

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

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MISSION RULES

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		<div style="border: 1px solid black; padding: 5px; display: inline-block;">INTRODUCTION &amp; PURPOSE</div>			
		<p>MISSION RULES ARE PROCEDURAL STATEMENTS WHICH PROVIDE FLIGHT CONTROL PERSONNEL WITH GUIDELINES TO EXPEDITE THE DECISION-MAKING PROCESS. THE RULES ARE BASED ON AN ANALYSIS OF MISSION EQUIPMENT CONFIGURATION, SYSTEMS OPERATIONS AND CONSTRAINTS, FLIGHT CREW PROCEDURES, AND MISSION OBJECTIVES.</p> <p>MISSION RULES CAN BE CATEGORIZED AS GENERAL AND SPECIFIC. GENERAL MISSION RULES CONTAIN THE BASIC PHILOSOPHIES USED IN THE DEVELOPMENT OF THE FLIGHT MISSION RULES. SPECIFIC MISSION RULES PROVIDE THE BASIC CRITERIA FROM WHICH REAL-TIME DECISIONS ARE MADE AND WILL BE FORMATTED AS FOLLOWS:</p> <ul style="list-style-type: none"> <li>A. THE CONDITION/MALFUNCTION COLUMN DEFINES THE FAILURE.</li> <li>B. THE PHASE COLUMN IDENTIFIES THE TIME INTERVAL IN WHICH THE CONDITION/MALFUNCTION OCCURS.</li> <li>C. THE RULING COLUMN DEFINES FLIGHT CONTROLLER ACTION AND/OR PROCEDURES THAT MUST BE ACCOMPLISHED AS A RESULT OF THE CONDITION.</li> <li>D. THE CUES/NOTES/COMMENTS COLUMN PROVIDES THE FLIGHT CONTROLLER WITH ADDITIONAL INFORMATION CONCERNING THE CONDITION/MALFUNCTION AND/OR RULING.</li> </ul>			
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SECTION I - GENERAL GUIDELINES

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REV	ITEM	
		<b>DEFINITIONS</b>
I-1		<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 MISSION.
I-2		<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 MISSION. REDLINE FUNCTIONS ARE MANDATORY.
I-3		<u>MANDATORY (M)</u> : A MANDATORY ITEM IS A VEHICLE OR OPERATIONAL SUPPORT ELEMENT THAT IS ESSENTIAL FOR ACCOMPLISHMENT OF THE MISSION, WHICH INCLUDES PREFLIGHT AND FLIGHT OPERATIONS THAT INSURE PILOT SAFETY AND EFFECTIVE OPERATIONAL CONTROL AS WELL AS THE ATTAINMENT OF THE TEST OBJECTIVES.
I-4		<u>HIGHLY DESIRABLE (HD)</u> : A HIGHLY DESIRABLE ITEM IS A VEHICLE OR OPERATIONAL SUPPORT ELEMENT THAT SUPPORTS AND ENHANCES THE ACCOMPLISHMENT OF THE MISSION AND IS ESSENTIAL FOR THE ACCOMPLISHMENT OF THE TEST OBJECTIVES.
I-5		<u>DESIRABLE (D)</u> : A DESIRABLE ITEM IS A VEHICLE ELEMENT OR OPERATIONAL SUPPORT ELEMENT THAT IS NOT ESSENTIAL FOR THE ACCOMPLISHMENT OF THE MISSION.
I-6		<u>PROCEED</u> : CONTINUE IN ACCORDANCE WITH PRESCRIBED PROCEDURES.
I-7		<u>HOLD</u> : INTERRUPTION OF THE PREFLIGHT PROCEDURES FOR UNFAVORABLE WEATHER, REPAIR OF HARDWARE, OR CORRECTION OF CONDITIONS UNSATISFACTORY FOR FLIGHT.
I-8		<u>INSTRUMENTATION</u> : INSTRUMENTATION IS THE EQUIPMENT THAT ACQUIRES, TRANSMITS AND MONITORS DATA FOR PERFORMANCE EVALUATION OF VEHICLE AND OPERATIONAL SUPPORT ITEMS.
I-9		<u>SHUTDOWN</u> : (GROUND USE ONLY) SECURE THE VEHICLE IN ACCORDANCE WITH EMERGENCY PROCEDURE NUMBER _____.

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REV	ITEM				
	I-10	<u>LAND:</u> LAND THE VEHICLE WITHOUT DELAY ON THE CLOSEST HARD SURFACE LANDING AREA.			
	I-11	<u>ENGINE CUTOFF:</u> (GROUND USE ONLY) SECURE THE ENGINE BY STOPCOCKING THE JET THROTTLE.			
	I-12	<u>PHASE</u> A. GROUND OPERATION B. INFLIGHT OUT OF LUNAR SIM C. INFLIGHT LUNAR SIM			
	I-13	<u>STOP SIM</u> - PILOT WILL PERFORM FOLLOWING STEPS: A. LUNAR SIM RELEASE - PUSH B. JET THROTTLE - ADVANCE C. LIFT ROCKET - HANDLE-DOWN D. GIMBAL LOCK SWITCH - ON			
MISSION	REV	DATE	SECTION	GROUP	PAGE
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REV	ITEM				
		GENERAL			
	2-1	THE FLIGHT MISSION RULES OUTLINE PREPLANNED DECISIONS DESIGNED TO MINIMIZE THE AMOUNT OF REAL-TIME RATIONALIZATION REQUIRED WHEN NON-NOMINAL SITUATIONS OCCUR DURING THE PREFLIGHT PREPARATIONS AND THE FLIGHT PHASE OF THE MISSION.			
	2-2	WHENEVER POSSIBLE, THE PILOT AND VAN WILL VERIFY ALL MALFUNCTIONS.			
	2-3	THE LLTV WILL NOT BE FLOWN WITH ANY KNOWN SYSTEM MALFUNCTIONS, UNLESS THAT MALFUNCTION IN NO WAY COMPROMISES THE SAFETY OF ANY MANEUVER OR FLIGHT PROFILE TO BE FLOWN ON THAT SPECIFIC FLIGHT.			
	2-4	WHEN A CHANGE IN FLIGHT PLAN ACTIVITIES IS REQUIRED, THE FLIGHT DIRECTOR WILL DETERMINE THE PRIORITY OF ACTIVITIES TO BE PERFORMED.			
	2-5	IN SOME INSTANCES, THE SPECIFIC MISSION RULES MAY DEVIATE FROM THE GENERAL GUIDELINES CONTAINED IN PART 1 OR FROM THESE GENERAL RULES. THE SPECIFIC MISSION RULE WILL APPLY IN ALL CASES, AND THE DEVIATIONS FROM THE GENERAL GUIDELINES WILL BE NOTED.			
	2-6	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.			
	2-7	THE SYSTEMS LIMITS LISTED IN THESE RULES ARE THE ACTUAL VEHICLE LIMITS AS WELL AS THEY ARE KNOWN AND UNDERSTOOD AND ARE NOT BIASED TO COMPENSATE FOR TIME DELAYS OR KNOWN INSTRUMENTATION ERRORS IN THE OVERALL DATA SYSTEM.			
	2-8	THE FLIGHT DIRECTOR WILL ASSUME CONTROL OF THE MISSION WHEN POSITIVE COMMUNICATION WITH THE PILOT AND THE PREFLIGHT GROUND CREW HAVE BEEN ESTABLISHED AND WILL CONTROL THE MISSION UNTIL COMMUNICATIONS WITH THE PILOT HAVE BEEN TERMINATED AFTER THE FINAL LANDING.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
LLTV		3/1/69	GENERAL RULES AND SOP'S	GENERAL	2-1

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REV	ITEM				
	2-9	THE FLIGHT DIRECTOR WILL BE RESPONSIBLE FOR DECISIONS AFFECTING THE CONDUCT OF THE MISSION INCLUDING DELETIONS FROM THE SCHEDULED FLIGHT PLAN ACTIVITIES AND EARLY MISSION TERMINATIONS.			
	2-10	NO ADDITIONAL MANEUVERS WILL BE ADDED TO THE FLIGHT PLAN IN REAL TIME.			
	2-11	THE PILOT WILL BE RESPONSIBLE FOR THE SAFE OPERATION OF THE VEHICLE AND MAY TERMINATE ANY MANEUVER OR THE MISSION IF HE FEELS THE SAFE OPERATION OF THE VEHICLE CANNOT BE MAINTAINED.			
	2-12	THE PILOT WILL LAND IN THE EVENT AN INFLIGHT SYSTEM MALFUNCTION OCCURS.			
	2-13	NO FLIGHT WILL BE CONDUCTED AT ANY ALTITUDE ABOVE 1000 FEET MSL.			
	2-14	A CHECK OF WIND <u>VELOCITY AND DIRECTION AT ALL ALTITUDES</u> AT WHICH THE VEHICLE IS PROGRAMED TO FLY WILL BE MADE WITHIN 30 MINUTES PRIOR TO TAKEOFF.			
	2-15	THE VEHICLE WILL NOT BE FLOWN AT ANY ALTITUDE AT WHICH THE WIND VELOCITY EXCEEDS <u>15 MPH ( 22 fts)</u> .			
	2-16	THE LLTV WILL NOT BE OPERATED ON THE GROUND OR IN FLIGHT DURING PERIODS OF PRECIPITATION.			
	2-17	ALL FLIGHT OPERATIONS WILL BE CONDUCTED DURING DAYLIGHT HOURS TO ALLOW VISUAL GROUND REFERENCE TO THE PILOT.			
	2-18	UNDER NORMAL OPERATIONS THE LLTV WILL ONLY BE OPERATED OVER THE HARD SURFACE RUNWAYS.			
	2-19	THE PILOT WILL INFORM THE FLIGHT DIRECTOR OF ANY UNPLANNED SWITCH ACTUATIONS AND OBTAIN CONCURRENCE IF TIME PERMITS.			
MISSION	REV	DATE	SECTION	GROUP	PAGE
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## MISSION RULES

REV	ITEM				
	2-20	THE PILOT WILL BE RESPONSIBLE FOR THE DECISION TO EJECT.			
	2-21	IF THE VEHICLE IS UNCONTROLLABLE THE PILOT WILL EJECT.			
	2-22	UPON BEING ADVISED TO STOP SIMULATION THE PILOT MAY ELECT TO CONTINUE IN THE LUNAR SIM MODE IF IN HIS OPINION A SAFE LANDING IS IMMINENT.			
	2-23	BOTH OR STANDARD SETS OF ATTITUDE THRUSTERS WILL NOT BE UTILIZED FOR NORMAL MANEUVERS UNLESS SPECIFICALLY REQUIRED BY THE FLIGHT PLAN.			
	2-24	IN THE EVENT OF LOSS OF COMMUNICATIONS BETWEEN THE FLIGHT DIRECTOR AND PILOT NO TAKEOFF WILL BE INITIATED IF THE VEHICLE IS ON THE GROUND AND AN IMMEDIATE LANDING WILL BE MADE IF THE VEHICLE IS IN FLIGHT.			
	2-25	IN THE EVENT OF COMPLETE LOSS OF TM OR DISPLAY CAPABILITY NO TAKEOFF WILL BE INITIATED IF THE VEHICLE IS ON THE GROUND AND AN IMMEDIATE LANDING WILL BE MADE IF THE VEHICLE IS IN FLIGHT.			
	2-26	THE FLIGHT DIRECTOR WILL TERMINATE THE MISSION BASED ON VISUAL OBSERVATION OF ANY UNUSUAL SITUATION (e.g., LEAKS, FIRE, SMOKE, OR UNUSUAL ATTITUDES.)			
	2-27	IN THE EVENT OF A DISCREPANCY BETWEEN ON-BOARD INSTRUMENTATION AND VAN INSTRUMENTATION, THE VAN INDICATIONS WILL BE PRIMARY. ANY DEVIATIONS FROM THIS RULE WILL BE LISTED IN THE SPECIFIC SYSTEM RULES.			
	2-28	DURING PRETAKEOFF PHASE THE NASA QA INSPECTOR OR THE CREW CHIEF IS RESPONSIBLE FOR SIGNALING ENGINE CUTOFF TO THE PILOT BASED ON VISUAL OBSERVATION OF ANY HAZARDOUS CONDITION.			
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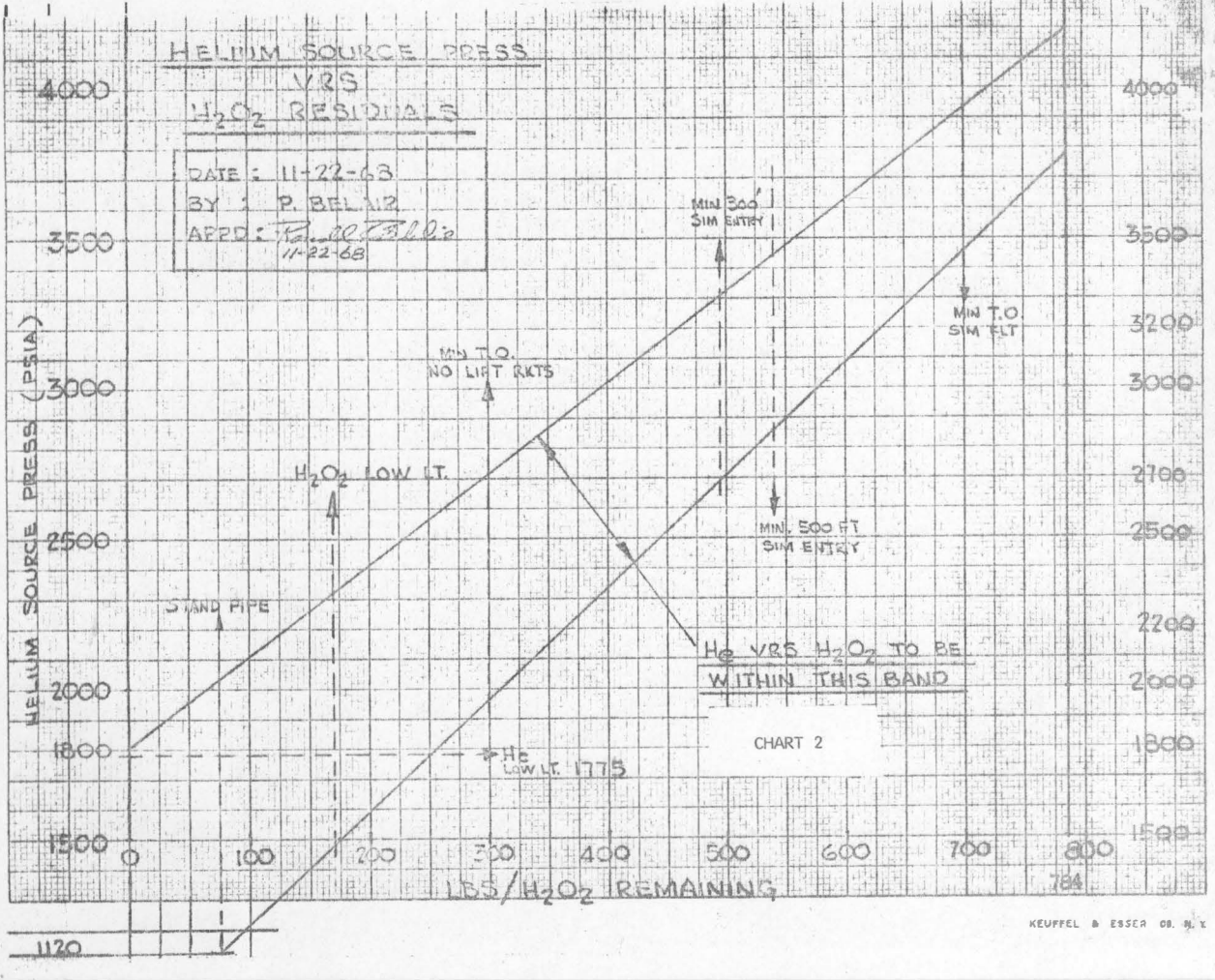
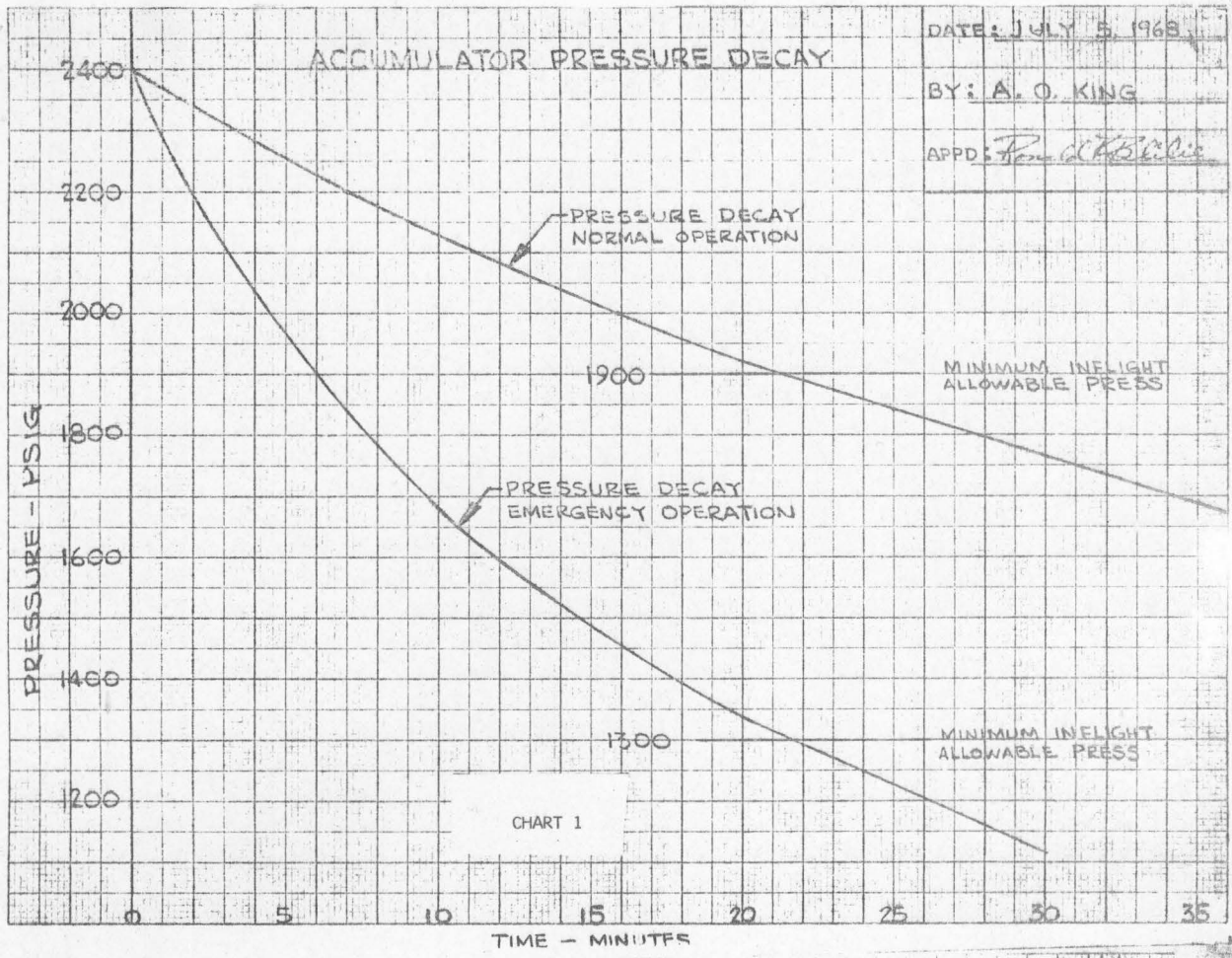
REV	ITEM	GO/NO-GO			
	<u>GENERAL - PRE TAKEOFF</u>				
3-1	JP-4 - FUEL QUANTITY TANK PRESSURE	340 LBS MIN FOR TAKEOFF 5 PSIG AND RISING MIN FOR TAKEOFF PRESSURE UNBALANCE BETWEEN TANKS NOT TO EXCEED 5 PSIG			
3-2	JET ENGINE - GAS GENERATOR - AFT FAN - OIL PRESSURE - EGT - CDP	101.2% MAX 9000 RPM MAX (9300 RPM ALLOWABLE FOR 2 MIN.) 5 PSIG MIN AT IDLE 15 PSIG MIN FOR TAKEOFF 60 PSIG MAX FOR TAKEOFF 750°C MAX ON START (7 SEC) 729°C MAX FOR TAKEOFF 60 PSIG MIN FOR TAKEOFF 95 PSIG MAX FOR TAKEOFF			
3-3	HYDRAULIC - ACCUMULATOR PRESSURE	SEE CHART NO. 1			
3-4	OXYGEN - PRESSURE	1700 PSIG MIN FOR TAKEOFF			
3-5	HELIUM - SOURCE PRESSURE	3500 PSIA MIN FOR TAKEOFF			
3-6	H <sub>2</sub> O <sub>2</sub> - TANK PRESSURE - QUANTITY	490 PSIA MIN 520 PSIA MAX 700 LBS MIN FOR TAKEOFF (LUNAR SIM) 300 LBS MIN FOR TAKEOFF (NO LIFT ROCKET OPERATION)			
3-7	ELECTRICAL - BATTERY VOLTAGE	27.0 VDC MIN FOR TAKEOFF (UNDER LOAD)			
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REV	ITEM				
		<u>GENERAL INFLIGHT</u>			
3-8	JP-4 - FUEL QUANTITY  - TANK PRESSURE	180 LBS MIN FOR LUNAR SIM ENTRY 94 LBS MIN FOR FLIGHTS  20 PSIG MIN FOR FLIGHT PRESSURE UNBALANCE BETWEEN TANKS NOT TO EXCEED 5 PSIG			
3-9	JET ENGINE - GAS GENERATOR  - AFT FAN - OIL PRESSURE  - EGT - CDP	101.2% MAX FOR FLIGHT  9000 RPM MAX FOR FLIGHT  15 PSIG MIN FOR FLIGHT 60 PSIG MAX FOR FLIGHT  729°C MAX FOR FLIGHT  95 PSIG MAX FOR FLIGHT			
3-10	HYDRAULIC - ACCUMULATOR PRESSURE	SEE CHART 1 FOR FLIGHT MINIMUM			
3-11	HELIUM - SOURCE PRESSURE	<i>and life comes on @ 1700 psia</i> 1600 PSIA MIN IN LUNAR SIM SEE CHART 2 FOR FLIGHT MINIMUM PRESSURE UNBALANCE NOT TO EXCEED 100 PSI			
3-12	H <sub>2</sub> O <sub>2</sub> - TANK PRESSURE  QUANTITY	475 MIN FOR FLIGHT 530 MAX FOR FLIGHT  180 LBS MIN IN LUNAR SIM 170 LBS MIN FOR FLIGHT			
3-13	ELECTRICAL - PRIMARY DC  PRIMARY AC	26 VDC MIN FOR FLIGHT 30 VDC MAX FOR FLIGHT  115 VAC MIN FOR FLIGHT 125 VAC MAX FOR FLIGHT			
NOTE: ADDITIONAL SPECIFIC GO/NO-GO'S WILL BE ESTABLISHED FOR EACH MISSION BASED ON PROGRAMED FLIGHT PLAN MANEUVERS AND REQUIREMENTS.					
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CH NO.	WORD	BIT	DAC	DRIVER	PARAMETER TITLE	TRANSducer RANGE	CALIB VEH VAN	ON-BOARD DISPLAY INSTR	COLOR LIGHT OR SCALE	READOUTS NOMINAL CRITICAL	RECORDING 5-FLY/PF-PREFLT	CONSOLE
1					PITCH ATTITUDE	±50°		B-DALL			3F	FD
2					ROLL ATTITUDE	±50°		B-DALL			6F	FD
3					YAW ATTITUDE	10V AT .05V/°		B-DALL				FD
4					PITCH VELOCITY	±20°/SEC					1F	
5					ROLL VELOCITY	±20°/SEC					4F	AV
6					YAW VELOCITY	±20°/SEC					7F	AV
7					Az ERROR	33 V/°		NA				
8					HELIUM PRESS L/H	0 - 4500 PSIA		METER 0 - 4500 PSIA		3500 PSIA (FIG. _____)		RKT
9					HELIUM PRESS R/H	0 - 4500 PSIA		METER 0 - 4500 PSIA				RKT
10					ENGINE PITCH ATT	125 MV/DEG		NA				
11					ENGINE ROLL ATT	125 MV/DEG		NA				
12					Ax	±1.5g		NA				
13					Ay	±1.5g		NA				
14					Az	±1.5g		NA				
15					ALTITUDE	0 - 10000 FT		METER 0 - 10,000 FT		1000 FT MAX		FD
16					VERTICAL VELOCITY	0 - 50 FT/SEC		METER 0 - 60 FT/SEC				FD
17					DRIFT VELOCITY	0 - 50 FT/SEC		CROSS POINTER				
18					HORIZONTAL VELOCITY	0 - 50 FT/SEC		CROSS POINTER				
19					LIFT THROTTLE POSITION	0 - 60°		NA				RKT
20					PITCH RATE CMD	10V AT .05°/SEC		NA			2F	AV
21					ROLL RATE CMD	10V AT .05°/SEC		NA			5F	AV
22					YAW RATE CMD	10V AT .05°/SEC		NA				AV
23					ENGINE THROTTLE POSN	0 - 48°		NA				ENG
24					COMP DISC PRESS	0 - 100PSIA		NA				ENG
25					LIFT ROCKET CHP L/H	0 - 600 PSIA		METER 0 - 400 PSIA			8F	RKT
26					LIFT ROCKET CHP R/H	0 - 600 PSIA		METER 0 - 400 PSIA				RKT
27					ACS ROCKET CHP BS	0 - 400 PSIA		NA			6F	FD, DYN
28					ACS ROCKET CHP FS	0 - 400 PSIA		NA			6PF	FD, DYN
29					ACS ROCKET CHP BT	0 - 400 PSIA		NA			2F	FD, DYN
30					ACS ROCKET CHP FT	0 - 400 PSIA		NA			2PF	FD, DYN
31					ACS ROCKET CHP GS	0 - 400 PSIA		NA			7PF	FD, DYN
32					ACS ROCKET CHP CT	0 - 400 PSIA		NA			3F	FD, DYN
33					ACS ROCKET CHP CS	0 - 400 PSIA		NA			7F	FD, DYN
34					ACS ROCKET CHP GT	0 - 400 PSIA		NA			3PF	FD, DYN
35					ACS ROCKET CHP AS	0 - 400 PSIA		NA			5F	FD, DYN
36					ACS ROCKET CHP ES	0 - 400 PSIA		NA			5PF	FD, DYN
37					ACS ROCKET CHP BS	0 - 400 PSIA		NA			1PF	FD, DYN
38					ACS ROCKET CHP AT	0 - 400 PSIA		NA			1F	FD, DYN
39					ACS ROCKET CHP DT	0 - 400 PSIA		NA			4F	FD, DYN
40					ACS ROCKET CHP HT	0 - 400 PSIA		NA			8F	FD, DYN
41					ACS ROCKET CHP DS	0 - 400 PSIA		NA				
42					ACS ROCKET CHP HS	0 - 400 PSIA		NA				
43					AFT JP-4 PRESS	0 - 50 PSIG		METER 0 - 50 PSIG				ENG
44					FWD JP-4 PRESS	0 - 50 PSIG		METER 0 - 50 PSIG				ENG
45					FAN RPM	0 - 10,000 RPM		METER		9K CONT 9.3K 2 MIN		ENG
46					THRUST/WEIGHT COMP	1.24V/0.4g		NA				ENG
47					+5V CAL	+5.00V		NA				TM
48					-5V CAL	-5.00V		NA				TM
49					GAS GENERATOR RPM	0 - 4620 RPM		METER				ENG
50					H2O2 L/H PRESS	0 - 600 PSIA		METER 0 - 600 PSIA		415 - 510 PSIA		RKT
51					E G T	0 - 1200° C		DIGITAL R/O ±2° C		729° C MAX	790° C START 675° C C/DLE	ENG
52					H2O2 R/H PRESS	0 - 600 PSIA		METER 0 - 600 PSIA		475 - 510 PSIA		RKT
53					AY ERROR	10V MAX		NA				
54-1					JP-4 CAUTION	(1)		AMB LITE (117 ±2.2 LB)/TANK	AMB	50% JP-4 REM	FD	DYN
54-2					JP-4 LOW	(1)		RED LITE (46.8 ±1.7 LB)/TANK	RED	20% JP-4 REM	FD	DYN
54-3					H2O2 R/H LOW	(1)		RED LITE 85 ±5 LBS/TANK	RED	85 LB H2O2 REM	FD	RKT
54-4					H2O2 L/H LOW	(1)		RED LITE	RED	85 LB H2O2 REM	FD	RKT
54-5					LOW JET HOLD	(0)		LITE	RED	JET THROTTLE AT MIN SETTING	FD	DYN
54-6					LOW THRUST MAN	(1)		RED LITE <75 - 80% RPM	RED	JET THROTTLE BELOW MIN SET	FD	ENG
54-7					HE PRESS LOW	(1)		RED LITE <1775 PSIG	RED	HE PRESS BELOW 1775 PSI	FD	RKT
54-8					DOPPLER	(0)		AMB LITE RADAR UNRELIABLE	AMB	DOPPLER DATA INVALID	FD	
54-9					ATT ROCKET TEST	(0)		NA	GRN	PILOT HAS SELECTED TEST JETS	FD	RKT
55-1					JET STAB	(0)		GRN LITE	GRN	LUNAR SIM ARMED	FD	DYN
55-2					LOCAL VERTICAL	(0)		AMB LITE PILOT SEL, ENG TILT	AMB	LOCAL VERTICAL SYS ARMED	FD	DYN
55-3					EMER GIMBAL LOCK	(0)		15°±1° LAND STRUT ±1/2 IN.	RED	HYD OIL P LOSS, AC OR DC PWR	FD	DYN
55-4					ATT ROCKET STD	(0)		RED LITE PRI HYD P 1350±2 PSIG	RED	FAIL, EXCESS ENG TILT	FD	RKT
55-5					STUCK VALVE	(1)		AC/DC NO ENG TILT 15°±1°	GRN	PILOT SEL STD JETS	FD	RKT
55-6					P/R RATE B/U	(1)		NA	GRN	STUCK ROCKET - "BOTH" ON	FD	RKT
55-7					AUTO THROTTLE	(0)		GRN LITE	GRN	ACS SYS RATE IN BU IN PITCH ROLL	FD	DYN
55-8					MAX TILT	(0)		RED LITE 15°±1° (PIT + ROLL + 64°)	GRN	AUTO THROTTLE ACTIVATED	FD	DYN
55-9					GIMBAL LOCK	(0)		GRN LITE	GRN	ENG TILTED 15°+	FD	DYN
56-1					PITCH DIRECT	(0)		NA	RED	PILOT SEL GIMBAL LOCK	FD	DYN
56-2					YAW DIRECT	(0)		NA	RED	PILOT SEL	FD	AV
56-3					CB-7 TRIP	(1)		NA	RED	DC PWR LOSS MONITOR ACS,	FD	AV
56-4					B/U RATE GYRO	(1)		NA	REO	DRAG COMP, ATT GYRO PKG		AV
56-5					BAT CONT RELAY	(1)		NA	RED	EXCESS B/U GYRO RATE;		AV
56-6					HOR VEL X 10	(1)		NA	AMB	B/U ACS KAPUT		AV
56-7					EMERGENCY AC PWR	(1)		NA	RED	BAT FEEDING EMER BUS		AV
56-8					YAW RATE B/U	(1)		NA	RED	HOR VEL INDICATOR X 10		AV
56-9					OIL PRESS LOW	(1)		NA	RED	INVERTER - NO AC OUT		AV
57-1					ROLL DIRECT	(1)		LITE 15±2 PSIG	RED	ACS SYS IN RATE B/U IN YAW	FD	DYN
57-2						(0)		NA	RED	OIL PRESS BELOW 16 PSIG	FD	AV
57-3										PILOT SEL		AV
57-4												
57-5												
57-6												
57-7												
57-8												
57-9												
58					AZ ERROR	10V MAX		NA				
59					H2O2 REMAINING	0 - 990 LB		DIGITAL R/O±2 LB		15 - 60 PSIG		RKT
60					ENG OIL PRESS	0 - 100 PSIG		METER 0 - 60 PSIG				ENG
61					WIND VELOCITY	0 - 60 FT/SEC		METER				FD
62					WIND DIRECTION	0 - 340°		POINTNER				FD
63					ACCUMULATOR PRESS	0 - 3500 PSIA		NA		1900±100 PSIG (FIG. DELAY)		ENG
NA					ATT AUTH PIT							AV
NA					ATT AUTH ROLL							AV
NA					ATT AUTH YAW							AV
NA					H2O2 REM COMP							RKT
NA					JP-4 REM COMP							ENG
NA					GND WIND VEL							FD
NA					GND WIND DIRECTION							FD
NA					CLOCK			B-DAY-SWEEP SEC				
NA					AC VOLTAGE @ A OR C			METER AND SW				
NA					DC VOLTAGE PRI OR EMER			METER				
NA					RADAR ALTIMETER			AMB LITE RADAR ALTI-				
NA					MASTER WARNING			METER UNRELIABLE				
NA					GYRO FAILURE			RED LITE				
NA					DIGITAL CLOCK			RED LITE >22°/SEC RATE FROM				FD
NA					HELIUM TEMP			B/U RATE GYRO				RKT
NA					HE DIGITAL RO L/H							RKT
NA					HE DIGITAL RO R/H							RKT
NA					PITCH AUTH							AV
NA					ROLL AUTH							AV
NA					YAW AUTH							AV
NA					PERCENT RPM (ENG)			0 - 100%				AV

PRIMARY HYD.

SECTION 4 - INSTRUMENTATION/COMMUNICATION REQUIREMENTS

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MISSION RULES

REV	ITEM	INDICATION/PARAMETER	VEH	VAN	PICK-UP/OR TRA DUCER	CATEGORY	FLIGHT MODES	MISSION RULE REFERENCE	NOTES/COMMENTS
		JET THROTTLE POSITION INDICATOR	NO		POT	D			
		FAN RPM	NO		COUNTER	D			
		CDP	NO		YES	HD			
		EGT	YES		THERMOCOUPLE	HD			
		RPM	YES		COUNTER	HD			
		OIL PRESS	YES		YES	D			
		HYDRAULIC ACCUMULATOR PRESS	NO		YES	HD			
		FWD J-P4 TANK PRESSURE	YES		YES	D			
		AFT J-P4 TANK PRESSURE	YES		YES	D			
		J-P4 CAUTION LIGHT	YES			HD			
		J-P4 LOW LIGHT	YES			M			
		AUTO THROTTLE LIGHT	YES			D			
		LOCO THRUST MANUAL LIGHT	YES			D			
		LOW JET HOLD LIGHT	NO			D			
		OIL PRESSURE LOW LIGHT	YES			D			
		BLANK	---						
		EMERGENCY GIMBAL LOCK LIGHT	YES			D			

MISSION	REV	DATE	SECTION	GROUP	PAGE
LLTV		3/1/69	INSTRUMENTATION/COMMUNICATION REQ'T'S	ENGINE	4-1

## NASA — Manned Spacecraft Center

## MISSION RULES

REV	ITEM								
		<u>INDICATION/PARAMETER</u>	<u>VEH</u>	<u>VAN</u>	<u>PICK-UP/OR TRANSDUCER</u>	<u>CATEGORY</u>	<u>FLIGHT MODES</u>	<u>MISSION RULE REFERENCE</u>	<u>NOTES/COMMENTS</u>
		PITCH RATE	NO	4	COMMON	M			
		ROLL RATE	NO	5	COMMON	M			
		YAW RATE	NO	6	COMMON	M			
		PITCH COMMAND	NO	20	COMMON	HD			
		ROLL COMMAND	NO	21	COMMON	HD			
		YAW COMMAND	NO	22	COMMON	HD			
		PITCH AUTHORITY	NO	---	-----	M			
		ROLL AUTHORITY	NO	---	-----	M			
		YAW AUTHORITY	NO	---	-----	M			
		<u>(LIGHTS)</u>							
		PITCH DIRECT LATCH	NO	56-1	-----	M			
		ROLL DIRECT LATCH	NO	57-1	-----	M			
		YAW DIRECT LATCH	NO	56-2	-----	M			
		P/R RATE BACKUP	YES	55-6	COMMON	M			
		YAW RATE BACKUP	YES	56-8	COMMON	M			
		EMERG A-C FAIL	NO	56-7	-----	M			
		CB-7 TRIP	NO	56-3	-----	M			
		STUCK VALVE	YES	55-5	COMMON	M			
		ATT RKT TEST	NO	54-9	-----	HD			
		ATT RKT STD	NO	55-4	-----				
		<u>(LIGHTS)</u>							
		ATT RKT CHAMBER PRESSURE (16 RKT'S)	NO	27 THRU 42	COMMON	M			
		JP-4 LOW	YES	54-2	COMMON	D			
		OIL PRESS LOW	YES	56-9	COMMON	D			
		MAX TILT	YES	55-8	COMMON	M			
		EMERG G/L	YES	55-3	COMMON	M			
		JET STAB	YES	55-1	COMMON	M			
		AUTO THROTTLE	YES	55-7	COMMON	M			
		LOW THRUST MAN	YES	54-6	COMMON	HD			
		LOW JET HOLD	NO	54-5	-----	M			
		GIL	YES	55-9	COMMON	M			
		LOCAL VERT	YES	55-2	COMMON	M			
MISSION	REV	DATE	SECTION			GROUP	PAGE		
LLTV		3/1/69	INSTRUMENTATION/COMMUNICATIONS REQ'T'S			AVIONICS	4-2		

NASA — Manned Spacecraft Center

MISSION RULES

REV	ITEM	INDICATION/PARAMETER	VEH	VAN	PICK-UP/OR TRANSDUCER	CATEGORY	FLIGHT MODES	MISSION RULE REFERENCE	NOTES/COMMENTS
		JP4 CAUTION	YES	54-1	COMMON	D			
		JP4 LOW	YES	54-2	COMMON	D			
		OIL PRESS LOW	YES	56-9	COMMON	D			
		MAX TILT	YES	55-8	COMMON	M			
		EMERG G/L	YES	55-3	COMMON	M			
		JET STAB	YES	55-1	COMMON	M			
		AUTO THROTTLE	YES	55-7	COMMON	M			
		LOW THRUST MAN	YES	54-6	COMMON	HD			
		LOW JET HOLD	NO	54-5	-----	M			
		G/L	YES	55-9	COMMON	M			
		LOCAL VERT	YES	55-2	COMMON	M			
		(GAGES)							
		X-Y PLOTTER	YES	{ 60 W/S	COMMON	M			
			YES	{ 61 W/D					
		ENGINE GIMBAL POS	NO	{ 10	COMMON	M			
				{ 11					
		WIND SPEED	YES	60	COMMON	HD			
		WIND DIRECTION	YES	61	COMMON	HD			
MISSION	REV	DATE	SECTION			GROUP		PAGE	
LLTV		3/1/69	INSTRUMENTATION/COMMUNICATION REQ'T'S			DYNAMICS		4-3	

## NASA — Manned Spacecraft Center

## MISSION RULES

REV	ITEM								
		INDICATION/PARAMETER	VEH	VAN	PICK-UP/OR TRANSDUCER	CATEGORY	FLIGHT MODES	MISSION RULE REFERENCE	NOTES/COMMENTS
		<b>A. STATUS LIGHTS</b>							
		1. ATTITUDE RKT - STD	NO	55-4	N/A	HD	ALL	-----	INDICATED TO PILOT BY SWITCH POSITION ONLY
		2. ATTITUDE RKT - TEST	NO	54-9	N/A	HD	ALL	-----	
		3. LOCAL VERTICAL	YES	55-2	COMMON	HD	ALL	-----	
		4. JET STAB	YES	55-1	COMMON	M	LUNAR SIM	-----	
		5. AUTO THROTTLE	YES	55-7	COMMON	M	LUNAR SIM	-----	
		<b>B. WARNING LIGHTS</b>							
		1. STUCK VALVE	YES	55-5	COMMON	HD	ALL	8-5	
		2. HE LOW SOURCE	YES	54-7	COMMON	M	ALL	9-1, 9-2, 9-3	
		3. H <sub>2</sub> O <sub>2</sub> LOW L/H	YES	54-4	COMMON	M	ALL	9-9	
		4. H <sub>2</sub> O <sub>2</sub> LOW R/H	YES	54-3	COMMON	M	ALL	9-9	
		<b>C. METERS</b>							
		1. 'T' HANDLE POSITION	NO	19	N/A	M	ALL	9-10, 9-11	
		2. LIFT RKT CHAM PRESS L/H	YES	25	COMMON	M	ALL		
		3. LIFT RKT CHAM PRESS R/H	YES	26	COMMON	M	ALL		
		4. H <sub>2</sub> O <sub>2</sub> REMAINING (VEHICLE)	YES	58	COMMON	M	ALL		
		5. HE SOURCE PRESS L/H	YES	8	COMMON	M	ALL		
		6. HE SOURCE PRESS R/H	YES	9	COMMON	M	ALL		
		7. HELIUM TEMP	NO		N/A	D	ALL		
		8. H <sub>2</sub> O <sub>2</sub> TANK PRESS L/H	YES	50	COMMON	M	ALL		
		9. H <sub>2</sub> O <sub>2</sub> TANK PRESS R/H	YES	52	COMMON	M	ALL		
		<b>D. DIGITAL READ-OUTS</b>							
		1. HE SOURCE PRESS L/H	NO	8	N/A	M	ALL		
		2. HE SOURCE PRESS R/H	NO	9	N/A	M	ALL		
		3. H <sub>2</sub> O <sub>2</sub> REMAINING (VEHICLE)	YES	58	COMMON	M	ALL		
		4. H <sub>2</sub> O <sub>2</sub> REMAINING (VAN COMPUTER)	NO		N/A	HD	ALL		
		5. H <sub>2</sub> O <sub>2</sub> TANK PRESS L/H	NO	50	N/A	HD	ALL		
		6. H <sub>2</sub> O <sub>2</sub> TANK PRESS R/H	NO	52	N/A	HD	ALL		
		7. LIFT RKT ΔP	NO		N/A	HD	ALL		
MISSION	REV	DATE	SECTION			GROUP		PAGE	
LLTV		3/1/69	INSTRUMENTATION/COMMUNICATION REQT'S			ROCKETS		4-4	

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

REV	ITEM			
		GENERAL		
	5-1	<p>THE FOLLOWING EQUIPMENT AND SUPPORT SERVICES ARE REQUIRED, IN ADDITION TO THE VAN EQUIPMENT AND PERSONNEL, PRIOR TO MAKING ANY LLTV FLIGHT:</p> <p>A. A QUALIFIED MEDICAL DOCTOR IN ATTENDANCE.</p> <p>B. A QUALIFIED MEDICAL ATTENDANT/AMBULANCE DRIVER IN ATTENDANCE.</p> <p>C. A FULLY EQUIPPED AMBULANCE.</p> <p>D. A FIRE TRUCK (0-11A OR EQUIVALENT) AND FOUR QUALIFIED FIREMEN IN ATTENDANCE. THE FIRE TRUCK WILL BE EQUIPPED WITH A FUNCTIONING UHF RADIO CAPABLE OF COMMUNICATIONS WITH THE CONTROL VAN.</p> <p>E. TELEVISION EQUIPMENT WILL BE OPERATIONAL AND CAPABLE OF RECORDING UHF AUDIO AND VISUAL EVENTS OF THE ENTIRE FLIGHT. COLOR MOVIE FILM WILL BE USED TO RECORD FLIGHT EVENTS. BOTH TELEVISION AND COLOR MOVIES ARE DESIRABLE; HOWEVER, IT IS MANDATORY THAT EITHER TELEVISION OR COLOR MOVIES RECORD FLIGHT EVENTS FOR EVERY FLIGHT.</p>		
MISSION	REV	DATE	SECTION	PAGE
LLTV		3/1/69	GROUND SUPPORT REQUIREMENTS	5-1



SECTION VI - PAD SUPPORT  
**NASA — Manned Spacecraft Center**  
**MISSION RULES**

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	6-1	COMP ELEC PWR LOSS	A	<del>4</del> CREW CHIEF GIVE ENG CUTOFF TO PILOT AND NOTIFY FD.	VISUAL OBSERVATION OF SWITCHES /OP CB'S ON AGE	
	6-2	SWIRL COMP FAILURE	A	ADVISE FD TO DIRECT PILOT TO CUTOFF ENGINE	INSUFF AIR FROM SWIRL COMP SYSTEM	
	6-3	VISUAL OBSERVATION OF FIRE OR SMOKE	A	SIGNAL PILOT ENGINE CUTOFF AND ADVISE FD TO SHUT DOWN.		
	6-4	VISUAL OBSERVATION OF SYSTEM LEAKS	A	SIGNAL PILOT ENGINE CUTOFF AND ADVISE FD		
	6-5	VISUAL OBSERVATION OF FIRE, SMOKE, OR LEAKS	B C	ADVISE FD		
MISSION	REV	DATE	SECTION		GROUP	PAGE
LLTV		3/1/69	PAD SUPPORT		QA	6-1

SECTION VII - ENGINE

NASA — Manned Spacecraft Center

MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-1	EGT ABOVE 729°	A B,C	ENGINE CUTOFF (EXCEPT START) LAND	<u>COCKPIT AND TM VAN</u> 1. EGT NOTE: COULD USE LIFT ROCKETS TO MINIMIZE JET ENGINE THRUST MAX STARTING EGT 750°	
	7-2	ENGINE OR FAN RPM OVER- SPEED.  LIMIT: ENGINE - 101.2 PERCENT OR FAN - 9000 RPM	A B,C	ENGINE CUTOFF LAND	<u>COCKPIT AND TM VAN</u> 1. ENGINE RPM  <u>TM VAN</u> 1. FAN RPM 2. CDP NOTE: COULD USE LIFT ROCKETS TO MINIMIZE JET ENGINE THRUST	
	7-3	ENGINE FAILS TO RESPOND TO HYDRAULIC THROTTLE	A B	1. SWITCH TO EMERGENCY THPOTTLE. 2. ENGINE CUTOFF  1. PILOT ACTIVATE EMERGENCY THPOTTLE 2. LAND 3. IF AT LOW THRUST LEVFL, ATTEMPT TO USE LIFT POCKETS AND LAND.	<u>COCKPIT AND TM VAN</u> 1. THROTTLE POSITION 2. ENGINE RPM 3. LOW THRUST LIGHT 4. CDP GUAGE NOTE: FAILURE COULD BE CAUSED BY THE SHIP'S THROTTLE SYSTEM OR ENGINE FUEL CONTROL	
	7-4	ENGINE FLAME OUT	A B,C	SHUTDOWN EJECT		
	7-5	ENGINE LOW THRUST	A B C	N/A ? N/A 1. STOP SIM 2. LAND	<u>WARNING:</u> DO NOT SELECT EMFRGENCY THROTTLE	
MISSION	REV	DATE	SECTION		GROUP	PAGE
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**NASA — Manned Spacecraft Center**  
MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-6	VISUAL OBSERVATION OF FLUID LEAKAGE	B,C	LAND		
	7-7	FAILURE OF ENGINE SUPPORT STRUCTURE OR HYDRAULIC ACUTUATOR LINKS	A B,C	ENGINE CUTOFF LAND		
	7-8	OIL PRESSURE BELOW 15 PSI	A B,C	ENGINE CUTOFF LAND	<p><u>COCKPIT AND TM VAN</u></p> <ol style="list-style-type: none"> <li>OIL PPESSURE LIGHT</li> <li>OIL PPESSUPF GUAGE</li> </ol> <p><u>COCKPIT</u></p> <ol style="list-style-type: none"> <li>POSSIFLF ENGINE VIBRATION</li> </ol> <p><u>NOTE:</u> AT IDLE RPM OIL PPESSURE MAY BE BELOW 15 PSI</p>	
	7-9	JP4 TANK RUPTURES	A B,C	SHUTDOWN SELECT "BOTH" LAND	<p><u>COCKPIT AND TM VAN</u></p> <ol style="list-style-type: none"> <li>RAPID LOSS OF ONE JP4 TANK PPESSURE</li> <li>PITCH AUTHORITY</li> <li>ENGINE DEGRADATION</li> <li>EARLY CAUTION OR LOW LIGHT</li> </ol> <p><u>TM VAN</u></p> <ol style="list-style-type: none"> <li>FLUID LOSS</li> <li>FIPE</li> </ol> <p><u>NOTE:</u> TANK RUPTURE COULD CAUSE ENGINE FUEL STARVATION AND POSSIFLF LOSS OF PITCH CONTROL.</p>	
MISSION	REV	DATE	SECTION		GROUP	PAGE
LLTV		3/1/69	ENGINE			7-2

## SECTION VIII - ENGINE - CONTINUED

## NASA — Manned Spacecraft Center

## MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-10	JP4 TANK PRESSURIZATION SYSTEM BELOW  A. <u>5</u> PSI PRIOR TO TAKEOFF B. <u>20</u> PSI IN FLIGHT	A, B,C	NO TAKEOFF LAND	<u>NOTE:</u> LOW RPM CAUSES A SLOW DECREASE IN TANK PRESSURES.  <u>COCKPIT AND TM VAN</u> 1. JP2 TANK PRESSURE FWD 2. JP4 TANK PRESSURE AFT  <u>NOTE:</u> DURING INITIAL FLIGHT PHASE PRESSURE SHOULD RISE FROM 5 TO 20 PSI OR ABOVE
	7-11	ΔP BETWEEN JP4 TANKS GREATER THAN <u>5</u> PSI	A B,C	ENGINE CUTOFF 1. SELECT BOTH 2. LAND	<u>COCKPIT &amp; VAN</u> JP-4 TANK PRESSURES
	7-12	JP4 REMAINING COMPUTED LESS THAN <u>9½</u> LBS OR ILLUMINATION OF JP-4 LOW LIGHT.	A B,C	ENGINE CUTOFF LAND	<u>NOTE:</u> EITHER INDICATION WILL BE UTILIZED TO INVOKE RULE
	7-13	LOW THRUST LIGHT ILLUMINATED (INSTRUMENTATION FAILURE)	A B C	NO TAKEOFF DO NOT ENTER LUNAR SIM STOP LUNAR SIM	
	7-14	EMERGENCY GIMBAL LOCK ACTUATED	A B C	ENGINE CUTOFF LAND 1. STOP SIM 2. LAND	<u>COCKPIT AND TM VAN</u> 1. EMERGENCY GIMBAL LOCK LIGHT  <u>TM VAN</u> 1. VISUAL SIGHTING OF FLUID LOSS 2. PRIMARY SYSTEM PRESSURE
MISSION	REV	DATE	SECTION	GROUP	PAGE
LLTV		3/1/69	ENGINE		7-3

## NASA — Manned Spacecraft Center

## MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	7-15	FIRE (VISUAL INDICATION)	A  B,C	1. SHUTDOWN 2. EJECT IF REQUIRED  EJECT		
	7-16	HYDRAULIC ACCUMULATOR PRESSURE BELOW LIMITS	A  B,C	ENGINE CUTOFF  LAND	<u>TM VAN</u> 1. ACCUMULATOR PRESSURE GAUGE	
	7-17	ENGINE ANGLES NOT ZERO	A B  C	NO TAKEOFF 1. GIMBAL LOCK SWITCH OFF 2. LOCAL VERTICAL SWITCH-OFF IF REQUIRED 3. LAND N/A	<u>VAN IND</u> ENGINE POSITION	
MISSION	REV	DATE	SECTION		GROUP	PAGE
LLTV		3/1/69	ENGINE			7-4

SECTION VIII - AVIONICS  
**NASA — Manned Spacecraft Center**  
**MISSION RULES**

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	8-1	PRIMARY D.C. POWER FAILURE	A B C	N/A LAND 1. STOP SIM 2. LAND	CUES: COCKPIT: 1. D.C. FAIL 2. A.C. FAIL 3. BACKUP 4. EMERGENCY GIMBAL LOCK  <u>TLM VAN</u> LOSS OF TLM DATA	
	8-2	PRIMARY A.C. POWER FAILURE	A B C	N/A LAND 1. STOP SIM 2. LAND	CUES: COCKPIT: 1. A.C. PWR FAIL 2. BACKUP 3. EMERGENCY GIMBAL LOCK  <u>TLM VAN</u> LOSS OF TLM DATA	
	8-3	COMPLETE ELECTRICAL FAILURE	A B,C	SHUTDOWN EJECT	CUES: 1. LOSS OF ATTITUDE CONTROL 2. LOSS OF ALL COCKPIT LIGHTS 3. LOSS OF ALL COMMUNICATIONS	
	8-4	ACS SWITCH TO BACKUP (AUTO)	A B C	ENGINE CUTOFF LAND 1. STOP SIM 2. LAND	COCKPIT: 1. AUTO PILOT BACKUP LIGHT  VAN: 1. P/R OR YAW RATE BACKUP  <u>NOTE:</u> BACKUP ACS DOES NOT HAVE ATTITUDE HOLD	
MISSION	REV	DATE	SECTION		GROUP	PAGE
LLTV		3/1/69	AVIONICS		ACS	8-1

SECTION VIII - AVIONICS - CONTINUED  
 NASA -- Manned Spacecraft Center  
 MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	8-5	ACS THRUSTER STUCK "ON"	A B C	ENGINE CUTOFF LAND 1. STOP SIM 2. LAND	COCKPIT: 1. STUCK VALVE LIGHT 2. INCREASED CONTROL AUTHORITY  VAN: 1. STUCK VALVE LIGHT 2. BOTH SETS OF ACS THRUSTERS AUTO ENERGIZED BY AVIONICS	
	8-6	ACS THRUSTER INOPERATIVE	A B C	ENGINE CUTOFF 1. SWITCH TO "BOTH" 2. LAND  1. SWITCH TO "BOTH" 2. STOP SIM 3. LAND	COCKPIT: 1. LOW CONTROL POWER AND CROSS COUPLING  VAN: 1. THRUSTER INDICATOR LIGHTS 2. THRUSTER CHAMBER PRESSURE RECORDINGS	
	8-7	HAND CONTROLLER MALFUNCTION	A B C	ENGINE CUTOFF 1. ADVISE PILOT WHICH AXIS IS IN DIRECT 2. LAND  1. ADVISE PILOT WHICH AXIS IS IN DIRECT 2. STOP SIM 3. LAND	COCKPIT: 1. AUTO-PILOT BACKUP LIGHT 2. LOSS OF RATE FEEDBACK IN ONE OR MORE AXES  VAN: 1. PITCH, ROLL, YAW DIRECT LATCH LIGHTS	
	8-8	BACKUP RATE GYRO HARDOVER	A B C	ENGINE CUTOFF LAND 1. STOP SIM 2. LAND	COCKPIT: 1. GYRO FAIL LIGHT  VAN: 1. BACKUP RATE GYRO LIGHT	
MISSION	REV	DATE	SECTION		GROUP	PAGE
LLTV		3/1/69	AVIONICS		ACS	8-2

## NASA — Manned Spacecraft Center

## MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	8-9	EMERGENCY INVERTER POWER FAILURE	A B. C	ENGINE CUTOFF LAND 1. STOP SIM 2. LAND	COCKPIT: 1. LUNAR SIM IS INOPERATIVE, AUTO THROTTLE AND ENGINE POSITION REMAIN AS THEY WERE AT FAILURE VAN: 1. EMERGENCY A-C FAIL LIGHT	
	8-10	CIRCUIT BREAKER CB-7 TRIP	A B C	ENGINE CUTOFF 1. SELECT BACKUP 2. LAND 1. STOP SIM 2. SELECT BACKUP 3. LAND	COCKPIT:  IF LUNAR SIM IS SELECTED, JET STAB AND AUTO-THROTTLE LIGHTS WILL GO OUT, AUTO-THROTTLE WILL BE DISENGAGED AND ENGINE WILL GO TO ENGINE-CENTERED VAN: CB-7 TRIP LIGHT	
	8-11	BATTERY CONTROL RELAY ENERGIZED	A B C	ENGINE CUTOFF LAND 1. STOP SIM 2. LAND	COCKPIT: NOTE: IF NO PRIMARY D-C POWER FAILURE, NO INDICATION VAN: BAT CONT RELAY LIGHT	
	8-12	PITCH OR ROLL ATTITUDE HOLD CKT MALFUNCTION HARD OVER	A B C	ENGINE CUTOFF 1. SWITCH TO BACKUP 2. LAND 1. STOP SIM 2. SWITCH TO BACKUP 3. LAND	<u>COCKPIT AND VAN IND</u> MAXIMUM TILT LIGHT LOCAL VERTICAL LIGHT EMERGENCY GIMBAL LOCK LIGHT	
MISSION	REV	DATE	SECTION		GROUP	PAGE
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## NASA — Manned Spacecraft Center

## MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	8-13	YAW ATTITUDE HOLD CIRCUIT MALFUNCTION	A B C	ENGINE CUTOFF SWITCH TO BACKUP LAND 1. STOP SIM 2. SWITCH TO BACKUP 3. LAND	<u>COCKPIT IND</u> ABNORMAL VEHICLE RESPONSE <u>VAN IND</u> 1. YAW ATTITUDE 2. YAW RKT FIRING	
	8-14	ABNORMAL VEHICLE ATTITUDE RESPONSE	A B C	N/A 1. SWITCH TO BACKUP 2. LAND 1. STOP SIM 2. SWITCH TO BACKUP 3. LAND	<u>COCKPIT IND</u> ABNORMAL VEHICLE RESPONSE <u>VAN IND</u> NONE <u>NOTE:</u> ATTITUDE HOLD NOT AVAILABLE IN BACKUP MODE	
	8-15	INSUFFICIENT VEHICLE ATTITUDE RESPONSE	A B C	N/A 1. SWITCH TO BOTH 2. MOM COMP OFF IF REQUIRED 3. LAND 1. SWITCH TO BOTH 2. MOM COMP OFF 3. STOP SIM 4. LAND	<u>COCKPIT IND</u> SLOW OR SLUGGISH VEHICLE RESPONSE <u>VAN IND</u> NONE <u>NOTE:</u> ATTITUDE HOLD CANNOT BE SHUT OFF	
MISSION	REV	DATE	SECTION		GROUP	PAGE
LLTV		3/1/69	AVIONICS		ASC	8-4

## NASA — Manned Spacecraft Center

## MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	8-16	LOW JET HOLD LIGHT ILLUMINATED	A B C	N/A N/A 1. STOP SIM 2. LAND	<u>COCKPIT IND</u> PILOT WILL SENSE CHANGE IN HEIGHT CONTROL CHARACTERISTICS. POSSIBLE LOW JET HOLD LIGHT IF LOWER LIMIT SWITCH ENGAGED  <u>VAN IND</u> ENGINE THROTTLE POSITION INDICATOR LOW JET HOLD LIGHT IF LOWER LIMIT SWITCH ENGAGED  <u>NOTE:</u> THE JET ENGINE THROTTLE MAY EITHER DRIVEN TO THE LOW OR HIGH THROTTLE LIMIT SWITCHES THUS DISABLING FURTHER AUTO- THROTTLE DRIVE. PILOT SHOULD <u>NOT</u> SWITCH TO ELECT THROTTLE BECAUSE THE AUTO AND ELECT THROTTLE USE THE SAME CIRCUITRY	
	8-17	MAXIMUM TILT LIGHT ILLUMINATED	A B  C	ENGINE CUTOFF 1. RESET LOCAL VERTICAL 2. RESET EMER GIMBAL LOCK IS REQUIRED 3. CONTINUE IF RESET OKAY 4. IF NO RESET LAND 1. STOP SIM 2. LAND	<u>COCKPIT AND VAN IND</u> MAXIMUM TILT LIGHT LOCAL VERTICAL LIGHT EMERGENCY GIMBAL LOCK LIGHT  <u>NOTE:</u> THE SYSTEM WILL AUTOMATICALLY SWITCH TO EMERGENCY GIMBAL LOCK AFTER .5 SEC	
	8-18	LOSS OF GIMBAL LOCK CAPABILITY	A B  C	ENGINE CUTOFF 1. GIMBAL LOCK SW - OFF 2. LOCAL VERTICAL SW - OFF 3. LAND N/A	<u>COCKPIT IND</u> RANDOM VEHICLE TRANSLATION.  <u>VAN IND</u> ENGINE GIMBAL MOVEMENT WITH GIMBAL LOCK LIGHT ON.	
MISSION	REV	DATE	SECTION		GROUP	PAGE
LLTV		3/1/69	AVIONICS		ACS	8-5

## NASA — Manned Spacecraft Center

## MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	8-16	LOW JET HOLD LIGHT ILLUMINATED	A B C	N/A N/A 1. STOP SIM 2. LAND	<p><u>COCKPIT IND</u> PILOT WILL SENSE CHANGE OPERATING CHARACTERISTICS. POSSIBLE LOW JET HOLD LIGHT IF LOWER LIMIT SWITCH ENGAGED</p> <p><u>VAN IND</u> ENGINE THROTTLE POSITION INDICATOR LOW JET HOLD LIGHT IF LOWER LIMIT SWITCH ENGAGED</p> <p><u>NOTE:</u> THE JET ENGINE THROTTLE MAY BE EITHER DRIVEN TO THE LOW OR HIGH THROTTLE LIMIT SWITCHES THUS DISABLING FURTHER AUTO-THROTTLE DRIVE. PILOT SHOULD NOT SWITCH TO ELECT THROTTLE BECAUSE THE AUTO AND ELECT THROTTLE USE THE SAME CIRCUITRY</p>	
	8-17	MAXIMUM TILT LIGHT ILLUMINATED WITHOUT LOCAL VERTICAL OR EMERGENCY GIMBAL LOCK BEING SELECTED	A B C	ENGINE CUTOFF LAND 1. STOP SIM 2. LAND	<p><u>COCKPIT AND VAN IND</u> EXCESS ANGLE LIGHT</p> <p><u>NOTE:</u> LANDING IS REQUIRED DUE TO POSSIBLE LOSS OF FAILURE PROTECTION</p>	
	8-18	MAXIMUM TILT LIGHT WITH CORRESPONDING ACTIONS	A B C	DO NOT TAKE OFF LAND 1. STOP SIM 2. LAND	<p><u>COCKPIT AND VAN IND</u> MAXIMUM TILT LIGHT LOCAL VERTICAL LIGHT EMERGENCY GIMBAL LOCK LIGHT</p> <p><u>NOTE:</u> THE SYSTEM WILL AUTOMATICALLY SWITCH TO EMERGENCY GIMBAL LOCK</p>	
MISSION	REV	DATE	SECTION		GROUP	PAGE
LLTV		3/1/69	AVIONICS		ACS	8-5

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## MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	9-1	HELIUM TANK PRESSURE LOSS	A B C	ENGINE CUTOFF LAND 1. STOP SIM 2. LAND	<u>NOTE:</u> HELIUM SOURCE WOULD DEplete VERY RAPIDLY IN ONE TANK. MONITOR OTHER He TANK VERY CLOSELY TO ASCERTAIN SUFFICIENT He SUPPLY FOR LANDING	
	9-2	PREMATURE ILLUMINATION OF A HELIUM LOW LIGHT	A B,C	ENGINE CUTOFF CONTINUE MISSION NOTIFY PILOT	THE REAL TIME MONITORING OF He SOURCE PRESS WILL PROVIDE AN INDICATION OF PRESS SWITCH FAILURE. APPROACHING THE LOW LIMIT OF INFLIGHT He SOURCE THE COMMAND TO LAND THE VEHICLE WILL BE GIVEN WITH OR WITHOUT He LOW LIGHT	
	9-3	He DP BETWEEN TANKS EQUALS OR GREATER THAN 100 PSI	A B C	ENGINE CUTOFF LAND 1. STOP SIM 2. LAND	<u>COCKPIT AND VAN IND</u> He TANK PRESS	
	9-4	H <sub>2</sub> O <sub>2</sub> TANK PRESSURE GREATER THAN 530 PSI	A B C	1. ADVISE PILOT TO FIRE ACS 2. ENGINE CUTOFF IF PRESSURE CANNOT BE CONTROLLED 1. LAND 1. STOP SIM 2. LAND	RELIEF VALVE ACTUATES AT 540 PSI ±20	
MISSION	REV	DATE	SECTION		GROUP	PAGE
LLTV		3/1/69	ROCKETS		PRESSURIZATION SYSTEM	9-1

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## MISSION RULES

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS	
	9-5	H <sub>2</sub> O <sub>2</sub> TANK PRESSURE LESS THAN A. 490 PSI (GROUND) B. 475 PSI (FLIGHT)	A B C	ENGINE CUTOFF  1. CLOSE CROSSOVER 2. LAND  1. CLOSE CROSSOVER 2. STOP SIM 3. LAND		
	9-6	GROUND H <sub>2</sub> O <sub>2</sub> LEAKAGE	A	ENGINE CUTOFF	SHUTDOWN WILL BE ACCOMPLISHED IF LEAK IS SEVERE ENOUGH TO CAUSE HAZARD TO PERSONNEL	
	9-7	INFLIGHT DIFFERENCE OF He AND H <sub>2</sub> O <sub>2</sub> CONSUMPTION RATE	B C	1. CLOSE CROSSOVER 2. LAND  1. CLOSE CROSSOVER 2. STOP SIM 3. LAND	CUE: He PRESSURE COMPARED WITH NOMINAL He SOURCE PRESSURE VS H <sub>2</sub> O <sub>2</sub> RESIDUAL CURVES	
	9-8	H <sub>2</sub> O <sub>2</sub> LEVEL LESS THAN 170# OR ILLUMINATION OF EITHER LOW LIGHT.	A B C	ENGINE CUTOFF LAND 1. STOP SIM 2. LAND	CUE: H <sub>2</sub> O <sub>2</sub> LOW LIGHT H <sub>2</sub> O <sub>2</sub> RESIDUAL INDICATOR EITHER INDICATION WILL BE UTILIZED TO INVOKE RULE	
	9-9	EITHER OR BOTH LIFT ROCKETS FAIL TO FIRE	A B C	N/A T HANDLE DOWN STOP SIM		
	9-10	LIFT ROCKETS FAIL TO STOP FIRING OR FIRE INADVERTANTLY	A B,C	ROCKET PROP SWITCH OFF ROCKET PROP SWITCH OFF		
MISSION	REV	DATE	SECTION		GROUP	PAGE
LLTV		3/1/69	ROCKETS		PRESSURIZATION SYSTEM	9-2

SECTION IX - ROCKETS - CONCLUDED  
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MISSION RULES

REV	RULE	CONDITION/W/FUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	9-11	IMPROPER OR ASSYMETRIC LIFT ROCKET FIRING	A B C	N/A T HANDLE DOWN STOP SIM	
	9-12	He TANK PRESSURE IN EXCESS 4200 PSI	A B,C	VENT TANK TO 4000 PSI N/A	
	9-13	He TANK TEMP IN EXCESS OF 110°F (ON GROUND)	A B,C	ENGINE CUTOFF N/A	<u>VAN IND</u> He TEMP IND.
MISSION:	REV:	DATE:	SECTION:		GROUP:
LLTV		3/1/69	ROCKETS		PRESSURIZATION SYSTEM