MANEUVERS PRIOR TO CSI.</p> <p>(NOTE: GROUND WILL COMPUTE CSI, CDH, AND TPI BUT WILL NOT PASS THESE MANEUVERS UNLESS REQUESTED.)</p>				
	5-90	<p>PHASING AND INSERTION WILL BE TARGETED TO PRESERVE THE NOMINAL RENDEZVOUS.</p>				
	5-91	<p>ALL MANEUVERS WILL BE TRIMMED TO <u>0.2</u> FPS IN THE X-AXIS. Y AND Z-AXIS RESIDUALS WILL NOT BE TRIMMED.</p> <p>(NOTE: THIS INCLUDES NOMINAL AND/OR RESCUE MANEUVERS.)</p>				
MISSION	REV	DATE	SECTION	GROUP	PAGE	
APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	RENDEZVOUS	5-11	

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MISSION RULES

REV	ITEM				
A	5-92	<p>THE FOLLOWING RENDEZVOUS OPTIONS AND RESCUE MODES WILL BE UTILIZED AS NECESSARY FOR FAILURES REQUIRING TERMINATION OF THE NOMINAL RENDEZVOUS:</p> <p>A. DOI FAILURES</p> <p>1. UNDERBURN</p> <p>(A) ATTEMPT TO COMPLETE (B) DPS FAILURE - PDI ABORT AT PC (APS ONLY PROFILE) (C) PGNC S FAILURE - DIRECT RETURN</p> <p>2. OVERBURN</p> <p>(A) OVERBURN \leq 12 FPS, NULL RESIDUALS (B) OVERBURN \geq 12 FPS, DIRECT RETURN (C) PGNC S FAILURE - DIRECT RETURN</p> <p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">THE PGNC S, AGS, OR RR IS "GO" IF AGREEMENT WITH EITHER OF THE OTHER SOURCES IS WITHIN 2 FPS.</p> <p style="text-align: center;">PGNC S FAIL - DIRECT RETURN AGS FAIL - CONTINUE MISSION RR FAIL - CONTINUE MISSION</p> <p>B. FOR FAILURES FROM DOI + 10 MIN TO PERICYNTHION THAT REQUIRE DEVIATION FROM THE NOMINAL, THE FIVE-IMPULSE PDI ABORT SEQUENCE WILL BE INITIATED. DOCKING WILL OCCUR 2 HOURS EARLIER THAN NOMINAL.</p> <p>C. FOR DPS FAILURES FROM DOI C/O UNTIL THE V_{GO} OF THE PHASING MANEUVER IS 25 FPS, THE LM WILL STAGE AND COMPLETE THE BURN WITH THE APS. IF V_{GO} IS LESS THAN 25 FPS, THE LM WILL STAGE AND COMPLETE THE BURN WITH THE RCS. (NOTE: IF V_{GO} < 5 FPS, LM WILL COMPLETE BURN VIA RCS - NO STAGING.)</p> <p>D. FOR DPS FAILURES FOLLOWED BY APS FAILURES DURING PHASING, THE LM WILL TAKE NO FURTHER ACTION UNLESS V_M OF PHASING < 40 FPS. IF V_M IS LESS THAN 40, THE LM WILL UTILIZE RCS TO ACHIEVE 40 FPS. THE CSM WILL INITIATE A FIVE-IMPULSE RESCUE WITH DOCKING OCCURRING AT THE NOMINAL TIME.</p> <p>E. FOR COMPLETE LM FAILURES FOLLOWING DOI BUT PRIOR TO PHASING IGNITION, THE CSM WILL INITIATE THE FIVE-IMPULSE (R₂) RESCUE SEQUENCE WITH DOCKING OCCURRING 2 HOURS LATE.</p> <p>F. FOR CASES WHICH MAKE THE LM NO-GO FOR INSERTION, FOR NO APS IGNITION AT INSERTION, OR FOR V_M < 45 AND APS FAILURE, THE CSM WILL EXECUTE THE "ZERO INSERTION" BACKUP MANEUVER. THE CSM WILL ALSO EXECUTE CSI AND CDH WHILE EITHER VEHICLE MAY EXECUTE TERMINAL PHASE. (IF THE APS FAILS WITH V_M < 45 FPS, THE LM WILL UTILIZE THE RCS TO TRIM THE MANEUVER BACK TO ZERO.) DOCKING OCCURS AT THE NOMINAL TIME.</p> <p>G. FOR APS FAILURES DURING INSERTION WHERE V_M > 45 AND V_{GO} > 80, THE CSM WILL INITIATE A FIVE-IMPULSE RESCUE. DOCKING WILL OCCUR 2 HOURS LATE WITH EITHER VEHICLE EXECUTING TERMINAL PHASE. (IF V_G < 80 FPS, THE LM WILL UTILIZE THE RCS TO COMPLETE THE MANEUVER.)</p> <p>H. FOR LM FAILURES FOLLOWING INSERTION, THE CSM WILL EXECUTE ANY OR ALL OF THE CFP SEQUENCE UTILIZING THE MIRROR IMAGE TARGETING.</p> <p>RULES 5-93 THROUGH 5-99 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	RENDEZVOUS	5-12

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MISSION RULES

REV	ITEM				
	5-100	TRANSEARTH MCC WILL BE TARGETED TO ACHIEVE ENTRY CONDITIONS AS FOLLOWS:			
		A. IF $V_{EI} > 30000$ FPS USE STEEP TARGET LINE.			
		B. IF $V_{EI} < 30000$ FPS AND G&N GO, USE SHALLOW TARGET LINE.			
	5-101	TRANSEARTH MCC PHILOSOPHY.			
		A. TEC MCC WILL NOT USE LANDING POINT CONTROL UNLESS THE LANDING POINT IS UNACCEPTABLE.			
		B. IF γ_{EI} IS OUTSIDE THE ENTRY CORRIDOR, EXECUTE MCC ASAP (EXCEPTION: MCC ₅ ONLY).			
		C. THE LAST MCC WILL BE SCHEDULED NO LATER THAN EI-3 HOURS.			
		D. THE G&N WILL BE THE PRIMARY MODE OF EXECUTION FOR ALL TEC MCC.			
		E. MCC > 10 FPS WILL USE THE SPS IF PRACTICAL.			
		F. THE RESIDUALS FOR MCC'S WILL BE TRIMMED TO WITHIN 0.2 FPS IN EACH AXIS.			
	5-102	TEC MCC FOR LANDING AREA CONTROL:			
		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.			
		B. ATER EI-24 HRS: WILL NOT BE EXECUTED			
	5-103	ENTRY CONDITIONS WILL BE CONTROLLED TO AVOID HEAT SHIELD LIMITATIONS.			
	5-104	BACKUP ENTRY IS CONSTRAINED AS FOLLOWS:			
		A. THE CONSTANT G ENTRY MUST FALL BETWEEN <u>3</u> AND <u>5</u> G'S.			
		B. EMS RANGING WILL NOT BE ATTEMPTED UNTIL $V < 25500$ FPS			
	5-105	WEATHER AVOIDANCE WITH AERODYNAMIC LIFT WILL NOT BE ATTEMPTED UNLESS THE G&N IS OPERATIONAL, OR EMS-INDICATED VELOCITY < 25500 FPS.			
	5-106	PREDICTED ENTRY CORRIDOR VIOLATION AFTER THE LAST MCC OPPORTUNITY:			
		A. UNDERSHOOT LINE EXCEEDED: GROUND ADVISE CREW TO FLY FULL LIFT UNTIL PEAK G IS PASSED, THEN FLY G&N.			
		B. OVERSHOOT LINE EXCEEDED: GROUND ADVISE CREW TO FLY NEGATIVE LIFT TO 2 G'S FOLLOWED BY 4 G CONSTANT ENTRY.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	TRAJECTORY AND GUIDANCE	TRANSEARTH & ENTRY	5-13

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MISSION RULES

REV	ITEM			
	5-107	IF THE EMS INDICATES A SKIP CONDITION, NEGATIVE LIFT SHOULD BE ACHIEVED PRIOR TO VERIFYING THE EMS WITH CROSS CHECKS.		
	5-108	IF THE EMS INDICATES AN UNDERSHOOT CONDITION EXISTS, FULL LIFT SHOULD BE ACHIEVED PRIOR TO VERIFYING THE EMS WITH CROSS CHECKS.		
A	5-109	<p>THE G&N IS NO-GO DURING ENTRY IF:</p> <p>A. P65 VALUE OF V_L AND D_L ARE OUTSIDE THE TOLERANCE SPECIFIED BY GROUND DERIVED VALUES.</p> <p>B. CAUSES TRAJECTORY TO VIOLATE THE OFFSET LIMITS (SKIP) ON EMS SCROLL.</p> <p>C. CAUSES TRAJECTORY TO VIOLATE THE ONSET LIMITS (G) ON EMS SCROLL.</p> <p>D. IF THE G&N TRIM ATTITUDES AT CM/SM SEP DIFFER FROM THE HORIZON MONITOR ATTITUDE BY >5 DEG.</p> <p>E. IF THE G&N TRIM ATTITUDES AT .05 G DIFFERS FROM THE GROUND VALUES BY >5 DEG.</p> <p>F. IF THE CMC FAILS TO SEQUENCE FROM P63 TO P64 AT RET .05 G \pm 5 SEC.</p>		
		RULE NUMBERS 5-110 THROUGH 5-120 ARE RESERVED.		
MISSION	REV	DATE	SECTION	PAGE
APOLLO 10	A	4/23/69	TRAJECTORY AND GUIDANCE	5-14

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MISSION RULES

REV	ITEM				
		<u>GENERAL:</u>			
	5-121	RANGE SAFETY POLICIES AND CRITERIA ARE SPECIFIED IN AFETR MANUAL (AFETRM) 127-1 DATED JANUARY 1, 1969. THE FOLLOWING MISSION RULES CONCERNING SPECIFIC ETR/NASA INTERFACE SUPPLEMENT AFETRM 127-1.			
	5-122	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.			
	5-123	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 FIDO-RSO PRIVATE LINE WITH THE FLIGHT DIRECTOR LOOP AS BACKUP.			
	5-124	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 APOLLO-RSO LOOP, WITH THE FIDO-RSO PRIVATE LINE AS BACKUP.			
	5-125	THE FD WILL INFORM THE RSO WHEN THE NO. 3 OR NO. 4 ENGINE HAS SHUT DOWN BY STATING "RSO, NO. 3 OUT (NO. 4 OUT)" AND/OR ACTIVATE THE ENGINE OUT LIGHT ON THE RSO CONSOLE.			
	5-126	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.			
	5-127	IF AN ESTABLISHED IMPACT PREDICTION (IP) POINT IS ON THE CAPE KENNEDY LAND AREA, "DESTRUCT/PD" WILL BE TRANSMITTED.			
	5-128	IF AN ATTEMPT TO TERMINATE THRUST BY "ARM/MFCO" IS UNSUCCESSFUL WHILE THE IP IS ON THE CAPE KENNEDY LAND AREA, "DESTRUCT/PD" WILL BE SENT.			
	5-129	WHEN THE IP HAS MOVED OFF THE CAPE, FLIGHT TERMINATION ACTION WILL BE LIMITED TO "ARM/MFCO" OR CREW INITIATED ABORT. THE "DESTRUCT/PD" FUNCTION WILL BE SENT ONLY AFTER FD/FIDO CONFIRMATION OF SATISFACTORY SPACECRAFT SEPARATION, AND ONLY IF FUEL DISPERSION IS NECESSARY.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-15

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MISSION RULES

REV	ITEM				
5-130	IF AN IP POINT IS ESTABLISHED AND "DESTRUCT/PD" IS DEEMED UNNECESSARY, THE RSO WILL NOTIFY FD/FIDO AND SEND "SAFE" UPON FD/FIDO'S REQUEST.				
5-131	FD/FIDO WILL DECLARE TO THE RSO WHEN THERE IS NO POSSIBILITY OF INSERTING THE SPACECRAFT INTO AN ORBIT, AND THE RSO WILL NOT ALLOW THE AFRICAN GATE TO BE OVERFLOWN.				
5-132	AN ETR RANGE SAFETY OFFICER (BRSO) IS REQUIRED AT BERMUDA TO MONITOR PRESENT POSITION AND IMPACT PREDICTION CHARTS, TO OBSERVE TELEMETRY DISPLAYS, AND TO TRANSMIT THE RANGE SAFETY FUNCTIONS WHEN COMMANDED TO DO SO BY THE RSO. FOR FLIGHT AZIMUTHS LESS THAN 90 DEGREES, THE BRSO WILL ASSUME RANGE SAFETY RESPONSIBILITY IN THE EVENT OF LOSS OF COMMUNICATIONS BETWEEN THE BRSO AND THE RSO.				
5-133	SAFING BY THE RSO WILL BE TRANSMITTED AFTER GATE PENETRATION IF THE RSO HAS VERIFICATION OF S-IVB C/O OR THE FD/FIDO REQUESTS "SAFE." WHEN SAFING IS CONFIRMED, THE RSO WILL STATE TO THE FD/FIDO "SAFING CONFIRMED."				
5-134	IF SAFING CANNOT BE CONFIRMED BY THE RSO, ANOTHER SAFING ATTEMPT WILL BE MADE BY THE RSO ON THE FIRST ORBITAL PASS OVER THE CAPE. COORDINATION WILL BE EFFECTED WITH THE SUPERINTENDENT OF RANGE OPERATIONS (SRO) AND FIDO TO ENSURE COMMAND COVERAGE, NON-INTERFERENCE WITH OTHER COMMAND FUNCTIONS, AND TELEMETRY DISPLAY AVAILABILITY. AT THE AGREED TIME, FIDO WILL STATE, "COMMAND CLEAR, RSO SEND SAFE." UPON CONFIRMATION, THE RSO WILL STATE, "SAFING CONFIRMED."				
	<u>TRACKING SOURCES:</u>				
5-135	AT LEAST TWO VEHICLE POSITION DATA SOURCES ARE MANDATORY BEFORE LAUNCH FOR EACH PHASE OF POWERED FLIGHT TO ENABLE THE RANGE SAFETY OFFICER TO DETERMINE IF THE SPACE VEHICLE IS NORMAL OR VIOLATES ESTABLISHED INFLIGHT SAFETY CRITERIA.				
5-136	DATA FROM TWO OF THE FOLLOWING THREE RADARS ARE MANDATORY BEFORE LAUNCH (OTHER HIGHLY DESIRABLE): BERMUDA FPS-16, BERMUDA FPQ-6, AND GRAND TURK TPQ-18.				
5-137	XY, XZ, AND IP PLOTS AT BERMUDA (BDA) USING INPUTS FROM EITHER THE BDA FPS-16 OR BDA FPQ-6 RADAR ARE <u>HIGHLY DESIRABLE</u> FOR LAUNCH.				
5-138	DDOP DATA TO THE CAPE KENNEDY REAL-TIME COMPUTER SYSTEM (RTCS) FOR IP COMPUTATION AND RSO DISPLAY DURING FIRST STAGE BURN ARE <u>HIGHLY DESIRABLE</u> .				
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-16

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MISSION RULES

REV	ITEM				
		<u>AIRBORNE SYSTEMS:</u>			
	5-139	TWO OPERATIONAL RANGE SAFETY COMMAND RECEIVERS ON EACH LAUNCH VEHICLE STAGE (S-IC, S-II, AND S-IVB) ARE MANDATORY FOR LAUNCH. THE RANGE SAFETY SUPERVISOR (CRSS) AT THE LAUNCH CONTROL CENTER WILL DETERMINE IF THE RECEIVERS ARE OPERATING PROPERLY FOR LAUNCH.			
	5-140	ONE OF TWO IU C-BAND BEACONS IS <u>MANDATORY</u> FOR LAUNCH FOR FLIGHT AZIMUTHS 72 TO 90 DEGREES (OTHER HIGHLY DESIRABLE). BEACON NO. 1 IS <u>MANDATORY</u> FOR LAUNCH FOR FLIGHT AZIMUTHS GREATER THAN 90 DEGREES.			
		<u>COMMAND/CONTROL:</u>			
	5-141	WHEN BERMUDA COMMAND COVERAGE IS REQUIRED, THE NASA BERMUDA DRS COMMAND/CONTROL SYSTEM IS <u>MANDATORY</u> FOR LAUNCH.			
	5-142	RANGE SAFETY COMMANDS ("ARM/MFCO" AND "DESTRUCT/PD") WILL HAVE <u>MANDATORY</u> PRECEDENCE OVER ALL OTHER COMMANDS. TIMERS IN THE RCC WILL PROVIDE A 4-SECOND TIME DELAY BETWEEN "ARM/MFCO" AND "DESTRUCT/PD."			
		<u>COMMUNICATIONS:</u>			
	5-143	TWO PRIVATE, INDEPENDENT, GEOGRAPHICALLY DIVERSIFIED COMMUNICATIONS LINKS BETWEEN THE RSO AND BRSO ARE REQUIRED. ONE OF TWO COMM LINKS IS <u>MANDATORY</u> .			
	5-144	TWO OF THE FOLLOWING THREE COMMUNICATIONS LINKS ARE <u>MANDATORY</u> BETWEEN THE RSO AND FD/FIDO:			
		A. RSO LOOP (CAPE 111)			
		B. RSO PRIVATE LINE			
		C. FLIGHT DIRECTOR LOOP			
	5-145	A COMMUNICATIONS LINK BETWEEN THE RSO AND THE RANGE SAFETY SUPERVISOR (CRSS) AT THE LAUNCH CONTROL CENTER IS <u>MANDATORY</u> .			
	5-146	A DIRECT LINE COMMUNICATIONS LINK BETWEEN THE RSO AND THE LAUNCH VEHICLE TEST CONDUCTOR (CLTC) IS <u>HIGHLY DESIRABLE</u> .			
		<u>TELEMETRY:</u>			
	5-147	IU TELEMETRY DATA (ONBOARD GUIDANCE PARAMETERS) TO THE RTCS ARE HIGHLY DESIRABLE) FROM T+0 UNTIL S-IVB CUTOFF FOR IP COMPUTATION AND RSO DISPLAY.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-17

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MISSION RULES

REV	ITEM				
		<u>TELEMETRY:</u>			
5-148		TELEMETRY REQUIREMENTS TO BE DISPLAYED FOR THE RSO AND THE BRSO ARE <u>HIGHLY DESIRABLE</u> .			
		A. FOR RSO DISPLAY: SEE ATCH NO. 1			
		B. FOR BRSO DISPLAY: SEE ATCH NO. 2			
		<u>RANGE SAFETY WEATHER RESTRICTIONS:</u>			
5-149		<u>WIND RESTRICTIONS:</u>			
		AN ANNUAL PROFILE WIND RESTRICTION OF 1.25 SIGMA (11%) WILL BE IN EFFECT FOR THE LAUNCH AREA.			
5-150		<u>CEILING AND VISIBILITY RESTRICTIONS:</u>			
		PAD 39A: 2000 FEET/11.5 MILES FROM RADAR 19.18			
		PAD 39B: 2000 FEET/12.5 MILES FROM RADAR 19.18			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	TRAJECTORY AND GUIDANCE	RANGE SAFETY	5-18

6 SLV - TB1 THROUGH
TB4/TB4A (LAUNCH)

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MISSION RULES

REV	ITEM				
		<p><u>BSE GENERAL RULES</u> (THESE RULES SUPPLEMENT ALL BSE RULES)</p> <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. INSUFFICIENT CONSUMABLES TO ASSURE A 1 SIGMA PROBABILITY OF GUIDANCE CUTOFF, OR 3. ANY CONDITION/MALFUNCTION(S) FOR WHICH A GUIDANCE CUTOFF WILL DEFINITELY NOT BE ACHIEVED. CONDITIONS LEADING ONLY TO A FAILURE TO RESTART WILL NOT BE CONSIDERED. <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 DURING LAUNCH PHASE WILL BE RECOMMENDED FOR THE FOLLOWING:</p> <ol style="list-style-type: none"> 6-1 S-IC LOSS OF THRUST 6-7 S-II LOSS OF THRUST 6-8 S-II GIMBAL SYSTEM FAILURE - ACTUATOR HARDOVER INBOARD 6-9 S-II SECOND PLANE SEPARATION FAILS TO OCCUR AT TB3 + 31 SEC 6-10 S-IVB LOSS OF HYDRAULIC FLUID 6-11 S-IVB 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 <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 (AFTER S-IVB TO ORBIT CAPABILITY) <p>K. SPACECRAFT SEPARATION OR TLI INHIBIT PRIOR TO RESTART WILL BE RECOMMENDED FOR THE FOLLOWING:</p> <ol style="list-style-type: none"> 7-1 INSUFFICIENT PROPELLANTS REMAIN FOR TLI GUIDANCE CUTOFF *7-11 TIME BASE 5 OR TIME BASE 7 FAILS TO INITIATE AT S-IVB CUTOFF 7-8 LOSS OF ATTITUDE CONTROL 7-16 J-2 ENGINE CONTROL BOTTLE PRESSURE LESS THAN 400 PSIA 8-1 INERTIAL PLATFORM FAILURE - ACCELEROMETER 8-6 S-IVB ACTUATOR CONFIRMED HARDOVER PRIOR TO RESTART 7-22 S-IVB LOSS OF ENGINE HYDRAULIC FLUID 8-8 LOSS OF ATTITUDE CONTROL DURING SECOND BURN 8-5 S-IVB LH₂ TANK ULLAGE PRESSURE LESS THAN 25 PSIA PRIOR TO SECOND BURN 			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB1 THROUGH TB4/TB4A	BSE GENERAL RULES	6-1

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MISSION RULES

REV	ITEM				
		<p>L. SPACECRAFT SEPARATION OR TLI INHIBIT PRIOR TO RESTART WILL BE RECOMMENDED UNLESS COMMAND ACTION IS SUCCESSFUL FOR THE FOLLOWING:</p> <p>7-4 J-2 ENGINE MAIN OXIDIZER VALVE FAILS TO CLOSE AT S-IVB CUTOFF 7-5 FAILURE OF THE RANGE SAFETY SYSTEM AFTER INSERTION *7-6 S-IVB COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE 7-9 S-IVB 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 S-IVB COLD HELIUM SPHERE PRESSURE LOW 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 7-19 LOW LOX TANK ULLAGE PRESSURE</p> <p>M. 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>*EMERGENCY SEPARATION REQUIRED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB1 THROUGH TB4/TB4A	BSE GENERAL RULES	6-2

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MISSION RULES

REV	ITEM				
		<u>SUMMARY OF LAUNCH PHASE RULES</u>			
		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 - ACTUATOR INBOARD		
		6-9	S-II SECOND PLANE SEPARATION 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			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB1 THROUGH TB4/TB4A		6-3

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	6-1	S-IC STAGE LOSS OF THRUST				
		A. ANY SINGLE ENGINE PRIOR TO TB3	LAUNCH	A. <u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND FIDO.	A&B. <u>CUES</u> : 1. THRUST OK SWITCHES OFF (K33-115, K34-115, K35-115, K36-115, K37-115, K38-115, K39-115, K40-115, K41-115, K42-115, K43-115, K44-115, K45-115, K46-115, K47-115).	
		B. ANY TWO OR MORE ENGINES	LAUNCH	B. <u>CONTINUE MISSION</u> BSE INFORM FLIGHT.	2. THRUST CHAMBER PRESSURE <500 PSIA (D8-101 THROUGH D8-105). 3. LONGITUDINAL ACCELERATION - ZERO (A2-603). 4. FINAL THRUST OK CUTOFF - ON (K52-115 THROUGH K56-115).	
		1. PRIOR TO DEACTIVATION OF TWO ENGINES AUTO ABORT		1. <u>ABORT</u> BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST.		
		2. AFTER DEACTIVATION OF TWO ENGINES AUTO ABORT		2. <u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF POTENTIAL OVERRATE CONDITION.		
		C. LOSS OF THRUST - ENGINE 3 OR 4 (THIS RULE APPLIES ONLY FOR THE UNIQUE CASE OF ENGINE 3 OR 4 THRUST LOSS BETWEEN 0 TO 45 SEC)	LAUNCH	C. <u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND FIDO. FLIGHT INFORM RSO.	A&B. <u>NOTE</u> : CREW MAY DEACTIVATE AUTOMATIC ABORT AFTER TB1 + 120 SEC.	
		1. VOICE COMM WITH RSO		1.(A) FLIGHT CONFIRM ENGINE 3 OR 4 OUT VIA RSO PRIVATE LINE. (B) FLIGHT CONFIRM NO OTHER KNOWN ANOMALIES BY <u>LITE ACTIVATION</u> AND VOICE REPORT.	C. <u>CUES</u> : 1. THRUST CHAMBER PRESSURE LESS THAN 500 PSIA (D8-103, D8-104). 2. ENGINE 3 THRUST OK SWITCHES OFF (K39-115, K40-115, K41-115, K42-115, K43-115, K44-115). 3. ENGINE 3 OR 4 FINAL THRUST OK CUTOFF (K54-115, K55-115).	
		2. NO VOICE COMM WITH RSO		2. FLIGHT CONFIRM ENGINE 3 OR 4 OUT AND NO OTHER KNOWN ANOMALIES BY <u>LITE ACTIVATION</u> .	C. <u>NOTES</u> : 1. RSO LOOP 111 OR FD LOOP BACKUP TO PL. 2. CONFIRMATION OF NO OTHER KNOWN ANOMALIES WILL BE BASED ON: (A) ENGINE CHAMBER PRESSURE ABOVE 500 PSIA AND HOLDING (B) THRUST OK SWITCHES ON.	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB1 THROUGH TB4/TB4A			6-4

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	6-2	LOSS OF ATTITUDE CONTROL A. S-IC BURN	LAUNCH	A. <u>LAUNCH VEHICLE ABORT</u> BSE INFORM FLIGHT AND FIDO. CAPCOM INFORM CREW OF LOSS OF ATTITUDE CONTROL. CREW WILL ABORT ON LIMITS (NOTE A.1.).	A. <u>CUES:</u> 1. ANGULAR RATES - PITCH (R4-602, R13-602) OR YAW (R5-602, R8-602) GREATER THAN 2 DEG/ SEC AND NOT DECREAS- ING. 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 A.1. 3. LOSS OF ATTITUDE CON- TROL ALERT (SEE NOTE A.2).. A. <u>NOTES:</u> 1. CREW ABORT LIMITS: (A) PITCH AND YAW RATE ± 4 DEG/SEC (B) ROLL RATE ± 20 DEG/SEC (C) PITCH, YAW, OR ROLL ERROR ± 5 DEG AND Q-BALL $\Delta P \pm 3.2$ PSID 2. LOSS OF ATTITUDE CON- TROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS: (A) LVDC/LVDA COM- PUTATIONAL FAILURE (B) ATTITUDE ERROR SIGNALS $> \pm 5$ DEG (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE (D) S-IC ENGINE ACTUATOR HARDOVER $> \pm 5$ DEG	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB1 THROUGH TB4/TB4A			6-5

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	6-2 (CONT'D)	B. S-II BURN	LAUNCH	B. <u>LAUNCH VEHICLE ABORT</u> BSE INFORM FLIGHT AND FIDO. CAPCOM INFORM CREW OF LOSS OF ATTITUDE CONTROL. CREW WILL ABORT ON LIMITS (NOTE B.1):	B. <u>CUES:</u> 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 B.1. 3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE B.2): B. <u>NOTES:</u> 1. CREW ABORT LIMITS: (A) PITCH AND YAW RATE ± 10 DEG/SEC (B) ROLL RATE ± 20 DEG/SEC 2. LOSS OF ATTITUDE CON- TROL ALERT WILL BE GIVEN FOR THE FOLLOW- ING CONDITIONS: (A) LVDC/LVDA COM- PUTATIONAL FAILURE (B) ATTITUDE ERROR SIGNALS $> \pm 5$ DEG (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE 3. LOSS OF ATTITUDE CON- TROL ALERT WILL BE GIVEN DURING S-II BURN FOR S-IVB ENGINE ACTUATOR HARDOVER ± 5 DEG	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB1 THROUGH TB4/TB4A			6-6

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	6-2 (CONT'D)	C. S-IVB BURN	LAUNCH	C. <u>LAUNCH VEHICLE ABORT</u> BSE INFORM FLIGHT AND FIDO. CAPCOM INFORM CREW OF LOSS OF ATTITUDE CONTROL. CREW WILL ABORT ON LIMITS (NOTE C.1):	C. <u>CUES:</u> 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 CON- TROL ALERT (SEE NOTE C.2): C. <u>NOTES:</u> 1. CREW ABORT LIMITS: (A) PITCH AND YAW RATE ± 10 DEG/SEC (B) ROLL RATE ± 20 DEG/SEC 2. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS: (A) LVDC/LVDA COM- PUTATIONAL FAILURE (B) ATTITUDE ERROR SIGNALS: ROLL > ± 3.5 DEG, PITCH AND YAW > ± 5 DEG. (C) FAILURE TO INI- TIATE PROPER GUIDANCE SEQUENCE	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB1 THROUGH TB4/TB4A			6-7

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	6-7	<p>S-II LOSS OF THRUST</p> <p>A. ANY SINGLE ENGINE-FAILURE TO ATTAIN THRUST OR LOSS OF THRUST PRIOR TO NOMINAL S-II CUTOFF</p> <p>B. ANY TWO ENGINES-FAILURE TO ATTAIN THRUST OR LOSS OF THRUST:</p> <ol style="list-style-type: none"> 1. VEHICLE CONTROLLING 2. IF ANGULAR RATES EXCEED 9.5 DEG/SEC OR THE DIFFERENCE IN COMMANDED ANGLES AND GIMBAL ANGLES EXCEEDS 40 DEG IN PITCH OR YAW <p>C. THREE OR MORE ENGINES OUT</p> <ol style="list-style-type: none"> 1. PRIOR TO S-IVB TO ORBIT CAPABILITY 2. AFTER S-IVB TO ORBIT CAPABILITY BUT PRIOR TO LOW LEVEL SENSE ARM 3. AFTER LOW LEVEL SENSE ARM <p>(A) THREE OR FOUR ENGINES OUT</p> <p>(B) ALL ENGINES OUT</p>	LAUNCH	<p>A. <u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND FIDO.</p> <p>B.1. <u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND FIDO.</p> <p>2. <u>ABORT</u> BSE INFORM FLIGHT AND FIDO AND TRANSMIT ABORT REQUEST.</p> <p>C. <u>ABORT/EARLY STAGE/CONTINUE MISSION</u></p> <ol style="list-style-type: none"> 1. <u>ABORT</u> BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST. 2. <u>EARLY STAGE</u> BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING. 3. BSE INFORM FLIGHT AND FIDO. <p>(A) <u>EARLY STAGE</u> BSE RECOMMEND EARLY STAGE.</p> <p>(B) <u>CONTINUE MISSION</u></p>	<p>CUES:</p> <p>A.1. THRUST OK SWITCHES OFF (K285-201 THROUGH 205, K286-201 THROUGH 205):</p> <p>2. THRUST CHAMBER PRESSURE ZERO (D13-201 THROUGH 205):</p> <p>3. LONGITUDINAL ACCELERATION (A2-603):</p> <p>B.1. TWO ENGINES OUT (CUES A.1, A.2, A.3):</p> <p>2. ANGULAR RATES PITCH OR YAW EXCEED 9.5 DEG/SEC (R4-602, R13-602, R5-602, R8-602):</p> <p>3. COMMANDED ANGLES AND GIMBAL ANGLES (H60-603) CHANGING AT THE RATES GIVEN IN CUE B.2.</p> <p>C.1. THREE OR MORE ENGINES OUT (CUES A.1, A.2, A.3):</p>	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB1 THROUGH TB4/TB4A			6-9

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	6-8	S-II STAGE GIMBAL SYSTEM FAILURE ANY SINGLE ACTUATOR HARDOVER (INBOARD)	LAUNCH	ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST.	<p><u>CUES:</u></p> <ol style="list-style-type: none"> 1. YAW ACTUATOR POSITION EXCEEDS + 6 DEG (G8-201 THROUGH 204) (G30-201 THROUGH 204). 2. PITCH ACTUATOR POSITION EXCEEDS + 6 DEG (G9-201 THROUGH 204) (G31-201 THROUGH 204). 3. ADJACENT CONTROL ENGINE ACTUATOR IN SAME PLANE MOVES 4-1/2 DEG INBOARD (SAME MEASUREMENTS AS CUES 1 AND 2). <p><u>NOTE:</u></p> <p>CREW SHOULD ABORT AS SOON AS POSSIBLE AFTER MALFUNCTION OCCURS TO PRECLUDE EXCESSIVE THERMAL PROBLEMS IN THE AFT INTERSTAGE.</p>	
	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 + 52 SEC.	<p><u>CUES:</u></p> <ol style="list-style-type: none"> 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). <p><u>NOTES:</u></p> <ol style="list-style-type: none"> 1. MANUAL ABORT BY CREW WITH ONBOARD INDICATION. 2. PROBABLE SUBSEQUENT LOSS OF VEHICLE DUE TO EXCESSIVE TEMPERATURE. 	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB1 THROUGH TB4/TB4A			6-10

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	6-10	S-IVB LOSS OF ENGINE HYDRAULIC FLUID PRIOR TO FIRST S-IVB BURN	LAUNCH	<p><u>SPACECRAFT SEPARATION</u> BSE INFORM FLIGHT AND FIDO AND RECOMMEND NO S-IVB START.</p> <p>FIDO WILL ADVISE FLT OF COI CAPABILITY</p>	<p><u>CUES:</u></p> <ol style="list-style-type: none"> 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). <p><u>NOTE:</u></p> <ol style="list-style-type: none"> 1. L7-403 (CUE 1) PLUS ONE OF THE OTHER CUES ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE. 2. COI CAPABILITY NOMINALLY EXISTS AT S-II CUTOFF 	
	6-11	<p>S-IVB STAGE LOSS OF THRUST</p> <p>A. FAILS TO ATTAIN THRUST OR PREMATURE SHUTDOWN PRIOR TO OBTAINING PARKING ORBIT</p> <p>B. FAILS TO ATTAIN THRUST OR PREMATURE SHUTDOWN PRIOR TO VELOCITY CUTOFF FOR SECOND BURN</p>	<p>LAUNCH</p> <p>EARTH ORBIT</p>	<p>A. <u>SPACECRAFT SEPARATION</u> BSE INFORM FLIGHT AND FIDO.</p> <p>FIDO WILL ADVISE FLT OF COI CAPABILITY.</p> <p>B. <u>CONTINUE MISSION</u> 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.</p>	<p><u>CUES:</u></p> <ol style="list-style-type: none"> 1. THRUST CHAMBER PRESSURE - ZERO (D0001-401). 2. THRUST OK SWITCHES - OFF (K0014-401, K0157-401). 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). <p><u>NOTE:</u></p> <p>SEPARATION WILL BE REQUIRED FOR VIOLATION OF FMR 7-6 OR FMR 7-14.</p>	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB1 THROUGH TB4/TB4A			6-11

7 SLV - TB5 AND
TB7 (COAST)

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MISSION RULES

REV	ITEM				
	<u>SUMMARY OF COAST PHASE RULES</u>				
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 ΔP				
7-15	LOSS OF S-IVB STAGE PNEUMATICS				
7-16	LOSS OF ENGINE CONTROL BOTTLE PRESSURE				
7-17	LH ₂ TANK VENT FAILURE OR LEAK				
7-18	LOW COLD HELIUM SUPPLY				
7-19	LOX TANK ULLAGE PRESSURE < 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	LH ₂ LATCHING VENT VALVE FAILS TO OPEN				
7-27	GH ₂ 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: NONE				
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB5 AND TB7		7-1

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-1	PRIOR TO RESTART, INSUFFICIENT PROPELLANT REMAINS FOR ACHIEVEMENT OF TLI GUIDANCE CUTOFF	COAST	<u>NO S-IVB RESTART</u> BSE INFORM FLIGHT AND RECOMMEND NO S-IVB RESTART.	<u>CUE:</u> PROPELLANT REMAINING AS ASCERTAINED DURING REAL-TIME MONITORING EVALUATIONS.	
		RULE NUMBER 7-2 IS RESERVED.				
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SLV - TB5 AND TB7			7-2

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-7	S-IVB AUXILIARY HYDRAULIC PUMP FAILS				
		A. TO TURN OFF AS SEQUENCED	COAST	A. <u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND ATTEMPT TO TURN OFF AUXILIARY HYDRAULIC PUMP AS SOON AS POSSIBLE	A. <u>CUES:</u> 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). A. <u>NOTES:</u> 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	COAST	B. <u>CONTINUE MISSION</u> 1. BSE INFORM FLIGHT AND ATTEMPT TO TURN ON AUXILIARY HYDRAULIC PUMP 2. BSE INFORM FLIGHT AND ATTEMPT TO TURN OFF AUXILIARY HYDRAULIC PUMP	B. <u>CUES:</u> 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).	
		1. AS SEQUENCED AND THE HYDRAULIC FLUID TEMP IS BELOW OR PREDICTED TO DROP BELOW 10°F BEFORE NEXT STATION AOS	RESTART			
		2. AT TB6 + 3 MIN 39 SEC				
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REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-8	LOSS OF ATTITUDE CONTROL DURING				
	A.	TB5 AND TB7 TO TB7 + 15 MIN	COAST	A. <u>SPACECRAFT GUIDANCE TAKEOVER</u> BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT GUIDANCE TAKEOVER IF UNSUCCESSFUL, BSE RECOMMEND SPACECRAFT SEPARATION	<u>CUES:</u> 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 20 SEC	RESTART	B. <u>TLI INHIBIT</u> 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 MIN	SLINGSHOT	C. <u>CREW DISCRETION</u> 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	SLINGSHOT	D. <u>CONTINUE MISSION</u> 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 <u>NOTES:</u> 1. AFTER S-IVB CUTOFF AND DURING PROGRAMED 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

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-10	APS ULLAGE ENGINE(S) THRUST FAILS TO TERMINATE AT SEQUENCED TIMES	COAST	<u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND ATTEMPT TO TERMINATE ULLAGE ENGINE THRUST. IF UNSUCCESSFUL, BSE INFORM FLIGHT OF IMPENDING LOSS OF ATTITUDE CONTROL.	<u>CUES:</u> 1. ULLAGE ENGINE THRUST CHAMBER PRESSURE GREATER THAN 90 PSIA (D220-414, D221-415). 2. APS HELIUM SPHERE PRESSURE DECREASING (D35-414, D036-415, D250-414, D251-415).	
	7-11	TIME BASE 5 OR TIME BASE 7 FAILS TO INITIATE AT S-IVB CUTOFF	COAST	<u>SPACECRAFT SEPARATION</u> BSE INFORM FLIGHT AND RECOMMEND IMMEDIATE SEPARATION TO A SAFE DISTANCE	<u>CUE:</u> LVDC FAILURE <u>NOTE:</u> THIS CONDITION WILL RESULT IN LOSS OF SEQUENCING AND PITCH AND YAW ATTITUDE CONTROL.	
		RULE NUMBER 7-12 IS RESERVED.				
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REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-13	<p>IU ECS WATER VALVE FAILS TO CYCLE OPEN AND CLOSED</p> <p>A. WATER VALVE CLOSED AND COOLANT INLET CONTROL TEMPERATURE IS 64°F OR HIGHER, AND</p> <p>THE INERTIAL GIMBAL TEMPERATURE IS PREDICTED TO BE EQUAL TO OR GREATER THAN 115°F BEFORE THE NEXT SITE AOS OR,</p> <p>THE LVDC MEMORY TEMPERATURE IS PREDICTED TO BE EQUAL TO OR GREATER THAN 124°F BEFORE THE NEXT SITE AOS.</p> <p>B. WATER VALVE OPEN AND COOLANT INLET CONTROL TEMP IS 55°F OR LESS, AND THE INERTIAL GIMBAL TEMPERATURE IS PREDICTED TO BE 104°F OR LESS BEFORE THE NEXT SITE AOS OR,</p> <p>THE LVDC MEMORY TEMPERATURE IS PREDICTED TO BE 32°F OR LESS BEFORE THE NEXT SITE AOS.</p>	ALL	<p><u>CONTINUE MISSION</u></p> <p>A. BSE INFORM FLIGHT AND SEND:</p> <p>1. ECS LOGIC INHIBIT COMMAND</p> <p>2. WATER VALVE OPEN</p> <p>B. BSE INFORM FLIGHT AND SEND:</p> <p>1. ECS LOGIC INHIBIT COMMAND</p> <p>2. WATER VALVE CLOSED</p>	<p><u>CUES:</u></p> <p>1. WATER VALVE CLOSED/OPEN (G5-601, G6-601).</p> <p>2. ME/H₂O TEMP (C15-601).</p> <p>3. OMW MODE CODE 27 BIT D8 SET TO "0" (H60-603).</p> <p>4. ST-124 INERTIAL GIMBAL TEMP (C34-603).</p> <p>5. SUBLIMATOR INLET TEMP (C11-601).</p> <p>6. LVDC MEMORY TEMP (C54-603).</p> <p>7. LVDA TEMP #1 (C55-603).</p> <p>8. LVDA TEMP #2 (C56-603).</p>
	7-14	<p>S-IVB STAGE COMMON BULK-HEAD DELTA PRESSURE REACHES OR EXCEEDS:</p> <p>A. MINUS 20 PSID OR PLUS 30 PSID</p> <p>B. MINUS 26 PSID OR PLUS 36 PSID</p>	COAST RESTART	<p>A. <u>CONTINUE MISSION</u></p> <p>BSE INFORM FLIGHT AND COMMAND:</p> <p>LH₂ AND/OR LOX VENT VALVES OPEN OR CLOSED TO PRECLUDE REACHING SEPARATION LIMITS</p> <p>B. <u>SPACECRAFT SEPARATION</u></p> <p>BSE INFORM FLIGHT AND FIDO AND RECOMMEND SPACECRAFT SEPARATION TO A SAFE DISTANCE</p>	<p><u>CUES:</u></p> <p>1. LH₂ TANK ULLAGE PRESSURE (D0177-410, D0178-410).</p> <p>2. LH₂ PUMP INLET PRESSURE (D0002-403).</p> <p>3. LOX TANK ULLAGE PRESSURE (D0180-406, D0179-406).</p> <p>4. LOX PUMP INLET PRESSURE (D0003-403).</p> <p><u>NOTES:</u></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>
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REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-15	LOSS OR IMPENDING LOSS OF S-IVB STAGE PNEUMATICS PRESSURE A. ENGINE PUMP PURGE FAILS (TB5 + 10 MIN 3 SEC) B. STAGE PNEUMATIC PRESSURE LEAKING AT GREATER THAN 6 PSI/MIN IN TB5 OR EXCESSIVE LEAKAGE DURING TB7	COAST	A. <u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND 1. ATTEMPT TO TERMINATE PURGE IF UNSUCCESSFUL, COMMAND: 2. AMBIENT HELIUM SUPPLY SHUTOFF VALVE CLOSED 3. REOPEN AMBIENT HELIUM SUPPLY SHUTOFF VALVE AS REQUIRED B. <u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND COMMAND: 1. AMBIENT HELIUM SHUTOFF VALVE CLOSED 2. REOPEN AMBIENT HELIUM SHUTOFF VALVE AS REQUIRED	<u>CUES:</u> A.1. ENGINE PUMP PURGE REGULATOR PRESSURE (D0050-403) FAILS TO DECREASE FROM ABOUT 100 PSIA TO ABOUT 10 PSIA. 2. AMBIENT HELIUM PNEUMATIC SPHERE PRESSURE (D0236-403, D0256-403) DECREASING AT 8 PSI/MIN. B.1. STAGE PNEUMATIC SUPPLY PRESSURE (D0236-403, D025-403).
	7-16	S-IVB ENGINE CONTROL BOTTLE PRESSURE LESS THAN 400 PSIA	COAST RESTART	<u>NO S-IVB RESTART (TB5)/TLI INHIBIT (TB6)</u> BSE INFORM FLIGHT AND RECOMMEND NO S-IVB RESTART	<u>CUES:</u> 1. ENGINE CONTROL BOTTLE PRESSURE (D019-401, D242-401). 2. REPRESSURIZATION BOTTLE PRESSURE (D20-403, D88-403, D249-403, D254-403).
	7-17	LH ₂ TANK VENT FAILURE OR LEAK DURING ORBITAL COAST	COAST RESTART	<u>CONTINUE MISSION</u> IF LH ₂ ULLAGE PRESSURE DROPS BELOW 17 PSIA, BSE COMMAND: 1. BOOST LH ₂ VENT VALVES CLOSED AND CVS REGULATOR CLOSED (ORIFICE OPEN) IF THE SITUATION CANNOT BE CORRECTED, AFTER INITIATION OF BURNER REPRESS, BSE COMMAND: 2. SECOND BURN RELAY OFF	<u>CUES:</u> 1. LH ₂ ULLAGE PRESSURE (D177-410, D178-410). 2. LH ₂ PUMP INLET PRESSURE (D002-403). 3. LH ₂ VENT CLOSED DISCRETES (K001-424, K210-410). <u>NOTES:</u> 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 LH ₂ TANK. 2. EXISTENCE OF A SERIOUS LEAK WILL BE VERIFIED BY LITTLE OR NO PRESSURE RISE DURING BURNER REPRESS.
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REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-17 (CONT'D)		COAST RESTART		<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	<p>LOW COLD HELIUM SUPPLY PRESSURE</p> <p>A. LESS THAN 1000 PSIA DURING TB5</p> <p>B. LESS THAN 450 PSIA DURING BURNER REPRESSURIZATION</p> <p>C. LESS THAN 350 PSIA PRIOR TO RESTART</p>	<p>COAST</p> <p>RESTART</p> <p>COAST RESTART</p>	<p>A. <u>CONTINUE MISSION</u></p> <p>BSE INFORM FLIGHT AND COMMAND FROM LAST STATION PRIOR TO TB6:</p> <p>BURNER LOX SHUTDOWN VALVE CLOSE ON</p> <p>B. <u>CONTINUE MISSION</u></p> <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> <p>C. <u>NO S-IVB RESTART (TB5)/TLI INHIBIT (TB6)</u></p> <p>BSE INFORM FLIGHT AND RECOMMEND NO S-IVB RESTART.</p>	<p><u>CUE:</u></p> <p>COLD HELIUM SPHERE PRESSURE (D0016-425, D0263-403).</p>	
	7-19	<p>LOW LOX TANK ULLAGE PRESSURE</p> <p>A. LOX ULLAGE PRESSURE <31 PSIA IN TB5</p> <p>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</p>	<p>COAST</p>	<p>A. <u>CONTINUE MISSION</u></p> <p>BSE INFORM FLIGHT AND COMMAND:</p> <p>1. BURNER LOX SHUTDOWN VALVE CLOSE</p> <p>2. LOX VENT VALVES BOOST CLOSE</p> <p>AS CLOSE AS POSSIBLE TO TB6 + 7 MIN 30 SEC, BSE COMMAND:</p> <p>3. LOX REPRESS ON</p> <p>B. <u>TLI INHIBIT</u></p> <p>BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT</p>	<p><u>CUES:</u></p> <p>A.1. LOX ULLAGE PRESSURES (D179-406, D180-406).</p> <p>2. LOX PUMP INLET PRESSURE (D0003-403).</p> <p>B. LOX ULLAGE PRESSURE (D0179-406, D0180-406).</p>	
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REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-20	<p>J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS</p> <p>A. ABOVE 1400 PSIA DURING ORBITAL COAST FOR FIRST OPPORTUNITY RESTART OR ABOVE 1500 PSIA FOR SECOND OPPORTUNITY RESTART</p> <p>B. ABOVE 1800 PSIA PRIOR TO RESTART</p>	COAST	<p>A. <u>CONTINUE MISSION</u></p> <p>BSE INFORM FLIGHT AND SEND:</p> <ol style="list-style-type: none"> START BOTTLE VENT OPEN FOR 3 SEC REPEAT COMMAND AS NECESSARY TO ENSURE A PRESSURE OF LESS THAN 1400 PSIA FOR FIRST OPPORTUNITY RESTART OR 1500 PSIA FOR SECOND OPPORTUNITY RESTART <p>B. <u>SPACECRAFT SEPARATION</u></p> <p>BSE INFORM FLIGHT AND FIDO AND RECOMMEND SPACECRAFT SEPARATION</p>	<p><u>CUES:</u></p> <ol style="list-style-type: none"> START BOTTLE PRESSURE (D17-401; D241-401) 	
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REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-21	PU VALVE FAILURE FAILS TO A HIGH MIXTURE RATIO GREATER THAN 5.0 TO 1 AND ANY TIME PRIOR TO RESTART	COAST	<u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND COMMAND: 1. PU VALVE HARDOVER POSITION ON (LOW EMR 4.5 TO 1) (SEE NOTE 1) IF 1 IS UNSUCCESSFUL, BSE INFORM FLIGHT AND: 2. VENT START BOTTLE TO ACCEPTABLE LIMITS	<u>CUES:</u> 1. PU VALVE POSITION (G010-401) 2. PU FEEDBACK VOLTAGE (M061-411) <u>NOTES:</u> 1. THIS FAILURE WILL REQUIRE EVALUATION OF RESIDUALS TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF (REF FMR 7-1). 2. PU FEEDBACK VOLTAGE M061, IS ONLY VALID WHEN PU SYSTEM POWER IS ON	
	7-22	S-IVB LOSS OF ENGINE HYDRAULIC FLUID	COAST RESTART	<u>NO S-IVB RESTART (TB5)/TLI INHIBIT (TB6)</u> BSE INFORM FLIGHT AND RECOMMEND NO S-IVB RESTART	<u>CUES:</u> 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). <u>NOTES:</u> 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.	
		RULE NUMBERS 7-23 AND 7-24 ARE RESERVED.				
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REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-28	S-IVB STAGE COLD HELIUM DUMP FAILS TO INITIATE	COAST SLINGSHOT	<u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND 1. ATTEMPT TO OPEN THE LH, CRYOGENIC REPRESSURIZATION SUPPLY VALVES IF UNSUCCESSFUL, BSE INFORM FLIGHT AND AT TB8 + 17 MIN 30 SEC SEND: 2. LOX PRESSURIZATION SHUTOFF VALVES OPEN	<u>CUES:</u> 1. COLD HELIUM BOTTLE PRES- SURE (D0016-425, D0263- 403).	
		RULE NUMBERS 7-29 AND 7-30 ARE RESERVED.				
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8 SLV - TB6
(RESTART)

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MISSION RULES

REV	ITEM				
<u>SUMMARY OF RESTART PHASE RULES</u>					
8-1	ACCELEROMETER FAILURE				
8-2	O ₂ /H ₂ BURNER LH ₂ VALVE FAILS				
8-3	LH ₂ CHILLDOWN SYSTEM FAILS				
8-4	LOX CHILLDOWN SYSTEM FAILS				
8-5	LH ₂ 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:					
6-11	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 20 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	LH ₂ 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				
7-22	S-IVB LOSS OF ENGINE HYDRAULIC FLUID				
7-21	PU VALVE FAILS TO A MIXTURE RATIO GREATER THAN 5.0 TO 1 ANY TIME AFTER RESTART				
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REV	RULE	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	RESTART	A. <u>TLI INHIBIT</u> BSE INFORM FLIGHT AND FIDO AND RECOMMEND TLI INHIBIT PRIOR TO TB6 + 9 MIN 10 SEC. B. <u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND FIDO.	<u>CUES:</u> 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 0.5 DEG AND NOT DECREASING (H10-603, H11- 603, H12-603). <u>NOTES:</u> 1. LVDC SWITCHES TO A BACKUP MODE AND UTILIZES A PRE- COMPUTED F/M PROFILE FOR FAILED AXIS DURING S-IVB BURN. 2. ACCELEROMETER FAILURE OCCURRING DURING TB5 WILL NOT BE RECOGNIZED UNTIL TB6 INITIATED.	
	8-2	S-IVB STAGE O ₂ /H ₂ BURNER FUEL PROPELLANT VALVE FAILS CLOSED	RESTART	<u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND COMMAND: A. BURNER SHUTDOWN B. CONTINUOUS VENT SYSTEM ORIFICE OPEN C. CRYOGENIC REPRESSURIZATION OFF	<u>CUES:</u> 1. BURNER CHAMBER DOME TEMP- PERATURE INDICATES 460°R OR LESS (C0382-403). 2. BURNER NOZZLE TEMPERATURE (C0380-403) OFF SCALE LOW. 3. BURNER GH ₂ INJECTOR TEM- PERATURE (C0383-403). 4. AMBIENT REPRESSURIZATION MODE SELECT (K0195-404). 5. BURNER PROPELLANT VALVE POSITIONS (K0180-404, K0192-403). <u>NOTES:</u> 1. THE O ₂ /H ₂ 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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REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	8-3	LH ₂ CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS	RESTART	<u>CONTINUE MISSION</u> A. BSE INFORM FLIGHT AND ATTEMPT TO CORRECT SITUATION SPECIFIED IN NOTE 1(A), 1(B), 1(D) B. IF UNSUCCESSFUL, BSE INFORM FLIGHT AND AT TB6 + 8 MIN 45 SEC COMMAND, FUEL LEAD	<u>CUES:</u> 1. LH ₂ PREVALVE OPEN (K111-404). 2. LH ₂ PREVALVE CLOSE (K112-404). 3. LH ₂ BLEED VALVE CLOSE (K127-401). 4. LH ₂ RECIRC VALVE CLOSE (K136-409). 5. LH ₂ RECIRC FLOW (F005-404). 6. LH ₂ PUMP INLET PRESS (D002-403). 7. LH ₂ ULLAGE PRESS (D177-409, D178-409). 8. LH ₂ PUMP INLET TEMP (C003-403). <u>NOTES:</u> 1. LH ₂ CHILLDOWN WILL NOT BE SATISFACTORY IF: (A) PREVALVE IS OPEN (B) RECIRCULATION VALVE IS CLOSED (C) BLEED VALVE IS CLOSED (D) CHILLDOWN PUMP IS NOT ON 2. THIS FAILURE AND THE FUEL LEAD WILL REQUIRE EVALUATION OF RESIDUALS TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF (REF FMR 7-1).	
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	8-4	S-IVB STAGE LOX CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS	RESTART	<u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND ATTEMPT TO CORRECT SITUATION SPECIFIED IN NOTE 1(A), 1(B), 1(D)	CUES: 1. LOX PUMP INLET PRESSURE (D0003-403) AND LOX TANK ULLAGE PRESSURE (D0179-406; D0180-406). 2. LOX CHILLDOWN FLOWRATE (F0004-424). 3. LOX PUMP INLET TEMPERATURE (C0004-403). 4. LOX PREVALVE OPEN POSITION (K0109-403). 5. LOX PREVALVE CLOSED POSITION (K0110-403). 6. LOX BLEED VALVE POSITION (K0126-401). 7. LOX RECIRCULATION VALVE POSITION (K0139-424). NOTES: 1. LOX CHILLDOWN WILL NOT BE SATISFACTORY IF: (A) PREVALVE IS OPEN (B) RECIRCULATION VALVE IS CLOSED (C) BLEED VALVE IS CLOSED (D) CHILLDOWN PUMP IS NOT ON	
	8-5	LOW LH ₂ TANK ULLAGE PRESSURE AT TB6 + 9 MIN 10 SEC (SEE NOTES 1 AND 2)	RESTART	<u>TLI INHIBIT</u> BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT.	CUES: 1. LH ₂ TANK ULLAGE PRESSURE (D177-410, D178-410). 2. LH ₂ PUMP INLET PRESSURE (D002-403). NOTES: 1. THIS RULE IS NOT VALID WITH ANY INDICATION OF AN LH ₂ VENT VALVE PROBLEM (I.E., LEAKAGE OR FAILURE TO CLOSE). (SEE FMR 7-17 AND 8-7.) 2. AT TB6 + 9 MIN 10 SEC, THE LH ₂ TANK ULLAGE PRESSURE SHOULD BE 4 PSIA HIGHER THAN ULLAGE PRESSURE DURING ORBITAL COAST TO MEET RESTART REQUIREMENTS.	
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	8-6	S-IVB ACTUATOR CONFIRMED HARDOVER PRIOR TO TB6 + 9 MIN 10 SEC	RESTART	<u>TLI INHIBIT</u> BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	<u>CUES:</u> 1. ACTUATOR POSITIONS ± 5 DEG OR GREATER (G1-400, G1-403, G2-400, G2-403). <u>NOTE:</u> BOTH INDIVIDUAL ACTUATOR POSITIONS MUST CONFIRM MALFUNCTION PRIOR TO RECOMMENDING S/C SEPARATION OR TLI INHIBIT.	
	8-7	S-IVB STAGE CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO CLOSE DURING RESTART SEQUENCE	RESTART	<u>CONTINUE MISSION/TLI INHIBIT</u> BSE INFORM FLIGHT AND COMMAND: 1. SECOND BURN RELAY OFF 2. ATTEMPT TO CLOSE THE CVS REGULATOR IF NEITHER 1 NOR 2 IS SUCCESSFUL, BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT.	<u>CUES:</u> 1. CVS REGULATOR CLOSED (K154-411). 2. CVS NOZZLE PRESSURE REMAINS GREATER THAN 3 PSIA (D181-409, D182-409) 3. LH ₂ TANK ULLAGE PRESSURE (D177-410, D178-410).	
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	8-8	LOSS OF ATTITUDE CONTROL DURING S-IVB SECOND BURN	RESTART	<p><u>SPACECRAFT SEPARATION</u></p> <p>BSE INFORM FLIGHT AND FIDO. CAPCOM INFORM CREW OF LOSS OF ATTITUDE CONTROL.</p> <p>CREW WILL ABORT ON LIMITS.</p>	<p>CUES:</p> <ol style="list-style-type: none"> 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 RATES GIVEN IN CUE 1. 3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE 2). <p>NOTES:</p> <ol style="list-style-type: none"> 1. THE SLV YAW GIMBAL (2-AXIS) IS CRITICAL BEYOND ± 45 DEG. 2. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS: <ul style="list-style-type: none"> (A) LVDC/LVDA COMPUTATIONAL FAILURE. (B) ATTITUDE ERROR SIGNALS ROLL $>\pm 3.5$ DEG, PITCH AND YAW $>\pm 5$ DEG (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE. (D) FAILURE OF S-IVB ENGINE HYDRAULICS. (E) ATTITUDE REFERENCE FAILURE. 	
MISSION	REV	DATE	SECTION		GROUP	PAGE
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9 SLV - TB8 (SAFING
AND SLINGSHOT)

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MISSION RULES

REV	ITEM				
		<u>SUMMARY OF SAFING AND SLINGSHOT RULES</u>			
		9-1 STAGE PNEUMATIC DUMP FAILS 9-2 LOX DUMP FAILS 9-3 ENGINE CONTROL BOTTLE DUMP FAILS 9-4 RESERVED 9-5 LOSS OF APS 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 TB8 + 17 MIN 3 SEC 7-26 LH ₂ LATCHING VENT VALVE FAILS TO LATCH OPEN AS PROGRAMED 7-28 S-IVB STAGE COLD HELIUM DUMP FAILS TO INITIATE			
MISSION	REV	DATE	SECTION	GROUP	PAGE
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	9-1	S-IVB STAGE PNEUMATIC DUMP FAILS TO INITIATE	SLINGSHOT	<u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND ATTEMPT TO OPEN THE ENGINE PUMP PURGE CONTROL VALVE	<u>CUES:</u> 1. ENGINE PUMP PURGE PRESSURE (D050-403). 2. AMBIENT HELIUM SUPPLY PRESSURE (D236-403, D256-403).	
	9-2	S-IVB LOX DUMP FAILS TO INITIATE AT TB8 + 12 MIN 2.8 SEC	SLINGSHOT	<u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND ATTEMPT TO INITIATE LOX DUMP BY OPENING THE MAIN OXIDIZER VALVE	<u>CUES:</u> 1. MAIN OXIDIZER VALVE POSITION (G0003-401). 2. MAIN OXIDIZER VALVE OPEN DISCRETE (K0120-401). 3. LOX PUMP INLET TEMPERATURE (C0004-403). 4. LOX RECIRCULATION FLOW-RATE (F0004-424).	
	9-3	ENGINE CONTROL BOTTLE DUMP FAILS TO INITIATE	SLINGSHOT	<u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND ATTEMPT TO OPEN THE ENGINE HELIUM CONTROL VALVE	<u>CUE:</u> ENGINE CONTROL HELIUM SPHERE PRESSURE (D019-401, D242-401).	
	9-4	RESERVED				
	9-5	LOSS OF EITHER OR BOTH APS MODULES PRIOR TO OR DURING PROPELLANT DUMP RULE NUMBERS 9-6 THROUGH 9-9 ARE RESERVED.	SLINGSHOT	<u>CONTINUE MISSION</u> BSE INFORM FLIGHT AND COMMAND S-IVB BURN MODE ON	<u>CUES:</u> 1. MANIFOLD PRESSURE MOD 1 LESS THAN 160 PSIA (OXID-FUEL) (D70-414, D71-414). 2. MANIFOLD PRESSURE MOD 2 LESS THAN 160 PSIA (OXID-FUEL) (D72-415, D73-415). 3. ATTITUDE CONTROL HELIUM CONTROL PRESSURE TANK 1 APPROXIMATELY 1100 PSIA (D35-414, D250-414). 4. ATTITUDE CONTROL HELIUM CONTROL PRESSURE TANK 2 APPROXIMATELY 1100 PSIA (D36-415, D251-415).	
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MISSION RULES

REV	ITEM	PRELAUNCH INSTRUMENTATION					
		MEAS NUMBER	ONBOARD	TRANS- DUCERS	CATE- GORY	EFFEC- TIVITY	MISSION RULE REFERENCE
9-10		MEASUREMENT DESCRIPTION					
		STAGE COMMUNICATIONS SYSTEMS AND FLIGHT CONTROL MEASUREMENT CATEGORIZATION					
		<u>STAGE COMMUNICATIONS SYSTEMS</u>					
		<u>S-IC STAGE-NONE</u>					
		<u>S-II STAGE-NONE</u>					
		<u>S-IVB STAGE</u>					
		MUX DP1B0 (VIA IU)			M		
		<u>INSTRUMENT UNIT</u>					
		LINK DP1B			M		
		EMERGENCY DETECTION SYSTEM (EDS)			M		
		COMMAND COMMUNICATIONS SYSTEM (CCS) UPLINK			M		
		<u>FLIGHT CONTROL MEASUREMENTS</u>					
		<u>S-IC STAGE-NONE</u>					
		<u>S-II STAGE</u>					
		POSITION YAW ACTUATOR	G8-201		HD		6-8, 8-6
		POSITION YAW ACTUATOR	G8-202		HD		6-8
		POSITION YAW ACTUATOR	G8-203		HD		6-8
		POSITION YAW ACTUATOR	G8-204		HD		6-8
		POSITION PITCH ACTUATOR	G9-201		HD		6-8, 8-6
		POSITION PITCH ACTUATOR	G9-202		HD		6-8
		POSITION PITCH ACTUATOR	G9-203		HD		6-8
		POSITION PITCH ACTUATOR	G9-204		HD		6-8
		E1 YAW ACTUATOR PIST POS	G30-201		HD		6-8
		E2 YAW ACTUATOR PIST POS	G30-202		HD		6-8
		E3 YAW ACTUATOR PIST POS	G30-203		HD		6-8
		E4 YAW ACTUATOR PIST POS	G30-204		HD		6-8
		E1 PITCH ACTUATOR PIST POS	G31-201		HD		6-8
		E2 PITCH ACTUATOR PIST POS	G31-202		HD		6-8
		E3 PITCH ACTUATOR PIST POS	G31-203		HD		6-8
		E4 PITCH ACTUATOR PIST POS	G31-204		HD		6-8
		VOLT, IGNITION DC BUS	M125-207		HD		6-9
		<u>S-IVB STAGE</u>					
		PRESS, FUEL PUMP INLET	D2-403				7-14
		PRESS, FUEL TANK ULLAGE EDS 1	D177-410	METER*	COMMON	2 OF 3	7-14
		PRESS, FUEL TANK ULLAGE EDS 2	D178-410	METER*	COMMON	M	7-14
		PRESS, OXID PUMP INLET	D3-403				7-14/19,
		PRESS, OXID TANK ULLAGE EDS 1	D179-406	METER*	COMMON	2 OF 3	7-14/19, 8-5
		PRESS, OXID TANK ULLAGE EDS 2	D180-406	METER*	COMMON	M	7-14/19, 8-5
		PRESS, COLD HELIUM SPHERE	D16-425		HD		7-18
		PRESS, GH2 START BOTTLE	D17-401		HD		7-20
		PRESS, ENG CONTROL He SPHERE	D19-401		HD		7-16
		PRESS, HYDRAULIC SYSTEM	D41-403		HD		6-10, 7-22
		PRESS, RESERVOIR OIL	D42-403		HD		6-10, 7-22
		PRESS, AMBIENT He PNEU SPHERE	D236-403		HD		7-15
		PRESS, GH2 START BOTTLE BKUP MEAS	D241-401		HD		7-20
		PRESS, ENG CONT He SPHERE BKUP					
		MEAS	D242-401		HD		7-16
		PRESS, AMB He PNEU SPHERE	D256-403		HD		7-15
		PRESS, COLD He SPHERE	D263-403		HD		7-18
		FLOWMETER, OXIDIZER	F1-401		HD		7-4
		POSITION, PITCH ACTUATOR	G1-403		HD		8-6
		POSITION, YAW ACTUATOR	G2-403		HD		8-6
		POSITION, MAIN OXIDIZER VALVE	G3-401		HD		7-4
		POSITION, PU SYSTEM RATIO VALVE	G10-401		HD		7-21
		VOLT, F/U 1 EBW RANGE SAFETY	M30-411		HD		7-5
		VOLT, F/U 2 EBW RANGE SAFETY	M31-411		HD		7-5
		VOLT, PU VALVE POSITION FEEDBACK	M61-411		HD		7-21
		NETWORK			MAND		
		MISSION	REV	DATE	SECTION	GROUP	PAGE
		APOLLO 10	FINAL	4/15/69	SLV - TB8	PRELAUNCH INSTRUMENTATION	9-3

10 CSM ENVIRONMENTAL
CONTROL

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MISSION RULES

REV	ITEM	GENERAL			
	10-1	<p><u>LAUNCH</u></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><u>TLC & TEC</u></p> <p>WATER EVAPORATION WILL BE LIMITED TO COMPONENT TESTING.</p> <p><u>ALL PHASES</u></p> <p>A. BACKUP SYSTEMS AND BACKUP COMPONENTS WILL BE USED FOR THE MOST RAPID PRACTICAL RETURN TO EARTH, NOT FOR MISSION CONTINUATION.</p> <p>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.</p> <p>C. TO CONTINUE, WATER QUANTITY PREDICTIONS MUST REFLECT ADEQUATE QUANTITIES TO MEET NORMAL MISSION REQUIREMENTS.</p>			
	10-2	<p><u>DEFINITIONS</u></p> <p><u>LOSS OF CABIN INTEGRITY:</u> CM PRESSURE VESSEL LEAKAGE SUCH THAT CABIN PRESSURE CANNOT BE MAINTAINED ≥ 4.5 PSIA BY CABIN PRESSURE REGULATORS (1.2 LB/HR TOTAL).</p> <p><u>LOSS OF SUIT INTEGRITY:</u> TOTAL PGA AND SUIT LOOP LEAKAGE > 0.5 PSI/MIN (1.5 LB/HR) DURING PGA SUIT LOOP PRESSURE CHECK.</p> <p><u>LOSS OF SUIT CIRCUIT:</u> INABILITY OF THE SUIT CIRCUIT TO MAINTAIN ADEQUATE CREW COMFORT AND/OF CO₂ REMOVAL WITHOUT USING DIRECT O₂.</p> <p><u>LOSS OF O₂ MANIFOLD:</u> AN O₂ MAINFOLD OR REGULATOR FAILURE WITH WHICH THE SUIT CIRCUIT O₂ DEMANDS CANNOT BE SUPPLIED FOR ENTRY.</p> <p><u>LOSS OF PRIMARY LOOP COOLING:</u> LOSS OF ALL FLOW, A LEAK WHICH CANNOT BE ISOLATED, OR COMBINED FAILURES SUCH THAT RADIATORS AND EVAPORATOR PROVIDE NO COOLING.</p> <p><u>LOSS OF SECONDARY LOOP COOLING:</u> LOSS OF ALL FLOW, A LEAK WHICH CANNOT BE ISOLATED, OR COMBINED FAILURES SUCH THAT RADIATORS AND EVAPORATOR PROVIDE NO COOLING.</p> <p><u>LOSS OF COOLANT LOOP RADIATORS:</u> 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><u>LOSS OF ALL COOLING:</u> LOSS OF PRIMARY AND SECONDARY LOOP COOLING.</p> <p><u>LOSS OF SURGE TANK AND/OR REPRESS PACK:</u> 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 10	FINAL	4/15/69	CSM ENVIRONMENTAL CONTROL SYSTEM	GENERAL	10-1

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MISSION RULES

REV	ITEM	SYSTEMS MANAGEMENT			
A	10-10	<p><u>O₂ SYSTEM</u></p> <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 >500 PSIA.</p> <p>D. THE PLSS VALVE WILL BE IN OFF POSITION FOR ALL PHASES EXCEPT LAUNCH 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. LIOH CANISTER WILL BE REPLACED EVERY 12 HOURS OR 7.6 MM HG OF PCO₂ WHICHEVER COMES FIRST.</p> <p>J. 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>K. 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 <p>L. CABIN FANS WILL NORMALLY BE OFF FOR MISSION DURATION.</p> <p><u>COOLANT MANAGEMENT</u></p> <p>A. FOR SIMULTANEOUS PRIMARY AND SECONDARY LOOP OPERATION, NORMALLY EITHER THE PRIMARY OR SECONDARY LOOP RADIATOR WILL BE ISOLATED.</p> <p>B. GLYCOL RESERVOIR WILL BE ON LINE AND RADIATORS WILL BE BYPASSED FOR LAUNCH.</p> <p>C. INDICATED GLYCOL ACCUMULATOR QUANTITY WILL BE MAINTAINED BETWEEN 30 AND 65 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 >-20 DEG.</p>			
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MISSION RULES

REV	ITEM				
		<p><u>WATER SYSTEM</u></p> <p>A. WASTE WATER WILL BE DUMPED OVERBOARD AS REQUIRED TO MAINTAIN INDICATED QUANTITY <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 >75 PERCENT. 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><u>SYSTEM BACKUP</u></p> <p>LM STSTEMS 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
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	10-20	CABIN PRESSURE CANNOT BE RELIEVED	LAUNCH	SPECIFIC MISSION RULES <u>CONTINUE MISSION</u>	NORMAL RELIEF STARTS AT <u>50</u> SECONDS	
	10-21	CABIN PRESSURE DECREASING AND/OR <4.5 PSIA AND: A. SUIT PRESSURE >3.5 PSIA B. SUIT PRESSURE <3.5 PSIA C. LOSS OF SUIT CIRCULATION	LAUNCH ALL LAUNCH ALL LAUNCH ALL	A.1. <u>CONTINUE MISSION</u> 2. <u>ENTER NEXT BEST PTP</u> IF CABIN PRESS NOT RESTORED >4.5 PSIA. B.1. <u>ABORT ASAP</u> 2. <u>ENTER ASAP</u> C.1. <u>ABORT ASAP</u> OPEN DIRECT O ₂ 45 DEG FROM LAUNCH SETTING. 2. <u>ENTER ASAP</u>	• CREW OPTION TO USE LM ENVIRONMENT FOR EARTH RETURN IN LIEU OF SUITED RETURN. C.1. CORRESPONDS TO 12.6 LB/HR (APPROX 3 CFM/CREWMAN)	
A	10-22	LOSS OF SUIT CIRCULATION CABIN STABLE, AND >4.5 PSIA	LAUNCH EO ALL	A. <u>CONTINUE MISSION</u> OPEN DIRECT O ₂ VALVE 45 DEG FROM LAUNCH SETTING. B. <u>ENTER NEXT BEST PTP WITHIN 4 HOURS</u> 1. DOFF SUITS. 2. OPEN WASTE OVERBOARD DRAIN VALVE TO OBTAIN CABIN BLEED FLOW. 3. DON FACE MASKS AFTER 1 HOUR C. <u>ENTER NEXT BEST PTP</u>	• LM SYSTEMS (IF AVAILABLE) WILL BE USED FOR CO ₂ AND H ₂ O REMOVAL. A. CORRESPONDS TO 12.6 LB/HR (APPROX 3 CFM/CREWMAN) B.2. WASTE OVERBOARD BLEED = 1.00 LB O ₂ /HR 3. TIME REQUIRED FOR CM CO ₂ PARTIAL PRESSURE TO INCREASE TO 7.6 MM HG 1 CREWMAN: 4 HR. 3 CREWMAN: 80 MIN.	
	10-23	LOSS OF SURGE TANK OR REPRESS PACK	LAUNCH ALL	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE MISSION</u>	FOR LEAK IN SURGE TANK, ISOLATE SURGE TANK AND PLACE PLSS VALVE TO FILL.	
MISSION	REV	DATE	SECTION		GROUP	PAGE
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	10-24	LOSS OF SURGE TANK AND REPRESS PACK	LAUNCH ALL TEC	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE MISSION</u> PLAN TO RESTORE ENTRY O ₂ BY STORING OPS IN CM AT FINAL LM EGRESS. C. <u>CONTINUE MISSION</u> <u>DOFF SUITS FOR ENTRY.</u>	B. OPS O ₂ QTY 2 TANKS -2 LB/TANK	
	10-25	FIRE OR SMOKE IN COMMAND MODULE	LAUNCH ALL	A. <u>ABORT</u> 1. DECOMPRESS CABIN 2. TROUBLESHOOT ELECTRICAL SYSTEM PER FLIGHT CREW CHECKLIST BOOST FIRE PROCEDURES. B.1. TROUBLESHOOT/COMBAT FIRE PER FLIGHT CREW CHECKLIST EMERGENCY PROCEDURES. 2. ASSESS DAMAGE AND REMOVE POWER FROM AFFECTED SYSTEMS. 3. <u>ENTER NEXT BEST PTP</u>		
	10-26	CONTAMINATION IN CABIN	ALL	<u>CREW MAY ELECT TO DECOMPRESS</u>	IF UNABLE TO CLEAR CONTAMINATION, MISSION MAY BE TERMINATED EARLY.	
	10-27	LOSS OF SUIT INTEGRITY	LAUNCH EO TEC TD&E ALL	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE MISSION</u> C. <u>INHIBIT TD&E</u> D. <u>TERMINATE PHASE</u> CONTINUE LM EJECTION IF LM IS PRESSURIZED AND TUNNEL WORK IS COMPLETE. NO-GO FOR UNDOCK E. <u>CONTINUE MISSION</u> NO-GO FOR UNDOCK	CONTINUE MISSION EXCEPT FOR MAJOR CSM PRESSURE VESSEL CONFIGURATION CHANGES	
MISSION	REV	DATE	SECTION		GROUP	PAGE
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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	10-40	<u>PRIMARY COOLANT LOOP MALFUNCTIONS</u> A. LOSS OF EVAPORATOR B. LOSS OF RADIATORS C. TOTAL LOSS OF LOOP	LAUNCH ALL LAUNCH EO ALL LAUNCH EO ALL	A.1. <u>CONTINUE MISSION</u> 2. <u>CONTINUE MISSION</u> ACTIVATE SECONDARY COOLANT LOOP WITH RADIATORS IN BY-PASS AS REQUIRED TO MAINTAIN PRIMARY EVAPORATOR OUT TEMP <80°F OR AS REQUIRED FOR CREW COMFORT. B.1. <u>CONTINUE MISSION</u> 2. <u>NO-GO FOR TLI</u> (A) ACTIVATE SECONDARY LOOP. (B) USE PRIMARY LOOP IN ADDITION TO SECONDARY LOOP FOR G&N OPERATIONS. 3. <u>ENTER NEXT BEST PTP</u> C.1. <u>CONTINUE MISSION</u> ACTIVATE SECONDARY LOOP 2. <u>NO-GO FOR TLI</u> ACTIVATE SECONDARY LOOP 3. <u>ENTER NEXT BEST PTP</u> ACTIVATE SECONDARY LOOP	A.1. REF MALF PROC ____ 2.(A) MAINTAIN PRI RAD OUT TEMP >-20°F. (B) WATER MANAGEMENT MAY DICTATE ACTIVATION AND DEACTIVATION OF SECONDARY LOOP TO MAINTAIN PRI RAD OUT TEMP BETWEEN 45 AND 80°F. B.1. REF MALF PROC ____ C.2. ALTERNATE MISSION MAY BE PERFORMED.	
	10-41	<u>SECONDARY LOOP MALFUNCTIONS</u> A. LOSS OF EVAPORATOR B. LOSS OF RADIATORS C. TOTAL LOSS OF LOOP	ALL EO ALL EO ALL	A. <u>CONTINUE MISSION</u> B.1. <u>NO-GO FOR TLI</u> LOOP IS STILL OPERATIONAL IN EVAPORATIVE MODE. 2. <u>ENTER NEXT BEST PTP</u> C.1. <u>NO-GO FOR TLI</u> 2. <u>ENTER NEXT BEST PTP</u>	A. MALF ECS ____ B.1. MALF ECS ____ C.1. MALF ECS ____	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM ENVIRONMENTAL CONTROL SYSTEM		COOLANT	10-7

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	10-42	LOSS OF PRIMARY AND SECONDARY EVAPORATORS	EO TLC ALL	A. <u>CONTINUE MISSION</u> NO-GO FOR TLI B. <u>CONTINUE MISSION</u> NO-GO FOR LOI C. <u>ENTER NEXT BEST PTP</u>		
	10-43	LOSS OF ALL COOLING, PRIMARY AND SECONDARY	LAUNCH EO ALL	A. <u>CONTINUE MISSION</u> B. <u>ENTER NEXT BEST ATP OR PTP</u> MAXIMUM ORBIT TIME: 4 HOURS EMERGENCY POWER DOWN FOLLOWED BY 1.5 HOURS OF POWER UP FOR ENTRY. C. <u>ENTER ASAP</u>	LM SYSTEMS (IF AVAILABLE) WILL BE USED TO SUPPLEMENT CSM OPERATIONS.	
	10-44	CONFIRMED LEAK OF GLYCOL COOLANT A. IN COMMAND MODULE B. IN SUIT CIRCUIT	LAUNCH EO ALL LAUNCH EO ALL	A.1. <u>CONTINUE MISSION</u> 2. <u>ENTER NEXT BEST PTP</u> DON SUITS. PURGE SUIT LOOP WITH DIRECT O ₂ . 3. <u>ENTER NEXT BEST PTP</u> B.1. <u>CONTINUE MISSION</u> 2. <u>ENTER NEXT BEST PTP</u> DOFF SUITS AND USE FACE MASKS IF REQUIRED. 3. <u>ENTER NEXT BEST PTP</u>	LM ENVIRONMENT (IF AVAILABLE) MAY BE USED FOR EARTH RETURN IN LIEU OF CSM.	
		RULE NUMBERS 10-45 THROUGH 10-49 ARE RESERVED.				
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM ENVIRONMENTAL CONTROL SYSTEM		COOLANT	10-8

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	10-50	LOSS OF OVERBOARD DUMPS A. NORMAL OVERBOARD DUMPS FROZEN OR BLOCKED B. LOSS OF ALL OVERBOARD DUMP CAPABILITY	ALL ALL	A. <u>CONTINUE MISSION</u> B. <u>ENTER NEXT BEST PTP</u>	A.1. UTILIZE AUXILIARY DUMP FOR URINE AND WASTE WATER DISPOSAL. 2. BLEED O ₂ FROM WATER TANK THROUGH WASTE MANAGEMENT OVERBOARD DRAIN VALVE INTO CABIN. B.1. 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. 2. LM URINE STORAGE BAGS (IF AVAILABLE) WILL BE USED.	
	10-51	FAILURE OF BOTH WATER ACCUMULATORS OR UNCONTROL- LABLE HIGH HUMIDITY	LAUNCH ALL	A. <u>CONTINUE MISSION</u> B. <u>ENTER NEXT BEST PTP</u>	LM SYSTEMS MAY BE USED FOR HUMIDITY CONTROL.	
	10-52	WASTE WATER TANK LEAK OR LOSS OF WASTE WATER STORAGE CAPABILITY	LAUNCH EO ALL	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE MISSION</u> NO-GO FOR TLI C. <u>ENTER NEXT BEST PTP</u>	LM SYSTEMS (IF AVAILABLE) MAY BE USED TO SUPPLEMENT CSM. WHEN POTABLE WATER TANK BECOMES FULL, FUEL CELL WATER WILL BE DUMPED THROUGH OVER- BOARD PRESSURE RELIEF VALVES	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM ENVIRONMENTAL CONTROL SYSTEM		WATER AND WASTE MANAGEMENT	10-9

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MISSION RULES

REV	RULE	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 ALL	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE MISSION</u> NO-GO FOR TLI ENTER NEXT BEST PTP AFTER TANK DEPLETED. C. <u>ENTER NEXT BEST PTP</u>	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 10	FINAL	4/15/69	CSM ENVIRONMENTAL CONTROL SYSTEM	WATER AND WASTE MANAGEMENT	10-10

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MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS					
		<u>MEAS DESCRIPTION</u>	<u>PCM</u>	<u>ONBOARD</u>	<u>TRANSDUCER</u>	<u>CATEGORY</u>	<u>REFERENCE</u>
A	10-60	CABIN PRESS	CF0001P	METER	COMMON	1 OF	10-20
		SUIT PRESS	CF0012P	METER	COMMON	3 M	
		TANK BLADDER PRESS	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 H ₂ O QTY	CF0010Q	METER	COMMON	1 OF	10-53,
		WASTE H ₂ O QTY	CF0009Q	METER	COMMON	2 M	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 O ₂ FLOW	CF0035R	METER	COMMON	HD	
		O ₂ 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	SF0263T	-----	-----	HD	
		SEC RAD OUT TEMP	SF0236T	METER	-----	HD	
MISSION		REV	DATE	SECTION		GROUP	PAGE
APOLLO 10		A	4/23/69	CSM ENVIRONMENTAL CONTROL SYSTEM		INSTRUMENTATION REQUIREMENTS	10-11

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MISSION RULES

REV	ITEM	GENERAL			
	11-1	<p><u>LAUNCH</u></p> <p>THERE ARE NO CRYO FAILURES FOR WHICH THE LAUNCH/INSERTION PHASE WILL BE TERMINATED. FOR COMPLETE LOSS OF THE SYSTEM RESULTING IN THREE FUEL CELL FAILURES, ENTRY WILL BE PLANNED INTO PTP 2-1. THREE ENTRY BATTERIES ARE CAPABLE OF SUPPORTING THE LAUNCH, ONE REV OF POWER DOWN AND SCS ENTRY.</p>			
	11-2	<p><u>ALL PHASES</u></p> <p>THE CRYOGENICS SYSTEM IS REQUIRED UNTIL CM/SM SEP SO THAT THE ENTRY AND LANDING PHASES WILL BE ENTERED INTO WITH FULL CONSUMABLES POTENTIAL, THAT IS, FULLY CHARGED ENTRY BATTERIES AND ENTRY O₂ TANKS. IF THIS CAPABILITY IS POTENTIALLY JEOPARDIZED BY CRYO SYSTEMS DEPLETION OR MALFUNCTION, MISSION TERMINATION PROCEDURES WILL BE ENACTED IN WHATEVER TIME FRAME IS APPROPRIATE OR AVAILABLE. ANY ENTRY BATTERY OR ENTRY O₂ USAGE AFTER LOSS OF RECHARGE CAPABILITY FROM THE CRYO SYSTEM WILL REDUCE SUPPLY AVAILABLE FOR ENTRY, LANDING, AND POSTLANDING.</p>			
A	11-3	<p>LOSS OF CRYOGENIC TANK IS DEFINED AS: PRESSURE CANNOT BE MAINTAINED ABOVE 150 PSIA FOR O₂ AND 100 PSIA FOR H₂.</p>			
A	11-4	<p>LUNAR MISSION WILL BE CONTINUED AS LONG AS ENOUGH CRYO (O₂, H₂) IS MAINTAINED IN LOWEST TANK TO PERFORM AN EARTH RETURN FROM ANY POINT WITH AT LEAST A POWER LEVEL OF 50 AMPS AVERAGE. EARTH ORBIT MISSION WILL BE CONTINUED AS LONG AS ENOUGH TOTAL CRYO (O₂, H₂) IS AVAILABLE TO PERFORM AN ENTRY INTO THE NEXT DAILY GO/NO-GO AREA.</p>			
		<p>RULE NUMBERS 11-5 THROUGH 11-9 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	CSM CRYOGENICS	GENERAL	11-1

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MISSION RULES

REV	ITEM	SYSTEMS MANAGEMENT		
A	11-10	<p><u>CRYO MANAGEMENT</u></p> <p>A. MANUAL PRESSURE CONTROL WILL BE USED AS REQUIRED TO MAINTAIN:</p> <ol style="list-style-type: none"> 1. TANK PRESSURES GREATER THAN <u>750</u> PSIA O₂ AND <u>200</u> PSIA FOR H₂ 2. QUANTITY BALANCE WITHIN <u>4</u> PERCENT O₂ AND <u>3</u> PERCENT FOR H₂ <p>B. IT IS PREFERABLE TO EITHER PURGE F/C OR POWER UP TO PRECLUDE VENTING.</p> <p>C. O₂ TANK FANS AND H₂ TANK FANS WILL NOT BE OPERATED IN THE AUTO MODE.</p> <p>D. MANUAL FAN CYCLE CRITERIA:</p> <p>O₂ AND H₂ FANS WILL BE CYCLED BOTH PRE AND POST SLEEP.</p>		
	11-11	<p><u>CRYO GAGING</u></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	PAGE
APOLLO 10	A	4/23/69	CSM CRYOGENICS	11-2

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
				SPECIFIC MISSION RULES		
	11-20	LOSS OF ONE O ₂ AND/OR H ₂ CRYO TANK (TANK PRESSURE <150 O ₂ , <100 H ₂ , RESPECTIVELY).	LAUNCH EO TD&E ALL	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE MISSION</u> NO-GO FOR TLI C. <u>CONTINUE MISSION</u> D. <u>ENTER NEXT BEST PTP</u>	LM, PLSS, AND OPS O ₂ WILL BE USED AS REQUIRED TO SUPPLEMENT CSM O ₂ .	
	11-21	LOSS OF BOTH O ₂ AND/OR H ₂ CRYO TANK (TANK PRESSURE <150 O ₂ , <100 H ₂ , RESPECTIVELY)	LAUNCH EO	A. <u>CONTINUE MISSION</u> ISOLATE SURGE TANK PRIOR TO 800 PSIA. B. <u>ENTER NEXT BEST ATP OR PTP</u> MAXIMUM ORBIT 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 10	FINAL	4/15/69	CSM CRYOGENICS		SPECIFIC	11-3

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MISSION RULES

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

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM CRYOGENICS	INSTRUMENTATION REQUIREMENTS	11-4

12 CSM ELECTRICAL
POWER SYSTEM

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MISSION RULES

REV	ITEM	GENERAL			
12-1	<u>LAUNCH</u>	LAUNCH WILL BE CONTINUED AS LONG AS SUFFICIENT ENERGY IS AVAILABLE TO PERFORM AN ENTRY INTO AT LEAST PTP 2-1. THERE MUST BE AT LEAST ONE MAIN BUS AND ONE AC BUS OPERATIONAL TO CONTINUE.			
12-2		THERE ARE NO FUEL CELL FAILURES FOR WHICH THE LAUNCH PHASE WILL BE TERMINATED AS LONG AS THREE ENTRY BATTERIES ARE REMAINING TO SUPPLY MAIN BUS LOADS.			
12-3	<u>ALL PHASES</u>	THE MISSION WILL BE CONTINUED AS LONG AS THE REQUIRED NUMBER OF FUEL CELLS ARE AVAILABLE AND ARE CAPABLE OF SUPPORTING MISSION REQUIREMENTS OF 75 TO 90 AMPS (WITHOUT BATTERY SUPPLEMENT EXCEPT DURING SPS ΔV'S) AND THREE GOOD ENTRY BATTERIES REMAIN.			
12-4		BATTERY IS CONSIDERED FAILED IF:			
		A. OUTPUT <3 AMPS WHEN CONNECTED TO A MAIN BUS DURING SPS MANEUVERS (NOMINAL TOTAL BATTERY CURRENT FOR SPS MANEUVERS IS 20 ± 2 AMPS).			
		B. SUSTAINED BATTERY CHARGER OUTPUT >2.0 AMPS AND ALL LOADS REMOVED.			
12-5		AN AC BUS IS CONSIDERED FAILED IF ANY TWO PHASES CANNOT BE MAINTAINED >95 VOLTS.			
12-6		AN INVERTER IS CONSIDERED FAILED IF:			
		A. OUTPUT VOLTAGE ON ANY PHASE >130 VAC.			
		B. OUTPUT VOLTAGE ON ANY TWO PHASES <95 VAC.			
12-7		FUEL CELL IS CONSIDERED FAILED FOR MISSION PLANNING IF:			
		A. FUEL CELL CANNOT SUPPLY SUFFICIENT POWER TO MEET ITS OWN PARASITIC LOADS (5 AMPS PLUS INLINE HEATER POWER AS REQUIRED).			
		B. FUEL CELL H ₂ LOOP IS CONTAMINATED WITH KOH.			
		C. REGULATED H ₂ PRESSURE <36.7 PSIA (CORRESPONDS TO N ₂ PRESSURE SHIFT DOWN TO 28.2 PSIA FOR CRITICAL OPERATION; LOWER N ₂ PRESSURE CAN BE MANAGED BY TURNING OFF H ₂ O TANK PRESSURE).			
12-8		TLI MINIMUM PURGE CAPABILITY IS BOTH OXYGEN AND HYDROGEN ON ONE FUEL CELL AND AT LEAST OXYGEN ON ANY OTHER FUEL CELL.			
		RULE NUMBERS 12-9 THROUGH 12-19 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM ELECTRICAL POWER SYSTEM	GENERAL	12-1

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MISSION RULES

REV	ITEM	SYSTEMS MANAGEMENT			
	12-20	<u>BUS MANAGEMENT</u>			
		<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 >26.5 VDC AND <31 VDC. ONE FUEL CELL MAY BE OPEN CIRCUITED FOR OPTIMUM VOLTAGE AND POWER MANAGEMENT.</p> <p>D. THE BATTERY CHARGER WILL BE USED TO CHECK OUT A SUSPECTED SHORTED BUS (EXCEPT MAIN BUSES) AFTER ALL EQUIPMENT AND POWER SOURCES HAVE BEEN REMOVED FROM BUS.</p> <p>E. MINIMUM MAIN BUS VOLTAGE WILL BE MAINTAINED TO BE COMPATABLE WITH ONLINE OPERATION EQUIPMENT.</p> <p>1. SPS <u>24.5</u></p> <p>2. PGNS <u>25.0</u></p> <p>3. AUTO SM-RCS <u>22.0</u></p> <p>4. AUTO CM-RCS <u>21.0</u></p> <p>5. DIRECT SM-RCS <u>21.0</u></p> <p>6. DIRECT CM-RCS <u>17.0</u></p> <p>7. INVERTERS <u>19.0</u></p>			
	12-21	<u>BATTERY MANAGEMENT</u>			
		<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 IN THE EVENT THE BATTERY CHARGER FAILS TO MAINTAIN BATTERY BALANCE.</p> <p>C. BATTERY CHARGING WILL BE TERMINATED FOR ONE OF THE FOLLOWING, WHICHEVER OCCURS FIRST:</p> <p>1. INTEGRATED AMP-HOURS INTO BATTERY BY CHARGER EQUALS INTEGRATED AMP-HOURS OUT OF BATTERY BY LOADS.</p> <p>2. WHEN BATTERY CHARGER CURRENT DROPS TO 0.4 AMPS.</p> <p>D. THREE BATTERIES WILL BE TIED TO THE MAIN BUSES FOR DEORBIT MANEUVER AND ENTRY.</p> <p>E. BATTERIES ARE CONSIDERED TO HAVE 40 AMP-HR CAPABILITY INFLIGHT AND 45 AMP-HR CAPABILITY FOR POSTLANDING.</p> <p>F. A SINGLE BATTERY THAT CANNOT BE RECHARGED WILL NOT BE USED EXCEPT DURING DEORBIT, ENTRY, AND POSTLANDING.</p> <p>G. BATTERY VENT VALVE WILL REMAIN CLOSED UNLESS MANIFOLD PRESSURE IS GREATER THAN 6 PSIA. VENTING OPERATION WILL BE ALLOWED TO TROUBLESHOOT A SUSPECTED FROZEN DUMP.</p>			
	12-22	<u>FUEL CELL MANAGEMENT</u>			
		<p>A. FUEL CELL WILL BE "SHUTDOWN" FOR THE FOLLOWING:</p> <p>1. SUSTAINED CURRENT OUTPUT LESS THAN 5 AMPS.</p> <p>2. FUEL CELL H₂ LOOP IS CONTAMINATED WITH KOH.</p> <p>3. REACTANT LEAKAGE JEOPARDIZING MISSION DURATION.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM ELECTRICAL POWER SYSTEM	MANAGEMENT	12-2

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MISSION RULES

REV	ITEM				
A	12-22 (CONT)	<p>B. FUEL CELL MAY BE "OPEN CIRCUITED" FOR THE FOLLOWING:</p> <ol style="list-style-type: none"> 1. SKIN TEMP >475°F 2. TCE TEMP >215°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 MIMUTES 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 <u>AT ALL TIMES</u> UNLESS THE FUEL CELL IS DECLARED FAILED.</p> <p>I. ADDITIONAL POWER LOADS WILL BE ADDED AS REQUIRED TO MAINTAIN FC RAD OUT TEMP > -40 DEGREES. IF CRYO BUDGET JEOPARDIZED OR RAD OUT TEMPS NOT MAINTAINED > -40 DEGREES, FC RAD WILL BE PLACED IN EMERGENCY BYPASS.</p> <p>J. FUEL CELLS MAY BE PURGED TO PRECLUDE VENTING OF CRYO TANKS.</p>			
A	12-23	<p><u>INVERTER MANAGEMENT</u></p> <p>INVERTERS MAY BE REMOVED FROM LINE FOR ANY OF THE FOLLOWING REASONS:</p> <ol style="list-style-type: none"> A. INVERTER TEMP >190°F B. SPACECRAFT LOAD MANAGEMENT 			
		<p>RULE NUMBERS 12-24 THROUGH 12-29 ARE RESERVED</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	CSM ELECTRICAL POWER SYSTEM	MANAGEMENT	12-3

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	12-30	LOSS OF ONE FUEL CELL (OUTPUT <5 AMPS)	LAUNCH EO TLC ALL	<p style="text-align: center;">SPECIFIC MISSION RULES</p> <p>A. <u>CONTINUE MISSION</u></p> <p>B. <u>NO-GO FOR TLI</u></p> <ol style="list-style-type: none"> 1. OPEN CIRCUIT FUEL CELL. 2. RECONFIGURE REMAINING TWO FUEL CELLS TO ONE FUEL CELL PER MAIN BUS ONLY. 3. IF FUEL CELL CANNOT BE RESTORED, PERFORM SHUT-DOWN. <p>C. BASED ON THE FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING WITH LOI.</p> <p>D. <u>CONTINUE MISSION</u></p>	B.1. REF MALF PROC EPS 5.	
A	12-31	LOSS OF TWO FUEL CELLS (OUTPUT <5 AMPS EACH)	LAUNCH ALL	<p>A. <u>CONTINUE MISSION</u> AFTER 2 + 00 GET PERFORM:</p> <ol style="list-style-type: none"> 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. <p>B. <u>ENTER NEXT BEST PTP</u></p> <ol style="list-style-type: none"> 1. CONNECT REMAINING FUEL CELL TO BOTH MAIN BUSES. 2. PERFORM "LOSS OF TWO FC POWER DOWN." 	<ul style="list-style-type: none"> • LM SYSTEMS (IF AVAILABLE) MAY BE USED IN LIEU OF CSM SYSTEMS TO CONSERVE CSM POWER. <p>B. ONE ENTRY BATTERY MAY BE USED TO SUPPLEMENT REMAINING FC FOR G&N ALIGNMENT PRIOR TO DEORBIT.</p>	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	CSM ELECTRICAL POWER SYSTEM		FUEL CELLS	12-4

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	12-32	LOSS OF THREE FUEL CELLS A. OUTPUT <10 AMPS EACH B. TOTAL OUTPUT CAPABILITY INSUFFICIENT TO SUPPORT DRIFTING FLIGHT LOADS C. TOTAL OUTPUT CAPABILITY <36 AMPS AT MAIN BUS VOLTAGE OF 26.5 VDC	LAUNCH ALL ALL LAUNCH ALL LAUNCH	A.1. <u>CONTINUE MISSION</u> (A) AFTER 2 + 00 EDS AUTO/OFF TO OFF. (B) TIE BAT C TO BOTH MAIN BUSES. (C) POWER DOWN AT INSERTION ENTER 2-1 IF FUEL CELLS CANNOT BE RESTORED. 2. <u>ENTER NEXT BEST PTP</u> B.1. <u>ENTER NEXT BEST PTP</u> MANIPULATION OF CYCLIC LOADS WILL BE ATTEMPTED TO MAINTAIN VM >26.5 VDC 2. <u>NOT APPLICABLE</u> C.1. <u>ENTER NEXT BEST ATP OR PTP</u> 2. <u>NOT APPLICABLE</u>	LM SYSTEMS (IF AVAILABLE) MAY BE USED IN LIEU OF CSM SYSTEMS TO CONSERVE CSM POWER. A.1.(A) IF TOTAL OUTPUT CAPABILITY LESS THAN 8 AMPS AT 22 VDC, SMJC WILL BE INOPERATIVE FOR CM/SM SEP. A.1.(C) 4.75 HOURS LEFT IN ORBIT BEFORE DEORBIT MANEUVER. B.1. 95 AMPS REPRESENTS MAXIMUM DRIFTING FLIGHT REQUIREMENTS (66 AMPS AVERAGE). C.1. 36 AMPS REPRESENTS MINIMUM POWER TO SUPPORT S/C SYSTEMS IN ORBIT.	
	12-33	LOSS OF THREE FUEL CELLS PLUS ONE BATTERY CURRENT <50 PERCENT OF LOAD ON EITHER REMAINING BATTERY RULE NUMBERS 12-34 THROUGH 12-39 ARE RESERVED	LAUNCH EO ALL	A. <u>ABORT</u> B. <u>ENTER NEXT BEST ATP OR PTP</u> PERFORM EMERGENCY POWER DOWN C. <u>ENTER NEXT BEST PTP</u> PERFORM EMERGENCY POWER DOWN	USE LM SYSTEMS (IF AVAILABLE). RESERVE ENTRY BATTERIES FOR ENTRY. A. ASSUMES ALL THREE FUEL CELL CURRENTS ≤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 10	A	4/23/69	CSM ELECTRICAL POWER SYSTEM		FUEL CELLS	12-5

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	12-50	<p>MAIN BUS TIE MOTOR SWITCH FAILURES</p> <p>A. ONE MOTOR SWITCH FAILS OPEN</p> <p>B. ONE OR BOTH MOTOR SW FAILED CLOSED</p>	<p>LAUNCH</p> <p>ALL</p> <p>ALL</p>	<p>A.1. <u>CONTINUE MISSION</u></p> <p>(A) IF MOTOR SW A/C, TIE BAT C TO MAIN BUS A.</p> <p>(B) IF MOTOR SW B/C, TIE BAT C TO MAIN BUS B.</p> <p>2. <u>CONTINUE MISSION</u> CLOSE ALTERNATE MOTOR SW AND USE MAIN BUS TIE CB'S AS MOTOR SWITCHES.</p> <p>B. <u>CONTINUE MISSION</u> USE CB'S AS MOTOR SWITCHES.</p>	<p>A.2. BATTERIES MUST BE CHARGED THROUGH OPEN MOTOR SW. LEAVE BATTERY CB CLOSED FOR CHARGING.</p> <p>B. IF BOTH MOTOR SWITCHES FAIL CLOSED, BATTERIES CANNOT BE CHARGED.</p>	
	12-51	<p>MAIN BUS SHORTED CAUSING FUEL CELL REVERSE CURRENT DISCONNECT</p> <p>A. FUEL CELL 2 DISCONNECTS FROM MAIN A</p> <p>B. FUEL CELL 2 DISCONNECTS FROM MAIN B</p>	<p>LAUNCH</p> <p>ALL</p> <p>LAUNCH</p> <p>ALL</p>	<p>A.1. <u>CONTINUE MISSION</u></p> <p>(A) PLACE EDS AUTO/OFF TO OFF.</p> <p>(B) F/C 2 TO BUS A ONLY.</p> <p>(C) TIE BAT C TO MAIN A.</p> <p>(D) INVERTER 3 TO AC BUS 2, MAIN A.</p> <p>(E) POWER DOWN MAIN BUS B.</p> <p>A.2. <u>ENTER NEXT BEST PTP IF BUS NOT RESTORED</u> POWER DOWN MAIN BUS B.</p> <p>B.1. <u>CONTINUE MISSION</u></p> <p>(A) PLACE EDS AUTO/OFF TO OFF.</p> <p>(B) FC 2 TO BUS B ONLY.</p> <p>(C) TIE BAT C TO MAIN BUS B.</p> <p>(D) INVERTER 3 TO AC BUS 1, MAIN B.</p> <p>(E) POWER DOWN MAIN BUS A.</p> <p>(F) TVC GIMBAL DRIVE (P,Y) -2.</p> <p>(G) GIMBAL MOTOR CONTROL (YAW 2, PITCH 2) BAT B OPEN FOLLOWING GIMBAL MOTOR TURN ON.</p> <p>B.2. <u>ENTER NEXT BEST PTP IF BUS NOT RESTORED.</u> POWER DOWN MAIN BUS A</p>	<p>A.1. >85 AMPS SHORT ON MAIN B WILL CAUSE REVERSE DISCONNECT DURING LAUNCH MALF <u>EPS-3</u>.</p> <p>A.2. REF MALF PROC EPS <u>5SR-1</u></p> <p>B.1. >79 AMPS SHORT ON MAIN A WILL CAUSE REVERSE DISCONNECT DURING LAUNCH</p>	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM ELECTRICAL POWER SYSTEM		DC DISTRIBUTION	12-7

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	12-51 (CONT)	C. MAIN BUS SHORTED >25 AMPS AND FUEL CELLS CANNOT BE DISCONNECTED FROM SHORTED BUS.	LAUNCH ALL	C.1. <u>ABORT</u> 2. <u>ENTER NEXT BEST PTP IF MAIN BUS NOT RESTORED.</u>	C.1. FAILURE OF MOTOR SWITCH TO DISCONNECT FROM SHORTED BUS INDICATED BY FC SHORTED BUS T/B GRAY. 2. IF FUEL CELL FEED CIRCUITRY SHORTED, CLOSE FC REACTANT VALVES.	
	12-52	A. BATTERY BUS SHORTED >5 AMPS B. BATTERY BUS SHORTED <5 AMPS	LAUNCH ALL ALL	A.1. <u>CONTINUE MISSION</u> (A) PLACE EDS AUTO/OFF TO OFF. (B) OPEN ASSOCIATED MAIN BUS TO BAT BUS CB. (C) TIE BAT C TO ASSOCIATED MAIN BUS. 2. <u>ENTER NEXT BEST PTP IF BUS NOT RESTORED</u> B. <u>CONTINUE MISSION</u> REMOVE POWER FROM BUS EXCEPT FOR MANEUVERS AND ENTRY	A.1. >22 AMPS WILL CAUSE BATTERY BUS VOLTAGE TO BE \leq MAIN BUS VOLTAGE. A.2. REMOVE POWER FROM BUS, IF SHORTED \leq 10 AMPS. POWER BUS JUST PRIOR TO ENTRY TO MAINTAIN SECS REDUNDANCY.	
	12-53	BATTERY RELAY BUS SHORTED A. SHORT >2.0 AMPS B. SHORT <2.0 AMPS	LAUNCH ALL ALL	A.1. <u>CONTINUE MISSION</u> 2. <u>ENTER NEXT BEST PTP</u> OPEN BATTERY BUS TO BATTERY RELAY BUS CB'S. B. <u>CONTINUE MISSION</u>	A.2. REF MALF PROC <u>EPS-SSR-2</u> 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 <u>EPS SSR-2</u>	
	12-54	LOSS OF ONE BATTERY BUS, MAIN BUS, OR BATTERY RELAY BUS. (UNABLE TO POWER BUS) RULE NUMBERS 12-54 THROUGH 12-59 ARE RESERVED	LAUNCH ALL	A. <u>CONTINUE MISSION</u> B. <u>ENTER NEXT BEST PTP</u>		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM ELECTRICAL POWER SYSTEM		DC DISTRIBUTION	12-8

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	12-60	LOSS OF TWO INVERTERS	LAUNCH ALL	A. <u>CONTINUE MISSION</u> B. <u>ENTER NEXT BEST PTP</u>	A. REF MALF PROC _____ PLACE REMAINING INVERTER ON BOTH AC BUSES. B. CONSIDERATION WILL BE GIVEN TO RETAINING LM FOR SYSTEM BACKUP.	
	12-61	LOSS OF ONE AC BUS (TWO PHASES CANNOT BE MAINTAINED >95 VAC)	LAUNCH ALL	A. <u>CONTINUE MISSION</u> B. <u>ENTER NEXT BEST PTP</u>	B. REF MALF PROC <u>EPS-1</u>	
	12-62	LOSS OF BOTH AC BUSES	LAUNCH ALL	A. <u>ABORT MODE I OR MODE II</u> 1. OPEN DIRECT O ₂ FOR SUIT VENTILATION. 2. IF AFTER MODE II, <u>ENTER</u> <u>2-1 PTP.</u> B. <u>ENTER NEXT BEST PTP OR ATP</u> IF SUITED, REMOVE HELMET AND GLOVES. IF TIME PERMITS, RE- MOVE SUITS. IF CABIN DEPRES- SURIZED, USE DIRECT O ₂ UNTIL CABIN IS REPRESSURIZED.	A. REF MR _____ A.2. INITIATE CONTINUOUS FC H ₂ PURGE FOR COOLING. B.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 H ₂ PURGE FOR COOLING.	
		RULE NUMBERS 12-63 THROUGH 12-69 ARE RESERVED				
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM ELECTRICAL POWER SYSTEM		AC	12-9

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MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS					MISSION RULE REFERENCE
	12-70	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	
		AC BUS 1 ϕ A VAC	CC0200V	METER	SEPARATE	HIGHLY DESIRABLE	} 12-5,6,61
		AC BUS 1 ϕ B VAC	-----	METER	-----	HIGHLY DESIRABLE	
		AC BUS 1 ϕ C VAC	-----	METER	-----	HIGHLY DESIRABLE	
				COMMON METER			
		AC BUS 2 ϕ A VAC	CC0203V	METER	SEPARATE	HIGHLY DESIRABLE	} 12-5,6,61
		AC BUS 2 ϕ B VAC	-----	METER	-----	HIGHLY DESIRABLE	
		AC BUS 2 ϕ C VAC	-----	METER	-----	HIGHLY DESIRABLE	
		MAIN BUS A VDC	CC0206V	METER	SEPARATE	1 OF 2 MANDATORY	} 12-32,52,20C 12-22
		MAIN BUS B VDC	CC0207V	METER	SEPARATE		
		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 O ₂ FLO	SC2141R	METER	COMMON		
		FC 1 H ₂ FLO	SC2139R	METER	COMMON		
		FC 2 CURRENT	SC2114C	METER	COMMON	} 1 OF 3 MANDATORY	} 12-7,31,32,33, 22A
		FC 2 O ₂ FLO	SC2142R	METER	COMMON		
		FC 2 O ₂ FLO	SC2140R	METER	COMMON		
		FC 3 CURRENT	SC2115C	METER	COMMON	} 1 OF 3 MANDATORY	} 12-7,31,32,33, 22A
		FC 3 O ₂ FLO	SC2144R	METER	COMMON		
		FC 3 H ₂ 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 10	FINAL	4/15/69	CSM ELECTRICAL POWER SYSTEM		INSTRUMENTATION REQUIREMENTS	12-10	

13 CSM COMM/
INSTRUMENTATION
(SEE SECTION 32)

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MISSION RULES

REV	ITEM
<p>THIS SECTION HAS BEEN DELETED</p> <p>ALL DATA FORMERLY CONTAINED IN THIS SECTION IS NOW IN SECTION 32.</p>	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM COMMUNICATIONS/INSTRUMENTATION		13-1

14- CSM SEQUENTIAL

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MISSION RULES

GENERAL

REV	ITEM				
	14-1	<u>LAUNCH</u>			
		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	<u>ALL MISSION PHASES</u>			
		TO CONTINUE THE MISSION, BOTH PYRO BUSES AND BOTH LOGIC BUSES ARE REQUIRED.			
	14-4	SEQUENTIAL LOGIC BUS IS CONSIDERED FAILED IF:			
		A. VOLTAGE <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 >10 AMPS			
	14-5	PYRO BUS IS CONSIDERED FAILED IF:			
		A. SHORTED >10 AMPS			
		B. FAILURE TO PERFORM ANY SEQUENTIAL FUNCTION WITH SUSPECTED FAILED PYRO SYSTEM			
		RULE NUMBERS 14-6 THROUGH 14-9 ARE RESERVED			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM SEQUENTIAL	GENERAL	14-1

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MISSION RULES

REV	ITEM	MANAGEMENT			
	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 10	FINAL	4/15/69	CSM SEQUENTIAL	MANAGEMENT	14-2

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	14-20	SEQUENTIAL LOGIC BUS A OR B <22 VDC AND UNABLE TO ACTIVATE RCS ENABLE AND/OR SLA SEP RELAYS	LAUNCH ALL	SPECIFIC MISSION RULES A. <u>CONTINUE MISSION</u> ENTER 3-1 IF BUS NOT RESTORED B. <u>TERMINATE OPERATIONS</u> ENTER NEXT BEST PTP IF BUS NOT RESTORED	CD0170X AND/OR CD0123X SYSTEM A, CD0171X AND/OR CD0124X SYSTEM B	
	14-21	PYRO BUS A OR B <35 VDC A. SHORTED >10 AMPS B. SHORTED <10 AMPS C. PYRO BUS NOT SHORTED	LAUNCH ALL ALL LAUNCH	A.1. <u>CONTINUE MISSION</u> 2. <u>TERMINATE OPERATIONS</u> ENTER NEXT BEST PTP B. <u>CONTINUE MISSION</u> C.1. <u>CONTINUE MISSION</u> 2. <u>ATTEMPT FUNCTION USING SUSPECTED FAILED BUS ONLY:</u> (A) IF FUNCTION NORMAL, <u>CONTINUE MISSION</u> (B) IF FUNCTION DOES NOT WORK NORMALLY, <u>ENTER NEXT BEST PTP</u>	• SHORTS CAN ONLY BE DETECTED USING ENTRY BATTERY TIE A.2. USE BATTERY TIE FOR PYRO POWER TO AFFECTED BUS B. USE BATTERY TIE FOR PYRO POWER TO AFFECTED BUS	
	14-22	TELEMETRY INDICATES AN EDS VOTE INPUT 1, 2, OR 3	LAUNCH	<u>CONTINUE MISSION</u> A. IF ANY ENTRY BATTERY <22 VDC, EDS AUTO/OFF SWITCH TO OFF B. ALL ENTRY BATTERIES >22 VDC: CHECK CORRESPONDING EDS CB'S 1, 2, OR 3 CLOSED	PARAMETERS ARE CD0132X, CD0133X, AND CD0134X RESPECTIVELY. A. BAT C VOLTAGE CAN ONLY BE MONITORED ONBOARD	
	14-23	LET JETTISON MOTOR DOES NOT FIRE	LAUNCH	<u>CONTINUE MISSION</u> ATTEMPT JETTISON PER CREW CHECK-LIST EMERGENCY PROCEDURE		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM SEQUENTIAL		SPECIFIC	14-3

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	14-24	SMJC ACTIVATES PREMATURELY	ALL	<u>ENTER NEXT BEST PTP</u> A. TERMINATE OPERATIONS AND POWER DOWN AFFECTED MAIN BUS. DO NOT ARM AFFECTED PYRO BUS B. IF UNDOCKED, <u>RETURN TO CSM AND PERFORM CSM/LM FINAL SEP</u> C. REPOWER AFFECTED MAIN BUS AFTER CM/SM SEP	A. 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. B. USE GOOD SEQUENTIAL SYSTEM	
	14-25	ACTIVATED CM RCS PRESS LOGIC RELAYS.	ALL	<u>CONTINUE MISSION</u> 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	
	14-26	ACTIVATED SLA DEPLOY LOGIC RELAYS	ALL	<u>CONTINUE MISSION</u> 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	<u>ENTER NEXT BEST PTP</u>	REF MR _____	
A	14-28	LOST GROUND TO RESISTER NETWORK FOR LOGIC OR PYRO BUS VOLTS MEASUREMENTS RULE NUMBERS 14-29 THROUGH 14-39 ARE RESERVED	ALL	<u>CONTINUE MISSION</u> DO NOT ARM AFFECTED SYSTEM UNTIL SEQ GO/NO-GO PRIOR TO ENTRY UNLESS OTHER SYSTEM FAILS.	ARMING SYSTEM WITH VOLTAGE >18 VDC WILL RESULT IN PERMANENT LOSS OF ALL ANALOG TELEMETRY PARAMETERS.	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	CSM SEQUENTIAL		SPECIFIC	14-4

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	14-40	ACTIVATED APEX JETTISON LOGIC RELAYS	ALL	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	ALL	ENTER NEXT BEST PTP DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED	MAY BE DETECTED AT ANY TIME (CE0001X AND/OR CE0002X)	
	14-42	ACTIVATED PILOT CHUTE DEPLOY LOGIC RELAYS	TEC	ENTER NEXT BEST PTP DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED	DETECTED AT SECS POWER UP PRIOR TO ENTRY (CE0003X AND/OR CE0004X) WITH ELS BAT A(B) CB CLOSED	
		RULE NUMBERS 14-43 THROUGH 14-49 ARE RESERVED				
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM SEQUENTIAL		SPECIFIC	14-5

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MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS					MISSION RULE REFERENCE
A	14-50	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	
		PYRO BUS A VOLTS	CD0005V	-----	-----	} 1 OF 2 M	14-21
		PYRO BUS B VOLTS	CD0006V	-----	-----		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	CE0322X	-----	-----	HD	-----
		EDS ABORT REQ A	BS0080X	-----	-----	HD	-----
		EDS ABORT REQ B	BS0081X	-----	-----	HD	-----
		DOCKING PROBE TEMP	CS0220T	-----	-----	HD	-----
		CSM-LM LOCK RING SEP RELAY A	CD1154X	-----	-----	HD	19-23
		CSM-LM LOCK RING SEP RELAY B	CD1155X	-----	-----	HD	19-23
		LM CURRENT	SC2962C	METER	COMMON	HD	-----

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MISSION RULES

REV	ITEM	GENERAL			
	15-1	<p><u>LAUNCH</u></p> <p>THERE ARE NO FAILURES OF THE CSM GUIDANCE AND CONTROL SYSTEM WHICH ARE CAUSE FOR ABORT.</p>			
	15-2	<p><u>EARTH ORBIT PHASE</u></p> <p>A. IN ORDER TO CONTINUE THE MISSION PAST THE NEXT BEST PTP, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE SPS CRITICAL BURN CAPABILITY AND ONE BACKUP DEORBIT METHOD (SM OR HYBRID). THE FOLLOWING MINIMUM CAPABILITIES MUST BE AVAILABLE:</p> <ol style="list-style-type: none"> 1. <u>ATTITUDE CONTROL</u>: DIRECT RCS AND RATE DAMPING IN EACH AXIS. 2. <u>TVC (CRITICAL BURNS)</u>: ONE TVC SERVO LOOP IN EACH AXIS AND ONE TVC CONTROL MODE (ACCEL CMD EXCLUDED). 3. <u>BACKUP DEORBIT</u>: AS LONG AS ENOUGH PROPELLANT IS AVAILABLE FOR AN SM DEORBIT, THE G&C SYSTEMS MUST PROVIDE THAT CAPABILITY. IF SM DEORBIT IS NOT POSSIBLE DUE TO LACK OF PROPELLANT OR A SYSTEMS FAILURE, THE G&C SYSTEMS MUST PROVIDE CAPABILITY FOR A HYBRID DEORBIT. <ul style="list-style-type: none"> (A) SM DEORBIT REQUIREMENTS: <ul style="list-style-type: none"> - TRANSLATION CAPABILITY - ONE OPERATIONAL FDAI - RATE DAMPING IN ALL THREE AXES (DAP OR SCS) (B) HYBRID DEORBIT REQUIREMENTS: <ul style="list-style-type: none"> - ALL SM DEORBIT REQUIREMENTS (RATE DAMPING MUST BE SCS) - OPERATIONAL, IMU, CMC, AND MAIN DSKY - TWO OPERATIONAL RHC'S <p>B. IN ORDER TO PERFORM A NON-CRITICAL BURN AFTER THE STORAGE TANKS ARE EMPTY, 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> <p>C. IN ORDER TO COMMIT TO THE TRANSLUNAR COAST PHASE, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE SPS NON-CRITICAL BURN CAPABILITY. THE FOLLOWING MINIMUM CAPABILITIES MUST ALSO BE AVAILABLE TO BE GO FOR TLI:</p> <ol style="list-style-type: none"> 1. <u>ATTITUDE CONTROL</u>: DIRECT RCS AND RATE DAMPING IN EACH AXIS. 2. <u>TVC</u>: TWO SERVO LOOPS AND BOTH G&N AND ONE SCS TVC CONTROL MODES (ACCEL CMD EXCLUDED) 3. <u>G&N</u>: CMC, IMU, AND MDC DSKY FULLY OPERATIONAL AND OPTICS CAPABLE OF ALIGNING PLATFORM. 4. <u>DISPLAYS</u>: ONE OPERATIONAL FDAI. 5. <u>ATTITUDE REFERENCE</u>: REDUNDANT ATTITUDE SOURCES ARE REQUIRED FOR ENTRY. 			
	15-3	<p><u>TRANSLUNAR COAST</u></p> <p>IN ORDER TO CONTINUE THE MISSION PAST THE NEXT BEST PTP, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:</p> <ol style="list-style-type: none"> A. <u>ATTITUDE CONTROL</u>: DIRECT RCS AND RATE DAMPING IN EACH AXIS. B. <u>RCS TRANSLATION</u>: X-AXIS VIA AUTO COILS OR DIRECT ULLAGE PUSHBUTTON. C. <u>ATTITUDE REFERENCE</u>: REDUNDANT ATTITUDE REFERENCE SOURCES ARE REQUIRED FOR ENTRY. 			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	GUIDANCE AND CONTROL	GENERAL	15-1

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MISSION RULES

REV	ITEM				
	15-4	<p><u>LOI, LUNAR ORBIT PHASES:</u></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. <u>ATTITUDE CONTROL:</u> DIRECT RCS AND RATE DAMPING IN EACH AXIS. 2. <u>TVC:</u> BOTH SERVO LOOPS AND TWO TVC CONTROL MODES (ACCEL CMD EXCLUDED). 3. <u>G&N:</u> THE G&N MUST BE FULLY OPERATIONAL WITH THE EXCEPTION OF OPTICS AND NAV DSKY. OPTICS MUST BE CAPABLE OF ALIGNING PLATFORM. 4. <u>RCS TRANSLATION:</u> 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><u>DOCKED SPS MANEUVERS</u></p> <p>THE GUIDANCE AND CONTROL SYSTEM MUST PROVIDE A MINIMUM OF ONE TVC SERVO LOOP IN EACH AXIS AND ONE TVC CONTROL MODE TO ALLOW DOCKED SPS MANEUVERS.</p>			
	15-6	<p><u>UNDOCKED</u></p> <p>THE UNDOCKED PHASE WILL BE DELETED OR TERMINATED IF THE G&C SYSTEMS CANNOT PROVIDE REDOCKING CAPABILITY. THE G&C SYSTEMS MUST PROVIDE DIRECT RCS, RATE DAMPING AND TRANSLATION CAPABILITY IN EACH AXIS FOR DOCKING/UNDOCKING CONTROL.</p>			
	15-7	<p><u>RENDEZVOUS</u></p> <p>THE RENDEZVOUS PHASE WILL BE DELETED IF THE G&C SYSTEM CANNOT PROVIDE AN SPS CRITICAL BURN CAPABILITY. IN ADDITION, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES FOR LM RESCUE:</p> <ul style="list-style-type: none"> ● OPERATIONAL OPTICS SUBSYSTEM ● ONE DSKY ● TRANSLATION CAPABILITY ● RATE DAMPING IN ALL THREE AXES ● OPERATIONAL IMU AND CMC ● ONE OPERATIONAL RHC ● ONE OPERATIONAL FDAI ● DIRECT RCS 			
		<p>RULES 15-8 THROUGH 15-9 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	GUIDANCE AND CONTROL	GENERAL	15-2

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MISSION RULES

REV	ITEM	SYSTEMS MANAGEMENT			
	15-10	<p><u>ATTITUDE CONTROL:</u> CSM IN ACTIVE RCS CONTROL; LM WILL NOT BE IN ACTIVE ATTITUDE HOLD.</p> <p>LM IN ACTIVE RCS CONTROL; CSM WILL NOT BE IN ACTIVE ATTITUDE HOLD.</p> <p>FOR DOCKED ACTIVITIES AFTER OPENING THE APS INTERCONNECT (BOTH VEHICLES IN ACTIVE RCS CONTROL), THE CSM MUST BE IN A TIGHTER DEADBAND THAN THE LM.</p>			
	15-11	<p>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.</p>			
A	15-12	<p><u>AV COUNTER DRIFT</u></p> <p>SHOULD THE AV COUNTER DRIFT BE $>0.01 \text{ FT/SEC}^2$ FOR AN RCS MANEUVER, THE V_c SETTING WILL BE APPROPRIATELY BIASED. SHOULD THE DRIFT BE $>0.1 \text{ FT/SEC}^2$, THE EMS WILL BE CONSIDERED FAILED.</p>			
	15-13	<p><u>DAP INITIALIZATION</u></p> <p><u>GIMBAL TRIMS:</u> 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 G&N CONTROLLED, THE CMC STORED VALUES WILL BE USED. TRIMS WILL BE REINITIALIZED FROM THE GROUND AFTER EACH VEHICLE CONFIGURATION CHANGE AND AFTER EACH WEIGHT UPDATE. TRIMS MUST BE UPDATED WHEN GROUND COMPUTED VALUES DIFFER FROM CMC STORED VALUES BY 0.5 DEGREE.</p> <p><u>CSM, LM WEIGHT:</u> WILL BE UPDATED WHEN GROUND COMPUTED VALUES DIFFER FROM CMC STORED VALUES BY 1.0 PERCENT. WEIGHTS MUST BE UPDATED WHEN GROUND VALUES DIFFER FROM CMC VALUES BY 10.0 PERCENT.</p>			
		<p>RULE NUMBERS 15-14 THROUGH 15-19 RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	GUIDANCE AND CONTROL	MANAGEMENT	15-3

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
			SPECIFIC MISSION RULES			
	15-20	LOSS OF EITHER BMAG 1 OR 2 IN EITHER PITCH OR YAW CHANNEL	ALL	<u>CONTINUE MISSION</u>	<p>A. REF MALF PROC _____</p> <p>B. NO SCS AUTO TVC</p> <p>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.</p>	
	15-21	LOSS OF BOTH BMAG 1 AND 2 IN EITHER PITCH OR YAW CHANNEL	<p>LAUNCH</p> <p>TLC</p> <p>RNDZ</p> <p>ALL OTHERS</p> <p>ENTRY</p>	<p>A. <u>CONTINUE MISSION</u></p> <p>B. <u>NO-GO FOR LOI</u></p> <p>C. <u>CONTINUE MISSION</u></p> <p>D. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u></p> <p>E. <u>CONTINUE MISSION</u></p>	<p>A. MIVC ACCEL CMD IS ONLY MODE III OR MODE IV SPS CONTROL MODE.</p> <p>D. 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</p> <p>E. RSI AND SCS FDAI ROLL UNUSABLE WITH YAW CHANNEL FAILURES.</p>	
	15-22	<p>LOSS OF ROLL BMAG</p> <p>A. NUMBER ONE</p> <p>B. NUMBER TWO</p>	<p>ALL</p> <p>ALL</p>	<p>A. <u>CONTINUE MISSION</u></p> <p>B. <u>CONTINUE MISSION</u></p>	<p>A.1. MANUAL ROLL ATTITUDE CONTROL REQUIRED IN ALL SCS MODES.</p> <p>2. NO SCS FDAI ROLL. RSI VALID.</p> <p>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.</p> <p>2. SELECTION OF RATE 1 WILL PROVIDE BOTH RSI AND SCS FDAI ROLL FOR ENTRY. RSI MUST BE REALIGNED FOR ROLL FAILURE AFTER .05G.</p>	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	GUIDANCE AND CONTROL		SCS	15-4

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	15-23	LOSS OF BOTH ROLL BMAG'S	LAUNCH TLC LO/UN-DOCKED RNDZ ALL OTHERS ENTRY	A. <u>CONTINUE MISSION</u> B. <u>NO-GO FOR LOI</u> C. <u>CONTINUE MISSION</u> D. <u>CONTINUE MISSION</u> E. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u> F. <u>CONTINUE MISSION</u>	F. NO SCS FDAI ROLL OR RSI AVAILABLE	
	15-24	LOSS OF EITHER TVC SERVO LOOP IN EITHER PITCH OR YAW AXIS	LAUNCH/EO TLC RNDZ ALL OTHERS	A. <u>CONTINUE ALTERNATE EO MISSION</u> SELECT 1 OR 2 ON TVC GIMBAL DRIVE SWITCH IN APPROPRIATE AXIS B. <u>NO-GO FOR LOI</u> C. <u>CONTINUE MISSION</u> D. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u>	• MAINTAIN 20 LBS/QUAD/AXIS FOR HARDOVER RECOVERY FOR UNDOCKED AND _____ LBS/QUAD/AXIS FOR HARDOVER RECOVERY FOR DOCKED SPS MANEUVERS. C. DO NOT STAGE LM	
	15-25	LOSS OF BOTH TVC SERVO LOOPS	LAUNCH EO TLC RNDZ ALL OTHERS	A. <u>CONTINUE MISSION</u> B. <u>ENTER NEXT BEST PTP</u> RCS DEORBIT C. <u>NO-GO FOR LOI</u> D. <u>CONTINUE MISSION</u> E. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u>	A.1. REF MALF PROC SCS _____ 2. NO MODE III OR IV CAPABILITY. LIMITED LANDING POINT CONTROL IN MODE III OR IV WITH SM-RCS. D. DO NOT STAGE LM	
	15-26	LOSS OF PROPORTIONAL CONTROL FROM: A. EITHER RHC B. BOTH RHC'S	ALL ALL	A. <u>CONTINUE MISSION</u> USE REMAINING RHC B. <u>CONTINUE MISSION</u> 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 10	FINAL	4/15/69	GUIDANCE AND CONTROL		SCS	15-5

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	15-27	LOSS OF DIRECT RCS CONTROL FROM: A. EITHER RHC B. BOTH RHC'S	ALL LAUNCH RNDZ ALL OTHERS	A. CONTINUE MISSION B.1. <u>CONTINUE MISSION</u> 2. <u>CONTINUE MISSION</u> 3. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u>	• REF MALF PROC SCS ____ B.3. FAILURE VIOLATES DIRECT RCS REQUIREMENT.	
	15-28	COMPLETE LOSS OF AUTO ATTITUDE CONTROL IN PITCH AND YAW CHANNELS. A. CONTROL IS REGAINED BY OPENING EMS CB'S. B. CONTROL IS REGAINED BY PLACING S/C CONTROL SWITCH TO CMC. C. CONTROL IS NOT REGAINED	ALL ALL RNDZ ALL OTHERS	A. <u>CONTINUE MISSION</u> AFTER SM JETTISON EMS MAY BE REENABLED WITHOUT LOSS OF AUTO RCS. B. <u>CONTINUE MISSION</u> C.1. <u>CONTINUE MISSION</u> 2. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u> USE DIRECT ULLAGE AND DIRECT RCS.	• REF MALF PROC SCS ____ SUSPECTED FAILURE WOULD BE AUTO INHIBIT CIRCUITRY. B. NO SCS ATTITUDE OR TVC CONTROL C.2. FAILURE VIOLATES RATE DAMPING REQUIREMENTS.	
	15-29	LOSS OF FLIGHT DIRECTOR ATTITUDE INDICATORS A. ONE B. BOTH	ALL LAUNCH TLC RNDZ ALL OTHERS	A. <u>CONTINUE MISSION</u> B.1. <u>CONTINUE MISSION</u> 2. <u>NO-GO FOR LOI</u> 3. <u>CONTINUE MISSION</u> 4. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u>	• REF MALF PROC SCS ____ 4. USE WINDOW REF.	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	GUIDANCE AND CONTROL		SCS	15-6

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	15-30	LOSS OF AC1 ϕ A	LAUNCH TLC RNDZ ALL OTHERS	A. <u>CONTINUE MISSION</u> B. <u>NO-GO FOR LOI</u> C. <u>CONTINUE MISSION</u> D. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u>	<ul style="list-style-type: none"> • LOSS OF AC1 ϕA RESULTS IN THE LOSS OF: <ul style="list-style-type: none"> A. REDUNDANT SERVO LOOP POWER. BOTH SERVO LOOPS MUST BE POWERED BY THE SAME BUS. B. PROPORTIONAL ATTITUDE CONTROL FROM BOTH RHC'S. ALL PROPORTIONAL CONTROL FROM RHC #1. C. FDAI #1 D. GYRO ASSEMBLY #1 E. SCS TOTAL ATTITUDE ERROR F. SCS TOTAL ATTITUDE G. SCS AUTO TVC CAPABILITY H. SCS MINIMUM IMPULSE CAPABILITY I. SCS ATTITUDE CONTROL RATE DAMPING J. GPI P&Y DRIVE #1. • IN EARTH ORBIT, LOSS OF AC1 PRECLUDES HYBRID DEORBIT AND SUBJECTS BOTH REMAINING DEORBIT METHODS TO A SINGLE FAILURE (AC2 ϕA). <p>C. DO NOT STAGE LM.</p>	
	15-31	LOSS OF AC2 ϕ A	LAUNCH TLC RNDZ ALL OTHERS	A. <u>CONTINUE MISSION</u> B. <u>NO-GO FOR LOI</u> C. <u>CONTINUE MISSION</u> D. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u>	<ul style="list-style-type: none"> • LOSS OF AC2 ϕA RESULTS IN THE LOSS OF: <ul style="list-style-type: none"> A. REDUNDANT SERVO LOOP POWER B. ALL PROPORTIONAL CONTROL C. FDAI #2 D. GYRO ASSEMBLY #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 #2 • IN EARTH ORBIT, LOSS OF AC2 RESULTS IN ALL THREE DEORBIT METHODS BEING SUBJECTED TO A SINGLE FAILURE (AC1 ϕA). <p>C. DO NOT STAGE LM.</p>	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	GUIDANCE AND CONTROL		SCS	15-7

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	15-50	LOSS OF COMMAND MODULE COMPUTER	LAUNCH EO TLC LO UNDOCKED RNDZ ENTRY	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE ALTERNATE EO MISSION</u> IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE C. <u>NO-GO FOR LOI</u> D. <u>NO-GO FOR UNDOCKING</u> PERFORM ALTERNATE LO MISSION E. <u>DOCK</u> F. <u>CONTINUE MISSION</u> G. <u>PERFORM BACKUP ENTRY</u>	• REF MALF PROC G&C _____ B. VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS. D. VIOLATES LM RESCUE MINIMUM REQUIREMENTS	
	15-51	LOSS OF DSKY A. EITHER MDC OR LEB DSKY B. BOTH MDC AND LEB DSKY	ALL EO TLC LO UNDOCKED RNDZ ENTRY	A. <u>CONTINUE MISSION</u> B.1. <u>CONTINUE ALTERNATE EO MISSION</u> IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE 2. <u>NO-GO FOR LOI</u> 3. <u>NO-GO FOR UNDOCKING</u> PERFORM ALTERNATE LO MISSION 4. <u>DOCK</u> 5. <u>CONTINUE MISSION</u> 6. <u>PERFORM BACKUP ENTRY</u>	• REF MALF PROC G&C _____ B.1. VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS 3. VIOLATES LM RESCUE MINIMUM REQUIREMENTS	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO	FINAL	4/15/69	GUIDANCE AND CONTROL		G&N	15-9

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	15-52	CSM WARNING RELAY IN NAV DSKY CLOSED	LAUNCH EO TLC LO UNDOCKED RNDZ ENTRY	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE ALTERNATE EO MISSION</u> IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE C. <u>NO-GO FOR LOI</u> D. <u>NO-GO FOR UNDOCKING</u> PERFORM ALTERNATE LO MISSION E. <u>DOCK</u> F. <u>CONTINUE MISSION</u> G. <u>PERFORM BACKUP ENTRY</u>	<ul style="list-style-type: none"> • CONSTITUTES LOSS OF PIPA'S G&N TVC, ENTRY GUIDANCE AND FINE ALIGN. B. PIPA'S ARE REQUIRED FOR ΔV SENSING IN HYPRID DEORBIT. D. VIOLATES LM RESCUE MINIMUM REQUIREMENTS 	
	15-53	LOSS OF INERTIAL SUB- SYSTEM	LAUNCH EO TLC LO UNDOCKED RNDZ ENTRY	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE ALTERNATE EO MISSION</u> IF BOTH SPS AND SM DEORBIT C. <u>NO-GO FOR LOI</u> D. <u>NO-GO FOR UNDOCKING</u> PERFORM ALTERNATE LO MISSION E. <u>DOCK</u> F. <u>CONTINUE MISSION</u> G. <u>PERFORM BACKUP ENTRY</u>	<ul style="list-style-type: none"> • REF MALF PROC G&C _____ B. VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS D. VIOLATES LM RESCUE MINIMUM REQUIREMENTS 	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	GUIDANCE AND CONTROL		G&N	15-10

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	15-54	LOSS OF OPTICS SUBSYSTEM	LAUNCH EO TLC LUNAR ORBIT UNDOCKED RNDZ	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE ALTERNATE EO MISSION</u> USE BACKUP ALIGNMENT PROCEDURE (COAS) C. <u>NO-GO FOR LOI</u> D. <u>NO-GO FOR UNDOCKING</u> PERFORM ALTERNATE LO MISSION E. <u>DOCK</u> F. <u>CONTINUE MISSION</u>	• REF MALF PROC G&C _____ D. VIOLATES LM RESCUE MINIMUM REQUIREMENTS	
	15-55	LOSS OF OPTICS SUBSYSTEM COUPLING DATA UNIT DIGITAL TO ANALOG CONVERTER	LAUNCH EO TLC LO UNDOCKED RNDZ	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE ALTERNATE EO MISSION</u> IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE C. <u>NO-GO FOR LOI</u> D. <u>NO-GO FOR UNDOCKING</u> PERFORM ALTERNATE LO MISSION E. <u>DOCK</u> F. <u>CONTINUE MISSION</u>	• REF MALF PROC G&C _____ • CONSTITUTES LOSS OF TVC DAP	
		RULE NUMBERS 15-56 THROUGH 15-59 ARE RESERVED.				
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	GUIDANCE AND CONTROL		G&N	15-11

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MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS					MISSION RULE REFERENCE
	15-60	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	
		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	15-53/54/55
		PIPA TEMP	CG2300T	-	-	HIGHLY DESIRABLE	15-53
		IMU HTR +28 VDC	CH1513X	-	-	HIGHLY DESIRABLE	15-53
		CMC OPERATE +28 VDC	CG1523X	-	-	HIGHLY DESIRABLE	15-50
		OPTX OPERATE 28 VAC	CG1533X	-	-	HIGHLY DESIRABLE	15-55
		IG 1X RSVR OUT SIN	CG2112V	FDAI	COMMON	HIGHLY DESIRABLE	15-53
		IG 1X RSVR OUT COS	CG2113V	FDAI	COMMON	HIGHLY DESIRABLE	15-53
		MG 1X RSVR OUT SIN	CG2142V	FDAI	COMMON	HIGHLY DESIRABLE	15-53
		MG 1X RSVR OUT COS	CG2143V	FDAI	COMMON	HIGHLY DESIRABLE	15-53
		OG 1X RSVR OUT SIN	CG2172V	FDAI	COMMON	HIGHLY DESIRABLE	15-53
		OG 1X RSVR OUT COS	CG2173V	FDAI	COMMON	HIGHLY DESIRABLE	15-53
		SHAFT CDU DAC OUT	CG3721V	-	-	HIGHLY DESIRABLE	15-55
		TRUNNION CDU DAC OUT	CG3722V	-	-	HIGHLY DESIRABLE	15-55
		CMC WARNING	CG5040X	C&W	COMMON	HIGHLY DESIRABLE	15-52
		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 10	FINAL	4/15/69	GUIDANCE AND CONTROL			INSTRUMENTATION REQUIREMENTS	15-12

**16 CSM SERVICE
PROPULSION
SYSTEM**

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM SPS	GENERAL	16-1

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MISSION RULES

REV	ITEM	SYSTEMS MANAGEMENT			
	16-10	<u>PROPELLANT GAGING</u>			
		A. PRIME METHOD: ONBOARD GAGING SYSTEM (1%).			
		B. BACKUP METHOD: FLOW RATE x BURN TIME (3%).			
	16-11	<u>PROPELLANT UTILIZATION VALVE</u>			
		THE PU VALVE WILL BE USED TO CONTROL THE O/F MIXTURE RATIO TO MAINTAIN OXIDIZER IMBALANCE WITHIN ±100 POUNDS.			
A	16-12	<u>DUAL BANK vs SINGLE BANK OPERATION</u>			
		THE SPS WILL ALWAYS BE STARTED USING A SINGLE BANK. HOWEVER, THE OTHER BANK WILL BE OPEN 2 TO 5 SECONDS AFTER IGNITION FOR BURNS GREATER THAN 6 SEC. BANK A WILL BE USED FOR THE FIRST ENGINE IGNITION.			
A	16-13	<u>PROPELLANT MANAGEMENT</u>			
		A. THE SPS PROPELLANT REDLINE TO PROVIDE A GO CAPABILITY FOR LOI IS <u>92.6</u> PERCENT INDICATED PROPELLANT REMAINING AND INCLUDES LOI, TEI, AND TRANSEARTH MCC'S.			
		B. THE SPS PROPELLANT REDLINE TO PROVIDE A GO CAPABILITY FOR RENDEZVOUS IS <u>32.2</u> PERCENT INDICATED PROPELLANT REMAINING AND INCLUDES CSM RESCUE, TEI, AND TRANSEARTH MCC'S.			
A	16-14	<u>PROPELLANT FEEDLINE TEMPERATURE MANAGEMENT</u>			
		SPS LINE HEATERS WILL BE MANUALLY CYCLED TO MAINTAIN FEEDLINE TEMPERATURES BETWEEN 45°F AND 75°F AND ENGINE VALVE TEMPERATURE ABOVE 40°F.			
	16-15	<u>ULLAGE MANAGEMENT</u>			
		IN GENERAL, DOCKED SPS BURNS REQUIRING ULLAGE WILL BE PRECEDED BY A FOUR-JET ULLAGE - UNDOCKED SPS BURNS BY A TWO-JET ULLAGE. TWO-JET ULLAGE WILL BE USED WHENEVER NECESSARY TO IMPROVE SM RCS PROPELLANT CAPABILITY.			
		RULE NUMBERS 16-16 THROUGH 16-19 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	CSM SPS	MANAGEMENT	16-3

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
				SPECIFIC MISSION RULES		
	16-20	SUSTAINED PRESSURE DECAY IN EITHER THE FUEL OR OXIDIZER TANK (COULD BE HELIUM OR FUEL OR OXIDIZER)	LAUNCH	<u>CONTINUE MISSION</u> <ul style="list-style-type: none"> PLAN RCS DEORBIT AT NEXT BEST PTP IF LAND IMPACT IS IMMINENT AFTER ABORTING, REPRESS MANUALLY AND PERFORM BURN TO AVOID LAND. 	<ul style="list-style-type: none"> MALF PROC: SPS _____ MANUAL PRESSURIZATION OF THE TANKS SHOULD BE CONSIDERED PRIOR TO ANY REQUIRED SPS BURN. 	
			EO	<u>ENTER NEXT BEST PTP</u> RCS DEORBIT		
			TLC	<u>NO-GO FOR LOI</u> INHIBIT NON-CRITICAL SPS BURNS		
			LO	<u>PLAN TEI ASAP</u> USE LM DPS IF CAPABILITY EXISTS		
			UNDOCKED	<u>DOCK ASAP</u>		
			RNDZ	<u>RETURN TO CSM OR ATTEMPT CSM RESCUE</u>	DO NOT STAGE LM	
			TEC	<u>CONTINUE MISSION</u> INHIBIT NON-CRITICAL BURNS		
		A. DURING NON-CRITICAL BURN	ALL	A. <u>TERMINATE BURN</u>		
		B. DURING CRITICAL BURN	ALL	B. <u>CONTINUE BURN</u>		
	16-21	LOSS OF ONE GN ₂ TANK PRESSURE (<400 PSIA)	UNDOCKED	A. <u>NO-GO FOR RNDZ</u>	<ul style="list-style-type: none"> MALF PROC: SPS _____ TRANSDUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION. 	
			ALL OTHERS	B. <u>CONTINUE MISSION</u>		
	16-22	LOSS OF BOTH GN ₂ TANK PRESSURES (<400 PSIA)	LAUNCH	A. <u>CONTINUE MISSION</u>	<ul style="list-style-type: none"> MALF PROC: SPS _____ TRANSDUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION. 	
			EO	B. <u>ENTER NEXT BEST PTP</u> RCS DEORBIT		
			TLC	C. <u>NO-GO FOR LOI</u>		
			LO	D. <u>PLAN TEI ASAP</u> WITH LM DPS		
			UNDOCKED	E. <u>DOCK ASAP</u>		
			RNDZ	F. <u>CONTINUE MISSION</u>	F. DO NOT STAGE LM	
			TEC	G. <u>CONTINUE MISSION</u>		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM SPS		SPECIFIC	16-4

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	16-23	FUEL FEEDLINE AND/OR OXIDIZER FEEDLINE TEMP <40°F AND UNABLE TO INCREASE.	LAUNCH EO TLC LO UNDOCKED RNDZ TEC	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE ALTERNATE EO MISSION</u> <u>INHIBIT NON-CRITICAL BURNS</u> C. <u>NO-GO FOR LOI</u> D. <u>PLAN TEI ASAP</u> E. <u>DOCK ASAP</u> F. <u>CONTINUE MISSION</u> G. <u>CONTINUE MISSION</u>	• MALF PROC: SPS _____ LIMITATION FOR CRITICAL BURNS IS 27°F.	
	16-24	ENGINE FLANGE TEMP GOES HIGHER THAN 480°F DURING AN SPS BURN. A. DURING NON-CRITICAL BURN B. DURING CRITICAL BURN	LAUNCH EO ALL ALL	NOT APPLICABLE <u>ENTER NEXT BEST PTP</u> RCS DEORBIT A. <u>TERMINATE BURN</u> <u>INHIBIT FURTHER NON-CRITICAL BURNS</u> B. <u>CONTINUE BURN</u> <u>INHIBIT FURTHER NON-CRITICAL BURNS</u>	• MALF PROC: SPS _____	
	16-25	UNABLE TO IGNITE SPS	LAUNCH EO TLC LO UNDOCKED RNDZ TEC	A. NOT APPLICABLE B. <u>ENTER NEXT BEST PTP</u> RCS DEORBIT C. <u>NO-GO FOR LOI</u> D. <u>PLAN TEI ASAP</u> WITH LM DPS E. N/A F. <u>RETURN TO CSM ASAP</u> CONSERVING DPS IF POSSIBLE G. <u>CONTINUE MISSION</u>		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	CSM SPS		SPECIFIC	16-5

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	16-26	THRUST CHAMBER PRESSURE <70 PSI CONFIRMED BY OTHER INSTRUMENTATION A. DURING NON-CRITICAL BURN B. DURING CRITICAL BURN	LAUNCH EO	NO APPLICABLE <u>ENTER NEXT BEST PTP</u> A. <u>TERMINATE BURN</u> INHIBIT FURTHER NON-CRITICAL BURNS B. <u>CONTINUE BURN</u> INHIBIT FURTHER NON-CRITICAL BURNS	<ul style="list-style-type: none"> MALF PROC: SPS _____ CONFIRMING INSTRUMENTATION INCLUDES ONBOARD P. METER, CREW, DEGRADED THRUST, FU AND OX INTERFACE PRESSURES, F/O VALVE POSITIONS, FU AND OX TANK PRESSURES. 	
	16-27	LACK OF ULLAGE CAPABILITY	LAUNCH EO TLC LO UNDOCKED RNDZ	A. NOT APPLICABLE B. <u>NO-GO FOR TLI</u> CONTINUE MISSION IN EO WITH SUITABLE ALTERNATE C. <u>NO-GO FOR LOI</u> D. <u>PLAN TEI ASAP</u> E. <u>DOCK ASAP</u> F. <u>CONTINUE MISSION</u>	MALF PROC: SM RCS _____	
A	16-28	FIRST BURN SUBSEQUENT TO DOCKED DPS BURN WAS <40 SEC	ALL	<u>INHIBIT ALL BURNS</u>	IF BURN IS TERMINATED FOR ANY REASON: 1. <u>BEFORE 4 SECONDS</u> - REPEAT ENTIRE 40 SECOND BURN WITH ULLAGE. NO CONSTRAINT ON REIGNITION TIME. 2. <u>AFTER 4 SECONDS, BUT BEFORE 40 SECONDS</u> - IF REQUIRED TO COMPLETE A CRITICAL MANEUVER, REIGNITE ASAP WITH NO ULLAGE.	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	CSM SPS		SPECIFIC	16-6

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MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS					MISSION RULE REFERENCE
16-50	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY		
	OX TK PRESS	SP0003P	METER/C&W	COMMON	M O/B	16-20, 29	
	OX SM/ENG INTERFACE P	SP0931P	-	-	HD	16-20, 29	
	FU TK PRESS	SP0006P	METER/C&W	COMMON	M O/B	16-20, 29	
	FU SM/ENG INTERFACE P	SP0939P	-	-	HD	16-20, 29	
	SPS VLV ACT PRESS-PRI	SP0600P	METER	COMMON	-1 OF 2 M O/B	16-21, 22	
	SPS VLV ACT PRESS-SEC	SP0601P	METER	COMMON		16-21, 22	
	SPS FU FEEDLINE TEMP	SP0048T	METER	COMMON	-1 OF 2 M	16-23	
	SPS OX FEEDLINE TEMP	SP0049T	SYS TEST	COMMON			
	SPS INJ FLANGE TEMP 1	SP0061T	C&W	COMMON	-1 OF 2 M O/B	16-24	
	SPS INJ FLANGE TEMP 2	SP0062T	C&W	COMMON			
	ENG CHAMBER PRESS	SP0661P	METER	COMMON	M O/B	16-26	
	He TK PRESS	SP0001P	METER	SEPARATE	HD	16-30	
	FU/OX VLV 1 POS	SP0022H	DISPLAY	SEPARATE	M } 1 OF 2 O/B	16-25, 26	
	FU/OX VLV 2 POS	SP0023H	DISPLAY	SEPARATE		M }	16-25, 26
	FU/OX VLV 3 POS	SP0024H	DISPLAY	SEPARATE	M } 1 OF 2 O/B	16-25, 26	
	FU/OX VLV 4 POS	SP0025H	DISPLAY	SEPARATE		M }	16-25, 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 10	FINAL	4/15/69	CSM SPS	INSTRUMENTATION REQUIREMENTS	16-8

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MISSION RULES

REV	ITEM	GENERAL			
	17-1	<p><u>LAUNCH</u></p> <p>THE LOSS OF ONE QUAD IS NOT CAUSE FOR ABORT AND THERE ARE NO SINGLE FAILURES NOR ANY REASONABLE REALISTIC COMBINATION OF FAILURES WHICH LEAD ONLY TO LOSS OF MULTIPLE QUADS. THERE ARE, THEREFORE, NO SM-RCS FAILURES WHICH ARE CONSIDERED CAUSE FOR ABORT.</p>			
	17-2	<p><u>EARTH ORBIT PHASE</u></p> <p>A. LOSS OF ONE QUAD, IN ITSELF, IS NOT NECESSARILY CAUSE FOR EARLY TERMINATION OF THE MISSION. THE GUIDELINE IS THAT AS LONG AS THE SPACECRAFT ATTITUDE CAN BE CONTROLLED AND THE SPS CAN BE BURNED THE MISSION NEED NOT BE TERMINATED EARLY. HOWEVER, LOSS OF ONE QUAD WILL REQUIRE <u>TLI BE INHIBITED</u> AND MAY LEAD TO EARLY MISSION TERMINATION SINCE THE CAPABILITY TO PERFORM SM OR HYBRID DEORBIT WILL BE AFFECTED.</p> <p>B. LOSS OF TWO OR MORE QUADS IS CAUSE FOR ENTRY INTO THE NEXT BEST PTP.</p> <p>1. LOSS OF TWO ADJACENT QUADS WILL DESTROY THE CAPABILITY TO PERFORM ULLAGE MANEUVERS AND WILL REQUIRE DELETION OF NON-CRITICAL SPS MANEUVERS. LOSS OF TWO ADJACENT QUADS PRECLUDES SM OR HYBRID DEORBIT.</p> <p>2. LOSS OF TWO OPPOSITE QUADS WILL DESTROY THE CAPABILITY TO PERFORM PRECISE 3-AXIS ATTITUDE CONTROL AND PRECLUDES SM OR HYBRID DEORBIT.</p>			
	17-3	<p><u>TRANSLUNAR COAST</u></p> <p>LOSS OF ONE QUAD IS NOT, IN ITSELF, CAUSE FOR TERMINATION OF THE MISSION. HOWEVER, DEPENDING ON LM RCS CAPABILITY, THE TRANSLUNAR COAST PHASE MAY BE TERMINATED BY ENTRY INTO THE NEXT BEST PTP.</p>			
	17-4	<p><u>LOI</u></p> <p>LOSS OF ONE QUAD IS CAUSE FOR INHIBITING <u>LOI₁</u>, BECAUSE SUBSEQUENT FAILURE OF QUADS OR JETS IMPAIR ATTITUDE CONTROL OR ULLAGE.</p>			
	17-5	<p><u>LUNAR ORBIT</u></p> <p>LOSS OF ONE QUAD IS CAUSE FOR <u>EARLY TERMINATION OF LUNAR ORBIT PHASE AND FOR INHIBITING LOI₂ AND RENDEZVOUS</u>, BECAUSE SUBSEQUENT FAILURE OF QUADS OR JETS IMPAIR ATTITUDE CONTROL OR ULLAGE, CONSIDERATION MAY BE GIVEN TO A MANEUVER TO DECREASE THE REMAINING TIME OF FLIGHT.</p>			
		<p>RULE NUMBERS 17-6 THROUGH 17-14 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM SM-RCS	GENERAL	17-1

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MISSION RULES

REV	ITEM	SYSTEMS MANAGEMENT			
	17-15	<u>PROPELLANT GAGING</u> A. PRIME METHOD: RTCC EQUATION (6%) B. BACKUP METHOD: HELIUM PRESSURE/TEMPERATURE (11%) (ONBOARD)			
	17-16	<u>QUAD PROPELLANT BALANCE</u> 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	<u>SECONDARY PROPELLANT FUEL PRESSURE VALVE</u> 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 10	FINAL	4/15/69	CSM SM-RCS	MANAGEMENT	17-2

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
				SPECIFIC MISSION RULES		
	17-20	SUSTAINED LEAK IN HELIUM TANK A. ONE OR MORE QUADS B. ONE QUAD (ALL OTHER QUADS NORMAL) C. MORE THAN ONE QUAD	LAUNCH EO TLC LO UNDOCKED RNDZ EO ALL OTHER	A. <u>CONTINUE MISSION</u> B.1. <u>NO-GO FOR TLI</u> 2. <u>ENTER NEXT BEST PTP</u> 3. <u>PLAN TEI FOR NEXT OPPORTUNITY</u> 4. <u>DOCK ASAP</u> 5. <u>CONTINUE MISSION</u> C.1. <u>CONTINUE MISSION</u> <u>ENTER PRIOR TO LOSS OF HYBRID DEORBIT CAPABILITY</u> 2. <u>REF RULING B</u>	<ul style="list-style-type: none"> • MALF PROC: RCS _____ • QUAD WILL REMAIN USABLE UNTIL He MANIFOLD PRESSURE REACHES 75 PSI C.2. RETAIN LM ASCENT STAGE FOR TEI 	
	17-21	SUSTAINED LEAK BELOW He ISOLATION VALVE (COULD BE HELIUM OR FUEL OR OXIDIZER) A. ONE OR MORE QUADS B. ONE QUAD (ALL OTHER QUADS NORMAL) C. MORE THAN ONE QUAD	LAUNCH EO TLC LO UNDOCKED RNDZ EO ALL OTHER	A. <u>CONTINUE MISSION</u> B.1. <u>NO-GO FOR TLI</u> 2. <u>ENTER NEXT BEST PTP</u> 3. <u>PLAN TEI FOR NEXT OPPORTUNITY</u> 4. <u>DOCK ASAP</u> 5. <u>CONTINUE MISSION</u> C.1. <u>ENTER NEXT BEST PTP</u> 2. <u>REF RULING B</u>	<ul style="list-style-type: none"> • MALF PROC: RCS _____ • QUAD WILL REMAIN USABLE UNTIL He MANIFOLD PRESSURE REACHES 75 PSI. C.2. RETAIN LM ASCENT STAGE FOR TEI 	
	17-22	PACKAGE TEMP <55°F AND UNABLE TO INCREASE A. ONE QUAD (ALL OTHER QUADS NORMAL) B. MORE THAN ONE QUAD	LAUNCH EO TLC LO UNDOCKED RNDZ EO ALL OTHER	NOT APPLICABLE A.1. <u>NO-GO FOR TLI</u> 2. <u>ENTER NEXT BEST PTP</u> 3. <u>PLAN TEI FOR NEXT OPPORTUNITY</u> 4. <u>DOCK ASAP</u> 5. <u>CONTINUE MISSION</u> B.1. <u>ENTER NEXT BEST PTP</u> 2. <u>REF RULING A</u>	<ul style="list-style-type: none"> • MALF PROC: RCS _____ B.2. RETAIN LM ASCENT STAGE FOR TEI 	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM SM-RCS		SPECIFIC	17-3

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	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. <u>NO-GO FOR UNDOCKING</u> 2. <u>DOCK ASAP</u> 3. <u>CONTINUE MISSION</u>		
		B. LOSS OF FOLLOWING THRUSTER COMBINATIONS: 2 PITCH OR 2 YAW 1 PITCH AND 1 YAW 1 PITCH AND 2 ROLL IN SAME DIRECTION 1 YAW AND 2 ROLL IN SAME DIRECTION 3 ROLL IN SAME DIRECTION	EO TLC LO UNDOCKED RNDZ TEC	B.1. <u>CONTINUE ALTERNATE EO MISSION IF BOTH SPS AND SM RCS DEORBIT CAPABILITY AND ALL AXIS ATTITUDE CONTROL AVAILABLE</u> 2. <u>NO-GO FOR LOI</u> 3. <u>PLAN TEI FOR NEXT OPPORTUNITY</u> 4. <u>DOCK ASAP</u> 5. <u>CONTINUE MISSION</u> 6. <u>CONSIDER MANEUVER TO DECREASE FLIGHT TIME</u>	B.5. RETAIN LM ASCENT STAGE FOR TEI IF LOSS OF ALL THRUSTERS IN ONE DIRECTION IN SAME AXIS	
		C. LOSS OF +X THRUSTERS ON ADJACENT QUADS.	ALL	C. INHIBIT NON-CRITICAL SPS BURNS	C. REF SPS RULE 16-27, LACK OF ULLAGE CAPABILITY	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	CSM SM-RCS		SPECIFIC	17-4

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MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS					
REV	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
17-50		SM He TK A PRESS QTY SM-RCS PROP SYS A	SR5001P SR5025Q	METER METER	COMMON COMMON	} -1 OF 2 M	17-20, 21 17-20, 21
		SM He TK B PRESS QTY SM-RCS PROP SYS B	SR5002P SR5026Q	METER METER	COMMON COMMON		} -1 OF 2 M
		SM He TK C PRESS QTY SM-RCS PROP SYS C	SR5003P SR5027Q	METER METER	COMMON COMMON	} -1 OF 2 M	
		SM He TK D PRESS QTY SM-RCS PROP SYS D	SR5004P SR5028Q	METER METER	COMMON COMMON		} -1 OF 2 M
		SM ENG PKG A TEMP	SR5065T	METER/C&W	COMMON	HD	
		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, 21
		SM OX MAN B PRESS	SR5780P	-----	-----	HD	17-21, 21
		SM OX MAN C PRESS	SR5820P	-----	-----	HD	17-21, 21
		SM OX MAN D PRESS	SR5821P	-----	-----	HD	17-21, 21
MISSION	REV	DATE	SECTION	GROUP		PAGE	
APOLLO 10	FINAL	4/15/69	CSM SM-RCS	INSTRUMENTATION REQUIREMENTS		17-5	

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MISSION RULES

REV	ITEM	GENERAL			
A	18-1	<p><u>LAUNCH</u></p> <p>A. A SUSTAINED LEAK IN OR THE LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE IN <u>ONE CM RCS RING</u> 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 <u>BOTH CM RCS RINGS</u> 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	<p><u>ALL OTHER PHASES</u></p> <p>A. SUSTAINED LEAK IN OR LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE (COULD BE EITHER FUEL OR OXIDIZER) IN ONE CM RCS RING DELETES THE REDUNDANCY OF THE ENTRY ATTITUDE CONTROL SYSTEM AND REDUCES THE ΔV 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 18-3 THROUGH 18-9 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	CSM CM-RCS	GENERAL	18-1

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MISSION RULES

REV	ITEM	SYSTEMS MANAGEMENT			
A	18-10	<p><u>THRUSTER TEMP CONTROL</u></p> <p>CM RCS THRUSTERS WILL BE HEATED PRIOR TO ENTRY FOR 20 MINUTES OR UNTIL THE LOWEST INDICATED TEMPERATURE IS 28°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 ____.</p>			
	18-11	<p><u>HELIUM INTERCONNECT</u></p> <p>AS A LAST RESORT, IF THE HELIUM IN ONE RING IS DEPLETED DUE TO A LEAK AND THE PROPELLANT IS DEPLETED IN THE OTHER RING, THE SYSTEMS MAY BE INTERCONNECTED IF THE REMAINING PROPELLANT IS REQUIRED FOR CONTROL. ONCE INTERCONNECTED, THE RINGS CANNOT BE ISOLATED. MALF PROC RCS ____.</p>			
		<p>RULE NUMBERS 18-12 THROUGH 18-19 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	CSM CM-RCS	MANAGEMENT	18-2

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
				SPECIFIC MISSION RULES		
A	18-20	SUSTAINED LEAK IN OR COMPLETE LOSS OF HELIUM SUPPLY PRESSURE A. ONE RING B. BOTH RINGS	LAUNCH RNDZ ALL OTHERS LAUNCH RNDZ ALL OTHERS	A.1. <u>CONTINUE MISSION AND ENTER PTP 6-4</u> 2. <u>CONTINUE MISSION</u> 3. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u> B.1. <u>CONTINUE MISSION AND ENTER PTP 2-1, UNLESS PRIOR TO TOWER JETTISON. IF PRIOR TO TOWER JETTISON, ABORT</u> 2. <u>CONTINUE MISSION</u> 3. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u>	A.3. NORMAL ENTRY B.3. CONTINGENCY SM RCS SPIN-UP PRIOR TO CM/SM SEP	
A	18-21	SUSTAINED LEAK IN OR COMPLETE LOSS OF HELIUM MANIFOLD PRESSURE (COULD BE EITHER FUEL OR OXIDIZER) A. ONE RING B. BOTH RINGS	LAUNCH RNDZ ALL OTHERS LAUNCH RNDZ ALL OTHERS	A.1. <u>CONTINUE MISSION AND ENTER PTP 6-4</u> 2. <u>CONTINUE MISSION</u> 3. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u> B.1. <u>CONTINUE MISSION AND ENTER PTP 2-1 UNLESS PRIOR TO TOWER JETTISON. IF PRIOR TO TOWER JETTISON, ABORT.</u> 2. <u>CONTINUE MISSION</u> 3. <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u>	B.3. CONTINGENCY SM RCS SPIN-UP PRIOR TO CM/SM SEP	
	18-22	CM RCS IS ARMED FOR ANY REASON RULE NUMBERS 18-23 THROUGH 18-49 ARE RESERVED.	RNDZ ALL OTHERS	<u>CONTINUE MISSION</u> <u>TERMINATE PHASE AND ENTER NEXT BEST PTP</u>		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	CSM CM-RCS		SPECIFIC	18-3

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MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS					
	18-50	<u>MEAS DESCRIPTION</u>	<u>PCM</u>	<u>ONBOARD</u>	<u>TRANSDUCERS</u>	<u>CATEGORY</u>	<u>MISSION RULE REFERENCE</u>
		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	M	18-20
		CM TK B TEMP	CR0004P	METER	COMMON	M	18-20
		CM HE MNFLD A PRESS	CR0035P	METER/C&W	SEPARATE	M (BOTH)	18-21
		CM HE MNFLD B PRESS	CR0036P	METER/C&W	SEPARATE	M (BOTH)	18-21

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CSM CM-RCS	INSTRUMENTATION REQUIREMENTS	18-4

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MISSION RULES

REV	ITEM	GENERAL			
A	19-1	THREE GOOD DOCKING RING LATCHES 120 DEGREES APART ARE REQUIRED FOR AN IVT.			
A	19-2	THREE GOOD DOCKING RING LATCHES 120 DEGREES APART ARE REQUIRED FOR A DOCKED RCS MANEUVER.			
	19-3	DOCKED SPS OR DPS BURNS REQUIRE AT LEAST NINE DOCKING RING LATCHES.			
	19-4	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.			
	19-5	THE SECONDARY FORWARD HATCH MECHANISM MAY BE USED AS THE SOLE METHOD OF LOCKING OR UNLOCKING THE FORWARD HATCH.			
	19-6	LOSS OF VISUAL DOCKING AIDS (COAS AND TARGETS) WILL NOT INHIBIT DOCKING AND UNDOCKING.			
	19-7	TD&E WILL BE ATTEMPTED WITH A NON-EXTENDED DOCKING PROBE.			
		NOTE: THE ONLY DOCKING PROBE INSTRUMENTATION CONSISTS OF TWO TALK BACK INDICATORS IN THE CSM.			
A	19-8	LOW PROBE TEMPERATURE WILL NOT INHIBIT DOCKING ATTEMPTS.			
A		RULE NUMBERS 19-9 AND 19-10 ARE RESERVED..			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	DOCKING AND UMBILICAL	GENERAL	19-1

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MISSION RULES

REV	ITEM				
		MANAGEMENT			
	19-11	TWO NITROGEN BOTTLES ARE REQUIRED FOR UNDOCKING. FOR SYSTEM RETRACT FAILURE, USE THE SECOND BOTTLE IN THE SAME SYSTEM BEFORE UTILIZING BOTTLES IN THE REDUNDANT SYSTEM.			
	19-12	THE CM FORWARD AND LM UPPER HATCH NORMALLY WILL BE INSTALLED FOR ANY TYPE OF MANEUVER OR DOCKING.			
		RULE NUMBERS 19-13 THROUGH 19-19 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	DOCKING AND UMBILICAL	MANAGEMENT	19-2

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	19-20	FAILURE TO ACHIEVE OR MAINTAIN POWER TO X-LUNAR BUS LOADS FROM CSM	DOCKED	<p align="center">SPECIFIC MISSION RULES</p> <p><u>CONTINUE MISSION</u></p> <ol style="list-style-type: none"> INSURE LM DESCENT BATTERY LOW VOLTAGE TAPS ON OPEN CB (11) AND CB (16) EPS: DES ECA CB WITHIN 6 HRS OF TD&E CLOSE CB (11) AND CB (16) EPS: DES ECA CB'S AT FIRST PLANNED MANNING 	<ul style="list-style-type: none"> NOMINAL MISSION MAY BE PERFORMED BECAUSE ECA THERMAL CONSTRAINTS WILL NOT BE VIOLATED WITH DESCENT ECA CB OPEN. OVERCURRENT PROTECTION, HOWEVER, IS LOST UNTIL THESE CB'S ARE CLOSED.
	19-21	FAILURE TO ACHIEVE S-IVB/LM SEPARATION OR FAILURE TO MATE LM UMBILICALS (P23 AND P24)	TD&E	<u>PERFORM CSM/LM FINAL SEP</u>	<p>S-IVB/LM SEP CANNOT BE ACHIEVED WITHOUT MATING AT LEAST ONE UMBILICAL.</p> <p>POWER CAN BE SWITCHED AND MAINTAINED WITH EITHER PLUG.</p>
	19-22	FAILURE TO ACHIEVE CSM/LM FINAL SEPARATION	DOCKED	<p><u>MUST PERFORM NORMAL UNDOCKING</u></p> <ol style="list-style-type: none"> RETRIEVE PROBE AND DROGUE AND INSTALL. AFTER UNDOCKING, DEPRESS CSM AND JETTISON PROBE OVERBOARD. 	LM MASS MAY HAVE TO BE MODIFIED FOR APS BURN
	19-23	FAILURE TO INDICATE DOCKING PROBE EXTEND OR BOTH TALK BACK INDICATORS ARE BARBER POLE.	TD&E UNDOCKED	<ol style="list-style-type: none"> <u>CONTINUE MISSION</u> <u>ATTEMPT TD&E</u> <u>CONTINUE MISSION</u> <u>ATTEMPT DOCKING</u> 	DOCKING RING/TUNNEL STRUCTURE DAMAGE MAY OCCUR TO THE EXTENT THAT TUNNEL PRESSURE CAN NOT BE MAINTAINED.
	19-24	CANNOT REMOVE CSM FORWARD HATCH	TD&E DOCKED	<ol style="list-style-type: none"> <u>PERFORM CSM/LM FINAL SEP</u> <u>PERFORM CSM/LM FINAL SEP</u> IF LM MANNED, PERFORM EVT TO CSM. 	
	19-25	CANNOT REMOVE DOCKING PROBE, LM DROGUE, AND/OR LM UPPER HATCH.	DOCKED	<p><u>CONTINUE MISSION</u></p> <p>PERFORM EVT IF LM MANNED</p>	SPS AND SM RCS MANEUVERS MAY BE PERFORMED
	19-26	FAILURE TO RELEASE CAPTURE LATCHES	DOCKED	<p><u>REDOCK</u></p> <p>PERFORM RETRACTION</p>	
	MISSION	REV	DATE	SECTION	GROUP
APOLLO 10	A	4/23/69	DOCKING AND UMBILICAL	SPECIFIC	19-3

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	19-27	PRIMARY FORWARD HATCH LOCK/UNLOCK MECHANISM INOPERATIVE	ALL	<u>CONTINUE MISSION</u>		
	19-28	FAILURE TO REINSTALL CSM FORWARD HATCH	ALL	<u>CONTINUE MISSION</u>	REF BACKUP PROCEDURES	
	19-29	FAILURE TO REINSTALL PROBE AND/OR DROGUE OR FAILURE TO CLOSE LM UPPER HATCH	DOCKED	<u>NO UNDOCKING</u>	RETAIN DESCENT STAGE FOR TBI	
	19-30	LOSS OF PRIMARY OR SECONDARY DOCKING SYSTEM	ALL	<u>CONTINUE MISSION</u> TWO RETRACT BOTTLES ARE REQUIRED IN REMAINING SYSTEM.	TUNNEL INGRESS MAY HAVE TO BE PERFORMED TO INTERCHANGE PROBE UMBILICALS.	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	DOCKING AND UMBILICAL		SPECIFIC	19-4

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MISSION RULES

REV	ITEM	GENERAL			
	20-1	<p>TO INITIATE AND CONTINUE THE FOLLOWING MISSION PHASES, THE EXTRAVEHICULAR MOBILITY UNIT (EMU) MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:</p> <p>A. <u>DOCKED</u> (TUNNEL HARDWARE INSTALLED)</p> <p>TWO LIFE SUPPORT UNITS (PLSS AND OPS OR 2 OPS) PROVIDING SUFFICIENT CONSUMABLES TO SUPPORT A 30 MINUTE CONTINGENCY TRANSFER.</p> <p>B. <u>UNDOCKED/RNDZ</u></p> <p>TWO LIFE SUPPORT UNITS (PLSS AND OPS OR 2 OPS) PROVIDING SUFFICIENT CONSUMABLES TO SUPPORT A CONTINGENCY TRANSFER.</p>			
		MANAGEMENT			
A	20-2	THE PLSS BATTERY IS CONSIDERED TO HAVE A MINIMUM OF 14.3 AMP-HR CAPABILITY. THIS CONSUMABLE IS GAGED BY MONITORING GT8140C AND PROCESSING IN THE RTCC TO OBTAIN AMP-HRS.			
A	20-3	THE PLSS PRIMARY OXYGEN SUBSYSTEM (POS) IS CONSIDERED TO HAVE A NOMINAL SOURCE PRESSURE OF 850 PSIA. THIS CONSUMABLE IS GAGED BY MONITORING GT8182P AND PROCESSING IN THE RTCC TO OBTAIN LBS MASS.			
A	20-4	THE PLSS FEEDWATER RESERVOIR IS CONSIDERED TO HAVE A NOMINAL LOADING OF 8.3 LBS. THIS CONSUMABLE IS GAGED BY MONITORING GT8154T, GT8196T, GT8182P, GT8110P AND PROCESSING IN THE RTACF TO OBTAIN LBS REMAINING.			
	20-5	THE OPS IS CONSIDERED TO HAVE A MINIMUM SOURCE PRESSURE OF 5380 PSIA. THIS CONSUMABLE IS MONITORED BY A PRESSURE GAGE LOCATED ON THE OPS.			
		RULE NUMBERS 20-6 THROUGH 20-19 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	CEVT	GENERAL/MANAGEMENT	20-1

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	20-30	LOSS OF LIQUID TRANSPORT LOOP THERMAL CONTROL LOSS OF COOLING	CEVT	<u>CONTINUE</u> IF ADDITIONAL COOLING IS REQUIRED, ACTIVATE OPS IN PURGE MODE	GT8154T LCG H ₂ O TEMP GT8196T LCG H ₂ O ΔT GT8140C PLSS BAT CUR CREW SENSIBLE DETECTION LOW FEED H ₂ O PRESS TONE (1.5 KHZ)	
	20-31	FAILURE OF OPS TO CHECK OUT A. OPS SOURCE PRESSURE <5380 PSIA B. OPS REG PRESSURE >4.0 PSID OR <3.4 PSID C. LOSS OF BOTH GREEN HEATER STATUS LIGHTS	CEVT	A. <u>CHECK OUT PLSS</u> USE DEGRADED OPS WITH THE PLSS FOR CEVT B. <u>CHECK OUT PLSS</u> USE DEGRADED OPS WITH THE PLSS FOR CEVT C. <u>CHECK OUT PLSS</u> USE DEGRADED OPS WITH THE PLSS FOR CEVT	A. PRESSURE GAGE ON OPS B. PRESSURE GAGE ON CHECKOUT FIXTURE C. CREW DETECTION	
	20-32	<u>DEPLETION OF POS</u> POS PRESS <130 PSIA	CEVT	ACTIVATE OPS	GT8182P PLSS O ₂ PRESS GT8168P PGA PRESS PGA PRESS GAUGE LOW PGA PRESS TONE (3.0 KHZ) PLSS O ₂ QTY IND	
	20-33	<u>LOSS OF MAIN POWER SUPPLY</u>	CEVT	<u>CONTINUE</u> ACTIVATE OPS IN A PURGE MODE		
	20-34	DEGRADED POWER PROFILE CUR <2.0 AMP OR CUR >3.0 AMP	CEVT	<u>CONTINUE</u> VERIFY PERFORMANCE OF FAN, PUMP, AND SSC	GT8140C PLSS BAT CUR LOW VENT FLOW TONE (3 KHZ)	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CEVT		SPECIFIC	20-3

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	20-35	LOSS OF TM	CEVT	<u>CONTINUE</u>	
	20-36	LOSS OF ANY CRITICAL INSTRUMENTATION	CEVT	<u>CONTINUE</u> ACTIVATE OPS	REF MR 20-42
		RULES 20-37 THROUGH 20-40 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	CEVT	SPECIFIC	20-4

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MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS					MISSION RULE REFERENCE
	20-41	<u>MEAS DESCRIPTION</u>	<u>FM/FM</u>	<u>ONBOARD</u>	<u>TRANSDUCERS</u>	<u>CATEGORY</u>	
		FEED H ₂ O PRESS	GT8110P			HD	
		LOW FEED H ₂ O PRESS		WARNING TONE (1.5 KHZ)	} COMMON	M	
		PLSS EKG	GT8124J			**	
		PLSS BAT CUR	GT8140C			HD	
		PLSS BAT VOLT	GT8141V			HD	
		LCG H ₂ O TEMP	GT8154T			HD	
		PGA PRESS	GT8168P			HD	
		PLSS O ₂ PRESS	GT8182P	METER	} COMMON	HD	
		PLSS O ₂ QTY IND				M	
		LCG H ₂ O ΔT	GT8196T			HD	
		LOW VENT FLOW		WARNING TONE (3.0 KHZ)		M	
		PGA PRESS GAGE		METER		M	
		LOW PGA PRESS		WARNING TONE (3.0 KHZ)		M	
		OPS PRESS GAGE		METER		M	
		OPS REG PRESS GAGE		METER		***M	
		HEATER STATUS CHECK		GREEN LIGHTS		1 OF 2 M	
		*AEROMEDICAL PARAMETER REFERENCE SECTION 31.					
		***NOTE: 1 OF 2 OPS REG PRESS GAGES IS MANDATORY.					
	20-42	CRITICAL INSTRUMENTATION					
		<u>MEAS DESCRIPTION</u>	<u>FM/FM</u>	<u>ONBOARD</u>	<u>TRANSDUCER</u>		
		PLSS O ₂ PRESS/PLSS O ₂ QTY IND	GT8182P	METER	COMMON		
		PGA PRESS GAGE		METER			
		LOW VENT FLOW		WARNING TONE (3.0 KHZ)			
MISSION	REV	DATE	SECTION	GROUP	PAGE		
APOLLO 10	FINAL	4/15/69	CEVT	PRELAUNCH INSTRUMENTATION	20-5		

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MISSION RULES

REV	ITEM				
GENERAL MISSION RULES					
A	21-1	<p>TO INITIATE THE FOLLOWING MISSION EVENTS, THE PYROTECHNIC SYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:</p> <p>A. <u>DOCKED, UNDOCK RNDZ</u></p> <p>ONE OPERATIONAL PYRO SYSTEM</p> <p>B. <u>NORMAL STAGING</u></p> <p>TWO OPERATIONAL PYRO SYSTEMS</p>			
	21-2	<p>A PYRO SYSTEM IS CONSIDERED LOST IF:</p> <p>A. PYRO BATTERY OPEN CIRCUIT VOLTAGE <35 VDC</p> <p>B. UNABLE TO ARM SYSTEM</p>			
A	21-3	<p>A PYRO SYSTEM WILL BE DISABLED IF:</p> <p>A. ANY RELAY K2 THROUGH K6 INADVERTANTLY CLOSES (REF MR 21-13)</p> <p>B. ANY RELAY K7 THROUGH K15 INADVERTANTLY CLOSES</p> <p>A PYRO SYSTEM IS DISABLED BY OPENING THE APPROPRIATE "LOGIC POWER" CIRCUIT BREAKER. SYSTEM WILL BE USED FOR APS PRESSURIZATION AND STAGING.</p>			
	21-4	<p>THE ASCENT AND DESCENT STAGES ARE CONSIDERED RIGIDLY ATTACHED WITH TWO DIAGONALLY OPPOSITE BOLT/NUT PAIRS INTACT.</p>			
A	21-5	<p>THE ASCENT AND DESCENT STAGES ARE CONSIDERED NON-RIDIGLY ATTACHED IF ALL STAGING FUNCTIONS OCCUR EXCEPT THE GUILLOTINE FAILS TO SEVER THE INTERSTAGE UMBILICALS.</p> <p>RULE NUMBERS 21-6 THROUGH 21-9 ARE RESERVED.</p>			
MANAGEMENT MISSION RULES					
	21-10	<p>APS WILL BE PRESSURIZED 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, 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 THE MISSION.</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> <p>RULE NUMBERS 21-14 THROUGH 21-19 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM SEQUENTIAL AND PYROTECHNIC	GENERAL/MANAGEMENT	21-1

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	21-20	PYRO BATTERY VOLTAGE <35 VDC A. ONE SYSTEM B. TWO SYSTEMS		SPECIFIC MISSION RULES	<ul style="list-style-type: none"> ● REF MR 21-12, 3-58 	
			ALL	A. <u>CONTINUE MISSION</u> DELAY STAGING		
			ALL	B.1. <u>DO NOT STAGE</u>		
			DOCKED	2. <u>CONTINUE MISSION</u> DO NOT UNDOCK		
			UNDOCKED	3. <u>DOCK ASAP</u> DO NOT PERFORM SEPARATION		
			RNDZ	4. <u>DOCK ASAP</u> SEP - DO NOT PERFORM DOI DOI - CONTINUE MISSION PHASING - CONTINUE MISSION		
A	21-21	UNABLE TO ARM PYRO SYSTEM(S) A. ONE SYSTEM B. BOTH SYSTEMS PRIOR TO: 1. UNDOCKING 2. DPS SHE PRESSUR- IZATION 3. APS PRESSURIZATION/ STAGING	ALL	A. <u>CONTINUE MISSION</u> DELAY STAGING	<ul style="list-style-type: none"> ● REF MR 21-12, 3-58 	
			DOCKED	B.1. <u>CONTINUE MISSION</u> DO NOT UNDOCK	B.1. STAGING CANNOT BE ACCOMPLISHED	
			RNDZ	2. <u>DOCK ASAP</u> SEPARATION - <u>DO NOT PERFORM</u> <u>DOI</u>		
			RNDZ	3. <u>DOCK ASAP</u>	3. CSM RESCUE MAY BE REQUIRED DUE TO RCS REDLINES	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM SEQUENTIAL AND PYROTECHNIC		SPECIFIC	21-2

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	21-22	UNABLE TO DISARM PYRO SYSTEM(S)	DOCKED UNDOCKED RNDZ	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE MISSION</u> STAGE NORMALLY	REF MALF PROC ED 1 K1 = MASTER ARM RELAY • EPS WILL BE CONFIGURED TO INSURE ASCENT POWER.	
	21-23	RELAY K2 THROUGH K6 (OR K1 THROUGH K6 AFTER APS PRESS) INADVERTANTLY CLOSED AND CANNOT BE RESET A. SYSTEM A (DESCENT STAGE) B. SYSTEM B (ASCENT STAGE) C. BOTH SYSTEMS	DOCKED ALL ALL ALL	<u>CONTINUE MISSION</u> A. <u>CONTINUE MISSION</u> OPEN LOGIC POWER A CB UNTIL TIME TO PRESSURIZE APS, THEN: 1. ASC He SEL SW - BOTH 2. MSTR ARM SW - ON 3. ASC He PRESS SW - FIRE 4. MSTR ARM SW - OFF 5. LOGIC PWR A CB - CLOSE 6. ASC He PRESS SW - FIRE (HOLD) 7. STAGE SW - FIRE 8. MSTR ARM SW - ON 9. ASC He PRESS SW - SAFE B. <u>CONTINUE MISSION</u> OPEN LOGIC PWR B CB UNTIL TIME TO PRESSURIZE APS, THEN: 1. ASC He SEL SW - BOTH 2. MSTR ARM SW - ON 3. ASC He PRESS SW - FIRE 4. STAGE SW - FIRE 5. LOGIC PWR B CB - CLOSE 6. ASC He PRESS SW - FIRE C. <u>CONTINUE MISSION</u> OPEN BOTH LOGIC POWER A AND B CB'S UNTIL TIME TO PRESSURIZE APS, THEN: 1. ASC He SEL SW - BOTH 2. LOGIC PWR A CB - CLOSE 3. ASC He PRESS SW - FIRE (HOLD) 4. STAGE SW - FIRE 5. MSTR ARM SW - ON 6. ASC He PRESS SW - SAFE 7. LOGIC PWR B CB - CLOSE 8. ASC He PRESS SW - FIRE	RELAYS K2 = STAGE K3 = STAGE SEQUENCE K4 = 1 GUILLOTINE K5 = 2 BOLTS (SYS A) AND 2 NUTS (SYS B) K5A = 2 BOLTS (SYS A) AND 2 NUTS (SYS B) K6 = 2 ELECTRICAL CIRCUIT INTERRUPTERS A. ALL PYRO FUNCTIONS EXCEPT APS PRESSURIZATION AND STAGING WILL BE PERFORMED ON SYSTEM B. B. ALL PYRO FUNCTIONS EXCEPT APS PRESSURIZATION AND STAGING WILL BE PERFORMED ON SYSTEM A. C. NO PYRO FUNCTION CAN BE PERFORMED EXCEPT APS PRESSURIZATION/STAGING. FOR THIS EVENT SYSTEM B WILL BE BACKUP TO SYSTEM A.	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM SEQUENTIAL AND PYROTECHNIC		SPECIFIC	21-3

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MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS				
	21-50	<u>MEAS DESCRIPTION</u>	<u>PCM</u>	<u>ONBOARD</u>	<u>CATEGORY</u>	<u>MISSION RULE REFERENCE</u>
		ED RLY A K1-K6	GY0201X	SYS A STAGING LIGHT CAUTION	COMMON CAUTION LIGHT	M HD 21-1, 2, 3, 13, 21, 22, 23
		ED RLY B K1-K6	GY0202X	SYS B STAGING LIGHT CAUTION		M HD 21-1, 2, 3, 13, 21, 22, 23
		ED RLY A K7-K15	GY0231X	-----	M	21-1, 3, 24
		ED RLY B K7-K15	GY0232X	-----	M	21-1, 3, 24
		SELECTED ED. BAT VOLT	-----	METER	M	21-1, 2, 20

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM SEQUENTIAL & PYROTECHNIC	PRELAUNCH INSTRUMENTATION	21-5

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MISSION RULES

REV	ITEM				
		GENERAL			
A	22-1	<p>TO INITIATE THE FOLLOWING MISSION EVENTS, THE ELECTRICAL POWER SYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:</p> <p>A. <u>DOCKED WITH HATCH CLOSED</u></p> <ol style="list-style-type: none"> 1. CDR AND LMP BUSES 2. TWO DESCENT BATTERIES PLUS ONE ASCENT BATTERY 3. BOTH ASCENT FEEDERS PLUS ONE DESCENT FEEDER 4. SUFFICIENT AVAILABLE ELECTRICAL ENERGY TO POWER THE LM FOR 2 HRS BEYOND THE PLANNED LM TO CSM CREW TRANSFER <p>B. <u>DOCKED WITH HATCH OPEN AND TUNNEL CLEAR</u> (NOTE: DOCKED DPS BURN FOR TEI IS NO-GO FOR ITEM 1)</p> <ol style="list-style-type: none"> 1. CDR OR LMP BUS 2. TWO DESCENT BATTERIES WITH ASSOCIATED FEEDER OR ONE ASCENT BATTERY WITH ASSOCIATED FEEDER <p>C. <u>UNDOCKING, SEPARATION</u></p> <ol style="list-style-type: none"> 1. CDR AND LMP BUSES 2. TWO DESCENT BATTERIES PLUS ONE ASCENT BATTERY 3. BOTH ASCENT FEEDERS PLUS ONE DESCENT FEEDER 4. SUFFICIENT AVAILABLE ELECTRICAL ENERGY TO POWER THE LM FOR 2 HOURS BEYOND THE PLANNED LM TO CSM CREW TRANSFER 			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM ELECTRICAL POWER	GENERAL	22-1

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MISSION RULES

REV	ITEM				
A	22-1 CONT'D	<p>D. <u>DOI</u></p> <ol style="list-style-type: none"> 1. CDR AND LMP BUSES 2. TWO DESCENT BATTERIES PLUS TWO ASCENT BATTERIES OR FOUR DESCENT BATTERIES PLUS ONE ASCENT BATTERY 3. BOTH ASCENT FEEDERS PLUS ONE DESCENT FEEDER. 4. ONE INVERTER AND BOTH AC BUSES 5. SUFFICIENT AVAILABLE ELECTRICAL ENERGY TO POWER THE LM FOR 2 HOURS BEYOND THE PLANNED LM TO CSM CREW TRANSFER <p>E. <u>PHASING (FIVE IMPULSE RNDZ WILL BE SELECTED IF THESE CONDITIONS ARE VIOLATED)</u></p> <ol style="list-style-type: none"> 1. CDR AND LMP BUSES 2. TWO DESCENT BATTERIES PLUS TWO ASCENT BATTERIES OR FOUR DESCENT BATTERIES PLUS ONE ASCENT BATTERY 3. BOTH ASCENT FEEDERS PLUS ONE DESCENT FEEDER UNLESS DESCENT FEEDER LOST DUE TO HARD SHORT 4. SUFFICIENT AVAILABLE ELECTRICAL ENERGY TO POWER THE LM FOR 2 HOURS BEYOND THE PLANNED LM TO CSM CREW TRANSFER <p>F. <u>STAGING (NORMAL)</u></p> <ol style="list-style-type: none"> 1. CDR AND LMP BUSES 2. BOTH ASCENT BATTERIES OR ONE ASCENT BATTERY IF NO DESCENT ENERGY REMAINS AND DESCENT O₂ TANK IS DEPLETED 3. EITHER ASCENT FEEDER 4. ASCENT BATTERY OVERCURRENT PROTECTION 5. SUFFICIENT AVAILABLE ASCENT ELECTRICAL ENERGY TO POWER THE LM FOR 2 HOURS BEYOND THE PLANNED LM TO CSM CREW TRANSFER <p>G. <u>STAGING (DOCKED, HATCH OPEN AND TUNNEL CLEAR, OR DELAYED)</u></p> <ol style="list-style-type: none"> 1. CDR OR LMP BUS 2. ONE ASCENT BATTERY 3. ONE ASCENT FEEDER 4. SUFFICIENT AVAILABLE ASCENT ELECTRICAL ENERGY TO POWER THE LM FOR 2 HOURS BEYOND THE PLANNED LM TO CSM CREW TRANSFER <p>H. <u>UNMANNED APS BURN</u></p> <ol style="list-style-type: none"> 1. CDR AND LMP BUSES 2. ONE ASCENT BATTERY 3. ONE ASCENT FEEDER 			
	22-2	<p>THE CDR OR LMP BUS IS CONSIDERED LOST IF:</p> <ol style="list-style-type: none"> A. BUS VOLTAGE CANNOT BE MAINTAINED ABOVE 26.5 VDC B. BUS CURRENT \geq 90 AMPS 			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM ELECTRICAL POWER	GENERAL	22-2

NASA — Manned Spacecraft Center
MISSION RULES

REV	ITEM				
	22-3	<p>A BATTERY IS CONSIDERED LOST IF:</p> <p>A. OUTPUT ≤ 2 AMPS WHEN CONNECTED TO THE BUS</p> <p>B. TEMPERATURE IS $\geq 145^{\circ}\text{F}$</p> <p>C. CANNOT MEET VOLTAGE REGULATION AT REQUIRED LOAD</p> <p>D. CANNOT BE CONNECTED TO A FEEDER DUE TO A MALFUNCTIONING ECA</p> <p>E. BATTERY OPEN CIRCUIT VOLTAGE BELOW 31.8 VDC STEADY STATE</p>			
	22-4	<p>A DC BUS FEEDER IS CONSIDERED LOST IF:</p> <p>CANNOT BE USED AS A POWER PATH</p>			
	22-5	<p>AN INVERTER AND/OR ASSOCIATED AC DISTRIBUTION SYSTEM IS CONSIDERED LOST IF:</p> <p>A. AC BUS VOLTAGE ≤ 110.5 OR ≥ 120 VAC</p> <p>B. AC BUS FREQUENCY ≤ 390 OR ≥ 410 HZ</p> <p>C. POWER CANNOT BE SUPPLIED TO AN AC BUS</p>			
	22-6	<p>A. ECA OVERCURRENT PROTECTION IS <u>DEFINITELY</u> LOST IF:</p> <ol style="list-style-type: none"> 1. BOTH CIRCUIT BREAKERS POWERING THE ECA'S FAIL OPEN (ALL DESCENT OR ALL ASCENT ECA'S, WHICHEVER IS APPLICABLE) 2. ASCENT BATTERY BACKUP FEED IS USED <p>B. ECA OVERCURRENT PROTECTION IS <u>PROBABLY</u> LOST IF:</p> <ol 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>RULE NUMBERS 22-7 THROUGH 22-9 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM ELECTRICAL POWER	GENERAL	22-3

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MISSION RULES

REV	ITEM	MANAGEMENT			
	22-10	THE MISSION WILL BE CONTINUED WITH THE PROBABLE LOSS OF OVERCURRENT PROTECTION. IF THIS PROTECTION IS LOST PRIOR TO LIFTOFF, A HOLD WILL BE CALLED. (REF MR 22-22 FOR DEFINITE LOSS OF OVERCURRENT PROTECTION)			
	22-11	FOR NOMINAL STAGING, THE ASCENT BATTERIES WILL BE PRECONDITIONED FOR ONE ASCENT BATTERY OPERATION BY REMOVING 20 AMP-HRS FROM EACH BATTERY IMMEDIATELY PRIOR TO THE EVENT.			
A	22-12	FOR CONTINGENCY STAGING, THE ASCENT BATTERIES WILL BE PRECONDITIONED FOR TWO ASCENT BATTERY OPERATION BY REMOVING 5 AMP-HRS FROM EACH BATTERY IMMEDIATELY PRIOR TO THE EVENT. THIS IS PRESENTLY PLANNED TO BE ACCOMPLISHED ONLY FOR THE PHASING MANEUVER. IN THE EVENT THAT A BATTERY IS LOST AT, OR SUBSEQUENT TO STAGING, SINGLE BUS OPERATION WILL BE CONTINUED UNTIL 20 AMP-HOURS HAVE BEEN REMOVED FROM THE REMAINING ASCENT BATTERY.			
	22-13	DELETED			
		RULE NUMBERS 22-14 THROUGH 22-19 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM ELECTRICAL POWER	MANAGEMENT	22-4

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
SPECIFIC MISSION RULES						
A	22-20	LOSS OF EITHER DC BUS	DOCKED	A. <u>CONTINUE MISSION</u> 1. DO NOT UNDOCK 2. CREWMAN OPERATE WITH CONNECTING HATCHES OPEN AND TUNNEL CLEAR 3. PERFORM LIMITED SYSTEMS EVALUATION	<ul style="list-style-type: none"> REF MALF PROC <u>EPS</u>: 1. <u>UNSTAGED DC BUS</u> 2. <u>STAGED DC BUS</u> 3. <u>UNSTAGED C&W PWR</u> 4. <u>STAGED C&W PWR</u> LOSS OF DC BUS RESULTS IN LOSS OF ONE PYRO SYSTEM 	
			UNDOCKED RNDZ	B. <u>DOCK ASAP</u> DELAY STAGING	<ul style="list-style-type: none"> REF MR 21-12, 3-58 	
A	22-21	SHORTED DC BUS FEEDER	ALL	A. <u>CONTINUE MISSION</u> 1. PUT BOTH ASCENT BATTERIES ON NORMAL FEED WITH SHORT ISOLATED VIA DEADFACE RELAY 2. <u>CONTINUE MISSION</u> 3. <u>SEP - CONTINUE MISSION</u> <u>DOI - PERFORM FIVE IMPULSE RNDZ</u> <u>PHASING - CONTINUE MISSION</u>	<ul style="list-style-type: none"> 1. <u>UNSTAGED DC BUS</u> 2. <u>STAGED DC BUS</u> 3. <u>UNSTAGED C&W PWR</u> 4. <u>STAGED C&W PWR</u> 	
		A. DESCENT	DOCKED UNDOCKED RNDZ			
		B. ASCENT	ALL DOCKED UNDOCKED RNDZ	B.1. SET UP FOR UNMANNED APS BURN 2. <u>CONTINUE MISSION</u> (A) DO NOT UNDOCK (B) POWER AFFECTED BUS FROM OTHER BUS VIA 100 AMP CROSSTIE C/B'S (C) CREWMEN OPERATE WITH CONNECTING HATCHES OPEN AND TUNNEL CLEAR (D) PERFORM SYSTEMS EVALUATION 3. <u>DOCK ASAP</u>		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM ELECTRICAL POWER		SPECIFIC	22-5

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	22-22	DEFINITE LOSS OF OVER-CURRENT PROTECTION A. DESCENT BATTERIES B. ASCENT BATTERIES	ALL ALL	A. <u>CONTINUE MISSION</u> B. <u>CONTINUE MISSION</u> DELAY STAGING	• NO APPLICABLE MALF PROC REF MR 22-6, 21-12, 3-58	
A	22-23	LOSS OF ASCENT BATTERIES: A. LOSS OF ONE ASCENT BATTERY B. LOSS OF TWO ASCENT BATTERIES	ALL ALL DOCKED UNDOCKED RNDZ	A.1. <u>CONTINUE MISSION</u> DO NOT STAGE UNLESS DESCENT BATTERIES ARE DEPLETED AND DESCENT O ₂ TANK DEPLETED. B.1. <u>DO NOT STAGE</u> 2. <u>CONTINUE MISSION</u> (A) DO NOT UNDOCK (B) CREWMEN OPERATE WITH CONNECTING HATCHES OPEN AND TUNNEL CLEAR (C) PERFORM SYSTEMS EVALUATION 3. <u>DOCK ASAP</u>	• REF MALF PROC <u>EPS</u> : 2 <u>STAGED DC RUS</u> 4 <u>STAGED C&W POWER</u> 5 <u>BATTERY</u>	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM ELECTRICAL POWER		SPECIFIC	22-6

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	22-24	LOSS OF DESCENT BATTERIES: A. LOSS OF ONE OR TWO DESCENT BATTERIES B. LOSS OF THREE DESCENT BATTERIES C. LOSS OF FOUR DES BATTERIES	ALL DOCKED UNDOCKED RNDZ ALL DOCKED	A. <u>CONTINUE MISSION</u> B.1. <u>CONTINUE MISSION</u> 2. <u>CONTINUE MISSION</u> 3. SEP - <u>DO NOT PERFORM DOI</u> 4. DOI - <u>PERFORM FIVE IMPULSE RNDZ</u> 5. PHASING - <u>CONTINUE MISSION</u> C.1. SET UP FOR UNMANNED APS BURN 2. <u>CONTINUE MISSION</u> (A) DO NOT UNDOCK (B) CREWMAN OPERATE WITH CONNECTING HATCHES OPEN AND TUNNEL CLEAR (C) PERFORM SYSTEMS EVALUATION	• REF MALF PROC <u>EPS</u> : 1 <u>UNSTAGED DC BUS</u> 3 <u>UNSTAGED C&W POWER</u> 5 <u>BATTERY</u>	
A	22-25	LOSS OF INVERTERS A. LOSS OF ONE INVERTER B. LOSS OF BOTH INVERTERS	ALL DOCKED UNDOCKED RNDZ	A. <u>CONTINUE MISSION</u> B.1. <u>CONTINUE MISSION</u> 2. SEP - <u>DO NOT PERFORM DOI</u> 3. DOI - <u>CONTINUE MISSION</u> 4. PHASING - <u>CONTINUE MISSION</u>	• REF MALF PROC <u>EPS</u> : 7 <u>INVERTER</u> • LOSS OF AC BUS A RESULTS IN LOSS OF DPS GIMBAL CONTROL AND RR. • LOSS OF AC BUS B RESULTS IN LOSS OF S-BAND STEERABLE ANTENNA (HBR TM): • LOSS OF BOTH AC BUSES RESULTS IN THE ABOVE PLUS LOSS OF BOTH FDAI SPHERES.	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM ELECTRICAL POWER		SPECIFIC	22-7

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	22-26	LOSS OF AC BUSES A. LOSS OF BUS A, BUS B, OR BOTH BUSES	DOCKED UNDOCKED RNDZ	A.1. <u>CONTINUE MISSION</u> 2. SEPARATION - <u>CONTINUE MISSION</u> DO NOT PERFORM DOI 3. DOI - <u>CONTINUE MISSION</u> 4. PHASING - <u>CONTINUE MISSION</u>	<ul style="list-style-type: none"> • REF MALF PROC <u>EPS</u>: 7 <u>INVERTER</u> • LOSS OF AC BUS A RESULTS IN LOSS OF DPS GIMBAL CONTROL AND RR. • LOSS OF AC BUS B RESULTS IN LOSS OF S-BAND STEERABLE ANTENNA (HBR TM). • LOSS OF BOTH AC BUSES RESULTS IN THE ABOVE PLUS LOSS OF BOTH FDAI SPHERES. 	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM ELECTRICAL POWER		SPECIFIC	22-8

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MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS				MISSION RULE REFERENCE	
	22-50	MEAS DESCRIPTION	PCM	ONBOARD	CATEGORY		
		AC BUS FREQ	GC0155F	CAUTION	COMMON	M	} 22-1, 5, 25, 26
		AC BUS VOLTS	GC0071V	METER/CAUTION	LIGHT	M	
		BAT 1 VOLTS	GC0201V	METER	} COMMON METER	HD	} 22-1, 2, 3, 10, 20, 21, 22, 24
		BAT 2 VOLTS	GC0202V	METER		HD	
		BAT 3 VOLTS	GC0203V	METER		M	
		BAT 4 VOLTS	GC0204V	METER		M	
		BAT 5 VOLTS	GC0205V	METER		M	
		BAT 6 VOLTS	GC0206V	METER		M	
		CDR BUS VOLTS	GC0301V	METER/WARNING	COMMON	1 OF 2	} 22-1, 2, 3, 20, 21, 22, 23, 24
		LMP BUS VOLTS	GC0302V	METER/WARNING	LIGHT	M	
		BAT 1 CUR	GC1201C	METER	} COMMON METER	M PCM	} 22-1, 2, 3, 10 20, 21, 22, 24
		BAT 2 CUR	GC1202C	METER		M PCM	
		BAT 3 CUR	GC1203C	METER		M PCM	
		BAT 4 CUR	GC1204C	METER		M PCM	
		BAT 5 CUR	GC1205C	METER		M PCM	
		BAT 6 CUR	GC1206C	METER		M PCM	
		BAT 1 MAL	GC9961U	CAUTION/COMP	} COMMON LIGHTS	M ONBOARD	} 22-1, 2, 3, 10, 22, 24
		BAT 2 MAL	GC9962U	CAUTION/COMP		M ONBOARD	
		BAT 3 MAL	GC9963U	CAUTION/COMP		M ONBOARD	
		BAT 4 MAL	GC9964U	CAUTION/COMP		M ONBOARD	
		BAT 5 MAL	GC9965U	CAUTION/COMP		M ONBOARD	
		BAT 6 MAL	GC9966U	CAUTION/COMP		M ONBOARD	
		BATTERY MAL	GC4047X		HD	22-1, 2, 3, 10, 22, 23, 24	
		BAT 1 LOW TAP	GC4362X	FLAG	HD	} 22-1, 2, 3, 10, 20, 22, 24	
		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	} 22-1, 2, 3, 10, 20, 21, 22, 23	
		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

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APOLLO 10

FINAL

4/15/69

LM ELECTRICAL POWER

INSTRUMENTATION REQUIREMENTS

22-9

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MISSION RULES

REV	ITEM	GENERAL			
A	23-1	<p>TO INITIATE AND CONTINUE THE FOLLOWING MISSION EVENTS, THE ENVIRONMENTAL CONTROL SYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:</p> <p>A. <u>DOCKED WITH HATCH OPEN</u></p> <ol style="list-style-type: none"> 1. COMBINED VEHICLE PRESSURE INTEGRITY 2. ONE LM COOLANT LOOP <p>B. <u>DOCKED WITH HATCH CLOSED</u></p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT CIRCUIT INTEGRITY 3. ONE SUIT FAN 4. ONE DEMAND REGULATOR 5. ONE COOLANT LOOP 6. SUFFICIENT O₂, H₂O, AND LiOH CONSUMABLES TO COMPLETE THE SPECIFIED ACTIVITY PERIOD <p>C. <u>UNDOCKING</u></p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT CIRCUIT INTEGRITY 3. ONE SUIT FAN 4. ONE DEMAND REGULATOR 5. ONE COOLANT LOOP 6. SUFFICIENT O₂, H₂O, AND LiOH CONSUMABLES TO COMPLETE THE SPECIFIED ACTIVITY PERIOD PLUS 2 HOURS 7. SUFFICIENT ASCENT CONSUMABLES TO EFFECT A CONTINGENCY RETURN AND TRANSFER TO CSM FROM ANY POINT PLUS 2 HOURS <p>D. <u>SEPARATION</u></p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT CIRCUIT INTEGRITY 3. ONE SUIT FAN 4. ONE DEMAND REGULATOR 5. ONE COOLANT LOOP 6. SUFFICIENT O₂, H₂O, AND LiOH CONSUMABLES TO COMPLETE START OF EVENT THROUGH DOCKING AND CONTINGENCY TRANSFER TO CSM PLUS 2 HOURS 7. THE O₂ AND H₂O CONSUMABLES ARE TO BE CONTAINED IN AT LEAST TWO ASCENT O₂ TANKS AND ONE ASCENT H₂O TANK 			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM ENVIRONMENTAL CONTROL	GENERAL	23-1

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MISSION RULES

REV	ITEM				
A	23-1 (CONT'D)	<p>E. <u>DOI</u></p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT CIRCUIT INTEGRITY 3. ONE SUIT FAN 4. ONE DEMAND REGULATOR 5. ONE H₂O SEPARATOR 6. BOTH COOLANT LOOPS 7. PRIMARY H₂O FEEDPATH CAPABILITY 8. SUFFICIENT O₂, H₂O, AND LiOH CONSUMABLES TO COMPLETE A CONTINGENCY RETURN AND TRANSFER IF PHASING IS NOT PERFORMED PLUS 2 HOURS 9. THE O₂ AND H₂O CONSUMABLES ARE TO BE CONTAINED IN AT LEAST TWO OF THREE O₂ TANKS AND IN TWO OF THREE H₂O TANKS. <p>F. <u>PHASING</u></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 H₂O SEPARATOR 6. BOTH COOLANT LOOPS 7. SUFFICIENT O₂, ASCENT H₂O, AND LiOH CONSUMABLES TO COMPLETE THE SPECIFIED ACTIVITY PERIOD THROUGH DOCKING PLUS 2 HOURS 8. THE O₂ AND H₂O CONSUMABLES REQUIRED ARE TO BE CONTAINED IN AT LEAST TWO OF THREE O₂ TANKS AND TWO OF THREE H₂O TANKS. <p>G. <u>NOMINAL STAGING</u></p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT LOOP INTEGRITY 3. TWO SUIT FANS 4. ONE DEMAND REGULATOR 5. ONE H₂O SEPARATOR 6. ONE COOLANT LOOP 7. SUFFICIENT O₂, ASCENT H₂O, AND LiOH CONSUMABLES TO COMPLETE THE SPECIFIED ACTIVITY PERIOD THROUGH DOCKING PLUS 2 HOURS 8. THE O₂ AND H₂O CONSUMABLES REQUIRED THROUGH DOCKING ARE TO BE IN AT LEAST TWO ASCENT O₂ TANKS AND TWO ASCENT H₂O TANKS. <p>H. <u>NON-NOMINAL STAGING (DELAYED)</u></p> <ol style="list-style-type: none"> 1. CABIN PRESSURE INTEGRITY 2. SUIT LOOP INTEGRITY 3. ONE SUIT FAN 			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM ENVIRONMENTAL CONTROL	GENERAL	23-2

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MISSION RULES

REV	ITEM				
	23-1 (CONTD)	<p>4. ONE COOLANT LOOP</p> <p>5. SUFFICIENT ASCENT CONSUMABLES TO COMPLETE DOCKING IN TWO ASCENT O₂ TANKS AND ONE ASCENT H₂O TANK</p>			
A	23-2	<p><u>DEFINITIONS:</u></p> <p><u>LOSS OF CABIN INTEGRITY</u> LM PRESSURE VESSEL LEAKAGE SUCH THAT CABIN PRESSURE CANNOT BE MAINTAINED ≥ 4.6 PSIA WITH AN O₂ FLOW RATE OF .68 LBS/HR. FOR DOCKED ACTIVITIES, THIS WILL BE RELAXED TO A FLOW RATE OF 6 LBS/HR.</p> <p><u>LOSS OF SUIT INTEGRITY</u> TOTAL PGA/SUIT LOOP LEAKAGE >0.2 PSI/MIN (0.6 LB/HR) DURING SUIT LOOP PRESSURE CHECK OR A VISIBLE TEAR IN THE PGA.</p> <p><u>LOSS OF COOLANT LOOP</u> SUSTAINED GLYCOL TEMPERATURE $>50^{\circ}$F AND RISING EXCEPT DURING COOLANT LOOP STARTUP AND DRYOUT (SUBLIMATOR LOST) OR GLYCOL PUMP $\Delta P \leq 6$ PSID (CIRCULATION LOST) OR KNOWN LOSS OF H₂O FEED CAPABILITY TO THE SUBLIMATOR(S).</p> <p><u>GLYCOL COOLANT LEAK</u> OBSERVED FLUID IN CABIN CONFIRMED BY TASTE OR PRESENCE OF GLYCOL LOW INDICATION CONFIRMED BY STATIC PRESSURE DROP.</p> <p><u>LOSS OF DESCENT O₂ TANK</u> INABILITY TO TRANSFER O₂ FROM DESCENT TANK OR MSFN CONFIRMATION OF DESCENT TANK PRESSURE WITH O₂ MANIFOLD PRESSURE (WITHIN LIMITS).</p> <p><u>LOSS OF ASCENT O₂ TANK</u> (1) MSFN CONFIRMATION OF LOSS OF ASCENT TANK PRESSURE WITH O₂ MANIFOLD PRESSURE; OR (2) IF UNSTAGED AND DESCNET TANK >35 PERCENT, CREW CONFIRM LOSS BY BALANCING ONE TANK AGAINST THE OTHER; OR (3) IF STAGED OR IF DESCENT O₂ <35 PERCENT, LOSS OF ONBOARD AND MSFN READOUT.</p> <p><u>LOSS OF DESCENT H₂O TANK</u> INABILITY TO SUPPLY H₂O TO W/B RESULTING IN RISING GLYCOL AND SUIT LOOP TEMPERATURE (CREW AND MSFN) AND DROP IN H₂O ΔP (MSFN ONLY).</p> <p><u>LOSS OF ASCENT H₂O TANK</u> LOSS OF MEASUREMENT AND REMAINING TANK FEEDING AT TWICE NORMAL RATE OR ONE TANK FEEDING TWICE NORMAL RATE AND NO CHANGE IN MEASUREMENT ON OTHER TANK.</p>			
	23-3	WITH THE LOSS OF CABIN AND/OR SUIT LOOP INTEGRITY, THE LM MUST BE DOCKED AND MANNED BY ONE CREW MEMBER ON THE CSM TRANSFER UMBILICAL BEFORE STAGING IS ATTEMPTED.			
	23-4	IF A SUBLIMATOR IS LOST DUE TO BREAKTHROUGH, NO RESTART ATTEMPT WILL BE MADE.			
A	23-5	DELETED			
	23-6	OXYGEN PURGE SYSTEM AND PLSS CONSUMABLES WILL BE RESERVED FOR POSSIBLE EVT AND WILL NOT BE CONSIDERED FOR NOMINAL REDLINE USAGE.			
		RULE NUMBERS 23-7 THROUGH 23-9 ARE RESERVED			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM ENVIRONMENTAL CONTROL	GENERAL	23-3

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
			SPECIFIC MISSION RULES			
	23-20	LOSS OF CABIN PRESSURE INTEGRITY	ALL DOCKED UNDOCKED RNDZ	A. <u>SET UP FOR UNMANNED APS BURN</u> B.1. PERFORM SYSTEMS EVALUATION WITHIN CONSUMABLES LIFE-TIME CONSTRAINTS WITH ONE CREWMAN ON BOTH THE CSM AND LM UMBILICALS. 2. NO-GO FOR UNDOCKING C.1. <u>DOCK ASAP</u> 2. DO NOT STAGE WHILE UNDOCKED 3. NO-GO FOR RNDZ D.1. <u>DOCK ASAP</u> 2. DO NOT STAGE WHILE UNDOCKED	A. REF MALF PROC <u>ECS</u> CABIN	
	23-21	LOSS OF SUIT LOOP INTEGRITY	ALL DOCKED UNDOCKED RNDZ	A. <u>SET UP FOR UNMANNED APS BURN</u> B.1. PERFORM SYSTEMS EVALUATION 2. NO-GO FOR UNDOCKING C.1. <u>DOCK ASAP</u> 2. DO NOT STAGE WHILE UNDOCKED 3. NO-GO FOR RNDZ D.1. <u>DOCK ASAP</u> 2. DO NOT STAGE WHILE UNDOCKED		
	23-22	SUIT FAN(S) FAILURE A. ONE SUIT FAN B. TWO SUIT FANS	ALL DOCKED UNDOCKED RNDZ	A. <u>CONTINUE MISSION</u> B.1. <u>CONTINUE MISSION</u> ON CSM TRANSFER UMBILICAL NO-GO FOR UNDOCKING 2. <u>DOCK ASAP</u> NO-GO FOR RNDZ DO NOT STAGE WHILE DOCKING 3. <u>DOCK ASAP</u> DO NOT STAGE WHILE UNDOCKED	REF MALF PROC <u>ECS</u> SUIT/FAN B.1.(A) OTHER CREWMAN RETURN TO CSM (B) REMOVE HELMET AND GLOVES	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM ENVIRONMENTAL CONTROL		SPECIFIC	23-5

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	23-23	LOSS OF H ₂ O SEPARATOR(S) A. ONE SEPARATOR B. TWO SEPARATORS	ALL DOCKED UNDOCKED RNDZ	A. <u>CONTINUE MISSION</u> B.1. <u>CONTINUE MISSION</u> 2.(A) <u>CONTINUE MISSION AT CREW OPTION</u> (B) NO-GO FOR RNDZ (C) DELAY STAGING 3. <u>DOCK ASAP</u> DELAY STAGING	REF MALF PROC <u>ECS</u> ECS	
	23-24	DEMAND REGULATOR(S) FAIL OPEN OR CLOSED A. ONE REGULATOR B. TWO REGULATORS	ALL DOCKED UNDOCKED RNDZ	A. <u>CONTINUE MISSION</u> B.1.(A) SET UP FOR UNMANNED APS BURN (B) PERFORM SYSTEMS EVALUATION WITHIN CONSUMABLES LIFETIME CONSTRAINTS WITH ONE CREWMAN ON BOTH THE CSM AND LM UMBILICALS (C) NO-GO FOR UNDOCKING B.2.(A) <u>DOCK ASAP</u> (B) NO-GO FOR SEP, DOI, PHASING (C) DELAY STAGING		
	23-25	LOSS OF COOLANT LOOP(S) A. PRIMARY LOOP B. BOTH LOOPS (ANY COMBINATION OF LOSS OF CIRCULATION, SUBLIMATION CAPABILITY, OR H ₂ O FEED FOR BOTH LOOPS)	DOCKED UNDOCKED RNDZ DOCKED UNDOCKED RNDZ	A.1. <u>CONTINUE MISSION ON SECONDARY LOOP</u> NO-GO FOR DOI 2. <u>RETURN TO CSM VICINITY ASAP ON SECONDARY LOOP</u> B.1. <u>INGRESS CSM ASAP</u> NO-GO FOR UNDOCKING 2. <u>DOCK ASAP</u> NO-GO FOR SEPARATION 3. <u>DOCK ASAP</u> (A) CONTINUE GLYCOL CIRCULATION IF POSSIBLE (B) POWER DOWN S/C FOR LIFE SUPPORT ONLY (C) AWAIT CSM RESCUE	REF MALF PROC <u>ECS</u> ECS	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM ENVIRONMENTAL CONTROL		SPECIFIC	23-6

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	23-26	LOSS OF PRIMARY H ₂ O FEEDPATH	DOCKED UNDOCKED RNDZ	A. <u>CONTINUE MISSION</u> NO-GO FOR DOI B. RETURN TO VICINITY OF CSM ASAP	REF MALF PROC ECS GLYCOL	
	23-27	FIRE OR SMOKE IN CABIN OR SUIT	ALL	A. TROUBLESHOOT/COMBAT FIRE B. ASSESS DAMAGE AND TRANSFER TO CSM IF NECESSARY	REF AOH PROC 5.3.2	
	23-28	CONTAMINATION IN CABIN	ALL	CREW MAY ELECT TO DECOMPRESS	IF UNABLE TO CLEAR CONTAMINATION, MISSION MAY BE TERMINATED EARLY.	
	23-29	GLYCOL COOLANT LEAK A. CABIN B. SUIT	ALL ALL ALL	<u>TRANSFER TO CSM</u> SET UP FOR UNMANNED APS BURN A. PURGE SUIT WITH DIRECT O ₂ B. DISCONNECT FROM SUIT LOOP		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM ENVIRONMENTAL CONTROL		SPECIFIC	23-7

24 LM/COMM
INSTRUMENTATION
(SEE SECTION 32)

25 LM GUIDANCE
AND CONTROL

26 LM DPS

27 LM APS

28 LM REACTION
CONTROL SYSTEM

29 SPACE
ENVIRONMENT

30 RECOVERY

31 AEROMEDICAL

32 COMMUNICATIONS/
INSTRUMENTATION

APPENDICES

A ACRONYMS AND
SYMBOLS

B DISTRIBUTION
LIST

C CHANGE CONTROL

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MISSION RULES

REV	ITEM
<p>THIS SECTION HAS BEEN DELETED</p> <p>ALL DATA FORMERLY CONTAINED IN THIS SECTION IS NOW IN SECTION 32.</p>	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM COMMUNICATIONS/INSTRUMENTATION		24-1

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MISSION RULES

REV	ITEM	GENERAL			
	25-1	<p><u>DOCKED</u></p> <p>NO MINIMUM G&C SYSTEM CAPABILITIES ARE REQUIRED TO CONTINUE THE DOCKED PHASE.</p>			
	25-2	<p><u>UNDOCKED</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THE UNDOCKED PHASE, THE G&C SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:</p> <p>A. REDUNDANT 3-AXIS ATTITUDE CONTROL, INCLUDING ONE MANUAL CAPABILITY AND ONE AUTO ATT HOLD CAPABILITY.</p> <p>B. 3-AXIS TRANSLATION CAPABILITY, DEFINED AS HAVING A MINIMUM OF:</p> <ol style="list-style-type: none"> 1. ONE TTCA 2. PGNS OR AGS TRANSLATION CAPABILITY 			
A	25-3	<p><u>RENDEZVOUS</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THE RENDEZVOUS PHASE, THE G&C SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:</p> <p>A. <u>SEPARATION</u></p> <ol style="list-style-type: none"> 1. REDUNDANT 3-AXIS ATTITUDE CONTROL CAPABILITY 2. 3-AXIS TRANSLATION CAPABILITY <p>B. <u>DOI</u></p> <p>THE SAME MINIMUM G&C SYSTEMS CAPABILITIES FOR SEPARATION ARE REQUIRED TO INITIATE DOI PLUS THE FOLLOWING MINIMUM CAPABILITIES:</p> <ol style="list-style-type: none"> 1. OPERATIONAL PGNS, DEFINED AS: <ol style="list-style-type: none"> (A) NO LGC FAILURE (B) NO ISS FAILURE (C) 3-AXIS ATTITUDE CONTROL CAPABILITY (D) OPERATIONAL DSKY 2. ENG ON/OFF CAPABILITY 3. NO MORE THAN 100 SECONDS MAXIMUM DPS OPERATION IN NON-THROTTLEABLE RANGE 4. EITHER AN OPERATIONAL AOT OR COAS 5. ONE OPERATIONAL FDAI 6. OPERATIONAL RENDEZVOUS RADAR AND RR TRANSPONDER COMBINATION, DEFINED AS: <p style="margin-left: 40px;">A VALID LOCK-ON DURING THE SEPARATION PHASE</p> 			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM GUIDANCE AND CONTROL	GENERAL	25-1

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MISSION RULES

REV	ITEM				
	25-3 (CONT)	<p>C. <u>STAGING</u></p> <p>IN ORDER TO STAGE THE LM, THE G&C SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:</p> <ol style="list-style-type: none"> 1. 3-AXIS ATTITUDE CONTROL 2. +X TRANSLATION CAPABILITY 			
	25-4	<p><u>UNMANNED</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THE UNMANNED PHASE OF THE MISSION, THE G&C SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES FOR THE UNMANNED APS BURN:</p> <ol style="list-style-type: none"> A. APS ENG ARM-DEARM/ON-OFF CONTROL B. OPERATIONAL PGNS OR AGS 			
		<p>RULE NUMBERS 25-5 THROUGH 25-9 ARE RESERVED</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM GUIDANCE AND CONTROL	GENERAL	25-2

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MISSION RULES

REV	ITEM	<u>SYSTEMS MANAGEMENT</u>			
A	25-10	<u>IMU</u>			
		<p>A. THE IRIG BIASES WILL BE UPDATED WHEN THE GYRO DRIFT IS $\geq \pm .225^\circ/\text{HR}$ (15 MERU)</p> <p>B. THE PGNS WILL BE CONSIDERED NO-GO WITH A GYRO DRIFT $> \pm 1.5^\circ/\text{HR}$ (100 MERU) OR AN IRIG BIAS $\geq \pm 1.93^\circ/\text{HR}$ (128 MERU), THE MAXIMUM ALLOWABLE VALUE WITHIN THE LGC.</p> <p>C. THE PIPA BIAS WILL BE UPDATED WHENEVER THE Δ BIAS (LGC VALUE OF BIAS - MEASURED BIAS) IS $\geq \pm .200 \text{ CM}/\text{SEC}^2$ (.0066 FT/SEC²).</p> <p>D. THE PGNS WILL BE CONSIDERED NO-GO IF THE PIPA BIAS EXCEEDS $\pm 3.125 \text{ CM}/\text{SEC}^2$, THE MAXIMUM ALLOWABLE VALUE WITHIN THE LGC.</p>			
A	25-11	<u>LGC</u>			
		<p>A. A MASS UPDATE IS REQUIRED IF A MASS Δ OF $\pm 10\%$ (DIFFERENCE BETWEEN GROUND CALCULATION AND LGC VALUE) EXISTS WHEN IN THE DPS CONFIGURATION OR $\pm 5\%$ IN APS CONFIGURATION.</p> <p>B. ALL DESCENT ENGINE STARTS MUST NOMINALLY BE PRECEDED BY A PROPELLANT SETTling MANEUVER USING TWO SYSTEM "B" JETS OR TWO SYSTEM "A" JETS IN CASE OF A CONTINGENCY.</p> <p>C. ULLAGE FOR ALL APS BURNS MAY BE FOUR JET OR TWO JET SYSTEM "A" OR "B".</p> <p>D. ALL \pm (U-V) JETS WILL BE INHIBITED VIA V65 DURING DOCKED DPS BURNS.</p> <p>E. DURING DOCKED MANEUVERS, ALL DPS GIMBAL TRIMMING MUST BE DONE AT $>35\%$ THROTTLE. THE RECOMMENDED SETTING IS 40% THROTTLE.</p>			
A	25-12	<u>RENDEZVOUS RADAR</u>			
		<p>A. THE RR MUST NOT BE OPERATED UNTIL THE ANTENNA TEMPERATURE (HPM) IS $\geq 10^\circ\text{F}$ AND THE GYRO PACKAGE IS ESTIMATED TO BE $\geq 15^\circ\text{F}$.</p> <p>B. THE RR SHOULD NOT BE OPERATED AT AN ANTENNA TEMPERATURE $\geq 145^\circ\text{F}$ AND/OR A GYRO PACKAGE TEMP (ESTIMATED) OF $>200^\circ\text{F}$.</p> <p>C. IF THE RR ANTENNA TEMP EXCEEDS THE NOMINAL TEMPERATURE PROFILE BY $+10^\circ\text{F}$, THE RR SHOULD BE TURNED OFF IF IT IS NOT NEEDED.</p> <p>D. IF THE ESTIMATED GYRO PACKAGE TEMP SHOULD EXCEED 200°F (HPM $\approx 125^\circ\text{F}$) ANYTIME DURING THE RENDEZVOUS PHASE, THE AC POWER TO THE RR SHOULD NOT BE TURNED OFF.</p> <p>E. IF IT IS ESTIMATED THAT THE RR GYRO PACKAGE WILL EXCEED 200°F (HPM $\approx 125^\circ\text{F}$) PRIOR TO COMPLETION OF THE BRAKING PHASE, THE RR SHOULD BE TURNED OFF UNTIL REQUIRED FOR TPI AND BRAKING.</p>			
A	25-13	<u>AGS</u>			
		<p>A. THE AGS IS DECLARED NO-GO WITH AN ASA TEMPERATURE OF $< +90^\circ\text{F}$ OR $> +150^\circ\text{F}$.</p> <p>B. THE AGS IS DECLARED NO-GO DURING A GYRO AND ACCELEROMETER CALIBRATION IF THE GYRO DRIFT CHANGE IS GREATER THAN $2.50^\circ/\text{HR}$ AND IF THE ACCELEROMETER BIAS CHANGE IS GREATER THAN $0.049 \text{ FT}/\text{SEC}^2$ FROM THE VALUE AT THE START OF THE CALIBRATION.</p> <p>C. THE AGS SHOULD 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 PULSED MODE, USING ONLY TTCA CONTROL, CAN BE USED TO PERFORM A DOCKED DPS BURN.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM GUIDANCE AND CONTROL	MANAGEMENT	25-3

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MISSION RULES

REV	ITEM				
A	25-14	<p><u>LANDING RADAR</u></p> <p>A. THE LR SHOULD NOT BE OPERATED AT AN ANTENNA TEMP OF <50°F.</p> <p>B. THE LR SHOULD NOT BE OPERATED AT AN ANTENNA TEMP OF >145°F.</p>			
		<p>RULES 24-15 THROUGH 25-19 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM GUIDANCE AND CONTROL	MANAGEMENT	25-3A

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
				SPECIFIC MISSION RULES		
A	25-20	LOSS OF AN OPERATIONAL PGNS	DOCKED/ UNDOCKED RNDZ UNMANNED	A. 1. <u>CONTINUE THRU SEPARATION</u> 2. SELECT AGS 3. DOI NO-GO 4. START APS UNMANNED BURN IN AGS B. 1. <u>PRIOR TO DOI:</u> (A) SELECT AGS (B) DOI NO-GO 2. <u>WITHIN 10 MIN AFTER DOI;</u> <u>PERFORM DIRECT RETURN</u> 3. <u>AFTER DOI +10 MIN</u> (A) SELECT AGS (B) PERFORM 5-IMPULSE C. <u>CONTINUE BURN IN AGS</u>	REF MR 3-52	
	25-21	LOSS OF FDAI A. ONE B. BOTH	ALL DOCKED UNDOCKED RNDZ UNMANNED	A. <u>CONTINUE MISSION</u> B. 1. <u>CONTINUE MISSION</u> 2. <u>CONTINUE MISSION</u> DOI NO-GO 3. (A) <u>PRIOR TO DOI</u> DOI NO-GO (B) <u>AFTER DOI</u> <u>CONTINUE MISSION</u> 4. <u>CONTINUE MISSION</u>		
	25-22	LOSS OF AOT AND/OR COAS A. EITHER B. BOTH	ALL DOCKED/ UNDOCKED RNDZ UNMANNED	A. <u>CONTINUE MISSION</u> B. 1. <u>CONTINUE MISSION</u> DOI NO-GO 2. (A) <u>PRIOR TO DOI</u> DOI NO-GO (B) <u>AFTER DOI</u> <u>CONTINUE MISSION</u> 3. <u>CONTINUE MISSION</u>		
	25-23	LOSS OF RENDEZVOUS RADAR AND/OR TRANSPONDER	DOCKED/ UNDOCKED RNDZ UNMANNED	A. <u>CONTINUE MISSION</u> B. 1. <u>PRIOR TO DOI</u> DOI NO-GO 2. <u>AFTER DOI</u> <u>CONTINUE MISSION</u> C. <u>CONTINUE MISSION</u>		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM GUIDANCE AND CONTROL		SPECIFIC - PGNS/CES/AGS	25-4

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	25-24	LOSS OF REDUNDANT 3-AXIS ATTITUDE CONTROL	A. ONLY AUTO ATT HOLD CAPABILITY REMAINING	DOCKED	A.1.(A) DO NOT UNDOCK (B) PERFORM APS UNMANNED BURN IN PGNS	
			UNDOCKED	2. <u>RETURN TO CSM AND DOCK ASAP</u>		
			RNDZ	3.(A) <u>PRIOR TO DOI</u> .. DOI NO-GO (B) <u>AFTER DOI</u> <u>CONTINUE MISSION</u>		
			UNMANNED	4. <u>CONTINUE MISSION</u>		
		B. ONLY MANUAL CAPABILITY REMAINING	DOCKED	B.1.(A) DO NOT UNDOCK (B) APS UNMANNED BURN NO-GO		
			UNDOCKED	2. <u>RETURN TO CSM AND DOCK ASAP</u>		
			RNDZ	3.(A) <u>PRIOR TO DOI</u> DOI NO-GO RETURN TO CSM AND DOCK ASAP (B) <u>AFTER DOI</u> CSM RESCUE		
			UNMANNED	4. STOP BURN ASAP		
	25-25	LOSS OF TRANSLATION CAPABILITY	A. ULLAGE (+X)	DOCKED	A.1.(A) DO NOT UNDOCK (B) PERFORM APS UNMANNED BURN WITHOUT ULLAGE	
			UNDOCKED	2. <u>RETURN TO CSM AND DOCK ASAP</u> CSM ACTIVE DOCKING		
			RNDZ	3.(A) <u>PRIOR TO DOI</u> RETURN TO CSM AND DOCK ASAP CSM ACTIVE DOCKING (B) <u>AFTER DOI</u> CSM RESCUE LM STAGING NO-GO		
			UNMANNED	4. <u>CONTINUE MISSION</u>		
		B. EITHER ±Y, ±Z, -X TRANSLATION	DOCKED	B.1. DO NOT UNDOCK		
			UNDOCK/ RNDZ	2. <u>RETURN TO CSM AND DOCK ASAP</u> CSM PERFORM BRAKING MANEUVER AND DOCKING		
			UNMANNED	3. <u>CONTINUE MISSION</u>		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM GUIDANCE AND CONTROL		SPECIFIC - PGNS/CES/AGS	25-5

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	25-26	LOSS OF THRUST VECTOR CONTROL A. RCS IMPINGEMENT CONSTRAINTS WILL NOT BE VIOLATED B. RCS IMPINGEMENT CONSTRAINTS WILL BE VIOLATED	ALL ALL	A. <u>CONTINUE MISSION</u> B.1. INHIBIT DPS BURNS 2. STAGE LM 3. <u>CONTINUE MISSION USING APS</u>	B. RCS IMPINGEMENT CONSTRAINTS MAY BE VIOLATED BECAUSE OF RCS OPPOSING THRUST VECTOR OFFSET.	
	25-27	LOSS OF AUTO ENG ON/OFF CAPABILITY	RNDZ UNMANNED	A.1. DEPRESS START PB IMMEDIATELY 2. <u>CONTINUE MISSION</u> USING MANUAL ON/OFF CONTROL B. APS UNMANNED BURN NO-GO	B. NO FURTHER APS START CAPABILITY EXISTS	
	25-28	ENG DOES NOT IGNITE AFTER START PB DEPRESSION	RNDZ	A.1. <u>DOI</u> (A) SET STOP PB (B) DEARM DPS (C) MSFN EVALUATE FOR APS ON/OFF CONTROL 2. <u>PHASING:</u> (A) START DPS VIA DES ENG CMD OVRD SW (B) STOP BURN VIA STOP PB 3. <u>INSERTION</u> (A) SET STOP PB (B) DEARM APS (C) CSM PERFORM INSERTION (D) APS UNMANNED BURN NO-GO	A.1. STOP PB MUST BE SET TO RESET THE LATCHING RELAYS ENERGIZED BY START PB DEPRESSION 3. NO FURTHER APS START CAPABILITY EXISTS	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM GUIDANCE AND CONTROL		SPECIFIC - PGNS/CES/AGS	25-6

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	25-32	LOSS OF ACA A. ONE B. BOTH	ALL DOCKED UNDOCKED RNDZ UNMANNED	A. <u>CONTINUE MISSION</u> B.1. DO NOT UNDOCK 2. <u>RETURN TO CSM ASAP</u> CSM ACTIVE DOCKING 3.(A) <u>PRIOR TO DOI</u> DOI NO-GO CSM ACTIVE DOCKING (B) <u>AFTER DOI</u> CONTINUE LM ACTIVE UNTIL TERMINAL PHASE CSM ACTIVE DOCKING 4. <u>CONTINUE MISSION</u>		
	25-33	LOSS OF TTCA A. ONE B. BOTH RULE NUMBERS 25-34 THROUGH 25-39 ARE RESERVED.	ALL DOCKED UNDOCKED RNDZ UNMANNED	A. <u>CONTINUE MISSION</u> B.1. DO NOT UNDOCK 2. <u>RETURN TO CSM ASAP</u> CSM ACTIVE DOCKING 3.(A) <u>PRIOR TO DOI</u> DOI NO-GO CSM ACTIVE DOCKING (B) <u>AFTER DOI</u> CONTINUE LM ACTIVE UNTIL TERMINAL PHASE CSM ACTIVE DOCKING 4. <u>CONTINUE MISSION</u>		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM GUIDANCE AND CONTROL		SPECIFIC - PGNS/CES/AGS	25-8

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MISSION RULES

REV	ITEM	PRELAUNCH INSTRUMENTATION					MISSION RULE REFERENCE
	25-40	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	
		LGC DOWNLINK	GG0001U	-	-	M	25-20
		PLS TORO REF	GG1040V	-	-	HD	25-20
		2.5 VDC TM BIAS	GG1110V	-	-	HD	25-20
		IMU 28 VAC 800	GG1201V	-	-	HD	25-20
		IRIG SUSP 3.2 KC	GG1331V	-	-	HD	25-20
		IMU STBY	GG1513X	-	-	HD	25-20
		LGC OPR	GG1523X	-	-	HD	25-20
		X PIPA OUT IN ϕ	GG2001V	-	-	HD	25-20
		Y PIPA OUT IN ϕ	GG2021V	-	-	HD	25-20
		Z PIPA OUT IN ϕ	GG2041V	-	-	HD	25-20
		IG SVO ERR IN ϕ	GG2107V	-	-	HD	25-20
		IG IX RSVR OUT SIN	GG2112V	FDAI	COMMON	M-PCM	25-20
		IG IX RXVR OUT COS	GG2113V	FDAI	COMMON	M-PCM	25-20
		MG SVO ERR IN ϕ	GG2137V	-	-	HD	25-20
		MG IX RSVR OUT SIN	GG2142V	FDAI	COMMON	M-PCM	25-20
		MG IX RSVR OUT COS	GG2143V	FDAI	COMMON	M-PCM	25-20
		OG SVO ERR IN ϕ	GG2167V	-	-	HD	25-20
		OG RSVR OUT SIN	GG2172V	FDAI	COMMON	M-PCM	25-20
		OG RSVR OUT COS	GG2173V	FDAI	COMMON	M-PCM	25-20
		PITCH ATT ERR	GG2219V	FDAI	COMMON	HD - PCM	25-20
		YAW ATT ERR	GG2249V	FDAI	COMMON	HD - PCM	25-20
		ROLL ATT ERR	GG2279V	FDAI	COMMON	HD - PCM	25-20
		PIPA TEMP	GG2300T	C&W	SEPARATE	M-PCM	25-20
		RR SHFT SIN	GG3304V	FDAI	COMMON	HD - PCM	25-23
		RR SHFT COS	GG3305V	FDAI	COMMON	HD - PCM	25-23
		RR TRUN SIN	GG3324V	FDAI	COMMON	HD - PCM	25-23
		RR TRUN COS	GG3325V	FDAI	COMMON	HD - PCM	25-23
		LGC WARNING	GG9001X	C&W	COMMON	HD - PCM	25-20
		ISS WARNING	GG9002X	C&W	COMMON	HD - PCM	25-20
		LR ANT TEMP	GN7563T	TEMP MONITOR	COMMON	HD - PCM	25-23
		RR NO TRACK	GN7621X	C&W	COMMON	HD - PCM	25-23
		RR ANT TEMP	GN7723T	TEMP MONITOR	COMMON	M-PCM	25-23
		YAW ERR CMD	GH1247V	-	-	M	25-24
		PITCH ERR CMD	GH1248V	-	-	M	25-24
		ROLL ERR CMD	GH1249V	-	-	M	25-24
		JD A4D OUTPUT	GH1419V	-	-	HD	25-24, 25-25
		RCS TCP A4D	GR5032X	-	-	HD	25-24, 25-25
		JD B3D OUTPUT	GH1423V	-	-	HD	25-24, 25-25
		RCS TCP B3D	GR5036X	-	-	HD	25-24, 25-25
		JD A2D OUTPUT	GH1427V	-	-	HD	25-24, 25-25
		RCS TCP A2D	GR5040X	-	-	HD	25-24, 25-25
		JD B1D OUTPUT	GH1431V	-	-	HD	25-24, 25-25
		RCS TCP B1D	GR5044X	-	-	HD	25-24, 25-25
		JD B4U OUTPUT	GH1418V	-	-	HD	25-24, 25-25
		JD B4F OUTPUT	GH1420V	-	-	HD	25-24, 25-25
		JD A4R OUTPUT	GH1421V	-	-	HD	25-24, 25-25
		JD A3U OUTPUT	GH1422V	-	-	HD	25-24, 25-25
		JD B3A OUTPUT	GH1424V	-	-	HD	25-24, 25-25
		JD A3R OUTPUT	GH1425V	-	-	HD	25-24, 25-25
		JD B2U OUTPUT	GH1426V	-	-	HD	25-24, 25-25
		JD A2A OUTPUT	GH1428V	-	-	HD	25-24, 25-25
		JD B2L OUTPUT	GH1429V	-	-	HD	25-24, 25-25
		JD A1U OUTPUT	GH1430V	-	-	HD	25-24, 25-25
		JD A1F OUTPUT	GH1432V	-	-	HD	25-24, 25-25
		JD B1L OUTPUT	GH1433V	-	-	HD	25-24, 25-25
		RCS TCP B4U	GR5031X	-	-	HD	25-24, 25-25
		RCS TCP B4F	GR5033X	-	-	HD	25-24, 25-25
		RCS TCO A4R	GR5034X	-	-	HD	25-24, 25-25
		RCS TCP A3U	GR5035X	-	-	HD	25-24, 25-25
		RCS TCP B3A	GR5037X	-	-	HD	25-24, 25-25
		RCS TCP A3R	GR5038X	-	-	HD	25-24, 25-25
		RCS TCP B2U	GR5039X	-	-	HD	25-24, 25-25
		RCS TCP A2A	GR5041X	-	-	HD	25-24, 25-25
		RCS TCP B2L	GR5042X	-	-	HD	25-24, 25-25
		RCS TCP A1U	GR5043X	-	-	HD	25-24, 25-25
		RCS TCP A1F	GR5045X	-	-	HD	25-24, 25-25
		RCS TCP B1L	GR5046X	-	-	HD	25-24, 25-25
		YAW ATT ERR	GH1455V	FDAI	COMMON	HD	25-24
		PITCH ATT ERR	GH1456V	FDAI	COMMON	HD	25-24

NASA — Manned Spacecraft Center
MISSION RULES

REV	ITEM	GENERAL			
	26-1	<p><u>DOCKED</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THE DOCKED PHASE, THE DPS SUBSYSTEM MUST PROVIDE THE FOLLOWING CONDITION:</p> <p>NO DPS PROPELLANT LEAK</p>			
	26-2	<p><u>UNDOCKED/SEPARATION</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THE UNDOCKED PHASE, THE DPS SUBSYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CONDITION:</p> <p>NO DPS PROPELLANT LEAK</p>			
A	26-3	<p><u>DOI/RENDEZVOUS</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THE RENDEZVOUS PHASE, THE DPS SUBSYSTEM MUST PROVIDE A SAFE BURN CAPABILITY, DEFINED AS FOLLOWS:</p> <p>A. NO DPS PROPELLANT LEAKS</p> <p>B. AN OPERATIONAL DPS DEFINED AS FOLLOWS:</p> <ol style="list-style-type: none"> 1. FUEL AND OXID ENGINE INLET PRESSURE <u>>100</u> PSI AT BURN INITIATION. 2. DURING BURN, OXID AND FUEL ENGINE INLET PRESS <u>≥120</u> PSI (THROTTLE SETTING <65%) OR <u>>150</u> PSI (THROTTLE SETTING >65%): 3. DPS PROPELLANT TEMPS <75°F OR <u>>50</u>°F ONLY TO INITIATE A BURN. 4. ΔT BETWEEN FUEL AND OXID TEMP <u><25</u>°F ONLY TO INITIATE A BURN. 5. ΔP BETWEEN FUEL AND OXIDIZER ENGINE INLET PRESSURE <u><TBD</u> PSID AT <65% THROTTLE, OR <u><TBD</u> PSID AT >65% THROTTLE FOR BURNS <u><TBD</u> SEC. <p>C. SUFFICIENT ΔV CAPABILITY TO ACCOMPLISH DOI AND PHASING.</p>			
		<p>RULES 26-4 THROUGH 26-10 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM PROPULSION - DPS	GENERAL	26-1

NASA — Manned Spacecraft Center

MISSION RULES

REV	ITEM	SYSTEMS MANAGEMENT																							
A 1	26-11	THE LOW THROTTLE POINT IS THE MINIMUM THROTTLE POSITION THAT THE THROTTLE ACTUATOR WILL ASSUME WITH MINIMUM MANUAL THROTTLE COMMAND VOLTAGE (12.4% FOR LM-4).																							
	26-12	DPS USABLE PROPELLANT IS 17627.0 LBS.																							
		<table> <tr> <td>TOTAL LOADED</td> <td>18229.5 LBS</td> <td></td> <td></td> <td></td> </tr> <tr> <td>TRAPPED</td> <td>367.5 LBS</td> <td></td> <td></td> <td></td> </tr> <tr> <td>TM ERROR</td> <td>235.0 LBS</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td><u>17627.0 LBS</u></td> <td></td> <td></td> <td></td> </tr> </table>				TOTAL LOADED	18229.5 LBS				TRAPPED	367.5 LBS				TM ERROR	235.0 LBS					<u>17627.0 LBS</u>			
TOTAL LOADED	18229.5 LBS																								
TRAPPED	367.5 LBS																								
TM ERROR	235.0 LBS																								
	<u>17627.0 LBS</u>																								
	26-13	THE TOTAL CONTINUOUS BURN TIME OF THE DESCENT ENGINE SHALL NOT EXCEED 910 SECONDS OF OPERATION INDEPENDENT OF THRUST LEVEL.																							
A 1	26-14	THE DPS ENGINE MINIMUM BURN TIME IS 3.5 SECONDS. THE MINIMUM COAST TIME BETWEEN DPS ENGINE BURNS IS 2 SECONDS.																							
	26-15	ALL DPS STARTS MUST BE NOMINALLY PLANNED AT THE LOW THROTTLE POINT.																							
	26-16	THE DPS ENGINE MUST NOT BE OPERATED IN THE NON-THROTTLING RANGE (65% TO FTP) FOR MORE THAN 100 SEC.																							
	26-17	SUPERCRITICAL HELIUM BURST DISC RUPTURE DURING MANNED OPERATION IS AN ALLOWABLE EVENT.																							
A 1	26-18	ALL DESCENT ENGINE STARTS MUST NOMINALLY BE PRECEDED BY A PROPELLANT SETTLING MANEUVER.																							
A 1		RULE 26-19 IS RESERVED.																							
MISSION	REV	DATE	SECTION	GROUP	PAGE																				
APOLLO 10	A	4/23/69	LM PROPULSION - DPS	MANAGEMENT	26-2																				

NASA — Manned Spacecraft Center
MISSION RULES

REV ITEM

A 26-19

DPS ENGINE RESTART CAN BE MADE WITH THE FOLLOWING CONSTRAINTS:

INITIAL BURN	REQUIRED COAST TIME	MAXIMUM RESTART BURN TIME
A. 3.5 SEC TO TBD SEC	2 SECONDS	NO CONSTRAINT
B. TBD TO 190 SECS	2 SECONDS	400 SECS
C. 190 SECS TO 600 SECS	REFERENCE (SEE FIGURE BELOW)	100 SECS
D. GREATER THAN 600 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 5 RESTARTS AFTER THE INITIAL BURN.

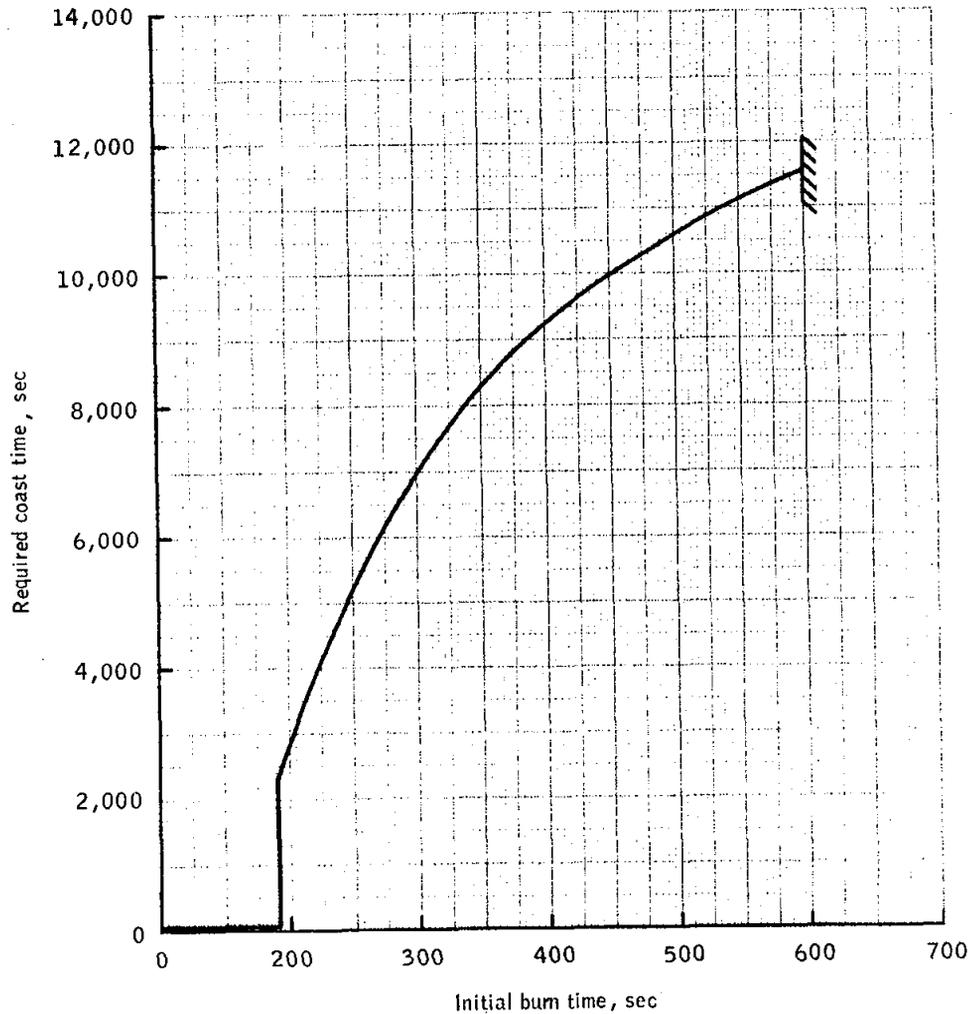


Figure 26-1 .- LMDE required coast time vs initial burn time for engine chamber heating limitations.

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM DPS	MANAGEMENT	26-3

FIG. 26-1 Form 297 (Rev. 1-69)

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MISSION RULES

REV	ITEM				
	26-20	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.			
A	26-21	<u>PROPELLANT GAGING</u> A. PRIME METHOD: GROUND MASS CALCULATION (1.5%) B. BACKUP METHOD: PQGS (TM, ONBOARD) (1.3%)			
		RULE NUMBERS 26-22 THROUGH 26-29 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM PROPULSION - DPS	MANAGEMENT	26-4

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	26-30	LOSS OF ALL OPERATIONAL DPS	ALL	<p style="text-align: center;">SPECIFIC MISSION RULES</p> <p>A. <u>CONTINUE MISSION</u></p> <ol style="list-style-type: none"> 1. DOI NO-GO 2. FOR FURTHER MAIN ENGINE BURNS USE APS <p>B. <u>PRIOR TO PHASING</u></p> <ol style="list-style-type: none"> 1. INHIBIT BURN 2. STAGE AND USE APS FOR FURTHER MAIN ENGINE BURNS <p>C. <u>DURING PHASING</u></p> <ol style="list-style-type: none"> 1. STOP BURN 2. COMPLETE BURN PER MR 3-53 	AN OPERATIONAL APS AND RCS IS REQUIRED	
	26-31	START TANK LEAK PRIOR TO PRESS A. FU AND OXID ENGINE INLET PRESS ≥ 100 PSIA AT IGNITION B. FU AND/OR OXID ENGINE INLET < 100 PSIA	ALL	<p>A. <u>CONTINUE MISSION</u></p> <p>INHIBIT FIRING DPS START TANK SQUIB</p> <p>B. <u>CONTINUE MISSION</u></p> <p>FIRE SQUIB TO START TANK</p>	REF MAL PROC <u>DPS #1</u> NOTE: PRESSURIZATION SYSTEM MAY BE OPENED TO START TANK LEAK; CLOSE PRIMARY He REG SOV AFTER EACH BURN AND REOPEN AT INITIATION OF EACH SUBSEQUENT BURN.	
	26-32	DPS FAILS TO PRESSURE A. VIA START TANK <ol style="list-style-type: none"> 1. INLET PRESS < 100 PSIA 2. INLET PRESS > 100 PSIA B. VIA SUPERCRITICAL HELIUM	ALL	<p>A.1. INHIBIT ALL DPS BURNS REF ALT MISSION ___ AND APS UNMANNED BURN</p> <p>2. <u>CONTINUE MISSION</u></p> <p>B. <u>CUT OFF BURN ON INLET PRESS</u></p> <ol style="list-style-type: none"> 1. DO NOT GO TO FTP 2. IF AT FTP, THROTTLE TO 40% 		
	26-33	OFF NOMINAL SUPERCRITICAL He PRESS < 500 PSI	RNDZ	<p>A. <u>CONTINUE MISSION</u></p> <p>REMAIN AT 10% UNTIL She PRESS > 500 PSIA</p>	REF MAL PROC DPS #1	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM PROPULSION - DPS		SPECIFIC	26-5

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	26-34	LEAK BETWEEN He REG SHUTOFF AND QUAD CHECK VALVES	ALL	<u>CONTINUE MISSION</u> A. CLOSE He REG SHUTOFF VALVES B. OPEN He SHUTOFF VALVES PRIOR TO EACH BURN	REF MAL PROC DPS #1 & 2.
A	26-35	DPS PROPELLANT LEAK	ALL	<u>STAGE ASAP</u>	REF MAL PROC DPS _____

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM PROPULSION - DPS	SPECIFIC	26-6

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MISSION RULES

REV	ITEM				
	27-1	<u>DOCKED, UNDOCKING, SEPARATION</u>			
		IN ORDER TO INITIATE THE ABOVE PHASES, THE APS MUST EXHIBIT THE FOLLOWING CAPABILITY:			
		NO PROPELLANT LEAK			
A	27-2	<u>DOI/RENDEZVOUS</u>			
		IN ORDER TO INITIATE THE RENDEZVOUS PHASE OF THE MISSION, THE APS SUBSYSTEM MUST PROVIDE A SAFE BURN CAPABILITY DEFINED AS FOLLOWS:			
		A. NO APS PROPELLANT LEAKS			
		B. AN OPERATIONAL APS, DEFINED AS FOLLOWS:			
		<u>MANNED</u>	<u>START BURN</u>	<u>CONTINUE BURN</u>	
		1. APS BULK TEMP	>30°F < 120°F	N/A	
		2. OX-FUEL ΔT	<60°F**	N/A	
		3. INLET PRESS	>115 < 250 PSI**	>115 < 250 PSI, NO PRESS OSCILLATIONS	
		4. INLET PRESS ΔP	<u>20</u> PSID**	< <u>12</u> PSID**	
		5. TCP	N/A	> <u>80</u> < 150 PSI**, NO PRESS OSCILLATIONS	
		6. PROPELLANT LEAK	NONE	NONE	
		<u>UNMANNED</u>			
		1. APS BULK TEMP	N/A	N/A	
		2. OXID-FUEL ΔT	N/A	N/A	
		3. INLET PRESS	<250 PSI	<250 PSI, NO PRESS OSCILLATIONS	
		4. INLET PRESS ΔP	< <u>90</u> PSID	< <u>20</u> PSID	
		5. TCP	N/A	<150, NO PRESS OSCILLATIONS	
		6. PROPELLANT LEAK	N/A	NONE	
		**VALUES SHOWN ARE FOR BURNS <100 SEC LONG.			
		C. SUFFICIENT ΔV CAPABILITY TO DO INSERTION BURN.			
	27-3	<u>STAGING/INSERTION</u>			
		IN ORDER TO STAGE THE LM PRIOR TO THE INSERTION BURN, THE APS SUBSYSTEM MUST PROVIDE A SAFE BURN CAPABILITY FOR THE INSERTION BURN			
		RULES 27-4 THROUGH 27-9 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM PROPULSION - APS	GENERAL	27-1

NASA — Manned Spacecraft Center

MISSION RULES

REV	ITEM	DPS - PRELAUNCH INSTRUMENTATION					MISSION RULE REFERENCE
	26-40	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCER	CATEGORY	
		START TNK PRESS	GQ3015P	HE MON	COMMON	M	26-31, 32
		HE REG PRESS	GQ3018P	C&W	COMMON	HD } 1 OF 2	26-34, 30
		HE REG PRESS	GQ3025P			HD } M-PCM	26-34, 30
		HE PRESS	GQ3435P			HD } 1 OF 2	26-33
		HE PRESS	GQ3436P	PRESS		HD } M	
		FU TNK 1 QTY	GQ3603Q	QTY	COMMON	HD } 1 OF 2	
		FU TNK 2 QTY	GQ3604Q	QTY	COMMON	HD } M	
		OX TNK 1 QTY	GQ4103Q	QTY	COMMON	HD } 1 OF 2	
		OX TNK 2 QTY	GQ4104Q	QTY	COMMON	HD } M	
		FU 1 TEMP	GQ3718T	TEMP MON	COMMON	HD } 1 OF 2	26-30
		FU 2 TEMP	GQ3719T	TEMP MON	COMMON	HD } M	26-30
		OX 1 TEMP	GQ4218T	TEMP MON	COMMON	HD } 1 OF 2	26-30
		OX 2 TEMP	GQ4219T	TEMP MON	COMMON	HD } M	26-30
		FU PRESS	GQ3611P			M	26-30, 35
		OX PRESS	GQ4111P			M	26-30, 35
		TCP	GQ6510P	THRUST	COMMON	M-PCM	26-30

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM DPS	PRELAUNCH INSTRUMENTATION	26-7

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MISSION RULES

GENERAL

REV	ITEM				
	27-1	<u>DOCKED, UNDOCKING, SEPARATION</u>			
		IN ORDER TO INITIATE THE ABOVE PHASES, THE APS MUST EXHIBIT THE FOLLOWING CAPABILITY:			
		NO PROPELLANT LEAK			
	27-2	<u>DOI/RENDEZVOUS</u>			
		IN ORDER TO INITIATE THE RENDEZVOUS PHASE OF THE MISSION, THE APS SUBSYSTEM MUST PROVIDE A SAFE BURN CAPABILITY DEFINED AS FOLLOWS:			
		A. NO APS PROPELLANT LEAKS			
		B. AN OPERATIONAL APS, DEFINED AS FOLLOWS:			
		1. ΔP BETWEEN APS FUEL AND OXIDIZER ENGINE INLET PRESSURE $<TBD$ PSID.			
		2. ΔT BETWEEN APS FUEL AND OXIDIZER TEMP $<10^{\circ}F$. ONLY TO INITIATE A BURN.			
		3. APS FUEL AND/OR OXIDIZER TEMP $>40^{\circ}F$ AND $<85^{\circ}F$. ONLY TO INITIATE A BURN.			
		4. APS FUEL AND/OR OXIDIZER INLET PRESSURE >115 PSI AND <220 PSI			
		C. SUFFICIENT ΔV CAPABILITY TO DO INSERTION BURN.			
	27-3	<u>STAGING/INSERTION</u>			
		IN ORDER TO STAGE THE LM PRIOR TO THE INSERTION BURN, THE APS SUBSYSTEM MUST PROVIDE A SAFE BURN CAPABILITY FOR THE INSERTION BURN			
		RULES 27-4 THROUGH 27-9 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM PROPULSION - APS	GENERAL	27-1

NASA — Manned Spacecraft Center

MISSION RULES

REV	ITEM	SYSTEMS MANAGEMENT			
A	27-10	APS MANNED ENGINE STARTS WILL BE PRECEDED BY A PROPELLANT SETTLLING MANEUVER.			
	27-11	APS PROPULSION SYSTEM CANNOT REMAIN ACTIVATED (COMPATABILITY 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.			
	27-12	THE USABLE PROPELLANT FOR APS IS 2465.6 LBS.			
		TOTAL LOADED	2631.7 LBS		
		TRAPPED	53.1 LBS		
		TM ERROR	<u>113.0 LBS</u>		
		USABLE	2465.6 LBS		
A	27-13	THE MINIMUM IMPULSE OF THE APS ENGINE IS 1200 LBS/SEC, WHICH CORRESPONDS TO A BURN TIME OF 0.5 SEC.			
	27-14	ONLY PREMISSION APPROVED APS MULTIBURN PROFILES WILL BE EXECUTED, SINCE NO DATA EXISTS TO ALLOW REAL-TIME SUPPORT FOR EXAMINING APS FREEZING, CHARRING, BACKWALL TEMPERATURE CONSTRAINTS FOR MULTIBURN PROFILES.			
	27-15	PROPELLANT GAGING (NO ONBOARD READOUT):			
		A. PRIME METHOD: FLOWRATE X TIME (5%)			
		B. BACKUP METHOD: GROUND MASS CALCULATION (5%)			
A	27-16	THE APS ENGINE MAY BE RESTARTED WITH COAST TIMES			
		A. <10 SEC OR >200 SEC, WITH PROPELLANT TEMP <65°F			
		B. <10 SEC OR >90 SEC, WITH PROPELLANT TEMP >65°F			
A		RULES 27-17 THROUGH 27-19 ARE RESERVED.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM PROPULSION - APS	MANAGEMENT	27-2

NASA — Manned Spacecraft Center

MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A 1	27-24	APS PROPELLANT LEAK	DOCKED UNDOCKED RNDZ UNMANNED	A. <u>EGRESS TO CSM ASAP</u> 1. JETTISON LM 2. APS UNMANNED BURN NO-GO B.1. <u>DOCK ASAP</u> 2. CSM ACTIVE DOCKING C. <u>CSM RESCUE</u> D. <u>CONTINUE BURN</u>	REF MAL PROC <u>APS #1 & 4</u>	
	27-25	APS PROP VALVE MISMATCH (ΔPOS)	RNDZ UNMANNED	A. <u>CONTINUE BURN IN PROGRESS</u> <u>INHIBIT FURTHER MANNED APS</u> <u>BURNS</u> B. <u>CONTINUE MISSION</u>	THIS INDICATION PRIOR TO FIRST APS ENGINE ON WILL BE CONSIDERED A TM FAILURE.	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM PROPULSION - APS		SPECIFIC	27-4

NASA — Manned Spacecraft Center
MISSION RULES

REV	ITEM	APS - PRELAUNCH INSTRUMENTATION					MISSION RULE REFERENCE
	27-30	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCER	CATEGORY	
		APS HE 1 PRESS	GP0001P	HEL MON C&W	COMMON	M - PCM	27-22,20
		APS HE 2 PRESS	GP0002P	HEL MON C&W	COMMON	M - PCM	27-22,20
		APS HE REG PRESS	GP0018P			HD } 1 OF 2	27-20,23
		APS HE REG PRESS	GP0025P	C&W	COMMON	HD } M - PCM	27-20,23
		APS HE 1 TEMP	GP0201T	HEL MON	COMMON	M - PCM	27-21,22
		APS HE 2 TEMP	GP0202T	HEL MON	COMMON	M - PCM	27-21,22
		APS FUEL TEMP	GP0718T	TEMP	COMMON	M - PCM	27-20
		APS FUEL LOW	GP0908X	C&W	COMMON	HD	
		APS OXID TEMP	GP1218T	TEMP	COMMON	M - PCM	27-20
		APS OXID LOW	GP1408X	C&W	COMMON	HD	
		APS FUEL PRESS	GP1501P	C&W	COMMON	M - PCM	27-20,21,24
		APS OXID PRESS	GP1503P	C&W	COMMON	M - PCM	27-20,21,24
		VLVS A ΔPOS	GP2997U			M	27-25
		VLVS B ΔPOS	GP2998U			M	27-25
		APS TCP	GP2010P			M	27-20

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM APS	PRELAUNCH INSTRUMENTATION	27-5

28 LM REACTION
CONTROL SYSTEM

NASA — Manned Spacecraft Center

MISSION RULES

REV	ITEM				
	28-1	<p><u>DOCKED</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THE DOCKED PHASE OF THE MISSION, THE RCS SUBSYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITY:</p> <p>NO PROPELLANT LEAKS</p>			
A	28-2	<p>A. <u>UNDOCKED</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THE UNDOCKED MISSION PHASE, 3-AXIS TRANSLATION CONTROL AND REDUNDANT 3-AXIS RCS ATTITUDE CONTROL CAPABILITY IS REQUIRED. TO ASSURE THAT NO SINGLE FAILURE CAN DISABLE ATTITUDE CONTROL, THE FOLLOWING MINIMUM CAPABILITIES ARE REQUIRED:</p> <ol style="list-style-type: none"> 1. REDUNDANT CAPABILITY TO SUPPLY PROPELLANT FOR MAINTAINING RCS 3-AXIS ATTITUDE CONTROL VIA ONE OF THE FOLLOWING: <ul style="list-style-type: none"> (A) OPERATIONAL SYSTEM A AND B (B) OPERATIONAL SYSTEM A OR B, PLUS CROSSFEED CAPABILITY AND ASC FEED CAPABILITY 2. NO THRUSTER PAIRS ISOLATED OR ANY SINGLE VERTICAL JET FAILED 3. NO PROPELLANT LEAKS <p>B. <u>SEPARATION/DOI/PHASING</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THIS MISSION PHASE, 3-AXIS TRANSLATION CONTROL AND REDUNDANT 3-AXIS RCS ATTITUDE CONTROL CAPABILITY IS REQUIRED. TO ASSURE THAT NO SINGLE FAILURE CAN DISABLE ATTITUDE CONTROL, THE FOLLOWING MINIMUM CAPABILITIES ARE REQUIRED:</p> <ol style="list-style-type: none"> 1. RCS SYSTEM A AND B OPERATIONAL 2. NO THRUSTER PAIRS ISOLATED OR ANY SINGLE VERTICAL JET FAILED 3. NO LEAKS <p>C. <u>STAGING</u></p> <p>IN ORDER TO INITIATE STAGING, THE FOLLOWING MINIMUM CAPABILITIES ARE REQUIRED:</p> <ol style="list-style-type: none"> 1. 3-AXIS RCS ATTITUDE CONTROL 2. 3-AXIS RCS TRANSLATION <p>D. <u>INSERTION</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THE INSERTION, +X-AXIS TRANSLATION CONTROL AND REDUNDANT 3-AXIS RCS ATTITUDE CONTROL IS REQUIRED. THE FOLLOWING MINIMUM CAPABILITIES ARE REQUIRED.</p> <ol style="list-style-type: none"> 1. SAME AS SEPARATION/PHASING 			
A	28-3	DELETED			
	28-4	<p><u>UNMANNED</u></p> <p>IN ORDER TO INITIATE AND CONTINUE THE UNMANNED PHASE OF THE MISSION, THE RCS SUBSYSTEM MUST PROVIDE THIS MINIMUM CAPABILITY:</p> <p>3-AXIS ATTITUDE CONTROL</p> <p>RULE NUMBERS 28-5 THROUGH 28-8 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM REACTION CONTROL SYSTEM	GENERAL	28-1

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MISSION RULES

REV	ITEM				
A	28-15	<p><u>RCS PLUME IMPINGEMENT ON THE LM</u></p> <p>MAXIMUM ALLOWABLE CONTINUOUS FIRING OF RCS JETS:</p> <p>A. LM, +X (DOWN FIRING ENGINE): 15 SEC UNSTAGED EXCEEDING +X IMPINGEMENT TIME COULD RESULT IN PROPELLANT LINE FREEZING AND LARGE TEMPERATURE DIFFERENCES BETWEEN PROPELLANT TANK DUE TO DAMAGE TO ASCENT AND DESCENT STAGE THERMAL INSULATION.</p> <p>B. LM, +X (DOWN FIRING ENGINE): 55 SEC STAGED.</p> <p>C. UNDOCKED LM, -X (UP FIRING ENGINE): 30 SEC (-X THRUSTERS OF QUAD 1, 3, AND 4): EXCEEDING -X IMPINGEMENT TIME COULD RESULT IN DAMAGE TO S-BAND AND/OR RR ANTENNA BECAUSE OF OVERHEATING OR OVERPRESSURE DUE TO PLUME.</p> <p>D. DOCKED LM, -X: 15 SEC FIRING EXCEEDING -X IMPINGEMENT TIME COULD RESULT IN DAMAGE TO CSM THERMAL COATINGS.</p>			
A		<p>RULE NUMBERS 28-16 THROUGH 28-19 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	LM REACTION CONTROL SYSTEM	MANAGEMENT	28-2A

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
				SPECIFIC MISSION RULES		
A	28-20	LOSS OF RCS SYSTEM A OR B	ALL DOCKED UNDOCKED/ RNDZ UNMANNED	A.1. ISOLATE EFFECTED SYSTEM 2. UTILIZE GOOD SYSTEM B. DO NOT UNDOCK REFER TO ALT MISSION C. CSM RESCUE LM IN FREE DRIFT UNTIL DOCKING D. CONTINUE MISSION	REF MAL PROC RCS #1 AND MR 28-2	
	28-21	RCS THRUSTER PAIR A. ONE PAIR ISOLATED B. COMBINATION ISOLATED RESULTING IN LOSS OF ATTITUDE CONTROL	DOCKED UNDOCKED/ RNDZ UNMANNED DOCKED UNDOCK RNDZ UNMANNED	A.1. DO NOT UNDOCK REFER TO ALT MISSION 2. RETURN TO CSM AND DOCK ASAP 3. CONTINUE MISSION B.1. DO NOT UNDOCK UNMANNED APS BURN NO-GO 2. CSM ACTIVE DOCK ASAP 3. CSM RESCUE 4. STOP UNMANNED APS BURN	REF MAL PROC RCS #3	
	28-22	DECREASING OR LOSS OF RCS He PRESSURE	ALL DOCKED UNDOCKED RNDZ UNMANNED	A. CONTINUE MISSION 1. CONTINUE USING BOTH SYSTEMS UNTIL MFLD PRESS IN BAD SYSTEM <100 PSI. THEN ISOLATE BAD SYSTEM. 2. CROSSFEED FROM GOOD SYSTEM B. DO NOT UNDOCK C. DOCK ASAP D. RETURN TO CSM AND DOCK ASAP E. CONTINUE MISSION	REF MAL PROC RCS #1 AND 2 WHEN MFLD PRESS DROPS BELOW 100 PSI, THE SYSTEM IS CON- SIDERED NON-OPERATIONAL REF 28-20	
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	LM REACTION CONTROL SYSTEM		SPECIFIC	28-3

NASA — Manned Spacecraft Center

MISSION RULES

REV	ITEM	PRELAUNCH INSTRUMENTATION				MISSION RULE REFERENCE	
	28-30	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCER	CATEGORY	
		RCS "A" PROP QTY	GR1085Q	QUANTITY	COMMON	M	28-23,22
		RCS "B" PROP QTY	GR1095Q	QUANTITY	COMMON	M	28-23,22
		RCS "A" REG PRESS	GR1201P	PRESS MON C&W	COMMON	M-PCM	28-20,22,23
		RCS "B" REG PRESS	GR1202P	PRESS MON C&W	COMMON	M-PCM	28-20,22,23
		RCS "A" HE PRESS	GR1101P	PRESS MON C&W	COMMON	M-PCM	28-23,24
		RCS "B" HE PRESS	GR1102P	PRESS MON C&W	COMMON	M-PCM	28-23,24
		RCS "A" FUEL TEMP	GR2121T	TEMP MON	COMMON	M-PCM	28-20
		RCS "B" FUEL TEMP	GR2122T	TEMP MON	COMMON	M-PCM	28-20
		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	28-20,24,23
		RCS "B" FUEL MFLD PRESS	GR2202P	PRESS MON	COMMON	M	28-20,24,23
		RCS "A" OX MFLD PRESS	GR3201P	PRESS MON	COMMON	M	28-20,24,23
		RCS "B" OX MFLD PRESS	GR3202P	PRESS MON	COMMON	M	28-20,24,23
		A/B XFEED OPEN	GR9613U	CRSFD	COMMON	HD	
		QUAD 1 "A" TCA ISOL VLV	GR9667U	SYS A QUAD 1	COMMON	HD	28-21
		QUAD 2 "A" TCA ISOL VLV	GR9665U	SYS A QUAD 2	COMMON	HD	28-21
		QUAD 3 "A" TCA ISOL VLV	GR9663U	SYS A QUAD 3	COMMON	HD	28-21
		QUAD 4 "A" TCA ISOL VLV	GR9661U	SYS A QUAD 4	COMMON	HD	28-21
		QUAD 1 "B" TCA ISOL VLV	GR9668U	SYS B QUAD 1	COMMON	HD	28-21
		QUAD 2 "B" TCA ISOL VLV	GR9666U	SYS B QUAD 2	COMMON	HD	28-21
		QUAD 3 "B" TCA ISOL VLV	GR9664U	SYS B QUAD 3	COMMON	HD	28-21
		QUAD 4 "B" TCA ISOL VLV	GR9662U	SYS B QUAD 4	COMMON	HD	28-21
		QUAD 1 TEMP	GR6004T	TEMP MON C&W	COMMON	M	28-25
		QUAD 2 TEMP	GR6003T	TEMP MON C&W	COMMON	M	28-25
		QUAD 3 TEMP	GR6002T	TEMP MON C&W	COMMON	M	28-25
		QUAD 4 TEMP	GR6001T	TEMP MON C&W	COMMON	M	28-25
		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	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	LM REACTION CONTROL SYSTEM	PRELAUNCH INSTRUMENTATION	28-5

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MISSION RULES

REV	ITEM	GENERAL			
	29-1	ALL DECISIONS WILL BE BASED ON CONFIRMED MEASUREMENTS AND/OR EVENTS AND PROJECTIONS BASED ON CONFIRMED EVENTS.			
	29-2	DEFINITIONS: A. THE MAXIMUM OPERATIONAL DOSE (MOD) IS THE MAXIMUM RADIATION DOSE TO WHICH THE CREW WOULD BE SUBJECTED BASED ON A SKIN DOSE OF 400 RAD AN/OR A DEPTH (GASTROINTESTINAL) DOSE OF 50 RAD. B. THE PLANNING OPERATIONAL DOSE (POD) IS THE MAXIMUM RADIATION DOSE TO THE CREW WHICH ANY MISSION WOULD BE DESIGNED DURING THE PLANNING PERIOD BASED ON A SKIN DOSE OF 250 RAD AND/OR A DEPTH DOSE OF 25 RADS. C. THESE DOSES REPRESENT THE CUTOFF POINT WHERE A DECISION MUST BE MADE WHETHER TO CONTINUE OR TERMINATE THE MISSION. D. THE RADIATION ABSORBED DOSE (RAD) IS A UNIT OF ABSORBED DOSE WHICH IS EQUAL TO AN ENERGY DEPOSITION OF 100 ERGS/GRAM. E. THE RELATIVE BIOLOGICAL EFFECTIVENESS (RBE) EXPRESSES THE EFFECTIVENESS OF PARTICULAR TYPES OF RADIATION IN PRODUCING THE SAME BIOLOGICAL RESPONSE. THE AVERAGE RBE THAT WILL BE USED FOR SOLAR PARTICLE EVENT RADIATION FROM PROTONS IS 1.2. F. THE ROENTGEN EQUIVALENT MAN (REM) IS THE PRODUCT OF THE RAD AND THE RBE (REM = RAD X RBE). G. A CONFIRMED EVENT IS DEFINED AS AN EVENT THAT HAS BEEN MEASURED BY TWO OR MORE RELIABLE SOURCES. H. A SIGNIFICANT INCREASE OF THE MOD IS DEFINED AS A PARTICLE EVENT THAT WILL PRODUCE A FLUX OF 10^{10} AND A SKIN DOSE OF 575 RADS AND/OR A DEPTH DOSE OF 140 RADS.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	SPACE ENVIRONMENT	GENERAL	29-1

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(CONTINUED)

NASA — Manned Spacecraft Center
MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS					
		MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REF
A	29-15	RADIATION DOSIMETER 1 (CM DEPTH DOSE RATE)	CK1051K	-	-	HD	29-12
		RADIATION DOSIMETER 2 (CM SKIN DOSE RATE)	CK1052K	-	-	HD	29-12
		DOSIMETER RATE CHANGE	CK1053R	-	-	HD	29-12
		PROTON COUNT RATE CHAN 1	ST0820K	-	-	HD	29-14
		PROTON COUNT RATE CHAN 2	ST0821K	-	-	HD	29-14
		PROTON COUNT RATE CHAN 3	ST0822K	-	-	HD	29-14
		PROTON COUNT RATE CHAN 4	ST0823K	-	-	HD	29-14
		ALPHA COUNT RATE CHAN 1	ST0830K	-	-	HD	29-14
		ALPHA COUNT RATE CHAN 2	ST0831K	-	-	HD	29-14
		ALPHA COUNT RATE CHAN 3	ST0832K	-	-	HD	29-14
		PROTON INTEGER COUNT RATE	ST0838K	-	-	HD	29-14
		TEMP NUCLEAR PART. DET	ST0840T	-	-	HD	29-14
		TEMP NUCLEAR PART. ANAL	ST0841T	-	-	HD	29-14
		PERSONAL RADIATION DOSIMETER (PRD)	-	3 - ONBOARD	-	MANDATORY TO BE ONBOARD	29-14
		RATE SURVEY METER (RSM)	-	1 - ONBOARD	-	MANDATORY TO BE ONBOARD	29-14

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
A	30-5	TARGET POINTS WILL BE LOCATED SUCH THAT THE FOLLOWING AREAS WILL BE CLEAR OF ALL LAND: A. AN ELLIPSE 163 NM UPRANGE, 152 NM DOWNRANGE, AND 50 NM EITHER SIDE OF 55°/55° TARGET POINT. B. AN ELLIPSE 105 NM UPRANGE, 105 NM DOWNRANGE, AND 40 NM EITHER SIDE OF ROLL RIGHT 90° (DELAYED) LANDING POINT.	EARTH ORBITAL	MANDATORY		
A	30-6	TARGET POINTS WILL BE LOCATED SUCH THAT THE FOLLOWING AREAS WILL BE CLEAR OF LARGE LAND MASSES: A. AN ELLIPSE 109 NM UPRANGE, 109 NM DOWNRANGE, AND 40 NM EITHER SIDE OF 90°/90° LANDING POINT. B. AN ELLIPSE 105 NM UPRANGE AND DOWNRANGE AND 40 NM EITHER SIDE OF ROLL RIGHT 90° LANDING POINT.	EARTH ORBITAL	HIGHLY DESIRABLE		
A	30-7	TARGET POINTS WILL BE LOCATED SUCH THAT THE FOLLOWING AREAS WILL BE CLEAR OF ALL LAND: A. AN ELLIPSE 5 NM UPRANGE, 5 NM DOWNRANGE, AND 3 NM TO EITHER SIDE OF THE GNCS TARGET POINT. B. AN ELLIPSE 18 NM UPRANGE, 18 NM DOWNRANGE, AND 45 NM TO EITHER SIDE OF EMS LANDING POINT.	POST-TLI	MANDATORY		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/69	RECOVERY		SPECIFIC	30-2

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	30-8	TARGET POINTS WILL BE LOCATED SUCH THAT THE FOLLOWING AREAS WILL BE CLEAR OF LARGE LAND MASSES: A. REMAINDER OF OPERATIONAL FOOTPRINT. B. AN ELLIPSE 130 NM UPRANGE, 270 NM DOWN-RANGE, AND 35 NM TO EITHER SIDE OF THE CONSTANT "G" LANDING POINT.	POST-TLI	HIGHLY DESIRABLE	

MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	RECOVERY	SPECIFIC	30-3

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MISSION RULES

GENERAL

REV	ITEM				PAGE
	31-1	<u>PRELAUNCH</u>			
		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.			
	31-2	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.			
	31-3	THE POTABLE WATER PH MUST BE WITHIN 6.0 TO 8.0 AT SERVICING AND FINAL SAMPLING.			
	31-4	THE MAXIMUM ALLOWABLE CONCENTRATION OF PCO ₂ IS 5 MM HG.			
	31-5	<u>LAUNCH</u>			
		THERE ARE NO MEDICAL REASONS FOR ABORTING DURING THE LAUNCH PHASE OTHER THAN THOSE CONDITIONS INTOLERABLE TO THE CREW.			
	31-6	<u>ORBIT</u>			
		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.			
	31-7	<u>WATER PALATABILITY</u>			
		CREW EVALUATION OF THE DRINKING WATER TASTE WILL BE THE BASIS FOR DETERMINING WATER PALATABILITY, EVEN FOR KOH CONTAMINATION.			
		RULE NUMBERS 31-8 THROUGH 31-14 ARE RESERVED			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	AEROMEDICAL	GENERAL	31-1

NASA — Manned Spacecraft Center
MISSION RULES

REV	ITEM	INSTRUMENTATION REQUIREMENTS					MISSION RULE REFERENCE
		<u>CSM</u>					
	31-35	<u>MEAS DESCRIPTION</u>	<u>PCM</u>	<u>ONBOARD</u>	<u>TRANSDUCERS</u>	<u>CATEGORY</u>	
		ELECTROCARDIOGRAM	CJ0060J	NOT DISPLAYED		M*	31-15/16
		ELECTROCARDIOGRAM	CJ0061J	NOT DISPLAYED		M*	31-15/16
		ELECTROCARDIOGRAM	CJ0062J	NOT DISPLAYED		M*	31-15/16
		CO ₂ PARTIAL PRESSURE	CF0005P	METER	COMMON	HD	31-2/27/28
		SUIT CABIN DELTA PRESS	CF0003P	NOT DISPLAYED		HD	31-3/19
		ORAL TEMPERATURE		CLINICAL THERMOMETER		M*	31-20
		PNEUMOGRAM	CJ0200R	NOT DISPLAYED		HD	31-17
		PNEUMOGRAM	CJ0201R	NOT DISPLAYED		HD	31-17
		PNEUMOGRAM	CJ0202R	NOT DISPLAYED		HD	31-17
		<u>LM</u>					
		CO ₂ PARTIAL PRESSURE	GF1521P	METER		HD	
		ELECTROCARDIOGRAM	GT9999	NOT DISPLAYED		HD	31-15/16
		PNEUMOGRAM		NOT DISPLAYED		HD	31-17
		<u>PLSS</u>					
		P LSS ELECTROCARDIOGRAM	GT8124J			M	31-15/16
		*MANDATORY TO CABIN CLOSEOUT					
MISSION	REV	DATE	SECTION	GROUP	PAGE		
APOLLO 10	FINAL	4/15/69	AEROMEDICAL	INSTRUMENTATION REQUIREMENTS	31-5		

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MISSION RULES

REV	ITEM	GENERAL			
	32-1	<p>TO INITIATE AND CONTINUE THE FOLLOWING MISSION PHASES, THE CSM AND LM COMMUNICATIONS AND INSTRUMENTATION SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:</p> <p>A. <u>LAUNCH</u></p> <p>THERE ARE NO COMMUNICATIONS/INSTRUMENTATION FAILURES FOR WHICH THE LAUNCH/INSERTION PHASE WILL BE TERMINATED.</p> <p>B. <u>ALL PHASES EXCEPT LAUNCH AND RNDZ</u></p> <ol style="list-style-type: none"> 1. CRITICAL INSTRUMENTATION (CRITICAL INSTRUMENTATION IS THAT INSTRUMENTATION, ONBOARD OR TM, REQUIRED TO VERIFY GO/NO-GO CRITERIA) 2. TWO-WAY VOICE COMM BETWEEN SPACECRAFT. NOTE: THIS MAY BE SATISFIED BY UMBILICAL INTERCOM DURING DOCKED PHASES. 3. TWO-WAY VOICE COMM BETWEEN CSM OR LM AND MSFN DURING ALL DOCKED ACTIVITIES AND BETWEEN BOTH SPACECRAFT AND MSFN DURING UNDOCKED ACTIVITIES. <p>C. <u>RENDEZVOUS</u></p> <ol style="list-style-type: none"> 1. CRITICAL ONBOARD DISPLAYS 2. TWO-WAY VOICE COMM BETWEEN CSM AND LM 3. LM LBR AND CSM OPERATIONAL TELEMETRY 4. DIRECT TWO-WAY VOICE COMM BETWEEN CSM/LM AND MSFN 			
	32-2	<p>THE MISSION WILL BE CONTINUED WITH THE LOSS OF:</p> <ol style="list-style-type: none"> A. EITHER OR BOTH THE CSM AND THE LM UPDATA LINK B. EITHER OR BOTH THE CSM AND THE LM CAUTION AND WARNING SYSTEM C. THE CSM DATA STORAGE EQUIPMENT D. THE CSM OR LM HIGH GAIN ANTENNA 			
A	32-3	<p><u>VOICE CONFIGURATION</u></p> <p>A. LM/CSM/MSFN</p> <ol style="list-style-type: none"> 1. VHF DUPLEX B AND USB WILL BE TRANSMITTED/RECEIVED SIMULTANEOUSLY FOR LAUNCH. VHF SIMPLEX A AND USB WILL BE TRANSMITTED/RECEIVED SIMULTANEOUSLY FOR EARTH ORBIT. (THE BEST QUALITY DOWNLINK WILL BE REMOTED TO HOUSTON.) 2. VHF A SIMPLEX 296.8 MHZ IS PRIME VOICE COMM BETWEEN VEHICLES EXCEPT DURING RANGING WHEN DUPLEX B (CSM) AND DUPLEX A (LM) WILL BE USED. 3. VHF B SIMPLEX 259.7 MHZ IS BACKUP TO VHF A, BUT WILL BE USED ONLY IF REQUIRED. 4. USB IS PRIME VOICE COMM BETWEEN MSFN AND CSM/LM. 5. USB/VHF RELAY IS VOICE COMM BACKUP TO USB BETWEEN MSFN AND MALFUNCTIONED S/C. 6. NORMAL VOICE COMM WILL USE SIMULTANEOUS MSFN UPLINK TO BOTH VEHICLES. HOWEVER, IF REQUIREMENT SHOULD EXIST, SIMULTANEOUS INDEPENDENT MSFN/CSM AND MSFN/LM COMM MODES WILL BE INITIATED. 7. CSM AND LM WILL TRANSMIT SIMULTANEOUSLY ON VHF AND USB. <p>RULE NUMBERS 32-4 THROUGH 32-9 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	COMMUNICATIONS AND INSTRUMENTATION	GENERAL	32-1

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MISSION RULES

REV	ITEM	<u>MANAGEMENT</u>			
	32-10	<u>CSM VHF/USB MANAGEMENT</u> A. FOR CREW REST PERIODS, CSM S-BAND ANTENNAS WILL BE SELECTED BY GROUND COMMANDS. B. NORMAL CONTROL OF THE S-BAND MODES WILL BE BY GROUND COMMAND. CSM COMMUNICATIONS SWITCH POSITION WILL REFLECT OUT-OF-SITE CONTACT CONFIGURATION.			
	32-11	<u>DSE MANAGEMENT</u> A. LM AND CSM LOW BIT RATE TELEMETRY WILL BE RECORDED CONTINUOUSLY WHEN NOT IN CONTACT WITH GROUND TELEMETRY SITES AND WILL BE PLAYED BACK AT LEAST ONCE PER REVOLUTION IN LUNAR ORBIT. B. CM HIGH BIT RATE DSE RECORDINGS WILL BE MADE DURING THE FOLLOWING OPERATIONS: <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) C. DATA DUMP LOGS WILL BE MAINTAINED AND MSFN DATA RECORDING STORAGE WILL BE MANAGED IN ORDER TO ALLOW IMMEDIATE REPLAY OF ANY DATA RECORDED WITHIN THE PREVIOUS 24 HOURS. D. DURING SLEEP PERIODS <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. 			
	32-12	<u>CTE AND MISSION TIMER MANAGEMENT</u> A. CTE AND THE MISSION TIMER 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. B. CTE AND THE MISSION TIMER WILL BE ALLOWED TO DRIFT ±5 SEC BEFORE BEING UPDATED AFTER ORBIT INSERTION.			
	32-13	<u>LM USB/TM MANAGEMENT</u> A. FOR NORMAL LM POWERED UP PHASES, THE LM STEERABLE ANTENNA WILL BE USED. 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.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	COMMUNICATIONS AND INSTRUMENTATION	MANAGEMENT	32-2

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MISSION RULES

REV	ITEM				
	32-14	<p><u>SYSTEMS MONITORING</u></p> <p>DURING SLEEP PERIODS TBD CREWMEN WILL SLEEP WITH HEADSETS TO MONITOR FOR MC&W AND/OR GROUND ALERT SIGNAL.</p>			
A	32-15	<p><u>LM STEERABLE ANTENNA MANAGEMENT</u></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°F AND 185°F.</p>			
A		<p>RULE NUMBERS 32-16 THROUGH 32-19 ARE RESERVED.</p>			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	A	4/23/69	COMMUNICATIONS AND INSTRUMENTATION	MANAGEMENT	32-3

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
				SPECIFIC MISSION RULES		
	32-20	LOSS OF TWO-WAY DIRECT VOICE COMM BETWEEN CSM AND LM	DOCKED UNDOCKED RNDZ	A. <u>CONTINUE MISSION</u> DO NOT UNDOCK B. <u>DOCK WITH TWO VEHICLE MSFN COVERAGE</u> NO-GO FOR RNDZ C. <u>CONTINUE MISSION</u>	REF MALF PROC _____	
	32-21	LOSS OF TWO-WAY VOICE COMM WITH MSFN A. LM ONLY B. CSM ONLY	DOCKED UNDOCKED RNDZ LAUNCH ORBIT ALL	A.1. <u>CONTINUE MISSION</u> UNDOCKING OK 2. <u>NO-GO FOR RNDZ</u> 3. <u>CONTINUE MISSION</u> B.1. <u>CONTINUE MISSION</u> 2. ENTER NEXT BLOCK DATA POINT C. <u>ENTER NEXT BEST PTP</u>	CONFIGURE FOR CSM OR LM VOICE RELAY AS REQUIRED.	
	32-22	LOSS OF CSM TM A. HBR OR LBR B. ALL TM	ALL LAUNCH ALL	A. <u>CONTINUE MISSION</u> B.1. <u>CONTINUE MISSION</u> 2. <u>ENTER NEXT BEST PTP</u>		
	32-23	LOSS OF LM TM A. LBR B. ALL TM	ALL DOCKED UNDOCKED RNDZ	A. <u>CONTINUE MISSION</u> B.1. <u>CONTINUE MISSION</u> 2. <u>NO-GO FOR RNDZ</u> 3. <u>CONTINUE MISSION</u>		
	32-24	LOSS OF USB RANGING (CSM OR LM)	ALL	<u>CONTINUE MISSION</u>		
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	FINAL	4/15/69	COMMUNICATIONS AND INSTRUMENTATIONS		SPECIFIC	32-4

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	32-25	LOSS OF ONE CSM PMP POWER SUPPLY	ALL	<u>CONTINUE MISSION</u>		
	32-26	LOSS OF FM DOWNLINK (CSM OR LM)	ALL	<u>CONTINUE MISSION</u>		
	32-27	LOSS OF THE UPDATA LINK (CSM AND/OR LM)	ALL	<u>CONTINUE MISSION</u>		
	32-28	LOSS OF BOTH CSM POWER AMPLIFIERS	EPO	<u>NO-GO FOR TLI</u>		
	32-29	LOSS OF THE SCE	EPO TLC	A. <u>NO-GO FOR TLI</u> B. <u>ENTER NEXT BEST PTP</u> NO-GO FOR LOI		
	32-30	LOSS OF TWO CSM AUDIO CENTERS	EPO	<u>NO-GO FOR TLI</u>		
	32-31	LOSS OF CRITICAL INSTRUMENTATION A. ONBOARD B. ONBOARD AND TM RULE NUMBERS 32-32 THROUGH 32-39 ARE RESERVED.	LAUNCH EO TLC ALL ALL	<u>CONTINUE MISSION</u> <u>NO-GO FOR TLI</u> <u>CONTINUE MISSION</u> NO-GO FOR LOI <u>NO-GO FOR RNDZ</u> <u>ENTER NEXT BEST PTP</u>		
A						
MISSION	REV	DATE	SECTION		GROUP	PAGE
APOLLO 10	A	4/23/68	COMMUNICATIONS AND INSTRUMENTATIONS		SPECIFIC	32-5

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MISSION RULES

REV	ITEM	COMM/INST INSTRUMENTATION			
A	32-40	LM			
		<u>MEAS DESCRIPTION</u>	<u>PCM</u>	<u>ONBOARD</u>	<u>CATEGORY</u>
		PCM OSC FAIL 2 }	GL0422V		1 OF 2
		PCM OSC FAIL 3 }	GL0423V		HIGHLY DESIRABLE
		CAL 85 PCT	GL0401V		HIGHLY DESIRABLE
		CAL 15 PCT	GL0402V		HIGHLY DESIRABLE
		MET	GL0501W		HIGHLY DESIRABLE
		C&W PWR FAIL	GL4054X	CAUTION	HIGHLY DESIRABLE
		MASTER ALARM	GL4069X	MASTER ALARM	HIGHLY DESIRABLE
		DUA STATUS	GT0441X		HIGHLY DESIRABLE
		S-BND ST PH ERR	GT0992B		HIGHLY DESIRABLE
		S-BND XMTR PO	GT0993E		HIGHLY DESIRABLE
		S-BND RCVR SIG	GT0994V	METER	HIGHLY DESIRABLE
		DSE TAPE MOTION MONITOR	CT0012X		HIGHLY DESIRABLE
		SIG COND POS SUPPLY VOLTS	CT0015V		HIGHLY DESIRABLE
		SIG COND NEG SUPPLY VOLTS	CT0016V		HIGHLY DESIRABLE
		SENSOR EXCITATION 5 VOLTS	CT0017V		HIGHLY DESIRABLE
		SENSOR EXCITATION 10 VOLTS	CT0018V		HIGHLY DESIRABLE
		CTE TIME FROM LAUNCH	CT0145F		HIGHLY DESIRABLE
		UDL SYS VALIDITY SIG	CT0262V		HIGHLY DESIRABLE
		USB REC AGS VOLTS	CT0620E		HIGHLY DESIRABLE
		USB REC STATIC PH ERR	CT0640F		HIGHLY DESIRABLE
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APPENDICES

A ACRONYMS AND
SYMBOLS

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MISSION RULES

REV	ITEM				
A		FL	FULL LIFT	LMDE	LM DESCENT ENGINE
		FM	FREQUENCY MODULATION	LMP	LM MODULE PILOT
		FPS	FEET PER SECOND	LMRD	LAUNCH MISSION RULE DOCUMENT
		FQR	FLIGHT QUALIFICATION RECORDER	L/O	LIFTOFF
		FTP	FIXED THROTTLE POINT	LOI	LUNAR ORBIT INSERTION
				LOS	LINE-OF-SIGHT
				LOX	LIQUID OXYGEN
				L/R	LEFT/RIGHT
		G	GRAVITY	LV	LOW-VOLTAGE
		G&C	GUIDANCE AND CONTROL	L/V	LAUNCH VEHICLE
		GASTA	GIMBAL ANGLE SEQUENCE TRANSLATION ASSEMBLY	LVDA	LAUNCH VEHICLE DATA ADAPTER
		GBI	GRAND BAHAMA ISLAND	LVDC	LAUNCH VEHICLE DIGITAL COMPUTER
		GDA	GIMBAL DRIVE ASSEMBLY		
		GDC	GYRO DISPLAY COUPLER	MALF	MALFUNCTION
		GET	GROUND ELAPSED TIME	MCC	MISSION CONTROL CENTER
		GETI	GROUND ELAPSED TIME OF IGNITION	MCC	MIDCOURSE CORRECTION
		GMT	GREENWICH MEAN TIME	MC&W	MASTER CAUTION AND WARNING
		GMTLO	GREENWICH MEAN TIME OF LIFTOFF	MDAS	MEDICAL DATA ACQUISITION SYSTEM
		G&N	GUIDANCE AND NAVIGATION	MED	MANUAL ENTRY DEVICE
		GN ₂	GASEOUS NITROGEN	MERU	MILLI EARTH RATE UNIT
		GNC	GUIDANCE NAVIGATION CONTROL	MESC	MASTER EVENTS SEQUENCE CONTROLLER
		GNCs	GUIDANCE, NAVIGATION, AND CONTROL SYSTEM	MFCO	MANUAL FUEL CUTOFF
		GND	GROUND	MFV	MAIN FUEL VALVE
		GRR	GUIDANCE REFERENCE RELEASE	MGA	MIDDLE GIMBAL AXIS
		GSFC	GODDARD SPACE FLIGHT CENTER	MIL	MERRITT ISLAND
		GTS	GIMBAL TRIM SYSTEM	MITE	MASTER INSTRUMENTATION TIMING
		GUIDO	GUIDANCE OFFICER		EQUIPMENT
				MNFLD	MANIFOLD
				M&O	MAINTENANCE AND OPERATION
		H ₂	HYDROGEN	MOC	MISSION OPERATIONS COMPUTER
		H ₂ O	WATER	MSFN	MANNED SPACE FLIGHT NETWORK
		H _a	HEIGHT OF APOGEE	MSK	MANUAL SELECT KEYBOARD
		HAW	HAWAII	MSTC	CSM SPACECRAFT TEST CONDUCTOR
		HBR	HIGH-BIT-RATE	MTVC	MANUAL THRUST VECTOR CONTROL
		HF	HIGH FREQUENCY	MUX	MULTIPLEXER
		H _p	HEIGHT OF PERIGEE		
		H _S	HIGH-SPEED	NASA	NATIONAL AERONAUTICS AND SPACE
		HZ	HERTZ		ADMINISTRATION
				NCC	COMBINED CORRECTIVE MANEUVER
		IC	INTERCOMMUNICATIONS EQUIPMENT	NM	NAUTICAL MILES
		IGA	INNER GIMBAL AXIS	NPV	NON-PROPULSIVE VENT
		IMU	INERTIAL MEASUREMENT UNIT	NSR	COELLIPTICAL MANEUVER
		INJ	INJECTOR		
		INST	INSTRUMENTATION	O ₂	OXYGEN
		INV	INVERTER	O/B	ONBOARD
		IP	IMPACT POINT OR IMPACT PREDICTOR	ODOP	OFFSET DOPPLER AND POSITION
		IRIG	INERTIAL RATE INTEGRATING GYRO	OGA	OUTER GIMBAL AXIS
		ISOL	ISOLATION	QMSF	OFFICE OF MANNED SPACE FLIGHT
		ISS	INERTIAL SUBSYSTEM	OPS	OXYGEN PURGE SYSTEM
		IU	INSTRUMENTATION UNIT	ORDEAL	ORBITAL RATE DRIVE ELECTRONICS
		IVT	INTRAVEHICULAR TRANSFER		APOLLO LM
				OXID	OXIDIZER
		JD	JET-DRIVER		
				PAFB	PATRICK AIR FORCE BASE
		KOH	POTASSIUM HYDROXIDE	PAM	PULSE AMPLITUDE MODULATION
		KSC	KENNEDY SPACE CENTER	PB	PUSH-BUTTON
				PC	PERICYNTHION
				PCM	PULSE CODE MODULATION
				PCMGs	PULSE CODE MODULATION GROUND
		LB	POUND		STATION
		LBR	LOW-BIT-RATE	PCO ₂	PARTIAL PRESSURE CARBON DIOXIDE
		LCG	LIQUID COOLING GARMENT	PDS/DD	PLOTTING DISPLAY SUBCHANNEL/DATA
		LES	LAUNCH ESCAPE SYSTEM		DISTRIBUTION
		LET	LAUNCH ESCAPE TOWER	PGA	PRESSURE GARMENT ASSEMBLY
		LGC	LM GUIDANCE COMPUTER	PGNCS	PRIMARY GUIDANCE AND NAVIGATION
		LH ₂	LIQUID HYDROGEN		CONTROL SYSTEM (CSM)
		LiOH	LITHIUM HYDROXIDE	PGNS	PRIMARY GUIDANCE AND NAVIGATION
		LM	LUNAR MODULE		SYSTEM (LM)
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	PIPA	PULSE INTEGRATING PENDULOUS ACCELEROMETER	SODB	SPACECRAFT OPERATIONAL DATA BOOK	
	PLSS	PORTABLE LIFE SUPPORT SYSTEM	SOL	SOLENOID	
	PO	POWER OUT	SOP	STANDARD OPERATING PROCEDURE	
	PO ₂	PARTIAL PRESSURE OXYGEN	SOV	SHUT-OFF VALVE	
	POS	POSITION	SPAN	SPACECRAFT PLANNING AND ANALYSIS	
	POS	PRIMARY OXYGEN SYSTEM	SPS	SERVICE PROPULSION SYSTEM	
	PPM	PARTS PER MILLION	SRO	SUPERINTENDENT RANGE OPERATIONS	
	PQGS	PROPELLANT QUANTITY GAGING SYSTEM	SSC	SPACE SUIT COMMUNICATOR	
	PRELN	PRELAUNCH	STBY	STANDBY	
	PRESS	PRESSURE	SW	SWITCH	
	PRI	PRIMARY	SXT	SEXTANT	
	PROC	PROCEDURE			
	PROP	PROPELLANT			
	PSA	POWER SERVO AMPLIFIER	TB	TIME BASE	
	PSI	POUNDS PER SQUARE INCH	TBD	TO BE DETERMINED	
	PSID	POUNDS PER SQUARE INCH DIFFERENCE	TC	TEST CONDUCTOR	
	PSS	PAD SAFETY SUPERVISOR	T/C	TELEMETRY AND COMMUNICATIONS	
	PTA	PULSE TORQUE ASSEMBLY	TCE	CONDENSER EXHAUST TEMPERATURE	
	PTP	PREFERRED TARGET POINT	TCP	THRUST CHAMBER PRESSURE	
	PTV	PITCH THRUST VECTOR	TD&E	TRANSPORTATION, DOCKING AND EXTRACTION	
	PU	PROPELLANT UTILIZATION	TDP	TELEMETRY DATA PROCESSOR	
	PUGS	PROPELLANT UTILIZATION AND GAGING SYSTEM	TELCOM	LM EECOM	
	PVT	PRESSURE-VOLUME-TEMPERATURE	TEMP	TEMPERATURE	
	PYRO	PYROTECHNICS	T _{FF}	TIME OF FREE FALL	
			THC	THRUST HAND CONTROLLER	
			T _{ig}	TIME OF IGNITION	
	QTY	QUANTITY	TLI	TRANSLUNAR INJECTION	
			TM	TELEMETRY	
			TMG	THERMAL METEROID GARMENT	
			TNK	TANK	
			TOK	THRUST OKAY	
	RAD	RADIATOR	TPF	TERMINAL PHASE FINALIZATION	
	RET	RETRACT	TPI	TERMINAL PHASE INITIATE	
	RCS	REACTION CONTROL SYSTEM	TRNS	TRANSFER	
	RCU	REMOTE CONTROL UNIT	TRUN	TRUNNION	
	RCVR	RECEIVER	TTC	TRANSLATION THRUST CONTROLLER	
	REF	REFERENCE	TTY	TELETYPE	
	REFSMMAT	REFERENCE STABLE MEMBER MATRIX	TVC	THRUST VECTOR CONTROL	
	REQD	REQUIRED			
	RETRB	RETRO ELAPSED TIME TO REVERSE BANK			
	RETRO	RETROFIRE OFFICER			
	REV	REVOLUTION	U/D	UP/DOWN	
	RF	RADIO FREQUENCY	UDL	UPDATE LINK	
	RFO	RETROFIRE OFFICER	UHF	ULTRA HIGH FREQUENCY	
	RGA	RATE GYRO ASSEMBLY	UNDKD	UNDOCKED	
	RHC	ROTATION HAND CONTROLLER	USB	UNIFIED S-BAND	
	RIP	RANGE OF IMPACT POINT			
	RL	ROLL LEFT			
	RNDZ	RENDEZVOUS			
	Rp-Rt	DOWNRANGE ERROR	Vc	VELOCITY COUNTER	
	RR	RENDEZVOUS RADAR	VEI	INERTIAL VELOCITY AT ENTRY INTERFACE	
	RR	ROLL RIGHT	Vgx	VELOCITY TO BE GAINED X-AXIS	
	RSI	ROLL STABILITY INDICATOR	Vgy	VELOCITY TO BE GAINED Y-AXIS	
	RSO	RANGE SAFETY OFFICER	Vgz	VELOCITY TO BE GAINED Z-AXIS	
	RSVR	RESOLVER	VHF	VERY HIGH FREQUENCY	
	RTACF	REAL-TIME AUXILIARY COMPUTING FACILITY	VLV	VALUE	
	RTC	REAL-TIME COMMAND	VSM	VIDEO SWITCHING MATRIX	
	RTCC	REAL-TIME COMPUTER COMPLEX			
			WBD	WIDE-BAND DATA	
	S/C	SPACECRAFT	WMS	WASTE MANAGEMENT SYSTEM	
	SCE	SIGNAL CONDITIONING EQUIPMENT	WT	WEIGHT	
	SCS	STABILIZATION AND CONTROL SYSTEM			
	SEC	SECONDARY			
	SEC	SECOND			
	SECO	SUSTAINER ENGINE CUTOFF (S-IVB CUTOFF)	XFEED	CROSSFEED	
	SECS	SEQUENTIAL EVENTS CONTROL SYSTEM	XMIT	TRANSMIT	
	SHe	SUPER-CRITICAL HELIUM	XMTR	TRANSMITTER	
	SIG	SIGNAL			
	SLA	SPACECRAFT LM ADAPTER			
	SLV	SATURN LAUNCH VEHICLE			
	SM	SERVICE MODULE	Y	YAW OR Y-AXIS	
	SMJC	SERVICE MODULE JETTISON CONTROLLER	YTV	YAW THRUST VECTOR	
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		Z	Z-AXIS		
		<u>SYMBOLS</u>			
		h	ALTITUDE		
		Δ	DIFFERENCE		
		γ	FLIGHT PATH ANGLE		
		φ	LATITUDE OR PHASE		
		q	DYNAMIC PRESSURE		
		≈	APPROXIMATELY		
		d	DOWNRANGE DISTANCE		
		±	PLUS OR MINUS		
		>	GREATER THAN		
		<	LESS THAN		
		≥	EQUAL TO OR GREATER THAN		
		≤	EQUAL TO OR LESS THAN		
		λ	LONGITUDE		
		γ _i	INERTIAL FLIGHT PATH ANGLE		
		γ _{EI}	INERTIAL FLIGHT PATH ANGLE AT ENTRY		
		ΔV _{IN}	DELTA VELOCITY IN INSERTION		
		ΔT _B	DELTA BURN TIME		
		Δh	DELTA ALTITUDE		
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REV	ITEM	DISTRIBUTION LIST				
A		<p><u>DIRECTOR OF FLIGHT OPERATIONS</u></p> <p>FA/KRAFT, C.C., JR. (2) SJOBERG, S.A. ROSE, R.G. KOONS, W.E.</p> <p><u>FLIGHT CONTROL DIVISION</u></p> <p>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.</p> <p><u>FLIGHT CONTROL OPERATIONS BRANCH</u></p> <p>FC2/HARLAN, C.S. LEWIS, C.R. FENDELL, E.I. (3) EALICK, P.L. (9) PLATT, W.E. (3) MOLNAR, W.M. (4)</p> <p><u>CSM SYSTEMS BRANCH</u></p> <p>FC3/ALDRICH, A.D. HUTCHINSON, N.B. LOE, T.R. (20) WILLOUGHBY, B.N. (20) BLAIR, W.L. (2)</p> <p><u>LM SYSTEMS BRANCH</u></p> <p>FC4/HANNIGAN, J.E. (5) PUDDY, D.R. (20) CARLTON, R.L. (23) EDELIN, F. (5)</p> <p><u>FLIGHT DYNAMICS BRANCH</u></p> <p>FC5/BOSTICK, J.C. SHAFFER, P.C. LLEWELYN, J.S. (4) PARKER, C.B. (4) PAVELKA, E.L. (4)</p> <p><u>MISSION SIMULATIONS BRANCH</u></p> <p>FC6/SHELLEY, C.B. (28)</p> <p><u>MISSION CONTROL REQUIREMENTS</u></p> <p>FC7/PETTITT, G.I. (2)</p> <p><u>EXPERIMENTS SYSTEMS BRANCH</u></p> <p>FC8/SAULTZ, J.E. (12)</p> <p><u>MSFC FLIGHT CONTROL OFFICE</u></p> <p>I-MO-F/HAMNER, R.S. (20)</p> <p><u>FLIGHT SUPPORT DIVISION</u></p> <p><u>SYSTEMS ENGINEERING BRANCH</u></p> <p>FS2/SATTERFIELD, J.M.</p>	<p><u>OPERATIONS SUPPORT BRANCH</u></p> <p>FS4/FREIRE, J.A. SANBORN, S.D. (15) MONKVIC, J.A. (2)</p> <p><u>FLIGHT SOFTWARE BRANCH</u></p> <p>FS5/STOKES, J.D. (3) GIBSON, T.F., JR. GARMAN, J.R. (2)</p> <p><u>MISSION PLANNING AND ANALYSIS DIVISION</u></p> <p>FM/MAYER, J.P. (2) HUSS, C. (1) TINDALL, H.W. OWEN, D.H.</p> <p><u>FLIGHT ANALYSIS BRANCH</u></p> <p>FM3/ALLEN, C.F. (14)</p> <p><u>LANDING ANALYSIS BRANCH</u></p> <p>FM2/BENNETT, F.V. BOLT, W.M. GRAVES, C.A. HARPOLD, J.C. ALPHIN, J. DUPNICK, E. HANSEN, V.</p> <p><u>MATH PHYSICS BRANCH</u></p> <p>FM4/MCPHERSON, J.C. (2)</p> <p><u>MISSION ANALYSIS BRANCH</u></p> <p>FM5/BERRY, R. (2)</p> <p><u>RENDEZVOUS ANALYSIS BRANCH</u></p> <p>FM6/LINEBERRY, E.C. (2) CONWAY, H.L.</p> <p><u>GUIDANCE AND PERFORMANCE BRANCH</u></p> <p>FM7/CASSETTI, M.D. (2)</p> <p><u>APOLLO TRAJECTORY SUPPORT OFFICE</u></p> <p>FM13/PARTEN, R. COLLINS, M. BENNET, W.J.</p> <p><u>LANDING AND RECOVERY DIVISION</u></p> <p>FL/HAMMACK, J.B. (8)</p> <p><u>DIRECTOR OF FLIGHT CREW OPERATIONS</u></p> <p>CA/SLAYTON, D.K. (2)</p> <p><u>ASTRONAUT OFFICE</u></p> <p>CB/SHEPARD, A.B. (20) DUKE, C.P. (2)</p> <p><u>FLIGHT CREW SUPPORT DIVISION</u></p> <p>CF/NORTH, W.J. GRIMM, D.F. BILODEAU, J.W.</p>	<p><u>FLIGHT CREW SUPPORT DIVISION (CONTINUED)</u></p> <p>DEMENT, M.E. (4) ALLEN, L.D. (4) KRAMER, P.C. (5) WARREN, D.K. (3) ANDERSON, W.M. WOODLING, C.H. SMITH, A.F. KUEHNEL, H.A. (4) SMITH, J.C. 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.</p> <p><u>DIRECTOR OF MEDICAL RESEARCH AND OPERATIONS DA</u></p> <p>BERRY, C.A., M.D. CATTERSON, A.D., M.D. ZIEGLSCHMID, J.F., M.D. (6)</p> <p><u>PUBLIC AFFAIRS OFFICE</u></p> <p>AP/HANEY, P. AP8/GREEN, D.J. (5)</p> <p><u>APOLLO SPACECRAFT PROGRAM OFFICE</u></p> <p>PA/LOW, G.M. BOLENDER, C.H., BRIG. GEN. PA2/APOLLO FILES PD/BATTEY, R.V. DENNETT, A.</p> <p>PD5/GOREE, J. PD7/KOHR, R. SILVER, M. (40)</p> <p>PD9/CRAIG, J. PD12/PERRINE, C.H. TOMBERLIN, J.L. WARD, R.J. (2) PD14/BYINGTON, H.W. PP/MCLINTOCK, J. PP32/TASH, H.L. 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)</p> <p><u>DIRECTOR OF ENGINEERING AND DEVELOPMENT</u></p> <p>EA/FAGET, M.A. GARDINER, R.A. CHAMBERLIN, J.A. BOND, A.C. EA2/LEE, J.B. EA4/BURT, R.P. EA5/DEANS, P.M. EB/KYLE, H. EB3/TRAVIS, D. STOKER, C. EB5/NEWLIN, R. EC/SMYLIE, R.E.</p>		
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A		<p><u>DIRECTOR OF ENGINEERING AND DEVELOPMENT (CONTINUED)</u></p> <p>EC3/GILLEN, R.J. TUCKER, E.M. EC9/STUTESMAN, H.L.</p> <p>EE/SAWYER, R.S. EE4/RIEGERT, D. JOHNSON, G. MUFORD, R.E. ROTRAMEL, F. COMPOS, A.B. DIETZ, R.H. FENNER, R.G. WALTER, R.T. GIESECKE, R.L. EE12/LUSE, M.B. EE13/TREMONT, R. EDMISTON, C.R. EG/KAYTON, M. EG23/COX, K.J., DR. EG25/HANAWAY, J. WASSON, C. EG42/RICE, G. (2) EG43/LEWIS, R.E. KURTEN, P.M. SHELTON, D.H. EP/MCSHEEHY, R. EP2/TOWNSEND, N.A. HUMPHRIES, C.E. HAMMOCK, W.R. LAMBERT, C.H. EP4/KARAKULKO, W. EP5/BELL, D. OWENS, S. TROUT, B. ES/CHAUVEN, L. ES3/STROUHAL, G. ES127/SMITH, J. ES12/GLYNN, P.C. WEISS, S.P. PAVLOSKY, J.E. EX/SILVERIA, M. EX2/REDD, B.</p> <p><u>FLIGHT SAFETY OFFICE</u></p> <p>MSC/SA FRENCH, J.C. SF/GREENWELL, D. KSC/HY VAUGHN, N.B.</p> <p><u>RELIABILITY AND CERTIFICATION OFFICE</u></p> <p>NB2/WILLIAMS, H.L. (2)</p> <p><u>DIRECTOR OF SCIENCE AND APPLICATIONS</u></p> <p>TG5/LILL, J.C. TA/CALIO, A.J.</p> <p><u>TRW-HOUSTON</u></p> <p>ROBERTSON, R.L. (3) TRW TECHNICAL INFORMATION CENTER, HOUSTON OPERATIONS (2)</p> <p><u>NORTH AMERICAN ROCKWELL HOUSTON</u></p> <p>HARMAN, H.A. (2)</p>			
		<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/PETRONE, 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/SEDLER, 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/I-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. (12) 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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A	<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, N/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>				
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C CHANGE CONTROL

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	1.0	INTRODUCTION			
	1.1	PURPOSE			
		THE PURPOSE OF THIS APPENDIX IS TO DELINEATE CHANGE CONTROL PROCEDURES FOR THE AS-505/106/LM-4 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).			
	1.2	EFFECTIVITY			
		FEBRUARY 24, 1969			
	2.0	CHANGE PROCEDURES			
	2.1	SUBMISSION OF CHANGES			
		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 THE PRIME MISSION OPERATIONS CONTROL ROOM (MOCR) POSITION CONCERNED.			
	2.1.1	<u>FORMAT</u>			
		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.			
		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.			
	2.2	APPROVAL			
	2.2.1	<u>COORDINATION</u>			
		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.			
	2.2.2	<u>SIGNOFF/DISAPPROVAL</u>			
		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.			
	2.2.3	<u>DISAPPROVED CHANGES</u>			
		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.			
	2.3	<u>PUBLICATION AND DISTRIBUTION OF INTERIM CHANGES</u>			
		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).			
	3.0	REVISIONS			
	3.1	DEVELOPMENT			
		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.)			
	3.2	APPROVAL			
		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.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	APPENDIX C - CHANGE CONTROL		C-1

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MISSION RULES

REV	ITEM				
	3.3	PUBLICATION			
	3.3.1	<u>SCHEDULE</u>			
		REVISIONS WILL BE MADE ON AN "AS REQUIRED" BASIS.			
	3.3.2	<u>DISTRIBUTION</u>			
		REVISIONS WILL BE PRINTED AND DISTRIBUTED THROUGH THE NORMAL ADMINISTRATIVE CHANNELS.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
APOLLO 10	FINAL	4/15/69	APPENDIX C - CHANGE CONTROL		C-2

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MISSION RULES

REV	ITEM						
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:			APPROVED:		APPROVED:		
NAME _____ ORGANIZATION _____ EXT _____			COGNIZANT BRANCH CHIEF _____		FLIGHT DIRECTOR _____		
AFD: _____	BSE: _____	FIDO: _____	GUIDO: _____	RETRO: _____	GNC: _____	EECOM: _____ OTHER: _____	
<small>MSC FORM 1555 (JAN 68)</small>							
FIGURE C-1.- MISSION RULE CHANGE REQUEST FORM.							
MISSION	REV	DATE	SECTION	GROUP	PAGE		
APOLLO 10	FINAL	4/15/69	APPENDIX C - CHANGE CONTROL		C-3		

APOLLO

FMR

**FINAL
FLIGHT
MISSION RULES**

**APOLLO 10
(AS-505/106/LM-4)**



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MSC
NASA**