

# NASA — Manned Spacecraft Center

## MISSION RULES

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|-----|------|--|
|     | I-1  | MISSION RULES ARE EFFECTIVE DURING THE LAUNCH COUNTDOWN, FLIGHT AND RECOVERY OPERATIONS, AND DURING PRELAUNCH TESTS WHEN APPLICABLE. THEY ARE BASED ON 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.  |

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|     | 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.  |

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|                                       | 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. |      |   |

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|      |      | <u>DEFINITIONS</u>  |
| I-36 |      | <u>REDLINE</u> : A REDLINE VALUE IS A MAXIMUM AND/OR MINIMUM LIMIT OF A CRITICAL PARAMETER NECESSARY TO IDENTIFY VEHICLE, SYSTEM, AND COMPONENT PERFORMANCE AND OPERATION. REDLINE VALUES WILL BE ESTABLISHED SUCH THAT FURTHER DEGRADATIONS OF THE SYSTEM OR COMPONENT COULD LEAD TO A FAILURE TO ACCOMPLISH THE PRIMARY MISSION.              |
| I-37 |      | <u>REDLINE FUNCTION</u> : A REDLINE FUNCTION IS A PARAMETER THAT HAS BEEN IDENTIFIED TO MONITOR THE FUNCTIONING OF A UNIT TO INSURE THE OPERATIONAL PERFORMANCE OF THAT UNIT IS ACCEPTABLE TO MEET THE PRIMARY MISSION. REDLINE FUNCTIONS ARE MANDATORY.  |
| I-38 |      | <u>PRIMARY OBJECTIVE</u> : A STATEMENT OF THE PRIMARY PURPOSE OF FLIGHT. WHEN USED IN CENTER CONTROL DOCUMENTATION, THE PRIMARY OBJECTIVE MAY BE AMPLIFIED BUT NOT MODIFIED. DETAILED TEST OBJECTIVES WILL BE GENERATED AND AMPLIFIED TO FULFILL EACH PRIMARY OBJECTIVE.  |
| I-39 |      | <u>PRINCIPAL DETAILED TEST OBJECTIVE</u> : A DETAILED TEST OBJECTIVE WHICH MUST BE ACCOMPLISHED PRIOR TO THE LUNAR LANDING MISSION. ANY PRINCIPAL DETAILED TEST OBJECTIVE NOT SATISFACTORILY COMPLETED ON THE ASSIGNED MISSION CAN BE ATTEMPTED ON A SUBSEQUENT MISSION WITHOUT MAJOR IMPACT.   |
| I-40 |      | <u>MANDATORY DETAILED TEST OBJECTIVE</u> : A PRINCIPAL DETAILED TEST OBJECTIVE WHICH MUST BE SATISFACTORILY COMPLETED ON THE ASSIGNED MISSION. FAILURE TO DO SO WOULD UNDULY COMPROMISE SUBSEQUENT FLIGHT SCHEDULES AND/OR REQUIRE SUBSEQUENT SPACE VEHICLE RECONFIGURATION.  |
| I-41 |      | <u>SECONDARY DETAILED TEST OBJECTIVE</u> : A DETAILED TEST OBJECTIVE WHICH WOULD PROVIDE SIGNIFICANT DATA OR EXPERIENCE BUT WHICH IS NOT A PREREQUISITE TO THE LUNAR LANDING MISSION.   |
| I-42 |      | <u>MANDATORY (M)</u> : A MANDATORY ITEM IS A SPACE VEHICLE OR OPERATIONAL SUPPORT ELEMENT THAT IS ESSENTIAL FOR ACCOMPLISHMENT OF THE PRIMARY MISSION, WHICH INCLUDES PRELAUNCH, FLIGHT, AND RECOVERY OPERATIONS THAT INSURE CREW SAFETY AND EFFECTIVE OPERATIONAL CONTROL AS WELL AS THE ATTAINMENT OF THE MANDATORY DETAILED TEST OBJECTIVES. |
| I-43 |      | <u>HIGHLY DESIRABLE (HD)</u> : A HIGHLY DESIRABLE ITEM IS A SPACE VEHICLE OR OPERATIONAL SUPPORT ELEMENT THAT SUPPORTS AND ENHANCES THE ACCOMPLISHMENT OF THE PRIMARY MISSION AND IS ESSENTIAL FOR THE ACCOMPLISHMENT OF THE PRIMARY DETAILED TEST OBJECTIVES.  |
| I-44 |      | <u>DESIRABLE (D)</u> : A DESIRABLE ITEM IS A SPACE VEHICLE ELEMENT OR OPERATIONAL SUPPORT ELEMENT THAT IS NOT ESSENTIAL FOR THE ACCOMPLISHMENT OF THE PRIMARY MISSION.  |
| I-45 |      | <u>COUNTDOWN</u> : THE PERIOD OF TIME STARTING WITH LAUNCH VEHICLE POWER UP FOR THE LAUNCH (OR SIMULATED LAUNCH) WHICH INCLUDES SERVICE STRUCTURE REMOVAL, LAUNCH VEHICLE CRYOGENIC TANKING, SPACECRAFT CLOSEOUT, AND THE TERMINAL COUNT.   |
| I-46 |      | <u>HOLD</u> : INTERRUPTION OF THE COUNTDOWN FOR UNFAVORABLE WEATHER, REPAIR OF HARDWARE, OR CORRECTION OF CONDITIONS UNSATISFACTORY FOR LAUNCH OR FLIGHT.   |
| I-47 |      | <u>HOLD-POINT</u> : A PREDETERMINED POINT WHERE THE COUNTDOWN MAY BE CONVENIENTLY INTERRUPTED.  |

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

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**II FLIGHT  
MISSION RULES**

1 GEN RULES  
AND SOP'S

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|     | 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.  |
|     |      | <u>CONFIRMATION OF MALFUNCTIONS</u>   |
|     | 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:<br><br>A. REQUIRED TO INSURE FLIGHT CREW SAFETY.<br><br>B. REQUIRED TO IMPLEMENT RULES RESULTING IN LAUNCH ABORTS.<br><br>C. REQUIRED TO IMPLEMENT RULES RESULTING IN EARLY MISSION TERMINATION.<br><br>D. REQUIRED TO MAKE DECISION TO CONTINUE TO THE NEXT MISSION PHASE.<br><br>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.  |

| MISSION  | REV   | DATE    | SECTION                 | GROUP   | PAGE |
|----------|-------|---------|-------------------------|---------|------|
| APOLLO 8 | FINAL | 11/7/68 | GENERAL RULES AND SOP'S | GENERAL | 1-1  |



## NASA — Manned Spacecraft Center

### MISSION RULES

| REV      | ITEM | DESCRIPTION  |                         |                          |      |
|----------|------|--|-------------------------|--------------------------|------|
|          |      | <u>FLIGHT CONTROLLER ACTION FOR FAILURES DURING TERMINAL COUNTDOWN</u>   |                         |                          |      |
|          | 1-21 | <u>MANDATORY</u> - 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 <u>MANDATORY TO L/O</u> . AFTER T-1 MIN, HOLDS WILL BE REQUESTED FOR MANDATORY ITEMS WITHOUT VERIFICATION DUE TO THE LIMITED TIME REMAINING. |                         |                          |      |
|          | 1-22 | <u>HIGHLY DESIRABLE</u> - THE COGNIZANT FLIGHT CONTROLLER WILL NOTIFY THE FLIGHT DIRECTOR IN CASE OF A LOSS OR A FAILURE OF A HIGHLY DESIRABLE ITEM. 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 | <u>DESIRABLE</u> - FLIGHT CONTROLLERS WILL NOT CALL HOLDS FOR THE LOSS OF DESIRABLE ITEMS AS THEY ARE PLACED IN THIS CATEGORY BECAUSE THEY ARE ITEMS OF SUPPORT WHICH ARE OF MINOR IMPORTANCE TO FLIGHT OPERATIONS.  |                         |                          |      |
| A        | 1-24 | MANUAL CUTOFF WILL NOT BE ATTEMPTED FROM T-11 SECONDS TO T-0.  |                         |                          |      |
|          |      | RULE NUMBERS 1-25 THROUGH 1-30<br>ARE RESERVED.  |                         |                          |      |
| MISSION  | REV  | DATE   | SECTION                 | GROUP                    | PAGE |
| APOLLO 8 | A    | 12/11/68   | GENERAL RULES AND SOP'S | FLIGHT CONTROLLER ACTION | 1-3  |

# NASA — Manned Spacecraft Center

## MISSION RULES

| REV | ITEM |  |
|-----|------|--|
|     | 1-31 | <u>ASAP</u> : AS SOON AS PRACTICABLE (I.E., AS SOON AS POSSIBLE AND REASONABLE).   |
|     | 1-32 | <u>REENTER ASAP</u> : REENTER AS SOON AS PRACTICABLE (I.E., AS SOON AS POSSIBLE AND REASONABLE).   |
|     | 1-33 | <u>TERMINATE ASAP</u> : REENTER WITH THE MINIMUM TRIP TIME TO AN UNSPECIFIED LANDING AREA.   |
|     | 1-34 | <u>PTP</u> : A "PREFERRED TARGET POINT" IS A STRATEGICALLY LOCATED SET OF COORDINATES FOR WHICH THE SPACECRAFT SHOULD BE TARGETED IF TIME PERMITS.   |
|     | 1-35 | <u>ATP</u> : AN "ALTERNATE TARGET POINT" IS A STRATEGICALLY LOCATED SET OF COORDINATES CHOSEN TO PROVIDE A SPACECRAFT TARGET POINT BETWEEN PTP'S.  |
|     | 1-36 | <u>NEXT BEST PTP</u> : A PREFERRED TARGET POINT WHICH CAN BE REACHED BY THE SPACECRAFT WITHIN THE CONSTRAINTS IMPOSED BY THE SPACECRAFT PROBLEM CAUSING 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: <ul style="list-style-type: none"> <li>A. MODE III ABORT BURNS</li> <li>B. MODE IV CONTINGENCY ORBIT INSERTION BURNS</li> <li>C. APOGEE KICK BURNS</li> <li>D. DEORBIT BURNS</li> <li>E. MCC'S REQUIRED TO ACHIEVE A FREE RETURN TRAJECTORY</li> <li>F. TRANSLUNAR AND TRANSEARTH ABORT MANEUVERS</li> <li>G. MODE I AND III ABORTS FROM LUNAR ORBIT</li> <li>H. TEI</li> <li>I. MCC'S REQUIRED FOR ENTRY CORRIDOR CONTROL</li> </ul>   |
|     | 1-38 | <p><u>FLIGHT PHASE</u>: THE FLIGHT PHASE IS THE TIME INTERVAL FROM LIFTOFF TO SPLASHDOWN AND FOR THE PURPOSE OF THE FLIGHT MISSION RULES A DETAILED BREAKDOWN FOLLOWS:</p> <p><u>LAUNCH/INSERTION PHASE</u>: THE TIME INTERVAL FROM LIFTOFF TO INSERTION.</p> <p><u>EARTH PARKING ORBIT PHASE</u>: THE TIME INTERVAL FROM INSERTION UNTIL TLI CUTOFF.</p> <p><u>TRANSLUNAR COAST PHASE</u>: THE TIME INTERVAL FROM TLI CUTOFF UNTIL LOI<sub>1</sub> CUTOFF.</p> <p><u>LUNAR PARKING ORBIT PHASE</u>: THE TIME INTERVAL FROM LOI<sub>1</sub> CUTOFF UNTIL TEI CUTOFF.</p> <p><u>TRANSEARTH COAST PHASE</u>: THE TIME INTERVAL FROM TEI CUTOFF UNTIL SPLASHDOWN.</p> |
|     | 1-39 | <u>RECOVERY PHASE</u> : THE RECOVERY PHASE IS THE TIME INTERVAL FROM SPLASHDOWN TO PICKUP OF THE SPACECRAFT BY THE RECOVERY FORCES.  |

| MISSION  | REV   | DATE    | SECTION                 | GROUP       | PAGE |
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| APOLLO 8 | FINAL | 11/7/68 | GENERAL RULES AND SOP'S | DEFINITIONS | 1-4  |

## NASA — Manned Spacecraft Center

### MISSION RULES

| REV      | ITEM  |  |                         |             |      |
|----------|-------|--|-------------------------|-------------|------|
|          | 1-40  | <p><u>REENTRY DEFINITIONS</u></p> <p>A. AUTOMATIC - REENTRY CONTROLLED BY CMC WHICH OUTPUTS BANK ANGLE COMMANDS TO THE RCS.</p> <p>B. CLOSED LOOP - REENTRY CONTROLLED BY THE CREW MANUALLY FLYING BANK ANGLE MODULATION USING CMC ENTRY PROGRAM OUTPUTS.</p> <p>C. OPEN LOOP REENTRY - REENTRY CONTROLLED BY THE CREW USING SPACECRAFT DISPLAYS AND FLYING:</p> <ol style="list-style-type: none"> <li>1. BANK ANGLE (RL 0-180) AND RETRB (RR 0-180).</li> <li>2. CONSTANT BANK ANGLE - CONSTANT BANK ANGLES &gt;90 DEGREES WILL NOT BE FLOWN EXCEPT WHEN SKIPOUT RULE IS VIOLATED.</li> <li>3. ROLLING ENTRY - MAINTAIN CONSTANT 18 DEGREES PER SECOND ROLL RATE.</li> <li>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.</li> </ol> <p>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.</p> <p>E. EMS REENTRY - REENTRY CONTROLLED BY THE CREW USING THE CONSTANT G MODE UNTIL VELOCITY &lt;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.</p> <p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">OPEN LOOP REENTRY FOR LOW EARTH ORBIT REENTRY ONLY.</p> <p style="text-align: center;">RULE NUMBERS 1-41 THROUGH 1-44 ARE RESERVED.</p> |                         |             |      |
| MISSION  | REV   | DATE   | SECTION                 | GROUP       | PAGE |
| APOLLO 8 | FINAL | 11/7/68  | GENERAL RULES AND SOP'S | DEFINITIONS | 1-5  |

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**MISSION RULES**

| REV   | ITEM            |  |          |                         |                                 |      |                 |   |   |                               |   |   |   |   |   |   |   |  |   |  |   |   |   |
|---|-----------------|--|----------|-------------------------|---------------------------------|------|-----------------|---|---|-------------------------------|---|---|---|---|---|---|---|--|---|--|---|---|---|
|   | 1-45            | <p><u>CRITERIA FOR TARGET POINT SELECTION IN EPO</u></p> <p>THE CRITERIA LISTED BELOW WILL BE USED WHEN CHOOSING BETWEEN TWO OR MORE TARGET POINTS. THE CRITICALITY OF THE MISSION SITUATION WILL AFFECT THE APPLICATION OF THESE CRITERIA.</p> <table style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="width: 85%;"></th> <th style="width: 15%; text-align: right;"><u>PRIORITY</u></th> </tr> </thead> <tbody> <tr> <td>ACCEPTABLE WEATHER CONDITIONS FOR RECOVERY OPERATIONS</td> <td style="text-align: right;">1</td> </tr> <tr> <td>CAPABILITY OF RECOVERY FORCES</td> <td style="text-align: right;">2</td> </tr> <tr> <td>COMMUNICATION WITH THE SPACECRAFT FROM A GROUND STATION AT LEAST 40 MINUTES PRIOR TO DEORBIT BURN</td> <td style="text-align: right;">3</td> </tr> <tr> <td>SUFFICIENT DAYLIGHT FOR RECOVERY OPERATIONS</td> <td style="text-align: right;">4</td> </tr> <tr> <td>A GROUND STATION FOR POST-DEORBIT BURN TRACKING</td> <td style="text-align: right;">5</td> </tr> <tr> <td>VOICE CONTACT PRIOR TO AND DURING DEORBIT BURN</td> <td style="text-align: right;">6</td> </tr> <tr> <td>POST-BLACKOUT TRACKING DATA AVAILABLE FOR REENTRY (ASSUMES PRE-BLACKOUT ACQUISITION)</td> <td style="text-align: right;">7</td> </tr> <tr> <td>GROUND STATIONS AVAILABLE TO OBTAIN DELTA <math>V_c</math> READOUTS AND TO PASS CREW BACKUP GUIDANCE QUANTITIES<sup>C</sup></td> <td style="text-align: right;">8</td> </tr> </tbody> </table> |          |                         |                                 |      | <u>PRIORITY</u> | 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 <sup>C</sup> | 8 |
|   | <u>PRIORITY</u> |  |          |                         |                                 |      |                 |   |   |                               |   |   |   |   |   |   |   |  |   |  |   |   |   |
| 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 <sup>C</sup> | 8               |  |          |                         |                                 |      |                 |   |   |                               |   |   |   |   |   |   |   |  |   |  |   |   |   |
| A   | 1-46            | <p><u>LUNAR RETURN ENTRY RANGE PRIORITY</u></p> <p>THE RELATIVE ENTRY RANGE (400,000 FEET TO SPLASH) PRIORITY IS AS FOLLOWS:</p> <p>A. 1200 NM - 1400 NM (NOMINAL)</p> <p>B. 1400 NM - 1800 NM (USED TO AVOID WEATHER VIOLATIONS IN PRIORITY 1)</p> <p>C. 1800 NM - 2500 NM (USED TO AVOID EXTREME WEATHER VIOLATIONS IN PRIORITY 1 AND 2)</p>   |          |                         |                                 |      |                 |   |   |                               |   |   |   |   |   |   |   |  |   |  |   |   |   |
| A   |                 | <p>RULE NUMBERS 1-47 THROUGH 1-49 ARE RESERVED.</p>  |          |                         |                                 |      |                 |   |   |                               |   |   |   |   |   |   |   |  |   |  |   |   |   |
| MISSION   |                 | REV  | DATE     | SECTION                 | GROUP                           | PAGE |                 |   |   |                               |   |   |   |   |   |   |   |  |   |  |   |   |   |
| APOLLO 8  |                 | A  | 12/11/68 | GENERAL RULES AND SOP'S | TARGET POINT SELECTION CRITERIA | 1-6  |                 |   |   |                               |   |   |   |   |   |   |   |  |   |  |   |   |   |

NASA — Manned Spacecraft Center

MISSION RULES

| 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:<br><br>A. MAJOR STRUCTURAL FAILURE OR EXPLOSION.<br><br>B. LOSS OF POSITIVE VERTICAL MOTION.<br><br>C. UNCONTROLLABLE VEHICLE TILTING.<br><br>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.   |

| MISSION  | REV   | DATE    | SECTION                 | GROUP         | PAGE |
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**MISSION RULES**

| REV       | ITEM                           |  |                                       |               |       |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |
|-----------|--------------------------------|--|---------------------------------------|---------------|-------|------------|-----------|------------|-----------------|------------------|-----------|--------------------------------|---------------|------------------------------------|-----|---------------|-----------------|------------------|-----|----------------------------|-----|---------------------------------------|
| A         | 1-57                           | <p>ENGINE SHUTDOWN METHODS AVAILABLE:</p> <table border="1"> <thead> <tr> <th>INITIATOR</th> <th>METHOD</th> <th>STAGE</th> <th>TIME FRAME</th> </tr> </thead> <tbody> <tr> <td>ASTRONAUT</td> <td>CCW ON THC</td> <td>SIC, SII, S-IVB</td> <td>T+30 SEC TO SECO</td> </tr> <tr> <td>ASTRONAUT</td> <td>S-II/S-IVB<br/>L/V STAGE SWITCH</td> <td>SII, S-IVB</td> <td>T+2:33 TO SECO<br/>ALSO IN TLI BURN</td> </tr> <tr> <td>RSO</td> <td>RF CMD (MFCO)</td> <td>SIC, SII, S-IVB</td> <td>T-0 TO INSERTION</td> </tr> <tr> <td>EDS</td> <td>2 OUT OF 3 VOTING<br/>LOGIC</td> <td>SIC</td> <td>T+30 SEC TO EDS AUTO<br/>OFF AT T+2:00</td> </tr> </tbody> </table> <p>NOTE: THE FLIGHT CREW AND THE EDS CANNOT SHUT DOWN THE SLV DURING THE FIRST 30 SEC OF POWERED FLIGHT.</p> | INITIATOR                             | METHOD        | STAGE | TIME FRAME | ASTRONAUT | CCW ON THC | SIC, SII, S-IVB | T+30 SEC TO SECO | ASTRONAUT | S-II/S-IVB<br>L/V STAGE SWITCH | SII, S-IVB    | T+2:33 TO SECO<br>ALSO IN TLI BURN | RSO | RF CMD (MFCO) | SIC, SII, S-IVB | T-0 TO INSERTION | EDS | 2 OUT OF 3 VOTING<br>LOGIC | SIC | T+30 SEC TO EDS AUTO<br>OFF AT T+2:00 |
| INITIATOR | METHOD                         | STAGE  | TIME FRAME                            |               |       |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |
| ASTRONAUT | CCW ON THC                     | SIC, SII, S-IVB  | T+30 SEC TO SECO                      |               |       |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |
| ASTRONAUT | S-II/S-IVB<br>L/V STAGE SWITCH | SII, S-IVB   | T+2:33 TO SECO<br>ALSO IN TLI BURN    |               |       |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |
| RSO       | RF CMD (MFCO)                  | SIC, SII, S-IVB  | T-0 TO INSERTION                      |               |       |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |
| EDS       | 2 OUT OF 3 VOTING<br>LOGIC     | SIC  | T+30 SEC TO EDS AUTO<br>OFF AT T+2:00 |               |       |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |
|           | 1-58                           | <p>ABORTS ARE INITIATED BY:</p> <p>A. CREW</p> <p>B. EMERGENCY DETECTION SYSTEM (EDS)</p> <p>ABORTS MAY BE REQUIRED BY:</p> <p>A. LAUNCH OPERATIONS MANAGER</p> <p>B. FLIGHT DIRECTOR</p> <p>C. FLIGHT DYNAMICS OFFICER (FDO)</p> <p>D. BOOSTER SYSTEMS ENGINEER (BSE)</p>   |                                       |               |       |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |
| A         | 1-59                           | <p>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:</p> <p>1 + 45 MODE I</p> <p>3 + 00 MODE I</p> <p>4 + 30 MODE II</p> <p>9 + 00 MODE II</p>   |                                       |               |       |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |
|           | 1-60                           | <p>THE FIXED TIME ABORT PROCEDURE IS AS FOLLOWS:</p> <p>A. APPROPRIATE FLIGHT CONTROLLER GIVES RED STATUS AND VOICE REPORT OF FAILURE TO FLIGHT DIRECTOR.</p> <p>B. CREW CONFIRM FAILURE.</p> <p>C. FLIGHT DETERMINE ABORT TIME TO BE USED.</p> <p>D. RETRO BEGIN COUNTDOWN AT ABORT TIME MINUS 10 SECONDS.</p> <p>E. CAPCOM RELAY COUNTDOWN TO CREW.</p> <p>F. CREW INITIATE ABORT ON "MARK".</p> <p>G. FLIGHT DIRECTOR WILL REQUEST "RSO SEND MFCO" IF THE CREW IS UNABLE TO SHUT DOWN WITHIN 5 SECONDS AFTER "MARK".</p>  |                                       |               |       |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |
|           |                                | <table border="1"> <thead> <tr> <th>MISSION</th> <th>REV</th> <th>DATE</th> <th>SECTION</th> <th>GROUP</th> <th>PAGE</th> </tr> </thead> <tbody> <tr> <td>APOLLO 8</td> <td>A</td> <td>12/11/68</td> <td>GENERAL RULES AND SOP'S</td> <td>LAUNCH ABORTS</td> <td>1-8</td> </tr> </tbody> </table>  | MISSION                               | REV           | DATE  | SECTION    | GROUP     | PAGE       | APOLLO 8        | A                | 12/11/68  | GENERAL RULES AND SOP'S        | LAUNCH ABORTS | 1-8                                |     |               |                 |                  |     |                            |     |                                       |
| MISSION   | REV                            | DATE   | SECTION                               | GROUP         | PAGE  |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |
| APOLLO 8  | A                              | 12/11/68   | GENERAL RULES AND SOP'S               | LAUNCH ABORTS | 1-8   |            |           |            |                 |                  |           |                                |               |                                    |     |               |                 |                  |     |                            |     |                                       |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV      | ITEM | ABORT MODES:    |  |  |      |
|----------|------|-----------------|--|--|------|
|          | 1-61 | <u>MODE I</u>   | <u>BOUNDARY OF APPLICATION</u>   | <u>PROCEDURES</u>  |      |
|          |      | 1A              | LES ABORT ENABLE ( $\approx$ T-30 MIN) TO GET 0 + 42   | REFERENCE AOH _____  |      |
|          |      | 1B              | GET = 0 + 42 TO 100K FEET ALTITUDE (GET $\approx$ 1 + 50)  | REFERENCE AOH _____  |      |
|          |      | 1C              | 100K FEET ALTITUDE TO TOWER JETTISON (GET $\approx$ 3 + 07)  | REFERENCE AOH _____  |      |
| A        | 1-62 | <u>MODE II</u>  | TOWER JETTISON (GET $\approx$ 3 + 07 UNTIL FULL LIFT SPLASHPOINT IS 3200 NM DOWNRANGE.                       | A. REFERENCE AOH _____<br>B. MCC PROVIDES<br>1. GET AND PITCH AT 400K FT<br>2. GET DROGUE<br>C. ENTRY IS FULL LIFT   |      |
| A        | 1-63 | <u>MODE III</u> | FULL LIFT SPLASHPOINT BETWEEN 3200 NM AND INSERTION.   | A. REFERENCE AOH _____<br>B. MCC PROVIDES:<br>1. GETI AT S-IVB CUTOFF PLUS 2:05<br>2. DELTA V FOR 3350 NM SPLASHPOINT<br>3. BURN DURATION<br>4. GET AND PITCH ATT AT 400K FT<br>5. GET DROGUE<br>C. MANEUVER IS SCS AUTO.<br>D. ENTRY IS ROLL LEFT 55 DEGREES. |      |
|          | 1-64 | <u>MODE IV</u>  | ATTAINMENT OF CONTINGENCY ORBIT INSERTION CAPABILITY UNTIL INSERTION.  | A. REFERENCE AOH _____<br>B. MCC PROVIDES:<br>1. GETI AT S-IVB CUTOFF PLUS 2:05<br>2. DELTA V REQUIRED TO ACHIEVE PERIGEE $\geq$ 75 NM<br>3. BURN DURATION<br>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 _____<br>B. MCC PROVIDES:<br>1. GETI FOR BURN AT APOGEE<br>2. DELTA V REQUIRED TO ACHIEVE $\geq$ 75 NM<br>3. BURN DURATION<br>C. MANEUVER IS SCS AUTO   |      |
| MISSION  | REV  | DATE            | SECTION  | GROUP  | PAGE |
| APOLLO 8 | A    | 12/11/68        | GENERAL RULES AND SOP'S  | LAUNCH ABORTS - MODES  | 1-9  |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

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

| MISSION  | REV | DATE     | SECTION                 | GROUP                  | PAGE |
|----------|-----|----------|-------------------------|------------------------|------|
| APOLLO 8 | A   | 12/11/68 | GENERAL RULES AND SOP'S | LAUNCH ABORTS - LIMITS | 1-10 |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| 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 MFCD, THE RSO WILL INITIATE SAFING AFTER VERIFICATION OF S-IVB CUTOFF. |                         |       |      |
| MISSION  | REV   | DATE  | SECTION                 | GROUP | PAGE |
| APOLLO 8 | FINAL | 11/7/68   | GENERAL RULES AND SOP'S | SOP'S | 1-11 |

**2 FLIGHT  
OPERATIONS  
RULES**

**NASA — Manned Spacecraft Center  
MISSION RULES**

| REV      | ITEM |   |          |                         |         |      |
|----------|------|---|----------|-------------------------|---------|------|
|          |      | <u>PRELAUNCH</u>  |          |                         |         |      |
| A        | 2-1  | THE LAUNCH WINDOW WILL BE CONTROLLED BY:<br>A. LAUNCH AREA LIGHTING REQUIREMENTS RESTRICTING LAUNCH TO OCCUR BETWEEN SUNRISE AND SUNSET.<br>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 LANDING 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.  |          |                         |         |      |
|          |      | <u>LAUNCH</u>   |          |                         |         |      |
| 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.  |          |                         |         |      |
|          |      | <u>EARTH ORBIT</u>  |          |                         |         |      |
| A        | 2-5  | THE DEORBIT CAPABILITY REQUIREMENTS FOR EARTH ORBIT ARE:<br>A. THE CAPABILITY OF SPS DEORBIT AND ONE ALTERNATE METHOD ARE REQUIRED.<br>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.<br>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.<br>D. IN MAINTAINING THE HYBRID DEORBIT REDLINE, THE FOLLOWING ASSUMPTIONS ARE MADE:<br>1. A MAXIMUM OF 80 FPS IS AVAILABLE FROM THE CM-RCS.<br>2. A MINIMUM OF 30 POUNDS IN EACH CM-RCS RING WILL BE RESERVED FOR ENTRY ATTITUDE CONTROL.<br>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.  |          |                         |         |      |
| MISSION  |      | REV   | DATE     | SECTION                 | GROUP   | PAGE |
| APOLLO 8 |      | A   | 12/11/68 | FLIGHT OPERATIONS RULES | GENERAL | 2-1  |

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MISSION RULES

| REV | ITEM |   |     |          |                         |         |      |
|-----|------|---|-----|----------|-------------------------|---------|------|
|     |      | <u>TRANSLUNAR COAST</u>   |     |          |                         |         |      |
| A   | 2-7  | <p><u>DISPERSED S-IVB TLI CUTOFF:</u></p> <p>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 <u>1000</u> FPS, THE MIDCOURSE CORRECTION (MCC) WILL BE PERFORMED CONSISTENT WITH A LUNAR ORBIT MISSION.</p> <p>B. IF THE PREDICTED END OF LUNAR ORBIT MISSION FUEL RESERVE IS LESS THAN <u>1000</u> FPS AND THE PREDICTED END OF LUNAR FLYBY MISSION FUEL RESERVE IS GREATER THAN <u>5500</u> FPS THE MCC WILL BE PERFORMED FOR A FREE RETURN FLYBY.</p> <p>C. IF THE PREDICTED END OF LUNAR FLYBY MISSION FUEL RESERVES IS LESS THAN <u>5500</u> FPS AN ALTERNATE EARTH ORBIT MISSION OR A DIRECT ABORT WILL BE PERFORMED.</p>  |     |          |                         |         |      |
| A   | 2-8  | <p>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.</p>   |     |          |                         |         |      |
| A   | 2-9  | <p>IF THE <math>\Delta V</math> 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.</p> <p>IF THE <math>\Delta V</math> OF SUBSEQUENT MCC'S IS BETWEEN 5 FPS AND 10 FPS IT WILL BE EXECUTED AT THE PLANNED TIME. IF THE MCC <math>\Delta V</math> IS LESS THAN 5 FPS THE EXECUTION TIME MAY BE DELAYED (EXCEPT FOR THE LAST MCC) TO ALLOW THE <math>\Delta V</math> TO GROW. IF THE MCC <math>\Delta V</math> IS GREATER THAN 10 FPS, IT MAY BE PERFORMED EARLY TO REDUCE THE MCC <math>\Delta V</math>.</p>  |     |          |                         |         |      |
| A   | 2-10 | <p>THE FLIGHT CREW WILL TERMINATE LOI AND TAKE THE FOLLOWING ACTION, DEPENDING UPON THE SPECIFIC FAILURE</p> <p>A. PERFORM THE 15 MINUTE ABORT FOR:</p> <ol style="list-style-type: none"> <li>1. LOSS OF ONE GN<sub>2</sub> BOTTLE (&lt;400 PSI) AND DECAY IN THE OTHER.</li> <li>2. PRESSURE DECAY IN EITHER SPS PROPELLANT TANK TO 140 PSI.</li> <li>3. FUEL-OXIDIZER <math>\Delta P</math> &gt;20 PSI.</li> <li>4. CHAMBER PRESSURE &lt;70 PSI.</li> <li>5. FLANGE TEMPERATURE LIGHT AS LONG AS MODE I (APPROXIMATELY FIRST 2 MINUTES).</li> <li>6. ANY BALL VALVE FAILS TO OPEN AT IGNITION</li> </ol> <p>B. MTVC TAKEOVER AND COMPLETE THE BURN FOR:</p> <ol style="list-style-type: none"> <li>1. G6N NO-GO.</li> <li>2. ATTITUDE EXCURSION &gt;10°</li> <li>3. RATES &gt;10°/SEC</li> </ol> <p>C. RESTART AND COMPLETE THE BURN UNDER SCS CONTROL FOR:</p> <p>SPS SHUTDOWN AT CMC RESTART.</p> <p>D. STANDBY UNTIL MSFN COVERAGE FOR:</p> <ol style="list-style-type: none"> <li>1. INADVERTENT SPS SHUTDOWN.</li> <li>2. FLANGE TEMPERATURE SHUTDOWN AFTER 2 MINUTES OF BURN.</li> </ol> |     |          |                         |         |      |
|     |      | MISSION   | REV | DATE     | SECTION                 | GROUP   | PAGE |
|     |      | APOLLO 8  | A   | 12/11/68 | FLIGHT OPERATIONS RULES | GENERAL | 2-2  |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV      | ITEM | DESCRIPTION   |                         |         |      |
|----------|------|---|-------------------------|---------|------|
|          |      | <u>LUNAR ORBIT</u>  |                         |         |      |
| A        | 2-11 | <p><u>DISPERSED LOI CUTOFF:</u></p> <p>A. IF THE RESULTING APOLUNE IS GREATER THAN APPROXIMATELY 9000 NM, A DIRECT RETURN ABORT MANEUVER WILL BE PERFORMED ASAP.</p> <p>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.</p> <p>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.</p>  |                         |         |      |
| A        | 2-12 | <p><u>TRANSEARTH COAST MCC PHILOSOPHY</u></p> <p>A. THE STEEP TARGET LINE WILL BE USED FOR MCC'S UNLESS THE VELOCITY AT ENTRY INTERFACE IS LESS THAN 30,000 FPS AND THE G&amp;N IS GO, THEN THE SHALLOW TARGET LINE WILL BE USED.</p> <p>B. MCC'S MAY BE USED FOR LANDING AREA CONTROL PRIOR TO ENTRY INTERFACE MINUS 24 HOURS FOR RECOVERY ACCESS VIOLATIONS, UNACCEPTABLE WEATHER, OR LAND MASSES IN ANY PART OF THE OPERATIONAL FOOTPRINT.</p> <p>C. IF THE FLIGHT PATH ANGLE IS OUTSIDE THE ENTRY CORRIDOR 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).</p> <p>D. THE LAST MCC WILL BE SCHEDULED NO LATER THAN ENTRY INTERFACE MINUS 2 HOURS.</p> |                         |         |      |
| A        | 2-13 | <p><u>GO/NO-GO'S</u></p> <p>COMBINED FLIGHT CONTROL/FLIGHT CREW GO/NO-GO'S WILL BE MADE FOR EACH OF THE FOLLOWING MISSION PHASES AT THE TIMES INDICATED:</p> <p>A. ORBIT AT INSERTION</p> <p>B. TRANSLUNAR INJECTION AT THE SITE PRIOR TO THE MANEUVER</p> <p>C. TRANSLUNAR COAST PRIOR TO MCC NO. 1 AND ONCE EVERY <u>24</u> HOURS THEREAFTER.</p> <p>D. LOI NO. 1 APPROXIMATELY 1 HOUR PRIOR TO THE MANEUVER</p> <p>E. LOI NO. 2 APPROXIMATELY 1 HOUR PRIOR TO THE MANEUVER</p> <p>F. TEI APPROXIMATELY 1 HOUR PRIOR TO THE MANEUVER.</p>   |                         |         |      |
| MISSION  | REV  | DATE  | SECTION                 | GROUP   | PAGE |
| APOLLO 8 | A    | 12/11/68  | FLIGHT OPERATIONS RULES | GENERAL | 2-3  |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV      | ITEM |   |                         |         |      |
|----------|------|---|-------------------------|---------|------|
| A        | 2-14 | <p><u>ALTERNATE MISSIONS</u></p> <p>A. CONTINGENCY ORBIT INSERTION REQUIRING AN SPS <math>\Delta V</math> GREATER THAN 900 FPS: CONDUCT A LOW EARTH ORBIT MISSION OF APPROXIMATELY 10 DAYS DURATION.</p> <p>B. NO S-IVB REIGNITION OR CONTINGENCY ORBIT INSERTION REQUIRING LESS THAN 900 FPS: PERFORM AN SPS MANEUVER TO ACHIEVE A HIGH ELLIPSE (<math>H_a</math> 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).</p> <p>C. S-IVB CUTOFF RESULTING IN AN APOGEE <math>&gt;100</math> NM BUT <math>&lt;4000</math> NM: RESHAPE THE ELLIPSE TO PLACE APOGEE IN THE DESIRED LOCATION FOR SPS INJECTION AND PERFORM ALTERNATE "B" DESCRIBED ABOVE.</p> <p>D. S-IVB CUTOFF RESULTING IN AN APOGEE <math>&gt;4000</math> NM BUT <math>&lt;25000</math> 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).</p> <p>E. S-IVB CUTOFF RESULTING IN AN APOGEE <math>\geq 22000</math> NM BUT <math>&lt;60000</math> 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.</p> <p>F. S-IVB CUTOFF RESULTING IN AN APOGEE <math>&gt;60000</math> NM: PERFORM A CIRCULUNAR OR LUNAR ORBIT MISSION DEPENDING UPON THE <math>\Delta V</math> REQUIRED (REF RULE 2-6 FOR <math>\Delta V</math> OPTIONS).</p> |                         |         |      |
| A        |      | <p>RULES 2-15 THROUGH 2-19 ARE RESERVED.</p>  |                         |         |      |
| MISSION  | REV  | DATE  | SECTION                 | GROUP   | PAGE |
| APOLLO 8 | A    | 12/11/68  | FLIGHT OPERATIONS RULES | GENERAL | 2-4  |

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MISSION RULES

| REV   | ITEM         |  |                         |              |   |      |   |      |  |      |   |      |   |      |                                       |      |                                     |     |                                 |      |                                    |      |                  |      |   |      |                                    |      |                                 |      |  |      |  |       |  |  |  |
|---|--------------|--|-------------------------|--------------|---|------|---|------|--|------|---|------|---|------|---------------------------------------|------|-------------------------------------|-----|---------------------------------|------|------------------------------------|------|------------------|------|---|------|------------------------------------|------|---------------------------------|------|--|------|--|-------|--|--|--|
| A   | 2-20         | <p><u>SUMMARY RULES</u></p> <p>THE LAUNCH PHASE WILL BE ABORTED FOR THE FOLLOWING REASONS:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right;"><u>RULES</u></td> </tr> <tr> <td>S-IC ENGINE HARDOVER</td> <td style="text-align: right;">5-5</td> </tr> <tr> <td>S-IVB LOX OVERPRESSURE DURING S-IC OR S-II HARDOVER</td> <td style="text-align: right;">5-46</td> </tr> <tr> <td>VIOLATION OF AUTO/MANUAL EDS LIMITS (REF RULES 1-66, 1-67, 1-68, 1-69)</td> <td></td> </tr> <tr> <td>TWO ENGINE OUT ON S-II (TIME DEPENDENT)</td> <td style="text-align: right;">5-15</td> </tr> <tr> <td>FAILURE OF SECOND PLANE SEPARATION</td> <td style="text-align: right;">5-16</td> </tr> <tr> <td>S-IVB LOSS OF THRUST (TIME DEPENDENT)</td> <td style="text-align: right;">5-19</td> </tr> <tr> <td>VIOLATION OF TRAJECTORY LIMIT LINES</td> <td style="text-align: right;">4-1</td> </tr> <tr> <td>LOSS OF CABIN AND SUIT PRESSURE</td> <td style="text-align: right;">6-21</td> </tr> <tr> <td>LOSS OF CABIN AND SUIT CIRCULATION</td> <td style="text-align: right;">6-21</td> </tr> <tr> <td>FIRE/SMOKE IN CM</td> <td style="text-align: right;">6-25</td> </tr> <tr> <td>LOSS OF CABIN PRESSURE AND O<sub>2</sub> MANIFOLD LEAK</td> <td style="text-align: right;">6-28</td> </tr> <tr> <td>LOSS OF 3 FUEL CELLS AND 1 BATTERY</td> <td style="text-align: right;">8-27</td> </tr> <tr> <td>UNCONTROLLABLE SHORTED MAIN BUS</td> <td style="text-align: right;">8-47</td> </tr> <tr> <td>LOSS OF BOTH AC BUSES DURING MODE I OR MODE II</td> <td style="text-align: right;">8-59</td> </tr> <tr> <td>SUSTAINED LEAK OR LOSS OF HE PRESSURE IN BOTH CM-RCS RINGS (MODE I ONLY)</td> <td style="text-align: right;">14-15</td> </tr> </table> |                         | <u>RULES</u> | 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 <sub>2</sub> 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 |  |  |  |
|   | <u>RULES</u> |  |                         |              |   |      |   |      |  |      |   |      |   |      |                                       |      |                                     |     |                                 |      |                                    |      |                  |      |   |      |                                    |      |                                 |      |  |      |  |       |  |  |  |
| 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 <sub>2</sub> 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         | <p><u>EARTH ORBIT</u></p> <p>THE MISSION WILL BE CONTINUED AS LONG AS:</p> <p>PERIGEE WILL BE GREATER THAN 75 NM AFTER 20 REVS<br/>           CREW CONDITION SATISFACTORY<br/>           TWO-WAY A/G VOICE COMMUNICATIONS<br/>           OPERATIONAL CRITICAL INSTRUMENTATION<br/>           SUFFICIENT CONSUMABLES FOR AT LEAST TWO REVS PAST THE NEXT GO/NO-GO PTP PLUS ENTRY<br/>           CAPABILITY OF SPS DEORBIT <u>AND</u> ONE <u>ALTERNATE</u> METHOD</p> <p>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<br/>           FOR THE SM-RCS DEORBIT ADEQUATE PROPELLANT, TRANSLATION CAPABILITY, ONE FDAI AND RATE DAMPING (DAP OR SCS) IN ALL THREE AXES.<br/>           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.</p> <p>- CABIN INTEGRITY (ALSO NO UNDUE CONTAMINATION IN EITHER CABIN OR SUIT SYSTEM)<br/>           - TWO GOOD MAIN, BATTERY, AC, AND LOGIC, PYRO BUSES AND THE BATTERY RELAY BUS<br/>           - AT LEAST TWO GOOD FUEL CELLS, TWO IN ERTERS AND TWO ENTRY BATTERIES<br/>           - SATISFACTORY PRIMARY COOLANT LOOP, URINE DUMP, SUIT CIRCULATION</p>  |                         |              |   |      |   |      |  |      |   |      |   |      |                                       |      |                                     |     |                                 |      |                                    |      |                  |      |   |      |                                    |      |                                 |      |  |      |  |       |  |  |  |
| A   | 2-23         | <p>SPACECRAFT SEPARATION FROM THE S-IVB WILL BE PERFORMED EARLY FOR THE FOLLOWING:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right;"><u>RULES</u></td> </tr> <tr> <td>TIME BASE 5 FAILS TO INITIATE AT CUTOFF</td> <td style="text-align: right;">5-25</td> </tr> <tr> <td>S-IVB RANGE SAFETY PROPELLANT DISPERSAL SYSTEM ARMS INADVERTENTLY AFTER INSERTION AND PRIOR TO SAFING</td> <td style="text-align: right;">5-47</td> </tr> <tr> <td>S-IVB COLD HE SHUTOFF VALVE FAILS TO CLOSE</td> <td style="text-align: right;">5-49</td> </tr> <tr> <td>LOSS OF ATTITUDE CONTROL DURING TB5</td> <td style="text-align: right;">5-51</td> </tr> <tr> <td>S-IVB COMMON BULKHEAD DELTA PRESSURE EXCEEDS LIMITS</td> <td style="text-align: right;">5-55</td> </tr> </table>   |                         | <u>RULES</u> | 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 DURING TB5     | 5-51 | S-IVB COMMON BULKHEAD DELTA PRESSURE EXCEEDS LIMITS | 5-55 |                                       |      |                                     |     |                                 |      |                                    |      |                  |      |   |      |                                    |      |                                 |      |  |      |  |       |  |  |  |
|   | <u>RULES</u> |  |                         |              |   |      |   |      |  |      |   |      |   |      |                                       |      |                                     |     |                                 |      |                                    |      |                  |      |   |      |                                    |      |                                 |      |  |      |  |       |  |  |  |
| 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 DURING TB5   | 5-51         |  |                         |              |   |      |   |      |  |      |   |      |   |      |                                       |      |                                     |     |                                 |      |                                    |      |                  |      |   |      |                                    |      |                                 |      |  |      |  |       |  |  |  |
| S-IVB COMMON BULKHEAD DELTA PRESSURE EXCEEDS LIMITS   | 5-55         |  |                         |              |   |      |   |      |  |      |   |      |   |      |                                       |      |                                     |     |                                 |      |                                    |      |                  |      |   |      |                                    |      |                                 |      |  |      |  |       |  |  |  |
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| REV      | ITEM |  |                         |         |      |
|----------|------|--|-------------------------|---------|------|
| A        | 2-24 | <p>TLI WILL BE INHIBITED FOR THE FOLLOWING REASONS:</p> <p style="text-align: right;"><u>RULES</u></p> <p>S-IVB INERTIAL GUIDANCE SYSTEM IS NO-GO 4-31</p> <p>MISALIGNMENT RATE BETWEEN THE IU AND IMU IS &gt;0.6 DEG/HR. 4-32</p> <p>UNACCEPTABLE DIFFERENCES BETWEEN CMC AND IU PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION 4-35</p> <p>UNACCEPTABLE DIFFERENCE BETWEEN MSFN AND IU DOWNRANGE POSITION AT 55 MIN GET. 4-36</p> <p>S-IVB FIRST BURN LONGER THAN 303 SECONDS 5-22</p> <p>S-IVB ENGINE MAIN LOX VALVE FAILS TO CLOSE AT CUTOFF 5-46</p> <p>LOSS OF ATTITUDE CONTROL 5-51</p> <p>CONTINUOUS VENT SYSTEM REGULATOR FAILS TO OPEN 5-50</p> <p>LOSS OF STAGE PNEUMATICS 5-54</p> <p>LOSS OF ENGINE CONTROL BOTTLE PRESSURE (&lt;600 PSI) 5-57</p> <p>CONFIRMED ACTUATOR HARDOVER 5-65</p> <p>LOSS OF ENGINE HYDRAULIC FLUID 5-66</p> <p>LOSS OF CABIN INTEGRITY 6-21</p> <p>LOSS OF SUIT CIRCULATION 6-22</p> <p>LOSS OF SURGE TANK AND REPRESS PACK 6-24</p> <p>FIRE OR SMOKE IN THE CABIN 6-25</p> <p>LOSS OF SUIT INTEGRITY 6-27</p> <p>O<sub>2</sub> MANIFOLD LEAK 6-28</p> <p>LOSS OF ONE MAIN O<sub>2</sub> REGULATORS 6-29</p> <p>LOSS OF ONE SUIT COMPRESSOR 6-31</p> <p>LOSS OF PRIMARY RADIATOR 6-35</p> <p>LOSS OF PRIMARY COOLANT LOOP 6-35</p> <p>LOSS OF SECONDARY EVAPORATOR 6-36</p> <p>LOSS OF SECONDARY RADIATOR 6-36</p> <p>LOSS OF SECONDARY LOOP 6-36</p> <p>LEAK OF GLYCOL COOLANT 6-38</p> <p>FAILURE OF BOTH H<sub>2</sub>O ACCUMULATORS 6-46</p> <p>LOSS OF POTABLE OR WASTE H<sub>2</sub>O TANK 6-47</p> <p>LOSS OF ANY CRYO TANK 7-15</p> <p>LOSS OF ONE FUEL CELL 8-24</p> <p>LOSS OF ONE ENTRY BATTERY 8-37</p> <p>LOSS OF ONE BATTERY, MAIN OR BATTERY RELAY BUS 8-50</p> <p>LOSS OF TWO INVERTERS 8-57</p> <p>LOSS OF ONE A/C BUS 8-58</p> <p>LOSS OF ALL T/M 9-12</p> <p>LOSS OF NORMAL DOWN VOICE 9-14</p> <p>LOSS OF DOWN VOICE BACKUP 9-15</p> <p>LOSS OF NORMAL UP VOICE 9-17</p> <p>LOSS OF UP VOICE BACKUP 9-18</p> <p>LOSS OF ALL UP OR DOWN VOICE IN ONE TRANSPONDER 9-20</p> <p>LOSS OF ONE PM POWER SUPPLY 9-22</p> <p>LOSS OF BOTH POWER AMPLIFIERS 9-25</p> <p>LOSS OF THE SCE 9-26</p> <p>LOSS OF TWO AUDIO CENTERS 9-27</p> <p>SMJC ACTIVATED PREMATURELY 10-16</p> <p>ACTIVATED DROGUE CHUTE DEPLOY CIRCUIT 10-20</p> <p>LOSS OF BOTH BMAGS IN PITCH, YAW, OR ROLL 11-26,28</p> <p>LOSS OF BOTH FDAI'S 11-34</p> <p>LOSS OF AC1 PHASE A 11-35</p> <p>LOSS OF AC2 PHASE A 11-36</p> <p>GROUND AT EITHER SPS SOL DRIVER OUTPUT 11-39</p> <p>LOSS OF CMC 11-45</p> <p>LOSS OF NAV DSKY (CMC WARNING RELAY) 11-47</p> <p>LOSS OF ISS 11-48</p> <p>LOSS OF OPTICS SUBSYSTEM 11-49</p> <p>LOSS OF OPTICS CDU DAC 11-50</p> <p>SUSTAINED PRESSURE DECAY IN SPS FUEL OR OX TANK 12-25</p> <p>LOSS OF BOTH GN<sub>2</sub> TANK PRESSURES 12-28</p> <p>FUEL FEED LINE AND/OR OXID FEED LINE TEMP &lt;25°F AND UNABLE TO INCREASE 12-29</p> <p>FUEL/OXIDIZER ΔP GREATER THAN 20 PSI 12-34</p> <p>LOSS OF HE SOURCE PRESSURE 12-35</p> <p>HELIUM TANK LEAK IN ONE QUAD 13-20</p> <p>LEAK DOWN STREAM OF HE ISOLATION VALVE (SM-RCS) 13-21</p> <p>LOSS OF ONE PITCH, ONE YAW, OR TWO ROLL THRUSTERS IN THE SAME DIRECTION 13-23</p> <p>LOSS OF HELIUM SOURCE PRESS - ONE RING 14-15</p> <p>CM-RCS ARMED 14-17</p> <p>PACKAGE TEMP &lt;70°F AND UNABLE TO INCREASE 13-22</p> |                         |         |      |
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| A        | 2-24<br>(CONT) | IU PLATFORM ACCELEROMETER FAILURE<br>COLD HE SPHERE PRESS LOW<br>LH <sub>2</sub> ULLAGE PRESS LOW<br>J <sub>2</sub> ENGINE START BOTTLE PRESS HIGH<br>LOX ULLAGE PRESS LOW   |                         | 5-58<br>5-61<br>5-64<br>5-67<br>5-68 |      |
| A        | 2-25           | LOI WILL BE INHIBITED AND A CIRCUMLUNAR FLIGHT WILL BE ACCOMPLISHED IF THESE FAILURES OCCUR POST TLI.  |                         |                                      |      |
|          |                |  |                         | <u>RULE</u>                          |      |
|          |                | 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 <sub>2</sub> 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  |                         |                                      |      |
|          |                |  |                         | <u>RULE</u>                          |      |
|          |                | LOSS OF CABIN INTEGRITY  |                         | 6-21                                 |      |
|          |                | FIRE OR SMOKE IN THE CABIN   |                         | 6-25                                 |      |
|          |                | O <sub>2</sub> MANIFOLD LEAK   |                         | 6-28                                 |      |
|          |                | LOSS OF ONE MAIN O <sub>2</sub> 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 <sub>2</sub> O ACCUMULATOR   |                         | 6-46                                 |      |
|          |                | LOSS OF POTABLE OR WASTE H <sub>2</sub> O 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                                 |      |
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| A        | 2-26<br>(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: |                         |         |      |
|          |                |   | <u>RULE</u>             |         |      |
|          |                | O <sub>2</sub> 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 <sub>2</sub> O 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 <sub>2</sub> 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                   |         |      |
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**3 GROUND INSTRUMENTATION  
REQUIREMENTS**



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**MISSION RULES**

| REV      | RULE  | CONDITION/MALFUNCTION                         | PHASE                               | RULING                                  | CUES/NOTES/COMMENTS  |      |
|----------|-------|---|-------------------------------------|---|--|------|
|          | 3-5   | <u>COMPUTER</u>                               |                                     |   |  |      |
|          |       | A. MOC (IBM 360/75)                           | PRELAUNCH                           | MANDATORY                               | TO PROCESS MANDATORY S/V PARAMETERS AND TRAJECTORY DATA<br><br>AN SSC (IBM 360/75) IS AVAILABLE AS BACKUP TO THE MOC OR DSC. |      |
|          |       | B. DSC (IBM 360/75)                           | PRELAUNCH                           | HIGHLY DESIRABLE                        |  |      |
|          |       | C. CCATS (UNIVAC 494) -<br>ONLINE             | PRELAUNCH                           | 1 MANDATORY AND 1 HIGHLY DESIRABLE      |  |      |
|          |       | D. CCATS (UNIVAC 494) -<br>STANDBY            |                                     |   |  |      |
|          |       | E. RTACF - 2                                  | PRELAUNCH                           | 1 HIGHLY DESIRABLE                      |  |      |
|          | 3-6   | <u>COMMAND</u>                                |                                     |   |  |      |
|          |       | A. MOCR TOGGLE SWITCHES<br>(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<br>SELECT CAPABILITY     |                                     |   |  |      |
|          |       | 1. RTC CONSOLE (CCATS)                        | PRELAUNCH                           | 1 HIGHLY DESIRABLE                      |  |      |
|          |       | 2. CCATS CMD CONSOLE<br>MED                   |                                     |   |  |      |
|          |       | D. FC/M&O SWITCHING<br>CAPABILITY             |                                     |   |  |      |
|          |       | 1. FLIGHT DIRECTOR                            | PRELAUNCH                           | 1 HIGHLY DESIRABLE                      |  |      |
|          |       | 2. CCATS CMD MED                              |                                     |   |  |      |
|          | 3-7   | <u>TELEMETRY</u>                              |                                     |   |  |      |
|          |       | A. CONSOLE DISPLAY (D/TV,<br>EVENTS, ANALOGS) | PRELAUNCH                           | MANDATORY                               | FOR DISPLAY OF MANDATORY S/V PARAMETERS.   |      |
|          |       | B. PCM GROUND STATIONS (4)                    | PRELAUNCH                           | 1 OF 4 MANDATORY, 1 HIGHLY<br>DESIRABLE | FOR DISPLAY OF MANDATORY S/V<br>EVENTS AND ANALOGS.  |      |
|          |       | C. RECORDING AND PLAYBACK                     |                                     |   |  |      |
|          |       | 1. ALDS                                       | PRELAUNCH                           | BOTH DESIRABLE                          |  |      |
|          |       | 2. MSFN                                       |                                     |   |  |      |
|          |       | D. FM/FM GND STATION                          | PRELAUNCH                           | 1 OF 2 MANDATORY                        |  |      |
| MISSION  | REV   | DATE  | SECTION                             |   | GROUP  | PAGE |
| APOLLO 8 | FINAL | 11/7/68                                       | GROUND INSTRUMENTATION REQUIREMENTS |   | SPECIFIC - MCC   | 3-2  |



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MISSION RULES

| REV             | RULE            | CONDITION/MALFUNCTION  | PHASE                               | RULING   | CUES/NOTES/COMMENTS   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|-----------------|-----------------|--|-------------------------------------|--|---|-----------------|-------|---|------|---|-------|---|-------|---|-----|---|------|---|---------|---|--|--|--|
| A               | 3-10            | <u>DISPLAY</u>   |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | A. <u>MOCR D/TV CHANNELS</u>   | PRELAUNCH                           | 10 OF 36 MANDATORY   |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | <table border="0"> <tr> <td></td> <td style="text-align: center;">NO. OF</td> </tr> <tr> <td style="text-align: center;"><u>POSITION</u></td> <td style="text-align: center;"><u>CHANNELS</u></td> </tr> <tr> <td>RETRO</td> <td style="text-align: center;">1</td> </tr> <tr> <td>FIDO</td> <td style="text-align: center;">1</td> </tr> <tr> <td>GUIDO</td> <td style="text-align: center;">1</td> </tr> <tr> <td>EECOM</td> <td style="text-align: center;">1</td> </tr> <tr> <td>GNC</td> <td style="text-align: center;">1</td> </tr> <tr> <td>RTCC</td> <td style="text-align: center;">1</td> </tr> <tr> <td>BOOSTER</td> <td style="text-align: center;">4</td> </tr> </table> |                                     | NO. OF   | <u>POSITION</u>   | <u>CHANNELS</u> | RETRO | 1 | FIDO | 1 | GUIDO | 1 | EECOM | 1 | GNC | 1 | RTCC | 1 | BOOSTER | 4 |  |  |  |
|                 | NO. OF          |  |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
| <u>POSITION</u> | <u>CHANNELS</u> |  |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
| RETRO           | 1               |  |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
| FIDO            | 1               |  |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
| GUIDO           | 1               |  |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
| EECOM           | 1               |  |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
| GNC             | 1               |  |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
| RTCC            | 1               |  |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
| BOOSTER         | 4               |  |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | B. <u>TRAJECTORY DISPLAY</u>   |                                     |  |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | 1. FDO LAUNCH DIGITALS   | PRELAUNCH                           | MANDATORY ON D/TV  | FOR CONTINGENCY ORBIT INSERTION MANEUVER DATA AND $T_{FF}$ LIMITS.                                      |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | 2. $\gamma$ VS $V$   | PRELAUNCH                           | MANDATORY ON 1 OF 4:<br>(A) 10 X 20 SCRIBER PLOTTER<br>(B) D/TV<br>(C) RTCC PLOTBOARD<br>(D) SSR PLOTBOARD | FROM SELECTED TRACKING DATA SOURCE.   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | 3. RFO LAUNCH DIGITALS   | PRELAUNCH                           | MANDATORY ON D/TV  | MONITOR FOR MODES III AND IB MANEUVER DATA.   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | 4. $\gamma_{EI}$ VS $V_{EI}$   | PRELAUNCH                           | MANDATORY OF 1 OF 2:<br>(A) D/TV<br>(B) SSR PLOTBOARD  | MONITOR FOR G-LIMIT VIOLATION.  |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | 5. $\phi$ VS $\lambda$   | PRELAUNCH                           | MANDATORY ON 1 OF 2:<br>(A) RTCC PLOTBOARD<br>(B) SSR PLOTBOARD  | MONITOR FOR CROSS-RANGE LIMITS.   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | 6. $T_{FF}$ VS $R_{IP}$  | PRELAUNCH                           | HIGHLY DESIRABLE ON 1 OF 2:<br>(A) D/TV<br>(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. $\gamma_i$ VS $V_i$ (CMC DYNAMIC STATUS)  | PRELAUNCH                           | HIGHLY DESIRABLE ON 10 X 10 SCRIBER PLOTTER.   | MONITOR FOR L/V AND S/C NAVIGATION PERFORMANCE (GUIDANCE SYSTEM ANALYSIS - COMPARES CMC WITH TRACKING). |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | 9. WEDGE ANGLE MONITOR   | PRELAUNCH                           | HIGHLY DESIRABLE ON D/TV   | MONITOR FOR L/V AND S/C NAVIGATION PERFORMANCE.   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | 10. GUIDO ANALOG CHART RECORDERS ONE AND TWO   | PRELAUNCH                           | MANDATORY ON TV  | CMC/IU GUIDANCE LAUNCH ANALOGS  |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | C. <u>ADEG CHANNELS 90-93</u>  | PRELAUNCH                           | HIGHLY DESIRABLE   | FOR DSC DISPLAYS  |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | D. <u>VSM</u>  | PRELAUNCH                           | MANDATORY  | FOR DISPLAY CAPABILITY  |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | E. <u>AUX VSM</u>  | PRELAUNCH                           | HIGHLY DESIRABLE   |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | F. <u>EIDOPHORS (3)</u>  | PRELAUNCH                           | 2 HIGHLY DESIRABLE   |   |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
|                 |                 | NOTE: INDIVIDUAL FLIGHT CONTROLLERS WILL BE RESPONSIBLE FOR REPORTING LOSSES TO THE FLIGHT DIRECTOR.   |                                     |  | OF DISPLAY CAPABILITY OF  |                 |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
| MISSION         | REV             | DATE   | SECTION                             |  | GROUP   | PAGE            |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |
| APOLLO 8        | A               | 12/11/68   | GROUND INSTRUMENTATION REQUIREMENTS |  | SPECIFIC - MCC  | 3-4             |       |   |      |   |       |   |       |   |     |   |      |   |         |   |  |  |  |

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MISSION RULES

| REV                                  | RULE | CONDITION/MALFUNCTION  | PHASE  | RULING   | CUES/NOTES/COMMENTS  |      |
|--------------------------------------|------|--|--|--|--|------|
| A                                    | 3-11 | <u>TIMING</u><br>A. MITE (2)   | PRELAUNCH  | 1 MANDATORY  | MCC TIMING STANDARD TO SUPPORT MANDATORY RTCC/CCATS COMPUTERS  |      |
| A                                    | 3-12 | <u>COMMUNICATIONS</u><br>A. MOCR<br>1. FD LOOP<br>2. AFD CONF LOOP<br>3. MOCR SYS 1 & 2<br>4. MOCR DYN<br>5. A/G 1 LOOP<br>6. A/G 2 LOOP<br><br>B. MCC/LAUNCH COMPLEX<br>1. 121 - CLTC<br>2. 111 - CVTS<br>3. 212 - MSTC<br>4. ALL OTHER MCC/LAUNCH COMPLEX LOOPS<br><br>C. MCC/RSO<br>1. FD LINE TO RSO<br>2. RSO PRIVATE LINE<br>3. CAPE 111 RSO LOOP<br><br>D. MISCELLANEOUS<br>1. BSE TM MONITOR LOOP<br>2. CIF/USB LOOP<br><br>E. MCC/REMOVED SITES - A/G TO THE MSFN SITES | PRELAUNCH<br>PRELAUNCH<br>PRELAUNCH<br><br>PRELAUNCH<br>PRELAUNCH<br><br>PRELAUNCH<br>PRELAUNCH<br><br>PRELAUNCH<br>PRELAUNCH<br><br>PRELAUNCH | 1 OF 2 MANDATORY<br>ALL HIGHLY DESIRABLE<br>1 OF 2 MANDATORY TO T-3+07<br><br>1 OF 3 MANDATORY, OTHER HIGHLY DESIRABLE<br>DESIRABLE<br><br>1 OF 3 MANDATORY, OTHER HIGHLY DESIRABLE<br><br>DESIRABLE<br><br>1 LINE MANDATORY, 1 HIGHLY DESIRABLE | FOR MISSION CONTROL<br><br>MCC/CREW COMMUNICATIONS. AFTER T-3+07 MILA CAN MANUALLY KEY IF REQUIRED.<br><br>FOR TERMINAL COUNT COORDINATION OF MCC - PAD ACTIVITIES.<br><br>FOR TRAJECTORY VERIFICATION AND BOOSTER SAFING<br><br>USED FOR MONITORING SPACE VEHICLES SUBSYSTEM CHECKOUT<br><br>FOR MISSION CONTROL AND A/G VOICE. |      |
| RULES 3-13 THROUGH 3-16 ARE RESERVED |      |  |  |  |  |      |
| MISSION                              | REV  | DATE   | SECTION  |  | GROUP  | PAGE |
| APOLLO 8                             | A    | 12/11/68   | GROUND INSTRUMENTATION REQUIREMENTS  |  | SPECIFIC - MCC   | 3-5  |

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MISSION RULES

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE  | RULING   | CUES/NOTES/COMMENTS   |      |
|----------|------|--|--|--|---|------|
| A        | 3-17 | <u>GSFC</u><br>A. GSFC UNIVAC 494 (2) COMMUNICATIONS PROCESSOR<br>B. WBD (40.8 KBPS) LINES (2) BETWEEN MCC AND GSFC<br>C. TTY CIRCUITS BETWEEN MCC AND GSFC<br>1. THREE TEXT CIRCUITS<br>2. SIX LOW-SPEED (JJ) CIRCUITS  | PRELAUNCH<br>PRELAUNCH<br>PRELAUNCH<br>PRELAUNCH | 1 MANDATORY<br>1 MANDATORY<br>1 OF 3 HIGHLY DESIRABLE<br>1 OF 6 MANDATORY                  | A. ONE UNIVAC 494 CAN PERFORM ALL NECESSARY FUNCTIONS, THE SECOND ONE IS BACKUP.<br>B. EITHER LINE CAN BE SWITCHED TO EITHER UNIVAC 494.<br>1. FOR ACQ MESSAGE, LOW-SPEED CMD.<br>2. FOR RECEPTION OF LOW-SPEED RADAR DATA. |      |
| A        | 3-18 | <u>KSC</u><br><u>TELEMETRY</u><br>A.1. TEL IV 30-FT ANTENNA<br>2. CIF VHF ANTENNA<br>3. MILA VHF ANTENNA<br>B. FINE MONITOR<br>1. CIF<br>2. MILA<br>C. CASTS<br>D. USB ANTENNAS<br>1. MILA<br>2. MANDY<br><u>COMMAND</u><br>THIS CAPABILITY IS DEFINED UNDER KSC/MSFN COMMAND RULE 3-19 FOR LAUNCH COVERAGE.<br><u>TRACKING</u><br>A. THAT CAPABILITY REQUIRED TO SATISFY THE REQUIREMENT OF RULE 3-8.<br>B. TRACKING DATA RECORD<br><u>VOICE COMMUNICATIONS</u><br>THIS KSC CAPABILITY IS DEFINED UNDER MCC RULE 3-12 COMMUNICATIONS. | PRELAUNCH<br>PRELAUNCH<br>PRELAUNCH<br>PRELAUNCH | 1 OF 3 MANDATORY FOR S-II VHF TM<br>BOTH DESIRABLE<br>DESIRABLE<br>1 OF 2 MANDATORY FOR TM | THESE ANTENNAS CAN BE SWITCHED TO MILA OR CIF FACILITIES.<br>TO SUPPORT ONLY CSM DATA SOURCE.   |      |
| MISSION  | REV  | DATE   | SECTION  |  | GROUP   | PAGE |
| APOLLO 8 | A    | 12/11/68   | GROUND INSTRUMENTATION REQUIREMENTS              |  | SPECIFIC - GSFC/KSC/MSFN  | 3-6  |



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**MISSION RULES**

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

| MISSION  | REV   | DATE    | SECTION                             | GROUP           | PAGE |
|----------|-------|---------|-------------------------------------|-----------------|------|
| APOLLO 8 | FINAL | 11/7/68 | GROUND INSTRUMENTATION REQUIREMENTS | SPECIFIC - SPAN | 3-8  |

**4 TRAJECTORY  
AND  
GUIDANCE**

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**MISSION RULES**

| REV      | ITEM | DESCRIPTION  |                         |        |      |
|----------|------|--|-------------------------|--------|------|
|          | 4-1  | <p>THE LAUNCH PHASE WILL BE TERMINATED FOR THE FOLLOWING CONDITIONS:</p> <p>A. VIOLATION OF VEHICLE BREAKUP LINE.</p> <p>B. <math>T_{FF} \leq 1 + 40</math> AND DECREASING AFTER TOWER JETTISON.</p> <p>C. VIOLATION OF ENTRY "G" LIMIT.</p> <p>D. VS INCREASING.</p> <p>E. OVERSPEED CONDITIONS AT INSERTION.</p>   |                         |        |      |
|          | 4-2  | <p>THE LES WILL NOT BE JETTISONED UNTIL MODE II CAPABILITY IS ESTABLISHED BY <math>T_{FF} \geq 1 + 20</math> AND INCREASING.</p>   |                         |        |      |
|          | 4-3  | <p>AFTER ACHIEVING "S-IVB TO ORBIT" CAPABILITY, EARLY STAGING WILL BE EXECUTED FOR PREMATURE S-II SHUTDOWNS OR FAILURES AS OUTLINED IN SECTION 5.</p>  |                         |        |      |
|          | 4-4  | <p>MODE II, III, IV, AND APOGEE KICK</p> <p>A. THE GROUND IS PRIME FOR ABORT MODE DETERMINATION AND MANEUVER COMPUTATION.</p> <p>B. MANEUVERS WILL BE INTERRUPTED WHEN <math>T_{FF} = 1 + 40</math> AND DECREASING.</p> <p>C. MODE IV MANEUVERS WILL BE INTERRUPTED IF THE CURRENT ALTITUDE IS 75 NM, DECREASING AND <math>h_p &lt; 400K</math> FT.</p> <p>D. IF ENTERING, UTILIZE LIFT TO AVOID LAND. UNAVOIDABLE LAND LANDING USE RL 90°.</p> <p>E. MAXIMUM NUMBER OF SPS RESTART ATTEMPTS IS TWO.</p> <p>F. IF NO SLA SEP OR IF SPS FAILS:</p> <ol style="list-style-type: none"> <li>1. <math>h_p &lt; 40</math> - EXECUTE CM/SM SEPARATION BY <math>T_{FF} = 1 + 40</math>.</li> <li>2. <math>40 &lt; h_p &lt; 75</math> - GROUND WILL DECIDE TO USE SM RCS ASAP OR AT APOGEE TO REDUCE <math>h_p</math> TO 40 NM.</li> </ol> |                         |        |      |
| A        | 4-5  | <p>MODE III ABORTS</p> <p>A. PREDICTED <math>T_{FF}</math> AFTER SPS CUTOFF <math>&lt; 1 + 40</math>.</p> <ol style="list-style-type: none"> <li>1. FULL LIFT IP ON WATER - DO NOT BURN.</li> <li>2. G&amp;N GO AND FULL LIFT IP ON LAND - BURN TO <math>T_{FF} = 1 + 40</math>, RL 90°.</li> <li>3. G&amp;N NO-GO AND FULL LIFT IP ON LAND - BURN A REDUCED <math>\Delta V</math> TO OBTAIN <math>T_{FF}</math> AFTER C/O AND RL 90°.</li> </ol> <p>B. IF <math>\Delta T_B \leq 2</math> SECONDS, DO NOT BURN.</p> <p>C. IF IGNITION OCCURS AFTER GETI +10 SECONDS, BURN UNTIL G&amp;N <math>\Delta R = 0</math>, RL 55°. (IF UNABLE TO BURN <math>\Delta R = 0</math>, RL 90°)</p>   |                         |        |      |
|          | 4-6  | <p>THE SPACECRAFT CMC WILL BE NO-GO FOR ABORT MANEUVER DETERMINATION AND MONITORING FOR THE FOLLOWING:</p> <p>A. CMC PROGRAM FAILURE.</p> <p>B. RTCC AND CMC <math>T_{FF}</math> DIFFERENCE <math>&gt; 40</math> SECONDS.</p> <p>C. CONFIRMED ERROR IN S/C PLATFORM VELOCITY COMPONENTS OF <math>&gt; 50</math> FPS IN X OR 100 FPS IN Z.</p>  |                         |        |      |
| MISSION  | REV  | DATE   | SECTION                 | GROUP  | PAGE |
| APOLLO 8 | A    | 12/11/68   | TRAJECTORY AND GUIDANCE | LAUNCH | 4-1  |

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**MISSION RULES**

| REV      | ITEM  |  |                         |        |      |
|----------|-------|--|-------------------------|--------|------|
|          | 4-7   | THE ORBIT IS "GO" IF $h_p \geq 75$ NM          |                         |        |      |
|          |       | RULE NUMBERS 4-8 THROUGH<br>4-19 ARE RESERVED. |                         |        |      |
| MISSION  | REV   | DATE   | SECTION                 | GROUP  | PAGE |
| APOLLO 8 | FINAL | 11/7/68  | TRAJECTORY AND GUIDANCE | LAUNCH | 4-2  |

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**MISSION RULES**

| REV      | ITEM  |   |                         |                     |      |
|----------|-------|---|-------------------------|---------------------|------|
|          | 4-20  | <p>EARTH ORBITAL ALTITUDE CONSTRAINTS:</p> <p>A. REAL-TIME MISSION PLANNING</p> <p>PERIGEE - 85 NM MINIMUM, MAXIMUM <math>h_p</math> IS DETERMINED BY THE AMOUNT OF SM-RCS AVAILABLE FOR HYBRID DEORBIT.</p> <p>B. CONTINGENCY</p> <p>PERIGEE - 75 NM MINIMUM (VIOLATIONS WILL BE CORRECTED ASAP)</p> <p>IF <math>h_p &lt; 75</math> NM AND MANEUVER TO RAISE <math>h_p</math> IS NOT POSSIBLE.</p> <p>1. <math>40 &lt; h_p &lt; 75</math> - EXECUTE SPS RETROGRADE ASAP UNTIL <math>h_p &lt; 40</math>. IF NO SPS USE SM-RCS.</p> <p>2. <math>h_p &lt; 40</math> - CM/SM SEP RETRO WILL RECOMMEND ENTRY PROFILE.</p> |                         |                     |      |
|          | 4-21  | <p>THE SEPARATION MANEUVER FOR CONTINGENCY CSM SEPARATION FROM S-IVB IS:</p> <p>A. IMPENDING S-IVB EXPLOSION - <u>4</u> SECONDS SPS ASAP. (7000 FEET SEPARATION IN 200 SECONDS.)</p> <p>B. ATTITUDE RATES <math>\geq 5</math> DEG/SEC - <u>20</u> SECONDS RCS ASAP.</p> <p>C. YAW ATTITUDE <math>&gt; 60</math> DEG - <u>20</u> SECONDS RCS ASAP.</p> <p>D. CSM RETROFIRE REQUIRED - SEPARATE 20 MINUTES PRIOR TO RETRO, 5 FPS RCS RETROGRADE WITH LINE ON HORIZON.</p>   |                         |                     |      |
|          | 4-22  | SPACECRAFT COMPUTER TIMING UPDATES ARE REQUIRED FOR SET ERRORS GREATER THAN <u>.1</u> 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 $\Delta T_B \leq 7$ SECONDS, USE SCS AUTO TVC.   |                         |                     |      |
|          | 4-25  | <p>PLANNED G&amp;N AND SCS RETROFIRE MANEUVERS WILL BE UPDATED IF:</p> <p>A. THE COMPUTED RETROFIRE POSITION CHANGES BY <math>&gt; 0.50</math> DEG LONGITUDE PRIOR TO GETI - 30 MINUTES.</p> <p>B. THE COMPUTED RETROFIRE POSITION CHANGES BY <math>&gt; 2</math> DEG LONGITUDE AFTER GETI - 30 MINUTES.</p>  |                         |                     |      |
|          | 4-26  | IF A G&N FAILURE IS DETECTED PRIOR TO RETROFIRE, CREW USES SCS $\Delta V$ MODE WITH AN EMS ENTRY.   |                         |                     |      |
|          | 4-27  | <p>IF SPS FAILS AFTER EPO RETROFIRE IGNITION OR NO SLA SEP:</p> <p>A. <math>h_p &gt; 75</math> NM - RETARGET FOR NEXT BEST PTP USING THE RCS.</p> <p>B. <math>h_p &lt; 75</math> NM - REMAIN IN RETRO ATTITUDE AND BURN SM RCS USING FOLLOWING PRIORITY:</p> <p>1. BURN <math>\Delta V</math> RESIDUALS.</p> <p>2. BURN MAXIMUM SM <math>\Delta V</math> AVAILABLE.</p> <p>3. BURN CM RCS TO <math>h_p = 40</math> NM IF SM RCS <math>\Delta V</math> NOT SUFFICIENT TO OBTAIN 40 NM. IF <math>h_p \leq 40</math> NM TERMINATE ALL THRUSTING AT <math>T_{FF} = 7</math> MINUTES.</p>                                  |                         |                     |      |
| MISSION  | REV   | DATE  | SECTION                 | GROUP               | PAGE |
| APOLLO 8 | FINAL | 11/7/68   | TRAJECTORY AND GUIDANCE | EARTH ORBIT AND TLI | 4-3  |

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MISSION RULES

| REV      | RULE | CONDITION/MALFUNCTION   | PHASE                   | RULING  | CUES/NOTES/COMMENTS   |      |
|----------|------|---|-------------------------|---|---|------|
|          | 4-28 | THE G&N IS NO-GO FOR ENTRY IF:<br>A. CMC VALUE OF DOWNRANGE ERROR (RP - RT) 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.<br>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.<br>A. PREDICTED END OF LUNAR ORBIT MISSION FUEL RESERVES >1000 FPS.<br>B. PREDICTED END OF LUNAR ORBIT MISSION FUEL RESERVES <1000 FPS. AND:<br>1. PREDICTED END OF LUNAR FLYBY MISSION FUEL RESERVES >5500 FPS.<br>2. PREDICTED END OF LUNAR FLYBY MISSION FUEL RESERVES <5500 FPS.                          |                         | A. CONTINUE MISSION: EXECUTE MIDCOURSE CORRECTIONS CONSISTENT WITH LUNAR ORBIT MISSION.<br>B.<br>1. CONTINUE MISSION; EXECUTE MIDCOURSE CORRECTIONS FOR FREE RETURN FLYBY.<br>2. PERFORM ALTERNATE EARTH ORBIT MISSION OR DIRECT ABORT. | A. END OF LUNAR ORBIT MISSION FUEL RESERVES ARE AFTER EXECUTION OF BAP MCC, LOI, CIRCULATION, AND TEI. (ACTUAL VALUES VARY WITH DAILY WINDOW.)<br>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 VALUES VARY WITH DAILY WINDOW.)<br>1. CONTINGENT UPON CHECK-OUT OF GROUND CAPABILITY TO COMPUTE LARGE INITIAL MCC. |      |
| MISSION  | REV  | DATE  | SECTION                 |   | GROUP   | PAGE |
| APOLLO 8 | A    | 12/11/68  | TRAJECTORY AND GUIDANCE |   | EARTH ORBIT AND TLI   | 4-4  |

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MISSION RULES

| REV      | RULE  | CONDITION/MALFUNCTION  | PHASE                   | RULING  | CUES/NOTES/COMMENTS  |
|----------|-------|--|-------------------------|---|--|
|          | 4-35  | <p>DIFFERENCE IN CMC AND IU PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION:</p> <p>A. VIOLATION OF ANY OF THE FOLLOWING:</p> <p><math>\Delta \dot{X} &gt; \underline{34.8}</math> FPS</p> <p><math>\Delta \dot{Y} &gt; \underline{64.2}</math> FPS</p> <p><math>\Delta \dot{Z} &gt; \underline{86.6}</math> FPS</p> <p><math>\Delta V_T &gt; \underline{32.4}</math> FPS</p> <p>B. FOR ANY OF THE FOLLOWING:</p> <p><math>\underline{7.4} &lt; \Delta \dot{X} &lt; \underline{34.8}</math></p> <p><math>\underline{44.6} &lt; \Delta \dot{Y} &lt; \underline{64.2}</math></p> <p><math>\underline{27.0} &lt; \Delta \dot{Z} &lt; \underline{86.6}</math></p> <p><math>\underline{13.0} &lt; \Delta V_T &lt; \underline{32.4}</math></p> <p>C. VIOLATION OF ANY OF THE FOLLOWING ORBITAL DECISION PARAMETERS AT GET = 1 HR 45 MIN.</p> <p><math>\Delta A &gt; \underline{17,400}</math> FT</p> <p><math>\Delta W &gt; \underline{31.2}</math> FT/SEC</p> <p><math>\Delta W &gt; \underline{26,400}</math> FT</p> |                         | <p>A. TLI IS NO-GO.</p> <p>B. TLI IS TEMPORARILY NO-GO.</p> <p>C. TLI IS NO-GO.</p> | <p>B. REFER TO ORBITAL DECISION PARAMETERS (PART C)</p> <p>C. IU COMPARED TO MSFN.</p> |
|          | 4-36  | <p>DIFFERENCE IN MSFN AND IU DOWNRANGE POSITION (<math>\Delta R_D</math>) <math>&gt; \underline{103,500}</math> FT. AT GET = <math>\underline{55}</math> MIN.</p> <p>RULES 4-37 THROUGH 4-45 ARE RESERVED.</p>   |                         | <p>TLI IS NO-GO.</p>  |  |
| MISSION  | REV   | DATE   | SECTION                 | GROUP   | PAGE   |
| APOLLO 8 | FINAL | 11/7/68  | TRAJECTORY AND GUIDANCE | EARTH ORBIT AND TLI   | 4-5  |

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**MISSION RULES**

| REV      | ITEM |   |                         |          |      |
|----------|------|---|-------------------------|----------|------|
|          | 4-46 | <p>THE CMC WILL BE NO-GO FOR MANEUVER CONTROL FOR ANY OF THE FOLLOWING:</p> <p>A. COMPUTER PROGRAM FAILURE.</p> <p>B. CMC/IMU ALIGNMENT DISCREPANCY (FOR MANEUVER EXECUTION, MONITORING, AND ORBIT DETERMINATION.</p> <p>1. SEXTANT STAR CHECK: AUTO OPTICS POSITIONING DOES NOT PLACE SELECTED STAR IN FIELD OF VIEW OF SXT.</p> <p>2. HORIZON CHECK ERROR <math>&gt; 4</math> DEG FOR RETROFIRE FROM EPO.</p> |                         |          |      |
|          | 4-47 | <p>MODE III, MODE IV, APOGEE KICK OR EPO RETROFIRE WILL BE COMPLETED BY MANUAL TAKEOVER FOR ANY OF THE FOLLOWING:</p> <p>A. ATTITUDE EXCURSIONS <math>\geq 5</math> DEG.</p> <p>B. <math>V_G</math> INCREASING.</p>   |                         |          |      |
|          | 4-48 | <p>LOI (ONE &amp; TWO), TEI, TLC ABORTS AND LUNAR ORBIT ABORTS WILL BE COMPLETED BY MANUAL TAKEOVER FOR ANY OF THE FOLLOWING:</p> <p>A. ATTITUDE EXCURSIONS <math>\geq 10</math> DEG. } EXCLUDING START TRANSIENTS</p> <p>B. ATTITUDE RATES <math>\geq 10</math> DEG/SEC. }</p>   |                         |          |      |
| A        | 4-49 | <p>MIDCOURSE CORRECTIONS, LOI AND LUNAR ORBIT CIRCULARIZATION WILL BE TERMINATED AFTER MANUAL TAKEOVER AND RATE DAMPING FOR ATTITUDE RATES <math>\geq 10</math> DEG/SEC.</p>  |                         |          |      |
|          |      | <p>RULES 4-50 THROUGH 4-55 ARE RESERVED.</p>  |                         |          |      |
| MISSION  | REV  | DATE  | SECTION                 | GROUP    | PAGE |
| APOLLO 8 | A    | 12/11/68  | TRAJECTORY AND GUIDANCE | MANEUVER | 4-6  |

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MISSION RULES

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE                        | RULING   | CUES/NOTES/COMMENTS  |      |
|----------|------|--|------------------------------|--|--|------|
| A        | 4-56 | MIDCOURSE CORRECTION<br>NOMINAL EXECUTION POINTS<br>WILL BE AT<br><br>A. TLI C/O + 6 HRS.<br><br>B. TLI C/O + 25 HRS.<br><br>C. LOI - 22 HRS.<br><br>D. LOI - 8 HRS.   |                              |  | THE MANEUVER EXECUTION<br>CRITERIA (RULE 4-57) WILL BE<br>APPLIED TO MANEUVERS CALCULATED<br>AT THESE POINTS.<br>EARLIEST MCC IS AT TLI C/O<br>+4 HRS.   |      |
|          | 4-57 | TRANSLUNAR MIDCOURSE<br>CORRECTION EXECUTION<br>CRITERIA.<br><br>A. FIRST MCC <3 FPS AT<br>TLI C/O +6 HRS.<br><br>B. ALL SUBSEQUENT MCC'S.<br><br>1. $\Delta V_{MCC} < 1$ FPS<br><br>2. $\frac{1}{2}$ FPS $\leq \Delta V_{MCC} \leq$<br><br>3. $\frac{5}{2}$ FPS $< \Delta V_{MCC} < 10$<br>FPS<br><br>4. $\Delta V_{MCC} > 10$ FPS. |                              | A. DO NOT EXECUTE MCC AT PLANNED<br>TIME<br><br>B.<br><br>1. DO NOT EXECUTE MCC AT<br>PLANNED TIME. (EXCEPTION-<br>LAST MCC)<br><br>2. CONSIDER LATER MCC TIME<br>TO ALLOW $\Delta V > \frac{5}{2}$ FPS.<br><br>3. EXECUTE MCC WITH SPS AT<br>PLANNED TIME.<br><br>4. SCHEDULE EARLIER MCC<br>TIME TO ALLOW REDUCTION<br>IN $\Delta V$ . | A. THREE FPS IS THE $3\sigma$ MSFN<br>VELOCITY UNCERTAINTY AT<br>TIME OF MANEUVER COMPUTATION.<br><br>B.<br><br>1. ONE-HALF FPS IS $3\sigma$<br>MSFN TRACKING UNCERTAINTY<br>AFTER 20 HRS.<br><br>2. $\frac{5}{2}$ FPS IS SPS MINIMUM<br>IMPULSE; MAY BE<br>EXECUTED RCS AT<br>PLANNED TIME. |      |
|          | 4-58 | THE G&N WILL BE THE PRIMARY  | MODE OF EXECUTING            | TRANSLUNAR MIDCOURSE CORRECTIONS:  | (A) RCS (B) SPS $> \frac{7}{2}$ 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  |  |      |
| MISSION  | REV  | DATE   | SECTION                      |  | GROUP  | PAGE |
| APOLLO 8 | A    | 12/11/68   | TRAJECTORY AND GUIDANCE      |  | TRANSLUNAR COAST   | 4-7  |

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**MISSION RULES**

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE    | RULING   | CUES/NOTES/COMMENTS   |                  |      |
|----------|------|--|----------|--|---|------------------|------|
| A        | 4-61 | A "GO" FOR LOI REQUIRES:<br>A. COMMITMENT TO AT LEAST 4 HOURS IN LPO.<br>B. ADEQUATE FUEL REMAINING FOR SUBSEQUENT MISSION OPERATIONS.<br>C. $h_{pc} > 50$ NM        |          |  | A. THIS PROVIDES ONE REV OF TRACKING POST-LOI FOR CALCULATION OF TEI.<br>B. INCLUDES LOI, CIRCULARIZATION, TEI, AND RESERVES. |                  |      |
| A        | 4-62 | PREMATURE LOI SHUTDOWN:<br>A. RESULTING APOLUNE $< \approx 9000$ NM AND PERILUNE $> 25$ NM<br>B. RESULTING APOLUNE $> \approx 9000$ NM<br>C. RESULTING $h_p < 25$ NM | B        | A. EVALUATE TEI/CIRCULARIZATION<br>B. DO DIRECT RETURN ABORT BURN ASAP.<br>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 $\pm 30$ DEG.   |          |  |   |                  |      |
| A        |      | RULES 4-64 THROUGH 4-75 ARE RESERVED.  |          |  |   |                  |      |
| MISSION  |      | REV  | DATE     | SECTION  |   | GROUP            | PAGE |
| APOLLO 8 |      | A  | 12/11/68 | TRAJECTORY AND GUIDANCE  |   | TRANSLUNAR COAST | 4-8  |

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MISSION RULES

| 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:<br><br>COMMITMENT TO AT LEAST <u>4</u> HOURS IN <u>60</u> NM CIRCULAR LPO  |                         |   | THIS PROVIDES ONE REV OF TRACKING POST-CIRCULARIZATION FOR CALCULATION OF TEI. |      |
|          | 4-78  | LUNAR ORBIT ALTITUDE CONSTRAINTS<br><br>A. REAL-TIME MISSION PLANNING - PERILUNE <u>60</u> NM MINIMUM.<br><br>B. CONTINGENCY (VIOLATIONS MUST BE CORRECTED ASAP) - PERILUNE <u>25</u> NM MINIMUM. |                         |   |  |      |
|          |       | RULES 4-79 THROUGH 4-85 ARE RESERVED.   |                         |   |  |      |
| MISSION  | REV   | DATE  | SECTION                 |   | GROUP  | PAGE |
| APOLLO 8 | FINAL | 11/7/68   | TRAJECTORY AND GUIDANCE |   | LUNAR ORBIT  | 4-9  |



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**MISSION RULES**

| 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 | <p>THE G&amp;N IS NO-GO DURING ENTRY IF:</p> <p>A. P65 VALUE <math>V_L</math> DIFFERS FROM GROUND VALUE BY GREATER THAN <math>\pm 800</math> FPS.</p> <p>B. P65 VALUE OF <math>D_L</math> DIFFERS FROM GROUND VALUE BY GREATER THAN <math>\pm .6G</math>'S.</p> <p>C. CAUSES TRAJECTORY TO VIOLATE THE OFFSET LIMITS (SKIP) ON EMS SCROLL.</p> <p>D. CAUSES TRAJECTORY TO VIOLATE ONSET LIMITS (G) ON EMS SCROLL.</p> <p>E. IF G&amp;N TRIM ATTITUDES AT CM/SM SEPARATION DIFFER FROM HORIZON MONITOR ATTITUDE BY <math>&gt;5</math> DEGREES.</p> <p>F. IF THE G&amp;N TRIM ATTITUDES AT <math>.05G</math> DIFFERS FROM THE GROUND VALUES BY <math>&gt;5</math> DEGREES.</p> <p>G. IF CMC FAILS TO SEQUENCE FROM P63 TO P64 AT RET <math>.05G \pm 5</math> SEC.</p> |                         |                      |      |
| <p>RULES 4-96 THROUGH 4-100<br/>ARE RESERVED.</p> |      |   |                         |                      |      |
| MISSION   | REV  | DATE  | SECTION                 | GROUP                | PAGE |
| APOLLO 8  | A    | 12/11/68  | TRAJECTORY AND GUIDANCE | TRANSEARTH AND ENTRY | 4-11 |

## NASA — Manned Spacecraft Center

### MISSION RULES

| REV      | ITEM  | DESCRIPTION   |                         |              |      |
|----------|-------|---|-------------------------|--------------|------|
|          | 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". |                         |              |      |
|          |       | <u>TRACKING SOURCES:</u>  |                         |              |      |
|          | 4-102 | AT LEAST TWO VEHICLE POSITION DATA SOURCES ARE <u>MANDATORY</u> 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 <u>MANDATORY</u> 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 <u>MANDATORY</u> FOR LAUNCH. OTHER IS <u>HIGHLY DESIRABLE</u> .  |                         |              |      |
|          | 4-105 | ODOP DATA TO THE CAPE KENNEDY RTCS FOR IP COMPUTATION AND RSO DISPLAY DURING FIRST STAGE BURN IS <u>HIGHLY DESIRABLE</u> .  |                         |              |      |
|          |       | <u>AIRBORNE SYSTEMS:</u>  |                         |              |      |
|          | 4-106 | TWO OPERATIONAL RANGE SAFETY COMMAND RECEIVERS ON EACH LAUNCH BOOSTER STAGE (THE S-IC, S-II AND THE S-IVB) ARE <u>MANDATORY</u> 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 <u>MANDATORY</u> FOR LAUNCH.   |                         |              |      |
|          |       | <u>COMMAND/CONTROL:</u>   |                         |              |      |
|          | 4-108 | THE NASA BERMUDA DRS COMMAND/CONTROL SYSTEM IS <u>MANDATORY</u> 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".   |                         |              |      |
|          |       | <u>COMMUNICATIONS:</u>  |                         |              |      |
|          | 4-110 | TWO PRIVATE, INDEPENDENT, GEOGRAPHICALLY DIVERSIFIED COMMUNICATION LINKS BETWEEN THE RSO AND BRSO ARE <u>MANDATORY</u> .  |                         |              |      |
|          | 4-111 | TWO OF THE FOLLOWING THREE COMMUNICATIONS LINKS ARE MANDATORY BETWEEN THE RSO AND FD/FIDO: <ul style="list-style-type: none"> <li>A. RSO LOOP (CAPE 111).</li> <li>B. RSO PRIVATE LINE (GREENPHONE/YELLOWPHONE).</li> <li>C. FLIGHT DIRECTOR'S LOOP.</li> </ul>   |                         |              |      |
| MISSION  | REV   | DATE  | SECTION                 | GROUP        | PAGE |
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**MISSION RULES**

| REV      | ITEM  |  |                         |              |      |
|----------|-------|--|-------------------------|--------------|------|
|          | 4-112 | A COMMUNICATIONS LINK BETWEEN RSO AND RANGE SAFETY SUPERVISOR (CRSS) AT THE LAUNCH CONTROL CENTER IS <u>MANDATORY</u> .  |                         |              |      |
| A        | 4-113 | GREENPHONE COMMUNICATIONS LINK BETWEEN RSO AND THE LAUNCH VEHICLE TEST CONDUCTOR (CLTC) IS <u>HIGHLY DESIRABLE</u> .   |                         |              |      |
|          |       | <u>TELEMETRY:</u>  |                         |              |      |
|          | 4-114 | IU TELEMETRY DATA (ONBOARD GUIDANCE PARAMETERS) TO THE RTCS ARE <u>HIGHLY DESIRABLE</u> 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 <u>HIGHLY DESIRABLE</u> . FOR LAUNCH VEHICLE AND SPACECRAFT HARDWARE ENTRIES AND APPROPRIATE CATEGORIES, REFERENCE THE FOLLOWING ITEMS:<br><br>(1) FOR RSO DISPLAY: TO BE DETERMINED<br><br>(2) FOR BRSO DISPLAY: TO BE DETERMINED |                         |              |      |
|          |       | <u>WEATHER:</u>  |                         |              |      |
|          | 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.  |                         |              |      |
| MISSION  | REV   | DATE   | SECTION                 | GROUP        | PAGE |
| APOLLO 8 | A     | 12/11/68   | TRAJECTORY AND GUIDANCE | RANGE SAFETY | 4-13 |

5 SLV-BOOSTER

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**MISSION RULES**

| REV      | ITEM |   |         |         |      |
|----------|------|---|---------|---------|------|
| A        | 5-1  | <p>BSE GENERAL RULES</p> <p>A. BSE GENERALIZED SWITCH SELECTOR COMMAND CAPABILITY EXISTS:</p> <ol style="list-style-type: none"> <li>1. WHEN CREW ENABLES IU COMMAND SYSTEM (EXCEPT AS NOTED BELOW IN ITEM D)</li> <li>2. AFTER TB7 + 20 MINUTES</li> <li>3. AFTER SPACECRAFT SEPARATION EXCEPT AS NOTED IN ITEM D.</li> </ol> <p>B. BSE MANEUVER UPDATE CAPABILITY EXISTS FOR TB7 MANEUVERS ONLY.</p> <p>C. BSE HAS NO NAVIGATION UPDATE OR TARGET UPDATE CAPABILITY.</p> <p>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.</p> <p>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.</p> <p>F. A SAFE DISTANCE BETWEEN THE SPACECRAFT AND S-IVB/IU IS DEFINED AS 7000 FT.</p> <p>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:</p> <ol style="list-style-type: none"> <li>1. A CATASTROPHIC HAZARD,</li> <li>2. INSUFFICIENT CONSUMABLES TO ASSURE A 95 PERCENT PROBABILITY OF GUIDANCE CUTOFF,</li> <li>3. OR, FUNCTIONAL CONDITIONS LEADING TO A DEFINITE PREDICTION OF LESS THAN 1<math>\sigma</math> 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.</li> </ol> <p>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<sub>2</sub> AND LOX ULLAGE PRESSURES. IF SEPARATION IS REQUIRED, THE SPACECRAFT SHOULD IMMEDIATELY GO TO A SAFE DISTANCE (7000 FT) FROM THE S-IVB/IU.</p> <p>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.</p> <p>J. ABORT DURING LAUNCH PHASE WILL BE RECOMMENDED FOR THE FOLLOWING:</p> <ul style="list-style-type: none"> <li>5-3 S-IC LOSS OF THRUST</li> <li>5-14 LAUNCH VEHICLE INERTIAL PLATFORM FAILURE - ATTITUDE REFERENCE</li> <li>5-15 S-II LOSS OF THRUST ON TWO OR MORE ENGINES PRIOR TO S-IVB TO ORBIT CAPABILITY</li> <li>5-16 S-II SECOND PLANE SEPARATION FAILS TO OCCUR</li> <li>5-17 S-II GIMBAL SYSTEM FAILURE - ACTUATOR HARDOVER INBOARD PRIOR TO S-IVB TO ORBIT CAPABILITY</li> <li>5-18 COLD HELIUM SHUTOFF VALVES FAIL OPEN</li> <li>5-20 S-IVB LOSS OF HYDRAULIC FLUID</li> <li>5-21 S-IVB LOSS OF THRUST</li> </ul> <p>K. S-II/S-IVB EARLY STAGING WILL BE RECOMMENDED FOR THE FOLLOWING:</p> <ul style="list-style-type: none"> <li>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</li> <li>5-17 S-II ACTUATOR HARDOVER INBOARD AFTER S-IVB TO ORBIT CAPABILITY</li> </ul> <p>L. SPACECRAFT SEPARATION OR TLI INHIBIT PRIOR TO RESTART WILL BE RECOMMENDED FOR THE FOLLOWING:</p> <ul style="list-style-type: none"> <li>5-22 S-IVB FIRST BURN LONGER THAN 3 MIN 03 SEC</li> <li>5-51 LOSS OF ATTITUDE CONTROL DURING TB5, TB6, OR TB7 PRIOR TO RESTART</li> <li>5-57 J-2 ENGINE CONTROL BOTTLE PRESSURE LESS THAN 400 PSIA</li> <li>5-58 INERTIAL PLATFORM FAILURE</li> <li>5-65 ACTUATOR HARDOVER</li> <li>5-66 LOSS OF S-IVB HYDRAULICS</li> </ul> <p>M. SPACECRAFT SEPARATION OF TLI INHIBIT PRIOR TO RESTART WILL BE RECOMMENDED UNLESS COMMAND ACTION IS SUCCESSFUL FOR THE FOLLOWING:</p> <ul style="list-style-type: none"> <li>5-46 J-2 ENGINE MAIN LOX VALVE FAILS TO CLOSE AT S-IVB CUTOFF</li> <li>5-49 S-IVB COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE</li> <li>5-50 S-IVB CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO OPEN IN TB5</li> <li>5-55 S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS +36 OR -26 PSID</li> </ul> |         |         |      |
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MISSION RULES

| REV | ITEM          |  |
|-----|---------------|--|
| A   | 5-1<br>(CONT) | <p>5-61 S-IVB COLD HELIUM SPHERE PRESSURE LOW (&lt;600 PSIA)<br/>                     5-64 S-IVB LH<sub>2</sub> TANK ULLAGE PRESSURE LOW<br/>                     5-67 J-2 ENGINE START BOTTLE PRESSURE HIGH<br/>                     5-68 S-IVB LOX TANK ULLAGE PRESSURE LOW</p> <p>RULE 5-2 IS RESERVED.</p> |

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|----------|-----|----------|---------|---------|------|
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MISSION RULES

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

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE   | RULING   | CUES/NOTES/COMMENTS   |      |
|----------|------|--|---------|--|---|------|
|          | 5-5  | <p>S-IC STAGE GIMBAL SYSTEM FAILURE</p> <p>ANY SINGLE ACTUATOR HARD-OVER - ANY ENGINE - PITCH OR YAW</p> <p>(TB1 + 0 SEC TO TB3 + 0 SEC)</p> <p>RULES 5-6 THROUGH 5-11 ARE RESERVED.</p> | LAUNCH  | <p><u>CONTINUE MISSION</u></p> <p>BSE INFORM FLIGHT AND FIDO</p> | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>1. ACTUATOR POSITION EXCEEDS <math>\pm 5</math> DEG (VG1-101, VG1-102, VG1-103, VG1-104, VG2-101, VG2-102, VG2-103, VG2-104)</li> <li>2. ROLL ATTITUDE RATE EXCEEDS <math>5</math> DEG PER SEC (VR12-602, VR15-602)</li> <li>3. ROLL ATTITUDE ERROR EXCEEDS <math>5</math> DEG (VH69-602, VH56-603)</li> </ol> <p><u>NOTES:</u></p> <ol style="list-style-type: none"> <li>1. AUTOMATIC ABORT BY LES WHEN ATTITUDE RATE LIMIT IS EXCEEDED PRIOR TO AUTOMATIC ABORT DEACTIVATION.</li> <li>2. MANUAL ABORT BY LES WITH TWO CUES:               <ol style="list-style-type: none"> <li>A. ROLL ATTITUDE LIMIT -5 DEG</li> <li>B. Q-BALL <math>\Delta P</math> - 3.2 PSID</li> <li>C. PITCH OR YAW RATE -4 DEG/SEC</li> </ol> </li> </ol> |      |
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MISSION RULES

| REV      | RULE             | CONDITION/MALFUNCTION                   | PHASE   | RULING   | CUES/NOTES/COMMENTS   |      |
|----------|------------------|---|---------|--|---|------|
| A        | 5-12<br>(CONT'D) |   | LAUNCH  |  | <p>3. ACTUATOR POSITION INDICATES SUSTAINED HARD-OVER OR ERRATIC OPERATION (+6 DEG) (G1-401, G2-401, G1-403, G2-403)</p> <p>4. S-IVB BURN MODE DISCRETE REMAINS OFF AT STAGING (K20-602)</p> <p>NOTES:</p> <p>CREW WILL ABORT ON ESTABLISHED LIMITS:</p> <p>1. S-IC BURN</p> <p>A. PITCH OR YAW RATE - ±4 DEG/SEC</p> <p>B. ROLL RATE - ±20 DEG/SEC</p> <p>C. ROLL ERROR - ±5 DEG</p> <p>D. Q-BALL ΔP - 3.2 PSID</p> <p>2. S-II AND S-IVB BURN</p> <p>A. PITCH OR YAW RATE - ±10 DEG/SEC</p> <p>B. ROLL RATE - ±20 DEG/SEC</p>                                |      |
|          | 5-13             | INERTIAL PLATFORM FAILURE-ACCELEROMETER | LAUNCH  | <p>CONTINUE MISSION</p> <p>BSE INFORM FLIGHT AND FIDO.</p> <p>CAPCOM ADVISE CREW OF PROBABLE DEGRADED ORBIT.</p> | <p>CUES:</p> <p>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"</p> <p>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)</p> <p>NOTES:</p> <p>1. NO EFFECT ON VEHICLE TRAJECTORY DURING S-IC STAGE BURN</p> <p>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.</p> |      |
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**MISSION RULES**

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE   | RULING   | CUES/NOTES/COMMENTS  |      |
|----------|------|--|---------|--|--|------|
| A        | 5-14 | <p>LAUNCH VEHICLE INERTIAL PLATFORM FAILURE - ATTITUDE REFERENCE</p> <p>A. PRIOR TO TB1 + 50 SEC</p> <p>B. AFTER TB1 + 50 SEC BUT PRIOR TO TB1 + 100 SEC</p> <p>C. AFTER TB1 + 100 SEC</p>   |         | <p>A. <u>ABORT</u><br/>BSE INFORM FLIGHT, FIDO AND GUIDO. BSE TRANSMIT ABORT REQUEST AT 50 SEC</p> <p>B. <u>ABORT</u><br/>BSE INFORM FLIGHT, FIDO AND GUIDO. BSE TRANSMIT ABORT REQUEST (REF NOTE 3)</p> <p>C. <u>CONTINUE MISSION</u><br/>BSE INFORM FLIGHT, FIDO AND GUIDO. (REF NOTE 4)</p> | <p><u>CUES:</u></p> <p>1. GUIDANCE STATUS WORD - (MODE CODE 24) (H60-603)</p> <p>BITS D20 AND D19 FOR Z GIMBAL SET TO "ONE"</p> <p>BITS D18 AND D17 FOR X GIMBAL SET TO "ONE"</p> <p>BITS D16 AND D15 FOR Y GIMBAL SET TO "ONE"</p> <p>2. LADDER OUTPUTS CONSTANT FOR FAILED AXES (H54-603, H55-603, H56-603)</p> <p>3. ATTITUDE ERROR CONSTANT FOR FAILED AXES (H69-602, H70-602, H71-602)</p> <p>4. GUIDANCE REFERENCE FAILURE (D04) MODE CODE 26 BIT 8 SET TO "ONE" (H60-603)</p> <p><u>NOTES:</u></p> <p>1. THE LVDC/LVDA WILL HOLD THE LADDER SIGNALS AT THE LAST PREVIOUS VALID VALUE</p> <p>2. ATTITUDE CONTROL WILL BE LOST IN THE FAILED AXES</p> <p>3. CREW PERFORM MANUAL ABORT ON THE TWO GUIDANCE FAILURE LIGHTS. (REF RULING B)</p> <p>4. MANUAL ABORT WHEN FIDO LIMITS ARE EXCEEDED. (REF RULING C)</p> |      |
| A        | 5-15 | <p>S-II LOSS OF THRUST</p> <p>A. ANY SINGLE ENGINE - FAILURE TO ATTAIN THRUST OR LOSS OF THRUST PRIOR TO NOMINAL S-II CUTOFF</p> <p>B. ANY TWO ENGINES FAILURE TO ATTAIN THRUST OR LOSS OF THRUST</p> <p>1. ANGULAR RATES PITCH OR YAW EXCEED 10°/SEC OR ATTITUDE ERROR EXCEEDS 40°.</p> |         | <p>A. <u>CONTINUE MISSION</u><br/>BSE INFORM FLIGHT AND FDO</p> <p>B.1. <u>ABORT</u><br/>BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST</p>  | <p><u>CUES:</u></p> <p>A.1. THRUST OK SWITCHES OFF (K285-201 THROUGH 205) (K286-201 THROUGH 205)</p> <p>2. THRUST CHAMBER PRESSURE ZERO (D13-201 THROUGH 205)</p> <p>3. LONGITUDINAL ACCELERATION (A2-603)</p> <p>B.1. A. TWO ENGINES OUT (CUES A.1, A.2, A.3)</p> <p>B. ANGULAR RATE (R7-602, R8-602, R11-602, R13-602, R12-602, R15-602)</p> <p>C. ATTITUDE ERRORS (H54-603, H55-603, H56-603, H69-602, H70-602, H71-602)</p> <p>D. COMMAND ANGLES AND GIMBAL ANGLES (H60-603)</p>   |      |
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| REV      | RULE             | CONDITION/MALFUNCTION  | PHASE   | RULING   | CUES/NOTES/COMMENTS  |      |
|----------|------------------|--|---------|--|--|------|
| A        | 5-15<br>(CONT'D) | <p>B.2. PRIOR TO LOW LEVEL SENSE ARM (8:05 GET) FLY UNTIL CHI FREEZE +5 SEC (VARIABLE TIME)</p> <p>A. ANGULAR RATES IN PITCH OR YAW EXCEED 4 DEG/SEC OR ATTITUDE ERROR EXCEEDS 40°.</p> <p>B. ANGULAR RATES IN PITCH OR YAW ARE LESS THAN 4 DEG/SEC AND ATTITUDE ERROR IS LESS THAN 40°</p> <p>3. AFTER LOW LEVEL SENSE ARM (8:05 GET)</p> <p>C. THREE OR MORE ENGINES</p> <p>1. PRIOR TO S-IVB TO ORBIT CAPABILITY</p> <p>2. AFTER S-IVB TO ORBIT CAPABILITY BUT PRIOR TO LOW LEVEL SENSE ARM (8:05 GET)</p> <p>3. AFTER LOW LEVEL SENSE ARM (8:05 GET)</p> |         | <p>A. <u>ABORT</u><br/>BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST AT CHI FREEZE PLUS 5 SECONDS.</p> <p>B. <u>EARLY STAGE</u><br/>BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING AT CHI FREEZE PLUS 5 SECONDS.</p> <p>3. <u>CONTINUE MISSION</u><br/>BSE INFORM FLIGHT AND FDO</p> <p>C.1. <u>ABORT</u><br/>BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST</p> <p>2. <u>EARLY STAGE</u><br/>BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING</p> <p>3. <u>CONTINUE MISSION</u><br/>BSE INFORM FLIGHT AND FDO.</p> | <p>2. SAME AS B.1</p> <p>C. SAME AS A.1, 2, AND 3 ABOVE</p>  |      |
|          | 5-16             | S-II SECOND PLANE SEPARATION FAILS TO OCCUR AT TB3 + 31 SEC  | LAUNCH  | <p><u>ABORT</u><br/>BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST. CREW MUST ABORT PRIOR TO TB3 +56 SEC (NOM 3'26" GET)</p>   | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>SECOND PLANE SEPARATION INDICATION SHOWS NO SEPARATION (M86-206)</li> <li>GUIDANCE MODE WORD 1 MODE CODE 25 BIT D15 REMAINS ZERO (H60-603)</li> <li>IGNITION BUS VOLTAGE REMAINS AT APPROXIMATELY 28 VOLTS (M125-207)</li> <li>RECIRCULATION BUS VOLTAGE REMAINS APPROXIMATELY 56 VOLTS (M111-207)</li> </ol> <p><u>NOTES:</u></p> <ol style="list-style-type: none"> <li>MANUAL ABORT BY CREW WITH ONBOARD INDICATION.</li> <li>PROBABLE SUBSEQUENT LOSS OF VEHICLE DUE TO EXCESSIVE TEMPERATURE.</li> </ol> |      |
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| REV      | RULE | CONDITION/MALFUNCTION  | PHASE   | RULING   | CUES/NOTES/COMMENTS   |      |
|----------|------|--|---------|--|---|------|
| A        | 5-17 | S-II STAGE GIMBAL SYSTEM FAILURE ANY SINGLE ACTUATOR HARDOVER (INBOARD).<br><br>A. PRIOR TO S-IVB TO ORBIT CAPABILITY.<br><br>B. AFTER S-IVB TO ORBIT CAPABILITY.  | LAUNCH  | A. <u>ABORT</u><br>BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST.<br><br>B. <u>EARLY STAGE</u><br>BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING.  | <u>CUES:</u><br><br>1. YAW ACTUATOR POSITION EXCEEDS +6 DEGREES (VG8-201 THROUGH 204) (G30-201 THROUGH 204).<br><br>2. PITCH ACTUATOR POSITION EXCEEDS +6 DEGREES (G9-201 THROUGH 204) (G31-201 THROUGH 204).<br><br>3. ROLL ATTITUDE ERROR EXCEEDS 5 DEG (VH69-602 AND VH56-603).<br><br>4. ROLL ATTITUDE RATE EXCEEDS 3 DEG/SEC (VR12-602 AND VR15-602).<br><br><u>NOTE:</u><br><br>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<br><br>A. PRIOR TO LAUNCH ESCAPE TOWER (LET) JETTISON<br><br>B. AFTER LAUNCH ESCAPE TOWER (LET) JETTISON<br><br>C. AFTER THE S-II DEPLETION CUTOFF SENSORS ARMED (TB3 + 5 MIN 30 SEC) |         | A. <u>ABORT</u><br>BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST<br><br>B. <u>EARLY STAGE</u><br>BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING<br><br>C. <u>CONTINUE MISSION</u><br>BSE INFORM FLIGHT | <u>CUES:</u><br><br>A. LOX ULLAGE PRESSURE AT 50 PSIA OR SATURATED AT UPPER LIMIT (D179-424; D180-424)<br><br>B.1. COLD HELIUM DISCHARGE PRESSURE GREATER THAN 300 PSIA (D105-403)<br><br>2. LOX ULLAGE PRESSURE AT VENT VALVE RELIEF SETTING (NOMINAL 44 PSIA) AND RELIEVING (D179-424; D180-424)<br><br>3. COLD HELIUM BOTTLE PRESSURE DECAYING (D16-425; D263-405)<br><br>C. SAME AS B.1, 2, AND 3 ABOVE.<br><br><u>NOTES:</u><br><br>1. ACTION REQUIRED TO AVOID EXCEEDING LOX OVER PRESSURE STRUCTURAL LIMITS AND POSITIVE (+) ΔP COMMON BULKHEAD LIMITS.<br><br>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. |      |
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|----------|------|---|----------|---|--|------|
|          | 5-19 | S-IVB ENGINE ACTUATOR HARDOVER INDICATED PRIOR TO FIRST BURN.     | LAUNCH   | <p><u>CONTINUE MISSION</u></p> <p>BSE INFORM FLIGHT AND FIDO.</p> <p>CAPCOM ADVISE CREW OF IMPENDING OVERRATE CONDITION AFTER S-IVB IGNITION.</p> <p>CREW EXECUTE MANUAL ABORT ON ESTABLISHED LIMIT AFTER S-IVB IGNITION.</p>   | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>1. ACTUATOR POSITIONS +6 DEG OR GREATER (G1-403, G2-403)</li> <li>2. ENGINE ACTUATOR ΔP EQUALS TO OR GREATER THAN 3300 PSIA. (D44-403, D45-403)</li> </ol> <p><u>NOTE:</u></p> <p>THE RATE LIMITS WHICH THE CREW WILL ABORT DURING S-IVB FLIGHT:</p> <p>PITCH OR YAW RATE - ±10 DEG/SEC</p> |      |
| A        | 5-20 | S-IVB LOSS OF STAGE HYDRAULIC FLUID CONFIRMED PRIOR TO FIRST BURN |          | <p>ABORT</p> <p>BSE INFORM FLIGHT AND FIDO.</p> <p>TRANSMIT ABORT PRIOR TO S-II/S-IVB STAGING</p>   | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>1. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (D41-403)</li> <li>2. HYDRAULIC RESERVOIR OIL LEVEL APPROXIMATELY ZERO PERCENT. (L7-403)</li> <li>3. HYDRAULIC RESERVOIR PRESSURE APPROXIMATELY ZERO PSIA (D42-403)</li> </ol>   |      |
| A        | 5-21 | S-IVB STAGE LOSS OF THRUST  |          | <p>A. <u>ABORT</u></p> <p>BSE INFORM FLIGHT AND FIDO AND RECOMMEND ABORT.</p> <p>IMMEDIATELY AFTER SPACECRAFT SEPARATION BSE SEND APS ULLAGE ENGINES NOS. 1 AND 2 OFF.</p> <p>B. <u>CONTINUE MISSION</u></p> <ol style="list-style-type: none"> <li>1. BSE INFORM FLIGHT AND FIDO.</li> <li>2. IMMEDIATELY AFTER SPACECRAFT SEPARATION BSE SEND APS ULLAGE ENGINES NOS. 1 AND 2 OFF.</li> </ol> | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>1. THRUST CHAMBER PRESSURE - ZERO (D1-401)</li> <li>2. THRUST OK SWITCHES - OFF (K14-401, K157-401)</li> <li>3. LONGITUDINAL ACCELERATION ZERO (A2-603)</li> <li>4. TIME BASE 5 IS INITIATED. MODE CODE 25, BIT D2 SET TO 1. (H60-603)</li> </ol>   |      |
| A        | 5-22 | S-IVB FIRST BURN IS EXTENDED LONGER THAN 3 MIN 03 SEC             |          | <p><u>S/C SPACECRAFT</u></p> <p>BSE INFORM FLIGHT AND FIDO AND RECOMMENDED SPACECRAFT SEPARATION PRIOR TO RESTART</p>   | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>1. S-IVB FIRST BURN TIME</li> </ol> <p><u>NOTE:</u></p> <p>CURRENT PLANNING IS TO ASSESS PROPELLANT QUANTITIES REQUIRED TO ACHIEVE SATISFACTORY TLI GUIDANCE CUTOFF IN NEAR REAL TIME SIMULATIONS.</p>  |      |
|          |      | RULES 5-23 THROUGH 5-24 ARE RESERVED                              |          |   |  |      |
| MISSION  |      | REV   | DATE     | SECTION   | GROUP  | PAGE |
| APOLLO 8 |      | A   | 12/11/68 | BOOSTER   | SPECIFIC   | 5-10 |

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MISSION RULES

| REV      | RULE | CONDITION/MALFUNCTION                                 | PHASE   | RULING  | CUES/NOTES/COMMENTS   |      |
|----------|------|---|---------|---|---|------|
|          | 5-25 | TIME BASE 5 OR TB7 FAILS TO INITIATE AT S-IVB CUT-OFF |         | <p><u>SPACECRAFT SEPARATION</u></p> <p>BSE INFORM FLIGHT AND RECOMMEND IMMEDIATE SEPARATION TO A SAFE DISTANCE.</p> | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>1. TIME OF TB INITIATE REMAINS AT PREVIOUS VALUE (H60-603)</li> <li>2. TIME-IN-TIME BASE CONTINUES TO COUNT (H60-603)</li> <li>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)</li> <li>4. ORBITAL SEQUENCING FAILS TO INITIATE</li> </ol> <p><u>NOTES:</u></p> <ol style="list-style-type: none"> <li>1. THIS CONDITION WILL RESULT IN LOSS OF SEQUENCING AND PITCH AND YAW ATTITUDE CONTROL.</li> <li>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               <ul style="list-style-type: none"> <li>A. S-IVB ENGINE OUT "A"</li> <li>B. S-IVB ENGINE OUT "B"</li> <li>C. S-IVB VELOCITY CUTOFF</li> <li>D. ACCELEROMETER LOSS OF THRUST INDICATION</li> </ul> </li> </ol> |      |
|          |      | RULES 5-26 THROUGH 5-44 ARE RESERVED                  |         |   |   |      |
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MISSION RULES

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

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE                 | RULING  | CUES/NOTES/COMMENTS  |      |
|----------|------|--|-----------------------|---|--|------|
|          |      |  |                       |   | 2. FIRING UNIT 2 RC EBW (M031-411) BETWEEN 2.4 AND 4.5 VOLTS.<br>3. RANGE SAFETY RECEIVER NO. 1 ENABLE (N057-411).<br>4. RANGE SAFETY RECEIVER NO. 2 ENABLE (N052-411).<br>5. RSO DISPLAY AND COMMAND SYSTEM STATUS. (VOICE VERIFICATION)<br><br><u>NOTES:</u><br>1. THE SPACECRAFT ABORT REQUEST LIGHT MAY BE ILLUMINATED FOR A PROPELLANT DISPERSION SYSTEM ARMED CONDITION.<br>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.<br>3. EITHER CUE 1 OR CUE 2 IS SUFFICIENT FOR IMPLEMENTATION OF THIS RULE.<br>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:<br><br>A. FAILS TO TURN OFF<br><br>TB5 + 4.1 SEC<br>TB5 + 44 MIN 8 SEC<br>TB5 + 1 HR 30 MIN 48 SEC<br>TB5 + 3 HR 3 MIN<br>TB7 + 4.1 SEC<br>TB7 + 54 MIN 8 SEC<br>TB7 + 2 HR 17 MIN 03 SEC<br><br>B. FAILS TO TURN ON<br><br>1. S-IVB HYDRAULIC FLUID IS BELOW OR PREDICTED TO DROP BELOW 10°F BEFORE NEXT AOS. | EARTH ORBITAL RESTART | A. <u>CONTINUE MISSION</u><br><br>BSE INFORM FLIGHT AND SEND:<br><br>AUXILIARY HYDRAULIC PUMP FLIGHT MODE OFF AS SOON AS POSSIBLE.<br><br>B. <u>CONTINUE MISSION</u><br><br>1. BSE INFORM FLIGHT AND SEND<br><br>AUXILIARY HYDRAULIC PUMP FLIGHT MODE ON. | CUES:<br>1. SYSTEM PRESSURE ABOVE 1700 PSIA (D41-403)<br>2. RESERVOIR LEVEL BELOW 50 PERCENT (L7-403)<br>3. AFT BUS NO. 2 CURRENT ABOVE 20 AMPS (M22-404)<br>4. HYDRAULIC RESERVOIR OIL PRESSURE GREATER THAN 137 PSIA (D42-403)<br><br><u>NOTE:</u><br>1. FAILURE TO TURN OFF HYDRAULIC PUMP DEPLETES AFT NO. 2 BATTERY IN APPROXIMATELY 90 MIN AND OVERHEATS HYDRAULIC SYSTEM IN APPROXIMATELY 13 MIN.   |      |
| MISSION  | REV  | DATE   | SECTION               |   | GROUP  | PAGE |
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| 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:<br><br>AUXILIARY HYDRAULIC PUMP FLIGHT MODE OFF.   | <u>CUES:</u><br>1. SYSTEM PRESSURE BELOW 1700 PSIA (D41-403)<br>2. RESERVOIR OIL LEVEL ABOVE 50 PERCENT (L7-403)<br>3. AFTER BUS NO. 2 CURRENT AT ZERO AMPS (M22-404)<br>4. RESERVOIR PRESSURE LESS THAN 89 PSI (D42-403)<br>5. HYDRAULIC PUMP INLET OIL TEMP (C50-401)<br>6. RESERVOIR OIL TEMP (C51-403)<br><br><u>NOTE:</u><br>S-IVB AUXILIARY HYDRAULIC PUMP IS PROGRAMED TO TURN ON AT:<br><br>TB5 + 43 MIN 20 SEC<br>TB5 + 1 HR 30 MIN<br>TB5 + 2 HR 55 MIN<br>TB6 + 3 MIN 39 SEC<br>TB7 + 53 MIN 20 SEC<br>TB7 + 2 HR 11 MIN 30 SEC |
|          | 5-49 | S-IVB COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE AT<br><br>A. TB5 + 1.4 SEC<br><br><br><br><br><br><br><br><br><br>B. TB7 + 1.4 SEC |         | CONTINUE MISSION/SPACECRAFT SEPARATION<br><br>A. BSE INFORM FLIGHT AND SEND:<br><br>1. LOX TANK NPV VALVE OPEN<br><br>2. LOX TANK FLIGHT PRESSURIZATION SHUTOFF VALVES CLOSED.<br><br>IF (2) SUCCESSFUL CLOSE LOX NPV WHEN TANK PRESSURE IS BETWEEN 38-41 PSIA.<br><br>3. RECOMMEND SPACECRAFT SEPARATION IF LOX TANK ULLAGE PRESSURE AT 48 PSIA.<br><br><br>B. BSE INFORM FLIGHT AND SEND:<br><br>1. LOX TANK NPV VALVE OPEN AFTER TB7 + 2 MIN 30 SEC UNTIL THE ULLAGE PRESSURE IS BELOW 7 PSIA<br><br>2. RECOMMEND IMMEDIATE SEPARATION IF LOX TANK ULLAGE PRESSURE AT 48 PSIA. | <u>CUES:</u><br>1. COLD HELIUM DISCHARGE PRESSURE GREATER THAN 100 PSIA (D105-403)<br>2. COLD HELIUM BOTTLE PRESSURE DECAYING (D16-425, D263-405)<br>3. LOX TANK ULLAGE PRESSURES (D179-424, D180-424) AT RELIEF SETTING.<br>4. LOX PUMP INLET PRESS (D003-403)<br><br><u>NOTES:</u><br>1. FAILURE TO CLOSE THE SHUTOFF VALVES WILL RESULT IN THE DEPLETION OF THE COLD HELIUM.<br>2. ACTION REQUIRED TO AVOID, EXCEEDING LOX TANK OVERPRESSURE LIMITS OR POSITIVE ΔP LIMITS.  |
|          | 5-50 | CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO OPEN IN TB5 (TB5 + 50 SEC).   |         | <u>CONTINUE MISSION</u><br><br>BSE INFORM FLIGHT AND SEND:  | <u>CUES:</u><br>1. LH <sub>2</sub> ULLAGE PRESSURE (D177-410, D178-410)<br>2. CVS NOZZLE PRESSURE (D181-409, D182-409)   |
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| REV      | RULE | CONDITION/MALFUNCTION   | PHASE                 | RULING  | CUES/NOTES/COMMENTS  |      |
|----------|------|---|-----------------------|---|--|------|
|          |      |   |                       | 1. CVS RELIEF OVERRIDE SHUT-OFF VALVE OPEN<br><br>IF UNSUCCESSFUL BSE:<br><br>2. VENT THE LH <sub>2</sub> TANK PRIOR TO TB6 TO A PRESSURE BELOW THE VALUE REQUIRED FOR TB6 INITIATE<br><br>3. IF THE LH <sub>2</sub> BLOWDOWN IS COMPLETED WITHIN 30 MINUTES PRIOR TO TB6 INITIATE SEND<br><br>A. ULLAGE ENGINES ON<br><br>AFTER 90 SEC OF ULLAGE SEND<br><br>B. ULLAGE ENGINES OFF<br><br>ULLAGING SHOULD BE COMPLETED PRIOR TO THE AMBIENT REPRESSURIZATION.<br><br>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)<br><br><u>NOTE:</u><br><br>1. IF THE CVS REGULATOR FAILS TO OPEN, THE LH <sub>2</sub> SATURATION TEMPERATURE WILL INCREASE ABOVE RESTART LIMITS TO INSURE A COMPLETE BURN.  |      |
| A        | 5-51 | LOSS OF ATTITUDE CONTROL<br><br>A: DURING TB5 AND TB7<br><br>B. FROM TB6 INITIATE TO TB6 + 9 MIN 10 SEC | EARTH ORBITAL RESTART | <u>SPACECRAFT SEPARATION</u><br><br>A. BSE INFORM FLIGHT AND RECOMMEND S/C SEP.<br><br>B. <u>TLI INHIBIT</u><br><br>BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT   | <u>CUES:</u><br><br>1. THE DIFFERENCE BETWEEN COMMANDED ATTITUDE (CHI) AND ACTUAL VEHICLE ATTITUDE (THETA) IS GREATER THAN 5 DEG AND DIVERGING (H60-603)<br><br>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, H56-603)<br><br>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)<br><br>4. FLIGHT CONTROL COMPUTER NOT IN CORRECT MODE (K20-602)<br><br>5. LVDA ERROR MONITOR REGISTER BIT D26, D25 AND D24 SET TO "ONES" (H60-603)<br><br>6. ORBITAL STATUS WORD (MODE CODE 28) BITS D20, D18 OR (60-603)<br><br>7. GUIDANCE FAILURE DISCRETE (D04) (MODE CODE 26) BIT D8 SET TO "ONE" (H60-603) |      |
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| REV      | RULE | CONDITION/MALFUNCTION   | PHASE                 | RULING   | CUES/NOTES/COMMENTS   |          |      |
|----------|------|---|-----------------------|--|---|----------|------|
|          |      |   |                       |  | <p><u>NOTES:</u></p> <ol style="list-style-type: none"> <li>1. THE SLV YAW GIMBAL (Z-AXIS) IS CRITICAL BEYOND ±45 DEGREES.</li> <li>2. DURING PERIODS OF NO GND COM, CREW MAY ATTEMPT ATTITUDE CONTROL SWITCH-OVER TO ALLOW SEPARATION OVER A GROUND STATION</li> </ol>   |          |      |
| 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 | <p><u>CONTINUE MISSION</u></p> <p>BSE INFORM FLIGHT AND SEND:</p> <p>A. S-IVB ULLAGE ENGINE NO. 1 AND 2 OFF.</p> <p>B. IF UNSUCCESSFUL, BSE INFORM FLIGHT OF IMPENDING LOSS OF ATTITUDE CONTROL.</p>   | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>1. ULLAGE ENGINE THRUST CHAMBER PRESSURE GREATER THAN 90 PSIA (D220-414, D221-415)</li> <li>2. APS HELIUM SPHERE PRESSURE DECREASING (D35-414, D36-414, D250-414, D251-415)</li> </ol>   |          |      |
|          | 5-53 | <p>IU ECS WATER VALVE FAILS TO CYCLE OPEN AND CLOSED.</p> <p>A. WATER VALVE CLOSED AND COOLANT INLET CONTROL TEMPERATURE IS 64°F OR HIGHER, AND</p> <p>THE INERTIAL GIMBAL TEMPERATURE IS PREDICTED TO BE EQUAL TO OR GREATER THAN 115°F BEFORE THE NEXT SITE AOS OR,</p> <p>THE LVDC MEMORY TEMPERATURE IS PREDICTED TO BE EQUAL TO OR GREATER THAN 112°F BEFORE THE NEXT SITE AOS.</p> <p>B. WATER VALVE OPEN AND COOLANT INLET CONTROL TEMP IS 55°F OR LESS, AND</p> <p>THE INERTIAL GIMBAL TEMPERATURE IS PREDICTED TO BE 104°F OR LESS BEFORE THE NEXT SITE AOS OR,</p> <p>THE LVDC MEMORY TEMPERATURE IS PREDICTED TO BE 32°F OR LESS BEFORE THE NEXT SITE AOS.</p> | EARTH ORBITAL RESTART | <p><u>CONTINUE MISSION</u></p> <p>A. BSE INFORM FLIGHT AND SEND:</p> <ol style="list-style-type: none"> <li>1. ECS LOGIC INHIBIT COMMAND (AS NO. 5)</li> <li>2. WATER VALVE OPEN</li> </ol> <p>B. BSE INFORM FLIGHT AND SEND:</p> <ol style="list-style-type: none"> <li>1. ECS LOGIC INHIBIT COMMAND (AS NO. 5)</li> <li>2. WATER VALVE CLOSED</li> </ol> | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>1. WATER VALVE CLOSED/OPEN (G5-601; G6-601)</li> <li>2. ME/H<sub>2</sub>O TEMP (C15-601)</li> <li>3. OMW MODE CODE 27 BIT D8 SET TO "0".</li> <li>4. ST-124 INERTIAL GIMBAL TEMP (C34-603)</li> <li>5. SUBLIMATER INLET TEMP (C11-601)</li> <li>6. LVDC MEMORY TEMP (C54-603)</li> <li>7. LVDA TEMP NO. 1 (C55-603)</li> <li>8. LVDA TEMP NO. 2 (C56-603)</li> </ol> |          |      |
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| 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 | <p><u>CONTINUE MISSION</u></p> <p>BSE INFORM FLIGHT AND SEND:</p> <p>ENGINE PUMP PURGE OFF</p>   | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>ENGINE PUMP PURGE REGULATOR FAILS TO DECREASE FROM ABOUT 100 PSIA TO ABOUT 10 PSIA. (D50-403)</li> <li>AMBIENT PNEUMATIC BOTTLE PRESSURE DECREASING AT A RATE OF 23 PSI/MIN (D236-403, D256-403)</li> </ol> <p><u>NOTE:</u></p> <p>IF NOT TERMINATED, THE PURGE WILL CAUSE THE DEPLETION OF THE AMBIENT HELIUM PNEUMATIC SUPPLY AT THE RATE OF 23 PSI/MIN.</p>  |      |
|          | 5-55 | <p>S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS:</p> <p>A. MINUS 20 PSID</p> <p>B. PLUS 30 PSID</p> <p>C. MINUS 26 PSID PLUS 36 PSID</p> | EARTH ORBITAL RESTART | <p><u>CONTINUE MISSION</u></p> <p>A. BSE INFORM FLIGHT AND SEND:</p> <p>LH<sub>2</sub> VENT VALVE OPEN</p> <p>IF UNSUCCESSFUL SEND:</p> <ol style="list-style-type: none"> <li>LH<sub>2</sub> LATCHING RELIEF VALVE OPEN</li> <li>LH<sub>2</sub> VENT VALVE CLOSED</li> </ol> <p>VALVES WILL BE CYCLED OPENED/CLOSED OR LEFT OPEN TO PRECLUDE REACHING SEPARATION LIMITS.</p> <p>B. BSE INFORM FLIGHT AND SEND:</p> <p>LOX NPV VALVE OPEN</p> <p>IF SUCCESSFUL SEND:</p> <ol style="list-style-type: none"> <li>LOX VENT VALVE OPEN</li> <li>LOX NPV VALVE CLOSED</li> </ol> <p>VALVES WILL BE CYCLED OPENED/CLOSED OR LEFT OPEN TO PRECLUDE REACHING SEPARATION LIMITS.</p> <p>C. BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT SEPARATION TO A SAFE DISTANCE.</p> | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>LH<sub>2</sub> ULLAGE PRESSURE (D177-410, D178-410)</li> <li>LH<sub>2</sub> PUMP INLET PRESSURE (D2-403)</li> <li>LOX ULLAGE PRESSURE</li> <li>LOX PUMP INLET PRESSURE (D3-403)</li> </ol> <p><u>NOTES:</u></p> <ol style="list-style-type: none"> <li>MINUS DELTA PRESSURE IS DEFINED AS A FUEL TANK ULLAGE PRESSURE GREATER THAN THE LOX TANK ULLAGE PRESSURE.</li> <li>PLUS DELTA PRESSURE IS DEFINED AS A LOX TANK ULLAGE PRESSURE. GREATER THAN THE FUEL TANK ULLAGE PRESSURE.</li> <li>THE MINIMUM RECOMMENDED DISTANCE BETWEEN THE S-IVB AND THE SPACECRAFT IS 7000 FT.</li> <li>THE BULKHEAD WILL STRUCTURALLY FAIL AT THE ULTIMATE LIMITS OF MINUS 32.5 PSID OR PLUS 42.0 PSID.</li> </ol> |      |
| A        | 5-56 | <p>LOSS OF S-IVB STAGE PNEUMATIC PRESSURE</p> <p>A. PRIOR TO TB6 + 8 MIN 45 SEC REGULATOR OUTLET PRESSURE &lt;320 PSIA.</p>                               |                       | <p>A. <u>CONTINUE MISSION</u></p> <p>IMPLEMENT FMR 5-62</p>  | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>AMBIENT HELIUM SUPPLY PRESS (D256-403, D236-403)</li> <li>CONTROL HELIUM REGULATOR DISCHARGE PRESSURE 320 PSIA (D014-403, D247-403)</li> </ol>  |      |
| MISSION  |      | REV   | DATE                  | SECTION  | GROUP  | PAGE |
| APOLLO 8 |      | A   | 12/11/68              | BOOSTER  | SPECIFIC   | 5-17 |

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MISSION RULES

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE                 | RULING   | CUES/NOTES/COMMENTS   |      |
|----------|------|--|-----------------------|--|---|------|
|          |      | B. PRIOR TO LOX NPV BLOW-DOWN AT TB7 + 0.7 SEC   |                       | B. <u>CONTINUE MISSION</u><br><br>1. BSE INFORM FLIGHT AND CAPCOM ADVISE FLIGHT CREW THAT PROPULSIVE VENTING MAY OCCUR AFTER TB7 + 35 MIN<br><br>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)<br><br><u>NOTE:</u><br><br>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<br><br>A. PRIOR TO TB6<br><br>B. FROM TB6 INITIATE TO TB6 + 9 MIN 10 SEC   | EARTH ORBITAL RESTART | A. <u>SPACECRAFT SEPARATION</u><br><br>BSE INFORM FLIGHT AND RECOMMEND S/C SEPARATION PRIOR TO TB6<br><br>B. <u>TLI INHIBIT</u><br><br>BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT   | <u>CUES:</u><br><br>ENGINE CONTROL BOTTLE PRESS (D019-401; D242-401)  |      |
| A        | 5-58 | INERTIAL PLATFORM FAILURE-ACCELEROMETER<br><br>A. AFTER TB6 INITIATED BUT PRIOR TO TB6 + 9 MIN 10 SEC<br><br>B. AFTER TB6 + 9 MIN 20 SEC (FOR ALL GROUND COVERAGE DURING BURN) | EARTH ORBITAL RESTART | A. <u>TLI INHIBIT</u><br><br>BSE INFORM FLIGHT AND FIDO. RECOMMEND TLI INHIBIT PRIOR TO TB6 + 9 MIN 20 SEC<br><br>B. <u>CONTINUE MISSION</u><br><br>BSE INFORM FLIGHT AND FIDO   | <u>CUES:</u><br><br>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"<br><br>2. ACCELEROMETER PICKOFFS (X, Y, OR Z) INDICATES IN EXCESS OF 0.5 DEG. (H10-603, H11-603, H12-603)<br><br><u>NOTES:</u><br><br>1. LVDC SWITCHES TO A BACKUP MODE AND UTILIZES A PRE-COMPUTED F/M PROFILE FOR FAILED AXIS DURING S-IVB BURN.<br><br>2. ACCELEROMETER FAILURE OCCURRING DURING TB5 WILL NOT BE RECOGNIZED UNTIL TB6 INITIATED. |      |
|          | 5-59 | LH <sub>2</sub> ULLAGE PRESSURE LESS THAN 15 PSIA DURING OR AFTER LAST STATESIDE PASS PRIOR TO RESTART   |                       | <u>CONTINUE MISSION</u><br><br>BSE INFORM FLIGHT AND SEND<br><br>1. CONTINUOUS VENT SYSTEM CLOSE<br><br>2. CONTINUOUS VENT ORIFICE SHUT-OFF VALVE OPEN   | <u>CUES:</u><br><br>1. LH <sub>2</sub> TANK ULLAGE PRESSURE (D177-410, D178-410)<br><br>2. LH <sub>2</sub> PUMP INLET PRESSURE (D002-403)<br><br><u>NOTES:</u><br><br>LOW PRESSURE MAY RESULT IN BURNER OVERTEMPERATURE.  |      |
| MISSION  | REV  | DATE   | SECTION               |  | GROUP   | PAGE |
| APOLLO 8 | A    | 12/11/68   | BOOSTER               |  | SPECIFIC  | 5-18 |

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MISSION RULES

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE                 | RULING   | CUES/NOTES/COMMENTS   |          |      |
|----------|------|--|-----------------------|--|---|----------|------|
| A        | 5-60 | O <sub>2</sub> /H <sub>2</sub> BURNER VOTING CIRCUIT FAILS TO DETECT A BURNER FLAME-OUT OR T AT THE BURNER HAS FAILED TO IGNITE.<br><br>(TB6 + 48 SEC UNTIL TB6 + 8 MIN 17 SEC)  | EARTH ORBITAL RESTART | <u>CONTINUE MISSION</u><br><br>BSE INFORM FLIGHT AND SEND:<br><br>1. BURNER SHUTDOWN<br><br>2. CONTINUOUS VENT SYSTEM ORIFICE OPEN<br><br>3. CRYOGENIC REPRESSURIZATION OFF (THE THREE COMMANDS LISTED ABOVE ARE COMBINED UNDER ONE SW SEL LOAD)   | <u>CUES:</u><br><br>1. BNR CHAMBER DOME TEMPERATURE INDICATES 0°F OR LESS (C382-403)<br><br>2. BNR NOZZLE TEMPERATURE (C380-403)<br><br>3. BNR GH <sub>2</sub> INJECTOR TEMPERATURE (C383-403)<br><br>4. AMBIENT REPRESS MODE SELECT (K195-404)<br><br>5. BURNER PROPELLANT VALVE POSITIONS (K180-404, K192-404)<br><br><u>NOTE:</u><br><br>FAILURE CAUSED BY PROPELLANT VALVE FAILING TO OPEN.           |          |      |
| A        | 5-61 | COLD HELIUM SPHERE PRESSURE LOW<br><br>A. LESS THAN 1200 PSIA BUT GREATER THAN 600 PSIA PRIOR TO TB6 INITIATE<br><br>B. LESS THAN 600 PSIA PRIOR TO TB6 INITIATE<br><br>C. LESS THAN 600 PSIA AFTER TB6 + 8 MIN 20 SEC |                       | <u>CONTINUE MISSION</u><br><br>A.1. BSE INFORM FLIGHT AND SEND PRIOR TO TB6 INITIATE:<br><br>BURNER LOX SHUTDOWN VALVES CLOSED<br><br>2. IF COMMAND ACTION UNSUCCESSFUL, BSE SEND IN TB6 (ASAP):<br><br>BURNER LOX SHUTDOWN VALVE CLOSED<br><br>B. SPACECRAFT SEPARATION<br>BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT SEPARATION PRIOR TO TB6 INITIATE.<br><br>C. TLI INHIBIT<br>BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT. | <u>CUES:</u><br><br>1. COLD HELIUM SPHERE PRESSURE (D016-425, D263-425)<br><br><u>NOTES:</u><br><br>1. COMMAND ACTION WILL PRECLUDE BURNER START<br><br>2. COLD HELIUM REQUIREMENT<br><br>A. 1200 PSIA FOR REPRESS AND BURN<br><br>B. 600 PSIA FOR BURN   |          |      |
| A        | 5-62 | LH <sub>2</sub> CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATION:   |                       | <u>CONTINUE MISSION</u><br><br>BSE INFORM FLIGHT AND AT TB6 + 8 MIN 45 SEC SEND:<br><br>1. ENGINE READY BYPASS<br><br>2. PREVALVES OPEN<br><br>3. ENGINE START ON  | <u>CUES:</u><br><br>1. LH <sub>2</sub> PREVALVE OPEN (K111-404)<br><br>2. LH <sub>2</sub> PREVALVE CLOSE (I12-404)<br><br>3. LH <sub>2</sub> BLEED VALVE CLOSE (K127-401)<br><br>4. LH <sub>2</sub> RECIRC. VALVE CLOSE (K136-409)<br><br>5. LH <sub>2</sub> RECIRC. FLOW (F005-404)<br><br>6. LH <sub>2</sub> PUMP INLET PRESS (D002-403)<br><br>7. LH <sub>2</sub> ULLAGE PRESSURE (D177-410, D178-410) |          |      |
| MISSION  |      | REV  | DATE                  | SECTION  |   | GROUP    | PAGE |
| APOLLO 8 |      | A  | 12/11/68              | BOOSTER  |   | SPECIFIC | 5-19 |

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MISSION RULES

| REV      | RULE | CONDITION/MALFUNCTION   | PHASE                 | RULING   | CUES/NOTES/COMMENTS  |      |
|----------|------|---|-----------------------|--|--|------|
| A        | 5-63 | LOX CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS  |                       | <u>CONTINUE MISSION</u><br>BSE INFORM FLIGHT   | 8. LH <sub>2</sub> PUMP INLET TEMP (C003-404)<br><br><u>NOTES:</u><br>1. START MAY BE OFF NOMINAL IF COMMAND ACTION UNSUCCESSFUL BUT MANNED RESTART TO BE ATTEMPTED.<br>2. IF COMMAND ACTION SUCCESSFUL AND FIRST BURN LATER INHIBITED, RECOMMEND SPACECRAFT SEPARATION PRIOR TO SECOND OPPORTUNITY.<br><br><u>CUES:</u><br>1. LOX RECIRC FLOW (F004-424)<br>2. LOX PUMP INLET TEMP (C004-403)<br>3. LOX PREVALVE OPEN (K109-403)<br>4. LOX PREVALVE CLOSE (K110-403)<br>5. LOX BLEED VALVE CLOSE (K126-401)<br>6. LOX RECIRC VALVE CLOSE (K139-424)<br>7. LOX ULLAGE PRESSURE (D179-424, D180-424)<br>8. LOX PUMP INLET PRESSURE (D003-403) |      |
|          | 5-64 | S-IVB LH <sub>2</sub> TANK ULLAGE PRESSURE LOW<br><br>A. LH <sub>2</sub> VENT VALVE FAILS OPEN PRIOR TO TB6 + 9 MIN<br><br>B. CONTINUOUS VENTS SYSTEM (CVS) REGULATOR FAILS TO CLOSE AT TB6 + 6 MIN 17 SEC<br><br>C. LH <sub>2</sub> ULLAGE LESS THAN 25 PSIA AT TB6 + 9 MIN 10 SEC IF MANNED |                       | A. TLI INHIBIT<br>BSE INFORM FLIGHT AND SEND:<br>LH <sub>2</sub> VENT VALVES CLOSE<br>IF UNSUCCESSFUL, BSE RECOMMEND TLI INHIBITED.<br><br>B. TLI INHIBIT<br>BSE INFORM FLIGHT AND SEND: CVS REGULATOR CLOSE; IF UNSUCCESSFUL, BSE RECOMMEND TLI INHIBIT.<br><br>C. TLI INHIBIT<br>BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT | <u>CUES:</u><br>1. LH <sub>2</sub> ULLAGE PRESSURE (D177-410, D178-410)<br>2. LH <sub>2</sub> PUMP INLET PRESSURE (D002-403)<br>3. FUEL VENT VALVE OPEN (K017-410)<br>4. FUEL VENT VALVE CLOSED (K001-410)<br>5. CVS REGULATOR CLOSED (K154-411)<br>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 | <u>TLI INHIBIT</u><br>BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT.   | <u>CUES:</u><br>1. ACTUATOR POSITION ±6 DEGREES OR GREATER (G1-401, G1-403; G2-401; G2-403).   |      |
| MISSION  | REV  | DATE  | SECTION               |  | GROUP  | PAGE |
| APOLLO 8 | A    | 12/11/68  | BOOSTER               |  | SPECIFIC   | 5-20 |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE                 | RULING   | CUES/NOTES/COMMENTS  |      |
|----------|------|--|-----------------------|--|--|------|
|          |      |  |                       |  | <p>2. ENGINE ACTUATOR <math>\Delta P</math> EQUALS TO OR GREATER THAN 3300 PSIA (D44-403; D45-403)</p> <p><u>NOTE:</u></p> <p>BOTH INDIVIDUAL ACTUATOR POSITIONS MUST CONFIRM MALFUNCTION PRIOR TO RECOMMENDING S/C SEPARATION OR TLI INHIBIT.</p>   |      |
| A        | 5-66 | <p>S-IVB LOSS OF ENGINE HYDRAULIC FLUID</p> <p>A. PRIOR TO TB6</p> <p>B. FROM TB6 TO TB6 + 9 MIN 10 SEC IF MANNED</p>  | EARTH ORBITAL RESTART | <p>A. <u>S/C SEPARATION</u></p> <p>BSE INFORM FLIGHT AND RECOMMEND S/C SEPARATION PRIOR TO TB6</p> <p>B. <u>TLI INHIBIT</u></p> <p>BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT</p>   | <p><u>CUES:</u></p> <p>1. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (D41-403)</p> <p>2. HYDRAULIC RESERVOIR OIL LEVEL APPROXIMATELY ZERO PERCENT.</p> <p>3. HYDRAULIC RESERVOIR PRESSURE APPROXIMATELY ZERO PSIA (D42-403)</p>   |      |
| A        | 5-67 | <p>START BOTTLE PRESSURE</p> <p>A. GREATER THAN 1500 PSIA (1-1/2 ORBITS) FOR FIRST OPPORTUNITY</p> <p>B. GREATER THAN 1500 PSIA (2-1/2 ORBITS) FOR SECOND OPPORTUNITY</p>                  |                       | <p>A. BSE INFORM FLIGHT AND SEND:</p> <p>1. START TANK VENT VALVE OPEN</p> <p>2. START TANK VENT VALVE CLOSED IN 3 SECONDS</p> <p>3. COMMAND ACTION UNSUCCESSFUL RECOMMEND TLI INHIBIT</p> <p>B. CONTINUE MISSION/SPACECRAFT SEPARATION</p> <p>1. START TANK VENT VALVE OPEN</p> <p>2. START TANK VENT VALVE CLOSED IN 3 SECONDS</p> <p>3. IF COMMAND ACTION UNSUCCESSFUL, RECOMMEND S/C SEP PRIOR TO TB6.</p> | <p><u>CUES:</u></p> <p>1. START BOTTLE PRESSURE (D017-401, D241-401)</p>   |      |
|          | 5-68 | <p>LOX TANK ULLAGE PRESSURE LOW</p> <p>A. LOX VENT VALVES FAILS OPEN PRIOR TO TB6 + 9 MIN</p> <p>B. LOX ULLAGE PRESSURE LESS THAN <u>31</u> PSIA PRIOR TO TB6 + 9 MIN 10 SEC IF MANNED</p> |                       | <p>A. TLI INHIBIT</p> <p>BSE INFORM FLIGHT AND SEND: LOX VENT VALVE CLOSE</p> <p>IF UNSUCCESSFUL, BSE RECOMMEND TLI INHIBIT.</p> <p>B. TLI INHIBIT</p> <p>BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT</p>  | <p><u>CUES:</u></p> <p>1. LOX ULLAGE PRESSURE (D17-424, D180-424)</p> <p>2. LOX PUMP INLET PRESSURE (D003-403)</p> <p>3. LOX VENT VALVE OPEN (K016-404)</p> <p>4. LOX VENT CLOSED (K002-424)</p> <p><u>NOTES:</u></p> <p>1. ULLAGE PRESSURE LESS THAN 37 PSIA INDICATES A MALFUNCTION.</p> |      |
| MISSION  | REV  | DATE   | SECTION               |  | GROUP  | PAGE |
| APOLLO 8 | A    | 12/11/68   | BOOSTER               |  | SPECIFIC   | 5-21 |

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**MISSION RULES**

| 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 |         | <p>SPACECRAFT SEPARATION</p> <p>BSE INFORM FLIGHT AND COMMAND:</p> <p>APS ULLAGE ENGINES ON FOR 10 SEC AND THEN OFF</p> <p>IF NO COMMAND CAPABILITY EXISTS OR COMMAND ACTION IS UNSUCCESSFUL:</p> <p>THE SPACECRAFT SHOULD REMAIN ATTACHED TO THE S-IVB/IU AND MONITOR LH<sub>2</sub> AND LOX TANK ULLAGE PRESSURES. IF SEPARATION IS REQUIRED, THE SPACECRAFT SHOULD IMMEDIATELY GO TO A SAFE DISTANCE (7000 FT) FROM THE S-IVB/IU.</p> | <p><u>CUES:</u></p> <ol style="list-style-type: none"> <li>1. CHAMBER PRESSURE ZERO (D1-401)</li> <li>2. THRUST OK SWITCHES - OFF (K14-401, K157-401)</li> <li>3. TIME BASE SEVEN INITIATED (H60-603)</li> <li>4. TIME TO GO TO CUTOFF GREATER THAN ZERO (H60-603)</li> </ol> |      |
|          |      | RULES 5-70 THROUGH 5-90 ARE RESERVED   |         |  |   |      |
| MISSION  | REV  | DATE   | SECTION |  | GROUP   | PAGE |
| APOLLO 8 | A    | 12/11/68   | BOOSTER |  | SPECIFIC  | 5-22 |

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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:

*per Sigurd A. Sjoberg*  
\_\_\_\_\_  
CHRISTOPHER C. KRAFT, JR.  
DIRECTOR OF FLIGHT OPERATIONS

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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  
ia  
12-4A  
12-5A

## 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:

  
CHRISTOPHER C. KRAFT, JR.  
DIRECTOR OF FLIGHT OPERATIONS

CONCURRED BY:

  
GEORGE M. LOW  
MANAGER, APOLLO SPACECRAFT PROGRAM  
OFFICE

  
R. SCOTT HAMNER  
MSFC, MISSION OPERATIONS OFFICE



**NASA — Manned Spacecraft Center**

**MISSION RULES**

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE      | RULING   | CUES/NOTES/COMMENTS  |      |
|----------|------|--|------------|--|--|------|
|          | 5-94 | LH <sub>2</sub> TANK PRESSURE GREATER THAN 26 PSIA PRIOR TO INITIATION OF LOX DUMP (TB7 + 2 HR 12 MIN) | TRANSLUNAR | <u>CONTINUE MISSION</u><br>BSE INFORM FLIGHT AND SEND:<br>LH <sub>2</sub> CONTINUOUS VENT RELIEF OVERRIDE S/O VALVE OPEN<br>IF UNSUCCESSFUL, SEND:<br>LH <sub>2</sub> VENT VALVE OPEN AND CLOSED AS REQUIRED TO PROVIDE AN LH <sub>2</sub> ULLAGE PRESSURE OF <18 PSIA PRIOR TO LOX DUMP INITIATION. | <u>CUES:</u><br>1. LH <sub>2</sub> ULLAGE PRESSURE (D0177-410, D0178-410)<br>2. LH <sub>2</sub> PUMP INLET PRESSURE (D003-403) |      |
|          | 5-95 | LOX DUMP FAILS TO INITIATE AT TB7 + 2 HR 12 MIN 0 SEC  | TRANSLUNAR | <u>CONTINUE MISSION</u><br>BSE INFORM FLIGHT AND SEND:<br>ENGINE LOX VALVE OPEN  | <u>CUES:</u><br>1. MAIN LOX VALVE POSITION (G003-401)<br>2. MAIN LOX VALVE OPEN (K120-401)                                     |      |
|          | 5-96 | FAILURE TO INITIATE COLD HELIUM DUMP   | TRANSLUNAR | <u>CONTINUE MISSION</u><br>BSE INFORM FLIGHT AND SEND:<br>LOX PRESSURE S/O VALVE OPEN  | <u>CUES:</u><br>1. COLD HELIUM BOTTLE PRESSURE (D016-425, D263-405)<br>2. COLD HELIUM REGULATOR DISCHARGE PRESSURE (D105-403)  |      |
|          | 5-97 | ENGINE START BOTTLE DUMP FAILS TO INITIATE   | TRANSLUNAR | <u>CONTINUE MISSION</u><br>BSE INFORM FLIGHT AND SEND:<br>START BOTTLE VENT CONTROL VALVE OPEN   | <u>CUE:</u><br>GH <sub>2</sub> START BOTTLE PRESSURE (D017-401, D241-401)  |      |
|          | 5-98 | S-IVB AMBIENT HELIUM DUMP FAILS TO INITIATE  | TRANSLUNAR | <u>CONTINUE MISSION</u><br>BSE INFORM FLIGHT AND SEND:<br>ENGINE PURGE ON  | <u>CUES:</u><br>1. ENGINE PUMP PURGE PRESSURE (D050-403)<br>2. AMBIENT HELIUM SUPPLY PRESSURE (D236-403, D256-403)             |      |
| A        | 5-99 | ENGINE CONTROL BOTTLE DUMP FAILS TO INITIATE   | TRANSLUNAR | <u>CONTINUE MISSION</u><br>BSE INFORM FLIGHT AND SEND:<br>ENGINE HELIUM CONTROL VALVE OPEN   | <u>CUE:</u><br>ENGINE CONTROL HELIUM SPHERE PRESSURE (D019-401, D242-401)  |      |
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| APOLLO 8 |      | A  | 12/11/68   | BOOSTER  | SPECIFIC   | 5-24 |

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| REV | ITEM  | INSTRUMENTATION REQUIREMENTS |           |         |             |                  |                     |
|-----|-------|------------------------------|-----------|---------|-------------|------------------|---------------------|
|     | 5-100 | 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           | 5-12,16             |
|     |       | POS YAW ACTUATOR             | G30-201   |         |             | MANDATORY        |                     |
|     |       | POS YAW ACTUATOR             | VG8-202   |         |             | 1 OF 2           | 5-12,16             |
|     |       | POS YAW ACTUATOR             | G30-202   |         |             | MANDATORY        |                     |
|     |       | POS YAW ACTUATOR             | VG8-203   |         |             | 1 OF 2           | 5-12,16             |
|     |       | POS YAW ACTUATOR             | G30-203   |         |             | MANDATORY        |                     |
|     |       | POS YAW ACTUATOR             | VG8-204   |         |             | 1 OF 2           | 5-12,16             |
|     |       | POS YAW ACTUATOR             | G30-204   |         |             | MANDATORY        |                     |
|     |       | POS PITCH ACTUATOR           | G9-201    |         |             | 1 OF 2           | 5-12,16             |
|     |       | POS PITCH ACTUATOR           | G31-201   |         |             | MANDATORY        |                     |
|     |       | POS PITCH ACTUATOR           | G9-202    |         |             | 1 OF 2           | 5-12,16             |
|     |       | POS PITCH ACTUATOR           | G31-202   |         |             | MANDATORY        |                     |
|     |       | POS PITCH ACTUATOR           | G9-203    |         |             | 1 OF 2           | 5-12,16             |
|     |       | POS PITCH ACTUATOR           | G31-203   |         |             | MANDATORY        |                     |
|     |       | POS PITCH ACTUATOR           | G9-204    |         |             | 1 OF 2           | 5-12,16             |
|     |       | POS PITCH ACTUATOR           | G31-204   |         |             | MANDATORY        |                     |
|     |       | 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                |
|     |       | LH2 TANK ULLAGE P EDS 1      | D252-219  | METER   | COMMON      | HIGHLY DESIRABLE | NONE                |
|     |       | LH2 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                |
|     |       | SECONO 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 LH2        |           |         |             |                  |                     |
|     |       | NOZZLE                       | C380-403  |         |             | HIGHLY DESIRABLE | 5-60                |
|     |       | TEMP, BURNER CHAMBER         |           |         |             |                  |                     |
|     |       | DOME                         | C382-403  |         |             | HIGHLY DESIRABLE | 5-60                |
|     |       | TEMP, BURNER GH2 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 |

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|-----|-----------------|---|-------------|---------|-------------|------------------|---------------------------------|
|     | 5-100<br>(CONT) | PRESS - OXIDIZER PUMP<br>INLET                    | XD3-403     |         |             | HIGHLY DESIRABLE | 5-55, 68, 48, 63                |
|     |                 | PRESS - COLD HE REG<br>DISCHARGE                  | VXD14-403   |         |             | HIGHLY DESIRABLE | 5-57                            |
|     |                 | PRESS COLD HELIUM SPHERE                          | VXD16-425** |         |             | HIGHLY DESIRABLE | 5-48, 61, 96, 18                |
|     |                 | PRESS - GH <sub>2</sub> START BOTTLE              | VXD17-401   |         |             | HIGHLY DESIRABLE | 5-97, 67                        |
|     |                 | PRESS - ENGINE CONTROL<br>HE SPHERE               | VXD19-401   |         |             | HIGHLY DESIRABLE | 5-57-99                         |
|     |                 | PRESS - ATT CONT HE<br>PRESS TANK 1               | VXD35-414   |         |             | HIGHLY DESIRABLE | 5-52                            |
|     |                 | PRESS - ATT CONT HE<br>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<br>HE GAS                | D105-403**  |         |             | HIGHLY DESIRABLE | 5-48, 96, 18                    |
|     |                 | PRESS - FUEL TANK ULLAGE<br>EDS 1                 | VD177-410   | METER   | COMMON***   | HIGHLY DESIRABLE | 5-51, 55, 62,<br>64, 91, 94, 58 |
|     |                 | PRESS - FUEL TANK ULLAGE<br>EDS 2                 | VD178-410   | METER   | COMMON      | HIGHLY DESIRABLE | 5-51, 55, 62,<br>64, 91, 94, 58 |
|     |                 | PRESS - OXID TANK ULLAGE<br>EDS 1                 | VD179-424   | METER   | COMMON      | HD               | 5-48, 55, 68,<br>92, 18, 63     |
|     |                 | PRESS - OXID TANK ULLAGE<br>EDS 2                 | VD180-424   | METER   | COMMON      | HD               | 5-48, 55, 68,<br>92, 18, 63     |
|     |                 | PRESS - FUEL TK CONT<br>VENT 1                    | D181-409    |         |             | HIGHLY DESIRABLE | 5-51, 62, 64                    |
|     |                 | PRESS - FUEL TK CONT<br>VENT 2                    | D182-409    |         |             | HIGHLY DESIRABLE | 5-51, 62, 64                    |
|     |                 | PRESS - ULLAGE CONT<br>CHAMBER 1-4                | D220-414    |         |             | HIGHLY DESIRABLE | 5-52                            |
|     |                 | PRESS - ULLAGE CONT<br>CHAMBER 2-4                | D221-415    |         |             | HIGHLY DESIRABLE | 5-52                            |
|     |                 | PRESS - AMBIENT HE PNEU<br>SPHERE                 | VXD236-403  |         |             | HIGHLY DESIRABLE | 5-54, 56, 98                    |
|     |                 | PRESS - GH <sub>2</sub> ST BOTT<br>BACKUP         | D241-401    |         |             | HIGHLY DESIRABLE | 5-97, 67                        |
|     |                 | PRESS - ENG CONT HE<br>SP BKUP                    | D242-401    |         |             | HIGHLY DESIRABLE | 5-57, 99                        |
|     |                 | PRESS - CONTL HE REG<br>DISC                      | D247-403    |         |             | HIGHLY DESIRABLE | 5-56                            |
|     |                 | PRESS - ATT CONT HE<br>TANK 1                     | D250-414    |         |             | HIGHLY DESIRABLE | 5-52                            |
|     |                 | PRESS - ATT CONT HE<br>TANK 2                     | D251-415    |         |             | HIGHLY DESIRABLE | 5-52                            |
|     |                 | PRESS - AMB HE PNEU<br>SPH                        | D256-403    |         |             | HIGHLY DESIRABLE | 5-54, 56, 98                    |
|     |                 | PRESS - COLD HE SPHERE                            | D263-405**  |         |             | HIGHLY DESIRABLE | 5-55, 61, 96,<br>18, 48         |
|     |                 | FLOW RATE - FUEL<br>CIRCULATION PUMP              | F5-404      |         |             | HIGHLY DESIRABLE | 5-62                            |
|     |                 | POS - ACT PIST POT<br>PITCH                       | VG1-403     |         |             | HIGHLY DESIRABLE | 5-19, 65                        |
|     |                 | POS - ACT PIST POT<br>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<br>VALVE                      | G3-401      |         |             | HIGHLY DESIRABLE | 5-46, 95                        |
|     |                 | POS - MAIN FUEL VALVE                             | G4-401      |         |             | HIGHLY DESIRABLE | 5-45                            |
|     |                 | EVENT - FUEL TK VENT<br>VLV CL                    | K1-410      |         |             | HIGHLY DESIRABLE | 5-64                            |
|     |                 | EVENT - OXID TANK VENT<br>VLV - CL                | K2-424      |         |             | HIGHLY DESIRABLE | 5-68                            |
|     |                 | EVENT - FUEL TK VENT<br>VALVE 1 - OPEN            | K17-410     |         |             | HIGHLY DESIRABLE | 5-64                            |
|     |                 | EVENT - REL OVRD SOL<br>LH <sub>2</sub> TANK - CL | K154-411    |         |             | HIGHLY DESIRABLE | 5-51, 64                        |
|     |                 | *** M FOR CREW DISPLAY<br>* 2 OF 3 MANDATORY      |             |         |             |                  |                                 |

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| REV      | ITEM            | MEAS DESCRIPTION                                | PCM       | ONBOARD | TRANSDUCERS | CATEGORY         | REFERENCE   |
|----------|-----------------|---|-----------|---------|-------------|------------------|---|
|          | 5-100<br>(CONT) | EVENT - REPRESS SYS AMB<br>MODE                 | K195-404  |         |             | HIGHLY DESIRABLE | 5-60  |
|          |                 | EVENT - LOX NPV VLV<br>OPEN                     | K198-403  |         |             | HIGHLY DESIRABLE | 5-92  |
|          |                 | EVENT - LOX NPV VLV<br>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 <sub>2</sub> CRSE<br>MASS VOLT | VXN1-411  |         |             | HIGHLY DESIRABLE |   |
|          |                 | MISC - PU SYS LOX CRSE<br>MASS VOLT             | VXN3-411  |         |             | HIGHLY DESIRABLE |   |
|          |                 | SEC R/S RCVR 1 L/L SIG<br>STR                   | VN57-411  |         |             | HIGHLY DESIRABLE | 5-47  |
|          |                 | SEC R/S RCVR 2 L/L SIG<br>STR                   | VN62-411  |         |             | HIGHLY DESIRABLE | 5-47  |
|          |                 | ACCELERATION, LONGITU-<br>DINAL                 | VA2-603   |         |             | HIGHLY DESIRABLE | 5-3/15, 21  |
|          |                 | TEMP, METHANOL/WATER<br>CONTROL                 | VXC15-601 |         |             | HIGHLY DESIRABLE | 5-53  |
|          |                 | TEMP, ST-124M INT<br>INERTIAL GIMBAL            | VC34-603  |         |             | HIGHLY DESIRABLE | 5-53  |
|          |                 | TEMP, GUID COMPUTER<br>(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 <sub>2</sub> REG INLET                | XD10-603  |         |             | HIGHLY DESIRABLE |   |
|          |                 | POS, WATER CONT VALVE<br>CLOSED                 | VG5-601   |         |             | HIGHLY DESIRABLE | 5-53  |
|          |                 | POS, WATER CONT VALVE<br>OPEN                   | G6-601    |         |             | HIGHLY DESIRABLE | 5-53  |
|          |                 | ATT ERROR PITCH - LADDER<br>OUTPUT              | VH54-603  |         |             | HIGHLY DESIRABLE | 5-12, 14,<br>15, 50                                       |
|          |                 | ATT ERROR YAW - LADDER<br>OUTPUT                | VH55-603  |         |             | HIGHLY DESIRABLE | 5-12, 14,<br>15, 50                                       |
|          |                 | ATT ERROR ROLL - LADDER<br>OUTPUT               | VH56-603  |         |             | HIGHLY DESIRABLE | 5-5, 12, 14,<br>15, 50, 16                                |
|          |                 | GUID COMPUTER OPERATION                         | H60-603   |         |             | MANDATORY        | 5-13, 14, 15,<br>17, 21, 22,<br>25, 50, 53,<br>59, 69, 93 |
|          |                 | ATT ERROR SIG ANG POS<br>ROLL                   | VH69-602  |         |             | HIGHLY DESIRABLE | 5-5, 12, 14,<br>15, 50, 16                                |
|          |                 | ATT ERROR SIG ANG POS<br>YAW                    | VH70-602  |         |             | HIGHLY DESIRABLE | 5-12, 14, 15,<br>50                                       |
|          |                 | ATT ERROR SIG ANG POS<br>PITCH                  | VH71-602  |         |             | HIGHLY DESIRABLE | 5-12, 14, 15,<br>50                                       |
|          |                 | COMP RESET PULSE NO. 1<br>GUID DECODER          | VJ71-603  |         |             | HIGHLY DESIRABLE |   |
|          |                 | COMP RESET PULSE NO. 2<br>GUID DECODER          | VJ72-603  |         |             | HIGHLY DESIRABLE |   |
|          |                 | MODE SWITCH SPACECRAFT<br>IU                    | VK19-602  |         |             | HIGHLY DESIRABLE |   |
|          |                 | S-IVB BURN                                      | VK20-602  |         |             | HIGHLY DESIRABLE | 5-12, 50  |
|          |                 | ANG VEL, PITCH EDS<br>GROUP 1                   | VR7-602   |         |             | HIGHLY DESIRABLE | 5-12, 15, 50  |
|          |                 | ANG VEL, YAW EDS<br>GROUP 1                     | VR8-602   |         |             | HIGHLY DESIRABLE | 5-12, 15, 50  |
|          |                 | ANG VEL, YAW EDS<br>GROUP 2                     | VR11-602  |         |             | HIGHLY DESIRABLE | 5-12, 15, 50  |
|          |                 | ANG VEL, ROLL EDS<br>GROUP 2                    | VR12-602  |         |             | HIGHLY DESIRABLE | 5-5, 12, 15,<br>50, 16                                    |
|          |                 | ANG VEL, PITCH EDS<br>GROUP 3                   | VR13-602  |         |             | HIGHLY DESIRABLE | 5-12, 15, 50  |
|          |                 | ANG VEL, ROLL EDS<br>GROUP 3                    | VR15-602  |         |             | HIGHLY DESIRABLE | 5-5, 12, 15,<br>50, 16                                    |
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6 ENVIRONMEN-  
TAL CONTROL  
SYSTEM

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MISSION RULES

| REV | ITEM | GENERAL  |
|-----|------|--|
|     | 6-1  | <p><u>LAUNCH</u></p> <p>LAUNCH WILL BE CONTINUED AS LONG AS THE SUIT CIRCUIT AND O<sub>2</sub> 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.</p> |
|     | 6-2  | <p><u>OTHER PHASES</u></p> <p>BACKUP SYSTEMS AND BACKUP COMPONENTS WILL BE USED FOR THE MOST RAPID PRACTICAL RETURN TO EARTH; NOT FOR MISSION CONTINUATION.</p>  |
| A   | 6-3  | <p>FLIGHT CREW WILL DON SUITS FOR THE FOLLOWING:</p> <p>A. CABIN PRESSURE CANNOT BE MAINTAINED ABOVE 4.5 PSIA.</p> <p>B. GLYCOL LEAKS IN COMMAND MODULE.</p> <p>C. FIRE, SMOKE, CONTAMINATION IN CABIN.</p>  |
|     | 6-4  | <p>THE FLIGHT CREW WILL DOFF SUITS (TIME AND CONDITIONS PERMITTING) FOR THE FOLLOWING:</p> <p>A. LOSS OF SUIT CIRCULATION.</p> <p>B. CONFIRMED LEAK OF GLYCOL IN SUIT CIRCUIT.</p> <p>C. FLIGHT PLAN OPTION AFTER TLI.</p>   |
|     |      | <p>RULES 6-5 THROUGH 6-9<br/>ARE RESERVED.</p>   |

| MISSION  | REV | DATE     | SECTION                      | GROUP                      | PAGE |
|----------|-----|----------|------------------------------|----------------------------|------|
| APOLLO 8 | A   | 12/11/68 | ENVIRONMENTAL CONTROL SYSTEM | GENERAL SYSTEMS MANAGEMENT | 6-1  |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV      | ITEM | SYSTEMS MANAGEMENT   |                              |                            |      |
|----------|------|--|------------------------------|----------------------------|------|
| A        | 6-10 | <p><u>O<sub>2</sub> SYSTEM</u></p> <p>A. LIQH CANISTER WILL BE REPLACED EVERY 12 HOURS OR 7.6 MM Hg OF PCO<sub>2</sub> WHICHEVER COMES FIRST.</p> <p>B. SUIT FLOW RELIEF VALVE WILL REMAIN CLOSED FOR DURATION OF FLIGHT.</p> <p>C. NORMAL CABIN REPRESSURIZATION WILL UTILIZE SURGE TANK PLUS REPRESS PACK.</p> <p>D. SURGE TANK AND REPRESS TANK WILL BE RECHARGED SIMULTANEOUSLY.</p> <p>E. THE PLSS VALVE WILL BE IN OFF POSITION FOR TLC, LO AND TEC.</p> <p>F. SURGE TANK WILL BE ON LINE FOR DURATION OF FLIGHT.</p> <p>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.</p>     |                              |                            |      |
|          | 6-11 | <p><u>COOLANT MANAGEMENT</u></p> <p>A. FOR SIMULTANEOUS PRIMARY AND SECONDARY LOOP OPERATIONS ONE RADIATOR WILL BE ISOLATED.</p> <p>B. GLYCOL RESERVOIR WILL BE ON LINE FOR LAUNCH.</p> <p>C. INDICATED GLYCOL ACCUMULATOR QUANTITY WILL BE MAINTAINED BETWEEN <u>30</u> PERCENT AND <u>70</u> PERCENT. (CORRESPONDS TO 26 AND 81 PERCENT ACTUAL).</p> <p>D. SECONDARY COOLANT WILL BE OFF FOR LAUNCH.</p> <p>E. ADDITIONAL LOADS MAY BE ADDED TO MAINTAIN PRI RAD OUT T &gt;-20°F</p>   |                              |                            |      |
| A        | 6-12 | <p><u>H<sub>2</sub>O MANAGEMENT</u></p> <p>1. WATER DUMPS WILL BE MANAGED TO ACCOMMODATE THE FOLLOWING GUIDLINES:</p> <p style="margin-left: 20px;">A. MAXIMUM 90 PERCENT</p> <p style="margin-left: 20px;">B. LOI MINIMUM ____ PERCENT.</p> <p style="margin-left: 20px;">C. ENTRY INTERFACE MINIMUM <u>80</u> PERCENT.</p> <p style="margin-left: 20px;">D. TRANSLUNAR COAST MINIMUM ____ PERCENT.</p> <p style="margin-left: 20px;">E. TRANSEARTH COAST MINIMUM ____ PERCENT.</p> <p>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.</p> <p style="margin-top: 20px;">RULES 6-13 THROUGH 6-19<br/>ARE RESERVED.</p> |                              |                            |      |
| MISSION  | REV  | DATE   | SECTION                      | GROUP                      | PAGE |
| APOLLO 8 | A    | 12/11/68   | ENVIRONMENTAL CONTROL SYSTEM | GENERAL SYSTEMS MANAGEMENT | 6-2  |

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MISSION RULES

| REV      | RULE  | CONDITION/MALFUNCTION  | PHASE                        | RULING   | CUES/NOTES/COMMENTS   |  |
|----------|-------|--|------------------------------|--|---|--|
|          | 6-20  | CABIN PRESSURE CANNOT BE RELIEVED  | LAUNCH                       | <u>CONTINUE MISSION</u>  | NORMAL RELIEF START AT T + <u>47</u> SECONDS                          |  |
|          | 6-21  | CABIN PRESSURE DECREASING AND/OR <4.5 PSIA<br><br>A. SUIT PRESSURE >3.5 PSIA   | LAUNCH                       | A. <u>CONTINUE MISSION</u>   |   |  |
|          |       |  | EPO                          | <u>ENTER NEXT BEST PTP</u> IF CABIN NOT RESTORED >4.5 PSIA   | MALF <u>ECS 10</u>  |  |
|          |       |  | TLC                          | <u>ENTER NEXT BEST PTP</u>   |   |  |
|          |       |  | LO                           | <u>ENTER NEXT BEST PTP</u>   |   |  |
|          |       |  | LAUNCH                       | B. <u>ABORT ASAP</u>   | MALF <u>ECS 8</u>   |  |
|          |       |  | EPO                          | <u>ENTER ASAP</u>  |   |  |
|          |       |  | TLC                          | <u>ENTER ASAP</u>  |   |  |
|          |       |  | LO                           | <u>ENTER ASAP</u>  |   |  |
|          |       |  | TEC                          | <u>ENTER ASAP</u>  |   |  |
|          |       |  | LAUNCH                       | C. <u>ABORT ASAP</u><br>DIRECT O <sub>2</sub> - OPEN <u>45</u> DEG FROM LAUNCH SETTING FOR VENTILATION | MALF <u>ECS 9</u><br>CORRESPONDS TO 12.6 LB/HR (APPROX 3 CFM/CREWMAN) |  |
|          |       |  | EPO                          | <u>ENTER ASAP</u>  |   |  |
|          |       |  | TLC                          | <u>ENTER ASAP</u>  |   |  |
|          |       |  | LO                           | <u>ENTER ASAP</u>  |   |  |
|          |       |  | TEC                          | <u>ENTER ASAP</u>  |   |  |
|          |       |  | 6-22                         | LOSS OF SUIT CIRCULATION<br>CABIN STABLE AND >4.5 PSIA   | LAUNCH  | <u>CONTINUE MISSION</u><br>DIRECT O <sub>2</sub> - OPEN <u>45</u> DEG FROM LAUNCH SETTING FOR SUIT VENTILATION |
|          | EPO   | <u>ENTER NEXT BEST PTP</u> WITHIN 4 HOURS<br>A. DOFF SUITS<br>B. OPEN WASTE STOWAGE VENT OR WASTE OVERBOARD DRAIN TO OBTAIN BLEED FLOW<br>C. DON FACE MASKS (AFTER 1 HR) |                              |  |   |  |
|          | TLC   | <u>ENTER ASAP</u>  |                              |  |   |  |
|          | LO    | <u>ENTER ASAP</u>  |                              |  |   |  |
|          | TEC   | <u>ENTER ASAP</u>  |                              |  |   |  |
|          |       |  |                              |  |   |  |
| MISSION  | REV   | DATE   | SECTION                      |  | GROUP   | PAGE   |
| APOLLO 8 | FINAL | 11/7/68  | ENVIRONMENTAL CONTROL SYSTEM |  | SPECIFIC-SUIT/CABIN   | 6-3  |

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**MISSION RULES**

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

| MISSION  | REV | DATE     | SECTION                      | GROUP               | PAGE |
|----------|-----|----------|------------------------------|---------------------|------|
| APOLLO 8 | A   | 12/11/68 | ENVIRONMENTAL CONTROL SYSTEM | SPECIFIC-SUIT/CABIN | 6-4  |

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MISSION RULES

| REV      | RULE                                  | CONDITION/MALFUNCTION  | PHASE                        | RULING                     | CUES/NOTES/COMMENTS  |      |
|----------|---------------------------------------|--|------------------------------|----------------------------|--|------|
| A        | 6-28                                  | A. O <sub>2</sub> MANIFOLD LEAKS<br>>4 LBS/HR AND CABIN<br>PRESSURE >4.5 | LAUNCH                       | A. <u>CONTINUE MISSION</u> | B. THERE ARE NO SINGLE POINT<br>FAILURES WHICH WOULD<br>RESULT IN THIS CONDITION |      |
|          |                                       |  | EPO                          | <u>ENTER NEXT BEST PTP</u> |  |      |
|          |                                       |  | TLC                          | <u>ENTER NEXT BEST PTP</u> |  |      |
|          |                                       |  | LO                           | <u>ENTER NEXT BEST PTP</u> |  |      |
|          |                                       | B. O <sub>2</sub> MANIFOLD LEAKS<br>>4 LBS/HR AND CABIN<br>PRESSURE <4.5 | LAUNCH                       | B. <u>ABORT ASAP</u>       |  |      |
|          |                                       |  | EPO                          | <u>ENTER ASAP</u>          |  |      |
|          |                                       |  | TLC                          | <u>ENTER ASAP</u>          |  |      |
|          |                                       |  | LO                           | <u>ENTER ASAP</u>          |  |      |
|          | 6-29                                  | LOSS OF ONE MAIN REGULATOR   | LAUNCH                       | <u>CONTINUE MISSION</u>    |  |      |
|          |                                       |  | EPO                          | <u>NO-GO TLI</u>           |  |      |
|          |                                       |  | TLC                          | <u>ENTER NEXT BEST PTP</u> |  |      |
|          |                                       |  | LO                           | <u>ENTER NEXT BEST PTP</u> |  |      |
| A 6-30   | BOTH MAIN REGULATORS<br>FAILED CLOSED | LAUNCH   | <u>CONTINUE MISSION</u>      |                            |  |      |
|          |                                       | EPO  | <u>ENTER NEXT BEST PTP</u>   |                            |  |      |
|          |                                       | TLC  | <u>ENTER ASAP</u>            |                            |  |      |
|          |                                       | LO   | <u>ENTER ASAP</u>            |                            |  |      |
| A 6-31   | LOSS OF ONE SUIT<br>COMPRESSOR        | LAUNCH   | <u>CONTINUE MISSION</u>      |                            |  |      |
|          |                                       | EPO  | <u>NO-GO FOR TLI</u>         |                            |  |      |
|          |                                       | TLC  | <u>CONTINUE MISSION</u>      |                            |  |      |
|          |                                       | RULES 6-32 THROUGH<br>6-34 ARE RESERVED.                                 |                              |                            |  |      |
| MISSION  | REV                                   | DATE   | SECTION                      |                            | GROUP  | PAGE |
| APOLLO 8 | A                                     | 12/11/68   | ENVIRONMENTAL CONTROL SYSTEM |                            | SPECIFIC-SUIT/CABIN  | 6-5  |

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MISSION RULES

| REV      | RULE | CONDITION/MALFUNCTION              | PHASE   | RULING                     | CUES/NOTES/COMMENTS  |  |
|----------|------|------------------------------------|---|----------------------------|--|--|
| A        | 6-35 | PRIMARY COOLANT LOOP MALFUNCTIONS  | A. LOSS OF EVAPORATOR   | LAUNCH                     | A. <u>CONTINUE MISSION</u>   | MALF <u>ECS 16</u>                             |
|          |      |                                    |   | EPO                        | <u>CONTINUE MISSION</u><br>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                         | <u>ENTER NEXT BEST PTP</u>   |  |
|          |      |                                    | B. LOSS OF RADIATORS (LEAK IN RADIATORS RESULTING IN ISOLATION) | EPO                        | B. <u>NO-GO FOR TLI</u><br>1. ACTIVATE SECONDARY LOOP<br>2. USE PRIMARY LOOP IN ADDITION TO SECONDARY LOOP FOR G&N OPERATIONS  | MALF <u>ECS 19</u>                             |
|          |      |                                    |   | TLC                        | <u>ENTER NEXT BEST PTP</u>   |  |
|          |      |                                    |   | LO                         | <u>ENTER NEXT BEST PTP</u>   |  |
|          |      |                                    | C. TOTAL LOSS OF LOOP (COMPLETE LOSS OF FLUID OR LOSS OF FLOW)  | LAUNCH                     | C. <u>CONTINUE MISSION</u><br>1. ACTIVATE SECONDARY LOOP<br>2. <u>ENTER PTP 4-4</u>  |  |
|          |      |                                    |   | EPO                        | <u>ENTER NEXT BEST PTP</u><br>ACTIVATE SECONDARY LOOP  |  |
|          |      | TLC                                | <u>ENTER NEXT BEST PTP</u>                                      |                            |  |  |
|          |      | LO                                 | <u>ENTER NEXT BEST PTP</u>                                      |                            |  |  |
|          | 6-36 | <u>SECONDARY LOOP MALFUNCTIONS</u> | A. LOSS OF EVAPORATOR   | EPO                        | A. <u>NO-GO FOR TLI</u>  | MALF <u>ECS 21</u>                             |
|          |      |                                    |   | TLC                        | <u>ENTER NEXT BEST PTP</u>   |  |
|          |      |                                    |   | LO                         | <u>ENTER NEXT BEST PTP</u>   |  |
|          |      |                                    | B. LOSS OF RADIATORS (LEAK IN RADIATORS RESULTING IN ISOLATION) | EPO                        | B. <u>NO-GO FOR TLI</u><br>LOOP IS STILL OPERATIONAL IN EVAPORATIVE MODE.  | MALF <u>ECS 26</u>                             |
|          |      |                                    |   | TLC                        | <u>ENTER NEXT BEST PTP</u>   |  |
|          |      |                                    |   | LO                         | <u>ENTER NEXT BEST PTP</u>   |  |
|          |      |                                    | C. TOTAL LOSS OF LOOP (COMPLETE LOSS OF FLUID OR LOSS OF FLOW)  | EPO                        | C. <u>NO-GO FOR TLI</u>  | MALF <u>ECS 26</u>                             |
|          |      |                                    | TLC   | <u>ENTER NEXT BEST PTP</u> |  |  |
|          |      |                                    | LO  | <u>ENTER NEXT BEST PTP</u> |  |  |
| MISSION  | REV  | DATE                               | SECTION   | GROUP                      | PAGE   |  |
| APOLLO 8 | A    | 12/11/68                           | ENVIRONMENTAL CONTROL SYSTEM                                    | SPECIFIC-COOLANT           | 6-6  |  |

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**MISSION RULES**

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

| MISSION  | REV | DATE     | SECTION                      | GROUP            | PAGE |
|----------|-----|----------|------------------------------|------------------|------|
| APOLLO 8 | A   | 12/11/68 | ENVIRONMENTAL CONTROL SYSTEM | SPECIFIC-COOLANT | 6-7  |

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MISSION RULES

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

| MISSION  | REV | DATE     | SECTION                      | GROUP                                      | PAGE |
|----------|-----|----------|------------------------------|--|------|
| APOLLO 8 | A   | 12/11/68 | ENVIRONMENTAL CONTROL SYSTEM | SPECIFIC-H <sub>2</sub> O WASTE MANAGEMENT | 6-8  |

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**MISSION RULES**

| REV              | ITEM    | INSTRUMENTATION REQUIREMENTS |            |                  |                    |                  | REFERENCE   |  |
|------------------|---------|------------------------------|------------|------------------|--------------------|------------------|-------------|--|
|                  |         | <u>MEAS DESCRIPTION</u>      | <u>PCM</u> | <u>ONBOARD</u>   | <u>TRANSDUCERS</u> | <u>CATEGORY</u>  |             |  |
| A                | 6-55    | 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 <sub>2</sub> O QTY | CF0010Q    | METER            | COMMON             | ONE OF TWO       | 6-45, 6-46, |  |
|                  |         | WASTE H <sub>2</sub> O 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 <sub>2</sub> FLOW      | CF0035R    | METER            | COMMON             | HIGHLY DESIRABLE |             |  |
|                  |         | O <sub>2</sub> 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 |                    |                  |             |  |

|          |     |          |                              |                              |      |
|----------|-----|----------|------------------------------|------------------------------|------|
| MISSION  | REV | DATE     | SECTION                      | GROUP                        | PAGE |
| APOLLO 8 | A   | 12/11/68 | ENVIRONMENTAL CONTROL SYSTEM | INSTRUMENTATION REQUIREMENTS | 6-9  |

7 CRYOGENICS

**NASA — Manned Spacecraft Center**

**MISSION RULES**

| REV      | ITEM | GENERAL   |            |                            |      |
|----------|------|---|------------|----------------------------|------|
|          | 7-1  | <p><u>LAUNCH</u></p> <p>THERE ARE NO CRYO FAILURES FOR WHICH THE LAUNCH/INSERTION PHASE WILL BE TERMINATED. FOR COMPLETE LOSS OF THE SYSTEM RESULTING IN THREE FUEL CELL FAILURES, ENTRY WILL BE PLANNED INTO PTP 2-1. THREE ENTRY BATTERIES ARE CAPABLE OF SUPPORTING THE LAUNCH, ONE REV OF POWER DOWN, AND SCS ENTRY.</p>  |            |                            |      |
|          | 7-2  | <p><u>ORBIT</u></p> <p>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<sub>2</sub> 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<sub>2</sub> USAGE IN FLIGHT AFTER LOSS OF RECHARGE CAPABILITY FROM THE CRYO SYSTEM WILL REDUCE SUPPLY AVAILABLE FOR ENTRY, LANDING, AND POSTLANDING.</p> |            |                            |      |
|          | 7-3  | <p>LOSS OF A CRYOGENIC TANK IS DEFINED AS: PRESSURE CANNOT BE MAINTAINED ABOVE 150 PSIA FOR O<sub>2</sub> AND 100 PSIA FOR H<sub>2</sub>.</p>   |            |                            |      |
| A        | 7-4  | <p>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.</p>   |            |                            |      |
|          |      | <p>RULES 7-5 THROUGH 7-9 ARE RESERVED.</p>  |            |                            |      |
| MISSION  | REV  | DATE  | SECTION    | GROUP                      | PAGE |
| APOLLO 8 | A    | 12/11/68  | CRYOGENICS | GENERAL/SYSTEMS MANAGEMENT | 7-1  |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV      | ITEM | SYSTEMS MANAGEMENT   |            |                            |      |
|----------|------|--|------------|----------------------------|------|
| A        | 7-10 | <p><u>CRYO MANAGEMENT</u></p> <p>A. MANUAL PRESSURE CONTROL WILL BE USED AS REQUIRED TO MAINTAIN:</p> <ol style="list-style-type: none"> <li>1. TANK PRESSURES GREATER THAN <u>750</u> PSIA O<sub>2</sub> AND <u>200</u> PSIA FOR H<sub>2</sub>.</li> <li>2. QUANTITY BALANCE OF <u>4</u> PERCENT O<sub>2</sub> AND <u>3</u> PCT FOR H<sub>2</sub>.</li> </ol> <p>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<sub>2</sub>, 270 PSID H<sub>2</sub>.)</p> <p>C. CRYO FANS WILL NOT BE ALLOWED TO OPERATE IN AUTO MODE.<br/>MANUAL CYCLE CRITERIA:</p> <ol style="list-style-type: none"> <li>1. TANK QTY &gt;75 PERCENT _____ EVERY 6 TO 8 HOURS FOR 3 TO 5 MINUTES.</li> <li>2. TANK QTY &lt;75 PERCENT _____ EVERY 10 TO 14 HOURS FOR 3 TO 5 MINUTES.</li> <li>3. ANYTIME QTY READOUT APPEARS TO BE ERRONEOUS AND VALID READOUT IS REQUIRED.</li> </ol> |            |                            |      |
|          | 7-11 | <p><u>CRYO GAGING</u></p> <p>A. ONBOARD CRYOGENIC QUANTITY GAGING IS PRIME. ACCURACY IS ±2.65 PERCENT (±8.84 LBS O<sub>2</sub>, ±.72 LBS H<sub>2</sub>) PER TANK.</p> <p>B. MCC CALCULATED QUANTITY USING PRESSURE VERSUS TEMPERATURE IS BACKUP. ACCURACY IS UNKNOWN DUE TO INSTRUMENTATION PROBLEM.</p>   |            |                            |      |
|          |      | <p>RULES 7-12 THROUGH<br/>7-14 ARE RESERVED.</p>   |            |                            |      |
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**MISSION RULES**

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|----------|-------|---|------------|---|---|------|
|          | 7-15  | LOSS OF ONE O <sub>2</sub> AND/OR H <sub>2</sub> CRYO TANK (TANK PRESSURE <150 O <sub>2</sub> , <100 H <sub>2</sub> RESPECTIVELY).    | LAUNCH     | <u>CONTINUE MISSION</u>   |   |      |
|          |       |   | EPO        | <u>NO-GO FOR TLI</u>  |   |      |
|          |       |   | TLC        | <u>ENTER NEXT BEST PTP</u>  |   |      |
|          |       |   | LO         | <u>ENTER NEXT BEST PTP</u>  |   |      |
|          | 7-16  | LOSS OF BOTH O <sub>2</sub> AND/OR H <sub>2</sub> CRYO TANK (TANK PRESSURE <150 O <sub>2</sub> , <100 H <sub>2</sub> , RESPECTIVELY). | LAUNCH     | <u>CONTINUE MISSION</u><br><u>ISOLATE SURGE TANK PRIOR TO 800 PSIA</u>  |   |      |
|          |       |   | EPO        | <u>ENTER NEXT BEST ATP OR PTP</u><br><u>MAXIMUM ORBIT TIME IS 4.75 HRS</u><br><u>FOR LOSS OF THREE FUEL CELLS</u> | IF 3 FUEL CELLS ARE LOST, SMJC'S WILL BE INOPERATIVE FOR CM/SM SEP. |      |
|          |       | RULES 7-17 THROUGH 7-19 ARE RESERVED.   |            |   |   |      |
| MISSION  | REV   | DATE  | SECTION    |   | GROUP   | PAGE |
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**MISSION RULES**

| REV | ITEM | INSTRUMENTATION REQUIREMENTS |            |                |                    |                      |
|-----|------|------------------------------|------------|----------------|--------------------|----------------------|
| A   | 7-20 | <u>MEAS DESCRIPTION</u>      | <u>PCM</u> | <u>ONBOARD</u> | <u>TRANSDUCERS</u> | <u>CATEGORY</u>      |
|     |      | O <sub>2</sub> TNK 1 QTY     | SC0030Q    | METER          | COMMON }           | ONE OF TWO MANDATORY |
|     |      | O <sub>2</sub> TNK 2 QTY     | SC0033Q    | METER          | COMMON }           |                      |
|     |      | O <sub>2</sub> TNK 1 P       | SC0037P    | METER          | COMMON }           | ONE OF TWO MANDATORY |
|     |      | O <sub>2</sub> TNK 2 P       | SC0038P    | METER          | COMMON }           |                      |
|     |      | H <sub>2</sub> TNK 1 QTY     | SC0030Q    | METER          | COMMON }           | ONE OF TWO MANDATORY |
|     |      | H <sub>2</sub> TNK 2 QTY     | SC0031Q    | METER          | COMMON }           |                      |
|     |      | H <sub>2</sub> TNK 1 P       | SC0039P    | METER          | COMMON }           | ONE OF TWO MANDATORY |
|     |      | H <sub>2</sub> TNK 2 P       | SC0040P    | METER          | COMMON }           |                      |
|     |      | O <sub>2</sub> TNK 1 TEMP    | SC0041T    | ----           | ----               | HIGHLY DESIRABLE     |
|     |      | O <sub>2</sub> TNK 2 TEMP    | SC0042T    | ----           | ----               | HIGHLY DESIRABLE     |
|     |      | H <sub>2</sub> TNK 1 TEMP    | SC0043T    | ----           | ----               | HIGHLY DESIRABLE     |
|     |      | H <sub>2</sub> TNK 2 TEMP    | SC0044T    | ----           | ----               | HIGHLY DESIRABLE     |

  

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|----------|-----|----------|------------|------------------------------|------|
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8 ELECTRICAL  
POWER SYSTEM

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MISSION RULES

| REV | ITEM | GENERAL  |
|-----|------|--|
|     | 8-1  | <p><u>LAUNCH</u></p> <p>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.</p>  |
|     | 8-2  | <p>THERE ARE NO FUEL CELL FAILURES FOR WHICH THE LAUNCH PHASE WILL BE TERMINATED AS LONG AS THREE ENTRY BATTERIES ARE REMAINING TO SUPPLY MAIN BUS LOADS.</p>  |
|     | 8-3  | <p><u>ALL PHASES</u></p> <p>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.</p>   |
| A   | 8-4  | <p>BATTERY IS CONSIDERED FAILED IF:</p> <p>OUTPUT &lt;3 AMPS WHEN CONNECTED TO MAIN BUS DURING LAUNCH OR SPS MANEUVERS. (NOMINAL BAT CURRENT FOR LAUNCH AND SPS MANEUVERS IS 6-15 AMPS).</p>   |
|     | 8-5  | <p>AN AC BUS IS CONSIDERED FAILED IF ANY TWO PHASES CANNOT BE MAINTAINED &gt;95 VOLTS.</p>   |
|     | 8-6  | <p>AN INVERTER IS CONSIDERED FAILED IF:</p> <p>A. OUTPUT VOLTAGE ON ANY PHASE &gt;130 VAC.<br/>                     B. OUTPUT VOLTAGE ON ANY TWO PHASES &lt;95 VAC.</p>  |
| A   | 8-7  | <p>FUEL CELL IS CONSIDERED FAILED FOR MISSION PLANNING IF:</p> <p>A. FUEL CELL OUTPUT &lt;5 AMPS.<br/>                     B. FUEL CELL H<sub>2</sub> LOOP IS CONTAMINATED WITH KOH.<br/>                     C. REGULATED H<sub>2</sub> PRESSURE &lt;36.7 PSIA. (CORRESPONDS TO N<sub>2</sub> PRESSURE SHIFT DOWN TO 28.2 PSIA. FOR CRITICAL OPERATION, LOWER N<sub>2</sub> PRESSURE CAN BE MANAGED BY TURNING OFF H<sub>2</sub>O TANK PRESSURE REGULATORS WHILE FC IS ONLINE).</p> |
| A   | 8-8  | <p>TLI MINIMUM PUGRE CAPABILITY IS BOTH OXYGEN AND HYDROGEN ON ONE FUEL CELL AND AT LEAST OXYGEN ON ANY OTHER FUEL CELL.</p>   |
|     |      | <p>RULES 8-9 THROUGH 8-14 ARE RESERVED.</p>  |

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MISSION RULES

| REV      | ITEM | SYSTEMS MANAGEMENT  |                          |                            |      |
|----------|------|---|--------------------------|----------------------------|------|
| A        | 8-15 | <p><u>FUEL CELL MANAGEMENT</u></p> <p>A. FUEL CELL WILL BE "SHUTDOWN" FOR THE FOLLOWING:</p> <ol style="list-style-type: none"> <li>1. SUSTAINED CURRENT OUTPUT LESS THAN 5 AMPS</li> <li>2. FUEL CELL H<sub>2</sub> LOOP IS CONTAMINATED WITH KOH.</li> <li>3. REACTANT LEAKAGE JEOPARDIZING MISSION DURATION.</li> </ol> <p>B. FUEL CELL MAY BE "OPEN CIRCUITED" FOR THE FOLLOWING:</p> <ol style="list-style-type: none"> <li>1. SKIN TEMP &gt;475°F</li> <li>2. TCE TEMP &gt;200°F</li> <li>3. FAILURE OF H<sub>2</sub> PUMP OR GLYCOL PUMP</li> <li>4. VOLTAGE MANAGEMENT</li> <li>5. UNABLE TO PURGE IF TIME-TO-GO GREATER THAN PREDICTED FUEL CELL LIFETIME.</li> </ol> <p>C. NORMAL FUEL CELL PURGE WILL BE EVERY <u>12</u> HRS O<sub>2</sub> AND EVERY <u>48</u> HRS H<sub>2</sub>.</p> <p>D. ADDITIONAL PURGES WILL BE INITIATED AS OPERATIONAL CONDITONS DICTATE.</p> <p>E. FUEL CELLS WILL NOT BE PURGED UNDER THE FOLLOWING CONDITIONS:</p> <ol style="list-style-type: none"> <li>1. CONFIRMED HIGH PH.</li> </ol> <p>F. FUEL CELLS MAY BE PURGED TO PRECLUDE CRYOGENIC TANKS FROM VENTING.</p> <p>G. EACH H<sub>2</sub> PURGE WILL BE PRECEDED BY 20 MINUTES OF H<sub>2</sub> VENT HEATER OPERATION.</p> <p>H. FC INLINE HEATERS WILL OPERATE IN "AUTO" CONTINUOUSLY.</p> <p>I. REACTANT VALVES WILL REMAIN OPEN <u>AT ALL TIMES</u> UNLESS THE FUEL CELL IS DECLARED NON-OPERATIONAL.</p> <p>J. FUEL CELL RADIATOR VALVES WILL REMAIN IN THE "NORMAL" OR OPEN CONFIGURATION UNLESS RADIATOR OUTLET TEMPERATURE DECREASES BELOW -40°F.</p> |                          |                            |      |
| A        | 8-16 | <p><u>BUS MANAGEMENT</u></p> <p>A. ONE AND ONLY ONE FUEL CELL WILL BE TIED TO BOTH MAIN BUSES.</p> <p>B. INVERTERS WILL BE CONFIGURED SUCH THAT MAIN BUS A WILL SUPPLY AC BUS 1 AND MAIN BUS B WILL SUPPLY AC BUS 2.</p> <p>C. MAIN BUS VOLTAGE WILL BE MAINTAINED &gt;26.2 VDC AND &lt;31 VDC. ONE FUEL CELL MAY BE OPEN CIRCUITED FOR OPTIMUM VOLTAGE AND POWER MANAGEMENT.</p> <p>D. MINIMUM MAIN BUS VOLTAGE WILL BE MAINTAINED TO BE COMPATIBLE WITH ONLINE OPERATION EQUIPMENT.</p> <ol style="list-style-type: none"> <li>1. SPS <u>24.5</u></li> <li>2. PGNS <u>25.0</u></li> <li>3. AUTO SM-RCS <u>22.0</u></li> <li>4. AUTO CM-RCS <u>21.0</u></li> <li>5. DIRECT SM-RCS <u>21.0</u></li> <li>6. DIRECT CM-RCS <u>17.0</u></li> <li>7. INVERTERS <u>19.0</u></li> </ol>   |                          |                            |      |
|          | 8-17 | <p><u>INVERTER MANAGEMENT</u></p> <p>A. INVERTERS MAY BE REMOVED FROM LINE FOR ANY OF THE FOLLOIING REASONS:</p> <ol style="list-style-type: none"> <li>1. INVERTER TEMP &gt;<u>190</u>°F</li> <li>2. SPACECRAFT LOAD MANAGEMENT</li> </ol>   |                          |                            |      |
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MISSION RULES

| REV      | ITEM   |         |                          |                            |      |
|----------|--|---------|--------------------------|----------------------------|------|
| 8-18     | <p><u>BATTERY MANAGEMENT</u></p> <p>A. BATTERIES A AND B WILL BE USED TO SUPPLEMENT MAIN BUS LOADS FROM T-75 SECONDS TO INSERTION.</p> <p>B. BATTERIES A AND B WILL BE USED TO SUPPLEMENT MAIN BUS LOADS FOR SPS MANEUVERS. BATTERY C WILL BE ROTATED IN THE EVENT THE BATTERY CHARGER FAILS TO MAINTAIN BATTERY BALANCE.</p> <p>C. BATTERIES WILL BE RECHARGED <u>TBD</u>.</p> <p>D. THREE BATTERIES WILL BE TIED TO THE MAIN BUSES FOR ENTRY.</p> <p>E. BATTERIES ARE CONSIDERED TO HAVE 40 AMP-HR CAPABILITY INFLIGHT AND 50 AMP-HR CAPABILITY FOR POST-LANDING.</p> <p>F. FOR LOSS OF BATTERY CHARGER CAPABILITY TO A SINGLE BATTERY, THAT BATTERY WILL NOT BE USED EXCEPT FOR DEORBIT, ENTRY, AND POSTLANDING.</p> <p>G. BATTERY VENT VALVE WILL REMAIN CLOSED UNLESS MANIFOLD PRESSURE IS GREATER THAN 6 PSIA. VENTING OPERATION WILL BE ALLOWED TO TROUBLESHOOT A SUSPECTED FROZEN DUMP.</p> <p>RULES 8-19 THROUGH 8-23 ARE RESERVED.</p> |         |                          |                            |      |
| MISSION  | REV  | DATE    | SECTION                  | GROUP                      | PAGE |
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MISSION RULES

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE                    | RULING  | CUES/NOTES/COMMENTS   |  |
|----------|------|--|--------------------------|---|-----------------------|--|
| A        | 8-24 | LOSS OF ONE FUEL CELL<br>OUTPUT <5 AMPS  | LAUNCH                   | <u>CONTINUE MISSION</u>   | MALF <u>EPS 5</u>     |  |
|          |      |  | EPO                      | <u>NO-GO FOR TLI</u><br><br>1. OPEN CIRCUIT FUEL CELL<br>2. RECONFIGURE REMAINING TWO FUEL CELLS TO ONE FUEL CELL PER MAIN BUS ONLY.<br>3. IF FUEL CELL CANNOT BE RE-STORED - PERFORM SHUTDOWN.   |                       |  |
|          |      |  | TLC                      | <u>NO-GO FOR LOI</u>  |                       |  |
|          |      |  | LO                       | <u>ENTER NEXT BEST PTP</u>  |                       |  |
|          | 8-25 | LOSS OF TWO FUEL CELLS<br>OUTPUT <5 AMPS/FUEL CELL   | LAUNCH                   | <u>CONTINUE MISSION</u><br>AFTER 2 + 00<br><br>1. EDS AUTO/OFF TO OFF<br>2. IF LOSS OF FC 1 AND 2:<br>TIE BAT C TO MAIN A<br>3. IF LOSS OF FC 2 AND 3:<br>TIE BAT C TO MAIN B<br>4. IF LOSS OF FC 1 AND 3:<br>TIE BAT C TO BOTH MAIN BUSES. |                       |  |
|          |      |  | EPO                      | <u>ENTER NEXT BEST PTP</u> ONE ENTRY BATTERY MAY BE USED TO SUPPLEMENT REMAINING FC FOR G&N ALIGNMENT PRIOR TO DEORBIT.   |                       |  |
|          |      |  | TLC                      | <u>ENTER ASAP</u><br>PERFORM "LOSS OF TWO F/C POWER DOWN"   |                       |  |
|          |      |  | LO                       | <u>ENTER ASAP</u>   |                       |  |
|          | 8-26 | LOSS OF THREE FUEL CELLS<br><br>A. OUTPUT <5 AMPS/FUEL CELL<br><br>B. TOTAL OUTPUT CAPABILITY INSUFFICIENT TO SUPPORT DRIFTING FLIGHT LOADS.<br><br>C. TOTAL OUTPUT CAPABILITY <36 AMPS AT MAIN BUS VOLTAGE OF 26.5 VDC. | LAUNCH                   | A. <u>CONTINUE MISSION</u><br><br>1. AFTER 2 + 00 EDS AUTO/OFF TO OFF.<br>2. TIE BAT C TO BOTH MAIN BUSES.<br>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.<br><br>B. 80 AMPS REPRESENTS MAXIMUM DRIFTING FLIGHT REQUIREMENTS. <u>54</u> AMPS AVERAGE<br><br>C. 36 AMPS REPRESENTS MINIMUM POWER TO SUPPORT S/C SYSTEMS IN ORBIT. |
|          |      |  | EPO                      | B. <u>ENTER NEXT BEST PTP</u> MANIPULATION OF CYCLE LOADS WILL BE ATTEMPTED TO MAINTAIN VM >26.5.   |                       |  |
|          |      |  | EPO                      | C. <u>PLAN ENTRY NEXT ATP OR PTP</u> BASED ON FUEL CELL OUTPUT AND BATTERY ENERGY REMAINING.  |                       |  |
|          |      |  |                          |   |                       |  |
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MISSION RULES

| 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<br>EPO            | <u>ABORT</u><br><br>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.<br><br>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.  |                          |  |  |      |
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| 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                   | <u>CONTINUE MISSION</u><br>A. EDS AUTO - OFF<br>B. IF BAT A - TIE BAT C TO MAIN A<br>C. IF BAT B - TIE BAT C TO MAIN B | IF LOST DURING SPS MANEUVER, CONTINUE ON REMAINING BAT. ATTEMPT TO TIE BAT C TO CORRESPONDING MAIN BUS. |      |
|          |      |   | EPO                      | <u>NO-GO FOR TLI</u>   |   |      |
|          |      |   | TLC                      | <u>NO-GO FOR LOI</u>   |   |      |
|          |      |   | LO                       | <u>ENTER NEXT BEST PTP</u>   |   |      |
| A        | 8-37 | LOSS OF ANY ONE ENTRY BATTERY   | EPO                      | <u>NO-GO FOR TLI</u>   |   |      |
|          |      |   | TLC                      | <u>NO-GO FOR LOI</u>   |   |      |
|          |      |   | LO                       | <u>ENTER NEXT BEST PTP</u>   |   |      |
| A        | 8-38 | LOSS OF TWO ENTRY BATTERIES (OUTPUT <3 AMPS) EACH WHEN TIED TO MAIN BUS | LAUNCH                   | <u>CONTINUE MISSION</u><br>EDS AUTO - OFF<br>PERFORM ONE BATTERY ENTRY INTO 2-1  | IF LOSS DURING SPS MANEUVERS ATTEMPT TO TIE BAT C TO BOTH MAINS   |      |
|          |      |   | ALL PHASES               | <u>ENTER NEXT BEST PTP</u><br>USING ONE BATTERY ENTRY PROCEDURE  |   |      |
| A        | 8-39 | LOSS OF BATTERY CHARGER   | EPO                      | <u>CONTINUE MISSION</u>  |   |      |
|          |      |   | TLC                      | <u>NO-GO FOR LOI</u><br>IF SUM OF TWO LOWEST ENTRY BATTERIES <64 AMP-HRS   |   |      |
|          |      | RULES 8-40 THROUGH 8-45 ARE RESERVED.                                   |                          |  |   |      |
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| 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. <u>CONTINUE MISSION</u><br>1. IF MOTOR SW A/C - TIE BAT C TO MAIN BUS A<br>2. IF MOTOR SW B/C - TIE BAT C TO MAIN BUS B   |  |      |
|          |      |   | ALL PHASES               | <u>CONTINUE MISSION</u><br>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. <u>CONTINUE MISSION</u><br>USE CB'S AS MOTOR SWITCHES.  | B. IF BOTH MOTOR SWITCHES FAIL CLOSED, BATTERIES CANNOT BE CHARGED.<br>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. <u>CONTINUE MISSION</u><br>1. PLACE EDS AUTO/OFF TO OFF.<br>2. FUEL CELL 2 TO BUS A ONLY.<br>3. TIE BAT C TO MAIN A.<br>4. INVERTER 3 TO AC2 MAIN A.<br>5. POWER DOWN MAIN B.<br>6. TVC GIMBAL DRIVE (P,Y)-1.<br>7. GIMBAL MOTOR CONTROL (YAW 1, PITCH 1) BAT A - OPEN FOLLOWING GIMBAL MOTOR TURN ON.  | A. <u>85 AMPS SHORT ON MAIN B WILL CAUSE REVERSE DISCONNECT DURING LAUNCH.</u>         |      |
|          |      |   | ALL PHASES               | <u>ENTER NEXT BEST PTP IF BUS NOT RESTORED</u>   |  |      |
|          |      | B. FUEL CELL 2 DISCONNECTS FROM MAIN B                        | LAUNCH                   | B. <u>CONTINUE MISSION</u><br>1. PLACE EDS AUTO/OFF TO OFF.<br>2. FUEL CELL 2 TO BUS B ONLY.<br>3. TIE BAT C TO MAIN B.<br>4. INVERTER 3 TO AC-1 MAIN B.<br>5. POWER DOWN MAIN A.<br>6. TVC GIMBAL DRIVE (P,Y)-2.<br>7. GIMBAL MOTOR CONTROL (YAW 2, PITCH 2) BAT B - OPEN FOLLOWING GIMBAL MOTOR TURN ON. | B. <u>79 AMPS SHORT ON MAIN A WILL CAUSE REVERSE DISCONNECT DURING LAUNCH.</u>         |      |
|          |      |   | ALL PHASES               | <u>ENTER NEXT BEST PTP IF BUS NOT RESTORED</u>   |  |      |
|          |      | C. MAIN BUS SHORTED >25 AMPS AND POWER CANNOT BE REMOVED.     | LAUNCH                   | C. <u>ABORT</u>  | C. FAILURE TO DISCONNECT FC FROM SHORTED BUS INDICATED BY FC TO SHORTED BUS T/B GREY.  |      |
|          |      |   | ALL PHASES               | <u>ENTER NEXT BEST PTP</u><br><u>CLOSE F/C REACTANTS VALVES TO</u><br><u>POWER DOWN SHORTED FUEL CELL.</u>   |  |      |
| MISSION  | REV  | DATE  | SECTION                  |  | GROUP  | PAGE |
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**MISSION RULES**

| REV  | RULE | CONDITION/MALFUNCTION   | PHASE      | RULING  | CUES/NOTES/COMMENTS   |
|------|------|---|------------|---|---|
| A    | 8-48 | A. BATTERY BUS SHORTED<br>>5 AMPS   | LAUNCH     | A. <u>CONTINUE MISSION</u><br><br>1. EDS AUTO - OFF<br>2. OPEN ASSOCIATED MAIN BUS TO BAT BUS CB.<br>3. TIE BAT C TO ASSOCIATED MAIN BUS. | >22 AMPS WILL CAUSE BATTERY BUS VOLTAGE TO BE $\leq$ MAIN BUS VOLTAGE DURING LAUNCH WHICH WILL BE ONLY CUE.<br><br>MALF EPS SSR - 2<br>REMOVE POWER FROM BUS.<br>IF SHORTED <10 AMPS POWER BUS JUST PRIOR TO ENTRY TO MAINTAIN SECS REDUNDANCY. |
|      |      | B. BATTERY BUS SHORTED<br><5 AMPS   | ALL PHASES | B. <u>CONTINUE MISSION</u><br>REMOVE POWER FROM BUS EXCEPT FOR MANEUVERS AND ENTRY.   |   |
|      | 8-49 | BATTERY RELAY BUS SHORTED   | LAUNCH     | <u>CONTINUE MISSION</u><br><br>ENTER NEXT BEST PTP<br>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     | <u>CONTINUE MISSION</u>   |   |
|      |      |   | ALL PHASES | <u>ENTER NEXT BEST PTP</u>  |   |
|      |      | RULES 8-51 THROUGH 8-55 ARE RESERVED.   |            |   |   |

| MISSION  | REV | DATE     | SECTION                  | GROUP                      | PAGE |
|----------|-----|----------|--------------------------|----------------------------|------|
| APOLLO 8 | A   | 12/11/68 | ELECTRICAL POWER SYSTEMS | SPECIFIC - DC DISTRIBUTION | 8-8  |

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MISSION RULES

| REV      | RULE  | CONDITION/MALFUNCTION  | PHASE                    | RULING   | CUES/NOTES/COMMENTS        |      |
|----------|-------|--|--------------------------|--|----------------------------|------|
|          | 8-56  | LOSS OF ONE INVERTER   | ALL PHASES               | <u>CONTINUE MISSION</u>  |                            |      |
|          | 8-57  | LOSS OF TWO INVERTERS  | LAUNCH<br><br>ALL PHASES | <u>CONTINUE MISSION</u><br>PLACE REMAINING INVERTER ON BOTH AC BUSES.<br><br><u>ENTER NEXT BEST PTP</u>  |                            |      |
|          | 8-58  | LOSS OF ONE AC BUS (TWO PHASES CANNOT BE MAINTAINED >95 VAC) | LAUNCH<br><br>ALL PHASES | <u>CONTINUE MISSION</u><br><br><u>ENTER NEXT BEST PTP</u>  | <u>MALF EPS 1</u>          |      |
|          | 8-59  | LOSS OF BOTH AC BUSES  | LAUNCH<br><br><br>EPO    | <u>ABORT MODE I OR MODE II</u><br><br>A. OPEN DIRECT O <sub>2</sub> FOR SUIT VENTILATION.<br>B. IF AFTER MODE II, <u>ENTER 2-1 PTP</u><br><br><u>ENTER NEXT BEST PTP OR ATP WITHIN 1-1/2 HOURS</u><br><br>DOFF SUITS |                            |      |
|          |       | RULES 8-60 THROUGH 8-65 ARE RESERVED.                        |                          |  |                            |      |
| MISSION  | REV   | DATE   | SECTION                  |  | GROUP                      | PAGE |
| APOLLO 8 | FINAL | 11/7/68  | ELECTRICAL POWER SYSTEMS |  | SPECIFIC - AC DISTRIBUTION | 8-9  |

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MISSION RULES

| 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 <sub>2</sub> FLO | SC2141R | METER   | COMMON      | 1 OF 3 MANDATORY | 8-24, 8-25, 8-26       |
|  |      | FC 1 H <sub>2</sub> FLO | SC2139R | METER   | COMMON      |                  |                        |
|  |      | FC 2 CURRENT            | SC2114C | METER   | COMMON      |                  |                        |
|  |      | FC 2 O <sub>2</sub> FLO | SC2143R | METER   | COMMON      | 1 OF 3 MANDATORY | 8-24, 8-25, 8-26       |
|  |      | FC 2 H <sub>2</sub> FLO | SC2140R | METER   | COMMON      |                  |                        |
|  |      | FC 3 CURRENT            | SC2115C | METER   | COMMON      |                  |                        |
|  |      | FC 3 O <sub>2</sub> FLO | SC2143R | METER   | COMMON      | 1 OF 3 MANDATORY | 8-24, 8-25, 8-26       |
|  |      | FC 3 H <sub>2</sub> 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<br>TEMP      | CC0175T | MCWS    | COMMON      | HIGHLY DESIRABLE | 8-17                   |
|  |      | INVERTER 2<br>TEMP      | CC0175T | MCWS    | COMMON      | HIGHLY DESIRABLE | 8-17                   |
|  |      | INVERTER 3<br>TEMP      | CC0177T | MCWS    | COMMON      | HIGHLY DESIRABLE |                        |
| NOTE: USE BAT C IN LIEU OF BATTERY WITH LOST INST. |      |                         |         |         |             |                  |                        |

| MISSION  | REV | DATE     | SECTION                  | GROUP                        | PAGE |
|----------|-----|----------|--------------------------|------------------------------|------|
| APOLLO 8 | A   | 12/11/68 | ELECTRICAL POWER SYSTEMS | INSTRUMENTATION REQUIREMENTS | 8-10 |

9 COMMUNICA-  
TIONS/INSTRU-  
MENTATION

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## MISSION RULES

| REV      | ITEM | GENERAL  |                                |                            |      |
|----------|------|--|--------------------------------|----------------------------|------|
|          |      | GENERAL  |                                |                            |      |
|          |      | <u>LAUNCH</u>  |                                |                            |      |
|          | 9-1  | THERE ARE NO COMMUNICATIONS/INSTRUMENTATION FAILURES FOR WHICH THE LAUNCH/INSERTION PHASE WILL BE TERMINATED.  |                                |                            |      |
| A        | 9-2  | <u>EPO</u><br><br>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  | <u>TLC</u><br><br>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.  |                                |                            |      |
| MISSION  | REV  | DATE   | SECTION                        | GROUP                      | PAGE |
| APOLLO 8 | A    | 12/11/68   | COMMUNICATIONS/INSTRUMENTATION | GENERAL/SYSTEMS MANAGEMENT | 9-1  |

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**MISSION RULES**

| REV      | RULE | CONDITION/MALFUNCTION  | PHASE                          | RULING | CUES/NOTES/COMMENTS        |      |
|----------|------|--|--------------------------------|--------|----------------------------|------|
| A        | 9-5  | <u>COMM SYSTEMS MANAGEMENT</u><br>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.<br>B. SPACECRAFT AND GROUND WILL TRANSMIT SIMULTANEOUSLY ON VHF AND USB FOR LAUNCH AND EPO. |                                |        |                            |      |
| A        | 9-6  | <u>DSE MANAGEMENT</u><br>A. HBR WILL BE RECORDED DURING FOLLOWING:<br>1. LAUNCH<br>2. TLI<br>3. CSM/S-IVB SEP<br>4. SPS MANEUVERS<br>5. ENTRY  |                                |        |                            |      |
| A        | 9-7  | <u>CTE MANAGEMENT</u><br>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<br>B. CTE WILL BE ALLOWED TO DRIFT ±15 SECONDS BEFORE BEING UPDATED.  |                                |        |                            |      |
|          |      | RULES 9-8 THROUGH 9-9 ARE RESERVED.  |                                |        |                            |      |
| MISSION  | REV  | DATE   | SECTION                        |        | GROUP                      | PAGE |
| APOLLO 8 | A    | 12/11/68   | COMMUNICATIONS/INSTRUMENTATION |        | GENERAL/SYSTEMS MANAGEMENT | 9-2  |

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MISSION RULES

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

| MISSION  | REV | DATE     | SECTION                        | GROUP                      | PAGE |
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| APOLLO 8 | A   | 12/11/68 | COMMUNICATIONS/INSTRUMENTATION | GENERAL/SYSTEMS MANAGEMENT | 9-3  |

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**MISSION RULES**

| 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                              | <u>NO-GO LOI</u>        |  |      |
|          |      | 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                              | <u>NO-GO FOR TLI</u>    | AT LEAST ONE UP AND DOWN VOICE MODE VIA BOTH TRANSPONDERS (EXCLUDING COMMON VOICE MODE) IS REQUIRED FOR TLI. |      |
|          |      |   | TLC                              | <u>CONTINUE MISSION</u> |  |      |
|          |      | B. LOSS OF NORMAL AND BACKUP VOICE            | EPO                              | <u>NO-GO FOR TLI</u>    |  |      |
|          | TLC  | <u>CONTINUE MISSION</u>                       |                                  |                         |  |      |
| A        | 9-21 | LOSS OF FM DOWNLINK                           | ALL PHASES                       | <u>CONTINUE MISSION</u> |  |      |
| A        | 9-22 | LOSS OF ONE PMP POWER SUPPLY                  | EPO                              | <u>NO-GO FOR TLI</u>    |  |      |
|          |      |   | TLC                              | <u>CONTINUE MISSION</u> |  |      |
|          |      |   | LO                               | <u>CONTINUE MISSION</u> |  |      |
| A        | 9-23 | LOSS OF ALL VHF                               | ALL PHASES                       | <u>CONTINUE MISSION</u> |  |      |
| A        | 9-24 | LOSS OF THE UPDATE LINK                       | ALL PHASES                       | <u>CONTINUE MISSION</u> |  |      |
| A        | 9-25 | LOSS OF BOTH POWER AMPLIFIERS                 | EPO                              | <u>NO-GO FOR TLI</u>    |  |      |
|          |      |   | TLC                              | <u>CONTINUE MISSION</u> |  |      |
|          |      |   | LO                               | <u>CONTINUE MISSION</u> |  |      |
| A        | 9-26 | LOSS OF THE SCE                               | EPO                              | <u>NO-GO FOR TLI</u>    |  |      |
|          |      |   | TLC                              | ENTER NEXT PTP          |  |      |
| A        | 9-27 | LOSS OF TWO AUDIO CENTERS                     | EPO                              | <u>NO-GO FOR TLI</u>    |  |      |
|          |      |   | TLC                              | <u>CONTINUE MISSION</u> |  |      |
|          |      |   | LO                               | <u>CONTINUE MISSION</u> |  |      |
| MISSION  | REV  | DATE  | SECTION                          |                         | GROUP  | PAGE |
| APOLLO 8 | A    | 12/11/68                                      | COMMUNICATIONS / INSTRUMENTATION |                         | GENERAL/SYSTEMS MANAGEMENT   | 9-4  |

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**MISSION RULES**

| REV | ITEM | INSTRUMENTATION REQUIREMENTS |         |         |             | MISSION RULE REFERENCE |
|-----|------|------------------------------|---------|---------|-------------|------------------------|
| A   | 9-28 | MEAS DESCRIPTION             | PCM     | ONBOARD | TRANSDUCERS | CATEGORY               |
|     |      | UDL VALIDITY SIGNAL          | CT0262V | ----    | -----       | HIGHLY DESIRABLE       |
|     |      | USB RECEIVER AGC             | CT0620E | METER   | COMMON      | HIGHLY DESIRABLE       |
|     |      | USB REC $\phi$ 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       |

  

| MISSION  | REV | DATE     | SECTION                        | GROUP                        | PAGE |
|----------|-----|----------|--------------------------------|------------------------------|------|
| APOLLO 8 | A   | 12/11/68 | COMMUNICATIONS/INSTRUMENTATION | INSTRUMENTATION REQUIREMENTS | 9-5  |

10 SEQUENTIAL  
SYSTEM

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**MISSION RULES**

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

| MISSION  | REV | DATE     | SECTION           | GROUP              | PAGE |
|----------|-----|----------|-------------------|--------------------|------|
| APOLLO 8 | A   | 12/11/68 | SEQUENTIAL SYSTEM | GENERAL/MANAGEMENT | 10-1 |

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**MISSION RULES**

| REV      | RULE  | CONDITION/MALFUNCTION  | PHASE             | RULING  | CUES/NOTES/COMMENTS  |      |
|----------|-------|--|-------------------|---|--|------|
| A        | 10-10 | LOSS OF BATTERY BUS A OR B   | LAUNCH            | <u>CONTINUE MISSION</u><br>EDS AUTO/OFF - OFF   | REF MR 8-36<br>EDS BECOMES OPEN LOOP   |      |
|          |       |  | EPO               | <u>NO-GO FOR TLI</u><br>USE BAT C TO POWER BAT BUS IF BUS NOT SHORTED.  |  |      |
|          |       |  | TLC               | <u>ENTER NEXT BEST PTP</u>  |  |      |
|          |       |  | LO                | <u>ENTER NEXT BEST PTP</u>  |  |      |
|          |       |  | ENTRY             | <u>CONTINUE MISSION</u><br>REMAINING PORTION OF ENTRY WILL BE PERFORMED ON REMAINING SYSTEM.  |  |      |
|          | 10-11 | LOSS OF SEQUENTIAL LOGIC BUS A OR B  | LAUNCH            | <u>CONTINUE MISSION</u><br>PLAN ENTRY 3-1 IF BUS NOT RE-STORED.   |  |      |
|          |       |  | ALL PHASES        | <u>ENTER NEXT BEST PTP</u>  |  |      |
|          | 10-12 | PYRO BUS A OR B <35 VDC  | LAUNCH            | <u>CONTINUE MISSION</u>   | 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. |      |
|          |       |  | ALL PHASES        | A. IF SHORTED >10 AMPS, <u>ENTER NEXT BEST PTP.</u><br><br>B. IF UNSHORTED, ATTEMPT SLA SEP USING SUSPECTED BUS ONLY.<br><br>1. IF SLA SEP SUCCESSFUL, <u>CONTINUE MISSION.</u><br><br>2. IF SLA SEP UNSUCCESSFUL, POWER OTHER PYRO BUS FOR FUNCTION. <u>ENTER NEXT BEST PTP.</u> |  |      |
|          | 10-13 | TELEMETRY INDICATED AN EDS VOTE INPUT 1, 2, OR 3. (CD0132X, CD0133X, AND CD0134X RESPECTIVELY) | LAUNCH            | <u>CONTINUE MISSION</u><br>A. IF ANY ENTRY BAT <22 VDC EDS AUTO/OFF - OFF<br><br>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            | <u>CONTINUE MISSION</u><br>ATTEMPT JETTISON PER CREW CHECK-LIST PROCEDURE. IF UNSUCCESSFUL, CONTINUE INTO ORBIT.  |  |      |
| MISSION  | REV   | DATE   | SECTION           |   | GROUP  | PAGE |
| APOLLO 8 | A     | 12/11/68   | SEQUENTIAL SYSTEM |   | SPECIFIC   | 10-2 |

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**MISSION RULES**

| 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 | <u>CONTINUE MISSION</u><br>DO NOT ARM AFFECTED SYSTEM UNLESS OTHER SYSTEM FAILS UNTIL CM/SM SEP.<br><br>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.<br>B. REMOVE POWER FROM AFFECTED MAIN BUS. (FUEL CELLS AND BATTERIES.)<br><br><u>ENTER NEXT BEST PTP</u><br><br>A. RELY ON GOOD SEQUENTIAL SYSTEM FOR CSM/S-IVB AND CM/SM SEP.<br>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 | <u>CONTINUE MISSION</u><br>A. PRIOR TO CM-RCS PRESS: DO NOT ARM RESPECTIVE PYRO BUS. FOR BOTH INDICATIONS, PERFORM SLA SEP WITH SECS ARM CB'S OPEN.<br>B. AT CM-RCS PRESS, ARM RESPECTIVE PYRO BUS.  |  |
|     | 10-18 | ACTIVATED SLA DEPLOY CIRCUIT (CD0123X AND/OR CD0124X)                     | ALL PHASES | <u>CONTINUE MISSION</u><br>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 | <u>ENTER NEXT BEST PTP</u><br>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 | <u>ENTER NEXT BEST PTP</u><br>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.                                   |            |  |  |

|          |       |         |                   |          |      |
|----------|-------|---------|-------------------|----------|------|
| MISSION  | REV   | DATE    | SECTION           | GROUP    | PAGE |
| APOLLO 8 | FINAL | 11/7/68 | SEQUENTIAL SYSTEM | SPECIFIC | 10-3 |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV | ITEM  | INSTRUMENTATION REQUIREMENTS |         |         |             |                  | MISSION RULE REFERENCE |
|-----|-------|------------------------------|---------|---------|-------------|------------------|------------------------|
| A   | 10-24 | MEAS DESCRIPTION             | PCM     | ONBOARD | TRANSDUCERS | CATEGORY         |                        |
|     |       | 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 | -----   | -----       |                  | 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 |                        |

  

| MISSION  | REV | DATE     | SECTION           | GROUP                        | PAGE |
|----------|-----|----------|-------------------|------------------------------|------|
| APOLLO 8 | A   | 12/11/68 | SEQUENTIAL SYSTEM | INSTRUMENTATION REQUIREMENTS | 10-4 |



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MISSION RULES

| REV      | ITEM  | GENERAL  |                      |                            |      |
|----------|-------|--|----------------------|----------------------------|------|
|          | 11-1  | <p><u>LAUNCH</u></p> <p>THERE ARE NO FAILURES OF THE CSM GUIDANCE AND CONTROL SYSTEM WHICH ARE CAUSE FOR ABORT.</p>  |                      |                            |      |
|          | 11-2  | <p><u>EARTH ORBIT PHASE</u></p> <p>A. IN ORDER TO CONTINUE THE MISSION PAST THE NEXT BEST PTP, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE SPS CRITICAL BURN CAPABILITY AND ONE BACKUP DEORBIT METHOD (SM OR HYBRID). THE FOLLOWING MINIMUM CAPABILITIES MUST BE AVAILABLE:</p> <ol style="list-style-type: none"> <li>1. <u>ATTITUDE CONTROL</u>: DIRECT RCS AND RATE DAMPING IN EACH AXIS.</li> <li>2. <u>TVC (CRITICAL BURNS)</u>: ONE TVC SERVO LOOP IN EACH AXIS AND ONE TVC CONTROL MODE (ACCEL CMD EXCLUDED).</li> <li>3. <u>BACKUP DEORBIT</u>: AS LONG AS ENOUGH PROPELLANT IS AVAILABLE FOR AN SM DEORBIT, THE G&amp;C SYSTEMS MUST PROVIDE THAT CAPABILITY. IF SM DEORBIT IS NOT POSSIBLE DUE TO LACK OF PROPELLANT OR A SYSTEMS FAILURE, THE G&amp;C SYSTEMS MUST PROVIDE CAPABILITY FOR A HYBRID DEORBIT.</li> </ol> <p>(A) SM DEORBIT REQUIREMENTS:</p> <ul style="list-style-type: none"> <li>- TRANSLATION CAPABILITY</li> <li>- ONE OPERATIONAL FDAI</li> <li>- RATE DAMPING IN ALL THREE AXES (DAP OR SCS)</li> </ul> <p>(B) HYBRID DEORBIT REQUIREMENTS:</p> <ul style="list-style-type: none"> <li>- ALL SM DEORBIT REQUIREMENTS (RATE DAMPING MUST BE SCS)</li> <li>- OPERATIONAL, IMU, CMC, AND MAIN DSKY</li> <li>- TWO OPERATIONAL RHC'S</li> </ul> <p>B. IN ORDER TO PERFORM A NON-CRITICAL BURN AFTER THE STORAGE TANKS ARE EMPTY, THE G&amp;C SYSTEMS MUST PROVIDE THE CAPABILITY TO EXECUTE AN ULLAGE MANEUVER BY EITHER CMC AUTO (RCS DAP), SCS AUTO, OR DIRECT ULLAGE.</p> <p>C. IN ORDER TO COMMIT TO THE TRANSLUNAR COAST PHASE, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE SPS NON-CRITICAL BURN CAPABILITY. THE FOLLOWING MINIMUM CAPABILITIES MUST ALSO BE AVAILABLE TO BE GO FOR TLI:</p> <ol style="list-style-type: none"> <li>1. <u>ATTITUDE CONTROL</u>: DIRECT RCS AND RATE DAMPING IN EACH AXIS.</li> <li>2. <u>TVC</u>: TWO SERVO LOOPS AND BOTH G&amp;N AND ONE SCS TVC CONTROL MODES (ACCEL CMD EXCLUDED).</li> <li>3. <u>G&amp;N</u>: CMC, IMU, AND MDC DSKY FULLY OPERATIONAL AND OPTICS CAPABLE OF ALIGNING PLATFORM.</li> <li>4. <u>DISPLAYS</u>: ONE OPERATIONAL FDAI.</li> <li>5. <u>ATTITUDE REFERENCE</u>: REDUNDANT ATTITUDE SOURCES ARE REQUIRED FOR ENTRY.</li> </ol> |                      |                            |      |
|          | 11-3  | <p><u>TRANSLUNAR COAST</u></p> <p>IN ORDER TO CONTINUE THE MISSION PAST THE NEXT BEST PTP, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES:</p> <ol style="list-style-type: none"> <li>A. <u>ATTITUDE CONTROL</u>: DIRECT RCS AND RATE DAMPING IN EACH AXIS.</li> <li>B. <u>RCS TRANSLATION</u>: X-AXIS VIA AUTO COILS.</li> <li>C. <u>ATTITUDE REFERENCE</u>: REDUNDANT ATTITUDE REFERENCE SOURCES ARE REQUIRED FOR ENTRY.</li> </ol>  |                      |                            |      |
| MISSION  | REV   | DATE   | SECTION              | GROUP                      | PAGE |
| APOLLO 8 | FINAL | 11/7/68  | GUIDANCE AND CONTROL | GENERAL/SYSTEMS MANAGEMENT | 11-1 |

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**MISSION RULES**

| REV      | ITEM  |  |                      |                            |      |
|----------|-------|--|----------------------|----------------------------|------|
|          | 11-4  | <p><u>LOI, LUNAR ORBIT PHASES:</u></p> <p>A. LOI<sub>1</sub> WILL BE INHIBITED OR LUNAR ORBIT TERMINATED EARLY IF EITHER REDUNDANT ATTITUDE CONTROL, REDUNDANT SPS CONTROL OR NON-CRITICAL SPS CAPABILITY IS LOST. IN ADDITION, THE FOLLOWING MINIMUM CAPABILITIES MUST BE AVAILABLE BEFORE COMMITTING TO OR CONTINUING LUNAR ORBIT.</p> <ol style="list-style-type: none"> <li>1. <u>ATTITUDE CONTROL:</u> DIRECT RCS AND RATE DAMPING IN EACH AXIS.</li> <li>2. <u>TVC:</u> BOTH SERVO LOOPS AND TWO TVC CONTROL MODES (ACCEL CMD EXCLUDED).</li> <li>3. <u>G&amp;N:</u> THE G&amp;N MUST BE FULLY OPERATIONAL WITH THE EXCEPTION OF OPTICS AND NAV DSKY. OPTICS MUST BE CAPABLE OF ALIGNING PLATFORM.</li> <li>4. <u>RCS TRANSLATION:</u> "X"-AXIS VIA AUTO COILS.</li> </ol> <p>B. IN ORDER TO PERFORM A NON-CRITICAL BURN THE G&amp;C SYSTEMS MUST PROVIDE THE CAPABILITY TO EXECUTE AN ULLAGE MANEUVER BY EITHER CMC AUTO (RCS DAP), SCS AUTO, OR DIRECT ULLAGE.</p> |                      |                            |      |
|          |       | <p>RULES 11-5 THROUGH 11-14 ARE RESERVED.</p>  |                      |                            |      |
| MISSION  | REV   | DATE   | SECTION              | GROUP                      | PAGE |
| APOLLO 8 | FINAL | 11/7/68  | GUIDANCE AND CONTROL | GENERAL/SYSTEMS MANAGEMENT | 11-2 |

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**MISSION RULES**

| 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 <sup>2</sup> AND 0.075 DEG/HR RESPECTIVELY.  |                      |                            |      |
| A        | 11-16 | <u>ΔV COUNTER DRIFT</u><br><br>SHOULD THE ΔV COUNTER DRIFT BE >.032 FT/SEC <sup>2</sup> , AND BE REPEATABLE, SUBSEQUENT SETTINGS WILL BE SUITABLY BIASED. THE TOLERANCE SPREAD ON REPEATABILITY IS .03 FT/SEC <sup>2</sup> .  |                      |                            |      |
| A        | 11-17 | <u>DAP INITIALIZATION</u><br><br>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.<br><br><u>CSM WT:</u> WILL BE UPDATED WHEN ACTUAL VALUE DIFFERS FROM VALUE IN CMC ERASABLE BY 1 PERCENT. |                      |                            |      |
|          |       | RULES 11-18 THROUGH<br>11-24 ARE RESERVED.  |                      |                            |      |
| MISSION  | REV   | DATE  | SECTION              | GROUP                      | PAGE |
| APOLLO 8 | A     | 12/11/68  | GUIDANCE AND CONTROL | GENERAL/SYSTEMS MANAGEMENT | 11-3 |

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**MISSION RULES**

| REV      | RULE  | CONDITION/MALFUNCTION   | PHASE                | RULING  | CUES/NOTES/COMMENTS   |      |
|----------|-------|---|----------------------|---|---|------|
|          | 11-25 | LOSS OF BMAG 1 OR 2 IN:<br><br>A. PITCH AXIS<br><br>B. YAW AXIS | LAUNCH               | CONTINUE MISSION  | MALF PROC: SCS 3,6<br><br>IF FAILURE IS YAW 1, FDAI ROLL IS LOST.                               |      |
|          |       |   | ALL                  | A. CONTINUE MISSION<br>DELETE SCS AUTO BURNS  |   |      |
|          |       |   | ALL                  | B.1. CONTINUE MISSION<br>DELETE SCS AUTO BURNS<br><br>2. CONTINUE MISSION<br>AFTER .05G RSI IS USABLE IF REMAINING GYRO IS SELECTED FOR RATE.   |   |      |
|          | 11-26 | LOSS OF BOTH BMAG 1 AND 2 IN EITHER PITCH OR YAW AXIS           | LAUNCH               | CONTINUE MISSION<br>MTVC ACCEL CMD IS ONLY MODE III OR IV CAPABILITY.   | VIOLATES REDUNDANT ENTRY ATTITUDE REF CRITERIA.   |      |
|          |       |   | EPO                  | ENTER NEXT BEST PTP   |   |      |
|          |       |   | TLC                  | NO GO FOR LOI<br>ENTER NEXT BEST PTP IF YAW AXIS.   |   |      |
|          |       |   | LO                   | PLAN TEI FOR NEXT OPPORTUNITY   |   |      |
|          | 11-27 | LOSS OF ROLL BMAG<br><br>A. NUMBER ONE<br><br>B. NUMBER TWO     | LAUNCH               | CONTINUE MISSION<br>MANUAL ROLL ATTITUDE CONTROL REQUIRED IN ALL SCS MODES.   | MALF PROC: SCS 3.6<br><br>WITH A HARDOVER FAILURE THE ATT 1/RATE 2 CONFIGURATION IS NOT USABLE. |      |
|          |       |   | ENTRY                | CONTINUE MISSION<br>NO SCS FDAI ROLL. RSI VALID.  |   |      |
|          |       |   | ENTRY                | CONTINUE MISSION<br>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.)<br><br>CONTINUE MISSION<br>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<br>CONTINUE MISSION IF SM DEORBIT AVAILABLE.<br><br>2. ENTER NEXT BEST PTP<br>IF SM DEORBIT NOT AVAILABLE  |   |      |
|          |       |   | TLC                  | ENTER NEXT BEST PTP   |   |      |
|          |       |   | LO                   | PLAN TEI FOR NEXT OPPORTUNITY   |   |      |
|          |       |   | ENTRY                | CONTINUE MISSION<br>RSI AND FDAI ROLL UNUSABLE  |   |      |
| MISSION  | REV   | DATE  | SECTION              |   | GROUP   | PAGE |
| APOLLO 8 | A     | 12/11/68  | GUIDANCE AND CONTROL |   | SPECIFIC - SCS  | 11-4 |

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**MISSION RULES**

| REV      | RULE  | CONDITION/MALFUNCTION  | PHASE                                  | RULING  | CUES/NOTES/COMMENTS                      |      |
|----------|-------|--|--|---|--|------|
|          | 11-29 | LOSS OF EITHER TVC SERVO LOOP IN EITHER PITCH OR YAW AXIS.                   | LAUNCH/<br>EPO<br><br>TLC<br>LO<br>TEC | <u>NO GO FOR TLI.</u> AS APPROPRIATE, SELECT 1 OR 2 ON TVC GMBL DR SWITCH.<br><br><u>NO GO FOR LOI.</u><br><br><u>PLAN TEI FOR NEXT OPPORTUNITY.</u><br><br><u>CONTINUE MISSION.</u> AS APPROPRIATE, SELECT 1 OR 2 ON TVC GMBL DR SWITCH. | FAILURE PROBABLY NOT DETECTABLE PRE-TLI. |      |
|          | 11-30 | LOSS OF BOTH TVC SERVO LOOPS   | LAUNCH<br><br>EPO<br>TLC               | <u>CONTINUE MISSION</u><br>NO MODE III OR IV CAPABILITY. LIMITED LANDING POINT CONTROL IN MODE III OR IV WITH SM-RCS.<br><br><u>ENTER NEXT BEST PTP</u><br>RCS DEORBIT.<br><br><u>NO GO FOR LOI.</u>                                      | MALF PROC: SCS _____                     |      |
|          | 11-31 | LOSS OF PROPORTIONAL CONTROL FROM:<br><br>A. EITHER RHC<br><br>B. BOTH RHC'S | ALL<br><br>ALL                         | A. <u>CONTINUE MISSION</u><br>USE REMAINING RHC<br><br>B. <u>CONTINUE MISSION</u><br>USE DIRECT RCS OR ACCEL CMD FOR MANUAL MANEUVERS. NO MTVC CAPABILITY.  | MALF PROC: SCS _____                     |      |
|          | 11-32 | LOSS OF DIRECT RCS CONTROL<br><br>A. EITHER RHC<br><br>B. BOTH RHC'S         | ALL<br>LAUNCH<br>EPO<br>TLC<br>LO      | A. <u>CONTINUE MISSION</u><br><br>B. <u>CONTINUE MISSION</u><br><br><u>ENTER NEXT BEST PTP.</u><br><br><u>ENTER NEXT BEST PTP. NO GO FOR LOI.</u><br><br><u>PLAN TEI FOR NEXT OPPORTUNITY.</u>  | MALF PROC: SCS _____                     |      |
| MISSION  | REV   | DATE   | SECTION                                |   | GROUP                                    | PAGE |
| APOLLO 8 | FINAL | 11/7/68  | GUIDANCE AND CONTROL                   |   | SPECIFIC - SCS                           | 11-5 |

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**MISSION RULES**

| REV | RULE  | CONDITION/MALFUNCTION   | PHASE   | RULING                               | CUES/NOTES/COMMENTS  |  |
|-----|-------|---|---|--------------------------------------|--|--|
| A   | 11-33 | COMPLETE LOSS OF AUTO ATTITUDE CONTROL IN PITCH AND YAW CHANNELS. | LAUNCH  | <u>CONTINUE MISSION</u>              | MALF PROC: SCS _____<br>SUSPECTED FAILURE WOULD BE AUTO INHIBIT CIRCUITRY.<br><br>SCS TVC CAPABILITY COMPROMISED BY LACK OF ATTITUDE CONTROL.<br><br>FAILURE VIOLATES MINIMUM CAPABILITY CRITERIA FOR BOTH BACKUP DEORBIT METHODS.<br><br>FAILURE VIOLATES RATE DAMPING CRITERIA.  |  |
|     |       |   | A. CONTROL IS REGAINED BY OPENING EMS CB'S                          | ALL                                  |  | A. <u>CONTINUE MISSION</u><br>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. <u>NO-GO FOR TLI</u> CONTINUE MISSION IF SM DEORBIT CAPABILITY AVAILABLE.<br><br>2. <u>ENTER NEXT BEST PTP</u> IF SM DEORBIT NOT AVAILABLE. |
|     |       |   |   | TLC                                  |  | <u>NO-GO FOR LOI</u>   |
|     |       |   |   | LO                                   |  | <u>PLAN TEI FOR NEXT OPPORTUNITY</u>   |
|     |       |   |   | EPO                                  |  | C. <u>ENTER NEXT BEST PTP</u>  |
|     |       |   | C. CONTROL IS NOT REGAINED  | TLC                                  | <u>ENTER NEXT BEST PTP</u><br><u>NO-GO FOR LOI</u><br>USE DIRECT ULLAGE AND DIRECT RCS   |  |
|     |       |   |   | LO                                   | <u>PLAN TEI FOR NEXT OPPORTUNITY</u>   |  |
|     | 11-34 | LOSS OF FLIGHT DIRECTOR ATTITUDE INDICATORS                       |   |                                      |  | MALF PROC: SCS _____   |
|     |       |   | A. ONE  | ALL                                  | A. <u>CONTINUE MISSION</u>   |  |
|     |       |   | B. BOTH   | EPO                                  | B. <u>ENTER NEXT BEST PTP</u>  |  |
|     |       |   |   | TLC                                  | <u>NO-GO FOR LOI</u>   |  |
|     |       |   | LO  | <u>PLAN TEI FOR NEXT OPPORTUNITY</u> |  |  |
| A   | 11-35 | LOSS OF AC1 φ A   | LAUNCH  | <u>CONTINUE MISSION</u>              | LOSS OF AC1 φ A RESULTS IN THE LOSS OF:<br><br>A. REDUNDANT SERVO LOOP POWER.<br>B. PROPORTIONAL CONTROL FROM BOTH RHC'S FOR ATTITUDE CONTROL.<br>C. FDAI #1 BALL POWER.<br>D. SCS ATTITUDE ERROR.<br>E. GYRO ASSEMBLY NO. 1 (THEREFORE, LOSS OF SCS AUTO TVC AND ATTITUDE HOLD).<br>F. SCS ATTITUDE CONTROL-MIN. IMPULSE, RATE DAMPING PSEUDO RATE.<br>G. PROPORTIONAL CONTROL FROM RHC #1 FOR TVC.<br>H. FDAI ROLL FOR ENTRY.<br>I. GDC TOTAL ATTITUDE.<br>J. FDAI LIGHTING.<br>K. 1/2 OF FP/GPI |  |
|     |       |   |   | EPO                                  |  | <u>ENTER NEXT BEST PTP</u>   |
|     |       |   |   | TLC                                  |  | <u>NO-GO FOR LOI</u>   |
|     |       |   |   | LO                                   |  | <u>PLAN TEI FOR NEXT OPPORTUNITY</u>   |

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MISSION RULES

| REV      | RULE  | CONDITION/MALFUNCTION  | PHASE                | RULING  | CUES/NOTES/COMMENTS  |      |
|----------|-------|--|----------------------|---|--|------|
| A        | 11-36 | LOSS OF AC2 $\phi$ A   | LAUNCH               | <u>CONTINUE MISSION</u>   | LOSS OF AC2 $\phi$ A RESULTS IN THE LOSS OF:<br>A. REDUNDANT SERVO LOOP POWER.<br>B. PROPORTIONAL CONTROL FROM BOTH RHC'S.<br>C. FDAI #2 BALL POWER.<br>D. GYRO ASSEMBLY 2.<br>E. ALL SCS TVC CAPABILITY.<br>F. RSI<br>G. GDC TOTAL ATTITUDE<br>H. 1/2 OF FP/GPI |      |
|          |       |  | EPO                  | <u>ENTER NEXT BEST PTP</u>  |  |      |
|          |       |  | TLC                  | <u>NO-GO FOR LOI</u>  |  |      |
|          |       |  | LO                   | <u>PLAN TEI FOR NEXT OPPORTUNITY</u>                                    |  |      |
|          | 11-37 | LOSS OF ORBIT RATE DISPLAY EARTH AND LUNAR (ORDEAL)          | ALL                  | <u>CONTINUE MISSION</u>   |  |      |
|          | 11-38 | LOSS OF ENTRY MONITOR SYSTEM                                 | ALL                  | <u>CONTINUE MISSION</u>   |  |      |
|          | 11-39 | GROUND AT EITHER SPS SOL DRIVER OUTPUT AND UNABLE TO REMOVE. | LAUNCH               | <u>CONTINUE MISSION</u>   | REMOVAL MAY REQUIRE LOSS OF TVC DAP OR $\Delta$ V COUNTER.   |      |
|          |       |  | EPO                  | <u>NO-GO FOR TLI</u><br><u>USE OTHER SPS BANK FOR ENGINE OPERATION.</u> |  |      |
|          |       |  | TLC                  | <u>NO-GO FOR LOI</u>  |  |      |
|          |       |  | LO                   | <u>PLAN TEI FOR NEXT OPPORTUNITY</u>                                    |  |      |
|          |       | RULES 11-40 THROUGH 11-44 ARE RESERVED.                      |                      |   |  |      |
| MISSION  | REV   | DATE   | SECTION              |   | GROUP  | PAGE |
| APOLLO 8 | A     | 12/11/68   | GUIDANCE AND CONTROL |   | SPECIFIC - SCS   | 11-7 |

**NASA — Manned Spacecraft Center**

**MISSION RULES**

| REV      | RULE  | CONDITION/MALFUNCTION   | PHASE  | RULING   | CUES/NOTES/COMMENTS   |      |
|----------|-------|---|--|--|---|------|
|          | 11-45 | LOSS OF COMMAND MODULE COMPUTER                                   | LAUNCH<br>EPO<br><br>TLC<br>LO<br>ENTRY            | <u>CONTINUE MISSION</u><br><br>1. <u>NO-GO FOR TLI. CONTINUE MISSION IF SM DEORBIT CAPABILITY AVAILABLE.</u><br><br>2. <u>ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE.</u><br><br><u>NO-GO FOR LOI</u><br><br><u>PLAN TEI FOR NEXT OPPORTUNITY</u><br><br><u>FLY EMS ENTRY</u>                             | MALF PROC: G&C _____  |      |
|          | 11-46 | LOSS OF MDC DSKY  | ALL  | <u>CONTINUE MISSION</u>  | MALF PROC: G&C _____  |      |
|          | 11-47 | LOSS OF NAV DSKY<br>A. ENCODER OR DECODER<br>B. CMC WARNING RELAY | ALL<br>LAUNCH<br><br>EPO<br><br>TLC<br>LO<br>ENTRY | A. <u>CONTINUE MISSION</u><br><br>B. <u>CONTINUE MISSION</u><br><br>1. <u>NO-GO FOR TLI. CONTINUE MISSION IF SM DEORBIT AVAILABLE.</u><br><br>2. <u>ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE.</u><br><br><u>NO-GO FOR LOI.</u><br><br><u>PLAN TEI FOR NEXT OPPORTUNITY.</u><br><br><u>FLY EMS ENTRY</u> | B. CONSTITUTES LOSS OF PIPA'S G&N TVC, ENTRY GUIDANCE, AND FINE ALIGN.<br><br>PIPA'S ARE REQUIRED FOR ΔV SENSING IN HYBRID DEORBIT. |      |
|          | 11-48 | LOSS OF INERTIAL SUBSYSTEM  | LAUNCH<br>EPO<br><br>TLC<br>LO<br>ENTRY            | <u>CONTINUE MISSION</u><br><br>1. <u>NO-GO FOR TLI. CONTINUE MISSION IF SM DEORBIT AVAILABLE.</u><br><br>2. <u>ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE.</u><br><br><u>NO-GO FOR LOI</u><br><br><u>PLAN TEI FOR NEXT OPPORTUNITY</u><br><br><u>FLY EMS ENTRY</u>  | MALF PROC: G&C _____<br><br>VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS.   |      |
| MISSION  | REV   | DATE  | SECTION  |  | GROUP   | PAGE |
| APOLLO 8 | FINAL | 11/7/68   | GUIDANCE AND CONTROL                               |  | SPECIFIC - G&N  | 11-8 |

**NASA — Manned Spacecraft Center**

**MISSION RULES**

| REV      | RULE  | CONDITION/MALFUNCTION  | PHASE                          | RULING  | CUES/NOTES/COMMENTS   |      |
|----------|-------|--|--------------------------------|---|---|------|
|          | 11-49 | LOSS OF OPTICS SUBSYSTEM   | LAUNCH<br>EPO<br>TLC<br>LO/TEC | <u>NOT APPLICABLE</u><br><u>NO-GO FOR TLI</u><br><u>NO-GO FOR LOI</u><br><u>CONTINUE MISSION</u>              | FOR THIS PURPOSE "LOSS" MEANS OPTICS FOGGED OR COVERED SUCH THAT CREW CANNOT SIGHT STARS, OR INOPERABLE IN MANUAL MODE. |      |
| A        | 11-50 | LOSS OF OPTICS SUBSYSTEM COUPLING DATA UNIT DIGITAL TO ANALOG CONVERTER. | LAUNCH<br>EPO<br>TLC<br>LO     | <u>NOT APPLICABLE</u><br><u>NO-GO FOR TLI</u><br><u>NO-GO FOR LOI</u><br><u>PLAN TEI FOR NEXT OPPORTUNITY</u> | CONSTITUTES LOSS OF G&N TVC.  |      |
|          |       | RULE 11-51 THROUGH 11-59 ARE RESERVED.                                   |                                |   |   |      |
| MISSION  | REV   | DATE   | SECTION                        |   | GROUP   | PAGE |
| APOLLO 8 | A     | 12/11/68   | GUIDANCE AND CONTROL           |   | SPECIFIC - G&N  | 11-9 |

**NASA — Manned Spacecraft Center**

**MISSION RULES**

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

| MISSION  | REV   | DATE    | SECTION              | GROUP          | PAGE |
|----------|-------|---------|----------------------|----------------|------|
| APOLLO 8 | FINAL | 11/7/68 | GUIDANCE AND CONTROL | SPECIFIC - G&N | 11-9 |

NASA — Manned Spacecraft Center

MISSION RULES

| 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               |
| MISSION  | REV   | DATE                   | SECTION              |         | GROUP                        | PAGE                          |                        |
| APOLLO 8 | A     | 12/11/68               | GUIDANCE AND CONTROL |         | INSTRUMENTATION REQUIREMENTS | 11-10                         |                        |

12 CSM SERVICE  
PROPULSION  
SERVICE

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV      | ITEM | GENERAL   |                               |                            |      |
|----------|------|---|-------------------------------|----------------------------|------|
|          | 12-1 | <p><u>LAUNCH</u></p> <p>THERE ARE NO SPS FAILURES THAT ARE CONSIDERED CAUSE FOR ABORT.</p>  |                               |                            |      |
|          | 12-2 | <p><u>ALL OTHER PHASES:</u></p> <p>A. FAILURES AFFECTING THE SPS FALL INTO ONE OF THREE CATEGORIES:</p> <ol style="list-style-type: none"> <li>1. FAILURES THAT CAUSE THE SPS TO BE UNSAFE. FAILURES IN THIS CATEGORY CAUSE THE MISSION TO BE <u>TERMINATED BY ENTRY INTO THE NEXT BEST PTP.</u></li> <li>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.</li> <li>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.</li> </ol> <p>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.</p> <p>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.</p> |                               |                            |      |
|          | 12-3 | <p><u>EARTH ORBIT PHASE:</u></p> <p>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 <u>TERMINATED BY ENTRY INTO THE NEXT BEST PTP</u> USING SM OR HYBRID TECHNIQUES.</p> <p>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.</p>   |                               |                            |      |
| A        | 12-4 | <p><u>TRANSLUNAR COAST PHASE:</u></p> <p>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.</p> <p>B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL BURNS, FURTHER NON-CRITICAL BURNS AND LOI WILL BE INHIBITED.</p>  |                               |                            |      |
|          | 12-5 | <p><u>LUNAR ORBIT</u></p> <p>A. TEI IS THE ONLY CRITICAL MANEUVER IN THIS PHASE.</p> <p>B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL MANEUVERS, FURTHER NON-CRITICAL MANEUVERS WILL BE INHIBITED.</p>  |                               |                            |      |
| MISSION  | REV  | DATE  | SECTION                       | GROUP                      | PAGE |
| APOLLO 8 | A    | 12/11/68  | CSM SERVICE PROPULSION SYSTEM | GENERAL/SYSTEMS MANAGEMENT | 12-1 |



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MISSION RULES

| REV                                    | ITEM   |
|--|--|
|  | SYSTEM MANAGEMENT  |
| 12-15                                  | <p><u>PROPELLANT GAGING</u></p> <p>A. PRIME METHOD: ONBOARD GAGING SYSTEM (1%)</p> <p>B. BACKUP METHOD:</p> <ol style="list-style-type: none"> <li>1. FLOW RATE X BURN TIME ( _____ %)</li> <li>2. HELIUM PRESSURE/TEMPERATURE ( _____ %)</li> </ol> |
| 12-16                                  | <p><u>PROPELLANT UTILIZATION VALVE</u></p> <p>THE PU VALVE WILL BE USED TO CONTROL THE O/F MIXTURE RATIO TO MAINTAIN PROPELLANT BALANCE WITHIN ± 100 POUNDS.</p>   |
| 12-17                                  | <p><u>DUAL BANK VS SINGLE BANK OPERATION</u></p> <p>ALL PLANNED SPS BURNS WILL BE PERFORMED USING DUAL BANK OPERATION.</p>   |
| 12-18                                  | <p><u>FEEDLINE HEATERS:</u></p> <p>THE SPS PROPELLANT FEEDLINE TEMPERATURES WILL BE MAINTAINED BETWEEN 45 AND 75°F MANUALLY.</p>   |
| A 12-19                                | <p>THE SPS PU VALVE TEMPERATURE WILL BE MAINTAINED ABOVE 35°F BY ORIENTING THE SPACECRAFT FOR OPTIMUM SOLAR RADIATION EFFECTS.</p>   |
| RULES 12-20 THROUGH 12-24 ARE RESERVED |  |

| MISSION  | REV | DATE     | SECTION                       | GROUP                      | PAGE |
|----------|-----|----------|-------------------------------|----------------------------|------|
| APOLLO 8 | A   | 12/11/68 | CSM SERVICE PROPULSION SYSTEM | GENERAL/SYSTEMS MANAGEMENT | 12-3 |

## NASA — Manned Spacecraft Center

### MISSION RULES

| 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). | LAUNCH | <u>CONTINUE MISSION</u><br><ul style="list-style-type: none"> <li>● PLAN ENTRY INTO PTP 2-1. RCS DEORBIT.</li> <li>● IF LAND IMPACT IS IMMINENT AFTER ABORTING, REPRESS MANUALLY AND PERFORM BURN TO AVOID LAND.</li> </ul> | MALF PROC: SPS 1<br><br>MANUAL PRESSURIZATION OF THE TANKS SHOULD BE CONSIDERED PRIOR TO ANY REQUIRED SPS BURN<br><br>THIS RULING SUBJECT TO CHANGE PENDING INVESTIGATION OF SERIOUSNESS OF LIQUID LEAKS INTO SERVICE MODULE. |
|                  |  |   | EPO    | <u>ENTER NEXT BEST PTP</u><br>RCS DEORBIT   |   |
|                  |  |   | TLC    | <u>NO-GO FOR LOI INHIBIT NON-CRITICAL SPS BURNS</u>   |   |
|                  |  |   | LO     | <u>PLAN TEI ASAP</u>  |   |
|                  |  |   | TEC    | <u>CONTINUE MISSION INHIBIT NON-CRITICAL SPS BURNS.</u>   |   |
|                  |  |   | ALL    | A. TERMINATE BURN IF LOI <sub>1</sub> REPRESS MANUALLY AND PERFORM 15 MIN ABORT.  |   |
| A                | 12-26  | LOSS OF ONE GN <sub>2</sub> TANK PRESSURE (<400 PSI).   | LAUNCH | <u>CONTINUE MISSION</u>   | TRANSDUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION.  |
|                  |  |   | EPO    | <u>CONTINUE MISSION</u>   |   |
| TLC              | <u>NO-GO FOR LOI</u>   |   |        |   |   |
| LOI <sub>1</sub> | BE PREPARED TO SHUTDOWN SPS ASAP IF ALL BALL VALVES DO NOT OPEN. IF OTHER GN <sub>2</sub> TANK LEAKING, TERMINATE BURN AND PERFORM 15 MIN ABORT. |   |        |   |   |
| LO               | <u>PLAN TEI FOR NEXT OPPORTUNITY.</u>  |   |        |   |   |
| A                | 12-27  | ONE BANK OF BALL VALVES FAIL TO OPEN DURING AN SPS BURN   | LAUNCH | <u>CONTINUE MISSION</u>   |   |
| EPO              | <u>CONTINUE MISSION</u>  |   |        |   |   |
| TLC              | <u>NO-GO FOR LOI</u>   |   |        |   |   |
| LOI <sub>1</sub> | BE PREPARED TO SHUTDOWN SPS ASAP IF ALL BALL VALVES DO NOT OPEN. IF OTHER GN <sub>2</sub> TANK LEAKING, TERMINATE BURN AND PERFORM 15 MIN ABORT. |   |        |   |   |
| LO               | <u>PLAN TEI FOR NEXT OPPORTUNITY.</u>  |   |        |   |   |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV | RULE  | CONDITION/MALFUNCTION                                   | PHASE  | RULING   | CUES/NOTES/COMMENTS  |
|-----|-------|---|--|--|----------------------|
| A   | 12-28 | LOSS OF BOTH GN <sub>2</sub> TANK PRESSURES (<400 PSI). | LAUNCH<br>EARTH ORBIT<br>TLC<br>LUNAR ORBIT<br>TEC | <u>CONTINUE MISSION</u><br><br><u>ENTER NEXT BEST PTP</u><br>RCS DEORBIT<br><br><u>NO-GO FOR LOI</u> NO ABORT<br>CAPABILITY<br><br><u>ATTEMPT TEI</u><br><br><u>CONTINUE MISSION</u> | MALF PROC: SPS _____ |

  

| MISSION  | REV | DATE     | SECTION                       | GROUP        | PAGE  |
|----------|-----|----------|-------------------------------|--------------|-------|
| APOLLO 8 | A   | 12/11/68 | CSM SERVICE PROPULSION SYSTEM | SPECIFIC-SPS | 12-4A |

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**MISSION RULES**

| 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<br>EARTH ORBIT<br>TLC<br>LUNAR ORBIT<br>TEC | <u>CONTINUE MISSION</u><br><u>ENTER NEXT BEST PTP</u><br>RCS DEORBIT<br><u>NO-GO FOR LOI</u> NO ABORT<br>CAPABILITY<br><u>ATTEMPT TEI</u><br><u>CONTINUE MISSION</u>  | MALF PROC: SPS ____                        |      |
| A        | 12-30 | PU VALVE TEMP <27°F AND UNABLE TO INCREASE VIA SOLAR RADIATION.  | TLC<br>LUNAR ORBIT<br>TEC                          | <u>NO-GO FOR LOI</u><br><u>PLAN TEI FOR NEXT OPPORTUNITY.</u><br><u>CONTINUE MISSION</u>  |  |      |
| A        | 12-31 | ENGINE FLANGE TEMP GOES HIGHER THAN 480°F DURING AN SPS BURN.<br><br>A. DURING NON-CRITICAL BURNS<br><br>B. DURING CRITICAL BURNS    | LAUNCH<br>EARTH ORBIT<br>ALL<br>ALL                | NOT APPLICABLE<br><u>ENTER NEXT BEST PTP</u><br>RCS DEORBIT<br>A. <u>TERMINATE BURN</u><br>IF LOI <sub>1</sub> , MODE 1, PERFORM 15 MIN<br>ABORT.<br>B. <u>CONTINUE BURN INHIBIT</u><br>FURTHER NON-CRITICAL BURNS  | REF RULE <u>1-37</u> FOR CRITICAL<br>BURNS |      |
| A        | 12-32 | THRUST CHAMBER PRESSURE <70 PSI CONFIRMED BY OTHER INSTRUMENTATION<br><br>A. DURING NON-CRITICAL BURN<br><br>B. DURING CRITICAL BURN | LAUNCH<br>EARTH ORBIT<br>TLC<br>ALL<br>ALL         | NOT APPLICABLE<br><u>ENTER NEXT BEST PTP</u><br>RCS DEORBIT<br><u>NO-GO FOR LOI</u><br>INHIBIT FURTHER BURNS<br>A. <u>TERMINATE BURN</u><br>IF LOI <sub>1</sub> PERFORM 15 MIN ABORT.<br>B. <u>CONTINUE BURN AND</u><br>INHIBIT FURTHER NON-CRITICAL<br>BURNS | REF RULE <u>1-37</u> FOR CRITICAL<br>BURNS |      |
|          | 12-33 | LACK OF ULLAGE CAPABILITY  | LAUNCH<br>EPO<br>TLC<br>LO/TEC                     | NOT APPLICABLE<br><u>NO-GO FOR TLI</u><br><u>NO-GO FOR LOI</u><br>INHIBIT NON-CRITICAL MANEUVERS.   |  |      |
| MISSION  | REV   | DATE   | SECTION  |   | GROUP                                      | PAGE |
| APOLLO 8 | A     | 12/11/68   | CSM SERVICE PROPULSION SYSTEM                      |   | SPECIFIC-SPS                               | 12-5 |

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MISSION RULES

| REV      | RULE  | CONDITION/MALFUNCTION  | PHASE   | RULING  | CUES/NOTES/COMMENTS                      |       |
|----------|-------|--|---|---|--|-------|
| A        | 12-34 | <p>ΔP BETWEEN FUEL AND OXIDIZER TANK PRESSURES &gt;20 PSI AND UNABLE TO DECREASE</p> <p>A. DURING NON-CRITICAL BURN</p> <p>B. DURING CRITICAL BURN</p> | <p>LAUNCH</p> <p>EPO</p> <p>TLC</p> <p>LO</p> <p>ALL</p> <p>ALL</p> | <p><u>CONTINUE MISSION</u></p> <p><u>ENTER NEXT BEST PTP</u><br/><u>RCS DEORBIT</u></p> <p><u>NO-GO FOR LOI</u></p> <p><u>ATTEMPT TEI</u></p> <p>A. <u>TERMINATE BURN</u><br/>IF LOI<sub>1</sub> PERFORM 15 MIN ABORT.</p> <p>B. <u>CONTINUE BURN</u></p> | <p>REF RULE 1-37 FOR CRITICAL BURNS.</p> |       |
| MISSION  | REV   | DATE   | SECTION   |   | GROUP                                    | PAGE  |
| APOLLO 8 | A     | 12/11/68   | CSM SERVICE PROPULSION SYSTEM                                       |   | SPECIFIC-SPS                             | 12-5A |

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**MISSION RULES**

| 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<br><br>EPO<br><br>TLC<br><br>LO<br><br>TEC | <u>CONTINUE MISSION</u><br><br><u>ENTER NEXT BEST PTP</u><br>RCS DEORBIT<br><br><u>NO-GO FOR LOI</u><br><br><u>PLAN TEI ASAP</u><br><br>1. <u>CONTINUE MISSION</u><br>2. <u>SPS MANEUVERS ALLOWED</u><br>WITHIN BLOWDOWN CAPABILITY | RULING SUBJECT TO CHANGE PENDING INVESTIGATION OF BLOWDOWN CAPABILITY.<br><br>BLOWDOWN ΔV REMAINING IS A FUNCTION OF ULLAGE VOLUME AT TIME OF FAILURE. |      |
|          |       | RULES 12-36 THROUGH 12-39 ARE RESERVED   |   |   |  |      |
| MISSION  | REV   | DATE   | SECTION   |   | GROUP  | PAGE |
| APOLLO 8 | FINAL | 11/7/68  | CSM SERVICE PROPULSION SYSTEM                     |   | SPECIFIC-SPS   | 12-6 |

NASA — Manned Spacecraft Center

MISSION RULES

| REV      | ITEM  | INSTRUMENTATION REQUIREMENTS |                               |                              |             |                      | MISSION RULE REFERENCE |
|----------|-------|------------------------------|-------------------------------|------------------------------|-------------|----------------------|------------------------|
| MISSION  | REV   | DATE                         | SECTION                       | GROUP                        | PAGE        |                      |                        |
| A        | 12-40 |                              |                               |                              |             |                      |                        |
|          |       | MEAS DESCRIPTION             | PCM                           | ONBOARD                      | TRANSDUCERS | CATEGORY             | MISSION RULE REFERENCE |
|          |       | OX TK PRESS                  | SP0003P                       | METER/C&W                    | COMMON      | MANDATORY            | -1 OF 2<br>12-25/34    |
|          |       | OX SM/ENG INTERFACE P        | SP0931P                       | -                            | -           | MANDATORY            |                        |
|          |       | FU TK PRESS                  | SP0006P                       | METER/C&2                    | COMMON      | MANDATORY            | -1 OF 2<br>12-25/34    |
|          |       | FU SM/ENG INTERFACE P        | SP0930P                       | -                            | -           | MANDATORY            |                        |
|          |       | SPS VLV ACT PRESS-PRI        | SP0600P                       | METER                        | COMMON      | MANDATORY O/B        | -1 OF 2<br>12-26/28    |
|          |       | SPS VLV ACT PRESS-SEC        | SP0601P                       | METER                        | COMMON      | MANDATORY O/B        |                        |
|          |       | SPS FU FEEDLINE TEMP         | SP0048T                       | METER                        | COMMON      | MANDATORY            | -1 OF 2<br>12-29       |
|          |       | SPS OX FEEDLINE TEMP         | SP0049T                       | SYS TEST                     | COMMON      | MANDATORY            |                        |
|          |       | SPS INJ FLANGE TEMP 1        | SP0061T                       | C&W                          | COMMON      | MANDATORY O/B        | -1 OF 2<br>12-31       |
|          |       | SPS INJ FLANGE TEMP 2        | SP0062T                       | C&W                          | COMMON      | MANDATORY O/B        |                        |
|          |       | 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 -<br>TOTAL AUX   | SP0655Q                       | DISPLAY                      | COMMON      | HIGHLY DESIRABLE     | 12-12                  |
|          |       | OX TK2 QTY                   | SP0656Q                       | DISPLAY                      | COMMON      | HIGHLY DESIRABLE     | 12-12                  |
|          |       | FU TK 1 QTY -<br>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            | -1 OF 2<br>12-30       |
|          |       | P/U VLV OUTLET T             | SP0618T                       | T/M                          | -           | MANDATORY            |                        |
|          |       | 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                  |
| APOLLO 8 | A     | 12/11/68                     | CSM SERVICE PROPULSION SYSTEM | INSTRUMENTATION REQUIREMENTS |             | 12-7                 |                        |

13 CSM SM-RCS  
SYSTEM

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV      | ITEM  | GENERAL   |                   |                            |      |
|----------|-------|---|-------------------|----------------------------|------|
|          | 13-1  | <p><u>LAUNCH</u></p> <p>THE LOSS OF ONE QUAD IS NOT CAUSE FOR ABORT AND THERE ARE NO SINGLE FAILURES NOR ANY REASONABLE REALISTIC COMBINATION OF FAILURES WHICH LEAD ONLY TO LOSS OF MULTIPLE QUADS. THEREFORE, THERE ARE NO SM-RCS FAILURES WHICH ARE CONSIDERED CAUSE FOR ABORT.</p>  |                   |                            |      |
|          | 13-2  | <p><u>EARTH ORBIT PHASE</u></p> <p>A. LOSS OF ONE QUAD, IN ITSELF, IS NOT NECESSARILY CAUSE FOR EARLY TERMINATION OF THE MISSION. THE GUIDELINE IS THAT AS LONG AS THE SPACECRAFT ATTITUDE CAN BE CONTROLLED AND THE SPS CAN BE BURNED THE MISSION NEED NOT BE TERMINATED EARLY. HOWEVER, LOSS OF ONE QUAD WILL REQUIRE <u>TLI BE INHIBITED</u>, AND MAY LEAD TO EARLY MISSION TERMINATION SINCE THE CAPABILITY TO PERFORM SM OR HYBRID DEORBIT WILL BE AFFECTED.</p> <p>B. LOSS OF TWO OR MORE QUADS IS CAUSE FOR ENTRY INTO THE NEXT BEST PTP.</p> <p>1. LOSS OF TWO ADJACENT QUADS WILL DESTROY THE CAPABILITY TO PERFORM ULLAGE MANEUVERS AND WILL REQUIRE DELETION OF NON-CRITICAL SPS MANEUVERS. LOSS OF TWO ADJACENT QUADS PRECLUDES SM OR HYBRID DEORBIT.</p> <p>2. LOSS OF TWO OPPOSITE QUADS WILL DESTROY THE CAPABILITY TO PERFORM PRECISE 3-AXIS ATTITUDE CONTROL AND PRECLUDES SM OR HYBRID DEORBIT.</p> |                   |                            |      |
|          | 13-3  | <p><u>TRANSLUNAR COAST</u></p> <p>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 <u>TERMINATED BY ENTRY INTO THE NEXT BEST PTP</u>.</p>   |                   |                            |      |
|          | 13-4  | <p><u>LOI</u></p> <p>LOSS OF ONE QUAD IS CAUSE FOR INHIBITING <u>LOI<sub>1</sub></u>, BECAUSE SUBSEQUENT FAILURE OF QUADS OR JETS IMPAIR ATTITUDE CONTROL OR ULLAGE.</p>  |                   |                            |      |
|          | 13-5  | <p><u>LUNAR ORBIT</u></p> <p>LOSS ON ONE QUAD IS CAUSE FOR <u>EARLY TERMINATION OF LUNAR ORBIT PHASE</u> AND FOR <u>INHIBITING LOI<sub>2</sub></u>. BECAUSE SUBSEQUENT FAILURE OF QUADS OR JETS IMPAIR ATTITUDE CONTROL OR ULLAGE. CONSIDERATION MAY BE GIVEN TO A MANEUVER TO DECREASE THE REMAINING TIME OF FLIGHT.</p>   |                   |                            |      |
|          |       | <p>RULES 13-6 THROUGH 13-14<br/>ARE RESERVED</p>  |                   |                            |      |
| MISSION  | REV   | DATE  | SECTION           | GROUP                      | PAGE |
| APOLLO 8 | FINAL | 11/7/68   | CSM SM-RCS SYSTEM | GENERAL/SYSTEMS MANAGEMENT | 13-1 |

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**MISSION RULES**

| REV.     | ITEM  |   |                   |                            |      |
|----------|-------|---|-------------------|----------------------------|------|
|          |       | SYSTEM MANAGEMENT   |                   |                            |      |
|          |       | <u>PROPELLANT GAGING</u>  |                   |                            |      |
|          | 13-15 | A. PRIME METHOD: RTCC EQUATION (6%)   |                   |                            |      |
|          |       | B. BACKUP METHOD: (ONBOARD) HELIUM PRESSURE/TEMPERATURE (11%)   |                   |                            |      |
|          | 13-16 | <u>QUAD PROPELLANT BALANCE</u>  |                   |                            |      |
|          |       | 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<br>13-19 ARE RESERVED   |                   |                            |      |
| MISSION  | REV   | DATE  | SECTION           | GROUP                      | PAGE |
| APOLLO 8 | FINAL | 11/7/68   | CSM SM-RCS SYSTEM | GENERAL/SYSTEMS MANAGEMENT | 13-2 |



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**MISSION RULES**

| REV      | RULE  | CONDITION/MALFUNCTION   | PHASE  | RULING   | CUES/NOTES/COMMENTS  |
|----------|-------|---|--|--|--|
| A        | 13-23 | <p>LOSS OF INDIVIDUAL THRUSTERS AS A RESULT OF CLOGGING, FREEZING, OR BURNOUT WHICH RESULT IN:</p> <p>A. LOSS OF ONE PITCH OR ONE YAW OR TWO ROLL THRUSTERS IN THE SAME DIRECTION.</p> <p>B. LOSS OF +X THRUSTERS ON ADJACENT QUADS</p> <p>C. LOSS OF ATTITUDE CONTROL IN ONE OR MORE AXES.</p> | <p>LAUNCH</p> <p>EPO</p> <p>TLC</p> <p>LO</p> <p>TEC</p> <p>ALL</p> <p>EPO</p> | <p>NOT APPLICABLE</p> <p>1. <u>CONTINUE MISSION.</u></p> <p>2. <u>TLI NO-GO</u></p> <p><u>LOI NO-GO</u></p> <p><u>PLAN TEI FOR NEXT OPPORTUNITY.</u></p> <p>CONSIDER MANEUVER TO DECREASE FLIGHT TIME.</p> <p>INHIBIT NON-CRITICAL SPS BURNS</p> <p><u>ENTER NEXT BEST PTP</u></p> | <p>SUBSEQUENT JET OR QUAD SINGLE FAILURES DESTROY PRECISE ATTITUDE CONTROL FOR BOTH RCS TRANSLATIONS AND SPS BURN INITIATION.</p> <p>REF SPS RULE 15-20<br/>LACK OF ULLAGE CAPABILITY.</p> |
|          |       | <p>RULES 13-24 THROUGH 13-29 ARE RESERVED.</p>  |  |  |  |
| MISSION  | REV   | DATE  | SECTION  | GROUP  | PAGE   |
| APOLLO 8 | A     | 12/11/68  | CSM SM-RCS SYSTEM  | SPECIFIC - SM-RCS  | 13-4   |

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MISSION RULES

| REV      | ITEM  | INSTRUMENTATION REQUIREMENTS |                   |                |                    |                              | MISSION RULE REFERENCE |
|----------|-------|------------------------------|-------------------|----------------|--------------------|------------------------------|------------------------|
| A        | 13-30 | <u>MEAS DESCRIPTION</u>      | <u>PCM</u>        | <u>ONBOARD</u> | <u>TRANSDUCERS</u> | <u>CATEGORY</u>              |                        |
|          |       | SM HE TK A PRESS             | SR5001P           | METER          | COMMON             | MANDATORY <sup>-1</sup> OF 2 | 13-20/21               |
|          |       | SM HE P/T RATIO A            | SR5025U           | METER          | COMMON             | MANDATORY <sup>-1</sup> OF 2 | 13-20/21               |
|          |       | SM HE TK B PRESS             | SR5002P           | METER          | COMMON             | MANDATORY <sup>-1</sup> OF 2 | 13-20                  |
|          |       | SM HE P/T RATIO B            | SR5026U           | METER          | COMMON             | MANDATORY <sup>-1</sup> OF 2 | 13-20                  |
|          |       | SM HE TK C PRESS             | SR5003P           | METER          | COMMON             | MANDATORY <sup>-1</sup> OF 2 | 13-20                  |
|          |       | SM HE P/T RATIO C            | SR5027U           | METER          | COMMON             | MANDATORY <sup>-1</sup> OF 2 | 13-20                  |
|          |       | SM HE TK D PRESS             | SR5004P           | METER          | COMMON             | MANDATORY <sup>-1</sup> OF 2 | 13-20                  |
|          |       | SM HE P/T RATIO D            | SR5028U           | METER          | COMMON             | MANDATORY <sup>-1</sup> 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 G PRESS            | SR5817P           | METER/C&W      | COMMON             | HIGHLY DESIRABLE             | 13-21                  |
|          |       | SM HE MAN D PRESS            | SR5830P           | METER/C&W      | COMMON             | HIGHLY DESIRABLE             | 13-21                  |
| MISSION  | REV   | DATE                         | SECTION           |                |                    | GROUP                        | PAGE                   |
| APOLLO 8 | A     | 12/11/68                     | CSM SM-RCS SYSTEM |                |                    | INSTRUMENTATION REQUIREMENTS | 13-5                   |

14 CSM CM-RCS  
SYSTEM

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MISSION RULES

| REV      | ITEM  | GENERAL  |                   |                            |      |
|----------|-------|--|-------------------|----------------------------|------|
|          | 14-1  | <p><u>LAUNCH</u></p> <p>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 <u>6-4</u> SINCE SYSTEMS ARE NO LONGER REDUNDANT.</p> <p>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.</p> <p>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.</p>   |                   |                            |      |
|          | 14-2  | <p><u>ALL OTHER PHASES</u></p> <p>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 <math>\Delta V</math> 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.</p> <p>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.</p> <p>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.</p> |                   |                            |      |
|          |       | <p>RULES 14-3 THROUGH 14-9 ARE RESERVED.</p>   |                   |                            |      |
| MISSION  | REV   | DATE   | SECTION           | GROUP                      | PAGE |
| APOLLO 8 | FINAL | 11/7/68  | CSM CM-RCS SYSTEM | GENERAL SYSTEMS MANAGEMENT | 14-1 |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

| REV      | ITEM  | SYSTEM MANAGEMENT   |                   |                            |      |
|----------|-------|---|-------------------|----------------------------|------|
| A        | 14-10 | <p><u>THRUSTER TEMP CONTROL</u></p> <p>CM-RCS THRUSTERS WILL BE HEATED PRIOR TO ENTRY FOR 20 MINUTES OR UNTIL THE LOWEST INDICATED TEMPERATURE IS <math>&gt;28^{\circ}\text{F}</math>, WHICHEVER COMES FIRST. IF THRUSTER(S) HEATER FUNCTION FAILS, CM-RCS IS STILL CONSIDERED OPERATIONAL. MALF PROC: RCS 5.</p>       |                   |                            |      |
|          | 14-11 | <p><u>HELIUM INTERCONNECT</u></p> <p>AS A LAST RESORT, IF THE HELIUM IN ONE RING IS DEPLETED DUE TO A LEAK AND 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.</p> |                   |                            |      |
|          |       | <p>RULES 14-12 THROUGH 14-14 ARE RESERVED.</p>  |                   |                            |      |
| MISSION  | REV   | DATE  | SECTION           | GROUP                      | PAGE |
| APOLLO 8 | A     | 12/11/68  | CSM CM-RCS SYSTEM | GENERAL/SYSTEMS MANAGEMENT | 14-2 |

## NASA — Manned Spacecraft Center

### MISSION RULES

| 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. <u>CONTINUE MISSION.</u><br>PLAN ENTRY PTP _____.   |                     |      |
|          |       | B. BOTH RINGS   | LAUNCH            | B.1. PRIOR TO TOWER JETT: <u>ABORT MODE I.</u><br><br>2. AFTER TOWER JETT: <u>CONTINUE MISSION. PLAN ENTRY PTP 2-1.</u>                  |                     |      |
|          |       | C. ONE RING   | ALL               | C.1. <u>TERMINATE PHASE</u><br><br>2. <u>ENTER NEXT BEST PTP.</u><br>NORMAL ENTRY  |                     |      |
|          |       | D. BOTH RINGS   | ALL               | D.1. <u>TERMINATE PHASE.</u><br><br>2. <u>ENTER ASAP.</u><br>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               | <u>CONTINUE MISSION.</u>   | MALF PROC: NONE     |      |
|          | 14-17 | CM-RCS IS ARMED FOR ANY REASON.                               | ALL               | A. <u>TERMINATE PHASE.</u><br><br>B. <u>ENTER NEXT BEST PTP.</u>   | MALF PROC: NONE     |      |
|          |       | RULES 14-18 THROUGH 14-29 ARE RESERVED.                       |                   |  |                     |      |
| MISSION  | REV   | DATE  | SECTION           |  | GROUP               | PAGE |
| APOLLO 8 | FINAL | 11/7/68   | CSM CM-RCS SYSTEM |  | SPECIFIC - CM-RCS   | 14-3 |

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MISSION RULES

| REV | ITEM  | INSTRUMENTATION REQUIREMENTS |         |         |             |                  | MISSION RULE REFERENCE |
|-----|-------|------------------------------|---------|---------|-------------|------------------|------------------------|
|     |       | MEAS DESCRIPTION             | PCM     | ONBOARD | TRANSDUCERS | CATEGORY         |                        |
| A   | 14-30 | 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                  |

  

|          |     |          |                   |                              |      |
|----------|-----|----------|-------------------|------------------------------|------|
| MISSION  | REV | DATE     | SECTION           | GROUP                        | PAGE |
| APOLLO 8 | A   | 12/11/68 | CSM CM-RCS SYSTEM | INSTRUMENTATION REQUIREMENTS | 14-4 |



**NASA — Manned Spacecraft Center**

**MISSION RULES**

| REV      | ITEM |  |             |         |      |
|----------|------|--|-------------|---------|------|
|          | 15-1 | <u>PRELAUNCH</u>   |             |         |      |
|          |      | PRIOR TO COMMITTING TO LAUNCH, THE FOLLOWING CONDITIONS MUST BE MET:   |             |         |      |
|          |      | A. SATISFACTORY FLIGHT CREW PHYSIOLOGICAL STATUS.  |             |         |      |
|          |      | B. THE MINIMUM CABIN OXYGEN CONCENTRATION FOR LAUNCH IS 60 PERCENT.  |             |         |      |
|          |      | C. THE MINIMUM SUIT OXYGEN CONCENTRATION FOR LAUNCH IS 95 PERCENT.   |             |         |      |
|          | 15-2 | THE MAXIMUM ALLOWABLE CONCENTRATION OF PCO <sub>2</sub> 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 | <u>LAUNCH</u>  |             |         |      |
|          |      | THERE ARE NO MEDICAL REASONS FOR ABORTING DURING THE LAUNCH PHASE OTHER THAN THOSE CONDITIONS INTOLERABLE TO THE CREW.   |             |         |      |
| A        | 15-6 | <u>EARTH PARKING ORBIT, TRANSLUNAR COAST, AND LUNAR ORBIT</u>  |             |         |      |
|          |      | 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 SATISFACTORY ENVIRONMENT.   |             |         |      |
| A        | 15-7 | <u>WATER PALATABILITY</u>  |             |         |      |
|          |      | 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  |             |         |      |
| MISSION  | REV  | DATE   | SECTION     | GROUP   | PAGE |
| APOLLO 8 | A    | 12/11/68   | AEROMEDICAL | GENERAL | 15-1 |

**NASA — Manned Spacecraft Center**  
**MISSION RULES**

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

| REV      | RULE  | CONDITION/MALFUNCTION                                | PHASE       | RULING                     | CUES/NOTES/COMMENTS   |      |
|----------|-------|--|-------------|----------------------------|---|------|
| A        | 15-20 | ORAL TEMP EXCEEDS 101°F<br>DESPITE CORRECTIVE ACTION |             |                            | THE MCC SURGEON MAY RECOMMEND<br>EARLY MISSION TERMINATION IF<br>TREATMENT IS UNSUCCESSFUL. |      |
|          |       | A. IF DUE TO ILLNESS                                 | LAUNCH      | <u>NOT APPLICABLE</u>      |   |      |
|          |       |  | EPO         | <u>ENTER NEXT BEST PTP</u> |   |      |
|          |       |  | TLC         | <u>ENTER NEXT BEST PTP</u> |   |      |
|          |       |  | LO          | <u>ENTER NEXT BEST PTP</u> |   |      |
|          |       |  | TEC         | <u>ENTER NEXT BEST PTP</u> |   |      |
|          |       | B. IF RESULTANT FROM THER-<br>MAL OVERLOAD           | LAUNCH      | <u>NOT APPLICABLE</u>      |   |      |
|          |       |  | EPO         | <u>ENTER NEXT PTP</u>      |   |      |
|          |       |  | TLC         | <u>ENTER NEXT PTP</u>      |   |      |
|          |       |  | LO          | <u>ENTER NEXT PTP</u>      |   |      |
|          |       |  | TEC         | <u>ENTER NEXT PTP</u>      |   |      |
|          |       | RULES 15-21 THROUGH<br>15-26 ARE RESERVED.           |             |                            |   |      |
| MISSION  | REV   | DATE   | SECTION     |                            | GROUP   | PAGE |
| APOLLO 8 | A     | 12/11/68   | AEROMEDICAL |                            | SPECIFIC - PHYSIOLOGICAL  | 15-3 |

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MISSION RULES

| REV                | RULE       | CONDITION/MALFUNCTION   | PHASE       | RULING   | CUES/NOTES/COMMENTS   |      |
|--------------------|------------|---|-------------|--|---|------|
| A                  | 15-27      | INCREASE IN PCO <sub>2</sub><br>A. $\geq 7.6$ MM HG   | LAUNCH      | <u>CONTINUE MISSION</u>  | PCO <sub>2</sub> SHOULD DECREASE BELOW 2 MM HG WITHIN 30 MINUTES.   |      |
|                    |            |   | EPO         | <u>CONTINUE MISSION</u><br><u>CHANGE LiOH CANISTER</u>   |   |      |
|                    |            |   | TLC         | <u>CONTINUE MISSION</u><br><u>CHANGE LiOH CANISTER</u>   |   |      |
|                    |            |   | LO          | <u>CONTINUE MISSION</u><br><u>CHANGE LiOH CANISTER</u>   |   |      |
|                    |            |   | TEC         | <u>CONTINUE MISSION</u><br><u>CHANGE LiOH CANISTER</u>   |   |      |
|                    |            |   | LAUNCH      | <u>NOT APPLICABLE</u>  |   |      |
|                    |            | B. $\geq 7.6$ MM HG AND UNABLE TO DECREASE  | ALL PHASES  | <u>CONTINUE MISSION</u><br>1. OPEN SUITS AND BREATHE FROM CABIN<br>2. CHANGE SECOND LiOH CANISTER<br>3. TEST PCO <sub>2</sub> SENSOR | PCO <sub>2</sub> SENSOR TEST:<br>A. ISOLATE SUIT CIRCUIT BY DISCONNECTING SUIT HOSES FROM THE SPACECRAFT.<br>B. SUIT CIR RET AIR VALVE CLOSED.<br>C. CRACK O <sub>2</sub> METERING VALVE TO OPEN.<br>D. PURGE FOR 30 SECONDS.<br>E. CLOSED O <sub>2</sub> METERING VALVE.<br>F. IF ABOVE PROCEDURE RESULTS IN A PCO READING NEAR ZERO, THE PCO <sub>2</sub> SENSOR IS OPERATING PROPERLY. |      |
|                    |            |   | LAUNCH      | <u>CONTINUE MISSION</u>  |   |      |
|                    |            |   | EPO         | <u>ENTER NEXT BEST PTP</u>   |   |      |
|                    |            |   | TLC         | <u>ENTER NEXT BEST PTP</u>   |   |      |
|                    |            |   | LO          | <u>ENTER NEXT BEST PTP</u>   |   |      |
|                    |            |   | TEC         | <u>ENTER NEXT BEST PTP</u>   |   |      |
| C. $\geq 10$ MM HG | LAUNCH     | <u>CONTINUE MISSION</u>   |             |  |   |      |
|                    | EPO        | <u>ENTER NEXT BEST PTP</u>  |             |  |   |      |
|                    | TLC        | <u>ENTER NEXT BEST PTP</u>  |             |  |   |      |
|                    | LO         | <u>ENTER NEXT BEST PTP</u>  |             |  |   |      |
|                    | TEC        | <u>ENTER NEXT BEST PTP</u>  |             |  |   |      |
|                    | ALL PHASES | <u>CONTINUE MISSION</u><br><u>CONTINUE MISSION</u><br><u>USE ONBOARD CO<sub>2</sub> TAPES</u> |             |  |   |      |
| A                  | 15-28      | PCO <sub>2</sub> INSTRUMENTATION FAILURE  | ALL PHASES  | <u>CONTINUE MISSION</u><br><u>CONTINUE MISSION</u><br><u>USE ONBOARD CO<sub>2</sub> TAPES</u>  |   |      |
|                    |            | RULES 15-29 THROUGH 15-34 ARE RESERVED.   |             |  |   |      |
| MISSION            | REV        | DATE  | SECTION     |  | GROUP   | PAGE |
| APOLLO 8           | A          | 12/11/68  | AEROMEDICAL |  | SPECIFIC - EQUIPMENT  | 15-4 |

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**MISSION RULES**

| REV      | ITEM  | INSTRUMENTATION REQUIREMENTS     |             |                              |                    |                  | MISSION RULE REFERENCE |
|----------|-------|----------------------------------|-------------|------------------------------|--------------------|------------------|------------------------|
| A        | 15-35 | <u>MEAS DESCRIPTION</u>          | <u>PCM</u>  | <u>ONBOARD</u>               | <u>TRANSDUCERS</u> | <u>CATEGORY</u>  |                        |
|          |       | 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 <sub>2</sub> 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                  |
|          |       | PNE OGRAM                        | CJ0200R     | NOT DISPLAYED                |                    | HIGHLY DESIRABLE | 15-17                  |
|          |       | PNEUMOGRAM                       | CJ0201R     | NOT DISPLAYED                |                    | HIGHLY DESIRABLE | 15-17                  |
|          |       | PNEUMOGRAM                       | CJ0202R     | NOT DISPLAYED                |                    | HIGHLY DESIRABLE | 15-17                  |
| MISSION  | REV   | DATE                             | SECTION     | GROUP                        | PAGE               |                  |                        |
| APOLLO 8 | A     | 12/11/68                         | AEROMEDICAL | INSTRUMENTATION REQUIREMENTS | 15-5               |                  |                        |

16 RECOVERY

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MISSION RULES

| REV      | RULE   | CONDITION/MALFUNCTION  | PHASE    | RULING           | CUES/NOTES/COMMENTS   |      |
|----------|--|--|----------|------------------|---|------|
| A        | 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.  |      |
|          | 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:<br><br>SURFACE WINDS - 25 KNOTS<br>CEILING - 1500 FEET<br>VISIBILITY - 3 NM<br>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 ±500 NM UNTIL ENTRY -24 HOURS.                |          | HIGHLY DESIRABLE |   |      |
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APPENDIXES



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MISSION RULES

| REV      | ITEM            | APPENDIX A                                     |                                   |   |      |
|----------|-----------------|--|-----------------------------------|---|------|
|          |                 | ACRONYMS AND SYMBOLS                           |                                   |   |      |
|          | ACCEL           | ACCELEROMETER                                  | ECS                               | ENVIRONMENTAL CONTROL SYSTEM                  |      |
|          | ADEG            | AUXILIARY DISPLAY EQUIPMENT GROUP              | EDS                               | EMERGENCY DETECTION SYSTEM                    |      |
|          | AFD             | ASSISTANT FLIGHT DIRECTOR                      | EEDCOM                            | ELECTRICAL, ENVIRONMENTAL, AND COMMUNICATIONS |      |
|          | AFETR           | AIR FORCE EASTERN TEST RANGE                   | EI                                | ENTRY INTERFACE                               |      |
|          | A/G             | AIR-TO-GROUND                                  | EPS                               | ELECTRICAL POWER SYSTEM                       |      |
|          | ALDS            | APOLLO LAUNCH DATA SYSTEM                      | ESE                               | ELECTRONIC SUPPORT EQUIPMENT                  |      |
|          | AM              | AMPLITUDE MODULATION                           | ETDM                              | RANGE SAFETY SUPERVISOR                       |      |
|          | AMP             | AMPERES  | ETR                               | EASTERN TEST RANGE                            |      |
|          | AOA             | ANGLE OF ATTACK                                |                                   |   |      |
|          | AOH             | APOLLO OPERATIONS HANDBOOK                     |                                   |   |      |
|          | ASAP            | AS SOON AS PRACTICAL                           |                                   |   |      |
|          | ATP             | ALTERNATE TARGET POINT                         |                                   |   |      |
|          | AZUSA           | ELECTRONIC TRACKING AND VECTORING SYSTEM (ETR) |                                   |   |      |
|          |                 |  | 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                 |      |
|          | 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       | G&C                               | GUIDANCE AND CONTROL                          |      |
|          | CCATS           | COMMAND, COMMUNICATIONS, AND TELEMETRY SYSTEM  | GDC                               | GYRO DISPLAY COUPLER                          |      |
|          | CCW             | COUNTERCLOCKWISE                               | GET                               | GROUND ELAPSED TIME                           |      |
|          | CDP             | COMMAND DATA PROCESSOR                         | GETI                              | GROUND ELAPSED TIME OF IGNITION               |      |
|          | CDU             | COUPLING DATA UNIT                             | GMTLO                             | GREENWICH MEAN TIME OF LIFTOFF                |      |
|          | CIF             | CENTRAL INSTRUMENTATION FACILITY               | G&N                               | GUIDANCE AND NAVIGATION                       |      |
|          | CLTC            | CHIEF LAUNCH VEHICLE TEST CONDUCTOR            | GNC                               | GUIDANCE NAVIGATION CONTROL                   |      |
|          | CM              | COMMAND MODULE                                 | GN <sub>2</sub>                   | GASEOUS NITROGEN                              |      |
|          | CMC             | COMMAND MODULE COMPUTER                        | GRR                               | GUIDANCE REFERENCE RELEASE                    |      |
|          | C/O             | CUTOFF   |                                   |   |      |
|          | CO <sub>2</sub> | CARBON DIOXIDE                                 |                                   |   |      |
|          | CRYO            | CRYOGENICS                                     |                                   |   |      |
|          | CRO             | CARNARVON (MSFN REMOTED SITE)                  | H <sub>a</sub>                    | HEIGHT OF APOGEE                              |      |
|          | CSM             | COMMAND SERVICE MODULE                         | HF                                | HIGH FREQUENCY                                |      |
|          | CTE             | CENTRAL TIMING EQUIPMENT                       | H <sub>p</sub>                    | HEIGHT OF PERIGEE                             |      |
|          | CVTS            | CHIEF VEHICLE TEST SUPERVISOR                  | HZ                                | HERTZ   |      |
|          | CW              | CLOCKWISE                                      | HS                                | HIGH-SPEED                                    |      |
|          | DAP             | DIGITAL AUTO PILOT                             |                                   |   |      |
|          | DCS             | DIGITAL COMMAND SYSTEM                         | IGA                               | INNER GIMBAL AXIS                             |      |
|          | DOD             | DEPARTMENT OF DEFENSE                          | IMU                               | INERTIAL MEASUREMENT UNIT                     |      |
|          | DRA             | DISCRETE RECOVERY AREA                         | INST                              | INSTRUMENTATION                               |      |
|          | DRS             | DATA RECEIVING STATION                         | INV                               | INVERTER                                      |      |
|          | DSC             | DYNAMIC STANDBY COMPUTER                       | IP                                | IMPACT POINT OR IMPACT PREDICTOR              |      |
|          | DSE             | DATA STORAGE EQUIPMENT                         | IRIG                              | INERTIAL RATE INTEGRATING GYRO                |      |
|          | DSKY            | DISPLAY KEYBOARD                               | ISS                               | INERTIAL SUBSYSTEM                            |      |
|          | D/TV            | DIGITAL TO TELEVISION                          | IU                                | INSTRUMENTATION UNIT                          |      |
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### MISSION RULES

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|-----|------|------------------|---|--|
|     |      | KSC              | KENNEDY SPACE CENTER                          | PSID POUNDS PER SQUARE INCH DIFFERENCE<br>PTC PASSIVE THERMAL CONTROL<br>PTV PITCH THRUST VECTOR<br>PVT PRESSURE-VOLUME-TEMPERATURE<br>PYRO PYROTECHNICS   |
|     |      | LES              | LAUNCH ESCAPE SYSTEM                          |  |
|     |      | LET              | LAUNCH ESCAPE TOWER                           |  |
|     |      | LH <sub>2</sub>  | LIQUID HYDROGEN                               |  |
|     |      | LM               | LUNAR MODULE                                  |  |
|     |      | LiOH             | LITHIUM HYDROXIDE                             | QTY QUANTITY   |
|     |      | L/O              | LIFTOFF                                       |  |
|     |      | LOI              | LUNAR ORBIT INSERTION                         |  |
|     |      | LOX              | LIQUID OXYGEN                                 |  |
|     |      | L/R              | LEFT/RIGHT                                    | RCS REACTION CONTROL SYSTEM  |
|     |      | LVDA             | LAUNCH VEHICLE DATA ADAPTER                   | REFSMAT REFERENCE STABLE MEMBER MATRIX   |
|     |      | LVDC             | LAUNCH VEHICLE DIGITAL COMPUTER               | RETRB RETRO ELAPSED TIME TO REVERSE BANK<br>RETRO RETROFIRE OFFICER<br>RFO RETROFIRE OFFICER<br>RHC ROTATION HAND CONTROLLER<br>RIP RANGE OF IMPACT POINT<br>RL ROLL LEFT<br>RR ROLL RIGHT<br>RSI ROLL STABILITY INDICATOR<br>RSO RANGE SAFETY OFFICER<br>RTACF REAL-TIME AUXILIARY COMPUTING FACILITY<br>RTC REAL-TIME COMMAND<br>RTCC REAL-TIME COMPUTER COMPLEX |
|     |      | MALF             | MAJFUNCTION                                   |  |
|     |      | MCC              | MISSION CONTROL CENTER, MID-COURSE CORRECTION |  |
|     |      | MCSW             | 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                    | S/C SPACECRAFT   |
|     |      | MSFN             | MANNED SPACE FLIGHT NETWORK                   | SCE SIGNAL CONDITIONING EQUIPMENT  |
|     |      | MSTC             | CSM SPACECRAFT TEST CONDUCTOR                 | SCS STABILIZATION AND CONTROL SYSTEM   |
|     |      | MTVC             | MANUAL THRUST VECTOR CONTROL                  | SECO SUSTAINER ENGINE CUTOFF (S-IVB CUTOFF)<br>SLA SPACECRAFT LM ADAPTER<br>SLV SATURN LAUNCH VEHICLE<br>SM SERVICE MODULE<br>SMJC SERVICE MODULE JETTISON CONTROLLER<br>SOL SOLENOID<br>SPS SERVICE PROPULSION SYSTEM<br>SRO SUPERINTENDENT RANGE OPERATIONS  |
|     |      | NCC              | COMBINED CORRECTIVE MANUEVER                  |  |
|     |      | NSR              | COELLIPTICAL MANEUVER                         |  |
|     |      | NM               | NAUTICAL MILES                                |  |
|     |      | O/B              | ONBOARD                                       | TB TIME BASE   |
|     |      | ODOP             | OFFSET DOPPLER AND POSITION                   | TC TEST CONDUCTOR  |
|     |      | OGA              | OUTER GIMBAL AXIS                             | T/C TELEMETRY AND COMMUNICATIONS   |
|     |      | OXID             | OXIDIZER                                      | TEI TRANSEARTH INJECTION<br>TDP TELEMETRY DATA PROCESSOR<br>TM TELEMETRY<br>TFF TIME OF FREE FALL<br>THC THRUST HAND CONTROLLER<br>Tig TIME OF IGNITION<br>TOK THRUST OKAY<br>TLI TRANSLUNAR INJECTION<br>TPF TERMINAL PHASE FINALIZATION<br>TPI TERMINAL PHASE INITIATE<br>TTY TELETYPE<br>TVC THRUST VECTOR CONTROL  |
|     |      | PCM              | PULSE CODE MODULATION                         |  |
|     |      | PCO <sub>2</sub> | PARTIAL PRESSURE CARBON DIOXIDE               |  |
|     |      | PIPA             | PULSE INTEGRATING PENDULOUS ACCELEROMETER     |  |
|     |      | PLSS             | PORTABLE LIFE SUPPORT SYSTEM                  |  |
|     |      | PO <sub>2</sub>  | PARTIAL PRESSURE OXYGEN                       |  |
|     |      | PPM              | PARTS PER MILLION                             |  |
|     |      | PTP              | PREFERRED TARGET POINT                        |  |
|     |      | PUGS             | PROPELLENT UTILIZATION AND GAGING SYSTEM      |  |
|     |      | PROC             | PROCEDURE                                     |  |

| MISSION  | REV   | DATE    | SECTION                           | GROUP | PAGE |
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| A   |      | <p><u>DIRECTOR OF FLIGHT OPERATIONS</u></p> <p>FA/KRAFT, C.C., JR.<br/>SJOBERG, S.A.<br/>ROSE, R.G.<br/>KOONS, W.E.</p> <p><u>FLIGHT CONTROL DIVISION</u></p> <p>FC/KRANZ, E.F.<br/>LUNNEY, G.S.<br/>CHARLESWORTH, C.E.<br/>GRIFFIN, G.D.<br/>WINDLER, M.L.<br/>FRANK, M.P.</p> <p><u>FLIGHT CONTROL OPERATIONS BRANCH</u></p> <p>FC2/ROACH, J.W.<br/>HARLAN, C.S.<br/>FENDELL, E.I. (3)<br/>LEWIS, C.R. (3)<br/>EALICK, P.L. (5)<br/>PLATT, W.E. (3)<br/>GATLIN, W.P. (2)</p> <p><u>CSM SYSTEMS BRANCH</u></p> <p>FC3/ALDRICH, A.D. (1)<br/>HUTCHINSON, N.B. (1)<br/>GLOVER, R.D. (1)<br/>LOE, T.R. (20)<br/>WILLOUGHBY, B.N. (20)<br/>BLAIR, W.L. (2)</p> <p><u>LM SYSTEMS BRANCH</u></p> <p>FC4/HANNIGAN, J.E.<br/>SAULTZ, J.E.<br/>PUDDY, D.R.<br/>CARLTON, R.L.</p> <p><u>FLIGHT DYNAMICS BRANCH</u></p> <p>FC5/BOSTICK, J.C.<br/>SHAFFER, P.C.<br/>LLEWELYN, J.S. (4)<br/>PARKER, C.B. (4)<br/>PAVELKA, E.L. (4)</p> <p><u>MISSION SIMULATIONS BRANCH</u></p> <p>FC6/MILLER, H.G. (22)</p> <p><u>MISSION CONTROL REQUIREMENTS BRANCH</u></p> <p>FC7/HOOVER, R.H. (2)</p> <p><u>EXPERIMENTS SYSTEMS BRANCH</u></p> <p>FC8/BROOKS, M.F. (2)</p> <p><u>MSFC FLIGHT CONTROL OFFICE</u></p> <p>I-MO-F/HAMNER, R.S. (20)</p> <p><u>FLIGHT SUPPORT DIVISION</u></p> <p>FS/DUNSEITH, L.C.</p> <p><u>SYSTEMS ENGINEERING BRANCH</u></p> <p>FS2/SATTERFIELD, J.M.</p> | <p><u>OPERATIONS SUPPORT BRANCH</u></p> <p>FS4/FREERE, J.A.<br/>SANBORN, S.D. (15)<br/>OJELETTO, G. (2)</p> <p><u>FLIGHT SOFTWARE BRANCH</u></p> <p>FS5/STOKES, J.C. (3)<br/>GIBSON, T.F., JR.<br/>GARMAN, J.R. (2)</p> <p><u>MISSION PLANNING AND ANALYSIS BRANCH</u></p> <p>FM/MAYER, J.P. (2)<br/>HUSS, C. (1)<br/>OWEN, D.H. (1)<br/>FM2/HARPOLD, J.</p> <p><u>FLIGHT ANALYSIS BRANCH</u></p> <p>FM3/ALLEN, C. (14)</p> <p><u>MATH PHYSICS BRANCH</u></p> <p>FM4/MC PHERSON, J.C. (2)</p> <p><u>MISSION ANALYSIS BRANCH</u></p> <p>FM5/BERRY, R. (10)</p> <p><u>RENDEZVOUS ANALYSIS BRANCH</u></p> <p>FM6/LINEBERRY, E.C. (2)</p> <p><u>GUIDANCE AND PERFORMANCE BRANCH</u></p> <p>FM7/CASSETI, M.D. (2)</p> <p><u>APOLLO TRAJECTORY SUPPORT OFFICE</u></p> <p>FM13/PARTEN, R. (1)<br/>COLLINS, M. (1)</p> <p><u>LANDING AND RECOVERY DIVISION</u></p> <p>FL/HAMMACK, J.B. (8)<br/>FL/SANDERSON, A. (WEATHER ROOM)</p> <p><u>DIRECTOR OF FLIGHT CREW OPERATION</u></p> <p>CA/SLAYTON, D.K. (2)</p> <p><u>ASTRONAUT OFFICE</u></p> <p>CB/SHEPARD, A.B. (20)</p> <p><u>FLIGHT CREW SUPPORT DIVISION</u></p> <p>CF/NORTH, W.J.<br/>GRIMM, D.F.<br/>BILODEAU, J.W.<br/>DEMENT, M.E. (4)<br/>ALLEN, L.D. (4)<br/>KRAMER, P.C. (5)<br/>WARREN, D.K. (3)<br/>WOODLING, C.H.<br/>KUEHNEL, H.A. (4)<br/>VAN BOCKEL, J.J. (2)<br/>O'NEILL, J.W. (5)<br/>FABER, S. (3)<br/>MITCHELL, J. (CFK - 10)<br/>COLLINS, H.G. (CFK2 - 15) } KSC<br/>MC CAFFERTY, R. (CFK - 6)</p> | <p><u>DIRECTOR OF MEDICAL RESEARCH AND OPERATIONS DA</u></p> <p>BERRY, C.A., M.D.<br/>CATTERSON, A.D., M.D.<br/>ZIEGLSCHMID, J.F., M.D. (6)</p> <p><u>PUBLIC AFFAIRS OFFICE</u></p> <p>AP/HANEY, P.<br/>AP8/GREEN, D.J. (5)</p> <p><u>APOLLO SPACECRAFT PROGRAM OFFICE</u></p> <p>PA/LOW, G.M.<br/>SIMPKINSON, S.H.<br/>KLEINKNECHT, K.S.<br/>BOLENDER, C.H., BRIG. GEN.<br/>PENDLEY, D.</p> <p>PA2/APOLLO FILES<br/>PD/MAYNARD, O.E.<br/>COHEN, A.<br/>BATTERY, R.V.<br/>PD4/DENNETT, A.<br/>PD5/GOREE, J.<br/>PD7/SEGNA, D.R.<br/>KOHRS, R.<br/>GLANCY, C.H.<br/>GUILD, C. (2)<br/>PD8/HAINES, C.<br/>PD9/CRAIG, J.<br/>PD12/PERRINE, C.H.<br/>ZARCARO, J.G.<br/>TOMBERLIN, J.L.</p> <p>PE/MORRIS, O.E.<br/>PF/LANZKRON, R.W.<br/>PF2/TAYLOR, W.H. (2)<br/>PP/MC CLINTOCK, J.<br/>NA/BLAND, W.M. (2)<br/>NB2/WALKER, L.<br/>PT/MC KANN, R.E.<br/>ARABIAN, D.O.<br/>PT3/GOLDENBAUM, D.<br/>PT4/LOBB, J. (3)<br/>BM36/MISSION DATA PACK GE (15)</p> <p><u>DIRECTOR OF ENGINEERING AND DEVELOPMENT</u></p> <p>EA/FAGET, M.A.<br/>EA2/LEE, J.B.<br/>EA4/BURT, R.P.<br/>EA5/DEANS, P.M.<br/>EB/KYLE, H.<br/>EB3/TRAVIS, D.<br/>STOKER, C.<br/>EC/JOHNSTON, R.S.<br/>EC3/SAMONSKI, F.<br/>ECK11/MAYO, P.E.<br/>EC9/LAUTEN, W.<br/>KINCAIDE, W.C.<br/>EE/SAWYER, R.S.<br/>334/RIEGERT, D.<br/>MUNFORD, R.E.<br/>ROTRAMEL, F.<br/>CAMPOS, A.B.<br/>DIETZ, R.H.<br/>FENNER, R.G.<br/>WALTER, R.T.</p> |                                |       |      |
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| A   |          | <p><u>DIRECTOR OF ENGINEERING AND DEVELOPMENT (CONT'D)</u></p> <p>EE12/LUSE, M.<br/>TREMONT, R.<br/>EG/KAYTON, M.<br/>GARDINER, R.A.<br/>EG23/COX, K.J., DR.<br/>EG25/ELAM, F.<br/>EG412/HANAWAY, J.<br/>EG212/WASSON, C.<br/>EG42/RICE, G. (1)</p> <p>EP/MC SHEEHY, R.<br/>EP2/TOWNSEND, N.<br/>WOOD, T.<br/>HUMPHRIES, C.E.<br/>HAMMOCK, W.R.<br/>LAMBERT, C.H.<br/>EP4/WEARY, D.<br/>KARAKULKO, W.<br/>SIMMONS, W.H.<br/>EP5/BELL, D.<br/>OWENS, S.<br/>TROUT, J.B.<br/>ES/CHAUVEN, L.<br/>ES3/STROUHAL, G.<br/>ES16/SMITH, J.<br/>ES12/GLYNN, P.C.<br/>WEISS, S.P.<br/>PAULOSKY, J.E.<br/>ET/STONEY, W.E.<br/>ET25/REDD, B.</p> <p><u>FLIGHT SAFETY OFFICE</u></p> <p>MSC/SA FRENCH, J.C. (3)<br/>SF/GREENWEEL, D.<br/>KSC/HY VAUGHN, N.B.</p> <p><u>DIRECTOR OF SCIENCE AND APPLICATIONS</u></p> <p>TG/MODISETTE, J. (2)<br/>TG5/BATES, J.R.</p> <p><u>TRW - HOUSTON</u></p> <p>ROBERTSON, R.L. (3)<br/>TRW TECHNICAL INFORMATION CENTER, HOUSTON OPERATIONS (2)</p> <p><u>NORTH AMERICAN ROCKWELL HOUSTON, TEXAS</u></p> <p>HARMAN, H.A. (2)</p> <p><u>GODDARD SPACE FLIGHT CENTER</u></p> <p>KNOX, C.B. (9)<br/>CODE 821.1<br/>MANNED FLIGHT OPERATIONS DIVISION, REQUIREMENTS SECTION</p> <p><u>JOHN F. KENNEDY SPACE CENTER NASA - MSOB</u></p> <p>KENNEDY SPACE CENTER, FLORIDA<br/>ATTN, HO/ASTRO OFF (6)<br/>CD/DEBUS, K., DR. (1)<br/>AP-SAT/BARNETT, V. (2)<br/>AP-SCO/BEDDINGFELD, S. (1)<br/>AP-OPN/BLACKWOOD, H. (2)<br/>LO/PETRONE, R.A. (1)<br/>KAPYRAN, W.J. (1)</p> | <p><u>JOHN F. KENNEDY SPACE CENTER NASA - MSOB (CONT'D)</u></p> <p>LO-OPN/DONNELLY, P. (1)<br/>LO-PLN-2/KNIGHT, G.W. (3)<br/>HARRINGTON, R.D. (1)<br/>LV/GRUENE, H. DR. (1)<br/>LO-TOM-1/HART, J. (15)<br/>LS/WILLIAMS, J.J. (1)<br/>LS-ENG-1/GASKIN, R. (4)<br/>LS-TOM-1/BUCKLEY, R.H. (4)<br/>WILLIAMS, F.T. (4)<br/>TS/CLARK, R.L. (5)<br/>AP-SYM/MOORE, A.H. (6)<br/>IN/SEDLER, K. (5)<br/>SO/GORMAN, R. (3)<br/>IS-TSM/CLARK, B. (1)<br/>PSK/MORSE, A.E. (1)<br/>MISSION DIRECTORS OFFICE</p> <p><u>MARSHALL SPACE FLIGHT CENTER</u></p> <p>MSFC/I-MO-MGR, MISSION OPERATIONS OFFICE (30)</p> <p><u>OFFICE OF MANNED SPACEFLIGHT</u></p> <p>MUELLER, G.E., DR.<br/>PHILLIPS, S.C., MAJ. GEN.<br/>SCHNEIDER, W.C.<br/>ALLER, R.O. (12)</p> <p><u>DOD MSF SUPPORT OFFICE PAFB, FL.</u></p> <p>OLSON, R.G., COL (5)<br/>FRESE, F.J., JR., COL. MC (2)<br/>ETOOP-2 PAFB FLA 32925(6)</p> <p><u>MIT LABORATORIES BOSTON, MASS.</u></p> <p>NEVINS, J. (12)<br/>COPPS, E. (2)</p> <p><u>NORTH AMERICAN ROCKWELL, DOWNEY, CALIF.</u></p> <p>VUCELIC, M., CODE AB54 (25)<br/>NB2/WILLIAMS, H.L.</p> <p><u>LOCKHEED</u></p> <p>LAC C07/NOWAKOWSKI, J.</p> |                                |       |      |
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C CHANGE  
CONTROL

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| REV      | ITEM  |  |                             |      |
|----------|-------|--|-----------------------------|------|
|          |       | APPENDIX C   |                             |      |
|          |       | <u>CHANGE CONTROL</u>  |                             |      |
|          | 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 | <u>FORMAT</u>  |                             |      |
|          |       | PERSONS DESIRING TO SUBMIT A PROPOSED CHANGE WILL COMPLETE ALL ITEMS ON THE FORM SHOWN IN FIGURE C-1 (FORM MUST BE TYPED). ADDITIONAL PAGES MAY BE USED IF THE SPACE PROVIDED IS NOT ADEQUATE. THE COMPLETED ORIGINAL FORM AND ONE COPY WILL THEN BE FORWARDED TO THE AFD.   |                             |      |
|          |       | THE AFD WILL REVIEW THE FORM FOR COMPLETENESS AND PROPER MISSION RULE FORMAT, AND MAKE CORRECTIONS AS REQUIRED. THE ORIGINATOR WILL BE ADVISED OF ANY SUCH CHANGES.  |                             |      |
|          | 2.2   | APPROVAL   |                             |      |
|          | 2.2.1 | <u>COORDINATION</u>  |                             |      |
|          |       | THE ORIGINATOR OF THE CHANGE MAY OBTAIN PRELIMINARY CONCURRENCES. THE AFD WILL, HOWEVER, OBTAIN FORMAL CONCURRENCES OR DISAPPROVALS (VERBALLY OR BY INITIATING) FROM THE NECESSARY PERSONNEL. VERBAL CONCURRENCES WILL BE INDICATED IN THE APPROPRIATE SIGNATURE BOX.  |                             |      |
|          | 2.2.2 | <u>SIGNOFF/DISAPPROVAL</u>   |                             |      |
|          |       | UPON OBTAINING THE REQUIRED CONCURRENCES OR NEGATIVE COMMENTS, THE AFD WILL PRESENT THE PROPOSED CHANGE TO THE FLIGHT DIRECTOR FOR FINAL APPROVAL OR DISAPPROVAL. THE AFD MAY SIGN OFF OR DISAPPROVE PROPOSED CHANGES IN THE ABSENCE OF THE FLIGHT DIRECTOR.   |                             |      |
|          | 2.2.3 | <u>DISAPPROVED CHANGES</u>   |                             |      |
|          |       | IF A CHANGE IS DISAPPROVED THE AFD WILL RETURN THE COPY TO THE ORIGINATOR. THE ORIGINAL WILL BE RETAINED FOR FUTURE REFERENCE.   |                             |      |
|          | 2.3   | <u>PUBLICATION AND DISTRIBUTION OF INTERIM CHANGES</u>   |                             |      |
|          |       | 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).  |                             |      |
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|          | <p>3.2 APPROVAL</p> <p>SINCE ALL INTERIM CHANGES WILL HAVE RECEIVED PRIOR CONCURRENCES AND APPROVAL, ONLY THE FLIGHT DIRECTOR (OR THE AFD IN THE FLIGHT DIRECTOR'S ABSENCE) WILL BE REQUIRED TO APPROVE REVISIONS.</p> <p>3.3 PUBLICATION</p> <p>3.3.1 <u>SCHEDULE</u></p> <p>REVISIONS WILL BE MADE ON AN "AS REQUIRED" BASIS.</p> <p>3.3.2 <u>DISTRIBUTION</u></p> <p>REVISIONS WILL BE PRINTED AND DISTRIBUTED THROUGH THE NORMAL ADMINISTRATIVE CHANNELS.</p> |         |                             |       |      |
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| 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: _____                       |            |             | APPROVED: _____              |              |            | APPROVED: _____       |              |
| NAME _____ ORGANIZATION _____ EXT _____ |            |             | COGNIZANT BRANCH CHIEF _____ |              |            | 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.

|         |       |         |                             |       |      |
|---------|-------|---------|-----------------------------|-------|------|
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APOLLO

FFMR

FINAL  
FLIGHT  
MISSION  
RULES

MISSION C'

APOLLO 8



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