REV	ITEM

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I GENERAL GUIDELINES

REV	ITEM	OMSF GENERAL RULES
	I-1	MISSION RULES ARE EFFECTIVE DURING THE LAUNCH COUNTDOWN, FLIGHT AND RECOVERY OPERATIONS, AND DURING PRELAUNCH TESTS WHEN APPLICABLE. THEY ARE BASED ON MISSION OBJECTIVES AS STATED IN THE APOLLO FLIGHT MISSION ASSIGNMENTS DOCUMENT M-D MA 500-11. PROPOSED CHANGES TO THE MISSION 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.
	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.

REV	ITEM	
	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.
	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.

REV	ITEM	
	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 SPACE FLIGHT 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.
		RULES I-28 THROUGH I-35 ARE RESERVED.

REV	ITEM	
		DEFINITIONS
	I-36	REDLINE: A REDLINE VALUE IS A MAXIMUM AND/OR MINIMUM LIMIT OF A CRITICAL PARAMETER NECESSARY TO IDENTIFY VEHICLE, SYSTEM, AND COMPONENT PERFORMANCE AND OPERATION. REDLINE VALUES WILL BE ESTABLISHED SUCH THAT FURTHER DEGRADATIONS OF THE SYSTEM OR COMPONENT COULD LEAD TO A FAILURE TO ACCOMPLISH THE PRIMARY MISSION.
	I-37	REDLINE FUNCTION: A REDLINE FUNCTION IS A PARAMETER THAT HAS BEEN IDENTIFIED TO MONITOR THE FUCTIONING OF A UNIT TO INSURE THE OPERATIONAL PERFORMANCE OF THAT UNIT IS ACCEPTABLE TO MEET THE PRIMARY MISSION. REDLINE FUNCTIONS ARE MANDATORY.
	I-38	PRIMARY OBJECTIVE: A STATEMENT OF THE PRIMARY PURPOSE OF 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 PRIMARY OBJECTIVE.
	I-39	PRINCIPAL DETAILED TEST OBJECTIVE: 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	MANDATORY DETAILED TEST OBJECTIVE: 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	SECONDARY DETAILED TEST OBJECTIVE: A DETAILED TEST OBJECTIVE WHICH WOULD PROVIDE SIGNIFICANT DATA OR EXPERIENCE BUT WHICH IS NOT A PREREQUISITE TO THE LUNAR LANDING MISSION.
	I-42	MANDATORY (M): 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	HIGHLY DESIRABLE (HD): 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 PRIMARY DETAILED TEST OBJECTIVES.
	I-44	DESIRABLE (D): 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	COUNTDOWN: THE PERIOD OF TIME STARTING WITH LAUNCH VEHICLE POWER UP FOR THE LAUNCH (OR SIMULATED LAUNCH) WHICH INCLUDES SERVICE STRUCTURE REMOVAL, LAUNCH VEHICLE CRYOGENIC TANKING, SPACECRAFT CLOSEOUT, AND THE TERMINAL COUNT.
	I-46	HOLD: INTERRUPTION OF THE COUNTDOWN FOR UNFAVORABLE WEATHER, REPAIR OF HARDWARE, OR CORRECTION OF CONDITIONS UNSATISFACTORY FOR LAUNCH OR FLIGHT.
	I-47	HOLD-POINT: A PREDETERMINED POINT WHERE THE COUNTDOWN MAY BE CONVENIENTLY INTERRUPTED.

REV	ITEM	
	I-48	PROCEED: CONTINUE IN ACCORDANCE WITH PRESCRIBED COUNTDOWN PROCEDURES.
	I-49	RECYCLE: THE COUNTDOWN IS STOPPED AND RETURNED TO A DESIGNATED POINT OR AS SPECIFIED IN THE LAUNCH MISSION RULES.
	I-50	SCRUB: THE LAUNCH IS POSTPONED.
	I-51	CUTOFF: THE AUTOMATIC OR MANUAL COMMAND TO STOP THE LAUNCH SEQUENCE AFTER INITIATION OF THE "AUTOMATIC LAUNCH SEQUENCE START."
	I-52	LIFTOFF: THE EVENT DETERMINED BY THE INSTRUMENTATION UNIT UMBILICAL DISCONNECT SIGNAL AND IS THE POINT IN TIME WHEN PLUS TIME COMMENCES.
	I-53	ABORT: MISSION TERMINATION BY UNSCHEDULED INTENTIONAL SEPARATION OF THE SPACECRAFT FROM THE LAUNCH VEHICLE PRIOR TO ORBITAL INSERTION.
	I-54	EARLY MISSION TERMINATION: UNSCHEDULED INTENTIONAL MISSION TERMINATION AT OR AFTER ORBITAL INSERTION.
	I-55	MEASUREMENT: A MEASUREMENT IS A SPECIFIC DATA CHANNEL OF INSTRUMENTATION MONITORING A SINGLE FUNCTION.
	I-56	INSTRUMENTATION: INSTRUMENTATION IS THE EQUIPMENT THAT ACQUIRES, TRANSMITS AND MONITORS DATA FOR PERFORMANCE EVALUATION OF SPACE VEHICLE AND OPERATIONAL SUPPORT ITEMS.

II FLIGHT
MISSION RULES

1 GEN RULES
AND SOP'S

REV	ITEM	GENERAL
	1-1	THE FLIGHT MISSION RULES OUTLINE PREPLANNED DECISIONS DESIGNED TO MINIMIZE THE AMOUNT OF REAL-TIME RATIONALIZATION REQUIRED WHEN NON-NOMINAL SITUATIONS OCCUR DURING THE TERMINAL COUNTDOWN, THE FLIGHT PHASE, AND RECOVERY OPERATIONS.
	1-2	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.
	1-3	THE FLIGHT DIRECTOR MAY, AFTER ANALYSIS OF THE FLIGHT, CHOOSE TO TAKE ANY NECESSARY ACTION REQUIRED FOR THE SUCCESSFUL COMPLETION OF THE MISSION.
	1-4	THE COMMAND PILOT MAY INITIATE SUCH INFLIGHT ACTION AS HE DEEMS ESSENTIAL FOR CREW SAFETY.
	1-5	IN THE EVENT OF COMMUNICATIONS LOSS BETWEEN THE MANNED SPACE FLIGHT NETWORK AND THE SPACECRAFT, THE COMMAND PILOT WILL ASSUME RESPONSIBILITY OF MISSION DIRECTION WITHIN THE FRAMEWORK OF THE MISSION RULES.
		CONFIRMATION OF MALFUNCTIONS
	1-6	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.)
	1-7	MISSION RULE LIMITS THAT ARE CONSIDERED TO BE INTERIM OR UNCONFIRMED NUMBERS WILL BE UNDERLINED IN THIS PUBLICATION AND ALL SUBSEQUENT REVISIONS UNTIL THE NUMBERS ARE CONFIRMED BY THE RESPONSIBLE NASA AGENCY.
	1-8	THE SYSTEMS LIMITS LISTED IN THESE RULES ARE THE ACTUAL VEHICLE LIMITS AS WELL AS THEY ARE KNOWN AND UNDERSTOOD, AND ARE NOT BIASED TO COMPENSATE FOR TIME DELAYS IN THE DATA SYSTEM.
	1-9	UNLESS STATED OTHERWISE, MANDATORY AND HIGHLY DESIRABLE INSTRUMENTATION REQUIREMENTS ARE SATISFIED BY EITHER ONBOARD OR PCM CAPABILITY.
	1-10	MANDATORY SPACE VEHICLE INSTRUMENTATION FOR THE PURPOSES OF FLIGHT MISSION RULES MUST BE IN CONSONANCE WITH THE FOLLOWING CRITERIA: A. REQUIRED TO INSURE FLIGHT CREW SAFETY. B. REQUIRED TO IMPLEMENT RULES RESULTING IN LAUNCH ABORTS. C. REQUIRED TO IMPLEMENT RULES RESULTING IN EARLY MISSION TERMINATION. D. REQUIRED TO MAKE DECISION TO CONTINUE TO THE NEXT MISSION PHASE. THE MANDATORY INSTRUMENTATION LISTINGS IN THIS DOCUMENT WILL BE CROSS-REFERENCED TO THE APPROPRIATE MISSION RULE MEETING THE ABOVE CRITERIA.
	1-11	THE CRITERION FOR CATEGORIZING INSTRUMENTATION AS HIGHLY DESIRABLE IN THE FLIGHT MISSION RULES IS ANY INSTRUMENTATION REQUIRED FOR NORMAL SYSTEMS MANAGEMENT OR REQUIRED FOR FLIGHT CONTROL DECISIONS NOT IN THE MANDATORY CATEGORY.

REV	ITEM	
	1-12	SPACECRAFT LAUNCH WILL NOT BE ATTEMPTED IF KNOWN SPACECRAFT SYSTEMS MALFUNCTIONS WILL LIMIT THE MISSION DURATION SUCH THAT ACCOMPLISHMENT OF THE MANDATORY AND PRIMARY MISSION OBJECTIVES WILL BE COMPROMISED.

RULE NUMBERS 1-13 THROUGH
1-20 ARE RESERVED.

REV	ITEM	
		FLIGHT CONTROLLER ACTION FOR FAILURES DURING TERMINAL COUNTDOWN
	1-21	MANDATORY - THE COGNIZANT FLIGHT CONTROLLER WILL REQUEST A HOLD 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. AT T-11 SEC ALL MANDATORY ITEMS WILL REVERT TO HIGHLY DESIRABLE UNLESS SPECIFICALLY DESIGNATED AS MANDATORY TO L/O. AFTER T-1 MIN, HOLDS WILL BE REQUESTED FOR MANDATORY ITEMS WITHOUT VERIFICATION DUE TO THE LIMITED TIME REMAINING.
	1-22	HIGHLY DESIRABLE - THE COGNIZANT FLIGHT CONTROLLER WILL NOTIFY THE FLIGHT DIRECTOR IN CASE OF A LOSS OR A FAILURE OF A HIGHLY DESIRABLE ITEM. A HOLD MAY BE CALLED BY THE FLIGHT DIRECTOR TO REPAIR THIS ITEM WHEN IT IS CONVENIENT AND IF THE ESTIMATED TIME TO REPAIR OR REPLACE THE ITEM IS ACCEPTABLE.
	1-23	DESIRABLE - FLIGHT CONTROLLERS WILL NOT CALL HOLDS FOR THE LOSS OF DESIRABLE ITEMS AS THEY ARE PLACED IN THIS CATEGORY BECAUSE THEY ARE ITEMS OF SUPPORT WHICH ARE OF MINOR IMPORTANCE TO FLIGHT OPERATIONS.
A	1-24	MANUAL CUTOFF WILL NOT BE ATTEMPTED FROM T-11 SECONDS TO T-0.
		RULE NUMBERS 1-25 THROUGH 1-30 ARE RESERVED.

REV	ITEM	
	1-31	ASAP: AS SOON AS PRACTICABLE (I.E., AS SOON AS POSSIBLE AND REASONABLE).
	1-32	REENTER ASAP: REENTER AS SOON AS PRACTICABLE (I.E., AS SOON AS POSSIBLE AND REASONABLE).
	1-33	TERMINATE ASAP: REENTER WITH THE MINIMUM TRIP TIME TO AN UNSPECIFIED LANDING AREA.
	1-34	PTP: A "PREFERRED TARGET POINT" IS A STRATEGICALLY LOCATED SET OF COORDINATES FOR WHICH THE SPACECRAFT SHOULD BE TARGETED IF TIME PERMITS.
	1-35	ATP: AN "ALTERNATE TARGET POINT" IS A STRATEGICALLY LOCATED SET OF COORDINATES CHOSEN TO PROVIDE A SPACECRAFT TARGET POINT BETWEEN PTP'S.
	1-36	NEXT BEST PTP: A PREFERRED TARGET POINT WHICH CAN BE REACHED BY THE SPACECRAFT WITHIN THE CONSTRAINTS IMPOSED BY THE SPACECRAFT PROBLEM CAUSING THE EARLY MISSION TERMINATION AND ALLOWING THE BEST POSSIBLE REENTRY AND LANDING AREA CONDITIONS.
	1-37	FOR THE PURPOSE OF MISSION RULE ACTION, CRITICAL SPS MANEUVERS ARE DEFINED AS: A. MODE III ABORT BURNS B. MODE IV CONTINGENCY ORBIT INSERTION BURNS C. APOGEE KICK BURNS D. DEORBIT BURNS E. MCC'S REQUIRED TO ACHIEVE A FREE RETURN TRAJECTORY F. TRANSLUNAR AND TRANSEARTH ABORT MANEUVERS G. MODE I AND III ABORTS FROM LUNAR ORBIT H. TEI I. MCC'S REQUIRED FOR ENTRY CORRIDOR CONTROL
	1-38	FLIGHT PHASE: THE FLIGHT PHASE IS THE TIME INTERVAL FROM LIFTOFF TO SPLASHDOWN AND FOR THE PURPOSE OF THE FLIGHT MISSION RULES A DETAILED BREAKDOWN FOLLOWS: LAUNCH/INSERTION PHASE: THE TIME INTERVAL FROM LIFTOFF TO INSERTION. EARTH PARKING ORBIT PHASE: THE TIME INTERVAL FROM INSERTION UNTIL TLI CUTOFF. TRANSLUNAR COAST PHASE: THE TIME INTERVAL FROM TLI CUTOFF UNTIL LOI_1 CUTOFF. LUNAR PARKING ORBIT PHASE: THE TIME INTERVAL FROM LOI_1 CUTOFF UNTIL TEI CUTOFF. TRANSEARTH COAST PHASE: THE TIME INTERVAL FROM TEI CUTOFF UNTIL SPLASHDOWN.
	1-39	RECOVERY PHASE: THE RECOVERY PHASE IS THE TIME INTERVAL FROM SPLASHDOWN TO PICKUP OF THE SPACECRAFT BY THE RECOVERY FORCES.

REV	ITEM
	1-40

REENTRY DEFINITIONS

A. AUTOMATIC - REENTRY CONTROLLED BY CMC WHICH OUTPUTS BANK ANGLE COMMANDS TO THE RCS.

B. CLOSED LOOP - REENTRY CONTROLLED BY THE CREW MANUALLY FLYING BANK ANGLE MODULATION USING CMC ENTRY PROGRAM OUTPUTS.

C. OPEN LOOP REENTRY - REENTRY CONTROLLED BY THE CREW USING SPACECRAFT DISPLAYS AND FLYING:

1. BANK ANGLE (RL 0-180) AND RETRB (RR 0-180).

2. CONSTANT BANK ANGLE - CONSTANT BANK ANGLES >90 DEGREES WILL NOT BE FLOWN EXCEPT WHEN SKIPOUT RULE IS VIOLATED.

3. ROLLING ENTRY - 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 REVERSE.

D. CONSTANT G REENTRY - REENTRY CONTROLLED BY THE CREW USING G LEVELS AS A CUE TO ROLL THE SPACECRAFT TO MAINTAIN A SPECIFIED G LEVEL.

E. EMS REENTRY - REENTRY CONTROLLED BY THE CREW USING THE CONSTANT G MODE 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 EITHER AN ONSET OR OFFSET VIOLATION.

NOTE

OPEN LOOP REENTRY FOR LOW EARTH ORBIT REENTRY ONLY.

RULE NUMBERS 1-41 THROUGH 1-44 ARE RESERVED.

REV	ITEM	
	1-45	CRITERIA FOR TARGET POINT SELECTION IN EPO

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.

	PRIORITY
ACCEPTABLE WEATHER CONDITIONS FOR RECOVERY OPERATIONS	1
CAPABILITY OF RECOVERY FORCES	2
COMMUNICATION WITH THE SPACECRAFT FROM A GROUND STATION AT LEAST 40 MINUTES PRIOR TO DEORBIT BURN	3
SUFFICIENT DAYLIGHT FOR RECOVERY OPERATIONS	4
A GROUND STATION FOR POST-DEORBIT BURN TRACKING	5
VOICE CONTACT PRIOR TO AND DURING DEORBIT BURN	6
POST-BLACKOUT TRACKING DATA AVAILABLE FOR REENTRY (ASSUMES PRE-BLACKOUT ACQUISITION)	7
GROUND STATIONS AVAILABLE TO OBTAIN DELTA V_C READOUTS AND TO PASS CREW BACKUP GUIDANCE QUANTITIES	8

A	1-46	LUNAR RETURN ENTRY RANGE PRIORITY

THE RELATIVE ENTRY RANGE (400,000 FEET TO SPLASH) PRIORITY IS AS FOLLOWS:

A. 1200 NM - 1400 NM (NOMINAL)

B. 1400 NM - 1800 NM (USED TO AVOID WEATHER VIOLATIONS IN PRIORITY 1)

C. 1800 NM - 2500 NM (USED TO AVOID EXTREME WEATHER VIOLATIONS IN PRIORITY 1 AND 2)

A		RULE NUMBERS 1-47 THROUGH 1-49 ARE RESERVED.

REV	ITEM	
		LAUNCH ABORTS
	1-50	ABORT REQUEST COMMANDS ARE DEFINED AS COMMANDS TRANSMITTED FROM THE MSFN OR B/H WHICH ILLUMINATE THE ABORT REQUEST LIGHT ON THE CMD 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.
	1-51	WHENEVER POSSIBLE, ALL ABORTS AND EARLY MISSION TERMINATIONS WILL BE TIMED FOR A WATER LANDING.
	1-52	THE FLIGHT DIRECTOR WILL INITIATE THE ABORT REQUEST COMMAND FOR SPACECRAFT SYSTEMS MALFUNCTIONS, TRAJECTORY DEVIATIONS, AND LAUNCH VEHICLE MALFUNCTIONS IF TIME PERMITS.
	1-53	THE FLIGHT DYNAMICS OFFICER WILL INITIATE THE ABORT REQUEST COMMAND DURING THE FLIGHT PHASE IF THE LAUNCH VEHICLE EXCEEDS THE FLIGHT DYNAMICS ENVELOPE.
	1-54	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 FOR FAILURES OCCURRING FROM LIFTOFF TO S-IVB CUTOFF.
	1-55	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 FOLLOWING CRITERIA: A. MAJOR STRUCTURAL FAILURE OR EXPLOSION. B. LOSS OF POSITIVE VERTICAL MOTION. C. UNCONTROLLABLE VEHICLE TILTING. D. TOWER COLLISION RESULTING IN DAMAGE NECESSITATING IMMEDIATE ABORT ACTION.
	1-56	THE RSO CAN SHUT DOWN 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 4.0 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.

REV	ITEM	
A	1-57	ENGINE SHUTDOWN METHODS AVAILABLE:

INITIATOR	METHOD	STAGE	TIME FRAME
ASTRONAUT	CCW ON THC	SIC, SII, S-IVB	T+30 SEC TO SECO
ASTRONAUT	S-II/S-IVB L/V STAGE SWITCH	SII, S-IVB	T+2:33 TO SECO ALSO IN TLI BURN
RSO	RF CMD (MFCO)	SIC, SII, S-IVB	T-0 TO INSERTION
EDS	2 OUT OF 3 VOTING LOGIC	SIC	T+30 SEC TO EDS AUTO OFF AT T+2:00

NOTE: THE FLIGHT CREW AND THE EDS CANNOT SHUT DOWN THE SLV DURING THE FIRST 30 SEC OF POWERED FLIGHT.

1-58 ABORTS ARE INITIATED BY:

A. CREW

B. EMERGENCY DETECTION SYSTEM (EDS)

ABORTS MAY BE REQUIRED BY:

A. LAUNCH OPERATIONS MANAGER

B. FLIGHT DIRECTOR

C. FLIGHT DYNAMICS OFFICER (FDO)

D. BOOSTER SYSTEMS ENGINEER (BSE)

A 1-59 FIXED TIME ABORTS ARE IMPLEMENTED FOR NON-TIME-CRITICAL FAILURES WHICH PRECLUDE CONTINUING LAUNCH TO INSERTION. FIXED TIME ABORTS ARE SCHEDULED AT THE FOLLOWING GET:

1 + 45 MODE I
3 + 00 MODE I
4 + 30 MODE II
9 + 00 MODE II

1-60 THE FIXED TIME ABORT PROCEDURE IS AS FOLLOWS:

A. APPROPRIATE FLIGHT CONTROLLER GIVES RED STATUS AND VOICE REPORT OF FAILURE TO FLIGHT DIRECTOR.

B. CREW CONFIRM FAILURE.

C. FLIGHT DETERMINE ABORT TIME TO BE USED.

D. RETRO BEGIN COUNTDOWN AT ABORT TIME MINUS 10 SECONDS.

E. CAPCOM RELAY COUNTDOWN TO CREW.

F. CREW INITIATE ABORT ON "MARK".

G. FLIGHT DIRECTOR WILL REQUEST "RSO SEND MFCO" IF THE CREW IS UNABLE TO SHUT DOWN WITHIN 5 SECONDS AFTER "MARK".

REV	ITEM			
		ABORT MODES:		
	1-61	MODE I	BOUNDARY OF APPLICATION	PROCEDURES
		1A	LES ABORT ENABLE (≈T-30 MIN) TO GET 0 + 42	REFERENCE AOH ____
		1B	GET = 0 + 42 TO 100K FEET ALTITUDE (GET ≈ 1 + 50)	REFERENCE AOH ____
		1C	100K FEET ALTITUDE TO TOWER JETTISON (GET ≈ 3 + 07)	REFERENCE AOH ____
A	1-62	MODE II	TOWER JETTISON (GET ≈ 3 + 07 UNTIL FULL LIFT SPLASHPOINT IS 3200 NM DOWNRANGE.	A. REFERENCE AOH ____ B. MCC PROVIDES 1. GET AND PITCH AT 400K FT 2. GET DROGUE C. ENTRY IS FULL LIFT
A	1-63	MODE III	FULL LIFT SPLASHPOINT BETWEEN 3200 NM AND INSERTION.	A. REFERENCE AOH ____ B. MCC PROVIDES: 1. GETI AT S-IVB CUTOFF PLUS 2:05 2. DELTA V FOR 3350 NM SPLASHPOINT 3. BURN DURATION 4. GET AND PITCH ATT AT 400K FT 5. GET DROGUE C. MANEUVER IS SCS AUTO. D. ENTRY IS ROLL LEFT 55 DEGREES.
	1-64	MODE IV	ATTAINMENT OF CONTINGENCY ORBIT INSERTION CAPABILITY UNTIL INSERTION.	A. REFERENCE AOH ____ B. MCC PROVIDES: 1. GETI AT S-IVB CUTOFF PLUS 2:05 2. DELTA V REQUIRED TO ACHIEVE PERIGEE ≥75 NM 3. BURN DURATION C. MANEUVER IS SCS AUTO
	1-65	APOGEE KICK	PRE-APOGEE CUTOFFS, OUTSIDE THE COI BOUNDRY, CORRECTABLE TO SAFE ORBITAL CONDITIONS BY A MANEUVER AT APOGEE.	A. REFERENCE AOH ____ B. MCC PROVIDES: 1. GETI FOR BURN AT APOGEE 2. DELTA V REQUIRED TO ACHIEVE ≥75 NM 3. BURN DURATION C. MANEUVER IS SCS AUTO

REV	ITEM	
		CREW ABORT LIMITS
	1-66	MAX Q REGION A. (00:50 TO 2:00) AOA ≥100 PCT AND ROLL ATTITUDE ≥6 DEGREES - ABORT MODE I B. (00:50 TO 1:25) - ABORT MODE I 1. LV GUID LT - ON 2. LV RATE LT - ON
		RATES
	1-67	A. PITCH AND YAW 1. L/O TO STAGING - 4 DEG/SEC - ABORT MODE I 2. STAGING TO SECO - 10 DEG/SEC - ABORT MODE I, MODE II OR MODE III B. ROLL 1. L/O TO SECO - 20 DEG/SEC - ABORT MODE I, MODE II, MODE III OR MODE IV.
	1-68	EDS AUTOMATIC ABORT LIMITS (UNTIL MANUAL DEACTIVATION OF TWO ENG OUT AUTO AND LV RATES AT 2:00. A. RATES PITCH AND YAW 4.0 ± .5 DEG/SEC ROLL 20.0 ± .5 DEG/SEC B. ANY TWO ENGINES OUT C. CM TO IU BREAKUP
A		RULE NUMBERS 1-69 THROUGH 1-74 ARE RESERVED.

REV	ITEM	
	1-75	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.
	1-76	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.

REV	ITEM	
		PRELAUNCH
A	2-1	THE LAUNCH WINDOW WILL BE CONTROLLED BY: A. LAUNCH AREA LIGHTING REQUIREMENTS RESTRICTING LAUNCH TO OCCUR BETWEEN SUNRISE AND SUNSET. B. ETR LAUNCH AZIMUTH LIMITATIONS RESTRICTING LAUNCHES TO OCCUR BETWEEN 72° AND 107°.
A	2-2	THE FLIGHT DIRECTOR WILL EVALUATE THE MODE I (TOWER) ABORT IP TRACK WIND SIMULATIONS 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.
A	2-3	THE LAUNCH WILL NOT BE ATTEMPTED IF THE MINIMUM GROUND INSTRUMENTATION CAPABILITY IS COMPROMISED, REFERENCE SECTION 3 - GROUND INSTRUMENTATION REQUIREMENTS.
		LAUNCH
A	2-4	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 AND NO S/C OR SLV PROBLEMS ARE PRESENT WHICH JEOPARDIZE CREW SAFETY AND SUFFICIENT CONSUMABLES AND COOLANT REMAIN FOR AT LEAST ONE REVOLUTION PLUS ENTRY.
		EARTH ORBIT
A	2-5	THE DEORBIT CAPABILITY REQUIREMENTS FOR EARTH ORBIT ARE: A. THE CAPABILITY OF SPS DEORBIT AND ONE ALTERNATE METHOD ARE REQUIRED. B. SPS DEORBIT IS THE PRIME DEORBIT METHOD UNLESS SPECIFIC MISSION RULES ARE VIOLATED PROHIBITING ITS USE. FOR MISSION PLANNING, SUFFICIENT ΔV WILL BE RESERVED FOR SPS DEORBIT (WITHIN THE ENTRY CORRIDOR) FROM ANY POINT IN THE ORBIT. C. FOR THE HYBRID TECHNIQUE, THE SM-RCS WILL BE USED AS MUCH AS PRACTICAL AND THE CM-RCS AS LITTLE AS PRACTICAL IN ACHIEVING THE TARGET PERIGEE OF 40 NM. D. IN MAINTAINING THE HYBRID DEORBIT REDLINE, THE FOLLOWING ASSUMPTIONS ARE MADE: 1. A MAXIMUM OF 80 FPS IS AVAILABLE FROM THE CM-RCS. 2. A MINIMUM OF 30 POUNDS IN EACH CM-RCS RING WILL BE RESERVED FOR ENTRY ATTITUDE CONTROL. 3. SUFFICIENT SM-RCS WILL BE RESERVED TO SUPPLEMENT THE CM-RCS IN ACHIEVING A 40 NM PERIGEE.
A	2-6	IF INSUFFICIENT S-IVB CONSUMABLES ARE REMAINING TO ACHIEVE A GUIDED TLI CUTOFF (PREDICTED PRIOR TO TLI), THE CSM WILL BE SEPARATED FROM THE S-IVB, AN ALTERNATE EARTH ORBIT MISSION WILL BE PERFORMED, AND TLI WILL BE PERFORMED UNMANNED.

REV	ITEM	
		TRANSLUNAR COAST
A	2-7	DISPERSED S-IVB TLI CUTOFF:
		A. IF THE PREDICTED END OF LUNAR ORBIT MISSION FUEL RESERVES (INCLUDING EXECUTION OF BAP MCC, LOI, CIRCULATION AND TEI) ARE GREATER THAN OR EQUAL TO 1000 FPS, THE MIDCOURSE CORRECTION (MCC) WILL BE PERFORMED CONSISTENT WITH A LUNAR ORBIT MISSION.
		B. IF THE PREDICTED END OF LUNAR ORBIT MISSION FUEL RESERVE IS LESS THAN 1000 FPS AND THE PREDICTED END OF LUNAR FLYBY MISSION FUEL RESERVE IS GREATER THAN 5500 FPS THE MCC WILL BE PERFORMED FOR A FREE RETURN FLYBY.
		C. IF THE PREDICTED END OF LUNAR FLYBY MISSION FUEL RESERVES IS LESS THAN 5500 FPS AN ALTERNATE EARTH ORBIT MISSION OR A DIRECT ABORT WILL BE PERFORMED.
A	2-8	THE NOMINAL MIDCOURSE CORRECTION DECISION POINTS FOR THE TRANSLUNAR COAST PHASE ARE TLI C/O PLUS 6 HOURS, TLI C/O PLUS 25 HOURS, LOI MINUS 22 HOURS AND LOI MINUS 8 HOURS. THE EARLIEST EXECUTION TIME FOR A MCC WHICH WILL BE CONSIDERED IS TLI C/O PLUS 3 HOURS.
A	2-9	IF THE ΔV OF THE FIRST MCC IS LESS THAN 3 FPS IT WILL NOT BE EXECUTED AT THE PLANNED TIME SINCE THE 3 SIGMA MSFN VELOCITY UNCERTAINTY AT THE NOMINAL TIME OF MANEUVER COMPUTATION IS 3 FPS.
		IF THE ΔV OF SUBSEQUENT MCC'S IS BETWEEN 5 FPS AND 10 FPS IT WILL BE EXECUTED AT THE PLANNED TIME. IF THE MCC ΔV IS LESS THAN 5 FPS THE EXECUTION TIME MAY BE DELAYED (EXCEPT FOR THE LAST MCC) TO ALLOW THE ΔV TO GROW. IF THE MCC ΔV IS GREATER THAN 10 FPS, IT MAY BE PERFORMED EARLY TO REDUCE THE MCC ΔV.
A	2-10	THE FLIGHT CREW WILL TERMINATE LOI AND TAKE THE FOLLOWING ACTION, DEPENDING UPON THE SPECIFIC FAILURE
		A. PERFORM THE 15 MINUTE ABORT FOR:
		1. LOSS OF ONE GN_2 BOTTLE (<400 PSI) AND DECAY IN THE OTHER.
		2. PRESSURE DECAY IN EITHER SPS PROPELLANT TANK TO 140 PSI.
		3. FUEL-OXIDIZER ΔP >20 PSI.
		4. CHAMBER PRESSURE <70 PSI.
		5. FLANGE TEMPERATURE LIGHT AS LONG AS MODE I (APPROXIMATELY FIRST 2 MINUTES).
		6. ANY BALL VALVE FAILS TO OPEN AT IGNITION
		B. MTVC TAKEOVER AND COMPLETE THE BURN FOR:
		1. G&N NO-GO.
		2. ATTITUDE EXCURSION >10°
		3. RATES >10°/SEC
		C. RESTART AND COMPLETE THE BURN UNDER SCS CONTROL FOR:
		SPS SHUTDOWN AT CMC RESTART.
		D. STANDBY UNTIL MSFN COVERAGE FOR:
		1. INADVERTENT SPS SHUTDOWN.
		2. FLANGE TEMPERATURE SHUTDOWN AFTER 2 MINUTES OF BURN.

REV	ITEM	
		LUNAR ORBIT
A	2-11	DISPERSED LOI CUTOFF: A. IF THE RESULTING APOLUNE IS GREATER THAN APPROXIMATELY 9000 NM, A DIRECT RETURN ABORT MANEUVER WILL BE PERFORMED ASAP. B. IF THE RESULTING APOLUNE IS LESS THAN APPROXIMATELY 9000 NM AND PERILUNE IS GREATER THAN 25 NM THE SITUATION WILL BE EVALUATED AND A TEI OR A CIRCULARIZATION MANEUVER WILL BE PERFORMED. C. IF THE RESULTING PERILUNE IS LESS THAN 25 NM A MANEUVER(S) WILL BE PERFORMED ASAP TO INCREASE PERILUNE TO GREATER THAN 40 NM.
A	2-12	TRANSEARTH COAST MCC PHILOSOPHY A. THE STEEP TARGET LINE WILL BE USED FOR MCC'S UNLESS THE VELOCITY AT ENTRY INTERFACE IS LESS THAN 30,000 FPS AND THE G&N IS GO, THEN THE SHALLOW TARGET LINE WILL BE USED. B. MCC'S MAY BE USED FOR LANDING AREA CONTROL PRIOR TO ENTRY INTERFACE MINUS 24 HOURS FOR RECOVERY ACCESS VIOLATIONS, UNACCEPTABLE WEATHER, OR LAND MASSES IN ANY PART OF THE OPERATIONAL FOOTPRINT. C. IF THE FLIGHT PATH ANGLE IS OUTSIDE THE ENTRY CORRIDOR BY GREATER THAN THE MSFN ACCURACY A MCC WILL BE EXECUTED AS SOON AS PRACTICAL. MCC'S LESS THAN MSFN ACCURACY WILL NOT BE EXECUTED (SEE RULE 4-87 FOR MSFC ACCURACY). D. THE LAST MCC WILL BE SCHEDULED NO LATER THAN ENTRY INTERFACE MINUS 2 HOURS.
A	2-13	GO/NO-GO'S COMBINED FLIGHT CONTROL/FLIGHT CREW GO/NO-GO'S WILL BE MADE FOR EACH OF THE FOLLOWING MISSION PHASES AT THE TIMES INDICATED: A. ORBIT AT INSERTION B. TRANSLUNAR INJECTION AT THE SITE PRIOR TO THE MANEUVER C. TRANSLUNAR COAST PRIOR TO MCC NO. 1 AND ONCE EVERY 24 HOURS THEREAFTER. D. LOI NO. 1 APPROXIMATELY 1 HOUR PRIOR TO THE MANEUVER E. LOI NO. 2 APPROXIMATELY 1 HOUR PRIOR TO THE MANEUVER F. TEI APPROXIMATELY 1 HOUR PRIOR TO THE MANEUVER.

REV	ITEM	
A	2-14	ALTERNATE MISSIONS A. CONTINGENCY ORBIT INSERTION REQUIRING AN SPS ΔV GREATER THAN 900 FPS: CONDUCT A LOW EARTH ORBIT MISSION OF APPROXIMATELY 10 DAYS DURATION. B. NO S-IVB REIGNITION OR CONTINGENCY ORBIT INSERTION REQUIRING LESS THAN 900 FPS: PERFORM AN SPS MANEUVER TO ACHIEVE A HIGH ELLIPSE (H_a 4000 NM) AND PERFORM NAVIGATION AND PASSIVE THERMAL CONTROL OBJECTIVES. DEBOOST TO 400 NM APOGEE AND CONTINUE WITH A LOW EARTH ORBIT MISSION (TOTAL MISSION DURATION APPROXIMATELY 10 DAYS). C. S-IVB CUTOFF RESULTING IN AN APOGEE ≥100 NM BUT <4000 NM: RESHAPE THE ELLIPSE TO PLACE APOGEE IN THE DESIRED LOCATION FOR SPS INJECTION AND PERFORM ALTERNATE "B" DESCRIBED ABOVE. D. S-IVB CUTOFF RESULTING IN AN APOGEE ≥4000 NM BUT <25000 NM: PERFORM A PHASING MANEUVER AT FIRST PERIGEE TO PLACE LATER PERIGEE OVER A MSFN SITE. DEBOOST TO AN APOGEE OF APPROXIMATELY 400 NM AT THE LATER PERIGEE AND CONTINUE WITH LOW EARTH ORBIT MISSION (TOTAL MISSION DURATION APPROXIMATELY 10 DAYS). E. S-IVB CUTOFF RESULTING IN AN APOGEE ≥22000 NM BUT <60000 NM: PERFORM A PHASING MANEUVER AT FIRST PERIGEE TO PLACE LATER PERIGEE OVER THE RECOVERY SITE. PERFORM A MANEUVER AT THE LATER PERIGEE TO ESTABLISH A SEMISYNCHRONOUS ORBIT. REMAIN IN THIS ELLIPSE UNTIL MISSION TERMINATION. F. S-IVB CUTOFF RESULTING IN AN APOGEE ≥60000 NM: PERFORM A CIRCUMLUNAR OR LUNAR ORBIT MISSION DEPENDING UPON THE ΔV REQUIRED (REF RULE 2-6 FOR ΔV OPTIONS).
A		RULES 2-15 THROUGH 2-19 ARE RESERVED.

REV	ITEM	
A	2-20	SUMMARY RULES THE LAUNCH PHASE WILL BE ABORTED FOR THE FOLLOWING REASONS:

	RULES
S-IC ENGINE HARDOVER	5-5
S-IVB LOX OVERPRESSURE DURING S-IC OR S-II HARDOVER	5-46
VIOLATION OF AUTO/MANUAL EDS LIMITS (REF RULES 1-66, 1-67, 1-68, 1-69)	
TWO ENGINE OUT ON S-II (TIME DEPENDENT)	5-15
FAILURE OF SECOND PLANE SEPARATION	5-16
S-IVB LOSS OF THRUST (TIME DEPENDENT)	5-19
VIOLATION OF TRAJECTORY LIMIT LINES	4-1
LOSS OF CABIN AND SUIT PRESSURE	6-21
LOSS OF CABIN AND SUIT CIRCULATION	6-21
FIRE/SMOKE IN CM	6-25
LOSS OF CABIN PRESSURE AND O_2 MANIFOLD LEAK	6-28
LOSS OF 3 FUEL CELLS AND 1 BATTERY	8-27
UNCONTROLLABLE SHORTED MAIN BUS	8-47
LOSS OF BOTH AC BUSES DURING MODE I OR MODE II	8-59
SUSTAINED LEAK OR LOSS OF HE PRESSURE IN BOTH CM-RCS RINGS (MODE I ONLY)	14-15

A	2-21	THE EDS LOGIC WILL BE DISABLED EARLY FOR LOSS OF ANY ENTRY BATTERY.
	2-22	EARTH ORBIT THE MISSION WILL BE CONTINUED AS LONG AS: PERIGEE WILL BE GREATER THAN 75 NM AFTER 20 REVS CREW CONDITION SATISFACTORY TWO-WAY A/G VOICE COMMUNICATIONS OPERATIONAL CRITICAL INSTRUMENTATION SUFFICIENT CONSUMABLES FOR AT LEAST TWO REVS PAST THE NEXT GO/NO-GO PTP PLUS ENTRY CAPABILITY OF SPS DEORBIT AND ONE ALTERNATE METHOD FOR THE SPS DEORBIT ADEQUATE PROPELLANT, ONE TVC SERVO LOOP, ONE TVC CONTROL MODE AND AT LEAST TWO CONTROL METHODS FOR MAINTAINING THREE-AXIS ATTITUDE CONTROL FOR THE SM-RCS DEORBIT ADEQUATE PROPELLANT, TRANSLATION CAPABILITY, ONE FDAI AND RATE DAMPING (DAP OR SCS) IN ALL THREE AXES. FOR THE HYBRID DEORBIT, SM-RCS REQUIREMENTS (RATE DAMPING MUST BE SCS) PLUS TWO GOOD CM-RCS SYSTEMS, THE IMU, CMC, MAIN DSKY CONTROL, AND TWO RHC'S. - CABIN INTEGRITY (ALSO NO UNDUE CONTAMINATION IN EITHER CABIN OR SUIT SYSTEM) - TWO GOOD MAIN, BATTERY, AC, AND LOGIC, PYRO BUSES AND THE BATTERY RELAY BUS - AT LEAST TWO GOOD FUEL CELLS, TWO INVERTERS AND TWO ENTRY BATTERIES - SATISFACTORY PRIMARY COOLANT LOOP, URINE DUMP, SUIT CIRCULATION
A	2-23	SPACECRAFT SEPARATION FROM THE S-IVB WILL BE PERFORMED EARLY FOR THE FOLLOWING:

	RULES
TIME BASE 5 FAILS TO INITIATE AT CUTOFF	5-25
S-IVB RANGE SAFETY PROPELLANT DISPERSAL SYSTEM ARMS INADVERTENTLY AFTER INSERTION AND PRIOR TO SAFING	5-47
S-IVB COLD HE SHUTOFF VALVE FAILS TO CLOSE	5-49
LOSS OF ATTITUDE CONTROL DUIRNG TB5	5-51
S-IVB COMMON BULKHEAD DELTA PRESSURE EXCEEDS LIMITS	5-55

REV	ITEM	
A	2-24	TLI WILL BE INHIBITED FOR THE FOLLOWING REASONS:

	RULES
S-IVB INERTIAL GUIDANCE SYSTEM IS NO-GO	4-31
MISALIGNMENT RATE BETWEEN THE IU AND IMU IS >0.6 DEG/HR.	4-32
UNACCEPTABLE DIFFERENCES BETWEEN CMC AND IU PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION	4-35
UNACCEPTABLE DIFFERENCE BETWEEN MSFN AND IU DOWNRANGE POSITION AT 55 MIN GET.	4-36
S-IVB FIRST BURN LONGER THAN 303 SECONDS	5-22
S-IVB ENGINE MAIN LOX VALVE FAILS TO CLOSE AT CUTOFF	5-46
LOSS OF ATTITUDE CONTROL	5-51
CONTINUOUS VENT SYSTEM REGULATOR FAILS TO OPEN	5-50
LOSS OF STAGE PNEUMATICS	5-54
LOSS OF ENGINE CONTROL BOTTLE PRESSURE (<600 PSI)	5-57
CONFIRMED ACTUATOR HARDOVER	5-65
LOSS OF ENGINE HYDRAULIC FLUID	5-66
LOSS OF CABIN INTEGRITY	6-21
LOSS OF SUIT CIRCULATION	6-22
LOSS OF SURGE TANK AND REPRESS PACK	6-24
FIRE OR SMOKE IN THE CABIN	6-25
LOSS OF SUIT INTEGRITY	6-27
O_2 MANIFOLD LEAK	6-28
LOSS OF ONE MAIN O_2 REGULATORS	6-29
LOSS OF ONE SUIT COMPRESSOR	6-31
LOSS OF PRIMARY RADIATOR	6-35
LOSS OF PRIMARY COOLANT LOOP	6-35
LOSS OF SECONDARY EVAPORATOR	6-36
LOSS OF SECONDARY RADIATOR	6-36
LOSS OF SECONDARY LOOP	6-36
LEAK OF GLYCOL COOLANT	6-38
FAILURE OF BOTH H_2O ACCUMULATORS	6-46
LOSS OF POTABLE OR WASTE H_2O TANK	6-47
LOSS OF ANY CRYO TANK	7-15
LOSS OF ONE FUEL CELL	8-24
LOSS OF ONE ENTRY BATTERY	8-37
LOSS OF ONE BATTERY, MAIN OR BATTERY RELAY BUS	8-50
LOSS OF TWO INVERTERS	8-57
LOSS OF ONE A/C BUS	8-58
LOSS OF ALL T/M	9-12
LOSS OF NORMAL DOWN VOICE	9-14
LOSS OF DOWN VOICE BACKUP	9-15
LOSS OF NORMAL UP VOICE	9-17
LOSS OF UP VOICE BACKUP	9-18
LOSS OF ALL UP OR DOWN VOICE IN ONE TRANSPONDER	9-20
LOSS OF ONE PM POWER SUPPLY	9-22
LOSS OF BOTH POWER AMPLIFIERS	9-25
LOSS OF THE SCE	9-26
LOSS OF TWO AUDIO CENTERS	9-27
SMJC ACTIVATED PREMATURELY	10-16
ACTIVATED DROGUE CHUTE DEPLOY CIRCUIT	10-20
LOSS OF BOTH BMAGS IN PITCH, YAW, OR ROLL	11-26,28
LOSS OF BOTH FDAI'S	11-34
LOSS OF AC1 PHASE A	11-35
LOSS OF AC2 PHASE A	11-36
GROUND AT EITHER SPS SOL DRIVER OUTPUT	11-39
LOSS OF CMC	11-45
LOSS OF NAV DSKY (CMC WARNING RELAY)	11-47
LOSS OF ISS	11-48
LOSS OF OPTICS SUBSYSTEM	11-49
LOSS OF OPTICS CDU DAC	11-50
SUSTAINED PRESSURE DECAY IN SPS FUEL OR OX TANK	12-25
LOSS OF BOTH GN_2 TANK PRESSURES	12-28
FUEL FEED LINE AND/OR OXID FEED LINE TEMP <25°F AND UNABLE TO INCREASE	12-29
FUEL/OXIDIZER ΔP GREATER THAN 20 PSI	12-34
LOSS OF HE SOURCE PRESSURE	12-35
HELIUM TANK LEAK IN ONE QUAD	13-20
LEAK DOWN STREAM OF HE ISOLATION VALVE (SM-RCS)	13-21
LOSS OF ONE PITCH, ONE YAW, OR TWO ROLL THRUSTERS IN THE SAME DIRECTION	13-23
LOSS OF HELIUM SOURCE PRESS - ONE RING	14-15
CM-RCS ARMED	14-17
PACKAGE TEMP <70°F AND UNABLE TO INCREASE	13-22

REV	ITEM		
A	2-24 (CONT)	IU PLATFORM ACCELEROMETER FAILURE	5-58
		COLD HE SPHERE PRESS LOW	5-61
		LH_2 ULLAGE PRESS LOW	5-64
		J_2 ENGINE START BOTTLE PRESS HIGH	5-67
		LOX ULLAGE PRESS LOW	5-68
A	2-25	LOI WILL BE INHIBITED AND A CIRCUMLUNAR FLIGHT WILL BE ACCOMPLISHED IF THESE FAILURES OCCUR POST TLI.	
			RULE
		LOSS OF SURGE TANK AND REPRESS PACK	6-24
		LOSS OF PRIMARY EVAPORATOR	6-35
		LOSS OF ONE ENTRY BATTERY	8-37
		LOSS OF ONE FUEL CELL	8-24
		LOSS OF ALL T/M	9-12
		LOSS OF ALL REAL-TIME DOWN VOICE (CREW HAS FLYBY PAD)	9-16
		LOSS OF ALL UP VOICE (CREW HAS FLYBY PAD)	9-19
		LOSS OF BOTH BMAGS IN PITCH OR YAW AXIS	11-26
		LOSS OF EITHER TVC SERVO LOOP (CHECKED PRE-SPS BURNS)	11-29
		LOSS OF BOTH FDAI'S	11-34
		LOSS OF AC 1 PHASE A	11-35
		LOSS OF AC 2 PHASE A	11-36
		GROUND AT EITHER SPS SOL DRIVER OUTPUT AND UNABLE TO REMOVE	11-39
		LOSS OF CMC	11-45
		LOSS OF NAV DSKY (CMC WARNING RELAY)	11-47
		LOSS OF ISS	11-48
		LOSS OF OPTICS SUBSYSTEM	11-49
		LOSS OF OPTICS CDU D/A (CHECK PRE-SPS BURN)	11-50
		SUSTAINED PRESSURE DECAY IN SPS FUEL OR OX TANK	12-25
		LOSS OF ONE GN_2 TANK PRESSURE	12-26
		LOSS OF ONE BANK OF BALL VALVES	12-27
		LOW FUEL OR OX FEED LINE TEMPS (SPS)	12-29
		LOW PU VALVE TEMP AND UNABLE TO INCREASE	12-30
		ENGINE FLANGE OVERTEMP DURING A BURN	12-31
		THRUST CHAMBER PRESSURE BELOW 70 PSI	12-32
		LOSS OF ULLAGE CAPABILITY	12-33
		FUEL/OXIDIZER ΔP GREATER THAN 20 PSI	12-34
		LOSS OF HELIUM SOURCE PRESSURE (SPS)	12-35
		LOSS OF ONE PITCH, ONE YAW OR TWO ROLL THRUSTERS IN THE SAME DIRECTION	13-23
A	2-26	LOI WILL BE INHIBITED AND ENTRY ACCOMPLISHED IN THE NEXT BEST PTP FOR THE FOLLOWING FAILURES. THE NEXT BEST PTP COULD INCLUDE A CIRCUMLUNAR FLIGHT DEPENDANT ON INFLIGHT ANALYSIS OF THE FAILURE AND TRADEOFFS OF:	
		A. FLIGHT TIME REMAINING	
		B. ABORT MANEUVER REQUIRED	
		C. SYSTEMS REDUNDANCY REMAINING	
			RULE
		LOSS OF CABIN INTEGRITY	6-21
		FIRE OR SMOKE IN THE CABIN	6-25
		O_2 MANIFOLD LEAK	6-28
		LOSS OF ONE MAIN O_2 REGULATORS	6-29
		LOSS OF PRIMARY RADIATOR	6-35
		LOSS OF PRIMARY COOLANT LOOP	6-35
		LOSS OF SECONDARY EVAPORATOR	6-36
		LOSS OF SECONDARY RADIATOR	6-36
		LOSS OF SECONDARY LOOP	6-36
		LEAK OF GLYCOL COOLANT	6-38
		FAILURE OF BOTH H_2O ACCUMULATOR	6-46
		LOSS OF POTABLE OR WASTE H_2O TANK	6-47
		LOSS OF ANY CRYO TANK	7-15
		LOSS OF TWO FUEL CELLS	8-25
		LOSS OF ONE BATTERY, MAIN, OR BATTERY RELAY BUS	8-50
		LOSS OF TWO INVERTERS	8-57
		LOSS OF ONE A/C BUS	8-58

REV	ITEM		
A	2-26 (CONT)	LOSS OF ALL DOWN VOICE (CREW NOT UPDATED WITH FLYBY PAD)	9-16
		LOSS OF ALL UP VOICE (CREW NOT UPDATED WITH FLYBY PAD)	9-19
		SMJC ACTIVATED PREMATURELY	10-16
		ACTIVATED DROGUE CHUTE DEPLOY CIRCUIT	10-20
		LOSS OF BOTH BMAGS IN YAW OR ROLL	11-26,28
		LOSS OF DIRECT RCS CONTROL, BOTH RHC'S (CHECK ONCE POST-TLI)	11-32
		LOSS OF AUTO ATTITUDE CONTROL PITCH AND YAW	11-33
		LOSS OF ONE QUAD	13-20
		LEAK DOWNSTREAM OF HELIUM ISOLATION VALVE (SM-RCS)	13-21
		SM-RCS PACKAGE TEMP <70°F	13-22
		LOSS OF HELIUM SOURCE PRESS-ONE RING	14-15
		CM-RCS ARMED	14-17
A	2-27	TRANSEARTH INJECTION WILL BE PERFORMED AT THE NEXT BEST OPPORTUNITY FOR THE FOLLOWING FAILURES:	
			RULE
		O_2 MANIFOLD LEAK	6-28
		LOSS OF PRIMARY RADIATOR	6-35
		LOSS OF PRIMARY COOLANT LOOP	6-35
		LEAK OF GLYCOL COOLANT	6-38
		LOSS OF POTABLE OR WASTE H_2O TANK	6-47
		LOSS OF ONE FUEL CELL	8-24
		LOSS OF ONE MAIN OR BATTERY BUS	8-50
		LOSS OF TWO INVERTERS	8-57
		SMJC ACTIVATED PREMATURELY	10-16
		LOSS OF BOTH BMAGS IN PITCH OR YAW	11-26
		LOSS OF BOTH ROLL BMAGS	11-28
		LOSS OF EITHER TVC LOOP IN EITHER PITCH OR YAW (CHECKED PRE-SPS BURNS)	11-29
		LOSS OF DIRECT RCS CONTROL BOTH RHC	11-32
		COMPLETE LOSS OF AUTO ATTITUDE CONTROL IN PITCH AND YAW	11-33
		LOSS OF BOTH FDAI'S	11-34
		LOSS OF AC 1 PHASE A	11-35
		LOSS OF AC 2 PHASE A	11-36
		GROUND AT EITHER SPS SOL DRIVER OUTPUT AND UNABLE TO REMOVE	11-39
		LOSS OF CMC	11-45
		LOSS OF NAV DSKY (CMC WARNING RELAY)	11-47
		LOSS OF INERTIAL SUBSYSTEM	11-48
		LOSS OF OPTICS CDU D/A (CHECKED PRE-SPS BURNS)	11-50
		SUSTAINED PRESSURE DECAY IN SPS FUEL OR OX TANK	12-25
		LOSS OF ONE GN_2 TANK PRESSURE	12-26
		FAILURE OF ONE BANK OF BALL VALVES DURING LOI	12-27
		PU VALVE TEMP LOW AND UNABLE TO INCREASE	12-30
		LEAK OR LOSS OF HE SUPPLY PRESSURE	12-35
		LEAK IN ONE SM-RCS HE QUAD	13-20
		SM-RCS PACKAGE TEMP LOW AND UNABLE TO INCREASE	13-22
		LOSS OF ONE PITCH, ONE YAW, OR TWO ROLL THRUSTERS IN SAME DIRECTION	13-23
		LEAK IN OR LOSS OF ONE CM-RCS RING	14-15
		ARMING OF CM-RCS	14-17

3 GROUND INSTRUMENTATION REQUIREMENTS

REV	ITEM	GENERAL
	3-1	GENERAL A. THE FOLLOWING PRELAUNCH REQUIREMENTS DEFINE THE MCC/MSFN REQUIREMENTS WHICH MUST BE MET BEFORE A "GO" IS GIVEN FOR LAUNCH. 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 OPERATIONAL CAPABILITY ARE TO ASSUME A MANDATORY STATUS ALSO. C. WHERE REDUNDANCY EXISTS FOR MANDATORY ITEMS, A BACKUP CAPABILITY IS CONSIDERED HIGHLY DESIRABLE. RULES 3-2 THROUGH 3-4 ARE RESERVED.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	3-5	COMPUTER			
		A. MOC (IBM 360/75)	PRELAUNCH	MANDATORY	TO PROCESS MANDATORY S/V PARAMETERS AND TRAJECTORY DATA
		B. DSC (IBM 360/75)	PRELAUNCH	HIGHLY DESIRABLE	AN SSC (IBM 360/75) IS AVAILABLE AS BACKUP TO THE MOC OR DSC.
		C. CCATS (UNIVAC 494) - ONLINE D. CCATS (UNIVAC 494) - STANDBY	PRELAUNCH	1 MANDATORY AND 1 HIGHLY DESIRABLE	
		E. RTACF - 2	PRELAUNCH	1 HIGHLY DESIRABLE	
	3-6	COMMAND			
		A. MOCR TOGGLE SWITCHES (BOTH A AND B)			
		1. BSE ABORT REQUEST	PRELAUNCH	HIGHLY DESIRABLE	
		2. FIDO ABORT REQUEST	PRELAUNCH	HIGHLY DESIRABLE	
		3. FD ABORT REQUEST	PRELAUNCH	HIGHLY DESIRABLE	
		B. MOCR COMMAND PANELS			
		1. EECOM	PRELAUNCH	HIGHLY DESIRABLE	
		2. GUIDO	PRELAUNCH	HIGHLY DESIRABLE	
		3. BSE	PRELAUNCH	HIGHLY DESIRABLE	
		C. MOCR CONSOLE/SITE SELECT CAPABILITY			
		1. RTC CONSOLE (CCATS) 2. CCATS CMD CONSOLE MED	PRELAUNCH	1 HIGHLY DESIRABLE	
		D. FC/M&O SWITCHING CAPABILITY			
		1. FLIGHT DIRECTOR 2. CCATS CMD MED	PRELAUNCH	1 HIGHLY DESIRABLE	
	3-7	TELEMETRY			
		A. CONSOLE DISPLAY (D/TV, EVENTS, ANALOGS)	PRELAUNCH	MANDATORY	FOR DISPLAY OF MANDATORY S/V PARAMETERS.
		B. PCM GROUND STATIONS (4)	PRELAUNCH	1 OF 4 MANDATORY, 1 HIGHLY DESIRABLE	FOR DISPLAY OF MANDATORY S/V EVENTS AND ANALOGS.
		C. RECORDING AND PLAYBACK			
		1. ALDS 2. MSFN	PRELAUNCH	BOTH DESIRABLE	
		D. FM/FM GND STATION	PRELAUNCH	1 OF 2 MANDATORY	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	3-8	TRAJECTORY			
		A. TRAJECTORY DATA PROCESSING			
		1. AVAILABILITY OF ONE INDEPENDENT TRAJECTORY DATA SOURCES (IPR, USB TRACK) FROM L/O TO T+10 MIN.	PRELAUNCH	MANDATORY	(A) INDEPENDENT VERIFICATION OF L/V NAVIGATION. (B) PROTECT AGAINST VIOLATION OF LAUNCH ENVELOPE.
		2. IU AND CMC TM VECTORS FROM L/O TO INSERTION PLUS 60 SEC.	PRELAUNCH	BOTH MANDATORY	ORBIT GO/NO GO
		B. RTCC - DATA SELECT CAPABILITY	PRELAUNCH	MANDATORY	
		C. TRACKING DATA RECORDING	PRELAUNCH	DESIRABLE	
A	3-9	MCC POWER			
		A. BUS A_1	PRELAUNCH	MANDATORY	UNINTERRUPTABLE POWER FOR: 1. PCM AND FM GROUND STATIONS NO. 2. 2. D/TV CONVERTERS (SWITCHABLE) 3. MOC 4. MITE "A" 5. CP "A" 6. D/TV DATA DISTRIBUTION 7. 1/2 OF RTCC CIM 8. CMD CIM (SWITCHABLE TO BUS A_2) 9. CMD DDD'S
		B. BUS A_2	PRELAUNCH	MANDATORY	UNINTERRUPTABLE POWER FOR: 1. PCM AND FM G/S'S NO. 1 AND BM-DADS 2. DSC 3. MITE "B" 4. CP "B" 5. 1/2 OF RTCC CIM
		C. BUS B_1	PRELAUNCH	MANDATORY	20 SECONDS INTERRUPTABLE POWER FOR: 1. PLOTBOARDS (POWER) 2. FIDO SSR CONSOLES (POWER) 3. PD/SDD 4. RTACF
		D. BUS B_2	PRELAUNCH	MANDATORY	20 SECONDS INTERRUPTABLE POWER FOR: 1. VSM 2. DDD'S 3. MOCR, AREO-MED, AND VEHICLE SYS SSR CONSOLES (POWER) 4. RTCC CIM ENCODERS

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	3-10	DISPLAY			
		A. MOCR D/TV CHANNELS POSITION — NO. OF CHANNELS RETRO 1 FIDO 1 GUIDO 1 EECOM 1 GNC 1 RTCC 1 BOOSTER 4	PRELAUNCH	10 OF 36 MANDATORY	
		B. TRAJECTORY DISPLAY			
		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 OF 1 OF 2: (A) D/TV (B) SSR PLOTBOARD	MONITOR FOR G-LIMIT VIOLATION.
		5. ϕ VS λ	PRELAUNCH	MANDATORY 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	HIGHLY DESIRABLE 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	MANDATORY ON TV	CMC/IU GUIDANCE LAUNCH ANALOGS
		C. ADEG CHANNELS 90-93	PRELAUNCH	HIGHLY DESIRABLE	FOR DSC DISPLAYS
		D. VSM	PRELAUNCH	MANDATORY	FOR DISPLAY CAPABILITY
		E. AUX VSM	PRELAUNCH	HIGHLY DESIRABLE	
		F. EIDOPHORS (3)	PRELAUNCH	2 HIGHLY DESIRABLE	
		NOTE: INDIVIDUAL FLIGHT CONTROLLERS WILL BE RESPONSIBLE FOR REPORTING LOSS OF DISPLAY CAPABILITY OF MANDATORY PARAMETERS TO THE FLIGHT DIRECTOR.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	3-11	TIMING			
		A. MITE (2)	PRELAUNCH	1 MANDATORY	MCC TIMING STANDARD TO SUPPORT MANDATORY RTCC/CCATS COMPUTERS.
A	3-12	COMMUNICATIONS			
		A. MOCR			
		1. FD LOOP 2. AFD CONF LOOP	PRELAUNCH	1 OF 2 MANDATORY	FOR MISSION CONTROL
		3. MOCR SYS 1 & 2	PRELAUNCH	ALL HIGHLY DESIRABLE	
		4. MOCR DYN 5. A/G 1 LOOP 6. A/G 2 LOOP	PRELAUNCH	1 OF 2 MANDATORY TO T-3+07	MCC/CREW COMMUNICATIONS. AFTER T-3+07 MILA CAN MANUALLY KEY IF REQUIRED.
		B. MCC/LAUNCH COMPLEX			
		1. 121 - CLTC 2. 111 - CVTS 3. 212 - MSTC	PRELAUNCH	1 OF 3 MANDATORY, OTHER HIGHLY DESIRABLE	FOR TERMINAL COUNT COORDINATION OF MCC - PAD ACTIVITIES.
		4. ALL OTHER MCC/ LAUNCH COMPLEX LOOPS	PRELAUNCH	DESIRABLE	
		C. MCC/RSO			
		1. FD LINE TO RSO 2. RSO PRIVATE LINE 3. CAPE 111 RSO LOOP	PRELAUNCH	1 OF 3 MANDATORY, OTHER HIGHLY DESIRABLE	FOR TRAJECTORY VERIFICATION AND BOOSTER SAFING
		D. MISCELLANEOUS			
		1. BSE TM MONITOR LOOP 2. CIF/USB LOOP	PRELAUNCH	DESIRABLE	USED FOR MONITORING SPACE VEHICLES SUBSYSTEM CHECKOUT
		E. MCC/REMOTED SITES - A/G TO THE MSFN SITES	PRELAUNCH	1 LINE MANDATORY, 1 HIGHLY DESIRABLE	FOR MISSION CONTROL AND A/G VOICE.
		RULES 3-13 THROUGH 3-16 ARE RESERVED			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	3-17	GSFC			
		A. GSFC UNIVAC 494 (2) COMMUNICATIONS PROCESSOR	PRELAUNCH	1 MANDATORY	A. ONE UNIVAC 494 CAN PERFORM ALL NECESSARY FUNCTIONS, THE SECOND ONE IS BACKUP.
		B. WBD (40.8 KBPS) LINES (2) BETWEEN MCC AND GSFC	PRELAUNCH	1 MANDATORY	B. EITHER LINE CAN BE SWITCHED TO EITHER UNIVAC 494.
		C. TTY CIRCUITS BETWEEN MCC AND GSFC			
		1. THREE TEXT CIRCUITS	PRELAUNCH	1 OF 3 HIGHLY DESIRABLE	1. FOR ACQ MESSAGE, LOW-SPEED CMD.
		2. SIX LOW-SPEED (JJ) CIRCUITS	PRELAUNCH	1 OF 6 MANDATORY	2. FOR RECEPTION OF LOW-SPEED RADAR DATA.
A	3-18	KSC			
		TELEMETRY			
		A.1. TEL IV 30-FT ANTENNA 2. CIF VHF ANTENNA 3. MILA VHF ANTENNA	PRELAUNCH	1 OF 3 MANDATORY FOR S-II VHF TM	THESE ANTENNAS CAN BE SWITCHED TO MILA OR CIF FACILITIES.
		B. FINE MONITOR 1. CIF 2. MILA	PRELAUNCH	BOTH DESIRABLE	
		C. CASTS	PRELAUNCH	DESIRABLE	
		D. USB ANTENNAS 1. MILA 2. MANDY	PRELAUNCH	1 OF 2 MANDATORY FOR TM	TO SUPPORT ONLY CSM DATA SOURCE.
		COMMAND			
		THIS CAPABILITY IS DEFINED UNDER KSC/MSFN COMMAND RULE 3-19 FOR LAUNCH COVERAGE.			
		TRACKING			
		A. THAT CAPABILITY REQUIRED TO SATISFY THE REQUIREMENT OF RULE 3-8.	PRELAUNCH	MANDATORY	
		B. TRACKING DATA RECORD	PRELAUNCH	HIGHLY DESIRABLE	
		VOICE COMMUNICATIONS			
		THIS KSC CAPABILITY IS DEFINED UNDER MCC RULE 3-12 COMMUNICATIONS.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	3-19	LAUNCH PHASE			
		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.			
		CMD USB	PRELAUNCH	HIGHLY DESIRABLE	
		TM			
		CSM-USB MILA ALDS	PRELAUNCH	1 OF 2 MANDATORY	
		S-II VHF MILA ALDS	PRELAUNCH	1 OF 2 MANDATORY	
		S-IVB VHF MILA ALDS	PRELAUNCH	1 OF 2 MANDATORY	
		IU (S-BAND OR CCS) MILA ALDS	PRELAUNCH	1 OF 2 MANDATORY	
		TRACKING			
		C-BAND USB	PRELAUNCH	1 OF 2 MANDATORY TO T+10 MINUTES	
		A/G COMMUNICATIONS			
		USB	PRELAUNCH	MANDATORY	
		VHF SIMPLEX A	PRELAUNCH	HIGHLY DESIRABLE	
A	3-20	GENERAL ORBITAL COVERAGE			
		IT IS REQUIRED THE MSFN HAVE THE CAPABILITY OF PROVIDING THE MCC THE MINIMUM MISSION CONTROL SUPPORT LISTED BELOW OF 2 MSFN USB SITES PER REVOLUTION THROUGH REVOLUTION 3.			
		CMD USB	PRELAUNCH	HIGHLY DESIRABLE	
		TM VHF	PRELAUNCH	MANDATORY	
		USB	PRELAUNCH	MANDATORY	
		TRACK C-BAND	PRELAUNCH	HIGHLY DESIRABLE	
		USB	PRELAUNCH	MANDATORY	
		A/G COMMUNICATIONS			
		VHF	PRELAUNCH	HIGHLY DESIRABLE	
		USB	PRELAUNCH	MANDATORY	
	3-21	HSK, GDS, MAD			
		IT IS MANDATORY 2 OF 3 OF THESE SITES PROVIDE THE FOLLOWING CAPABILITIES:			
		TM USB	PRELAUNCH	MANDATORY	TO COVER TRANSLUNAR COAST AND LPO.
		TRACK USB	PRELAUNCH	MANDATORY	
		VOICE USB	PRELAUNCH	MANDATORY	
		RULES 3-22 THROUGH 3-24 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	3-25	RIOMETER NETWORK SITES			
		A. LIMA	PRELAUNCH	HIGHLY DESIRABLE	
		B. CRO CYI	PRELAUNCH	1 OF 2 HIGHLY DESIRABLE	

4 TRAJECTORY AND GUIDANCE

REV	ITEM	
	4-1	THE LAUNCH PHASE WILL BE TERMINATED FOR THE FOLLOWING CONDITIONS: A. VIOLATION OF VEHICLE BREAKUP LINE. B. $T_{FF} \leq 1 + 40$ AND DECREASING AFTER TOWER JETTISON. C. VIOLATION OF ENTRY "G" LIMIT. D. VS INCREASING. E. OVERSPEED CONDITIONS AT INSERTION.
	4-2	THE LES WILL NOT BE JETTISONED UNTIL MODE II CAPABILITY IS ESTABLISHED BY $T_{FF} \geq 1 + 20$ AND INCREASING.
	4-3	AFTER ACHIEVING "S-IVB TO ORBIT" CAPABILITY, EARLY STAGING WILL BE EXECUTED FOR PREMATURE S-II SHUTDOWNS OR FAILURES AS OUTLINED IN SECTION 5.
	4-4	MODE II, III, IV, AND APOGEE KICK A. THE GROUND IS PRIME FOR ABORT MODE DETERMINATION AND MANEUVER COMPUTATION. B. MANEUVERS WILL BE INTERRUPTED WHEN $T_{FF} = 1 + 40$ AND DECREASING. C. MODE IV MANEUVERS WILL BE INTERRUPTED IF THE CURRENT ALTITUDE IS 75 NM, DECREASING AND h_p <400K FT. D. IF ENTERING, UTILIZE LIFT TO AVOID LAND. UNAVOIDABLE LAND LANDING USE RL 90°. E. MAXIMUM NUMBER OF SPS RESTART ATTEMPTS IS TWO. F. IF NO SLA SEP OR IF SPS FAILS: 1. h_p <40 - EXECUTE CM/SM SEPARATION BY $T_{FF} = 1 + 40$. 2. $40 < h_p < 75$ - GROUND WILL DECIDE TO USE SM RCS ASAP OR AT APOGEE TO REDUCE h_p TO 40 NM.
A	4-5	MODE III ABORTS A. PREDICTED T_{FF} AFTER SPS CUTOFF <1 + 40. 1. FULL LIFT IP ON WATER - DO NOT BURN. 2. G&N GO AND FULL LIFT IP ON LAND - BURN TO $T_{FF} = 1 + 40$, RL 90°. 3. G&N NO-GO AND FULL LIFT IP ON LAND - BURN A REDUCED ΔV TO OBTAIN T_{FF} AFTER C/O AND RL 90°. B. IF $\Delta T_B \leq 2$ SECONDS, DO NOT BURN. C. IF IGNITION OCCURS AFTER GETI +10 SECONDS, BURN UNTIL G&N $\Delta R = 0$, RL 55°. (IF UNABLE TO BURN $\Delta R = 0$, RL 90°)
	4-6	THE SPACECRAFT CMC WILL BE NO-GO FOR ABORT MANEUVER DETERMINATION AND MONITORING FOR THE FOLLOWING: A. CMC PROGRAM FAILURE. B. RTCC AND CMC T_{FF} DIFFERENCE >40 SECONDS. C. CONFIRMED ERROR IN S/C PLATFORM VELOCITY COMPONENTS OF >50 FPS IN X OR 100 FPS IN Z.

REV	ITEM	
	4-7	THE ORBIT IS "GO" IF $h_p \geq 75$ NM
		RULE NUMBERS 4-8 THROUGH 4-19 ARE RESERVED.

REV	ITEM	
	4-20	EARTH ORBITAL ALTITUDE CONSTRAINTS: A. REAL-TIME MISSION PLANNING PERIGEE - 85 NM MINIMUM, MAXIMUM h_p IS DETERMINED BY THE AMOUNT OF 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.
	4-21	THE SEPARATION MANEUVER FOR CONTINGENCY CSM SEPARATION FROM S-IVB IS: A. IMPENDING S-IVB EXPLOSION - 4 SECONDS SPS ASAP. (7000 FEET SEPARATION IN 200 SECONDS.) B. ATTITUDE RATES ≥5 DEG/SEC - 20 SECONDS RCS ASAP. C. YAW ATTITUDE >60 DEG - 20 SECONDS RCS ASAP. D. CSM RETROFIRE REQUIRED - SEPARATE 20 MINUTES PRIOR TO RETRO, 5 FPS RCS RETROGRADE WITH LINE ON HORIZON.
	4-22	SPACECRAFT COMPUTER TIMING UPDATES ARE REQUIRED FOR SET ERRORS GREATER THAN .1 SECONDS.
	4-23	TIME BETWEEN EPO RETROFIRE GETI AND 400K MUST BE >9 MINUTES. IF NOT, RETARGET FOR NEXT PTP.
	4-24	IF SPS EPO RETROFIRE ΔT_B ≤7 SECONDS, USE SCS AUTO TVC.
	4-25	PLANNED G&N AND SCS RETROFIRE MANEUVERS WILL BE UPDATED IF: A. THE COMPUTED RETROFIRE POSITION CHANGES BY >0.50 DEG LONGITUDE PRIOR TO GETI - 30 MINUTES. B. THE COMPUTED RETROFIRE POSITION CHANGES BY >2 DEG LONGITUDE AFTER GETI - 30 MINUTES.
	4-26	IF A G&N FAILURE IS DETECTED PRIOR TO RETROFIRE, CREW USES SCS ΔV MODE WITH AN EMS ENTRY.
	4-27	IF SPS FAILS AFTER EPO RETROFIRE IGNITION OR NO SLA SEP: A. h_p >75 NM - RETARGET FOR NEXT BEST PTP USING THE RCS. B. h_p <75 NM - REMAIN IN RETRO ATTITUDE AND BURN SM RCS USING FOLLOWING PRIORITY: 1. BURN ΔV RESIDUALS. 2. BURN MAXIMUM SM ΔV AVAILABLE. 3. BURN CM RCS TO h_p = 40 NM IF SM RCS ΔV NOT SUFFICIENT TO OBTAIN 40 NM. IF h_p ≤40 NM TERMINATE ALL THRUSTING AT T_{FF} = 7 MINUTES.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-28	THE G&N IS NO-GO FOR ENTRY IF:			
		A. CMC VALUE OF DOWNRANGE ERROR ($R_P - R_T$) AT .2g DIFFERS >±100 NM FROM GROUND VALUE OF >±115 NM FROM BACKUP CHART VALUE. CREW FAILOVER TO EMS ENTRY AS FIRST PRIORITY OR GROUND BANK ANGLE AND RETRB AS SECOND PRIORITY.			
		B. V AND γ AT 400K ARE OUTSIDE CORRIDOR. GROUND WILL PROVIDE ENTRY PROFILE.			
	4-29	THERE WILL BE NO BOOSTER NAVIGATION OR TARGET UPDATES FOR EITHER TLI OPPORTUNITY.			
	4-30	THE CMC STATE VECTOR WILL BE UPDATED PRIOR TO TLI WITH BEST MSFN VECTOR.			
	4-31	A PROPERLY OPERATING G&N (CMC + IMU) AND S-IVB INERTIAL GUIDANCE SYSTEM ARE MANDATORY FOR TLI.			
A	4-32	THE MAXIMUM ALLOWABLE MISALIGNMENT RATE BETWEEN THE IU AND IMU IS 0.6 DEG/HR IN ANY AXIS.			
	4-33	THE S/C LIFT-OFF REFSMMAT WILL BE USED FOR BOTH TLI OPPORTUNITIES.			
	4-34	DISPERSED S-IVB TLI CUTOFF.			
		A. PREDICTED END OF LUNAR ORBIT MISSION FUEL RESERVES >1000 FPS.		A. CONTINUE MISSION: EXECUTE MIDCOURSE CORRECTIONS CONSISTENT WITH LUNAR ORBIT MISSION.	A. END OF LUNAR ORBIT MISSION FUEL RESERVES ARE AFTER EXECUTION OF BAP MCC, LOI, CIRCULATION, AND TEI. (ACTUAL VALVES VARY WITH DAILY WINDOW.)
		B. PREDICTED END OF LUNAR ORBIT MISSION FUEL RESERVES <1000 FPS. AND:		B.	B. 4500 FT/SEC IS RESERVED FOR CONTINGENCY ABORT SITUATIONS. END OF LUNAR FLYBY MISSION FUEL RESERVES ARE AFTER EXECUTION OF FLYBY MCC ONLY. (ACTUAL VALVES VARY WITH DAILY WINDOW.)
		1. PREDICTED END OF LUNAR FLYBY MISSION FUEL RESERVES >5500 FPS.		1. CONTINUE MISSION; EXECUTE MIDCOURSE CORRECTIONS FOR FREE RETURN FLYBY.	1. CONTINGENT UPON CHECKOUT OF GROUND CAPABILITY TO COMPUTE LARGE INITIAL MCC.
		2. PREDICTED END OF LUNAR FLYBY MISSION FUEL RESERVES <5500 FPS.		2. PERFORM ALTERNATE EARTH ORBIT MISSION OR DIRECT ABORT.	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-35	DIFFERENCE IN CMC AND IU PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION:			
		A. VIOLATION OF ANY OF THE FOLLOWING: $\dot{\Delta X}$ > 34.8 FPS $\dot{\Delta Y}$ > 64.2 FPS $\dot{\Delta Z}$ > 86.6 FPS ΔV_T >32.4 FPS		A. TLI IS NO-GO.	
		B. FOR ANY OF THE FOLLOWING: 7.4 < $\dot{\Delta X}$ < 34.8 44.6 < $\dot{\Delta Y}$ < 64.2 27.0 < ΔZ < 86.6 13.0 < ΔV_T < 32.4		B. TLI IS TEMPORARILY NO-GO.	B. REFER TO ORBITAL DECISION PARAMETERS (PART C)
		C. VIOLATION OF ANY OF THE FOLLOWING ORBITAL DECISION PARAMETERS AT GET = 1 HR 45 MIN. ΔA > 17,400 FT $\dot{\Delta W}$ > 31.2 FT/SEC ΔW > 26,400 FT		C. TLI IS NO-GO.	C. IU COMPARED TO MSFN.
	4-36	DIFFERENCE IN MSFN AND IU DOWNRANGE POSITION (ΔR_V) >103,500 FT. AT GET = 55 MIN.		TLI IS NO-GO.	
		RULES 4-37 THROUGH 4-45 ARE RESERVED.			

REV	ITEM	
	4-46	THE CMC WILL BE 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 VIEW OF SXT. 2. HORIZON CHECK ERROR >4 DEG FOR RETROFIRE FROM EPO.
	4-47	MODE III, MODE IV, APOGEE KICK OR EPO RETROFIRE WILL BE COMPLETED BY MANUAL TAKEOVER FOR ANY OF THE FOLLOWING: A. ATTITUDE EXCURSIONS ≥5 DEG. B. V_G INCREASING.
	4-48	LOI (ONE & TWO), TEI, TLC ABORTS AND LUNAR ORBIT ABORTS WILL BE COMPLETED BY MANUAL TAKEOVER FOR ANY OF THE FOLLOWING: A. ATTITUDE EXCURSIONS ≥10 DEG. B. ATTITUDE RATES ≥10 DEG/SEC. } EXCLUDING START TRANSIENTS
A	4-49	MIDCOURSE CORRECTIONS, LOI AND LUNAR ORBIT CIRCULARIZATION WILL BE TERMINATED AFTER MANUAL TAKEOVER AND RATE DAMPING FOR ATTITUDE RATES ≥10 DEG/SEC.
		RULES 4-50 THROUGH 4-55 ARE RESERVED.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	4-56	MIDCOURSE CORRECTION NOMINAL EXECUTION POINTS WILL BE AT A. TLI C/O + 6 HRS. B. TLI C/O + 25 HRS. C. LOI - 22 HRS. D. LOI - 8 HRS.			THE MANEUVER EXECUTION CRITERIA (RULE 4-57) WILL BE APPLIED TO MANEUVERS CALCULATED AT THESE POINTS. EARLIEST MCC IS AT TLI C/O +4 HRS.
	4-57	TRANSLUNAR MIDCOURSE CORRECTION EXECUTION CRITERIA.			
		A. FIRST MCC <3 FPS AT TLI C/O +6 HRS.		A. DO NOT EXECUTE MCC AT PLANNED TIME	A. THREE FPS IS THE 3σ MSFN VELOCITY UNCERTAINTY AT TIME OF MANEUVER COMPUTATION.
		B. ALL SUBSEQUENT MCC'S. 1. ΔV_{MCC} <1 FPS 2. 1 FPS $\leq \Delta V_{MCC} \leq$ 5 FPS 3. 5 FPS < ΔV_{MCC} <10 FPS 4. ΔV_{MCC} >10 FPS.		B. 1. DO NOT EXECUTE MCC AT PLANNED TIME. (EXCEPTION-LAST MCC) 2. CONSIDER LATER MCC TIME TO ALLOW ΔV >5 FPS. 3. EXECUTE MCC WITH SPS AT PLANNED TIME. 4. SCHEDULE EARLIER MCC TIME TO ALLOW REDUCTION IN ΔV.	B. 1. ONE-HALF FPS IS 3σ MSFN TRACKING UNCERTAINTY AFTER 20 HRS. 2. 5 FPS IS SPS MINIMUM IMPULSE; MAY BE EXECUTED RCS AT PLANNED TIME.
	4-58	THE G&N WILL BE THE PRIMARY MODE OF EXECUTING TRANSLUNAR MIDCOURSE CORRECTIONS: (A) RCS (B) SPS >7 SEC.			
	4-59	THE RESIDUALS OF ALL TRANSLUNAR MCC'S WILL BE TRIMMED TO .2 FPS IN ALL AXES.			
A	4-60	PERILUNE ALTITUDES BETWEEN 50 NM AND 70 NM WILL BE CONSIDERED IN ORDER TO RETAIN MINIMUM MISS DISTANCE OVER THE LUNAR LANDING SITE.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	4-61	A "GO" FOR LOI REQUIRES: A. COMMITMENT TO AT LEAST 4 HOURS IN LPO. B. ADEQUATE FUEL REMAINING FOR SUBSEQUENT MISSION OPERATIONS. C. hpc >50 NM			A. THIS PROVIDES ONE REV OF TRACKING POST-LOI FOR CALCULATION OF TEI. B. INCLUDES LOI, CIRCULARIZATION, TEI, AND RESERVES.
A	4-62	PREMATURE LOI SHUTDOWN: A. RESULTING APOLUNE $<\approx$ 9000 NM AND PERILUNE >25 NM B. RESULTING APOLUNE $>\approx$ 9000 NM C. RESULTING h_p <25 NM	B	A. EVALUATE TEI/CIRCULARIZATION B. DO DIRECT RETURN ABORT BURN ASAP. C. PERFORM MANEUVER(S) TO RAISE h_p >40 NM ASAP.	A. (CORRESPONDING CMC APOLUNE ALTITUDE IS $\approx$ 8900 NM-CONIC SOLUTION).
A	4-63	THE MAXIMUM ALLOWABLE SHIFT IN THE LINE OF APSIDES OF RESULTANT LUNAR PARKING ORBIT IS ±30 DEG.			
A		RULES 4-64 THROUGH 4-75 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-76	THE CIRCULARIZATION MANEUVER WILL NOT BE TARGETED TO REMOVE ANY OUT-OF-PLANE VELOCITY.			
	4-77	A "GO" FOR CIRCULARIZATION REQUIRES: COMMITMENT TO AT LEAST 4 HOURS IN 60 NM CIRCULAR LPO			THIS PROVIDES ONE REV OF TRACKING POST-CIRCULARIZATION FOR CALCULATION OF TEI.
	4-78	LUNAR ORBIT ALTITUDE CONSTRAINTS A. REAL-TIME MISSION PLANNING - PERILUNE 60 NM MINIMUM. B. CONTINGENCY (VIOLATIONS MUST BE CORRECTED ASAP) - PERILUNE 25 NM MINIMUM.			
		RULES 4-79 THROUGH 4-85 ARE RESERVED.			

REV	ITEM	
	4-86	TRANSEARTH MCC'S WILL BE TARGETED TO ACHIEVE ENTRY CONDITIONS AS FOLLOWS: A. IF V_{EI} >30,000 FPS OR G&N NO-GO, USE STEEP TARGET LINE. B. IF V_{EI} <30,000 FPS AND G&N GO, USE SHALLOW TARGET LINE.
A	4-87	TRANSEARTH MCC PHILOSOPHY. A. TEC MCC WILL NOT USE LANDING POINT CONTROL UNLESS THE LANDING POINT IS UNACCEPTABLE. B. MCC'S WITH ΔV LESS THAN TWICE MSFN HORIZONTAL VELOCITY ACCURACY WILL NOT BE EXECUTED. 2 X MSFN ≈ 2 FPS BEFORE EI-50 HRS 2 X MSFN ≈ 1 FPS AFTER EI-50 HRS C. IF γ_{EI} IS OUTSIDE THE ENTRY CORRIDOR BY > MSFN ACCURACY, EXECUTE MCC ASAP (EXCEPTION: FIRST TEC MCC) D. LAST MCC WILL BE SCHEDULED NO LATER THAN EI-2 HOURS. E. THE G&N WILL BE THE PRIMARY MODE OF EXECUTING ALL TEC MCC'S. (A) RCS (B) SPS >7 SEC. F. MCC'S >12 FPS WILL USE SPS IF PRACTICAL. G. THE X-AXIS RESIDUALS OF SPS MCC'S WILL BE TRIMMED TO WITHIN .2 FPS.
	4-88	TEC MCC'S FOR LANDING AREA CONTROL: A. PRIOR TO EI-24 HRS: WILL BE EXECUTED FOR RECOVERY ACCESS VIOLATIONS, UNACCEPTABLE WEATHER AT SPLASH, OR IF ANY PART OF THE OPERATIONAL FOOTPRINT IS ON LAND. B. AFTER EI-24 HRS: WILL NOT BE EXECUTED.
	4-89	ENTRY CONDITIONS WILL BE CONTROLLED TO AVOID HEAT SHIELD LIMITATIONS.
	4-90	BACKUP ENTRY IS CONSTRAINED AS FOLLOWS: A. THE CONSTANT G ENTRY MUST FALL BETWEEN 3 AND 5 G'S. B. EMS RANGING WILL NOT BE ATTEMPTED UNTIL V <25,500 FPS.
	4-91	WEATHER AVOIDANCE WITH AERODYNAMIC LIFT WILL NOT BE ATTEMPTED UNLESS THE G&N IS OPERATIONAL, OR EMS-INDICATED VELOCITY <25,500 FT/SEC.
	4-92	PREDICTED ENTRY CORRIDOR VIOLATION AFTER LAST MCC OPPORTUNITY (EI-2 HRS): A. UNDERSHOOT LINE EXCEEDED: GROUND ADVISE CREW TO FLY FULL LIFT UNTIL PEAK G IS PASSED THEN FLY G&N. B. OVERSHOOT LINE VIOLATED: GROUND ADVISE CREW TO FLY NEGATIVE LIFT TO 2 G'S FOLLOWED BY 4 G CONSTANT G ENTRY.

REV	ITEM	
	4-93	IF THE EMS INDICATES A SKIP CONDITION, NEGATIVE LIFT SHOULD BE ACHIEVED PRIOR TO VERIFYING THE EMS WITH CROSS CHECKS.
	4-94	IF THE EMS INDICATES AN UNDERSHOOT CONDITION EXISTS, FULL LIFT SHOULD BE ACHIEVED PRIOR TO VERIFYING THE EMS WITH CROSS CHECKS.
A	4-95	THE G&N IS NO-GO DURING ENTRY IF: A. P65 VALUE V_L DIFFERS FROM GROUND VALUE BY GREATER THAN ±800 FPS. B. P65 VALUE OF D_L DIFFERS FROM GROUND VALUE BY GREATER THAN ±.6G'S. C. CAUSES TRAJECTORY TO VIOLATE THE OFFSET LIMITS (SKIP) ON EMS SCROLL. D. CAUSES TRAJECTORY TO VIOLATE ONSET LIMITS (G) ON EMS SCROLL. E. IF G&N TRIM ATTITUDES AT CM/SM SEPARATION DIFFER FROM HORIZON MONITOR ATTITUDE BY >5 DEGREES. F. IF THE G&N TRIM ATTITUDES AT .05G DIEFERS FROM THE GROUND VALUES BY >5 DEGREES. G. IF CMC FAILS TO SEQUENCE FROM P63 TO P64 AT RET .05G ± 5 SEC.
		RULES 4-96 THROUGH 4-100 ARE RESERVED.

REV	ITEM	
	4-101	IF SAFING CANNOT BE CONFIRMED BY THE BRSO OR OTHER NASA TELEMETRY SOURCES, 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".
		TRACKING SOURCES:
	4-102	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.
	4-103	DATA FROM TWO (2) OF THE FOLLOWING THREE (3) RADARS ARE MANDATORY BEFORE LAUNCH (OTHER HIGH DESIRABLE): BERMUDA FPS-16, BERMUDA FPQ-6, AND GRAND TURK TPQ-18.
	4-104	XY, XZ, AND IP PLOTS AT BERMUDA USING INPUTS FROM EITHER THE BDA FPS-16 OR BDA FPQ-6 RADAR ARE MANDATORY FOR LAUNCH. OTHER IS HIGHLY DESIRABLE.
	4-105	ODOP DATA TO THE CAPE KENNEDY RTCS FOR IP COMPUTATION AND RSO DISPLAY DURING FIRST STAGE BURN IS HIGHLY DESIRABLE.
		AIRBORNE SYSTEMS:
	4-106	TWO OPERATIONAL RANGE SAFETY COMMAND RECEIVERS ON EACH LAUNCH BOOSTER STAGE (THE S-IC, S-II AND THE S-IVB) ARE MANDATORY FOR LAUNCH. THE RANGE SAFETY SUPERVISOR (CRSS) WILL DETERMINE IF THE RECEIVERS ARE OPERATING PROPERLY FOR LAUNCH.
	4-107	THE IU C-BAND BEACON SYSTEM (2 BEACONS) IS MANDATORY FOR LAUNCH.
		COMMAND/CONTROL:
	4-108	THE NASA BERMUDA DRS COMMAND/CONTROL SYSTEM IS MANDATORY FOR LAUNCH.
	4-109	RANGE SAFETY COMMANDS ("ARM/MFCO" AND "DESTRUCT/PD") WILL HAVE MANDATORY PRECEDENCE OVER ALL OTHER COMMANDS. TIMERS IN THE RSO CONSOLE WILL PROVIDE A 4 SECOND TIME DELAY BETWEEN "ARM/MFCO" AND "DESTRUCT/PD".
		COMMUNICATIONS:
	4-110	TWO PRIVATE, INDEPENDENT, GEOGRAPHICALLY DIVERSIFIED COMMUNICATION LINKS BETWEEN THE RSO AND BRSO ARE MANDATORY.
	4-111	TWO OF THE FOLLOWING THREE COMMUNICATIONS LINKS ARE MANDATORY BETWEEN THE RSO AND FD/FIDO: A. RSO LOOP (CAPE 111). B. RSO PRIVATE LINE (GREENPHONE/YELLOWPHONE). C. FLIGHT DIRECTOR'S LOOP.

REV	ITEM	
	4-112	A COMMUNICATIONS LINK BETWEEN RSO AND RANGE SAFETY SUPERVISOR (CRSS) AT THE LAUNCH CONTROL CENTER IS MANDATORY.
A	4-113	GREENPHONE COMMUNICATIONS LINK BETWEEN RSO AND THE LAUNCH VEHICLE TEST CONDUCTOR (CLTC) IS HIGHLY DESIRABLE.
		TELEMETRY:
	4-114	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.
	4-115	TELEMETRY REQUIREMENTS TO BE DISPLAYED FOR THE RSO AND BRSO ARE HIGHLY DESIRABLE. FOR LAUNCH VEHICLE AND SPACECRAFT HARDWARE ENTRIES AND APPROPRIATE CATEGORIES, REFERENCE THE FOLLOWING ITEMS: (1) FOR RSO DISPLAY: TO BE DETERMINED (2) FOR BRSO DISPLAY: TO BE DETERMINED
		WEATHER:
	4-116	ANNUAL PROFILE WIND RESTRICTION TO BE DETERMINED.
	4-117	MINIMUM RANGE SAFETY CEILING AND VISIBILITY TO BE DETERMINED.
		RULES 4-118 THROUGH 4-120 ARE RESERVED.

5 SLV-BOOSTER

REV	ITEM
A	5-1

BSE GENERAL RULES

A. BSE GENERALIZED SWITCH SELECTOR COMMAND CAPABILITY EXISTS:

1. WHEN CREW ENABLES IU COMMAND SYSTEM (EXCEPT AS NOTED BELOW IN ITEM D)

2. AFTER TB7 + 20 MINUTES

3. AFTER SPACECRAFT SEPARATION EXCEPT AS NOTED IN ITEM D.

B. BSE MANEUVER UPDATE CAPABILITY EXISTS FOR TB7 MANEUVERS ONLY.

C. BSE HAS NO NAVIGATION UPDATE OR TARGET UPDATE CAPABILITY.

D. BSE HAS NO COMMAND CAPABILITY DURING POWERED BURNS PHASES, WHETHER IT IS MANNED OR UNMANNED, THEREFORE, DURING AN UNMANNED BURN THERE IS NO WAY TO CUT THE LAUNCH VEHICLE OFF.

E. THERE ARE NO CONDITIONS FOR WHICH A UNMANNED RESTART ATTEMPT WILL BE TERMINATED BY THE BSE, EXCEPT IF THE SPACECRAFT IS NOT A SAFE DISTANCE AWAY FROM THE LAUNCH VEHICLE.

F. A SAFE DISTANCE BETWEEN THE SPACECRAFT AND S-IVB/IU IS DEFINED AS 7000 FT.

G. BSE WILL RECOMMEND A SPACECRAFT SEPARATION PRIOR TO TB6 INITIATE OR TLI INHIBIT IN TB6 FOR ANY CONFIRMED MALFUNCTION IN THE LAUNCH VEHICLE WHICH RESULTS IN:

1. A CATASTROPHIC HAZARD,

2. INSUFFICIENT CONSUMABLES TO ASSURE A 95 PERCENT PROBABILITY OF GUIDANCE CUTOFF,

3. OR, FUNCTIONAL CONDITIONS LEADING TO A DEFINITE PREDICTION OF LESS THAN 1σ PERCENT PROBABILITY OF ACHIEVING A SATISFACTORY TLI CUTOFF ONCE THE ENGINE IS STARTED. IN ASSESSING (3), CONDITIONS LEADING ONLY TO A FAILURE TO RESTART THE ENGINE WILL NOT BE CONSIDERED.

H. IN THE EVENT OF NO S-IVB IGNITION AT RESTART OR AN EARLY SECOND BURN S-IVB CUTOFF, THE SPACECRAFT SHOULD REMAIN ATTACHED TO THE S-IVB/IU AND MONITOR LH_2 AND LOX ULLAGE PRESSURES. IF SEPARATION IS REQUIRED, THE SPACECRAFT SHOULD IMMEDIATELY GO TO A SAFE DISTANCE (7000 FT) FROM THE S-IVB/IU.

I. IF THE SPACECRAFT TLI INHIBIT SWITCH IS SET IN THE INHIBIT POSITION AFTER TB6 INITIATE BUT PRIOR TO TB6 + 9 MIN 20 SEC, SPACECRAFT WILL NOT BE SEPARATED UNTIL POSITIVE VERIFICATION HAS BEEN RECEIVED BY THE GROUND OR CREW DISPLAYS THAT THE LVDC HAS RECYCLED TO TB5 OR TB6C.

J. ABORT DURING LAUNCH PHASE WILL BE RECOMMENDED FOR THE FOLLOWING:

5-3 S-IC LOSS OF THRUST
5-14 LAUNCH VEHICLE INERTIAL PLATFORM FAILURE - ATTITUDE REFERENCE
5-15 S-II LOSS OF THRUST ON TWO OR MORE ENGINES PRIOR TO S-IVB TO ORBIT CAPABILITY
5-16 S-II SECOND PLANE SEPARATION FAILS TO OCCUR
5-17 S-II GIMBAL SYSTEM FAILURE - ACTUATOR HARDOVER INBOARD PRIOR TO S-IVB TO ORBIT CAPABILITY
5-18 COLD HELIUM SHUTOFF VALVES FAIL OPEN
5-20 S-IVB LOSS OF HYDRAULIC FLUID
5-21 S-IVB LOSS OF THRUST

K. S-II/S-IVB EARLY STAGING WILL BE RECOMMENDED FOR THE FOLLOWING:

5-15 S-II LOSS OF THRUST TWO OR MORE ENGINES AFTER S-IVB TO ORBIT CAPABILITY BUT PRIOR TO TB3 + 5 MIN 35 SEC

5-17 S-II ACTUATOR HARDOVER INBOARD AFTER S-IVB TO ORBIT CAPABILITY

L. SPACECRAFT SEPARATION OR TLI INHIBIT PRIOR TO RESTART WILL BE RECOMMENDED FOR THE FOLLOWING:

5-22 S-IVB FIRST BURN LONGER THAN 3 MIN 03 SEC
5-51 LOSS OF ATTITUDE CONTROL DURING TB5, TB6, OR TB7 PRIOR TO RESTART
5-57 J-2 ENGINE CONTROL BOTTLE PRESSURE LESS THAN 400 PSIA
5-58 INERTIAL PLATFORM FAILURE
5-65 ACTUATOR HARDOVER
5-66 LOSS OF S-IVB HYDRAULICS

M. SPACECRAFT SEPARATION OF TLI INHIBIT PRIOR TO RESTART WILL BE RECOMMENDED UNLESS COMMAND ACTION IS SUCCESSFUL FOR THE FOLLOWING:

5-46 J-2 ENGINE MAIN LOX VALVE FAILS TO CLOSE AT S-IVB CUTOFF
5-49 S-IVB COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE
5-50 S-IVB CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO OPEN IN TB5
5-55 S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS +36 OR -26 PSID

REV	ITEM	
A	5-1 (CONT)	5-61 S-IVB COLD HELIUM SPHERE PRESSURE LOW (<600 PSIA) 5-64 S-IVB LH_2 TANK ULLAGE PRESSURE LOW 5-67 J-2 ENGINE START BOTTLE PRESSURE HIGH 5-68 S-IVB LOX TANK ULLAGE PRESSURE LOW

RULE 5-2 IS RESERVED.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	5-3	S-IC STAGE LOSS OF THRUST A. ANY SINGLE ENGINE PRIOR TO TB3. B. ANY TWO OR MORE ENGINES 1. PRIOR TO DEACTIVATION OF TWO ENGINES OUT AUTOMATIC ABORT. 2. AFTER DEACTIVATION OF TWO ENGINES OUT AUTOMATIC ABORT.	LAUNCH	A. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO. B.1. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST. 2. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF POTENTIAL OVERRATE CONDITION.	CUES: 1. THRUST OK SWITCHES (K33-115, K34-115, K36-115, K37-115, K39-115, K40-115, K42-115, K43-115, K45-115, K46-115) 2. THRUST CHAMBER PRESSURE (D8-101, D8-102, D8-103, D8-104, D8-105) 3. LONGITUDINAL ACCELERATION (VA2-603) 4. FINAL THRUST OK CUTOFF (K52-115, K53-115, K54-115, K55-115, K56-115) NOTE: CREW MAY DEACTIVATE AUTOMATIC ABORT AFTER TB1 + 120 SEC.
	5-4	LOSS OF THRUST - ENGINE 3 (THIS RULE APPLIES ONLY FOR THE UNIQUE CASE OF ENGINE 3 THRUST LOSS BETWEEN 0 TO 45 SECONDS) A. VOICE COMM WITH RSO B. NO VOICE COMM WITH RSO	LAUNCH	CONTINUE MISSION BSE INFORM FLIGHT AND FIDO. FLIGHT INFORM RSO. A.1. FLIGHT CONFIRM ENGINE 3 OUT VIA RSO PRIVATE LINE. 2. FLIGHT CONFIRM NO OTHER KNOWN ANOMALIES BY LIGHT ACTIVATION AND VOICE REPORT. B. FLIGHT CONFIRM ENGINE 3 OUT AND NO OTHER KNOWN ANOMALIES BY LITE ACTIVATION.	CUES: 1. ENGINE 3 THRUST CHAMBER PRESSURE LESS THAN 500 PSIA (D8-103) 2. ENGINE 3 THRUST OK SWITCHES OFF (K39-115, K40-115) 3. ENGINE 3 FINAL THRUST OK CUTOFF (K54-115) NOTES: 1. RSO LOOP III OR FD LOOP BACKUP TO PL 2. CONFIRMATION OF NO OTHER KNOWN ANOMALIES WILL BE BASED ON: A. ENGINE CHAMBER PRESSURE ABOVE 500 PSI AND HOLDING B. THRUST OK SWITCHES ON

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	5-5	S-IC STAGE GIMBAL SYSTEM FAILURE ANY SINGLE ACTUATOR HARD-OVER - ANY ENGINE - PITCH OR YAW (TB1 + 0 SEC TO TB3 + 0 SEC)	LAUNCH	CONTINUE MISSION BSE INFORM FLIGHT AND FIDO	CUES: 1. ACTUATOR POSITION EXCEEDS ±5 DEG (VG1-101, VG1-102, VG1-103, VG1-104, VG2-101, VG2-102, VG2-103, VG2-104) 2. ROLL ATTITUDE RATE EXCEEDS 5 DEG PER SEC (VR12-602, VR15-602) 3. ROLL ATTITUDE ERROR EXCEEDS 5 DEG (VH69-602, VH56-603) NOTES: 1. AUTOMATIC ABORT BY LES WHEN ATTITUDE RATE LIMIT IS EXCEEDED PRIOR TO AUTOMATIC ABORT DEACTIVATION. 2. MANUAL ABORT BY LES WITH TWO CUES: A. ROLL ATTITUDE LIMIT -5 DEG B. Q-BALL ΔP - 3.2 PSID C. PITCH OR YAW RATE -4 DEG/SEC
		RULES 5-6 THROUGH 5-11 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	5-12	LOSS OF ATTITUDE CONTROL	LAUNCH	CONTINUE MISSION	CUES:
		A. S-IC BURN		A. BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF IMPENDING LOSS OF ATTITUDE CONTROL.	A. S-IC BURN 1. ANGULAR RATES EXCEED 2 DEG/SEC (VR7-603, VR11-603, VR12-603, VR13-603, VR15-603, VR8-603) 2. ATTITUDE ERRORS EXCEED 4 DEG (H69-602, H70-602, H71-602, H54-603, H55-603, H56-603) 3. ACTUATOR POSITION INDICATES HARDOVER (+5 DEG) OR ERRATIC ACTUATOR (S) (VG1-101, VG1-102, VG1-103, VG1-104, VG2-103, VG2-104, VG2-101, VG2-102)
		B. S-II BURN		B. BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF IMPENDING LOSS OF ATTITUDE CONTROL	B. S-II BURN 1. ANGULAR RATES EXCEED 5 DEG/SEC (VR7-603, VR8-603, VR11-603, VR12-603, VR13-603, VR15-603) 2. ATTITUDE ERRORS EXCEED 10 DEG (H69-602, H70-602, H71-602, H54-603, H55-603, H56-603) 3. ACTUATOR POSITION INDICATES HARDOVER (+5 DEG) OR ERRATIC ACTUATOR(S) (G8-201, G8-202, G8-203, G8-204, G9-201, G9-202, G9-203, G9-204, G30-201-204, G31-201-204) 4. S-II BURN MODE DISCRETE REMAINS OFF AT STAGING (K90-602) 5. S-IC BURN MODE DISCRETE REMAINS ON AT STAGING (K89-602)
		C. S-IVB FIRST AND SECOND BURN		C. BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF IMPENDING LOSS OF ATTITUDE CONTROL.	C. S-IVB BURN 1. ANGULAR RATES EXCEED 5 DEG/SEC (R7-603, R8-603, R11-603, R12-603, R13-603, R15-603) 2. ATTITUDE ERRORS EXCEED 3.5 DEG (H69-602, H70-602, H71-602, H54-603, H55-603, H56-603)

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	5-12 (CONT'D)		LAUNCH		3. ACTUATOR POSITION INDICATES SUSTAINED HARDOVER OR ERRATIC OPERATION (±6 DEG) (G1-401, G2-401, G1-403, G2-403) 4. S-IVB BURN MODE DISCRETE REMAINS OFF AT STAGING (K20-602) NOTES: CREW WILL ABORT ON ESTABLISHED LIMITS: 1. S-IC BURN A. PITCH OR YAW RATE - ±4 DEG/SEC B. ROLL RATE - ±20 DEG/SEC C. ROLL ERROR - ±5 DEG D. Q-BALL ΔP - 3.2 PSID 2. S-II AND S-IVB BURN A. PITCH OR YAW RATE - ±10 DEG/SEC B. ROLL RATE - ±20 DEG/SEC
	5-13	INERTIAL PLATFORM FAILURE-ACCELEROMETER	LAUNCH	CONTINUE MISSION BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF PROBABLE DEGRADED ORBIT.	CUES: 1. GUIDANCE STATUS WORD (MODE CODE 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) INDICATES IN EXCESS OF 0.5 DEG OR REMAINS CONSTANT AT ZERO (H10-603, H11-603, H12-603) NOTES: 1. NO EFFECT ON VEHICLE TRAJECTORY DURING S-IC STAGE BURN 2. LVDC SWITCHES TO A BACKUP MODE AND UTILIZES A PRECOMPUTED F/M PROFILE FOR FAILED AXIS DURING THE S-IC, S-II, AND S-IVB BURNS.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	5-14	LAUNCH VEHICLE INERTIAL PLATFORM FAILURE - ATTITUDE REFERENCE A. PRIOR TO TB1 + 50 SEC B. AFTER TB1 + 50 SEC BUT PRIOR TO TB1 + 100 SEC C. AFTER TB1 + 100 SEC		A. ABORT BSE INFORM FLIGHT, FIDO AND GUIDO. BSE TRANSMIT ABORT REQUEST AT 50 SEC B. ABORT BSE INFORM FLIGHT, FIDO AND GUIDO. BSE TRANSMIT ABORT REQUEST (REF NOTE 3) C. CONTINUE MISSION BSE INFORM FLIGHT, FIDO AND GUIDO. (REF NOTE 4)	CUES: 1. GUIDANCE STATUS WORD - (MODE CODE 24) (H60-603) BITS D20 AND D19 FOR Z GIMBAL SET TO "ONE" BITS D18 AND D17 FOR X GIMBAL SET TO "ONE" BITS D16 AND D15 FOR Y GIMBAL SET TO "ONE" 2. LADDER OUTPUTS CONSTANT FOR FAILED AXES (H54-603, H55-603, H56-603) 3. ATTITUDE ERROR CONSTANT FOR FAILED AXES (H69-602, H70-602, H71-602) 4. GUIDANCE REFERENCE FAILURE (D04) MODE CODE 26 BIT 8 SET TO "ONE" (H60-603) NOTES: 1. THE LVDC/LVDA WILL HOLD THE LADDER SIGNALS AT THE LAST PREVIOUS VALID VALUE 2. ATTITUDE CONTROL WILL BE LOST IN THE FAILED AXES 3. CREW PERFORM MANUAL ABORT ON THE TWO GUIDANCE FAILURE LIGHTS. (REF RULING B) 4. MANUAL ABORT WHEN FIDO LIMITS ARE EXCEEDED. (REF RULING C)
A	5-15	S-II LOSS OF THRUST A. ANY SINGLE ENGINE - FAILURE TO ATTAIN THRUST OR LOSS OF THRUST PRIOR TO NOMINAL S-II CUTOFF B. ANY TWO ENGINES FAILURE TO ATTAIN THRUST OR LOSS OF THRUST 1. ANGULAR RATES PITCH OR YAW EXCEED 10°/SEC OR ATTITUDE ERROR EXCEEDS 40°.		A. CONTINUE MISSION BSE INFORM FLIGHT AND FDO B.1. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST	CUES: A.1. THRUST OK SWITCHES OFF (K285-201 THROUGH 205) (K286-201 THROUGH 205) 2. THRUST CHAMBER PRESSURE ZERO (D13-201 THROUGH 205) 3. LONGITUDINAL ACCELERATION (A2-603) B.1. A. TWO ENGINES OUT (CUES A.1, A.2, A.3) B. ANGULAR RATE (R7-602, R8-602, R11-602, R13-602, R12-602, R15-602) C. ATTITUDE ERRORS (H54-603, H55-603, H56-603, H69-602, H70-602, H71-602) D. COMMAND ANGLES AND GIMBAL ANGLES (H60-603)

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	5-15 (CONT'D)	B.2. PRIOR TO LOW LEVEL SENSE ARM (8:05 GET) FLY UNTIL CHI FREEZE +5 SEC (VARIABLE TIME) A. ANGULAR RATES IN PITCH OR YAW EXCEED 4 DEG/SEC OR ATTITUDE ERROR EXCEEDS 40°. B. ANGULAR RATES IN PITCH OR YAW ARE LESS THAN 4 DEG/SEC AND ATTITUDE ERROR IS LESS THAN 40° 3. AFTER LOW LEVEL SENSE ARM (8:05 GET) C. THREE OR MORE ENGINES 1. PRIOR TO S-IVB TO ORBIT CAPABILITY 2. AFTER S-IVB TO ORBIT CAPABILITY BUT PRIOR TO LOW LEVEL SENSE ARM (8:05 GET) 3. AFTER LOW LEVEL SENSE ARM (8:05 GET)		A. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST AT CHI FREEZE PLUS 5 SECONDS. B. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING AT CHI FREEZE PLUS 5 SECONDS. 3. CONTINUE MISSION BSE INFORM FLIGHT AND FDO C.1. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST 2. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING 3. CONTINUE MISSION BSE INFORM FLIGHT AND FDO.	2. SAME AS B.1 C. SAME AS A.1, 2, AND 3 ABOVE
	5-16	S-II SECOND PLANE SEPARATION FAILS TO OCCUR AT TB3 + 31 SEC	LAUNCH	ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST. CREW MUST ABORT PRIOR TO TB3 +56 SEC (NOM 3'26" GET)	CUES: 1. SECOND PLANE SEPARATION INDICATION SHOWS NO SEPARATION (M86-206) 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 APPROXIMATELY 56 VOLTS (M111-207) NOTES: 1. MANUAL ABORT BY CREW WITH ONBOARD INDICATION. 2. PROBABLE SUBSEQUENT LOSS OF VEHICLE DUE TO EXCESSIVE TEMPERATURE.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	5-17	S-II STAGE GIMBAL SYSTEM FAILURE ANY SINGLE ACTUATOR HARDOVER (INBOARD). A. PRIOR TO S-IVB TO ORBIT CAPABILITY. B. AFTER S-IVB TO ORBIT CAPABILITY.	LAUNCH	A. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST. B. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING.	CUES: 1. YAW ACTUATOR POSITION EXCEEDS +6 DEGREES (VG8-201 THROUGH 204) (G30-201 THROUGH 204). 2. PITCH ACTUATOR POSITION EXCEEDS +6 DEGREES (G9-201 THROUGH 204) (G31-201 THROUGH 204). 3. ROLL ATTITUDE ERROR EXCEEDS 5 DEG (VH69-602 AND VH56-603). 4. ROLL ATTITUDE RATE EXCEEDS 3 DEG/SEC (VR12-602 AND VR15-602). NOTE: IF ANY ACTUATOR POSITION IS LOST, THIS RULE WILL NOT BE IMPLEMENTED FOR THE ENGINE AND PLANE AFFECTED.
A	5-18	S-IVB COLD HELIUM SHUTOFF VALVE(S) FAIL OPEN A. PRIOR TO LAUNCH ESCAPE TOWER (LET) JETTISON B. AFTER LAUNCH ESCAPE TOWER (LET) JETTISON C. AFTER THE S-II DEPLETION CUTOFF SENSORS ARMED (TB3 + 5 MIN 30 SEC)		A. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST B. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING C. CONTINUE MISSION BSE INFORM FLIGHT	CUES: A. LOX ULLAGE PRESSURE AT 50 PSIA OR SATURATED AT UPPER LIMIT (D179-424; D180-424) B.1. COLD HELIUM DISCHARGE PRESSURE GREATER THAN 300 PSIA (D105-403) 2. LOX ULLAGE PRESSURE AT VENT VALVE RELIEF SETTING (NOMINAL 44 PSIA) AND RELIEVING (D179-424; D180-424) 3. COLD HELIUM BOTTLE PRESSURE DECAYING (D16-425; D263-405) C. SAME AS B.1, 2, AND 3 ABOVE. NOTES: 1. ACTION REQUIRED TO AVOID EXCEEDING LOX OVER PRESSURE STRUCTURAL LIMITS AND POSITIVE (+) ΔP COMMON BULKHEAD LIMITS. 2. THIS RULE WILL NOT BE IMPLEMENTED IF TWO OF THE THREE COLD HELIUM PRESSURE MEASUREMENTS AND/OR ONE OF TWO LOX ULLAGE PRESSURE MEASUREMENTS ARE LOST.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	5-19	S-IVB ENGINE ACTUATOR HARDOVER INDICATED PRIOR TO FIRST BURN.	LAUNCH	CONTINUE MISSION. BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF IMPENDING OVERRATE CONDITION AFTER S-IVB IGNITION. CREW EXECUTE MANUAL ABORT ON ESTABLISHED LIMIT AFTER S-IVB IGNITION.	CUES: 1. ACTUATOR POSITIONS +6 DEG OR GREATER (G1-403, G2-403) 2. ENGINE ACTUATOR ΔP EQUALS TO OR GREATER THAN 3300 PSIA. (D44-403, D45-403) NOTE: THE RATE LIMITS WHICH THE CREW WILL ABORT DURING S-IVB FLIGHT: PITCH OR YAW RATE - ±10 DEG/SEC
A	5-20	S-IVB LOSS OF STAGE HYDRAULIC FLUID CONFIRMED PRIOR TO FIRST BURN		ABORT BSE INFORM FLIGHT AND FIDO. TRANSMIT ABORT PRIOR TO S-II/S-IVB STAGING	CUES: 1. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (D41-403) 2. HYDRAULIC RESERVOIR OIL LEVEL APPROXIMATELY ZERO PERCENT. (L7-403) 3. HYDRAULIC RESERVOIR PRESSURE APPROXIMATELY ZERO PSIA (D42-403)
A	5-21	S-IVB STAGE LOSS OF THRUST A. FAILS TO ATTAIN THRUST BY TB4 + 10 SECONDS (NOMINAL S-II STAGES CUTOFF IS GET 8 MINUTES 49 SECONDS) OR TIME BASE 4A (EARLY STAGING SEQUENCE) PLUS 15 SECONDS B. S/C SEPARATED AND APS ULLAGE ENGINE ON.		A. ABORT BSE INFORM FLIGHT AND FIDO AND RECOMMEND ABORT. IMMEDIATELY AFTER SPACECRAFT SEPARATION BSE SEND APS ULLAGE ENGINES NOS. 1 AND 2 OFF. B. CONTINUE MISSION 1. BSE INFORM FLIGHT AND FIDO. 2. IMMEDIATELY AFTER SPACECRAFT SEPARATION BSE SEND APS ULLAGE ENGINES NOS. 1 AND 2 OFF.	CUES: 1. THRUST CHAMBER PRESSURE - ZERO (D1-401) 2. THRUST OK SWITCHES - OFF (K14-401, K157-401) 3. LONGITUDINAL ACCELERATION ZERO (A2-603) 4. TIME BASE 5 IS INITIATED, MODE CODE 25, BIT D2 SET TO 1. (H60-603)
A	5-22	S-IVB FIRST BURN IS EXTENDED LONGER THAN 3 MIN 03 SEC RULES 5-23 THROUGH 5-24 ARE RESERVED		S/C SPACECRAFT BSE INFORM FLIGHT AND FIDO AND RECOMMENDED SPACECRAFT SEPARATION PRIOR TO RESTART	CUES: 1. S-IVB FIRST BURN TIME NOTE: CURRENT PLANNING IS TO ASSESS PROPELLANT QUANTITIES REQUIRED TO ACHIEVE SATISFACTORY TLI GUIDANCE CUTOFF IN NEAR REAL TIME SIMULATIONS.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	5-25	TIME BASE 5 OR TB7 FAILS TO INITIATE AT S-IVB CUT-OFF		SPACECRAFT SEPARATION BSE INFORM FLIGHT AND RECOMMEND IMMEDIATE SEPARATION TO A SAFE DISTANCE.	CUES: 1. TIME OF TB INITIATE REMAINS AT PREVIOUS VALUE (H60-603) 2. TIME-IN-TIME BASE CONTINUES TO COUNT (H60-603) 3. GUIDANCE MODE WORD 1 (MODE CODE 25) BIT D2 NOT SET TO "ONE" FOR TB5 OR GUIDANCE MODE WORD 2 (MODE CODE 26) BIT D20 NOT SET TO "ONE" FOR TB7 (H60-603) 4. ORBITAL SEQUENCING FAILS TO INITIATE NOTES: 1. THIS CONDITION WILL RESULT IN LOSS OF SEQUENCING AND PITCH AND YAW ATTITUDE CONTROL. 2. THE LVDC WILL INITIATE TB5 OR TB7 AFTER RECEIVING ANY TWO OF FOUR FUNCTIONS, AFTER TB4 + 10 SEC, TB4A + 15 SEC, OR TB6 + 9 MIN 44 SEC A. S-IVB ENGINE OUT "A" B. S-IVB ENGINE OUT "B" C. S-IVB VELOCITY CUTOFF D. ACCELEROMETER LOSS OF THRUST INDICATION
		RULES 5-26 THROUGH 5-44 ARE RESERVED			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	5-45	J-2 ENGINE MAIN FUEL VALVE (MFV) FAILS OPEN: A. FIRST S-IVB CUTOFF		A. CONTINUE MISSION 1. BSE INFORM FLIGHT AND SEND (ASAP): PREVALVES AND RECIRC SHUTOFF VALVE CLOSED (SEE NOTE 1) 2. BSE ATTEMPT TO CYCLE MFV OPEN AND CLOSED. IF SUCCESSFUL, BSE SEND: A. ENGINE MFV CLOSED B. PREVALVE AND RECIRC SHUTOFF VALVES OPEN 3. IF COMMAND ACTION (A.2) UNSUCCESSFUL, BSE SEND: A. ENGINE MFV OPEN B. RECIRC SHUTOFF VALVES OPEN AFTER TB6 + 4 MIN 9 SEC 4. IF COMMAND ACTION (A.3.B) SENT AFTER TB6 + 6 MIN 30 SEC, IMPLEMENT FMR 5-62	CUES: 1. MAIN FUEL VALVE POSITION (G004-401) 2. MAIN FUEL VALVE OPEN (K118-401) 3. FUEL PUMP INLET PRESSURE (D002-403) NOTE: 1. IF THE MFV IS OPEN, THE LH_2 PUMP INLET PRESSURE WILL GO TO ZERO PSIA AFTER COMMAND ACTION (A.1).
		B. SECOND S-IVB CUTOFF		B. CONTINUE MISSION 1. BSE INFORM FLIGHT AND SEND PREVALVES AND RECIRC SHUTOFF VALVES CLOSED 2. PREVALVES AND RECIRC SHUTDOWN VALVES OPEN AT TB7 + 2 HR 12 MIN	
A	5-46	J-2 ENGINE MAIN OXIDIZER VALVE(S) FAILS TO CLOSE AT S-IVB CUTOFF. A. FIRST S-IVB CUTOFF		A. CONTINUE MISSION 1. BSE INFORM FLIGHT AND COMMAND (ASAP): PREVALVES AND RECIRC SHUTOFF VALVES CLOSED 2. BSE ATTEMPT TO CYCLE MOV OPEN AND CLOSED. IF SUCCESSFUL, BSE COMMAND: A. ENGINE MOV CLOSED B. PREVALVE AND RECIRC SHUTOFF VALVES OPEN 3. IF ATTEMPT OF CYCLE MOV IS UNSUCCESSFUL, RECOMMEND S/C SEPARATION PRIOR TO TB6.	CUES: 1. MAIN OXIDIZER VALVE POSITION (G3-401) 2. MAIN OXIDIZER VALVE OPEN (K120-401) 3. LOX PUMP INLET PRESSURE (D003-403) NOTE: A MANNED RESTART WILL BE ATTEMPTED IF THE MOV CAN BE CLOSED.
		B. SECOND BURN CUTOFF		B. CONTINUE MISSION BSE INFORM FLIGHT AND SEND: 1. PREVALVES AND RECIRC SHUTOFF VALVES CLOSED 2. PREVALVES AND RECIRC SHUTOFF VALVES OPEN AT TB7 + 2 HR 12 MIN	
	5-47	S-IVB RANGE SAFETY SYSTEM PROPELLANT DISPERSION SYSTEM INADVERTENTLY ARMS AFTER ORBITAL INSERTION AND PRIOR TO SAFING.	EARTH ORBITAL RESTART	SPACECRAFT SEPARATION BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT SEPARATION AND WITHDRAWAL TO A SAFE DISTANCE.	CUES: 1. FIRING UNIT 1 RC EBW (M030-411) BETWEEN 2.4 AND 4.5 VOLTS.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
					2. FIRING UNIT 2 RC EBW (M031-411) BETWEEN 2.4 AND 4.5 VOLTS. 3. RANGE SAFETY RECEIVER NO. 1 ENABLE (N057-411). 4. RANGE SAFETY RECEIVER NO. 2 ENABLE (N052-411). 5. RSO DISPLAY AND COMMAND SYSTEM STATUS. (VOICE VERIFICATION) NOTES: 1. THE SPACECRAFT ABORT REQUEST LIGHT MAY BE ILLUMINATED FOR A PROPELLANT DISPERSION SYSTEM ARMED CONDITION. 2. IF THE PROPELLANT DISPERSION SYSTEM ARMS DURING BOOST AND THE J-2 ENGINE DOES NOT CUT OFF PREMATURELY THE RSO CAN SEND SAFE COMMAND AFTER ORBITAL INSERTION. THIS CONDITION INDICATES THE FAILURE HAS OCCURRED IN THE RANGE SAFETY SYSTEM CONTROLLER K-2 RELAY. 3. EITHER CUE 1 OR CUE 2 IS SUFFICIENT FOR IMPLEMENTATION OF THIS RULE. 4. IF THE RANGE SAFETY SYSTEM IS NOT SAFED AND THE PROPELLANT DISPERSION SYSTEM IS NOT ARMED, THE RANGE SAFETY SYSTEM CAN BE SAFED AT THE NEXT OPPORTUNITY.
A	5-48	S-IVB AUXILIARY HYDRAULIC PUMP: A. FAILS TO TURN OFF TB5 + 4.1 SEC TB5 + 44 MIN 8 SEC TB5 + 1 HR 30 MIN 48 SEC TB5 + 3 HR 3 MIN TB7 + 4.1 SEC TB7 + 54 MIN 8 SEC TB7 + 2 HR 17 MIN 03 SEC B. FAILS TO TURN ON 1. S-IVB HYDRAULIC FLUID IS BELOW OR PREDICTED TO DROP BELOW 10°F BEFORE NEXT AOS.	EARTH ORBITAL RESTART	A. CONTINUE MISSION BSE INFORM FLIGHT AND SEND: AUXILIARY HYDRAULIC PUMP FLIGHT MODE OFF AS SOON AS POSSIBLE. B. CONTINUE MISSION 1. BSE INFORM FLIGHT AND SEND: AUXILIARY HYDRAULIC PUMP FLIGHT MODE ON.	CUES: 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) NOTE: 1. FAILURE TO TURN OFF HYDRAULIC PUMP DEPLETES AFT NO. 2 BATTERY IN APPROXIMATELY 90 MIN AND OVERHEATS HYDRAULIC SYSTEM IN APPROXIMATELY 13 MIN.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
		2. S-IVB AUXILIARY HYDRAULIC PUMP FAILS TO TURN ON AT TB6 + 3 MIN 39 SEC.		2. BSE INFORM FLIGHT AND SEND: AUXILIARY HYDRAULIC PUMP FLIGHT MODE OFF.	CUES: 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) NOTE: S-IVB AUXILIARY HYDRAULIC PUMP IS PROGRAMED TO TURN ON AT: TB5 + 43 MIN 20 SEC TB5 + 1 HR 30 MIN TB5 + 2 HR 55 MIN TB6 + 3 MIN 39 SEC TB7 + 53 MIN 20 SEC TB7 + 2 HR 11 MIN 30 SEC
	5-49	S-IVB COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE AT A. TB5 + 1.4 SEC		CONTINUE MISSION/SPACECRAFT SEPARATION A. BSE INFORM FLIGHT AND SEND: 1. LOX TANK NPV VALVE OPEN 2. LOX TANK FLIGHT PRESSURIZATION SHUTOFF VALVES CLOSED. IF (2) SUCCESSFUL CLOSE LOX NPV WHEN TANK PRESSURE IS BETWEEN 38-41 PSIA. 3. RECOMMEND SPACECRAFT SEPARATION IF LOX TANK ULLAGE PRESSURE AT 48 PSIA.	CUES: 1. COLD HELIUM DISCHARGE PRESSURE GREATER THAN 100 PSIA (D105-403) 2. COLD HELIUM BOTTLE PRESSURE DECAYING (D16-425, D263-405) 3. LOX TANK ULLAGE PRESSURES (D179-424, D180-424) AT RELIEF SETTING. 4. LOX PUMP INLET PRESS (D003-403) NOTES: 1. FAILURE TO CLOSE THE SHUTOFF VALVES WILL RESULT IN THE DEPLETION OF THE COLD HELIUM. 2. ACTION REQUIRED TO AVOID, EXCEEDING LOX TANK OVERPRESSURE LIMITS OR POSITIVE ΔP LIMITS.
		B. TB7 + 1.4 SEC		B. BSE INFORM FLIGHT AND SEND: 1. LOX TANK NPV VALVE OPEN AFTER TB7 + 2 MIN 30 SEC UNTIL THE ULLAGE PRESSURE IS BELOW 7 PSIA 2. RECOMMEND IMMEDIATE SEPARATION IF LOX TANK ULLAGE PRESSURE AT 48 PSIA.	
	5-50	CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO OPEN IN TB5 (TB5 + 50 SEC).		CONTINUE MISSION BSE INFORM FLIGHT AND SEND:	CUES: 1. LH_2 ULLAGE PRESSURE (D177-410, D178-410) 2. CVS NOZZLE PRESSURE (D181-409, D182-409)

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				1. CVS RELIEF OVERRIDE SHUTOFF VALVE OPEN IF UNSUCCESSFUL BSE: 2. VENT THE LH_2 TANK PRIOR TO TB6 TO A PRESSURE BELOW THE VALUE REQUIRED FOR TB6 INITIATE 3. IF THE LH_2 BLOWDOWN IS COMPLETED WITHIN 30 MINUTES PRIOR TO TB6 INITIATE SEND A. ULLAGE ENGINES ON AFTER 90 SEC OF ULLAGE SEND B. ULLAGE ENGINES OFF ULLAGING SHOULD BE COMPLETED PRIOR TO THE AMBIENT REPRESSURIZATION. 4. IF COMMAND ACTIONS 1 OR 2 IS NOT SUCCESSFUL PRIOR TO TB6 + 42 SEC, BSE RECOMMEND TLI INHIBIT	3. CVS REGULATOR CLOSED (K154-411) NOTE: 1. IF THE CVS REGULATOR FAILS TO OPEN, THE LH_2 SATURATION TEMPERATURE WILL INCREASE ABOVE RESTART LIMITS TO INSURE A COMPLETE BURN.
A	5-51	LOSS OF ATTITUDE CONTROL A. DURING TB5 AND TB7 B. FROM TB6 INITIATE TO TB6 + 9 MIN 10 SEC	EARTH ORBITAL RESTART	SPACECRAFT SEPARATION A. BSE INFORM FLIGHT AND RECOMMEND S/C SEP. B. TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	CUES: 1. THE DIFFERENCE BETWEEN COMMANDED ATTITUDE (CHI) AND ACTUAL VEHICLE ATTITUDE (THETA) IS GREATER THAN 5 DEG AND DIVERGING (H60-603) 2. ATTITUDE ERROR SIGNALS ARE EQUAL TO OR GREATER THAN 2.5 DEG IN PITCH AND YAW; 3.5 DEG IN ROLL AND ARE NOT DECREASING (H69-602, H70-602, H71-602, H54-603, H55-603, H56 H56-603) 3. THE VEHICLE ANGULAR RATES ARE GREATER THAN 2 DEG/SEC AND ARE NOT DECREASING (R7-603, R8-603, R11-603, R12-603, R13-603, R15-603) 4. FLIGHT CONTROL COMPUTER NOT IN CORRECT MODE (K20-602) 5. LVDA ERROR MONITOR REGISTER BIT D26, D25 AND D24 SET TO "ONES" (H60-603) 6. ORBITAL STATUS WORD (MODE CODE 28) BITS D20, D18 OR (60-603) 7. GUIDANCE FAILURE DISCRETE (D04) (MODE CODE 26) BIT D8 SET TO "ONE" (H60-603)

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
					NOTES: 1. THE SLV YAW GIMBAL (Z-AXIS) IS CRITICAL BEYOND ±45 DEGREES. 2. DURING PERIODS OF NO GND COM, CREW MAY ATTEMPT ATTITUDE CONTROL SWITCH-OVER TO ALLOW SEPARATION OVER A GROUND STATION
A	5-52	FAILURE TO TERMINATE APS ULLAGE ENGINE(S) THRUST AT TB5 + 1 MIN 27 SEC AND TB6 + 9 MIN 33 SEC	EARTH ORBITAL RESTART	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: A. S-IVB ULLAGE ENGINE NO. 1 AND 2 OFF. B. IF UNSUCCESSFUL, BSE INFORM FLIGHT OF IMPENDING LOSS OF ATTITUDE CONTROL.	CUES: 1. ULLAGE ENGINE THRUST CHAMBER PRESSURE GREATER THAN 90 PSIA (D220-414, D221-415) 2. APS HELIUM SPHERE PRESSURE DECREASING (D35-414, D36-414, D250-414, D251-415)
	5-53	IU ECS WATER VALVE FAILS TO CYCLE OPEN AND CLOSED. A. WATER VALVE CLOSED AND COOLANT INLET CONTROL TEMPERATURE IS 64°F OR HIGHER, AND THE INERTIAL GIMBAL TEMPERATURE IS PREDICTED TO BE EQUAL TO OR GREATER THAN 115°F BEFORE THE NEXT SITE AOS OR, THE LVDC MEMORY TEMPERATURE IS PREDICTED TO BE EQUAL TO OR GREATER THAN 112°F BEFORE THE NEXT SITE AOS. 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, THE LVDC MEMORY TEMPERATURE IS PREDICTED TO BE 32°F OR LESS BEFORE THE NEXT SITE AOS.	EARTH ORBITAL RESTART	CONTINUE MISSION A. BSE INFORM FLIGHT AND SEND: 1. ECS LOGIC INHIBIT COMMAND (AS NO. 5) 2. WATER VALVE OPEN B. BSE INFORM FLIGHT AND SEND: 1. ECS LOGIC INHIBIT COMMAND (AS NO. 5) 2. WATER VALVE CLOSED	CUES: 1. WATER VALVE CLOSED/OPEN (G5-601; G6-601) 2. ME/H_2O TEMP (C15-601) 3. OMW MODE CODE 27 BIT D8 SET TO "0". 4. ST-124 INERTIAL GIMBAL TEMP (C34-603) 5. SUBLIMATER INLET TEMP (C11-601) 6. LVDC MEMORY TEMP (C54-603) 7. LVDA TEMP NO. 1 (C55-603) 8. LVDA TEMP NO. 2 (C56-603)

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	5-54	ENGINE PUMP PURGE FAILS ON AT TB5 + 10 MIN 3 SEC	EARTH ORBITAL RESTART	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: ENGINE PUMP PURGE OFF	CUES: 1. ENGINE PUMP PURGE REGULATOR FAILS TO DECREASE FROM ABOUT 100 PSIA TO ABOUT 10 PSIA. (D50-403) 2. AMBIENT PNEUMATIC BOTTLE PRESSURE DECREASING AT A RATE OF 23 PSI/MIN (D236-403, D256-403) NOTE: IF NOT TERMINATED, THE PURGE WILL CAUSE THE DEPLETION OF THE AMBIENT HELIUM PNEUMATIC SUPPLY AT THE RATE OF 23 PSI/MIN.
	5-55	S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS: A. MINUS 20 PSID	EARTH ORBITAL RESTART	CONTINUE MISSION A. BSE INFORM FLIGHT AND SEND: LH_2 VENT VALVE OPEN IF UNSUCCESSFUL SEND: 1. LH_2 LATCHING RELIEF VALVE OPEN 2. LH_2 VENT VALVE CLOSED VALVES WILL BE CYCLED OPENED/CLOSED OR LEFT OPEN TO PRECLUDE REACHING SEPARATION LIMITS.	CUES: 1. LH_2 ULLAGE PRESSURE (D177-410, D178-410) 2. LH_2 PUMP INLET PRESSURE (D2-403) 3. LOX ULLAGE PRESSURE 4. LOX PUMP INLET PRESSURE (D3-403) NOTES: 1. MINUS DELTA PRESSURE IS DEFINED AS A FUEL TANK ULLAGE PRESSURE GREATER THAN THE LOX TANK ULLAGE PRESSURE. 2. PLUS DELTA PRESSURE IS DEFINED AS A LOX TANK ULLAGE PRESSURE. GREATER THAN THE FUEL TANK ULLAGE PRESSURE. 3. THE MINIMUM RECOMMENDED DISTANCE BETWEEN THE S-IVB AND THE SPACECRAFT IS 7000 FT. 4. THE BULKHEAD WILL STRUCTURALLY FAIL AT THE ULTIMATE LIMITS OF MINUS 32.5 PSID OR PLUS 42.0 PSID.
		B. PLUS 30 PSID		B. BSE INFORM FLIGHT AND SEND: LOX NPV VALVE OPEN IF SUCCESSFUL SEND: 1. LOX VENT VALVE OPEN 2. LOX NPV VALVE CLOSED VALVES WILL BE CYCLED OPENED/CLOSED OR LEFT OPEN TO PRECLUDE REACHING SEPARATION LIMITS.	
		C. MINUS 26 PSID PLUS 36 PSID		C. BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT SEPARATION TO A SAFE DISTANCE.	
A	5-56	LOSS OF S-IVB STAGE PNEUMATIC PRESSURE A. PRIOR TO TB6 + 8 MIN 45 SEC REGULATOR OUTLET PRESSURE <320 PSIA.		A. CONTINUE MISSION IMPLEMENT FMR 5-62	CUES: 1. AMBIENT HELIUM SUPPLY PRESS (D256-403, D236-403) 2. CONTROL HELIUM REGULATOR DISCHARGE PRESSURE 320 PSIA (D014-403, D247-403)

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
		B. PRIOR TO LOX NPV BLOW-DOWN AT TB7 + 0.7 SEC		B. CONTINUE MISSION 1. BSE INFORM FLIGHT AND CAPCOM ADVISE FLIGHT CREW THAT PROPULSIVE VENTING MAY OCCUR AFTER TB7 + 35 MIN 2. AT TB7 + 2:20:27 TERMINATE THE LOX DUMP IF BULKHEAD DELTA PRESSURE LIMITS EXCEEDED (SEE FMR 5-55).	2. CONTROL HELIUM REGULATOR DISCHARGE PRESSURE 320 PSIA (D014-403, D247-403) NOTE: LOSS OF S-IVB PNEUMATICS RESULTS IN LOSS OF LOX AND FUEL CHILLDOWN IN TB6.
A	5-57	S-IVB ENGINE CONTROL BOTTLE PRESSURE LESS THAN 400 PSIA A. PRIOR TO TB6 B. FROM TB6 INITIATE TO TB6 + 9 MIN 10 SEC	EARTH ORBITAL RESTART	A. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND RECOMMEND S/C SEPARATION PRIOR TO TB6 B. TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	CUES: ENGINE CONTROL BOTTLE PRESS (D019-401; D242-401)
A	5-58	INERTIAL PLATFORM FAILURE-ACCELEROMETER A. AFTER TB6 INITIATED BUT PRIOR TO TB6 + 9 MIN 10 SEC B. AFTER TB6 + 9 MIN 20 SEC (FOR ALL GROUND COVERAGE DURING BURN)	EARTH ORBITAL RESTART	A. TLI INHIBIT BSE INFORM FLIGHT AND FIDO. RECOMMEND TLI INHIBIT PRIOR TO TB6 + 9 MIN 20 SEC B. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO	CUES: 1. GUIDANCE STATUS WORD - (MOD 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) INDICATES IN EXCESS OF 0.5 DEG. (H10-603, H11-603, H12-603) NOTES: 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.
	5-59	LH_2 ULLAGE PRESSURE LESS THAN 15 PSIA DURING OR AFTER LAST STATESIDE PASS PRIOR TO RESTART		CONTINUE MISSION BSE INFORM FLIGHT AND SEND 1. CONTINUOUS VENT SYSTEM CLOSE 2. CONTINUOUS VENT ORIFICE SHUT-OFF VALVE OPEN	CUES: 1. LH_2 TANK ULLAGE PRESSURE (D177-410, D178-410) 2. LH_2 PUMP INLET PRESSURE (D002-403) NOTES: LOW PRESSURE MAY RESULT IN BURNER OVERTEMPERATURE.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	5-60	O_2/H_2 BURNER VOTING CIRCUIT FAILS TO DETECT A BURNER FLAME-OUT OR THAT THE BURNER HAS FAILED TO IGNITE. (TB6 + 48 SEC UNTIL TB6 + 8 MIN 17 SEC)	EARTH ORBITAL RESTART	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: 1. BURNER SHUTDOWN 2. CONTINUOUS VENT SYSTEM ORIFICE OPEN 3. CRYOGENIC REPRESSURIZATION OFF (THE THREE COMMANDS LISTED ABOVE ARE COMBINED UNDER ONE SW SEL LOAD)	CUES: 1. BNR CHAMBER DOME TEMPERATURE INDICATES 0°F OR LESS (C382-403) 2. BNR NOZZLE TEMPERATURE (C380-403) 3. BNR GH_2 INJECTOR TEMPERATURE (C383-403) 4. AMBIENT REPRESS MODE SELECT (K195-404) 5. BURNER PROPELLANT VALVE POSITIONS (K180-404, K192-404) NOTE: FAILURE CAUSED BY PROPELLANT VALVE FAILING TO OPEN.
A	5-61	COLD HELIUM SPHERE PRESSURE LOW A. LESS THAN 1200 PSIA BUT GREATER THAN 600 PSIA PRIOR TO TB6 INITIATE B. LESS THAN 600 PSIA PRIOR TO TB6 INITIATE C. LESS THAN 600 PSIA AFTER TB6 + 8 MIN 20 SEC		CONTINUE MISSION A.1. BSE INFORM FLIGHT AND SEND PRIOR TO TB6 INITIATE: BURNER LOX SHUTDOWN VALVES CLOSED 2. IF COMMAND ACTION UNSUCCESSFUL, BSE SEND IN TB6 (ASAP): BURNER LOX SHUTDOWN VALVE CLOSED B. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT SEPARATION PRIOR TO TB6 INITIATE. C. TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT.	CUES: 1. COLD HELIUM SPHERE PRESSURE (D016-425, D263-425) NOTES: 1. COMMAND ACTION WILL PRECLUDE BURNER START 2. COLD HELIUM REQUIREMENT A. 1200 PSIA FOR REPRESS AND BURN B. 600 PSIA FOR BURN
A	5-62	LH_2 CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS		CONTINUE MISSION BSE INFORM FLIGHT AND AT TB6 + 8 MIN 45 SEC SEND: 1. ENGINE READY BYPASS 2. PREVALVES OPEN 3. ENGINE START ON	CUES: 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 PRESSURE (D177-410, D178-410)

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
					8. LH_2 PUMP INLET TEMP (C003-404) NOTES: 1. START MAY BE OFF NOMINAL IF COMMAND ACTION UNSUCCESSFUL BUT MANNED RESTART TO BE ATTEMPTED. 2. IF COMMAND ACTION SUCCESSFUL AND FIRST BURN LATER INHIBITED, RECOMMEND SPACECRAFT SEPARATION PRIOR TO SECOND OPPORTUNITY.
A	5-63	LOX CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS		CONTINUE MISSION BSE INFORM FLIGHT	CUES: 1. LOX RECIRC FLOW (F004-424) 2. LOX PUMP INLET TEMP (C004-403) 3. LOX PREVALVE OPEN (K109-403) 4. LOX PREVALVE CLOSE (K110-403) 5. LOX BLEED VALVE CLOSE (K126-401) 6. LOX RECIRC VALVE CLOSE (K139-424) 7. LOX ULLAGE PRESSURE (D179-424, D180-424) 8. LOX PUMP INLET PRESSURE (D003-403)
	5-64	S-IVB LH_2 TANK ULLAGE PRESSURE LOW A. LH_2 VENT VALVE FAILS OPEN PRIOR TO TB6 + 9 MIN B. CONTINUOUS VENTS SYSTEM (CVS) REGULATOR FAILS TO CLOSE AT TB6 + 6 MIN 17 SEC C. LH_2 ULLAGE LESS THAN 25 PSIA AT TB6 + 9 MIN 10 SEC IF MANNED		A. TLI INHIBIT BSE INFORM FLIGHT AND SEND: LH_2 VENT VALVES CLOSE IF UNSUCCESSFUL, BSE RECOMMEND TLI INHIBITED. B. TLI INHIBIT BSE INFORM FLIGHT AND SEND: CVS REGULATOR CLOSE; IF UNSUCCESSFUL, BSE RECOMMEND TLI INHIBIT. C. TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	CUES: 1. LH_2 ULLAGE PRESSURE (D177-410, D178-410) 2. LH_2 PUMP INLET PRESSURE (D002-403) 3. FUEL VENT VALVE OPEN (K017-410) 4. FUEL VENT VALVE CLOSED (K001-410) 5. CVS REGULATOR CLOSED (K154-411) 6. CVS NOZZLE PRESSURE REMAINS GREATER THAN 3 PSIA (D181-409, D182-409)
A	5-65	S-IVB ACTUATOR CONFIRMED HARDOVER FROM TB6 INITIATE TO TB6 + 9 MIN 10 SEC	EARTH ORBITAL RESTART	TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT.	CUES: 1. ACTUATOR POSITION ±6 DEGREES OR GREATER (G1-401, G1-403; G2-401; G2-403).

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
					2. ENGINE ACTUATOR ΔP EQUALS TO OR GREATER THAN 3300 PSIA (D44-403; D45-403) NOTE: BOTH INDIVIDUAL ACTUATOR POSITIONS MUST CONFIRM MALFUNCTION PRIOR TO RECOMMENDING S/C SEPARATION OR TLI INHIBIT.
A	5-66	S-IVB LOSS OF ENGINE HYDRAULIC FLUID A. PRIOR TO TB6 B. FROM TB6 TO TB6 + 9 MIN 10 SEC IF MANNED	EARTH ORBITAL RESTART	A. S/C SEPARATION BSE INFORM FLIGHT AND RECOMMEND S/C SEPARATION PRIOR TO TB6 B. TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	CUES: 1. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (D41-403) 2. HYDRAULIC RESERVOIR OIL LEVEL APPROXIMATELY ZERO PERCENT. 3. HYDRAULIC RESERVOIR PRESSURE APPROXIMATELY ZERO PSIA (D42-403)
A	5-67	START BOTTLE PRESSURE A. GREATER THAN 1500 PSIA (1-1/2 ORBITS) FOR FIRST OPPORTUNITY B. GREATER THAN 1500 PSIA (2-1/2 ORBITS) FOR SECOND OPPORTUNITY		A. BSE INFORM FLIGHT AND SEND: 1. START TANK VENT VALVE OPEN 2. START TANK VENT VALVE CLOSED IN 3 SECONDS 3. COMMAND ACTION UNSUCCESSFUL RECOMMEND TLI INHIBIT B. CONTINUE MISSION/SPACECRAFT SEPARATION 1. START TANK VENT VALVE OPEN 2. START TANK VENT VALVE CLOSED IN 3 SECONDS 3. IF COMMAND ACTION UNSUCCESSFUL, RECOMMEND S/C SEP PRIOR TO TB6.	CUES: 1. START BOTTLE PRESSURE (D017-401, D241-401)
	5-68	LOX TANK ULLAGE PRESSURE LOW A. LOX VENT VALVES FAILS OPEN PRIOR TO TB6 + 9 MIN B. LOX ULLAGE PRESSURE LESS THAN 31 PSIA PRIOR TO TB6 + 9 MIN 10 SEC IF MANNED		A. TLI INHIBIT BSE INFORM FLIGHT AND SEND: LOX VENT VALVE CLOSE IF UNSUCCESSFUL, BSE RECOMMEND TLI INHIBIT. B. TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	CUES: 1. LOX ULLAGE PRESSURE (D17-424, D180-424) 2. LOX PUMP INLET PRESSURE (D003-403) 3. LOX VENT VALVE OPEN (K016-404) 4. LOX VENT CLOSED (K002-424) NOTES: 1. ULLAGE PRESSURE LESS THAN 37 PSIA INDICATES A MALFUNCTION.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	5-69	S-IVB FAILURE TO ATTAIN THRUST BY TB6 PLUS 9 MINUTES 40 SECONDS OR LOSS OF THRUST PRIOR TO TLI GUIDANCE CUTOFF		SPACECRAFT SEPARATION BSE INFORM FLIGHT AND COMMAND: APS ULLAGE ENGINES ON FOR 10 SEC AND THEN OFF IF NO COMMAND CAPABILITY EXISTS OR COMMAND ACTION IS UNSUCCESSFUL: THE SPACECRAFT SHOULD REMAIN ATTACHED TO THE S-IVB/IU AND MONITOR LH_2 AND LOX TANK ULLAGE PRESSURES. IF SEPARATION IS REQUIRED, THE SPACECRAFT SHOULD IMMEDIATELY GO TO A SAFE DISTANCE (7000 FT) FROM THE S-IVB/IU.	CUES: 1. CHAMBER PRESSURE ZERO (D1-401) 2. THRUST OK SWITCHES - OFF (K14-401, K157-401) 3. TIME BASE SEVEN INITIATED (H60-603) 4. TIME TO GO TO CUTOFF GREATER THAN ZERO (H60-603)
		RULES 5-70 THROUGH 5-90 ARE RESERVED			

FC021
12/11/68

APOLLO 8

FINAL FLIGHT MISSION RULES

REVISION A

PREFACE

THIS DOCUMENT CONTAINS REVISION A TO THE FLIGHT MISSION RULES FOR APOLLO 8 AS OF DECEMBER 11, 1968. 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. HAROLD M. DRAUGHON, FLIGHT CONTROL OPERATIONS BRANCH, BUILDING 45, ROOM 640, PHONE HU3-4846.

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

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

APPROVED BY:

for Sigurd A. Sjoberg

CHRISTOPHER C. KRAFT, JR.
DIRECTOR OF FLIGHT OPERATIONS

APOLLO 8

FINAL FLIGHT MISSION RULES

REVISION A

REVISION INSTRUCTION SHEET

UPDATE THIS DOCUMENT IN ACCORDANCE WITH THE FOLLOWING INSTRUCTIONS:

REMOVE AND REPLACE THE FOLLOWING REVISED PAGES:

iii	3-6	6-1	7-4	10-1	12-2
iv	3-7	6-2	8-1	10-2	12-3
1-3	4-1	6-4	8-2	10-4	12-4
1-6	4-4	6-5	8-3	11-3	12-5
1-8	4-6	6-6	8-4	11-4	12-7
1-9	4-7	6-7	8-5	11-6	13-3
1-10	4-8	6-8	8-6	11-7	13-4
3-3	4-10	6-9	8-7	11-9	13-5
3-4	4-11	7-1	8-8	11-10	14-2
3-5	4-13	7-2	8-10	12-1	14-4

REMOVE AND REPLACE THE FOLLOWING REVISED SECTIONS:

2, 5, 9, 15, 16, APPENDIX B

ADD THE FOLLOWING NEW PAGES:

i
iia
12-4A
12-5A

APOLLO 8

FINAL FLIGHT MISSION RULES

MISSION C'

PREFACE

THIS DOCUMENT CONTAINS THE FLIGHT MISSION RULES FOR APOLLO 8 AND CONSTITUTES THE FINAL DOCUMENTATION. THESE RULES WILL RECEIVE AN EXTENSIVE EVALUATION DURING THE SIMULATIONS PRIOR TO THE APOLLO 8 MISSION. SUBSEQUENT REVISIONS TO THIS DOCUMENT WILL BE PRINTED ON DIFFERENT COLORED PAGES FOR EASY RECOGNITION. INFORMATION CONTAINED WITHIN THIS DOCUMENT REPRESENTS THE FINAL FLIGHT MISSION RULES FOR THE APOLLO 8 MISSION AS OF NOVEMBER 7, 1968.

IT IS REQUESTED THAT ANY ORGANIZATION HAVING COMMENTS, QUESTIONS, OR SUGGESTIONS CONCERNING THESE MISSION RULES CONTACT MR. HAROLD M. DRAUGHON, FLIGHT CONTROL OPERATIONS BRANCH, BUILDING 45, ROOM 640, PHONE HU3-4846.

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APPROVED BY:

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REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	5-91	LH_2 LATCHING VENT VALVE FAILS TO OPEN AT: TB7 + 2 SEC OR, TB7 + 1 HOUR OR, TB7 + 2 HOURS 17 MIN 3 SEC	TRANSLUNAR	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: LH_2 LATCHING VENT VALVE OPEN IF UNSUCCESSFUL SEND: 1. LH_2 LATCHING VENT VALVE CLOSE 2. LH_2 VENT VALVE OPEN 3. LH_2 VENT VALVE CLOSED AT TB7 + 15 MIN OR TB7 + 1 HR 15 MIN	CUES: 1. LH_2 NPV NOZZLE PRESSURES (D183-409, D184-409) 2. LH_2 ULLAGE PRESSURE (D177-410, D178-410) NOTE: IF COMMAND ACTION UNSUCCESSFUL THERE MAY BE NON-PROPULSIVE VENTING DURING S/C SEPARATION.
A	5-92	LOX NON-PROPULSIVE VENT (NPV) FAILS TO OPEN AT: A. TB7 + 1 SEC B. TB7 + 2 HR 17 MIN 03 SEC	TRANSLUNAR	A. CONTINUE MISSION BSE INFORM FLIGHT AND SEND: LOX NPV VALVE OPEN IF UNSUCCESSFUL SEND: 1. LOX NPV VALVE CLOSE AND 2. LOX VENT VALVE (PROPULSIVE) OPEN FOR 45 SEC AND 3. LOX VENT VALVE CLOSE B. CONTINUE MISSION BSE INFORM FLIGHT AND SEND: LOX NPV VALVE OPEN IF UNSUCCESSFUL SEND: 1. LOX NPV VALVE CLOSE AND 2. LOX VENT VALVE (PROPULSIVE) OPEN	CUES: 1. LOX NPV NOZZLE PRESSURES (D243-404, D244-404) 2. LOX NPV OPEN DISCRETE (K198-424) 3. LOX NPV CLOSE DISCRETE (K199-424) 4. LOX ULLAGE PRESSURE (D179-424, D180-424)
	5-93	SPACECRAFT NOT SEPARATED BY TB7 + 1 HR 45 MIN (4 MIN PRIOR TO DUMP ATTITUDE MANEUVER)	TRANSLUNAR	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: 1. TIME BASE UPDATE TO PRECLUDE PROPELLANT DUMP UNTIL S/C SEPARATION 2. IF UNSUCCESSFUL, BSE SEND: PREVALVES AND RECIR VALVES CLOSED	CUES: 1. S/C SEPARATION NOT CONFIRMED BY CAPCOM 2. LVDC HAS NOT RECEIVED S/C SEP DISCRETE. DIN 4 (H60-603) NOTE: DIGITAL COMMAND SYSTEM IS ENABLED AT TB7 + 20 MIN

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	5-94	LH_2 TANK PRESSURE GREATER THAN 26 PSIA PRIOR TO INITIATION OF LOX DUMP (TB7 + 2 HR 12 MIN)	TRANSLUNAR	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: LH_2 CONTINUOUS VENT RELIEF OVERRIDE S/O VALVE OPEN IF UNSUCCESSFUL, SEND: LH_2 VENT VALVE OPEN AND CLOSED AS REQUIRED TO PROVIDE AN LH_2 ULLAGE PRESSURE OF <18 PSIA PRIOR TO LOX DUMP INITIATION.	CUES: 1. LH_2 ULLAGE PRESSURE (D0177-410, D0178-410) 2. LH_2 PUMP INLET PRESSURE (D003-403)
	5-95	LOX DUMP FAILS TO INITIATE AT TB7 + 2 HR 12 MIN 0 SEC	TRANSLUNAR	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: ENGINE LOX VALVE OPEN	CUES: 1. MAIN LOX VALVE POSITION (G003-401) 2. MAIN LOX VALVE OPEN (K120-401)
	5-96	FAILURE TO INITIATE COLD HELIUM DUMP	TRANSLUNAR	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: LOX PRESSURE S/O VALVE OPEN	CUES: 1. COLD HELIUM BOTTLE PRESSURE (D016-425, D263-405) 2. COLD HELIUM REGULATOR DISCHARGE PRESSURE (D105-403)
	5-97	ENGINE START BOTTLE DUMP FAILS TO INITIATE	TRANSLUNAR	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: START BOTTLE VENT CONTROL VALVE OPEN	CUE: GH_2 START BOTTLE PRESSURE (D017-401, D241-401)
	5-98	S-IVB AMBIENT HELIUM DUMP FAILS TO INITIATE	TRANSLUNAR	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: ENGINE PURGE ON	CUES: 1. ENGINE PUMP PURGE PRESSURE (D050-403) 2. AMBIENT HELIUM SUPPLY PRESSURE (D236-403, D256-403)
A	5-99	ENGINE CONTROL BOTTLE DUMP FAILS TO INITIATE	TRANSLUNAR	CONTINUE MISSION BSE INFORM FLIGHT AND SEND: ENGINE HELIUM CONTROL VALVE OPEN	CUE: ENGINE CONTROL HELIUM SPHERE PRESSURE (D019-401, D242-401)

REV	ITEM
	5-100

INSTRUMENTATION REQUIREMENTS

MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	REFERENCE
PRESS COMBUSTION CHAMBER	D8-101			HIGHLY DESIRABLE	5-3
PRESS COMBUSTION CHAMBER	D8-102			HIGHLY DESIRABLE	5-3
PRESS COMBUSTION CHAMBER	D8-103			HIGHLY DESIRABLE	5-3,4
PRESS COMBUSTION CHAMBER	D8-104			HIGHLY DESIRABLE	5-3
PRESS COMBUSTION CHAMBER	D8-105			HIGHLY DESIRABLE	5-3
POS PITCH ACTUATOR	VG1-101			HIGHLY DESIRABLE	5-5,12
POS PITCH ACTUATOR	VG1-102			HIGHLY DESIRABLE	5-5,12
POS PITCH ACTUATOR	VG1-103			HIGHLY DESIRABLE	5-5,12
POS PITCH ACTUATOR	VG1-104			HIGHLY DESIRABLE	5-5,12
POS YAW ACTUATOR	VG2-101			HIGHLY DESIRABLE	5-5,12
POS YAW ACTUATOR	VG2-102			HIGHLY DESIRABLE	5-5,12
POS YAW ACTUATOR	VG2-103			HIGHLY DESIRABLE	5-5,12
POS YAW ACTUATOR	VG2-104			HIGHLY DESIRABLE	5-5,12
THRUST OK PRESS SW NO. 1 ENG NO. 3	K39-115			HIGHLY DESIRABLE	5-3,4
THRUST OK PRESS SW NO. 2 ENG NO. 3	K40-115			HIGHLY DESIRABLE	5-3,4
FINAL THRUST OK CUTOFF ENG NO. 1	K52-115			HIGHLY DESIRABLE	5-3
FINAL THRUST OK CUTOFF ENG NO. 2	K53-115			HIGHLY DESIRABLE	5-3
FINAL THRUST OK CUTOFF ENG NO. 3	K54-115			HIGHLY DESIRABLE	5-3,4
FINAL THRUST OK CUTOFF ENG NO. 4	K55-115			HIGHLY DESIRABLE	5-3
FINAL THRUST OK CUTOFF ENG NO. 5	K56-115			HIGHLY DESIRABLE	5-3
E1 THRUST CHAMBER P	D13-201			HIGHLY DESIRABLE	5-15
E2 THRUST CHAMBER P	D13-202			HIGHLY DESIRABLE	5-15
E3 THRUST CHAMBER P	D13-203			HIGHLY DESIRABLE	5-15
E4 THRUST CHAMBER P	D13-204			HIGHLY DESIRABLE	5-15
E5 THRUST CHAMBER P	D13-205			HIGHLY DESIRABLE	5-15
POS YAW ACTUATOR	VG8-201			1 OF 2 MANDATORY	5-12,16
POS YAW ACTUATOR	G30-201				
POS YAW ACTUATOR	VG8-202			1 OF 2 MANDATORY	5-12,16
POS YAW ACTUATOR	G30-202				
POS YAW ACTUATOR	VG8-203			1 OF 2 MANDATORY	5-12,16
POS YAW ACTUATOR	G30-203				
POS YAW ACTUATOR	VG8-204			1 OF 2 MANDATORY	5-12,16
POS YAW ACTUATOR	G30-204				
POS PITCH ACTUATOR	G9-201			1 OF 2 MANDATORY	5-12,16
POS PITCH ACTUATOR	G31-201				
POS PITCH ACTUATOR	G9-202			1 OF 2 MANDATORY	5-12,16
POS PITCH ACTUATOR	G31-202				
POS PITCH ACTUATOR	G9-203			1 OF 2 MANDATORY	5-12,16
POS PITCH ACTUATOR	G31-203				
POS PITCH ACTUATOR	G9-204			1 OF 2 MANDATORY	5-12,16
POS PITCH ACTUATOR	G31-204				
E1 M/S OK DEPRESS A	K285-201			HIGHLY DESIRABLE	5-15
E2 M/S OK DEPRESS A	K285-202			HIGHLY DESIRABLE	5-15
E3 M/S OK DEPRESS A	K285-203			HIGHLY DESIRABLE	5-15
E4 M/S OK DEPRESS A	K285-204			HIGHLY DESIRABLE	5-15
E5 M/S OK DEPRESS A	K285-205			HIGHLY DESIRABLE	5-15
LH_2 TANK ULLAGE P EDS 1	D252-219	METER	COMMON	HIGHLY DESIRABLE	NONE
LH_2 TANK ULLAGE P EDS 2	D253-219	METER	COMMON	HIGHLY DESIRABLE	NONE
E1 M/S OK DEPRESS B	K286-201			HIGHLY DESIRABLE	5-15
E2 M/S OK DEPRESS B	K286-202			HIGHLY DESIRABLE	5-15
E3 M/S OK DEPRESS B	K286-203			HIGHLY DESIRABLE	5-15
E4 M/S OK DEPRESS B	K286-204			HIGHLY DESIRABLE	5-15
E5 M/S OK DEPRESS B	K286-205			HIGHLY DESIRABLE	5-15
SECOND SEP FIRING MON 1A	VM86-206			HIGHLY DESIRABLE	5-17
RECIRC DC BUS VOLT	XM111-207			HIGHLY DESIRABLE	5-17
IGNITION DC BUS VOLT	XM125-207			HIGHLY DESIRABLE	5-17
TEMP, FUEL PUMP INLET	XC3-403			HIGHLY DESIRABLE	5-62,45
TEMP, OXID PUMP INLET	XC4-403			HIGHLY DESIRABLE	5-63
TEMP, GOX/GH2 BNR LH_2 NOZZLE	C380-403			HIGHLY DESIRABLE	5-60
TEMP, BURNER CHAMBER DOME	C382-403			HIGHLY DESIRABLE	5-60
TEMP, BURNER GH_2 INJ	C383-403			HIGHLY DESIRABLE	5-60
PRESS - THRUST CHAMBER	D1-401			HIGHLY DESIRABLE	5-21,69
PRESS - FUEL PUMP INLET	XD2-403			HIGHLY DESIRABLE	5-55,62,64, 94,45,58

REV	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	REFERENCE
	5-100 (CONT)	PRESS - OXIDIZER PUMP INLET	XD3-403			HIGHLY DESIRABLE	5-55,68,48,63
		PRESS - COLD HE REG DISCHARGE	VXD14-403			HIGHLY DESIRABLE	5-57
		PRESS COLD HELIUM SPHERE	VXD16-425*			HIGHLY DESIRABLE	5-48,61,96,18
		PRESS - GH_2 START BOTTLE	VXD17-401			HIGHLY DESIRABLE	5-97,67
		PRESS - ENGINE CONTROL HE SPHERE	VXD19-401			HIGHLY DESIRABLE	5-57-99
		PRESS - ATT CONT HE PRESS TANK 1	VXD35-414			HIGHLY DESIRABLE	5-52
		PRESS - ATT CONT HE PRESS TANK 2	VXD36-415			HIGHLY DESIRABLE	5-52
		PRESS - HYDRAULIC SYSTEM	VXD41-403			HIGHLY DESIRABLE	5-20,49,66
		PRESS - RESERVOIR OIL	VXD42-403			HIGHLY DESIRABLE	5-20,49,66
		PRESS - LOX TK PRESS MOD HE GAS	D105-403*			HIGHLY DESIRABLE	5-48,96,18
		PRESS - FUEL TANK ULLAGE EDS 1	VD177-410	METER	COMMON**	HIGHLY DESIRABLE	5-51,55,62, 64,91,94,58
		PRESS - FUEL TANK ULLAGE EDS 2	VD178-410	METER	COMMON	HIGHLY DESIRABLE	5-51,55,62, 64,91,94,58
		PRESS - OXID TANK ULLAGE EDS 1	VD179-424	METER	COMMON	HD } 1 OF 2 M	5-48,55,68, 92,18,63
		PRESS - OXID TANK ULLAGE EDS 2	VD180-424	METER	COMMON	HD } 1 OF 2 M	5-48,55,68, 92,18,63
		PRESS - FUEL TK CONT VENT 1	D181-409			HIGHLY DESIRABLE	5-51,62,64
		PRESS - FUEL TK CONT VENT 2	D182-409			HIGHLY DESIRABLE	5-51,62,64
		PRESS - ULLAGE CONT CHAMBER 1-4	D220-414			HIGHLY DESIRABLE	5-52
		PRESS - ULLAGE CONT CHAMBER 2-4	D221-415			HIGHLY DESIRABLE	5-52
		PRESS - AMBIENT HE PNEU SPHERE	VXD236-403			HIGHLY DESIRABLE	5-54,56,98
		PRESS - GH_2 ST BOTT BACKUP	D241-401			HIGHLY DESIRABLE	5-97,67
		PRESS - ENG CONT HE SP BKUP	D242-401			HIGHLY DESIRABLE	5-57,99
		PRESS - CONTL HE REG DISC	D247-403			HIGHLY DESIRABLE	5-56
		PRESS - ATT CONT HE TANK 1	D250-414			HIGHLY DESIRABLE	5-52
		PRESS - ATT CONT HE TANK 2	D251-415			HIGHLY DESIRABLE	5-52
		PRESS - AMB HE PNEU SPH	D256-403			HIGHLY DESIRABLE	5-54,56,98
		PRESS - COLD HE SPHERE	D263-405*			HIGHLY DESIRABLE	5-55,61,96, 18,48
		FLOW RATE - FUEL CIRCULATION PUMP	F5-404			HIGHLY DESIRABLE	5-62
		POS - ACT PIST POT PITCH	VG1-403			HIGHLY DESIRABLE	5-19,65
		POS - ACT PIST POT PITCH	G1-400			HIGHLY DESIRABLE	5- 65
		POS - ACT PIST POT YAW	G2-403			HIGHLY DESIRABLE	5-19/65
		POS - ACT PIST POT YAW	G2-400			HIGHLY DESIRABLE	5- 65
		POS - MAIN OXIDIZER VALVE	G3-401			HIGHLY DESIRABLE	5-46,95
		POS - MAIN FUEL VALVE	G4-401			HIGHLY DESIRABLE	5-45
		EVENT - FUEL TK VENT VLV CL	K1-410			HIGHLY DESIRABLE	5-64
		EVENT - OXID TANK VENT VLV - CL	K2-424			HIGHLY DESIRABLE	5-68
		EVENT - FUEL TK VENT VALVE 1 - OPEN	K17-410			HIGHLY DESIRABLE	5-64
		EVENT - REL OVRD SOL LH_2 TANK - CL	K154-411			HIGHLY DESIRABLE	5-51,64

** M FOR CREW DISPLAY
* 2 OF 3 MANDATORY

REV	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	REFERENCE
	5-100 (CONT)	EVENT - REPRESS SYS AMB MODE	K195-404			HIGHLY DESIRABLE	5-60
		EVENT - LOX NPV VLV OPEN	K198-403			HIGHLY DESIRABLE	5-92
		EVENT - LOX NPV VLV CLOSE	K199-403			HIGHLY DESIRABLE	5-92
		LEVEL - RESERVOIR OIL	VXL7-403			HIGHLY DESIRABLE	5-20,49,66
		VOLT - F/U 1 EBW R/S	XM30-411			HIGHLY DESIRABLE	5-47
		VOLT - F/U 2 EBW R/S	XM31-411			HIGHLY DESIRABLE	5-47
		MISC - PU SYS LH_2 CRSE MASS VOLT	VXN1-411			HIGHLY DESIRABLE	
		MISC - PU SYS LOX CRSE MASS VOLT	VXN3-411			HIGHLY DESIRABLE	
		SEC R/S RCVR 1 L/L SIG STR	VN57-411			HIGHLY DESIRABLE	5-47
		SEC R/S RCVR 2 L/L SIG STR	VN62-411			HIGHLY DESIRABLE	5-47
		ACCELERATION, LONGITUDINAL	VA2-603			HIGHLY DESIRABLE	5-3/15,21
		TEMP, METHANOL/WATER CONTROL	VXC15-601			HIGHLY DESIRABLE	5-53
		TEMP, ST-124M INT INERTIAL GIMBAL	VC34-603			HIGHLY DESIRABLE	5-53
		TEMP, GUID COMPUTER (MEMORY)	VC54-603			HIGHLY DESIRABLE	5-53
		TEMP, DATA ADAPTER	VC55-603			HIGHLY DESIRABLE	5-53
		TEMP, DATA ADAPTER	VC56-603			HIGHLY DESIRABLE	5-53
		PRESS, GN_2 REG INLET	XD10-603			HIGHLY DESIRABLE	
		POS, WATER CONT VALVE CLOSED	VG5-601			HIGHLY DESIRABLE	5-53
		POS, WATER CONT VALVE OPEN	G6-601			HIGHLY DESIRABLE	5-53
		ATT ERROR PITCH - LADDER OUTPUT	VH54-603			HIGHLY DESIRABLE	5-12,14, 15,50
		ATT ERROR YAW - LADDER OUTPUT	VH55-603			HIGHLY DESIRABLE	5-12,14, 15,50
		ATT ERROR ROLL - LADDER OUTPUT	VH56-603			HIGHLY DESIRABLE	5-5,12,14, 15,50,16
		GUID COMPUTER OPERATION	H60-603			MANDATORY	5-13,14,15, 17,21,22, 25,50,53, 59,69,93
		ATT ERROR SIG ANG POS ROLL	VH69-602			HIGHLY DESIRABLE	5-5,12,14, 15,50,16
		ATT ERROR SIG ANG POS YAW	VH70-602			HIGHLY DESIRABLE	5-12,14,15, 50
		ATT ERROR SIG ANG POS PITCH	VH71-602			HIGHLY DESIRABLE	5-12,14,15, 50
		COMP RESET PULSE NO. 1 GUID DECODER	VJ71-603			HIGHLY DESIRABLE	
		COMP RESET PULSE NO. 2 GUID DECODER	VJ72-603			HIGHLY DESIRABLE	
		MODE SWITCH SPACECRAFT IU	VK19-602			HIGHLY DESIRABLE	
		S-IVB BURN	VK20-602			HIGHLY DESIRABLE	5-12,50
		ANG VEL, PITCH EDS GROUP 1	VR7-602			HIGHLY DESIRABLE	5-12,15,50
		ANG VEL, YAW EDS GROUP 1	VR8-602			HIGHLY DESIRABLE	5-12,15,50
		ANG VEL, YAW EDS GROUP 2	VR11-602			HIGHLY DESIRABLE	5-12,15,50
		ANG VEL, ROLL EDS GROUP 2	VR12-602			HIGHLY DESIRABLE	5-5,12,15, 50,16
		ANG VEL, PITCH EDS GROUP 3	VR13-602			HIGHLY DESIRABLE	5-12,15,50
		ANG VEL, ROLL EDS GROUP 3	VR15-602			HIGHLY DESIRABLE	5-5,12,15, 50,16

6 ENVIRONMENTAL CONTROL SYSTEM

REV	ITEM	GENERAL
	6-1	LAUNCH LAUNCH WILL BE CONTINUED AS LONG AS THE SUIT CIRCUIT AND O_2 SUPPLY WILL SUPPORT FLIGHT CREW DEMANDS AT LEAST ONE REV AND ENTRY INTO 2-1. THERE ARE NO COOLANT FAILURES FOR WHICH THE LAUNCH/INSERTION PHASE WILL BE TERMINATED.
	6-2	OTHER PHASES BACKUP SYSTEMS AND BACKUP COMPONENTS WILL BE USED FOR THE MOST RAPID PRACTICAL RETURN TO EARTH; NOT FOR MISSION CONTINUATION.
A	6-3	FLIGHT CREW WILL DON SUITS FOR THE FOLLOWING: A. CABIN PRESSURE CANNOT BE MAINTAINED ABOVE 4.5 PSIA. B. GLYCOL LEAKS IN COMMAND MODULE. C. FIRE, SMOKE, CONTAMINATION IN CABIN.
	6-4	THE FLIGHT CREW WILL DOFF SUITS (TIME AND CONDITIONS PERMITTING) FOR THE FOLLOWING: A. LOSS OF SUIT CIRCULATION. B. CONFIRMED LEAK OF GLYCOL IN SUIT CIRCUIT. C. FLIGHT PLAN OPTION AFTER TLI.
		RULES 6-5 THROUGH 6-9 ARE RESERVED.

REV	ITEM	SYSTEMS MANAGEMENT
A	6-10	O_2 SYSTEM A. LiOH CANISTER WILL BE REPLACED EVERY 12 HOURS OR 7.6 MM Hg OF PCO2 WHICHEVER COMES FIRST. B. SUIT FLOW RELIEF VALVE WILL REMAIN CLOSED FOR DURATION OF FLIGHT. C. NORMAL CABIN REPRESSURIZATION WILL UTILIZE SURGE TANK PLUS REPRESS PACK. D. SURGE TANK AND REPRESS TANK WILL BE RECHARGED SIMULTANEOUSLY. E. THE PLSS VALVE WILL BE IN OFF POSITION FOR TLC, LO AND TEC. F. SURGE TANK WILL BE ON LINE FOR DURATION OF FLIGHT. G. THE SUIT CIRCUIT MUST BE PURGED OF ACCUMULATED HYDROGEN ONCE EVERY 6 HOURS FOR ONE MINUTE DURATION WHEN ALL CREWMAN ARE SUITED AND THE SUIT CIRCUIT ISOLATED FROM THE CABIN.
	6-11	COOLANT MANAGEMENT A. FOR SIMULTANEOUS PRIMARY AND SECONDARY LOOP OPERATIONS ONE RADIATOR WILL BE ISOLATED. B. GLYCOL RESERVOIR WILL BE ON LINE FOR LAUNCH. C. INDICATED GLYCOL ACCUMULATOR QUANTITY WILL BE MAINTAINED BETWEEN 30 PERCENT AND 70 PERCENT. (CORRESPONDS TO 26 AND 81 PERCENT ACTUAL). D. SECONDARY COOLANT WILL BE OFF FOR LAUNCH. E. ADDITIONAL LOADS MAY BE ADDED TO MAINTAIN PRI RAD OUT T >-20°F
A	6-12	H_2O MANAGEMENT 1. WATER DUMPS WILL BE MANAGED TO ACCOMMODATE THE FOLLOWING GUIDLINES: A. MAXIMUM 90 PERCENT B. LOI MINIMUM ____ PERCENT. C. ENTRY INTERFACE MINIMUM 80 PERCENT. D. TRANSLUNAR COAST MINIMUM ____ PERCENT. E. TRANSEARTH COAST MINIMUM ____ PERCENT. 2. IN THE EVENT THE WASTE WATER TRANSDUCER IS INOPERATIVE, WASTE WATER WILL BE DUMPED TO ZERO IN ORDER TO GET A KNOWN STARTING POINT EACH TIME.
		RULES 6-13 THROUGH 6-19 ARE RESERVED.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-20	CABIN PRESSURE CANNOT BE RELIEVED	LAUNCH	CONTINUE MISSION	NORMAL RELIEF START AT T + 47 SECONDS
	6-21	CABIN PRESSURE DECREASING AND/OR <4.5 PSIA			
		A. SUIT PRESSURE >3.5 PSIA	LAUNCH	A. CONTINUE MISSION	
			EPO	ENTER NEXT BEST PTP IF CABIN NOT RESTORED >4.5 PSIA	MALF ECS 10
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
		B. SUIT PRESSURE <3.5 PSIA	LAUNCH	B. ABORT ASAP	MALF ECS 8
			EPO	ENTER ASAP	
			TLC	ENTER ASAP	
			LO	ENTER ASAP	
			TEC	ENTER ASAP	
		C. LOSS OF SUIT CIRCULATION	LAUNCH	C. ABORT ASAP DIRECT O_2 - OPEN 45 DEG FROM LAUNCH SETTING FOR VENTILATION	MALF ECS 9 CORRESPONDS TO 12.6 LB/HR (APPROX 3 CFM/CREWMAN)
			EPO	ENTER ASAP	
			TLC	ENTER ASAP	
			LO	ENTER ASAP	
			TEC	ENTER ASAP	
	6-22	LOSS OF SUIT CIRCULATION CABIN STABLE AND >4.5 PSIA	LAUNCH	CONTINUE MISSION DIRECT O_2 - OPEN 45 DEG FROM LAUNCH SETTING FOR SUIT VENTILATION	MALF ECS 9
			EPO	ENTER NEXT BEST PTP WITHIN 4 HOURS A. DOFF SUITS B. OPEN WASTE STOWAGE VENT OR WASTE OVERBOARD DRAIN TO OBTAIN BLEED FLOW C. DON FACE MASKS (AFTER 1 HR)	
			TLC	ENTER ASAP	
			LO	ENTER ASAP	
			TEC	ENTER ASAP	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-23	LOSS OF SURGE TANK OR REPRESS PACK (LEAK IN SYSTEM RESULTING IN ISOLATION)	ALL PHASES	CONTINUE MISSION LEAK IN SURGE TANK. ISOLATE SURGE TANK AND PLACE PLSS VALVE TO FILL	
A	6-24	LOSS OF SURGE TANK AND REPRESS PACK (LEAK IN TANKS RESULTING IN ISOLATION)	LAUNCH	CONTINUE MISSION	
			EPO	NO-GO FOR TLI	
			TLC	NO-GO FOR LOI	
			LO	CONTINUE MISSION	
	6-25	FIRE OR SMOKE IN COMMAND MODULE	LAUNCH	ABORT A. DECOMPRESS CABIN B. TROUBLESHOOT ELECTRICAL SYSTEM PER FLIGHT CREW CHECKLIST BOOST FIRE PROCEDURES	
			EPO	A. TROUBLESHOOT/COMBAT FIRE PER FLIGHT CREW CHECKLIST EMERGENCY PROCEDURES B. ASSESS DAMAGE AND REMOVE POWER FROM AFFECTED SYSTEMS C. ENTER NEXT BEST PTP	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
A	6-26	CONTAMINATION IN CABIN	ALL PHASES	CREW MAY ELECT TO DECOMPRESS IF UNABLE TO CLEAR CONTAMINATION, MISSION MAY BE TERMINATED EARLY	
	6-27	LOSS OF SUIT INTEGRITY	LAUNCH	CONTINUE MISSION	
			EPO	NO-GO FOR TLI	MALF ECS 9A
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-28	A. O_2 MANIFOLD LEAKS >4 LBS/HR AND CABIN PRESSURE >4.5	LAUNCH	A. CONTINUE MISSION	
			EPO	ENTER NEXT BEST PTP	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
		B. O_2 MANIFOLD LEAKS >4 LBS/HR AND CABIN PRESSURE <4.5	LAUNCH	B. ABORT ASAP	B. THERE ARE NO SINGLE POINT FAILURES WHICH WOULD RESULT IN THIS CONDITION
			EPO	ENTER ASAP	
			TLC	ENTER ASAP	
			LO	ENTER ASAP	
	6-29	LOSS OF ONE MAIN REGULATOR	LAUNCH	CONTINUE MISSION	
			EPO	NO-GO TLI	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
A	6-30	BOTH MAIN REGULATORS FAILED CLOSED	LAUNCH	CONTINUE MISSION	
			EPO	ENTER NEXT BEST PTP	
			TLC	ENTER ASAP	
			LO	ENTER ASAP	
A	6-31	LOSS OF ONE SUIT COMPRESSOR	LAUNCH	CONTINUE MISSION	
			EPO	NO-GO FOR TLI	
			TLC	CONTINUE MISSION	
		RULES 6-32 THROUGH 6-34 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	6-35	PRIMARY COOLANT LOOP MALFUNCTIONS			
		A. LOSS OF EVAPORATOR	LAUNCH	A. CONTINUE MISSION	MALF ECS 16
			EPO	CONTINUE MISSION ACTIVATE SECONDARY COOLANT LOOP WITH RADIATORS IN BYPASS TO MAINTAIN EVAP OUT TEMP <60°F AS REQUIRED. WATER MANAGEMENT MAY DICTATE DEACTIVATION AT RAD OUT <45°F.	DO NOT ALLOW PRIM RAD OUT TO DROP BELOW -20°F.
			TLC	NO-GO FOR LOI	
			LO	ENTER NEXT BEST PTP	
		B. LOSS OF RADIATORS (LEAK IN RADIATORS RESULTING IN ISOLATION)	EPO	B. NO-GO FOR TLI 1. ACTIVATE SECONDARY LOOP 2. USE PRIMARY LOOP IN ADDITION TO SECONDARY LOOP FOR G&N OPERATIONS	MALF ECS 19
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
		C. TOTAL LOSS OF LOOP (COMPLETE LOSS OF FLUID OR LOSS OF FLOW)	LAUNCH	C. CONTINUE MISSION 1. ACTIVATE SECONDARY LOOP 2. ENTER PTP 4-4	
			EPO	ENTER NEXT BEST PTP ACTIVATE SECONDARY LOOP	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
	6-36	SECONDARY LOOP MALFUNCTIONS			
		A. LOSS OF EVAPORATOR	EPO	A. NO-GO FOR TLI	MALF ECS 21
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
		B. LOSS OF RADIATORS (LEAK IN RADIATORS RESULTING IN ISOLATION)	EPO	B. NO-GO FOR TLI LOOP IS STILL OPERATIONAL IN EVAPORATIVE MODE.	MALF ECS 26
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
		C. TOTAL LOSS OF LOOP (COMPLETE LOSS OF FLUID OR LOSS OF FLOW)	EPO	C. NO-GO FOR TLI	MALF ECS 26
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	6-37	LOSS OF ALL COOLING PRIMARY AND SECONDARY	LAUNCH	CONTINUE MISSION	
			EPO	ENTER NEXT ATP OR PTP MAXIMUM ORBIT TIME: 4 HRS EMERGENCY POWER DOWN FOLLOWED BY 1.5 HRS OF POWER UP FOR ENTRY.	
			TLC	ENTER ASAP	
	6-38	CONFIRMED LEAK OF GLYCOL COOLANT	LAUNCH	CONTINUE MISSION	
		A. IN COMMAND MODULE	EPO	A. ENTER NEXT BEST PTP 1. DON SUITS 2. PURGE SUIT LOOP WITH DIRECT O_2	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
		B. IN SUIT CIRCUIT	EPO	B. ENTER NEXT BEST PTP DO NOT DON SUITS FOR ENTRY	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
		RULES 6-39 THROUGH 6-44 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-45	EITHER URINE DUMP FROZEN OR BLOCKED	ALL PHASES	CONTINUE MISSION	
	6-46	FAILURE OF BOTH WATER ACCUMULATORS OR UNCONTROL-LABLE HIGH SUIT CIRCUIT HUMIDITY	EPO	NO-GO FOR TLI. ENTER NEXT BEST PTP	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
	6-47	LOSS OF POTABLE OR WASTE TANK	EPO	NO-GO FOR TLI	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
		RULES 6-48 THROUGH 6-54 ARE RESERVED			

REV	ITEM
A	6-55

INSTRUMENTATION REQUIREMENTS

MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	REFERENCE
CABIN P	CF0001P	METER	COMMON	ONE OF THREE	6-21
SUIT P	CF0012P	METER	COMMON	MANDATORY	
TANK BLADDER P	CF0120P	-----	------		
PRIM ACCUM QTY	CF0019Q	METER	COMMON	ONE OF TWO	6-35, 6-37
PRIM PUMP OUT P	CF0016P	METER	COMMON	MANDATORY	6-38
POTABLE H_2O QTY	CF0010Q	METER	COMMON	ONE OF TWO	6-45, 6-46,
WASTE H_2O QTY	CF0009Q	METER	COMMON	MANDATORY	6-47, 6-12
SEC STEAM P	CF0073P	METER	COMMON	ONE OF TWO	6-36
SEC EVAP OUT T	CF0071T	METER	COMMON	MANDATORY	
SURGE TANK P	CF0006P	METER	COMMON	HIGHLY DESIRABLE	
SEC ACCUM QTY	CF0072P	METER	COMMON	HIGHLY DESIRABLE	
SEC PUMP OUT P	CF0070P	METER	COMMON	HIGHLY DESIRABLE	
PRIM EVAP OUT T	CF0018T	METER	COMMON	HIGHLY DESIRABLE	
PRIM STEAM P	CF0034	METER	COMMON	HIGHLY DESIRABLE	
ECS O_2 FLOW	CF0035R	METER	COMMON	HIGHLY DESIRABLE	
O_2 MANIFOLD P	CF0036P	-----	------	HIGHLY DESIRABLE	
SUIT COMP P	CF0015P	METER	COMMON	HIGHLY DESIRABLE	
PRIM RAD OUT TEMP	CF0020T	METER	COMMON	HIGHLY DESIRABLE	
PRIM EVAP INLET T	CF0181T	-----	------	HIGHLY DESIRABLE	
STEAM DUCT TEMP	CF0017T	-----	------	HIGHLY DESIRABLE	
SEC RAD OUT TEMP	SF0236T	METER	------	HIGHLY DESIRABLE	

7 CRYOGENICS

REV	ITEM	GENERAL
	7-1	LAUNCH 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.
	7-2	ORBIT THE CRYOGENICS SYSTEM IS REQUIRED UP TO AND INCLUDING THE ENTRY MANEUVER SO THAT THE ENTRY AND LANDING PHASES WILL BE ENTERED INTO WITH FULL CONSUMABLES POTENTIAL, THAT IS, FULLY CHARGED ENTRY BATTERIES AND ENTRY O_2 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 O_2 USAGE IN FLIGHT AFTER LOSS OF RECHARGE CAPABILITY FROM THE CRYO SYSTEM WILL REDUCE SUPPLY AVAILABLE FOR ENTRY, LANDING, AND POSTLANDING.
	7-3	LOSS OF A CRYOGENIC TANK IS DEFINED AS: PRESSURE CANNOT BE MAINTAINED ABOVE 150 PSIA FOR O_2 AND 100 PSIA FOR H_2.
A	7-4	MINIMUM REQUIREMENT TO CONTINUE BEYOND A GO/NO-GO POINT IS SUFFICIENT OXYGEN AND HYDROGEN TO SUPPLY FUEL CELL AND ECS DEMANDS TO COMPLETE THE NOMINAL MISSION.
		RULES 7-5 THROUGH 7-9 ARE RESERVED.

REV	ITEM	SYSTEMS MANAGEMENT
A	7-10	CRYO MANAGEMENT

A. MANUAL PRESSURE CONTROL WILL BE USED AS REQUIRED TO MAINTAIN:

1. TANK PRESSURES GREATER THAN 750 PSIA O_2 AND 200 PSIA FOR H_2.

2. QUANTITY BALANCE OF 4 PERCENT O_2 AND 3 PCT FOR H_2.

B. ADDITIONAL POWER LOADS AND/OR ADDITIONAL FUEL CELL PURGES WILL BE USED AS REQUIRED TO MAINTAIN TANK PRESSURES BELOW THE RELIEF POINT OF TANK RELIEF VALVES. (950 PSID O_2, 270 PSID H_2.)

C. CRYO FANS WILL NOT BE ALLOWED TO OPERATE IN AUTO MODE.
MANUAL CYCLE CRITERIA:

1. TANK QTY >75 PERCENT ____ EVERY 6 TO 8 HOURS FOR 3 TO 5 MINUTES.

2. TANK QTY <75 PERCENT ____ EVERY 10 TO 14 HOURS FOR 3 TO 5 MINUTES.

3. ANYTIME QTY READOUT APPEARS TO BE ERRONEOUS AND VALID READOUT IS REQUIRED.

7-11 CRYO GAGING

A. ONBOARD CRYOGENIC QUANTITY GAGING IS PRIME. ACCURACY IS ±2.65 PERCENT (±8.84 LBS O_2, ±.72 LBS H_2) PER TANK.

B. MCC CALCULATED QUANTITY USING PRESSURE VERSUS TEMPERATURE IS BACKUP. ACCURACY IS UNKNOWN DUE TO INSTRUMENTATION PROBLEM.

RULES 7-12 THROUGH
7-14 ARE RESERVED.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-15	LOSS OF ONE O_2 AND/OR H_2 CRYO TANK (TANK PRESSURE <150 O_2, <100 H_2 RESPECTIVELY.	LAUNCH	CONTINUE MISSION	
			EPO	NO-GO FOR TLI	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
	7-16	LOSS OF BOTH O_2 AND/OR H_2 CRYO TANK (TANK PRESSURE <150 O_2, <100 H_2, RESPECTIVELY).	LAUNCH	CONTINUE MISSION ISOLATE SURGE TANK PRIOR TO 800 PSIA	
			EPO	ENTER NEXT BEST ATP OR PTP MAXIMUM ORBIT TIME IS 4.75 HRS FOR LOSS OF THREE FUEL CELLS	IF 3 FUEL CELLS ARE LOST, SMJC'S WILL BE INOPERATIVE FOR CM/SM SEP.
		RULES 7-17 THROUGH 7-19 ARE RESERVED.			

REV	ITEM
A	7-20

INSTRUMENTATION REQUIREMENTS

MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY
O_2 TNK 1 QTY	SC0030Q	METER	COMMON	ONE OF TWO MANDATORY
O_2 TNK 2 QTY	SC0033Q	METER	COMMON	
O_2 TNK 1 P	SC0037P	METER	COMMON	ONE OF TWO MANDATORY
O_2 TNK 2 P	SC0038P	METER	COMMON	
H_2 TNK 1 QTY	SC0030Q	METER	COMMON	ONE OF TWO MANDATORY
H_2 TNK 2 QTY	SC0031Q	METER	COMMON	
H_2 TNK 1 P	SC0039P	METER	COMMON	ONE OF TWO MANDATORY
H_2 TNK 2 P	SC0040P	METER	COMMON	
O_2 TNK 1 TEMP	SC0041T	-----	------	HIGHLY DESIRABLE
O_2 TNK 2 TEMP	SC0042T	-----	------	HIGHLY DESIRABLE
H_2 TNK 1 TEMP	SC0043T	-----	------	HIGHLY DESIRABLE
H_2 TNK 2 TEMP	SC0044T	-----	------	HIGHLY DESIRABLE

8 ELECTRICAL
POWER SYSTEM

REV	ITEM	GENERAL
	8-1	LAUNCH 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, ONE BATTERY BUS, AND ONE AC BUS OPERATIONAL TO CONTINUE.
	8-2	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.
	8-3	ALL PHASES THE MISSION WILL BE CONTINUED AS LONG AS THE REQUIRED NUMBER OF FUEL CELLS ARE AVAILABLE AND ARE CAPABLE OF SUPPORTING MISSION REQUIREMENTS OF 75 TO 90 AMP (WITHOUT BATTERY SUPPLEMENT EXCEPT DURING SPS ΔV'S) AND THREE GOOD ENTRY BATTERIES REMAIN.
A	8-4	BATTERY IS CONSIDERED FAILED IF: OUTPUT ≤ 3 AMPS WHEN CONNECTED TO MAIN BUS DURING LAUNCH OR SPS MANEUVERS. (NOMINAL BAT CURRENT FOR LAUNCH AND SPS MANEUVERS IS 6-15 AMPS).
	8-5	AN AC BUS IS CONSIDERED FAILED IF ANY TWO PHASES CANNOT BE MAINTAINED >95 VOLTS.
	8-6	AN INVERTER IS CONSIDERED FAILED IF: A. OUTPUT VOLTAGE ON ANY PHASE >130 VAC. B. OUTPUT VOLTAGE ON ANY TWO PHASES <95 VAC.
A	8-7	FUEL CELL IS CONSIDERED FAILED FOR MISSION PLANNING IF: A. FUEL CELL OUTPUT <5 AMPS. 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_2O TANK PRESSURE REGULATORS WHILE FC IS ONLINE).
A	8-8	TLI MINIMUM PUGRE CAPABILITY IS BOTH OXYGEN AND HYDROGEN ON ONE FUEL CELL AND AT LEAST OXYGEN ON ANY OTHER FUEL CELL.
		RULES 8-9 THROUGH 8-14 ARE RESERVED.

REV	ITEM	SYSTEMS MANAGEMENT
A	8-15	FUEL CELL MANAGEMENT A. FUEL CELL WILL BE "SHUTDOWN" FOR THE FOLLOWING: 1. SUSTAINED CURRENT OUTPUT LESS THAN 5 AMPS 2. FUEL CELL H_2 LOOP IS CONTAMINATED WITH KOH. 3. REACTANT LEAKAGE JEOPARDIZING MISSION DURATION. B. FUEL CELL MAY BE "OPEN CIRCUITED" FOR THE FOLLOWING: 1. SKIN TEMP >475°F 2. TCE TEMP >200°F 3. FAILURE OF H_2 PUMP OR GLYCOL PUMP 4. VOLTAGE MANAGEMENT 5. UNABLE TO PURGE IF TIME-TO-GO GREATER THAN PREDICTED FUEL CELL LIFETIME. C. NORMAL FUEL CELL PURGE WILL BE EVERY 12 HRS O_2 AND EVERY 48 HRS H_2. D. ADDITIONAL PURGES WILL BE INITIATED AS OPERATIONAL CONDITONS DICTATE. E. FUEL CELLS WILL NOT BE PURGED UNDER THE FOLLOWING CONDITIONS: 1. CONFIRMED HIGH PH. F. FUEL CELLS MAY BE PURGED TO PRECLUDE CRYOGENIC TANKS FROM VENTING. G. EACH H_2 PURGE WILL BE PRECEDED BY 20 MINUTES OF H_2 VENT HEATER OPERATION. H. FC INLINE HEATERS WILL OPERATE IN "AUTO" CONTINUOUSLY. I. REACTANT VALVES WILL REMAIN OPEN AT ALL TIMES UNLESS THE FUEL CELL IS DECLARED NON-OPERATIONAL. J. FUEL CELL RADIATOR VALVES WILL REMAIN IN THE "NORMAL" OR OPEN CONFIGURATION UNLESS RADIATOR OUTLET TEMPERATURE DECREASES BELOW -40°F.
A	8-16	BUS MANAGEMENT A. ONE AND ONLY ONE FUEL CELL WILL BE TIED TO BOTH MAIN BUSES. B. INVERTERS WILL BE CONFIGURED SUCH THAT MAIN BUS A WILL SUPPLY AC BUS 1 AND MAIN BUS B WILL SUPPLY AC BUS 2. C. MAIN BUS VOLTAGE WILL BE MAINTAINED >26.2 VDC AND <31 VDC. ONE FUEL CELL MAY BE OPEN CIRCUITED FOR OPTIMUM VOLTAGE AND POWER MANAGEMENT. D. MINIMUM MAIN BUS VOLTAGE WILL BE MAINTAINED TO BE COMPATIBLE WITH ONLINE OPERATION EQUIPMENT. 1. SPS 24.5 2. PGNS 25.0 3. AUTO SM-RCS 22.0 4. AUTO CM-RCS 21.0 5. DIRECT SM-RCS 21.0 6. DIRECT CM-RCS 17.0 7. INVERTERS 19.0
	8-17	INVERTER MANAGEMENT A. INVERTERS MAY BE REMOVED FROM LINE FOR ANY OF THE FOLLOIWNG REASONS: 1. INVERTER TEMP >190°F 2. SPACECRAFT LOAD MANAGEMENT

REV	ITEM	
	8-18	BATTERY MANAGEMENT

A. BATTERIES A AND B WILL BE USED TO SUPPLEMENT MAIN BUS LOADS FROM T-75 SECONDS TO INSERTION.

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.

C. BATTERIES WILL BE RECHARGED TBD.

D. THREE BATTERIES WILL BE TIED TO THE MAIN BUSES FOR ENTRY.

E. BATTERIES ARE CONSIDERED TO HAVE 40 AMP-HR CAPABILITY INFLIGHT AND 50 AMP-HR CAPABILITY FOR POST-LANDING.

F. FOR LOSS OF BATTERY CHARGER CAPABILITY TO A SINGLE BATTERY, THAT BATTERY WILL NOT BE USED EXCEPT FOR DEORBIT, ENTRY, AND POSTLANDING.

G. BATTERY VENT VALVE WILL REMAIN CLOSED UNLESS MANIFOLD PRESSURE IS GREATER THAN 6 PSIA. VENTING OPERATION WILL BE ALLOWED TO TROUBLESHOOT A SUSPECTED FROZEN DUMP.

RULES 8-19 THROUGH
8-23 ARE RESERVED.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	8-24	LOSS OF ONE FUEL CELL OUTPUT <5 AMPS	LAUNCH	CONTINUE MISSION	
			EPO	NO-GO FOR TLI 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 SHUTDOWN.	MALF EPS 5
			TLC	NO-GO FOR LOI	
			LO	ENTER NEXT BEST PTP	
A	8-25	LOSS OF TWO FUEL CELLS OUTPUT <5 AMPS/FUEL CELL	LAUNCH	CONTINUE MISSION AFTER 2 + 00 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.	
			EPO	ENTER NEXT BEST PTP ONE ENTRY BATTERY MAY BE USED TO SUPPLEMENT REMAINING FC FOR G&N ALIGNMENT PRIOR TO DEORBIT.	
			TLC	ENTER ASAP PERFORM "LOSS OF TWO F/C POWER DOWN"	
			LO	ENTER ASAP	
A	8-26	LOSS OF THREE FUEL CELLS			
		A. OUTPUT <5 AMPS/FUEL CELL	LAUNCH	A. CONTINUE MISSION 1. AFTER 2 + 00 EDS AUTO/OFF TO OFF. 2. TIE BAT C TO BOTH MAIN BUSES. 3. POWER DOWN AT INSERTION. ENTER 2-1 IF FUEL CELLS CANNOT BE RESTORED.	IF TOTAL OUTPUT CAPABILITY LESS THAN 8 AMPS AT 22 VDC, SMJC WILL BE INOPERATIVE FOR CM/SM SEP.
		B. TOTAL OUTPUT CAPABILITY INSUFFICIENT TO SUPPORT DRIFTING FLIGHT LOADS.	EPO	B. ENTER NEXT BEST PTP MANIPULATION OF CYCLE LOADS WILL BE ATTEMPTED TO MAINTAIN VM >26.5.	B. 80 AMPS REPRESENTS MAXIMUM DRIFTING FLIGHT REQUIREMENTS. 54 AMPS AVERAGE
		C. TOTAL OUTPUT CAPABILITY <36 AMPS AT MAIN BUS VOLTAGE OF 26.5 VDC.	EPO	C. PLAN ENTRY NEXT ATP OR PTP BASED ON FUEL CELL OUTPUT AND BATTERY ENERGY REMAINING.	C. 36 AMPS REPRESENTS MINIMUM POWER TO SUPPORT S/C SYSTEMS IN ORBIT.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	8-27	LOSS OF THREE FUEL CELLS AND ONE BATTERY CURRENT <50 PERCENT OF EITHER TWO REMAINING BATTERIES	LAUNCH EPO	ABORT ENTER NEXT BEST PTP OR ATP WITHIN 2.4 HRS. PERFORM EMERGENCY POWER DOWN.	ASSUMES ALL THREE FUEL CELL CURRENTS <5 AMPS/EACH AND BAT C TIED TO BOTH MAINS. SPS DEORBIT WITH SCS ENTRY ASSUMED.
	8-28	LOSS OF THREE FUEL CELLS	EARTH ORBIT	ENTER NEXT BEST ATP OR PTP PERFORM EMERGENCY POWER DOWN.	2.4 HOURS LEFT IN ORBIT BEFORE SPS IGNITION.
		RULES 8-29 THROUGH 8-35 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	8-36	LOSS OF ONE ENTRY BATTERY (OUTPUT <3 AMPS WHEN TIED TO MAIN BUS).	LAUNCH	CONTINUE MISSION A. EDS AUTO - OFF B. IF BAT A - TIE BAT C TO MAIN A C. IF BAT B - TIE BAT C TO MAIN B	
			EPO	NO-GO FOR TLI	IF LOST DURING SPS MANEUVER, CONTINUE ON REMAINING BAT. ATTEMPT TO TIE BAT C TO CORRESPONDING MAIN BUS.
			TLC	NO-GO FOR LOI	
			LO	ENTER NEXT BEST PTP	
A	8-37	LOSS OF ANY ONE ENTRY BATTERY	EPO	NO-GO FOR TLI	
			TLC	NO-GO FOR LOI	
			LO	ENTER NEXT BEST PTP	
A	8-38	LOSS OF TWO ENTRY BATTERIES (OUTPUT <3 AMPS) EACH WHEN TIED TO MAIN BUS	LAUNCH	CONTINUE MISSION EDS AUTO - OFF PERFORM ONE BATTERY ENTRY INTO 2-1	
			ALL PHASES	ENTER NEXT BEST PTP USING ONE BATTERY ENTRY PROCEDURE	IF LOSS DURING SPS MANEUVERS ATTEMPT TO TIE BAT C TO BOTH MAINS
A	8-39	LOSS OF BATTERY CHARGER	EPO	CONTINUE MISSION	
			TLC	NO-GO FOR LOI IF SUM OF TWO LOWEST ENTRY BATTERIES <64 AMP-HRS	
		RULES 8-40 THROUGH 8-45 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	8-46	MAIN BUS TIE MOTOR SWITCH FAILURES			
		A. ONE MOTOR SWITCH FAILS OPEN	LAUNCH	A. CONTINUE MISSION 1. IF MOTOR SW A/C – TIE BAT C TO MAIN BUS A 2. IF MOTOR SW B/C – TIE BAT C TO MAIN BUS B	
			ALL PHASES	CONTINUE MISSION CLOSE ALTERNATE MOTOR SW AND USE MAIN BUS TIE CB'S AS MOTOR SWITCHES	BATTERIES MUST BE CHARGED THROUGH OPEN MOTOR SW. LEAVE BAT RLY CB CLOSED FOR CHARGING.
		B. ONE OR BOTH MOTOR SW FAILED CLOSED	ALL PHASES	B. CONTINUE MISSION USE CB'S AS MOTOR SWITCHES.	B. IF BOTH MOTOR SWITCHES FAIL CLOSED, BATTERIES CANNOT BE CHARGED. REF MR 11-49
	8-47	MAIN BUS SHORTED CAUSING FUEL CELL REVERSE CURRENT DISCONNECT			
		A. FUEL CELL 2 DISCONNECTS FROM MAIN A	LAUNCH	A. CONTINUE MISSION 1. PLACE EDS AUTO/OFF TO OFF. 2. FUEL CELL 2 TO BUS A ONLY. 3. TIE BAT C TO MAIN A. 4. INVERTER 3 TO AC2 MAIN A. 5. POWER DOWN MAIN B. 6. TVC GIMBAL DRIVE (P,Y)-1. 7. GIMBAL MOTOR CONTROL (YAW 1, PITCH 1) BAT A – OPEN FOLLOWING GIMBAL MOTOR TURN ON.	A. 85 AMPS SHORT ON MAIN B WILL CAUSE REVERSE DISCONNECT DURING LAUNCH.
			ALL PHASES	ENTER NEXT BEST PTP IF BUS NOT RESTORED	
		B. FUEL CELL 2 DISCONNECTS FROM MAIN B	LAUNCH	B. CONTINUE MISSION 1. PLACE EDS AUTO/OFF TO OFF. 2. FUEL CELL 2 TO BUS B ONLY. 3. TIE BAT C TO MAIN B. 4. INVERTER 3 TO AC-1 MAIN B. 5. POWER DOWN MAIN A. 6. TVC GIMBAL DRIVE (P,Y)-2. 7. GIMBAL MOTOR CONTROL (YAW 2, PITCH 2) BAT B – OPEN FOLLOWING GIMBAL MOTOR TURN ON.	B. 79 AMPS SHORT ON MAIN A WILL CAUSE REVERSE DISCONNECT DURING LAUNCH.
			ALL PHASES	ENTER NEXT BEST PTP IF BUS NOT RESTORED	
		C. MAIN BUS SHORTED >25 AMPS AND POWER CANNOT BE REMOVED.	LAUNCH	C. ABORT	C. FAILURE TO DISCONNECT FC FROM SHORTED BUS INDICATED BY FC TO SHORTED BUS T/B GREY.
			ALL PHASES	ENTER NEXT BEST PTP CLOSE F/C REACTANTS VALVES TO POWER DOWN SHORTED FUEL CELL.	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	8-48	A. BATTERY BUS SHORTED >5 AMPS	LAUNCH	A. CONTINUE MISSION 1. EDS AUTO - OFF 2. OPEN ASSOCIATED MAIN BUS TO BAT BUS CB. 3. TIE BAT C TO ASSOCIATED MAIN BUS.	>22 AMPS WILL CAUSE BATTERY BUS VOLTAGE TO BE ≤ MAIN BUS VOLTAGE DURING LAUNCH WHICH WILL BE ONLY CUE.
			ALL PHASES	ENTER NEXT BEST PTP IF BUS NOT RESTORED (SHORTED >5 AMPS)	MALF EPS SSR - 2 REMOVE POWER FROM BUS. IF SHORTED <10 AMPS POWER BUS JUST PRIOR TO ENTRY TO MAINTAIN SECS REDUNDANCY.
		B. BATTERY BUS SHORTED <5 AMPS	ALL PHASES	B. CONTINUE MISSION REMOVE POWER FROM BUS EXCEPT FOR MANEUVERS AND ENTRY.	
	8-49	BATTERY RELAY BUS SHORTED	LAUNCH	CONTINUE MISSION	
			ALL PHASES	ENTER NEXT BEST PTP OPEN BATTERY BUS TO BATTERY RELAY BUS CB'S.	
	8-50	LOSS OF ONE BATTERY BUS, MAIN BUS, OR BATTERY RELAY BUS. (SHORTED BUS WHICH CAN BE ISOLATED OR OPEN BUS.)	LAUNCH	CONTINUE MISSION	
			ALL PHASES	ENTER NEXT BEST PTP	
		RULES 8-51 THROUGH 8-55 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	8-56	LOSS OF ONE INVERTER	ALL PHASES	CONTINUE MISSION	
	8-57	LOSS OF TWO INVERTERS	LAUNCH	CONTINUE MISSION PLACE REMAINING INVERTER ON BOTH AC BUSES.	
			ALL PHASES	ENTER NEXT BEST PTP	
	8-58	LOSS OF ONE AC BUS (TWO PHASES CANNOT BE MAINTAINED >95 VAC)	LAUNCH	CONTINUE MISSION	
			ALL PHASES	ENTER NEXT BEST PTP	MALF EPS 1
	8-59	LOSS OF BOTH AC BUSES	LAUNCH	ABORT MODE I OR MODE II A. OPEN DIRECT O_2 FOR SUIT VENTILATION. B. IF AFTER MODE II, ENTER 2-1 PTP	
			EPO	ENTER NEXT BEST PTP OR ATP WITHIN 1-1/2 HOURS DOFF SUITS	
		RULES 8-60 THROUGH 8-65 ARE RESERVED.			

REV	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
A	8-66	AC BUS 1 YELLOW	-------	MCWS	--------	HIGHLY DESIRABLE	
		AC BUS 1 ϕ A VAC	CC0200V	METER	SEPARATE	HIGHLY DESIRABLE	8-5,8-58
		AC BUS 1 ϕ B VAC	-------	METER	--------	HIGHLY DESIRABLE	
		AC BUS 1 ϕ C VAC	-------	METER	--------	HIGHLY DESIRABLE	
		AC BUS 2 ϕ A VAC	CC0203V	METER	SEPARATE	HIGHLY DESIRABLE	
		AC BUS 2 ϕ B VAC	-------	METER	--------	HIGHLY DESIRABLE	8-16C,8-47
		AC BUS 2 ϕ C VAC	-------	METER	--------	HIGHLY DESIRABLE	
		AC BUS 2 YELLOW	-------	MCWS	--------	HIGHLY DESIRABLE	
		MAIN BUS A VDC	CC0206V	METER	SEPARATE	1 OF 2 MANDATORY	
		MAIN BUS B VDC	CC0207V	METER	SEPARATE		
		BAT BUS A VDC	CC0210V	METER	SEPARATE	HIGHLY DESIRABLE	8-16C,8-47
		BAT BUS B VDC	CC0211V	METER	SEPARATE	HIGHLY DESIRABLE	
		BAT RELAY BUS VDC	CC0232V	METER	SEPARATE	HIGHLY DESIRABLE	
		BAT A CURRENT	CC0222C	METER	COMMON		
		BAT B CURRENT	CC0223C	METER	COMMON	2 OF 3 MANDATORY	8-27, 8-36, 8-38
		BAT C CURRENT	CC0224C	METER	COMMON		SEE NOTE
		FC 1 CURRENT	SC2113C	METER	COMMON		
		FC 1 O_2 FLO	SC2141R	METER	COMMON	1 OF 3 MANDATORY	8-24, 8-25, 8-26
		FC 1 H_2 FLO	SC2139R	METER	COMMON		
		FC 2 CURRENT	SC2114C	METER	COMMON		
		FC 2 O_2 FLO	SC2143R	METER	COMMON	1 OF 3 MANDATORY	8-24, 8-25, 8-26
		FC 2 H_2 FLO	SC2140R	METER	COMMON		
		FC 3 CURRENT	SC2115C	METER	COMMON		
		FC 3 O_2 FLO	SC2143R	METER	COMMON	1 OF 3 MANDATORY	8-24, 8-25, 8-26
		FC 3 H_2 FLO	SC2141R	METER	COMMON		
		BAT CHARGER CURRENT	SC0215C	METER	COMMON	HIGHLY DESIRABLE	8-18C, 8-16D, 8-39
		FC 1 SKIN TEMP	SC2984T	METER	COMMON	HIGHLY DESIRABLE	8-15B
		FC 2 SKIN TEMP	SC2085T	METER	COMMON	HIGHLY DESIRABLE	8-15B
		FC 3 SKIN TEMP	SC2086T	METER	COMMON	HIGHLY DESIRABLE	8-15B
		FC 1 COND TEMP	SC2081T	METER	COMMON	HIGHLY DESIRABLE	8-15B
		FC 2 COND TEMP	SC2082T	METER	COMMON	HIGHLY DESIRABLE	8-15B
		FC 3 COND TEMP	SC2083T	METER	COMMON	HIGHLY DESIRABLE	8-15B
		FC 1 RAD OUT TEMP	SC2084T	METER	COMMON	HIGHLY DESIRABLE	8-15J
		FC 2 RAD OUT TEMP	SC2085T	METER	COMMON	HIGHLY DESIRABLE	8-15J
		FC 3 RAD OUT TEMP	SC2086T	METER	COMMON	HIGHLY DESIRABLE	8-15J
		BAT MANIFOLD P	------	METER	------	HIGHLY DESIRABLE	8-17
		INVERTER 1 TEMP	CC0175T	MCWS	COMMON	HIGHLY DESIRABLE	8-17
		INVERTER 2 TEMP	CC0175T	MCWS	COMMON	HIGHLY DESIRABLE	8-17
		INVERTER 3 TEMP	CC0177T	MCWS	COMMON	HIGHLY DESIRABLE	

NOTE: USE BAT C IN LIEU OF BATTERY WITH LOST INST.

9 COMMUNICA-
TIONS/INSTRU-
MENTATION

REV	ITEM	GENERAL
		LAUNCH
	9-1	THERE ARE NO COMMUNICATIONS/INSTRUMENTATION FAILURES FOR WHICH THE LAUNCH/INSERTION PHASE WILL BE TERMINATED.
A	9-2	EPO TWO-WAY VOICE COMMUNICATIONS AND CERTAIN CRITICAL INSTRUMENTATION ARE REQUIRED FOR MISSION CONTINUATION. THERE ARE NO COMMUNICATIONS/INSTRUMENTATION FAILURES WHICH WILL REQUIRE ASAP OR ATP ENTRY. (CRITICAL INSTRUMENTATION IS THAT INSTRUMENTATION REQUIRED TO VERIFY GO/NO-GO CRITERIA.)
A	9-3	TLC TWO-WAY VOICE COMM IS REQUIRED FOR MISSION CONTINUATION UNTIL A FREE RETURN TRAJECTORY IS INSURED. (NOMINALLY SECOND MIDCOURSE PLUS MANEUVER PAD DATA FOR FLY BY.)
A	9-4	LOI WILL NOT BE ATTEMPTED FOR LOSS OF TWO-WAY COMM.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	9-5	COMM SYSTEMS MANAGEMENT A. VHF-AM SIMPLEX A (RECEIVE TRANSMIT 296.8 MHZ) IS PRIME AIR/GROUND VOICE COMM FOR LAUNCH AND EPO. USB WILL BE PRIME RECEIVE REMOTE TO MCC. B. SPACECRAFT AND GROUND WILL TRANSMIT SIMULTANEOUSLY ON VHF AND USB FOR LAUNCH AND EPO.			
A	9-6	DSE MANAGEMENT A. HBR WILL BE RECORDED DURING FOLLOWING: 1. LAUNCH 2. TLI 3. CSM/S-IVB SEP 4. SPS MANEUVERS 5. ENTRY			
A	9-7	CTE MANAGEMENT A. CTE WILL BE CONFIGURED TO COUNT IN GET FOR FLIGHT. CTE WILL NOT BE REUPDATED AFTER T-20 MINUTES IN PRELAUNCH IF A HOLD IS REQUIRED. B. CTE WILL BE ALLOWED TO DRIFT ±15 SECONDS BEFORE BEING UPDATED.			
		RULES 9-8 THROUGH 9-9 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	9-10	LOSS OF LBR TM	ALL PHASES	CONTINUE MISSION	
A	9-11	LOSS OF HBR TM	ALL PHASES	CONTINUE MISSION	
A	9-12	LOSS OF ALL TM	EPO	NO-GO FOR TLI - ENTER NEXT BEST PTP	
			TLC	NO-GO FOR LOI	
A	9-13	LOSS OF RANGING	ALL PHASES	CONTINUE MISSION	
A	9-14	LOSS OF NORMAL DOWN VOICE	EPO	NO-GO TLI	
			TLC	CONTINUE MISSION	
			LPO	CONTINUE MISSION	
A	9-15	LOSS OF DOWN VOICE BACKUP	EPO	NO-GO TLI	
			TLC	CONTINUE MISSION	
			LPO	CONTINUE MISSION	
A	9-16	LOSS OF ALL REAL-TIME DOWN VOICE			
		A. CREW UPDATED WITH LOI -8 HR FLY BY MANEUVER PAD	TLC	NO-GO LOI	
			LO	CONTINUE MISSION	
				ATTEMPT TO USE DSE FOR DELAYED DOWN VOICE	
		B. CREW NOT UPDATED WITH LOI -8 HR FLY BY MANEUVER PAD	TLC	NO-GO FOR LOI	B. CREW REWIND DSE AND RECORD VOICE IN HBR THEN DUMP. MSFN CONFIGURE TO PATCH DUMP VOICE REAL-TIME MCC.
				EVALUATE DELAYED DOWN VOICE VIA DSE	
				IF UNSUCCESSFUL - ENTER NEXT BEST PTP	
A	9-17	LOSS OF NORMAL UP VOICE	EPO	NO-GO FOR TLI	
			TLC	CONTINUE MISSION	
			LO	CONTINUE MISSION	
A	9-18	LOSS OF UP VOICE BACKUP	EPO	NO-GO FOR TLI	
			TLC	CONTINUE MISSION	
			LO	CONTINUE MISSION	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	9-19	LOSS OF ALL UP VOICE			
		A. CREW UPDATED WITH LOI - 8 HR FLY BY PAD	TLC	NO-GO LOI	
		B. CREW NOT UPDATED WITH LOI -8 HR FLY BY PAD	TLC	ENTER NEXT BEST PTP	
A	9-20	MALFUNCTION OF ONE TRANSPONDER			
		A. LOSS OF NORMAL AND BACKUP DOWN VOICE	EPO	NO-GO FOR TLI	AT LEAST ONE UP AND DOWN VOICE MODE VIA BOTH TRANSPONDERS (EXCLUDING COMMON VOICE MODE) IS REQUIRED FOR TLI.
			TLC	CONTINUE MISSION	
		B. LOSS OF NORMAL AND BACKUP VOICE	EPO	NO-GO FOR TLI	
			TLC	CONTINUE MISSION	
A	9-21	LOSS OF FM DOWNLINK	ALL PHASES	CONTINUE MISSION	
A	9-22	LOSS OF ONE PMP POWER SUPPLY	EPO	NO-GO FOR TLI	
			TLC	CONTINUE MISSION	
			LO	CONTINUE MISSION	
A	9-23	LOSS OF ALL VHF	ALL PHASES	CONTINUE MISSION	
A	9-24	LOSS OF THE UPDATE LINK	ALL PHASES	CONTINUE MISSION	
A	9-25	LOSS OF BOTH POWER AMPLIFIERS	EPO	NO-GO FOR TLI	
			TLC	CONTINUE MISSION	
			LO	CONTINUE MISSION	
A	9-26	LOSS OF THE SCE	EPO	NO-GO FOR TLI	
			TLC	ENTER NEXT PTP	
A	9-27	LOSS OF TWO AUDIO CENTERS	EPO	NO-GO FOR TLI	
			TLC	CONTINUE MISSION	
			LO	CONTINUE MISSION	

REV	ITEM	INSTRUMENTATION REQUIREMENTS					MISSION RULE REFERENCE
		MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	
A	9-28	UDL VALIDITY SIGNAL	CT0262V	-----	------	HIGHLY DESIRABLE	
		USB RECEIVER AGC	CT0620E	METER	COMMON	HIGHLY DESIRABLE	
		USB REC ϕ ERROR	CT0640F	-----	------	HIGHLY DESIRABLE	
		DSE TAPE MOTION	CT0012X	TB	------	HIGHLY DESIRABLE	
		CTE TIME	CT0145F	-----	------	HIGHLY DESIRABLE	
		SCE +10 VDC	CT0018V	-----	------	HIGHLY DESIRABLE	
		SCE +5 VDC	CT0017V	-----	------	HIGHLY DESIRABLE	
		SCE +20 VDC	CT0015V	-----	------	HIGHLY DESIRABLE	
		SCE -20 VDC	CT0016V	-----	------	HIGHLY DESIRABLE	
		PCM HI REF 85 PERCENT	CT0125V	-----	------	HIGHLY DESIRABLE	
		PCM HI REF 15 PERCENT	CT0126V	-----	------	HIGHLY DESIRABLE	


10 SEQUENTIAL
SYSTEM

REV	ITEM	GENERAL
A	10-1	LAUNCH THERE ARE NO SEQUENTIAL MALFUNCTIONS FOR WHICH THE FLIGHT CREW WILL INITIATE AN ABORT DURING THE LAUNCH/INSERTION PHASE.
	10-2	LOSS OF AN ENTRY BATTERY REQUIRES FLYING THE EDS OPEN LOOP.
	10-3	ALL PHASES LOSS OF ONE SEQUENTIAL SYSTEM WILL BE CAUSE FOR TERMINATING THE MISSION INTO THE NEXT BEST PTP. A SEQUENTIAL SYSTEM WILL BE CONSIDERED FAILED FOR LOSS OF EITHER A LOGIC OR PYRO BUS. 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 THEN STANDBY FOR A GO FROM THE GROUND TO PROCEED WITH ARMING THE PYRO BUSES.
	10-4	SEQUENTIAL LOGIC BUS IS CONSIDERED FAILED IF: A. VOLTAGE <22 VDC AND UNABLE TO ACTIVATE RCS ENABLE AND SLA SEP RELAYS (CD0170X AND CD0123X SYSTEM A, CD0171X AND CD0124X SYSTEM B). B. LOGIC BUS SHORTED >10 AMPS.
	10-5	PYRO BUS IS CONSIDERED FAILED IF: A. SHORTED >10 AMPS. B. UNABLE TO PERFORM SLA SEP WITH SUSPECTED FAILED SYSTEM.
		RULES 10-6 THROUGH 10-9 ARE RESERVED.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-10	LOSS OF BATTERY BUS A OR B	LAUNCH	CONTINUE MISSION EDS AUTO/OFF - OFF	REF MR 8-36 EDS BECOMES OPEN LOOP
			EPO	NO-GO FOR TLI USE BAT C TO POWER BAT BUS IF BUS NOT SHORTED.	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
			ENTRY	CONTINUE MISSION REMAINING PORTION OF ENTRY WILL BE PERFORMED ON REMAINING SYSTEM.	
	10-11	LOSS OF SEQUENTIAL LOGIC BUS A OR B	LAUNCH	CONTINUE MISSION PLAN ENTRY 3-1 IF BUS NOT RESTORED.	
			ALL PHASES	ENTER NEXT BEST PTP	
A	10-12	PYRO BUS A OR B ≤35 VDC	LAUNCH	CONTINUE MISSION	
			ALL PHASES	A. IF SHORTED >10 AMPS, ENTER NEXT BEST PTP. B. IF UNSHORTED, ATTEMPT SLA SEP USING SUSPECTED BUS ONLY. 1. IF SLA SEP SUCCESSFUL, CONTINUE MISSION. 2. IF SLA SEP UNSUCCESSFUL, POWER OTHER PYRO BUS FOR FUNCTION. ENTER NEXT BEST PTP.	THIS ASSUMES PYRO BAT VERIFIED >35 VDC PRIOR TO ARMING BUS. IF ENTRY BAT USED IN LIEU OF PYRO BAT, VOLTAGE SHOULD BE APPROXIMATELY EQUAL TO BAT BUS VOLTAGE.
	10-13	TELEMETRY INDICATED AN EDS VOTE INPUT 1, 2, OR 3. (CD0132X, CD0133X, AND CD0134X RESPECTIVELY)	LAUNCH	CONTINUE MISSION A. IF ANY ENTRY BAT <22 VDC EDS AUTO/OFF - OFF B. ALL ENTRY BATS <22 VDC CHECK CORRESPONDING EDS CB'S 1, 2, OR 3 CLOSED.	BATTERY C VOLTAGE CAN ONLY BE MONITORED ONBOARD.
	10-14	LET JETTISON MOTOR DOES NOT FIRE	LAUNCH	CONTINUE MISSION ATTEMPT JETTISON PER CREW CHECKLIST PROCEDURE. IF UNSUCCESSFUL, CONTINUE INTO ORBIT.	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-15	LOST GROUND TO RESISTOR NETWORK FOR LOGIC OR PYRO BUS VOLTS MEASUREMENTS.	ALL PHASES	CONTINUE MISSION DO NOT ARM AFFECTED SYSTEM UNLESS OTHER SYSTEM FAILS UNTIL CM/SM SEP. IF PYRO BUS: USE BAT TO PYRO TIE, DO NOT ARM UNTIL CM/SM SEP.	ARMING SYSTEM WITH VOLTAGE >30 VDC WILL RESULT IN PERMANENT LOSS OF ALL ANALOG TELEMETRY PARAMETERS.
	10-16	SMJC ACTIVATES PREMATURELY	ALL PHASES	A. DO NOT ARM AFFECTED PYRO BUS. B. REMOVE POWER FROM AFFECTED MAIN BUS. (FUEL CELLS AND BATTERIES.) ENTER NEXT BEST PTP A. RELY ON GOOD SEQUENTIAL SYSTEM FOR CSM/S-IVB AND CM/SM SEP. B. REPOWER AFFECTED MAIN BUS AFTER CM/SM SEP.	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 EVENT. MAIN B IF SYSTEM B CM/SM EVENT IS ACTIVATED.
	10-17	ACTIVATED CM-RCS PRESS CIRCUIT (CD0173X AND/OR CD0174X)	ALL PHASES	CONTINUE MISSION A. PRIOR TO CM-RCS PRESS: DO NOT ARM RESPECTIVE PYRO BUS. FOR BOTH INDICATIONS, PERFORM SLA SEP WITH SECS ARM CB'S OPEN. B. AT CM-RCS PRESS, ARM RESPECTIVE PYRO BUS.	
	10-18	ACTIVATED SLA DEPLOY CIRCUIT (CD0123X AND/OR CD0124X)	ALL PHASES	CONTINUE MISSION PRIOR TO SLA SEP: DO NOT ARM RESPECTIVE PYRO BUS. FOR SLA SEP, ARM SUSPECTED BUS FIRST.	
	10-19	ACTIVATED APEX JETTISON CIRCUIT (CD0230X AND CD0231X)	ALL PHASES	ENTER NEXT BEST PTP DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED.	DETECTED AT SECS POWER UP
	10-20	ACTIVATED DROGUE CHUTE DEPLOY CIRCUIT (CE0001X AND/OR CE0002X)	ALL PHASES	ENTER NEXT BEST PTP DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED.	DETECTED ANYTIME.
	10-21	ACTIVATED MAIN CHUTE DEPLOY CIRCUIT (CD0003X AND/OR CE0004X)	ENTRY	DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED.	DETECTED AT SECS POWER UP PRIOR TO ENTRY. (WITH ELS BAT A (B) CB CLOSED.)
		RULES 10-22 THROUGH 10-23 ARE RESERVED.			

REV	ITEM
A	10-24

INSTRUMENTATION REQUIREMENTS

MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
SEQ LOGIC BUS A VOLTS	CD0200V	--------	----------	HIGHLY DESIRABLE	10-4, 10-11
SEQ LOGIC BUS B VOLTS	CD0201V	--------	----------	HIGHLY DESIRABLE	10-4, 10-11
APEX JET A	CD0230X	--------	----------	HIGHLY DESIRABLE	10-19
APEX JET B	CD0231X	--------	----------	HIGHLY DESIRABLE	10-19
DROGUE DEPLOY A	CE0001X	--------	----------	HIGHLY DESIRABLE	10-20
DROGUE DEPLOY B	CE0002X	--------	----------	HIGHLY DESIRABLE	10-20
MAIN CHUTE DEPLOY A	CE0003X	--------	----------	HIGHLY DESIRABLE	10-21
MAIN CHUTE DEPLOY B	CE0004X	--------	----------	HIGHLY DESIRABLE	10-21
PYRO BUS A VOLTS	CD0005V	--------	----------	1 OF 2 MANDATORY	10-5, 10-12
PYRO BUS B VOLTS	CD0006V	--------	----------	1 OF 2 MANDATORY	10-5, 10-12
SLA SEP RELAY A	CD0123X	--------	----------	HIGHLY DESIRABLE	10-18
SCS/RCS ACTIVATE A	CD0170X	--------	----------	HIGHLY DESIRABLE	10-18
SCS/RCS ACTIVATE B	CD0171X	--------	----------	HIGHLY DESIRABLE	10-18
SLA SEP RELAY B	CD0124X	--------	----------	HIGHLY DESIRABLE	10-18
CM-RCS PRESS SIG A	CD0173X	--------	----------	HIGHLY DESIRABLE	10-17
CM-RCS PRESS SIG B	CD0174X	--------	----------	HIGHLY DESIRABLE	10-17
CM-SM SEP RELAY A	CD0023X	--------	----------	HIGHLY DESIRABLE	
CM-SM SEP RELAY B	CD0024X	--------	----------	HIGHLY DESIRABLE	
CREW ABORT A	CD0130X	--------	----------	HIGHLY DESIRABLE	
CREW ABORT B	CD0131X	--------	----------	HIGHLY DESIRABLE	
EDS ABORT VOTE 1	CD0132X	--------	----------	HIGHLY DESIRABLE	
EDS ABORT VOTE 2	CD0133X	--------	----------	HIGHLY DESIRABLE	
EDS ABORT VOTE 3	CD0134X	--------	----------	HIGHLY DESIRABLE	
EDS ABORT A	CD0135X	--------	----------	HIGHLY DESIRABLE	
EDS ABORT B	CD0136X	--------	----------	HIGHLY DESIRABLE	
MAIN CHUTE DISC A	CE0321X	--------	----------	HIGHLY DESIRABLE	
MAIN CHUTE DISC B	CD0322X	--------	----------	HIGHLY DESIRABLE	
EDS ABORT REQ A	BS0080X	--------	----------	HIGHLY DESIRABLE	
EDS ABORT REQ B	BS0081X	--------	----------	HIGHLY DESIRABLE	

11 GUIDANCE AND CONTROL

REV	ITEM	GENERAL

11-1 LAUNCH

THERE ARE NO FAILURES OF THE CSM GUIDANCE AND CONTROL SYSTEM WHICH ARE CAUSE FOR ABORT.

11-2 EARTH ORBIT PHASE

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:

1. ATTITUDE CONTROL: DIRECT RCS AND RATE DAMPING IN EACH AXIS.

2. TVC (CRITICAL BURNS): ONE TVC SERVO LOOP IN EACH AXIS AND ONE TVC CONTROL MODE (ACCEL CMD EXCLUDED).

3. BACKUP DEORBIT: 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.

(A) SM DEORBIT REQUIREMENTS:

- TRANSLATION CAPABILITY
- ONE OPERATIONAL FDAI
- RATE DAMPING IN ALL THREE AXES (DAP OR SCS)

(B) HYBRID DEORBIT REQUIREMENTS:

- ALL SM DEORBIT REQUIREMENTS (RATE DAMPING MUST BE SCS)
- OPERATIONAL, IMU, CMC, AND MAIN DSKY
- TWO OPERATIONAL RHC'S

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.

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:

1. ATTITUDE CONTROL: DIRECT RCS AND RATE DAMPING IN EACH AXIS.

2. TVC: TWO SERVO LOOPS AND BOTH G&N AND ONE SCS TVC CONTROL MODES (ACCEL CMD EXCLUDED).

3. G&N: CMC, IMU, AND MDC DSKY FULLY OPERATIONAL AND OPTICS CAPABLE OF ALIGNING PLATFORM.

4. DISPLAYS: ONE OPERATIONAL FDAI.

5. ATTITUDE REFERENCE: REDUNDANT ATTITUDE SOURCES ARE REQUIRED FOR ENTRY.

11-3 TRANSLUNAR COAST

IN ORDER TO CONTINUE THE MISSION PAST THE NEXT BEST PTP, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:

A. ATTITUDE CONTROL: DIRECT RCS AND RATE DAMPING IN EACH AXIS.

B. RCS TRANSLATION: X-AXIS VIA AUTO COILS.

C. ATTITUDE REFERENCE: REDUNDANT ATTITUDE REFERENCE SOURCES ARE REQUIRED FOR ENTRY.

REV	ITEM
	11-4

LOI, LUNAR ORBIT PHASES:

A. LOI_1 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.

1. ATTITUDE CONTROL: DIRECT RCS AND RATE DAMPING IN EACH AXIS.

2. TVC: BOTH SERVO LOOPS AND TWO TVC CONTROL MODES (ACCEL CMD EXCLUDED).

3. G&N: THE G&N MUST BE FULLY OPERATIONAL WITH THE EXCEPTION OF OPTICS AND NAV DSKY. OPTICS MUST BE CAPABLE OF ALIGNING PLATFORM.

4. RCS TRANSLATION: "X"-AXIS VIA AUTO COILS.

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.

RULES 11-5 THROUGH
11-14 ARE RESERVED.

REV	ITEM	SYSTEM MANAGEMENT
	11-15	PIPA AND IRIG BIAS WILL BE UPDATED WHEN ACTUAL BIASES DIFFER FROM VALUES IN CMC ERASABLE BY .02 FT/SEC^2 AND 0.075 DEG/HR RESPECTIVELY.
A	11-16	ΔV COUNTER DRIFT SHOULD THE ΔV COUNTER DRIFT BE >.032 FT/SEC^2, AND BE REPEATABLE, SUBSEQUENT SETTINGS WILL BE SUITABLY BIASED. THE TOLERANCE SPREAD ON REPEATABILITY IS .03 FT/SEC^2.
A	11-17	DAP INITIALIZATION GIMBAL TRIMS: WILL BE UPDATED FOR EVERY SPS MANEUVER BASED ON FINAL TRIM POSITIONS OF THE PREVIOUS MANEUVER AS MONITORED ON TELEMETRY, IF THE PREVIOUS MANEUVER WAS SCS CONTROLLED. IF THE PREVIOUS MANEUVER WAS G&N CONTROLLED THE CMC STORED VALUES WILL BE USED. CSM WT: WILL BE UPDATED WHEN ACTUAL VALUE DIFFERS FROM VALUE IN CMC ERASABLE BY 1 PERCENT.
		RULES 11-18 THROUGH 11-24 ARE RESERVED.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	11-25	LOSS OF BMAG 1 OR 2 IN:	LAUNCH	CONTINUE MISSION	MALF PROC: SCS 3,6
		A. PITCH AXIS	ALL	A. CONTINUE MISSION DELETE SCS AUTO BURNS	
		B. YAW AXIS	ALL	B.1. CONTINUE MISSION DELETE SCS AUTO BURNS	
				2. CONTINUE MISSION AFTER .05G RSI IS USABLE IF REMAINING GYRO IS SELECTED FOR RATE.	IF FAILURE IS YAW 1, FDAI ROLL IS LOST.
	11-26	LOSS OF BOTH BMAG 1 AND 2 IN EITHER PITCH OR YAW AXIS	LAUNCH	CONTINUE MISSION MTVC ACCEL CMD IS ONLY MODE III OR IV CAPABILITY.	
			EPO	ENTER NEXT BEST PTP	
			TLC	NO GO FOR LOI ENTER NEXT BEST PTP IF YAW AXIS.	VIOLATES REDUNDANT ENTRY ATTITUDE REF CRITERIA.
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
			ENTRY	CONTINUE MISSION RSI AND FDAI ROLL UNUSABLE WITH YAW AXIS FAILURE.	
	11-27	LOSS OF ROLL BMAG			MALF PROC: SCS 3.6
		A. NUMBER ONE	ALL	CONTINUE MISSION MANUAL ROLL ATTITUDE CONTROL REQUIRED IN ALL SCS MODES.	
			ENTRY	CONTINUE MISSION NO SCS FDAI ROLL. RSI VALID.	
		B. NUMBER TWO	ALL	CONTINUE MISSION USE OF ATT 1/RATE 2 AND LIM CYCLE MAY PROVIDE RATE DAMPED ATTITUDE HOLD WHEN RCS DAP IS NOT USED. (UNLESS FAILURE IS HARDOVER.)	WITH A HARDOVER FAILURE THE ATT 1/RATE 2 CONFIGURATION IS NOT USABLE.
			ENTRY	CONTINUE MISSION SELECTION OF RATE 1 WILL PROVIDE BOTH RSI AND SCS FDAI ROLL.	
A	11-28	LOSS OF BOTH ROLL BMAGS	LAUNCH	CONTINUE MISSION	THESE FAILURES VIOLATE THE THREE-AXIS RATE-DAMPING REQUIREMENT FOR THE HYBRID DEORBIT.
			EPO	1. NO GO FOR TLI CONTINUE MISSION IF SM DEORBIT AVAILABLE.	
				2. ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE	
			TLC	ENTER NEXT BEST PTP	
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
			ENTRY	CONTINUE MISSION RSI AND FDAI ROLL UNUSABLE	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	11-29	LOSS OF EITHER TVC SERVO LOOP IN EITHER PITCH OR YAW AXIS.	LAUNCH/ EPO	NO GO FOR TLI. AS APPROPRIATE, SELECT 1 OR 2 ON TVC GMBL DR SWITCH.	FAILURE PROBABLY NOT DETECTABLE PRE-TLI.
			TLC	NO GO FOR LOI.	
			LO	PLAN TEI FOR NEXT OPPORTUNITY.	
			TEC	CONTINUE MISSION. AS APPROPRIATE, SELECT 1 OR 2 ON TVC GMBL DR SWITCH.	
	11-30	LOSS OF BOTH TVC SERVO LOOPS	LAUNCH	CONTINUE MISSION NO MODE III OR IV CAPABILITY. LIMITED LANDING POINT CONTROL IN MODE III OR IV WITH SM-RCS.	MALF PROC: SCS _____
			EPO	ENTER NEXT BEST PTP RCS DEORBIT.	
			TLC	NO GO FOR LOI.	
	11-31	LOSS OF PROPORTIONAL CONTROL FROM:			
		A. EITHER RHC	ALL	A. CONTINUE MISSION USE REMAINING RHC	MALF PROC: SCS _____
		B. BOTH RHC'S	ALL	B. CONTINUE MISSION USE DIRECT RCS OR ACCEL CMD FOR MANUAL MANEUVERS. NO MTVC CAPABILITY.	
	11-32	LOSS OF DIRECT RCS CONTROL			MALF PROC: SCS _____
		A. EITHER RHC	ALL	A. CONTINUE MISSION	
		B. BOTH RHC'S	LAUNCH	B. CONTINUE MISSION	
			EPO	ENTER NEXT BEST PTP.	
			TLC	ENTER NEXT BEST PTP. NO GO FOR LOI.	
			LO	PLAN TEI FOR NEXT OPPORTUNITY.	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	11-33	COMPLETE LOSS OF AUTO ATTITUDE CONTROL IN PITCH AND YAW CHANNELS.	LAUNCH	CONTINUE MISSION	MALF PROC: SCS _____ SUSPECTED FAILURE WOULD BE AUTO INHIBIT CIRCUITRY.
		A. CONTROL IS REGAINED BY OPENING EMS CB'S	ALL	A. CONTINUE MISSION AFTER SM JETTISON EMS MAY BE RE-ENABLED WITHOUT LOSS OF AUTO RCS.	
		B. CONTROL IS REGAINED BY PLACING SPACECRAFT CONTROL SWITCH TO CMC.	EPO	B.1. NO-GO FOR TLI CONTINUE MISSION IF SM DEORBIT CAPABILITY AVAILABLE. 2. ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE.	SCS TVC CAPABILITY COMPROMISED BY LACK OF ATTITUDE CONTROL.
			TLC	NO-GO FOR LOI	
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
		C. CONTROL IS NOT REGAINED	EPO	C. ENTER NEXT BEST PTP	FAILURE VIOLATES MINIMUM CAPABILITY CRITERIA FOR BOTH BACKUP DEORBIT METHODS.
			TLC	ENTER NEXT BEST PTP NO-GO FOR LOI USE DIRECT ULLAGE AND DIRECT RCS	FAILURE VIOLATES RATE DAMPING CRITERIA.
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
	11-34	LOSS OF FLIGHT DIRECTOR ATTITUDE INDICATORS			MALF PROC: SCS _____
		A. ONE	ALL	A. CONTINUE MISSION	
		B. BOTH	EPO	B. ENTER NEXT BEST PTP	
			TLC	NO-GO FOR LOI	
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
A	11-35	LOSS OF AC1 ϕ A	LAUNCH	CONTINUE MISSION	LOSS OF AC1 ϕ A RESULTS IN THE LOSS OF: A. REDUNDANT SERVO LOOP POWER. B. PROPORTIONAL CONTROL FROM BOTH RHC'S FOR ATTITUDE CONTROL. C. FDAI #1 BALL POWER. D. SCS ATTITUDE ERROR. E. GYRO ASSEMBLY NO. 1 (THEREFORE, LOSS OF SCS AUTO TVC AND ATTITUDE HOLD). F. SCS ATTITUDE CONTROL-MIN. IMPULSE, RATE DAMPING PSEUDO RATE. G. PROPORTIONAL CONTROL FROM RHC #1 FOR TVC. H. FDAI ROLL FOR ENTRY. I. GDC TOTAL ATTITUDE. J. FDAI LIGHTING. K. 1/2 OF FP/GPI
			EPO	ENTER NEXT BEST PTP	
			TLC	NO-GO FOR LOI	
			LO	PLAN TEI FOR NEXT OPPORTUNITY	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	11-36	LOSS OF AC2 ϕ A	LAUNCH	CONTINUE MISSION	LOSS OF AC2 ϕ A RESULTS IN THE LOSS OF: A. REDUNDANT SERVO LOOP POWER. B. PROPORTIONAL CONTROL FROM BOTH RHC'S. C. FDAI #2 BALL POWER. D. GYRO ASSEMBLY 2. E. ALL SCS TVC CAPABILITY. F. RSI G. GDC TOTAL ATTITUDE H. 1/2 OF FP/GPI
			EPO	ENTER NEST BEST PTP	
			TLC	NO-GO FOR LOI	
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
	11-37	LOSS OF ORBIT RATE DISPLAY EARTH AND LUNAR (ORDEAL)	ALL	CONTINUE MISSION	
	11-38	LOSS OF ENTRY MONITOR SYSTEM	ALL	CONTINUE MISSION	
	11-39	GROUND AT EITHER SPS SOL DRIVER OUTPUT AND UNABLE TO REMOVE.	LAUNCH	CONTINUE MISSION	
			EPO	NO-GO FOR TLI USE OTHER SPS BANK FOR ENGINE OPERATION.	REMOVAL MAY REQUIRE LOSS OF TVC DAP OR ΔV COUNTER.
			TLC	NO-GO FOR LOI	
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
		RULES 11-40 THROUGH 11-44 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	11-45	LOSS OF COMMAND MODULE COMPUTER	LAUNCH	CONTINUE MISSION	MALF PROC: G&C _____
			EPO	1. NO-GO FOR TLI. CONTINUE MISSION IF SM DEORBIT CAPABILITY AVAILABLE.	
				2. ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE.	
			TLC	NO-GO FOR LOI	
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
			ENTRY	FLY EMS ENTRY	
	11-46	LOSS OF MDC DSKY	ALL	CONTINUE MISSION	MALF PROC: G&C _____
	11-47	LOSS OF NAV DSKY			
		A. ENCODER OR DECODER	ALL	A. CONTINUE MISSION	
		B. CMC WARNING RELAY	LAUNCH	B. CONTINUE MISSION	B. CONSTITUTES LOSS OF PIPA'S G&N TVC, ENTRY GUIDANCE, AND FINE ALIGN.
			EPO	1. NO-GO FOR TLI. CONTINUE MISSION IF SM DEORBIT AVAILABLE.	
				2. ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE.	PIPA'S ARE REQUIRED FOR ΔV SENSING IN HYBRID DEORBIT.
			TLC	NO-GO FOR LOI.	
			LO	PLAN TEI FOR NEXT OPPORTUNITY.	
			ENTRY	FLY EMS ENTRY	
	11-48	LOSS OF INERTIAL SUBSYSTEM	LAUNCH	CONTINUE MISSION	MALF PROC: G&C _____
			EPO	1. NO-GO FOR TLI. CONTINUE MISSION IF SM DEORBIT AVAILABLE.	
				2. ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE.	VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS.
			TLC	NO-GO FOR LOI	
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
			ENTRY	FLY EMS ENTRY	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	11-49	LOSS OF OPTICS SUBSYSTEM	LAUNCH	NOT APPLICABLE	FOR THIS PURPOSE "LOSS" MEANS OPTICS FOGGED OR COVERED SUCH THAT CREW CANNOT SIGHT STARS, OR INOPERABLE IN MANUAL MODE.
			EPO	NO-GO FOR TLI	
			TLC	NO-GO FOR LOI	
			LO/TEC	CONTINUE MISSION	
A	11-50	LOSS OF OPTICS SUBSYSTEM COUPLING DATA UNIT DIGITAL TO ANALOG CONVERTER.	LAUNCH	NOT APPLICABLE	CONSTITUTES LOSS OF G&N TVC.
			EPO	NO-GO FOR TLI	
			TLC	NO-GO FOR LOI	
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
		RULE 11-51 THROUGH 11-59 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	11-49	LOSS OF OPTICS SUBSYSTEM	LAUNCH	NOT APPLICABLE	FOR THIS PURPOSE "LOSS" MEANS OPTICS FOGGED OR COVERED SUCH THAT CREW CANNOT SIGHT STARS, OR INOPERABLE IN MANUAL MODE.
			EPO	NO-GO FOR TLI	
			TLC	NO-GO FOR LOI	
			LO/TEC	CONTINUE MISSION	
	11-50	LOSS OF OPTICS SUBSYSTEM COUPLING DATA UNIT DIGITAL TO ANALOG CONVERTER.	LAUNCH	NOT APPLICABLE	CONSTITUTES LOSS OF TVC DAP.
			EPO	NO-GO FOR TLI	
			TLC	NO-GO FOR LOI	
			LO	PLAN TEI FOR NEXT OPPORTUNITY	
		RULE 11-51 THROUGH 11-59 ARE RESERVED.			

REV	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
A	11-60	CMC DIGITAL DATA	CG0001V	-	-	MANDATORY	11-15/17
		PITCH GIMBAL POS 1 & 2	CH3517H	GPI	COMMON	1 OF 2 MANDATORY O/B OTHER HD	11-29/30
		YAW GIMBAL POS 1 & 2	CH3518H	GPI	COMMON	1 OF 2 MANDATORY O/B OTHER HD	11-29/30
		TM BIAS 2.5 VDC	CG1110V	-	-	HIGHLY DESIRABLE	11-48/49/50
		IMU HTR +28 VDC	CG1513X	-	-	HIGHLY DESIRABLE	11-48
		CMC OPERATE +28 VDC	CG1523X	-	-	HIGHLY DESIRABLE	11-45
		OPTX OPERATE 28 VAC	CG1533X	-	-	HIGHLY DESIRABLE	11-49
		IG 1X RSVR OUT SIN	CG2112V	FDAI	COMMON	HIGHLY DESIRABLE	11-48
		IG 1X RSVR OUT COS	CG2113V	FDAI	COMMON	HIGHLY DESIRABLE	11-48
		MG 1X RSVR OUT SIN	CG2142V	FDAI	COMMON	HIGHLY DESIRABLE	11-48
		MG 1X RSVR OUT COS	CG2143V	FDAI	COMMON	HIGHLY DESIRABLE	11-48
		OG 1X RSVR OUT SIN	CG2172V	FDAI	COMMON	HIGHLY DESIRABLE	11-48
		OG 1X RSVR OUT COS	CG2173V	FDAI	COMMON	HIGHLY DESIRABLE	11-48
		SHAFT CDU DAC OUT	CG3721V	-	-	HIGHLY DESIRABLE	11-50
		TRUNNION CDU DAC OUT	CG3722V	-	-	HIGHLY DESIRABLE	11-50
		CMC WARNING	CG5040X	C&W	COMMON	HIGHLY DESIRABLE	11-45
		PITCH ATT ERROR	CH3500H	FDAI	COMMON	HIGHLY DESIRABLE	11-25/26/27/28
		YAW ATT ERROR	CH3501H	FDAI	COMMON	HIGHLY DESIRABLE	11-25/26/27/28
		ROLL ATT ERROR	CH3502H	FDAI	COMMON	HIGHLY DESIRABLE	11-25/26/27/28
		SCS PITCH BODY RATE	CH3503H	FDAI	COMMON	HIGHLY DESIRABLE	11-25/26/27/28
		SCS YAW BODY RATE	CH3504H	FDAI	COMMON	HIGHLY DESIRABLE	11-25/26/27/28
		SCS ROLL BODY RATE	CH3505H	FDAI	COMMON	HIGHLY DESIRABLE	11-25/26/27/28
		SCS TVC PITCH AUTO CMD	CH3582	-	-	HIGHLY DESIRABLE	11-2/4/29/30
		SCS TVC YAW AUTO CMD	CH3583	-	-	HIGHLY DESIRABLE	11-2/4/29/30
		MTVC PITCH CMD	CH3585	-	-	HIGHLY DESIRABLE	11-2/4/29/30
		MTVC YAW CMD	CH3586	-	-	HIGHLY DESIRABLE	11-2/4/29/30
		FDAI ERROR 5 RATE 5	CH3592	-	-	HIGHLY DESIRABLE	11-25/26/27/28
		FDAI ERROR 50/15	CH3593	-	-	HIGHLY DESIRABLE	11-25/26/27/28
		PITCH DIFF CLUTCH CUR	CH3666	-	-	HIGHLY DESIRABLE	11-29/30
		YAW DIFF CLUTCH CUR	CH3667	-	-	HIGHLY DESIRABLE	11-29/30

12 CSM SERVICE
PROPULSION
SERVICE

REV	ITEM	GENERAL
	12-1	LAUNCH THERE ARE NO SPS FAILURES THAT ARE CONSIDERED CAUSE FOR ABORT.
	12-2	ALL OTHER PHASES: A. FAILURES AFFECTING THE SPS FALL INTO ONE OF THREE CATEGORIES: 1. FAILURES THAT CAUSE THE SPS TO BE UNSAFE. FAILURES IN THIS CATEGORY CAUSE THE MISSION TO BE TERMINATED BY ENTRY INTO THE NEXT BEST PTP. 2. FAILURES THAT CAUSE THE SPS TO BE INOPERABLE OR UNSAFE TO OPERATE. FAILURES IN THIS CATEGORY CAUSE THE MISSION TO BE TERMINATED OR ALTERED SUCH THAT SUBSEQUENT SPS MANEUVERS ARE NOT NECESSARY. 3. FAILURES WHICH DEGRADE THE CAPABILITY OF THE SPS TO A DEGREE THAT REQUIRES THAT ALL PLANNED BURNS EXCEPT CRITICAL BURNS BE INHIBITED. FAILURES IN THIS CATEGORY CAUSE THE MISSION TO BE ALTERED SUCH THAT SUBSEQUENT SPS MANEUVERS ARE NOT NECESSARY, IF POSSIBLE. B. WITH STORAGE TANKS EMPTY, EITHER A TWO-JET OR FOUR-JET ULLAGE MANEUVER IS REQUIRED PRIOR TO ALL NON-CRITICAL MANEUVERS. LACK OF CAPABILITY TO PERFORM AN ULLAGE MANEUVER WILL NOT BE CAUSE FOR INHIBITING A CRITICAL BURN. C. SPS ANOMALIES OR DEGRADATIONS ARE NOT CAUSE FOR TERMINATING A CRITICAL BURN. NON-CRITICAL BURNS WILL BE TERMINATED FOR SPS ANOMALIES OR DEGRADATIONS WHICH CAUSE OR COULD LEAD TO UNSAFE CONDITIONS.
	12-3	EARTH ORBIT PHASE: A. CRITICAL BURNS IN THIS PHASE ARE MODE IV, APOGEE KICK, AND DEORBIT. IF THE SPS IS INCAPABLE OF PERFORMING CRITICAL BURNS, THE MISSION WILL BE TERMINATED BY ENTRY INTO THE NEXT BEST PTP USING SM OR HYBRID TECHNIQUES. B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL BURNS, TLI WILL BE INHIBITED AND A SUITABLE EARTH ORBIT ALTERNATE MISSION WILL BE IMPLEMENTED. THE SPS MAY BE USED FOR DEORBIT ONLY.
A	12-4	TRANSLUNAR COAST PHASE: A. CRITICAL MANEUVERS IN THIS PHASE ARE TIME CRITICAL ABORTS, BURNS TO ASSURE FREE RETURN, OR BURNS TO AVOID LUNAR OR LAND IMPACT WHICH ARE OUTSIDE SM-RCS CAPABILITY. HOWEVER, ONCE INITIATED, THESE MANEUVERS ARE CONSIDERED NON-CRITICAL BECAUSE SUFFICIENT TIME IS AVAILABLE FOR ANALYSIS AND POSSIBLE CORRECTIVE ACTION. B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL BURNS, FURTHER NON-CRITICAL BURNS AND LOI WILL BE INHIBITED.
	12-5	LUNAR ORBIT A. TEI IS THE ONLY CRITICAL MANEUVER IN THIS PHASE. B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL MANEUVERS, FURTHER NON-CRITICAL MANEUVERS WILL BE INHIBITED.

REV	ITEM	
A	12-6	TRANSEARTH COAST: A. CRITICAL MANEUVERS IN THIS PHASE ARE MIDCOURSE MANEUVERS TO ATTAIN THE PROPER ENTRY CORRIDER WHICH ARE OUTSIDE SM-RCS CAPABILITY. HOWEVER, ONCE INITIATED THESE MANEUVERS CAN BE CONSIDERED NON-CRITICAL BECAUSE SUFFICIENT TIME IS AVAILABLE FOR ANALYSIS AND POSSIBLE CORRECTIVE ACTION.

RULES 12-7 THROUGH
12-14 ARE RESERVED.

REV	ITEM	
		SYSTEM MANAGEMENT
	12-15	PROPELLANT GAGING A. PRIME METHOD: ONBOARD GAGING SYSTEM (1%) B. BACKUP METHOD: 1. FLOW RATE X BURN TIME (_____%) 2. HELIUM PRESSURE/TEMPERATURE (_____%)
	12-16	PROPELLANT UTILIZATION VALVE THE PU VALVE WILL BE USED TO CONTROL THE O/F MIXTURE RATIO TO MAINTAIN PROPELLANT BALANCE WITHIN ± 100 POUNDS.
	12-17	DUAL BANK VS SINGLE BANK OPERATION ALL PLANNED SPS BURNS WILL BE PERFORMED USING DUAL BANK OPERATION.
	12-18	FEEDLINE HEATERS: THE SPS PROPELLANT FEEDLINE TEMPERATURES WILL BE MAINTAINED BETWEEN 45 AND 75°F MANUALLY.
A	12-19	THE SPS PU VALVE TEMPERATURE WILL BE MAINTAINED ABOVE 35°F BY ORIENTING THE SPACECRAFT FOR OPTIMUM SOLAR RADIATION EFFECTS.
		RULES 12-20 THROUGH 12-24 ARE RESERVED

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	12-25	SUSTAINED PRESSURE DECAY IN EITHER THE FUEL OR OXIDIZER TANK (COULD BE HELIUM OR FUEL OR OXIDIZER).			MALF PROC: SPS 1
			LAUNCH	CONTINUE MISSION	MANUAL PRESSURIZATION OF THE TANKS SHOULD BE CONSIDERED PRIOR TO ANY REQUIRED SPS BURN
				• PLAN ENTRY INTO PTP 2-1. RCS DEORBIT.	
				• IF LAND IMPACT IS IMMINENT AFTER ABORTING, REPRESS MANUALLY AND PERFORM BURN TO AVOID LAND.	THIS RULING SUBJECT TO CHANGE PENDING INVESTIGATION OF SERIOUSNESS OF LIQUID LEAKS INTO SERVICE MODULE.
			EPO	ENTER NEXT BEST PTP RCS DEORBIT	
			TLC	NO-GO FOR LOI INHIBIT NON-CRITICAL SPS BURNS	
			LO	PLAN TEI ASAP	
			TEC	CONTINUE MISSION INHIBIT NON-CRITICAL SPS BURNS.	
		A. DURING NON-CRITICAL BURN	ALL	A. TERMINATE BURN IF LOI_1 REPRESS MANUALLY AND PERFORM 15 MIN ABORT.	
		B. DURING CRITICAL BURN	ALL	B. CONTINUE BURN	B. CRITICAL BURNS ARE MODE IV, APOGEE KICK, DEORBIT AND TEI.
A	12-26	LOSS OF ONE GN_2 TANK PRESSURE (<400 PSI).	LAUNCH	CONTINUE MISSION	
			EPO	CONTINUE MISSION	TRANSDUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION.
			TLC	NO-GO FOR LOI	
			LOI_1	BE PREPARED TO SHUTDOWN SPS ASAP IF ALL BALL VALVES DO NOT OPEN. IF OTHER GN_2 TANK LEAKING, TERMINATE BURN AND PERFORM 15 MIN ABORT.	
			LO	PLAN TEI FOR NEXT OPPORTUNITY.	
A	12-27	ONE BANK OF BALL VALVES FAIL TO OPEN DURING AN SPS BURN	LAUNCH	CONTINUE MISSION	
			EPO	CONTINUE MISSION	TRANSDUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION.
			TLC	NO-GO FOR LOI	
			LOI_1	BE PREPARED TO SHUTDOWN SPS ASAP IF ALL BALL VALVES DO NOT OPEN. IF OTHER GN_2 TANK LEAKING, TERMINATE BURN AND PERFORM 15 MIN ABORT.	
			LO	PLAN TEI FOR NEXT OPPORTUNITY.	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	12-28	LOSS OF BOTH GN_2 TANK PRESSURES (<400 PSI).	LAUNCH	CONTINUE MISSION	MALF PROC: SPS ____
			EARTH ORBIT	ENTER NEXT BEST PTP RCS DEORBIT	
			TLC	NO-GO FOR LOI NO ABORT CAPABILITY	
			LUNAR ORBIT	ATTEMPT TEI	
			TEC	CONTINUE MISSION	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	12-29	FUEL FEEDLINE AND/OR OXIDIZER FEEDLINE TEMP <27°F AND UNABLE TO INCREASE.	LAUNCH	CONTINUE MISSION	MALF PROC: SPS ____
			EARTH ORBIT	ENTER NEXT BEST PTP RCS DEORBIT	
			TLC	NO-GO FOR LOI NO ABORT CAPABILITY	
			LUNAR ORBIT	ATTEMPT TEI	
			TEC	CONTINUE MISSION	
A	12-30	PU VALVE TEMP <27°F AND UNABLE TO INCREASE VIA SOLAR RADIATION.	TLC	NO-GO FOR LOI	
			LUNAR ORBIT	PLAN TEI FOR NEXT OPPORTUNITY.	
			TEC	CONTINUE MISSION	
A	12-31	ENGINE FLANGE TEMP GOES HIGHER THAN 480°F DURING AN SPS BURN.	LAUNCH EARTH ORBIT	NOT APPLICABLE ENTER NEXT BEST PTP RCS DEORBIT	
		A. DURING NON-CRITICAL BURNS	ALL	A. TERMINATE BURN IF LOI_1, MODE 1, PERFORM 15 MIN ABORT.	
		B. DURING CRITICAL BURNS	ALL	B. CONTINUE BURN INHIBIT FURTHER NON-CRITICAL BURNS	REF RULE 1-37 FOR CRITICAL BURNS
A	12-32	THRUST CHAMBER PRESSURE <70 PSI CONFIRMED BY OTHER INSTRUMENTATION	LAUNCH	NOT APPLICABLE	
			EARTH ORBIT	ENTER NEXT BEST PTP RCS DEORBIT	
			TLC	NO-GO FOR LOI INHIBIT FURTHER BURNS	
		A. DURING NON-CRITICAL BURN	ALL	A. TERMINATE BURN IF LOI_1 PERFORM 15 MIN ABORT.	
		B. DURING CRITICAL BURN	ALL	B. CONTINUE BURN AND INHIBIT FURTHER NON-CRITICAL BURNS	REF RULE 1-37 FOR CRITICAL BURNS
	12-33	LACK OF ULLAGE CAPABILITY	LAUNCH EPO	NOT APPLICABLE NO-GO FOR TLI	
			TLC	NO-GO FOR LOI	
			LO/TEC	INHIBIT NON-CRITICAL MANEUVERS.	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	12-34	ΔP BETWEEN FUEL AND OXIDIZER TANK PRESSURES >20 PSI AND UNABLE TO DECREASE	LAUNCH	CONTINUE MISSION	
			EPO	ENTER NEXT BEST PTP RCS DEORBIT	
			TLC	NO-GO FOR LOI	
			LO	ATTEMPT TEI	
		A. DURING NON-CRITICAL BURN	ALL	A. TERMINATE BURN IF LOI_1 PERFORM 15 MIN ABORT.	
		B. DURING CRITICAL BURN	ALL	B. CONTINUE BURN	REF RULE 1-37 FOR CRITICAL BURNS.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	12-35	LEAK OR COMPLETE LOSS OF HELIUM SUPPLY PRESSURE OR BOTH HELIUM VALVES FAIL CLOSED.	LAUNCH	CONTINUE MISSION	
			EPO	ENTER NEXT BEST PTP RCS DEORBIT	RULING SUBJECT TO CHANGE PENDING INVESTIGATION OF BLOWDOWN CAPABILITY.
			TLC	NO-GO FOR LOI	BLOWDOWN ΔV REMAINING IS A FUNCTION OF ULLAGE VOLUME AT TIME OF FAILURE.
			LO	PLAN TEI ASAP	
			TEC	1. CONTINUE MISSION 2. SPS MANEUVERS ALLOWED WITHIN BLOWDOWN CAPABILITY	
		RULES 12-36 THROUGH 12-39 ARE RESERVED			

REV	ITEM
A	12-40

INSTRUMENTATION REQUIREMENTS

MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
OX TK PRESS	SP0003P	METER/C&W	COMMON	MANDATORY	
OX SM/ENG INTERFACE P	SP0931P	-	-	MANDATORY -1 OF 2	12-25/34
FU TK PRESS	SP0006P	METER/C&2	COMMON	MANDATORY	
FU SM/ENG INTERFACE P	SP0930P	-	-	MANDATORY -1 OF 2	12-25/34
SPS VLV ACT PRESS-PRI	SP0600P	METER	COMMON	MANDATORY O/B	
SPS VLV ACT PRESS-SEC	SP0601P	METER	COMMON	MANDATORY O/B -1 OF 2	12-26/28
SPS FU FEEDLINE TEMP	SP0048T	METER	COMMON	MANDATORY	
SPS OX FEEDLINE TEMP	SP0049T	SYS TEST	COMMON	MANDATORY -1 OF 2	12-29
SPS INJ FLANGE TEMP 1	SP0061T	C&W	COMMON	MANDATORY O/B	
SPS INJ FLANGE TEMP 2	SP0062T	C&W	COMMON	MANDATORY O/B -1 OF 2	12-31
ENG CHAMBER PRESS	SP0661P	METER	COMMON	HIGHLY DESIRABLE	12-32
HE TK PRESS	SP0001P	METER	SEPARATE	MANDATORY O/B	12-35
FU/OX VLV 1 POS	SP0022H	DISPLAY	SEPARATE	HIGHLY DESIRABLE	12-27
FU/OX VLV 2 POS	SP0023H	DISPLAY	SEPARATE	HIGHLY DESIRABLE	12-27
FU/OX VLV 3 POS	SP0024H	DISPLAY	SEPARATE	HIGHLY DESIRABLE	12-27
FU/OX VLV 4 POS	SP0025H	DISPLAY	SEPARATE	HIGHLY DESIRABLE	12-27
OX TK 1 QTY - TOTAL AUX	SP0655Q	DISPLAY	COMMON	HIGHLY DESIRABLE	12-12
OX TK2 QTY	SP0656Q	DISPLAY	COMMON	HIGHLY DESIRABLE	12-12
FU TK 1 QTY - TOTAL AUX	SP0657Q	DISPLAY	COMMON	HIGHLY DESIRABLE	12-12
FU TK 2 QTY	SP0658Q	DISPLAY	COMMON	HIGHLY DESIRABLE	12-12
P/U VLV INLET T	SP0617T	T/M	-	MANDATORY	
P/U VLV OUTLET T	SP0618T	T/M	-	MANDATORY -1 OF 2	12-30
OX TK PRESS	SP0003	METER/C&W	COMMON	MANDATORY O/B	12-25
FU TK PRESS	SP0006	METER/C&W	COMMON	MANDATORY O/B-2 OF 3	12-25
ENG CHAMBER PRESS	SP0661	METER	COMMON	MANDATORY O/B	12-32

13 CSM SM–RCS SYSTEM

REV	ITEM	GENERAL
	13-1	LAUNCH THE LOSS OF ONE QUAD IS NOT CAUSE FOR ABORT AND THERE ARE NO SINGLE FAILURES NOR ANY REASONABLE REALISTIC COMBINATION OF FAILURES WHICH LEAD ONLY TO LOSS OF MULTIPLE QUADS. THEREFORE, THERE ARE NO SM-RCS FAILURES WHICH ARE CONSIDERED CAUSE FOR ABORT.
	13-2	EARTH ORBIT PHASE 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 TLI BE INHIBITED, AND MAY LEAD TO EARLY MISSION TERMINATION SINCE THE CAPABILITY TO PERFORM SM OR HYBRID DEORBIT WILL BE AFFECTED. B. LOSS OF TWO OR MORE QUADS IS CAUSE FOR ENTRY INTO THE NEXT BEST PTP. 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. 2. LOSS OF TWO OPPOSITE QUADS WILL DESTROY THE CAPABILITY TO PERFORM PRECISE 3-AXIS ATTITUDE CONTROL AND PRECLUDES SM OR HYBRID DEORBIT.
	13-3	TRANSLUNAR COAST LOSS OF ONE QUAD IS NOT, IN ITSELF, CAUSE FOR TERMINATION OF THE MISSION. HOWEVER, CONSIDERING THE EFFECTS OF POSSIBLE SUBSEQUENT QUAD OR JET FAILURES, THE TRANSLUNAR COAST PHASE WILL BE TERMINATED BY ENTRY INTO THE NEXT BEST PTP.
	13-4	LOI LOSS OF ONE QUAD IS CAUSE FOR INHIBITING LOI_1, BECAUSE SUBSEQUENT FAILURE OF QUADS OR JETS IMPAIR ATTITUDE CONTROL OR ULLAGE.
	13-5	LUNAR ORBIT LOSS ON ONE QUAD IS CAUSE FOR EARLY TERMINATION OF LUNAR ORBIT PHASE AND FOR INHIBITING LOI_2. 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.
		RULES 13-6 THROUGH 13-14 ARE RESERVED

REV.	ITEM	
		SYSTEM MANAGEMENT
		PROPELLANT GAGING
	13-15	A. PRIME METHOD: RTCC EQUATION (6%) B. BACKUP METHOD: (ONBOARD) HELIUM PRESSURE/TEMPERATURE (11%)
	13-16	QUAD PROPELLANT BALANCE
		A. 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 QUADS AND BY CHOOSING SUITABLE JETS FOR ATTITUDE CONTROL. PROPELLANT DIFFERENCES BETWEEN QUADS WILL BE MAINTAINED WITHIN 15 POUNDS.
		RULES 13-17 THROUGH 13-19 ARE RESERVED

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	13-20	SUSTAINED LEAK IN HELIUM TANK			MALF PROC: RCS 2
		A. ONE OR MORE QUADS	LAUNCH	CONTINUE MISSION	QUAD WILL REMAIN USABLE UNTIL HE MANIFOLD PRESSURE REACHES 75 PSI.
		B. ONE QUAD (ALL OTHER QUADS NORMAL).	EPO	NO-GO FOR TLI	
			TLC	ENTER NEXT BEST PTP. NO-GO FOR LOI.	
			LO	PLAN TEI FOR NEXT OPPORTUNITY.	
		C. MORE THAN ONE QUAD	EPO	CONTINUE MISSION ENTER PRIOR TO LOSS OF HYBRID DEORBIT CAPABILITY.	
			ALL OTHER	REF RULING B	
	13-21	SUSTAINED LEAK BELOW HE ISOLATION VALVE (COULD BE HELIUM OR FUEL OR OXIDIZER)			MALF PROC: RCS 2A
		A. ONE OR MORE QUADS	LAUNCH	CONTINUE MISSION.	QUAD WILL REMAIN USABLE UNTIL HE MANIFOLD PRESSURE REACHES 75 PSI
		B. ONE QUAD (ALL OTHER QUADS NORMAL)	EPO	NO-GO FOR TLI.	
			TLC	ENTER NEXT BEST PTP. NO-GO FOR LOI.	
			LO	PLAN TEI FOR NEXT OPPORTUNITY.	
		C. MORE THAN ONE QUAD	EPO	ENTER NEXT BEST PTP.	
			ALL OTHER	REF RULING B	
	13-22	PACKAGE TEMP <70°F AND UNABLE TO INCREASE.	LAUNCH	NOT APPLICABLE	MALF PROC: RCS 1A
		A. ONE QUAD (ALL OTHER QUADS NORMAL)	EPO	NO-GO FOR TLI.	
			TLC	ENTER NEXT BEST PTP. NO-GO FOR LOI.	
			LO	PLAN TEI FOR NEXT OPPORTUNITY.	
		B. MORE THAN ONE QUAD	EPC	ENTER NEXT BEST PTP	
			ALL OTHER	REF FULING A.	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	13-23	LOSS OF INDIVIDUAL THRUSTERS AS A RESULT OF CLOGGING, FREEZING, OR BURNOUT WHICH RESULT IN:	LAUNCH	NOT APPLICABLE	
		A. LOSS OF ONE PITCH OR ONE YAW OR TWO ROLL THRUSTERS IN THE SAME DIRECTION.	EPO	1. CONTINUE MISSION. 2. TLI NO-GO	SUBSEQUENT JET OR QUAD SINGLE FAILURES DESTROY PRECISE ATTITUDE CONTROL FOR BOTH RCS TRANSLATIONS AND SPS BURN INITIATION.
			TLC	LOI NO-GO	
			LO	PLAN TEI FOR NEXT OPPORTUNITY.	
			TEC	CONSIDER MANEUVER TO DECREASE FLIGHT TIME.	
		B. LOSS OF +X THRUSTERS ON ADJACENT QUADS	ALL	INHIBIT NON-CRITICAL SPS BURNS	REF SPS RULE 15-20 LACK OF ULLAGE CAPABILITY.
		C. LOSS OF ATTITUDE CONTROL IN ONE OR MORE AXES.	EPO	ENTER NEXT BEST PTP	
		RULES 13-24 THROUGH 13-29 ARE RESERVED.			

REV	ITEM
A	13-30

INSTRUMENTATION REQUIREMENTS

MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
SM HE TK A PRESS	SR5001P	METER	COMMON	MANDATORY-1 OF 2	13-20/21
SM HE P/T RATIO A	SR5025U	METER	COMMON	MANDATORY-1 OF 2	13-20/21
SM HE TK B PRESS	SR5002P	METER	COMMON	MANDATORY-1 OF 2	13-20
SM HE P/T RATIO B	SR5026U	METER	COMMON	MANDATORY-1 OF 2	13-20
SM HE TK C PRESS	SR5003P	METER	COMMON	MANDATORY-1 OF 2	13-20
SM HE P/T RATIO C	SR5027U	METER	COMMON	MANDATORY-1 OF 2	13-20
SM HE TK D PRESS	SR5004P	METER	COMMON	MANDATORY-1 OF 2	13-20
SM HE P/T RATIO D	SR5028U	METER	COMMON	MANDATORY-1 OF 2	13-20
SM ENG PKG A TEMP	SR5065T	METER/C&W	COMMON	HIGHLY DESIRABLE	13-22
SM ENG PKG B TEMP	SR5066T	METER/C&W	COMMON	HIGHLY DESIRABLE	13-22
SM ENG PKG C TEMP	SR5067T	METER/C&W	COMMON	HIGHLY DESIRABLE	13-22
SM ENG PKG D TEMP	SR5068T	METER/C&W	COMMON	HIGHLY DESIRABLE	13-22
SM HE TK A TEMP	SR5013T	METER	COMMON	HIGHLY DESIRABLE	13-20/21
SM HE TK B TEMP	SR5014T	METER	COMMON	HIGHLY DESIRABLE	13-20/21
SM HE TK C TEMP	SR5015T	METER	COMMON	HIGHLY DESIRABLE	13-20/21
SM HE TK D TEMP	SR5016T	METER	COMMON	HIGHLY DESIRABLE	13-20/21
SM HE MAN A PRESS	SR5729P	METER/C&W	COMMON	HIGHLY DESIRABLE	13-21
SM HE MAN B PRESS	SR5776P	METER/C&W	COMMON	HIGHLY DESIRABLE	13-21
SM HE MAN C PRESS	SR5817P	METER/C&W	COMMON	HIGHLY DESIRABLE	13-21
SM HE MAN D PRESS	SR5830P	METER/C&W	COMMON	HIGHLY DESIRABLE	13-21

14 CSM CM-RCS SYSTEM

REV	ITEM	GENERAL
	14-1	LAUNCH A. A SUSTAINED LEAK IN OR THE LOSS OF HELIUM SUPPLY PRESSURE IN ONE CM-RCS RING IS NOT CAUSE FOR ABORT SINCE THE REMAINING RING IS CAPABLE OF ABORT OR ENTRY ATTITUDE CONTROL; THIS FAILURE WILL REQUIRE ENTRY INTO PTP 6-4 SINCE SYSTEMS ARE NO LONGER REDUNDANT. B. A SUSTAINED LEAK IN OR THE LOSS OF HELIUM SUPPLY PRESSURE IN BOTH CM-RCS RINGS PRIOR TO TOWER JETTISON IS JUSTIFICATION FOR MODE I ABORT. AFTER TOWER JETTISON FLIGHT WILL BE CONTINUED INTO ORBIT AND THE MISSION WILL BE TERMINATED AT THE NEXT BEST PTP. C. LOSS OF FUEL OR OXIDIZER TANK PRESSURE IN EITHER RING IS NOT CAUSE FOR ABORT SINCE THEY ARE SINGLE POINTS OF INSTRUMENTATION AND CANNOT BE VERIFIED.
	14-2	ALL OTHER PHASES A. SUSTAINED LEAK IN OR LOSS OF HELIUM PRESSURE IN ONE CM-RCS RING DEPLETES THE REDUNDANCY OF THE ENTRY ATTITUDE CONTROL SYSTEM AND REDUCES THE ΔV AVAILABLE FOR CM-RCS DEORBIT. LOSS OF HELIUM SUPPLY PRESSURE IN BOTH CM-RCS RINGS DELETES ALL ENTRY ATTITUDE CONTROL CAPABILITY REQUIRING CONTINGENCY SM-RCS SPIN-UP PRIOR TO CM/SM SEP FOR EARTH ORBIT ENTRIES. THE LOSS OF ONE OR BOTH CM-RCS RINGS IS CAUSE FOR TERMINATING THE PHASE AND MISSION BY ENTRY INTO THE NEXT BEST PTP. B. LOSS OF FUEL OR OXIDIZER TANK PRESSURE IN EITHER RING IS NOT CAUSE FOR PHASE OR MISSION TERMINATION SINCE THEY ARE SINGLE POINTS OF INSTRUMENTATION AND CANNOT BE VERIFIED. C. 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.
		RULES 14-3 THROUGH 14-9 ARE RESERVED.

REV	ITEM	SYSTEM MANAGEMENT
A	14-10	THRUSTER TEMP CONTROL 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. MALF PROC: RCS 5.
	14-11	HELIUM INTERCONNECT AS A LAST RESORT, IF THE HELIUM IN ONE RING IS DEPLETED DUE TO A LEAK AND PROPELLANT IS DEPLETED IN THE OTHER RING, THE SYSTEMS MAY BE INTERCONNECTED IF THE REMAINING PROPELLANT IS REQUIRED FOR CONTROL. ONCE INTERCONNECTED THE RINGS CANNOT BE ISOLATED. MALF PROC: RCS 4.
		RULES 14-12 THROUGH 14-14 ARE RESERVED.

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	14-15	SUSTAINED LEAK IN OR COMPLETE LOSS OF HELIUM SUPPLY PRESSURE.			MALF PROC: NONE
		A. ONE RING	LAUNCH	A. CONTINUE MISSION. PLAN ENTRY PTP _____.	
		B. BOTH RINGS	LAUNCH	B.1. PRIOR TO TOWER JETT: ABORT MODE I. 2. AFTER TOWER JETT: CONTINUE MISSION. PLAN ENTRY PTP 2-1.	
		C. ONE RING	ALL	C.1. TERMINATE PHASE 2. ENTER NEXT BEST PTP. NORMAL ENTRY	
		D. BOTH RINGS	ALL	D.1. TERMINATE PHASE. 2. ENTER ASAP. CONTINGENCY SM-RCS SPIN-UP PRIOR TO CM/SM SEP IF ENTERING FROM EARTH ORBIT.	
	14-16	LOSS OF FUEL OR OXIDIZER TANK PRESSURE IN EITHER RING.	ALL	CONTINUE MISSION.	MALF PROC: NONE
	14-17	CM-RCS IS ARMED FOR ANY REASON.	ALL	A. TERMINATE PHASE. B. ENTER NEXT BEST PTP.	MALF PROC: NONE
		RULES 14-18 THROUGH 14-29 ARE RESERVED.			

REV	ITEM
A	14-30

INSTRUMENTATION REQUIREMENTS

MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
CM HE TK A PRESS	CR0001P	METER	COMMON	MANDATORY	14-15
CM HE TK B PRESS	CR0002P	METER	COMMON	MANDATORY	14-15
CM HE TK A TEMP	CR0003T	METER	COMMON	HIGHLY DESIRABLE	14-15
CM HE TK B TEMP	CR0004T	METER	COMMON	HIGHLY DESIRABLE	14-15

15 AEROMEDICAL

REV	ITEM	
	15-1	PRELAUNCH PRIOR TO COMMITTING TO LAUNCH, THE FOLLOWING CONDITIONS MUST BE MET: A. SATISFACTORY FLIGHT CREW PHYSIOLOGICAL STATUS. B. THE MINIMUM CABIN OXYGEN CONCENTRATION FOR LAUNCH IS 60 PERCENT. C. THE MINIMUM SUIT OXYGEN CONCENTRATION FOR LAUNCH IS 95 PERCENT.
	15-2	THE MAXIMUM ALLOWABLE CONCENTRATION OF PCO_2 ALLOWABLE FOR LAUNCH IS 5 MM HG.
A	15-3	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.
	15-4	THE POTABLE WATER PH MUST BE WITHIN 6.0 TO 8.0 SERVICING AND FINAL SAMPLING.
	15-5	LAUNCH THERE ARE NO MEDICAL REASONS FOR ABORTING DURING THE LAUNCH PHASE OTHER THAN THOSE CONDITIONS INTOLERABLE TO THE CREW.
A	15-6	EARTH PARKING ORBIT, TRANSLUNAR COAST, AND LUNAR ORBIT EARLY MISSION TERMINATION FOR MEDICAL REASONS 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 SAITSFACTORY ENVIRONMENT.
A	15-7	WATER PALATABILITY CREW EVALUATION OF THE DRINKING WATER TASTE WILL BE THE BASIS FOR DETERMINING WATER PALATABILITY, EVEN FOR KOH CONTAMINATION.
		RULES 15-8 THROUGH 15-14 ARE RESERVED

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MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-15	UNREADABLE ELECTROCARDIOGRAM	LAUNCH	CONTINUE MISSION	ARTIFACTS ANTICIPATED DURING LAUNCH
			EARTH ORBIT	CONTINUE MISSION	
A	15-16	ABNORMAL HEART RATE, RHYTHM, OR EKG	LAUNCH	CONTINUE MISSION	THE MCC SURGEON WILL EVALUATE THE PROBLEM AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS INEFFECTIVE.
			EPO	NO-GO FOR TLI	
			TLC	NO-GO FOR LOI	
			LO	ENTER NEXT BEST PTP	
			TEC	ENTER NEXT BEST PTP	
A	15-17	ABNORMAL RESPIRATORY RATE	LAUNCH	CONTINUE MISSION	THE MCC SURGEON WILL EVALUATE THE PROBLEM AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS INEFFECTIVE.
			EPO	NO-GO FOR TLI	
			TLC	NO-GO FOR LOI	
			LO	ENTER NEXT BEST PTP	
			TEC	ENTER NEXT BEST PTP	
A	15-18	ONSET OF SERIOUS MEDICAL PROBLEM IN ANY CREWMAN	LAUNCH	CONTINUE MISSION	CREW MAY ELECT TO ABORT IF CONDITION INTOLERABLE. THE MCC SURGEON MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS INEFFECTIVE.
			EPO	ENTER NEXT BEST PTP	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
			TEC	ENTER NEXT BEST PTP	
A	15-19	DYSBARISM IN ANY CREWMAN	LAUNCH	CONTINUE MISSION THE CREW MAY ELECT TO ABORT IF CONDITION INTOLERABLE.	A. CHECK SUIT INTEGRITY B. IF CONDITIONS PERMIT CREW MAY ELECT TO OVERPRESSURIZE 1. ALL THREE SUITS CONNECTED TO SUIT CIRCUIT. 2. SUIT DEMAND REG TO PRESS POSITION. 3. MONITOR SUIT PRESS (SHOULD REACH 9 PSIA IN 75 SEC). 4. SELECT SUIT DEMAND REG INLET SEL VALVE TO OFF WHEN SUIT PRESS REACHES 9.0 PSIA. 5. MAINTAIN SUIT OVERPRESSURE BY OPENING INLET SELECTOR VALVE AS NECESSARY. NOTE: RELIEF FUNCTION OF DEMAND REGULATOR IS ISOLATED WHEN USING THIS PROCEDURE.
			EPO	ENTER NEXT BEST PTP	
			TLC	ENTER NEXT BEST PTP	

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	15-20	ORAL TEMP EXCEEDS 101°F DESPITE CORRECTIVE ACTION			THE MCC SURGEON MAY RECOMMEND EARLY MISSION TERMINATION IF TREATMENT IS UNSUCCESSFUL.
		A. IF DUE TO ILLNESS	LAUNCH	NOT APPLICABLE	
			EPO	ENTER NEXT BEST PTP	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
			TEC	ENTER NEXT BEST PTP	
		B. IF RESULTANT FROM THERMAL OVERLOAD	LAUNCH	NOT APPLICABLE	
			EPO	ENTER NEXT PTP	
			TLC	ENTER NEXT PTP	
			LO	ENTER NEXT PTP	
			TEC	ENTER NEXT PTP	
		RULES 15-21 THROUGH 15-26 ARE RESERVED.			

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
A	15-27	INCREASE IN PCO_2			
		A. $\geq$7.6 MM HG	LAUNCH	CONTINUE MISSION	
			EPO	CONTINUE MISSION CHANGE LiOH CANISTER	
			TLC	CONTINUE MISSION CHANGE LiOH CANISTER	PCO_2 SHOULD DECREASE BELOW 2 MM HG WITHIN 30 MINUTES.
			LO	CONTINUE MISSION CHANGE LiOH CANISTER	
			TEC	CONTINUE MISSION CHANGE LiOH CANISTER	
		B. $\geq$7.6 MM HG AND UNABLE TO DECREASE	LAUNCH	NOT APPLICABLE	PCO_2 SENSOR TEST:
			ALL PHASES	CONTINUE MISSION 1. OPEN SUITS AND BREATHE FROM CABIN 2. CHANGE SECOND LiOH CANISTER 3. TEST PCO_2 SENSOR	A. ISOLATE SUIT CIRCUIT BY DISCONNECTING SUIT HOSES FROM THE SPACECRAFT. B. SUIT CIR RET AIR VALVE CLOSED. C. CRACK O_2 METERING VALVE TO OPEN. D. PURGE FOR 30 SECONDS. E. CLOSED O_2 METERING VALVE. F. IF ABOVE PROCEDURE RESULTS IN A PCO READING NEAR ZERO, THE PCO_2 SENSOR IS OPERATING PROPERLY.
		C. $\geq$10 MM HG	LAUNCH	CONTINUE MISSION	
			EPO	ENTER NEXT BEST PTP	
			TLC	ENTER NEXT BEST PTP	
			LO	ENTER NEXT BEST PTP	
			TEC	ENTER NEXT BEST PTP	
A	15-28	PCO_2 INSTRUMENTATION FAILURE	ALL PHASES	CONTINUE MISSION CONTINUE MISSION USE ONBOARD CO_2 TAPES	
		RULES 15-29 THROUGH 15-34 ARE RESERVED.			

REV	ITEM
A	15-35

INSTRUMENTATION REQUIREMENTS

MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
ELECTROCARDIOGRAM	CJ0060J	NOT DISPLAYED		MANDATORY	15-15/16
ELECTROCARDIOGRAM	CJ0061J	NOT DISPLAYED		MANDATORY	15-15/16
ELECTROCARDIOGRAM	CJ0062J	NOT DISPLAYED		MANDATORY	15-15/16
CO_2 PARTIAL PRESSURE	CJ0005P	METER	COMMON	MANDATORY	15-2/27/28
SUIT CABIN DELTA PRESS	CF0003P	NOT DISPLAYED		MANDATORY	15-3/19
ORAL TEMPERATURE		CLINICAL THERMOMETER		MANDATORY	15-20
PNEUMOGRAM	CJ0200R	NOT DISPLAYED		HIGHLY DESIRABLE	15-17
PNEUMOGRAM	CJ0201R	NOT DISPLAYED		HIGHLY DESIRABLE	15-17
PNEUMOGRAM	CJ0202R	NOT DISPLAYED		HIGHLY DESIRABLE	15-17

16 RECOVERY

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	16-1	LAUNCH SHALL OCCUR BETWEEN 30 MIN PRIOR TO SUNRISE AND 30 MIN PRIOR TO SUNSET.		HIGHLY DESIRABLE	TO PROVIDE DAYLIGHT FOR A LAUNCH SITE RECOVERY OPERATION.
	16-2	LAUNCH SHALL OCCUR NO LATER THAN 1 HOUR 30 MIN PRIOR TO SUNSET.		HIGHLY DESIRABLE	TO PROVIDE 1 HOUR OF DAYLIGHT FOR LIGHT FOR CAMERA CAPSULE RECOVERY.
A	16-3	RECOVERY CAPABILITY* IN LAUNCH SITE AREA, LAUNCH ABORT AREA, MID-PACIFIC RECOVERY ZONE.		HIGHLY DESIRABLE	
		*RECOVERY CAPABILITY WILL BE BASED PRIMARILY UPON THE LOCAL RECOVERY UNIT COMMANDER'S EVALUATION OF HIS ABILITY TO PERFORM THE RECOVERY OPERATION. ONE OF THE FACTORS WHICH DETERMINES RECOVERY CAPABILITY IS PREDICTED WEATHER AT TIME OF LANDING. GUIDELINES USED TO INDICATE WHEN IT MAY BE NECESSARY TO RE-EVALUATE CAPABILITY ARE: SURFACE WINDS - 25 KNOTS CEILING - 1500 FEET VISIBILITY - 3 NM WAVE HEIGHT - 8 FEET			
	16-4	MINIMUM OF 35 AMP-HOURS OF CM POST-LANDING POWER AVAILABLE AT LANDING.		MANDATORY	TO PROVIDE FOR 18 HOURS OF CM POST-LANDING POWER PLUS ONE UPRIGHTING.
	16-5	RETAIN ΔV CAPABILITY TO MOVE LANDING POINT $\pm$500 NM UNTIL ENTRY -24 HOURS.		HIGHLY DESIRABLE	

APPENDIXES

A ACRONYMS AND SYMBOLS

REV	ITEM

APPENDIX A

ACRONYMS AND SYMBOLS

ACCEL	ACCELEROMETER
ADEG	AUXILIARY DISPLAY EQUIPMENT GROUP
AFD	ASSISTANT FLIGHT DIRECTOR
AFETR	AIR FORCE EASTERN TEST RANGE
A/G	AIR-TO-GROUND
ALDS	APOLLO LAUNCH DATA SYSTEM
AM	AMPLITUDE MODULATION
AMP	AMPERES
AOA	ANGLE OF ATTACK
AOH	APOLLO OPERATIONS HANDBOOK
ASAP	AS SOON AS PRACTICAL
ATP	ALTERNATE TARGET POINT
AZUSA	ELECTRONIC TRACKING AND VECTORING SYSTEM (ETR)
BA	BANK ANGLE
BDA	BERMUDA (MSFN REMOTED SITE)
B/H	BLOCK HOUSE
BMAG	BODY MOUNTED ATTITUDE GYRO
BRSO	BERMUDA RANGE SAFETY OFFICER
BSE	BOOSTER SYSTEMS ENGINEER
CASTS	COUNTDOWN AND STATUS TRANSMISSION SYSTEM
CCATS	COMMAND, COMMUNICATIONS, AND TELEMETRY SYSTEM
CCW	COUNTERCLOCKWISE
CDP	COMMAND DATA PROCESSOR
CDU	COUPLING DATA UNIT
CIF	CENTRAL INSTRUMENTATION FACILITY
CLTC	CHIEF LAUNCH VEHICLE TEST CONDUCTOR
CM	COMMAND MODULE
CMC	COMMAND MODULE COMPUTER
C/O	CUTOFF
CO_2	CARBON DIOXIDE
CRYO	CRYOGENICS
CRO	CARNARVON (MSFN REMOTED SITE)
CSM	COMMAND SERVICE MODULE
CTE	CENTERAL TIMING EQUIPMENT
CVTS	CHIEF VEHICLE TEST SUPERVISOR
CW	CLOCKWISE
DAP	DIGITAL AUTO PILOT
DCS	DIGITAL COMMAND SYSTEM
DOD	DEPARTMENT OF DEFENSE
DRA	DISCRETE RECOVERY AREA
DRS	DATA RECEIVING STATION
DSC	DYNAMIC STANDBY COMPUTER
DSE	DATA STORAGE EQUIPMENT
DSKY	DISPLAY KEYBOARD
D/TV	DIGITAL TO TELEVISION
ECS	ENVIRONMENTAL CONTROL SYSTEM
EDS	EMERGENCY DETECTION SYSTEM
EECOM	ELECTRICAL, ENVIRONMENTAL, AND COMMUNICATIONS
EI	ENTRY INTERFACE
EPS	ELECTRICAL POWER SYSTEM
ESE	ELECTRONIC SUPPORT EQUIPMENT
ETDM	RANGE SAFETY SUPERVISOR
ETR	EASTERN TEST RANGE
F/A	FORWARD/AFT
FC	FUEL CELL OR FLIGHT CONTROL
FCSM	FLIGHT COMBUSTION STABILITY MONITOR
FD	FLIGHT DIRECTOR
FDAI	FLIGHT DIRECTOR ATTITUDE INDICATOR
FDO	FLIGHT DYNAMICS OFFICER
FIDO	FLIGHT DYNAMICS OFFICER
FL	FULL LIFT
FM	FREQUENCY MODULATION
FPS	FEET PER SECOND
FQR	FLIGHT QUALIFICATION RECORDER
G&C	GUIDANCE AND CONTROL
GDC	GYRO DISPLAY COUPLER
GET	GROUND ELAPSED TIME
GETI	GROUND ELAPSED TIME OF IGNITION
GMTLO	GREENWICH MEAN TIME OF LIFTOFF
G&N	GUIDANCE AND NAVIGATION
GNC	GUIDANCE NAVIGATION CONTROL
GN_2	GASEOUS NITROGEN
GRR	GUIDANCE REFERENCE RELEASE
H_a	HEIGHT OF APOGEE
HF	HIGH FREQUENCY
H_p	HEIGHT OF PERIGEE
HZ	HERTZ
HS	HIGH-SPEED
IGA	INNER GIMBAL AXIS
IMU	INERTIAL MEASUREMENT UNIT
INST	INSTRUMENTATION
INV	INVERTER
IP	IMPACT POINT OR IMPACT PREDICTOR
IRIG	INERTIAL RATE INTEGRATING GYRO
ISS	INERTIAL SUBSYSTEM
IU	INSTRUMENTATION UNIT

REV	ITEM		
		KSC	KENNEDY SPACE CENTER
		LES	LAUNCH ESCAPE SYSTEM
		LET	LAUNCH ESCAPE TOWER
		LH_2	LIQUID HYDROGEN
		LM	LUNAR MODULE
		LiOH	LITHIUM HYDROXIDE
		L/O	LIFTOFF
		LOI	LUNAR ORBIT INSERTION
		LOX	LIQUID OXYGEN
		L/R	LEFT/RIGHT
		LVDA	LAUNCH VEHICLE DATA ADAPTER
		LVDC	LAUNCH VEHICLE DIGITAL COMPUTER
		MALF	MALFUNCTION
		MCC	MISSION CONTROL CENTER, MID-COURSE CORRECTION
		MC&W	MASTER CAUTION AND WARNING
		MDAS	MEDICAL DATA ACQUISITION SYSTEM
		MED	MANUAL ENTRY DIVICE
		MESC	MASTER EVENTS SEQUENCE CONTROLLER
		MFCO	MANUAL FUEL CUTOFF
		MGA	MIDDLE GIMBAL AXIS
		MITE	MASTER INSTRUMENTATION TIMING EQUIPMENT
		MOC	MISSION OPERATIONS COMPUTER
		M&O	MAINTENANCE AND OPERATIONS
		MSFN	MANNED SPACE FLIGHT NETWORK
		MSTC	CSM SPACECRAFT TEST CONDUCTOR
		MTVC	MANUAL THRUST VECTOR CONTROL
		NCC	COMBINED CORRECTIVE MANUEVER
		NSR	COELLIPTICAL MANEUVER
		NM	NAUTICAL MILES
		O/B	ONBOARD
		ODOP	OFFSET DOPPLER AND POSITION
		OGA	OUTER GIMBAL AXIS
		OXID	OXIDIZER
		PCM	PULSE CODE MODULATION
		PCO_2	PARTIAL PRESSURE CARBON DIOXIDE
		PIPA	PULSE INTEGRATING PENDULOUS ACCELEROMETER
		PLSS	PORTABLE LIFE SUPPORT SYSTEM
		PO_2	PARTIAL PRESSURE OXYGEN
		PPM	PARTS PER MILLION
		PTP	PREFERRED TARGET POINT
		PUGS	PROPELLENT UTILIZATION AND GAGING SYSTEM
		PROC	PROCEDURE
		PSID	POUNDS PER SQUARE INCH DIFFERENCE
		PTC	PASSIVE THERMAL CONTROL
		PTV	PITCH THRUST VECTOR
		PVT	PRESSURE-VOLUME-TEMPERATURE
		PYRO	PYROTECHNICS
		QTY	QUANTITY
		RCS	REACTION CONTROL SYSTEM
		REFSMMAT	REFERENCE STABLE MEMBER MATRIX
		RETRB	RETRO ELAPSED TIME TO REVERSE BANK
		RETRO	RETROFIRE OFFICER
		RFO	RETROFIRE OFFICER
		RHC	ROTATION HAND CONTROLLER
		RIP	RANGE OF IMPACT POINT
		RL	ROLL LEFT
		RR	ROLL RIGHT
		RSI	ROLL STABILITY INDICATOR
		RSO	RANGE SAFETY OFFICER
		RTACF	REAL-TIME AUXILIARY COMPUTING FACILITY
		RTC	REAL-TIME COMMAND
		RTCC	REAL-TIME COMPUTER COMPLEX
		S/C	SPACECRAFT
		SCE	SIGNAL CONDITIONING EQUIPMENT
		SCS	STABILIZATION AND CONTROL SYSTEM
		SECO	SUSTAINER ENGINE CUTOFF (S-IVB CUTOFF)
		SLA	SPACECRAFT LM ADAPTER
		SLV	SATURN LAUNCH VEHICLE
		SM	SERVICE MODULE
		SMJC	SERVICE MODULE JETTISON CONTROLLER
		SOL	SOLENOID
		SPS	SERVICE PROPULSION SYSTEM
		SRO	SUPERINTENDENT RANGE OPERATIONS
		TB	TIME BASE
		TC	TEST CONDUCTOR
		T/C	TELEMETRY AND COMMUNICATIONS
		TEI	TRANSEARTH INJECTION
		TDP	TELEMETRY DATA PROCESSOR
		TM	TELEMETRY
		T_{FF}	TIME OF FREE FALL
		THC	THRUST HAND CONTROLLER
		T_{ig}	TIME OF IGNITION
		TOK	THRUST OKAY
		TLI	TRANSLUNAR INJECTION
		TPF	TERMINAL PHASE FINALIZATION
		TPI	TERMINAL PHASE INITIATE
		TTY	TELETYPE
		TVC	THRUST VECTOR CONTROL

REV	ITEM

U/D	UP/DOWN
UDL	UPDATA LINK
UHF	ULTRA HIGH FREQUENCY
USB	UNIFIED S-BAND
V_{gx}	VELOCITY TO BE GAINED X-AXIS
V_{gy}	VELOCITY TO BE GAINED Y-AXIS
V_{gz}	VELOCITY TO BE GAINED Z-AXIS
VHF	VERY HIGH FREQUENCY
VSM	VIDEO SWITCHING MATRIX
WBD	WIDE-BAND DATA
YTV	YAW THRUST VECTOR

SYMBOLS

γ_i	INERTIAL FLIGHT PATH ANGLE
γ_{EI}	INERTIAL FLIGHT PATH ANGLE AT ENTRY INTERFACE
V_{EI}	INERTIAL VELOCITY AT ENTRY INTERFACE
ϕ	LATITUDE OR PHASE
λ	LONGITUDE
d	DOWNRANGE DISTANCE
$\pm$	PLUS OR MINUS
>	GREATER THAN
<	LESS THAN
ΔV_{INS}	DELTA VELOCITY IN INSERTION
ΔT_B	DELTA BURN TIME
ΔH	DELTA ALTITUDE

B DISTRIBUTION
LIST

REV	ITEM
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C CHANGE
CONTROL

REV	ITEM

APPENDIX C

CHANGE CONTROL

1.0 INTRODUCTION

1.1 PURPOSE

THE PURPOSE OF THIS APPENDIX IS TO DELINEATE CHANGE CONTROL PROCEDURES FOR THE AS-503 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

THE PROCEDURES CONTAINED IN THIS APPENDIX ARE APPLICABLE UPON PUBLICATION OF THIS DOCUMENT.

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 FORMAT

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 COORDINATION

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 SIGNOFF/DISAPPROVAL

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 DISAPPROVED CHANGES

IF A CHANGE IS DISAPPROVED THE AFD WILL RETURN THE COPY TO THE ORIGINATOR. THE ORIGINAL WILL BE RETAINED FOR FUTURE REFERENCE.

2.3 PUBLICATION AND DISTRIBUTION OF INTERIM CHANGES

INTERIM CHANGES WILL BE DISTRIBUTED TO 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 ON THE PAGE CONCERNED).

REV	ITEM

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.

3.3 PUBLICATION

3.3.1 SCHEDULE

REVISIONS WILL BE MADE ON AN "AS REQUIRED" BASIS.

3.3.2 DISTRIBUTION

REVISIONS WILL BE PRINTED AND DISTRIBUTED THROUGH THE NORMAL ADMINISTRATIVE CHANNELS.

REV	ITEM

NASA-MANNED SPACECRAFT CENTER
MISSION RULE REQUEST/REVISION

DATE _____

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	NOTES/COMMENTS

RATIONALE: ☐ NEW TECHNICAL DATA ☐ CLARIFICATION ☐ TYPOGRAPHICAL ERROR

ORIGINATOR: NAME / ORGANIZATION / EXT	APPROVED: COGNIZANT BRANCH CHIEF	APPROVED: FLIGHT DIRECTOR

AFD:	BSE:	FIDO:	GUIDO:	RETRO:	GNC:	EECOM:	OTHER:

MSC FORM 1555 (JAN 68)

MSC-950-69

FIGURE C-1.- MISSION RULE PROPOSED CHANGE REQUEST FORM.

APOLLO

FFMR

FINAL FLIGHT MISSION RULES

MISSION C′

APOLLO 8

FCD
MSC
NASA