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CSM/LM SPACECRAFT OPERATIONAL DATA BOOK

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PAGE 1 OF 30

AMENDMENT 6

SHORT TITLE OF CHANGE Specific changes to technical data pertaining to ALSEP Array "C". Apollo 15

CHANGE DESCRIPTION

Insert new or revised pages as follows:

C-i, C-ii, C-3-2, C-3-5, C-3-6, C-3-7, C-3-21, C-3-22, C-3-23, C-3-33, C-4-4.1, C-4-5.1, C-4-12, C-4-14.1, C-4-16.1, C-4-18.1, C-4-20.1, C-4-22.1, C-4-24.1, C-5-11

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VOLUME V

REVISIONS

REV.	AMEND. NO.	DESCRIPTION	DATE	APPROVAL
	1	Insert revised pages 3-11, 3-12, 3-13, 3-14, 3-16, 3-22, 3-24, 3-30, 3-34, 3-37, 3-46, 3-47, 3-48, 3-49, 3-54, 3-55, 3-56 4-4, 4-6, 4-8, 4-10, 4-11, 4-13, 4-17, 4-19, 4-21, 5-3, 5-4, 5-8, 5-9, 5-10, 5-13	10/1/69	SED
	2	Insert revised pages 3-7, 3-28 and 4-8	11/7/69	SED
	3	Insert complete, new Appendix B for ALSEP Array "B". 96 Pages plus tabs.	1/15/70	SED
	4	Insert revised pages B-3-34, B-3-35 and B-3-43. Insert newly added Apollo Lunar Surface Drill pages B-3-40.1 through B-3-40.6 and B-4-16.1.	3/20/70	SED
	5	Add Appendix C for ALSEP Array "C".	11/13/70	MOB
	6	Insert revised pages C-i, C-ii, C-3-2, C-3-5, C-3-6, C-3-7, C-3-21, C-3-22, C-3-23, C-3-33, C-4-4.1, C-4-5.1, C-4-12, C-4-14.1, C-4-16.1, C-4-18.1, C-4-20.1, C-4-22.1, C-4-24.1, C-5-11	1/15/71	MOB

APPENDIX C
CONTENTS

APPENDIX C
ILLUSTRATIONS

3.0 ALSEP ARRAY C OPERATIONAL DATA

This section includes operational data, figures and tables illustrating the performance of the ALSEP Array C subsystems described in Section 2.0.

In the measurement tables found in Section 3.0, the normal operating range is defined as the maximum and minimum excursion values of a particular measurement which are expected in continued experiment operation; the nominal value is the mean value at which the measurement is observed during the most usual operational mode; the red-line limits are defined as the extreme high and low values beyond which that particular measurement may not deviate without immediate attention and possible corrective action.

3.1 CENTRAL STATION

The normal operating ranges, upper and lower red-line limits of the 18 telemetered Central Station electronics measurements and 19 telemetered Central Station module temperatures are listed in Tables 3.1-1 and 3.1-2. Average Central Station radiator temperatures are illustrated in Figure 3.1-1.

3.1.1 Thermal Control Subsystem

The Central Station contains a 10-watt thermostatically controlled heater, Data Subsystem Heater #3, on the thermal plate which is energized when the thermal plate temperature drops below -10° F nominal. This heater is controlled by commands 024 and 025. There are also 10-watt and 5-watt heaters, Data Subsystem Heaters #1 and #2, on the thermal plate which are controlled by commands 055, 056, and 057.

Two resistive loads dissipate excess electrical energy as heat external to the radiator plate on the Power Dissipation Module. Power Dissipation Resistor (PDR) #1 dissipates 7 watts and PDR #2 dissipates 14 watts.

Internal and external temperature measurements of the Central Station will be continually monitored and managed through the choice of operational modes so that continued optimum performance can be assured. Normal operating ranges, upper and lower red-line limits of the thirteen measurements of Central Station temperatures are shown in Table 3.1-3.

TABLE 3.1-1 CENTRAL STATION ELECTRONICS MEASUREMENTS

TM MEAS. NO.	MUX CHANNEL	DESCRIPTION	NORMAL OPERATING RANGE		NOMINAL VALUE	RED-LINE LIMITS	
			LOW	HIGH		LOW	HIGH
AE-1	2	ADC Calibration 0.25V	0.24V	0.26V	0.25V	0.22V	0.28V
AE-2	3	ADC Calibration 4.75V	4.72V	4.78V	4.75V	4.70V	4.80V
AE-3	1	Converter Input Voltage	15.4V	16.9V	16.2V	15.0V	17.5V
AE-4	5	Converter Input Current	3.9a	4.7a	4.5a	3.25a	4.8a
AE-5	8	Shunt Regulator #1 Current	0.3a	2.7a	1.1a	0.05a	3.18a
AE-6	13	Shunt Regulator #2 Current	0.3a	2.7a	1.1a	0.05a	3.18a
AE-7	20	PCU Output Voltage #1 (29V)	28.0V	30.0V	29.0V	27.5V	30.5V
AE-8	35	PCU Output Voltage #2 (15V)	14.5V	15.6V	15.0V	14.2V	16.1V
AE-9	50	PCU Output Voltage #3 (12V)	11.75V	12.25V	12.0V	11.0V	13.0V
AE-10	65	PCU Output Voltage #4 (5V)	4.75V	5.3V	5.0V	4.0V	5.8V
AE-11	79	PCU Output Voltage #5 (-12V)	-12.7V	-11.9V	-12.0V	-12.9V	-11.8V
AE-12	80	PCU Output Voltage #6 (-6V)	-6.2V	-5.9V	-6.0V	-6.3V	-5.85V
AE-13	21	Receiver Pre-Limiting Level	-99dbm	-61dbm	-88dbm	-450dbm	-0dbm
AE-14	36	Receiver Local Oscillator Level	4.5dbm	7.5dbm	6.1dbm	1.8dbm	7.6dbm
AE-15	51	Transmitter A AGC Voltage	2.42V @-10°F	1.85V @+141°F	1.60V @+75°F	0.323V	5.00V
AE-16	66	Transmitter B AGC Voltage	2.90V @-10°F	1.90V @+141°F	1.90V @+75°F	0.26V	4.17V
AE-17	81	Transmitter A Power Doubler Current	161ma @-10°F	214ma @141°F	181ma @+75°F	100ma	250ma
AE-18	22	Transmitter B Power Doubler Current	170ma @-10°F	199ma @141°F	184ma @+75°F	100ma	250ma

Notes:
1. Values for AE-13 and AE-14 assume uplink carrier is present.
2. AE-13, AE-14, AE-17, AE-18 values are temperature dependent; refer to calibration curves.
3. AE-15, AE-16, AE-17, AE-18 values are valid at stated temperatures.

TABLE 3.1-3 CENTRAL STATION STRUCTURAL-THERMAL TEMPERATURES

TM MEAS. NO.	MUX CHANNEL	DESCRIPTION	NORMAL OPERATING RANGE - °F		NOMINAL OPER. VALUE	RED-LINE LIMITS °F	
			LOW	HIGH	°F	LOW	HIGH
AT-1	27	Sunshield #1	-245	+165	-80	-300	+300
AT-2	42	Sunshield #2	-245	+165	-80	-300	+300
AT-3	4	Thermal Plate #1	- 20	+140	+83	- 25	+150
AT-4	28	Thermal Plate #2	- 20	+140	+83	- 25	+150
AT-5	43	Thermal Plate #3	- 20	+140	+83	- 25	+150
AT-6	58	Thermal Plate #4	- 20	+140	+83	- 25	+150
AT-7	71	Thermal Plate #5	- 20	+140	+83	- 25	+150
AT-8	59	Left Side Structure-East	-210	+236	0	-300	+300
AT-9	87	Right Side Structure-West	-210	+236	0	-300	+300
AT-10	15	Bottom Structure #3	-210	+258	+ 6	-300	+300
AT-11	88	Power Dump Module	-300	+315	+28	-300	+315
AT-12	60	Inner Multilayer Insulation	- 20	+157	+64	- 25	+167
AT-13	72	Outer Multilayer Insulation	-135	+210	+26	-300	+300

3.1.2 Radioisotope Thermoelectric Generator (RTG)

Thermal equilibrium and stabilized electrical power output of the RTG will be achieved approximately 1.5 hours after the fuel capsule has been placed in the RTG. However, operation of the ALSEP via ground commands can be initiated approximately one hour after fueling. Prior to the time when the astronaut connects the cable from the RTG to the Central Station, the RTG output is shorted by means of the astronaut shorting plug attached to the RTG cable connector.

In order to prevent overheating and possible damage to the RTG, a constant load must be maintained on the RTG at all times after fueling. The current drawn from the generator by this load reduces the generator "hot side" temperature and thus prevents the generator from overheating and causing a degradation effect on the thermoelectric couples. The RTG is operated at 16 $\pm$ 0.2 volts, not at the maximum power point. The operating point is fixed by the Power Conditioning Unit (PCU).

The RTG operational parameters are shown in Table 3.1-4. The telemetry measurements used to make power calculations are shown in Table 3.1-5. Normal operating ranges, upper and lower red-line limits of the six RTG temperatures are shown in Table 3.1-6. Figures 3.1-2, 3.1-3, and 3.1-4 are graphs which illustrate normal operating characteristics of the RTG.

TABLE 3.1-4 RTG OPERATIONAL PARAMETERS

PARAMETER	VALUE
Output Power	66 to 74 watts, nominal for one year
Output Voltage	16 vdc, nominal
Output Current	4.5 amps, nominal
Hot Frame Temperature	1130 to 1150°F nominal, lunar day 1080 to 1100°F nominal, lunar night
Cold Frame Temperature	400 to 480°F nominal, lunar day Off Scale Low - less than 415°F - nominal, lunar night
Fuel Capsule Thermal Output	1480 watts + 0, -20 at fueling

NOTE: Cold Frame Temp. + 30°F = Cold Junction Temp.
Hot Frame Temp. - 50°F = Hot Junction Temp.

TABLE 3.1-5 ALSEP POWER CALCULATIONS

DESIGNATION	CALCULATION	DESCRIPTION
CS-1	(AE-03) X (AE-04)	RTG Output Power (watts)
CS-2	(AE-03) X (AE-05)	Reserve Power (PCU 1)
CS-3	CS-2 - 4.2 $(AE-05)^2$	Regulator Internal Dissipation (PCU 1)
CS-4	(AE-03) X (AE-06)	Reserve Power (PCU 2)
CS-5	CS-4 - 4.2 $(AE-06)^2$	Regulator Internal Dissipation (PCU 2)

TABLE 3.1-6 RTG TEMPERATURES

TM MEAS. NO.	MUX CHANNEL	DESCRIPTION	NORMAL OPERATING RANGE - °F		NOMINAL VALUE	RED-LINE LIMITS °F	
			LOW	HIGH	°F	LOW	HIGH
AR-1	6	Hot Frame #1 Temp.	N/A	N/A	N/A	N/A	N/A
AR-2	37	Hot Frame #2 Temp.	1060	1150	1140 Day 1090 Night	980	1150
AR-3	52	Hot Frame #3 Temp.	1060	1150	1140 Day 1090 Night	980	1150
AR-4	7	Cold Frame #1 Temp.	415	500	465 Day O/S Night	401	500
AR-5	67	Cold Frame #2 Temp.	N/A	N/A	N/A	N/A	N/A
AR-6	82	Cold Frame #3 Temp.	415	500	465 Day O/S Night	401	500

NOTES: 1150° F is the upper TM limit for AR-2 and AR-3.
AR-1 and AR-5 measurements are inoperative.

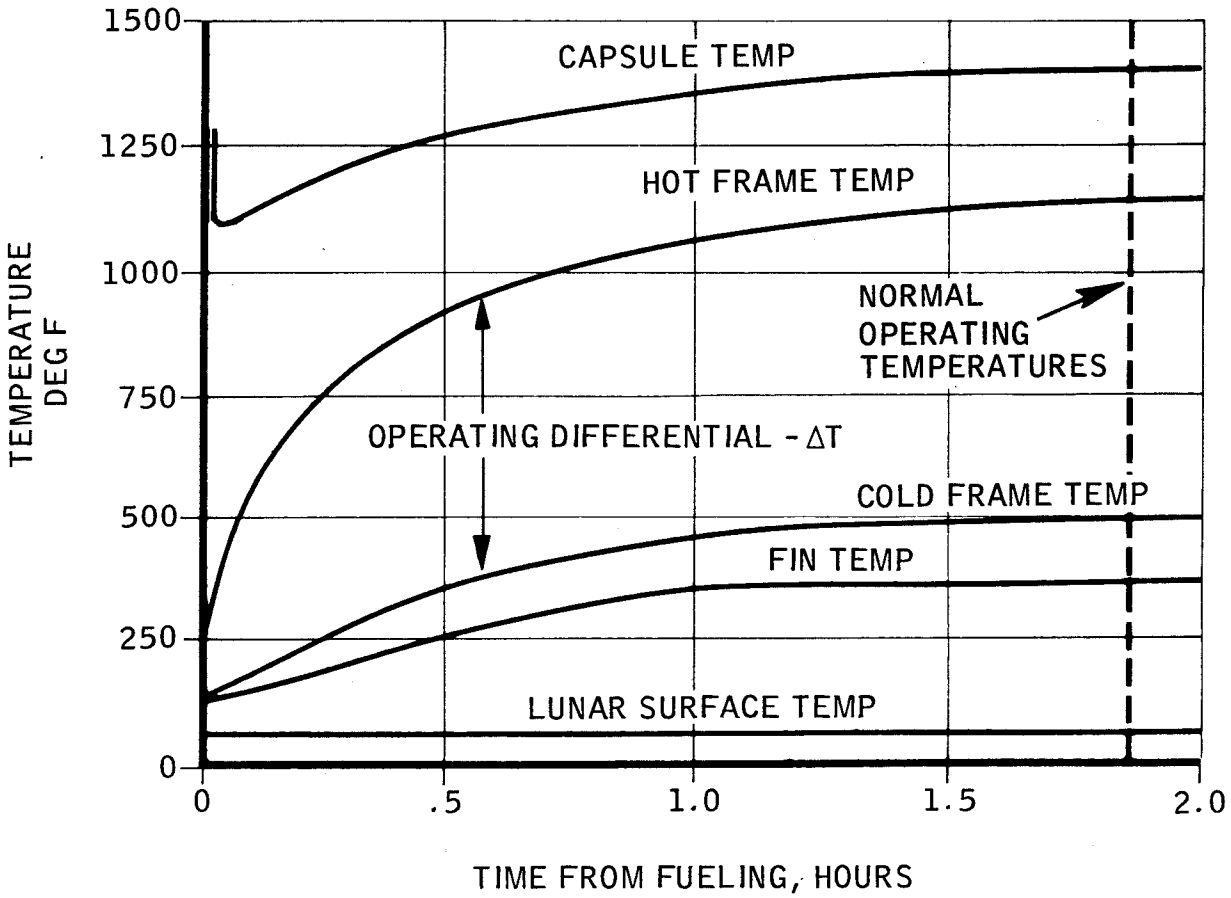


Figure 3.1-2 RTG WARM-UP CYCLE

TABLE 3.1-10 DTREM MEASUREMENTS

TM MEAS. NO.	MUX CHANNEL	DESCRIPTION	NORMAL OPERATING RANGE		NOMINAL VALUE	RED-LINE LIMITS	
			LOW	HIGH		LOW	HIGH
AX-1	83	Internal Temp. - ^{o}C	NA	NA	NA	-150*	+135*
AX-2	30	Cell Temp. - ^{o}C	+37	+125	+110	+ 37	+125*
AX-3	56	External IR Temp. - ^{o}C	NA	NA	NA	-150*	+135*
AX-4	84	Bare Cell Output - millivolts	0	+ 75	+ 65	0*	+ 75*
AX-5	26	6-mil Irradiated Cell Output - millivolts	0	+ 75	+ 65	0*	+ 75*
AX-6	41	6-mil Cell Output - millivolts	0	+ 75	+ 65	0*	+ 75*

Notes:

(1) Readings for AX-4, AX-5 and AX-6 will reach the low red-line limit when the Dust Detector is Off, and during lunar night.

(2) The Dust Detector is protected by two fuses, F-01 and F-02. If F-01 opens, AX-04, AX-05 and AX-06 are permanently lost. If F-02 opens, AX-01 through AX-06 are permanently lost.

(3) *Red-line limits are sensor limits.

(4) AX-03 sensor faces West.
AX-04 cell is the Northernmost cell.
AX-05 is center cell.
AX-06 cell is the Southernmost cell.

3.2 ALSEP ARRAY C DEPLOYMENT

ALSEP deployment will be performed at a time when the sun angle from the lunar horizon is 7 to 22 degrees. However, ALSEP design allows deployment at a maximum sun angle of 45 degrees.

After insertion of the fuel capsule into the RTG, the temperature of the RTG fin tips will increase to 250°F or higher. Visual indicators of temperature are provided on those parts of Subpackage #2 and the carry bar which are adjacent to the astronaut during deployment.

Astronaut switches are located on the Central Station to permit the astronaut to manually control ALSEP system operation. Under normal deployment conditions for Array C, he will throw Astronaut Switches #1 and #5 before he leaves the deployment site to return to the LM.

Switch #1 overrides the power hold-off circuit in the PCU. The hold-off circuit prevents operational power from being applied to the data subsystem and experiments until the RTG reaches an output open circuit voltage of about 24 volts which corresponds to an output power level of 56 watts.

Switch #2 provides a manual backup capability. In the event of a data subsystem failure, the astronaut may actuate this switch to manually select Data Processor Y, turn on and select Transmitter B and reset the receiver circuit breaker, CB-01.

Switch #3 also provides a manual backup capability. The astronaut may switch the experiments to the Operate mode sequentially in 1, 4, 3 order at approximately 0.1-second intervals.

Switch #4 when activated, puts the ASE in the Operate/On mode and the Central Station into the high bit rate mode. In normal operation, the astronaut will not actuate Switch #4.

Switch #5 controls the ASE 29-volt operational power line. In the stowed configuration and during deployment, the switch must be in the open, clockwise position. Prior to operation of the thumper, the switch must be rotated counter-clockwise, to close the circuit. Then the switch is rotated clockwise, open while the ASE mortar box safety rods are being removed. A final, counter-clockwise rotation is made when deployment has been accomplished and the astronauts are ready to leave the ALSEP deployment area. This places the ASE in Standby with the high bit rate Off.

A typical deployment arrangement for ALSEP Array C is illustrated in Figure 3.1-8.

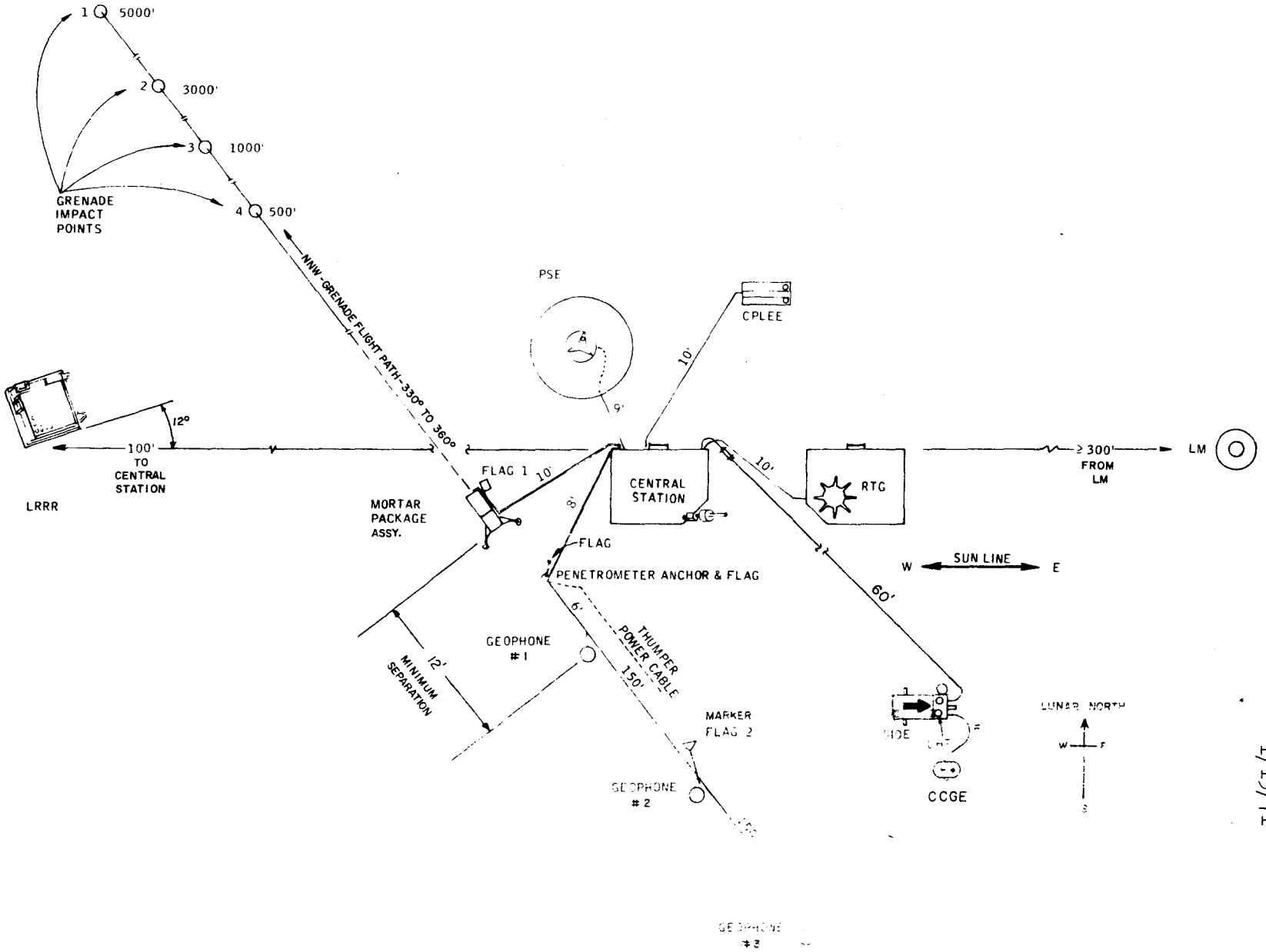


Figure 3.1-8 ALSEP ARRAY "C" DEPLOYMENT ARRANGEMENT

3.3 PASSIVE SEISMIC EXPERIMENT (PSE)

The PSE will monitor lunar seismic activity, detect meteoroid impacts and measure tidal deformations by utilizing a set of tri-axial, orthogonal long period seismometers and a short period seismometer.

3.3.1 PSE Turn-On Sequence

In the stowed configuration, the delicate PSE seismometers are protected by a caging device. To put the PSE into operation, the PSE Uncage Arm/Fire Command 073 will be sent twice. If the uplink subsystem should fail, uncaging can be accomplished in any number of ways by utilizing various combinations of Timer 12-hour output pulses and the one-time delayed command automatically generated by the Delayed Command Sequencer 84 to 96 hours plus 2 minutes after Central Station activation.

The PSE receives a Short Period Calibrate command every 12 hours from the Timer. The 12-hour Timer pulses are routed through the PDU as well as the Delayed Command Sequencer. If the PSE has not been previously uncaged, these repetitive pulses will Arm and Fire the PSE Uncaging mechanism. Subsequent commands will provide a Short Period Calibrate pulse for the short period seismometer.

The PSE will be turned on, uncaged, leveled, calibrated and put in the scientific operational mode before the LM leaves the lunar surface. Before the PSE is uncaged, the PSE housekeeping/engineering data measurements AL-1 through AL-8 in Word 33 will be monitored to insure that the preset states for the 15 PSE command functions are correct. Refer to Commands 063 through 103 shown in Section 5.0.

3.3.2 PSE Operational Mode

Heater power will be turned Off before a Level Motor is turned on. The order of leveling will be either X-axis, Y-axis, Z-axis, or Y-axis, X-axis, Z-axis, sequentially.

The Feedback Filter must be switched Out for any leveling operation and switched In for the normal scientific mode.

It will not be necessary to turn a Level Motor Off before commanding a change in direction, mode or speed.

The Coarse Level Sensor will be commanded In for the normal initial leveling sequence only.

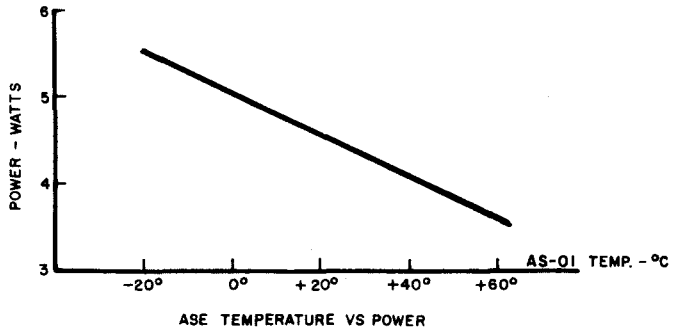
If the PSE needs to be turned Off, the first command to be sent would be Command 037, Standby; then Command 041, Off. The Off mode is considered highly critical because the instrument electronics are disabled, Standby heater power is disabled and there is no thermal control of the experiment.

TABLE 3.4-1 ASE MEASUREMENTS*

	Description	Normal Operating Range		Nominal Value	Red-Line Limits	
		Low	High		Low	High
AR-4	RTG Cold Frame Temp. #1 - °F	400	480	465	401	500
AR-1	RTG Hot Frame Temp. #1 - °F	Measurement Inoperative				
AS-1	Central Station Package Temperature - °C	-20	+60	+20	-30	+70
AS-3	Grenade Launcher Assy. Temp. - °C	-60 **	+85	+20	-60 **	+85
DS-5	Mortar Box Ground Monitor - Volts	-0.01	+0.4	0.0	-0.01	+0.5
DS-6	Roll Angle - Degrees	-10	+10	0	-12	+12
DS-7	Pitch Angle - Degrees	-10	+10	0	-12	+12
DS-8	Geophone Calibrate Pulse - Volts	-0.01	+2.50	+2.25	-0.01	+2.60
DS-10	A-D Calibration - 1.25V	1.15	1.35	1.25	1.10	1.40
DS-11	A-D Calibration - 3.75V	3.65	4.05	3.75	3.55	4.10
AE-3	Converter Input - Volts	15.4	16.9	16.2	15.0	17.5
AE-4	Converter Input Current - Amps	3.9	4.7	4.5	3.25	4.8

Notes: *These ASE measurements are valid when the ASE is in Operate/On and the Central Station is set to 10,600 bps.

**When the mortars are in a storage mode, GLA temp. should not go below -60°C. When the mortars are about to be fired, GLA temp. should not be below -20°C.



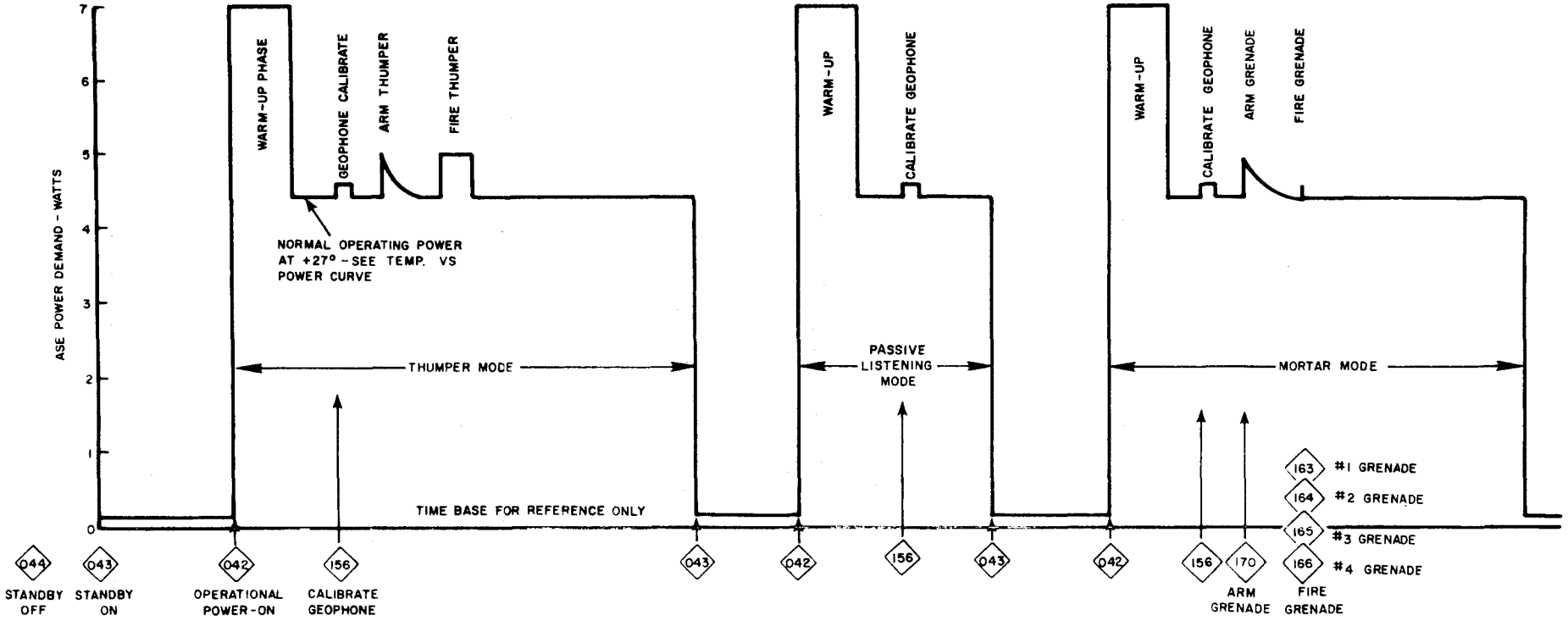


Figure 3.4-1 ASE POWER PROFILE

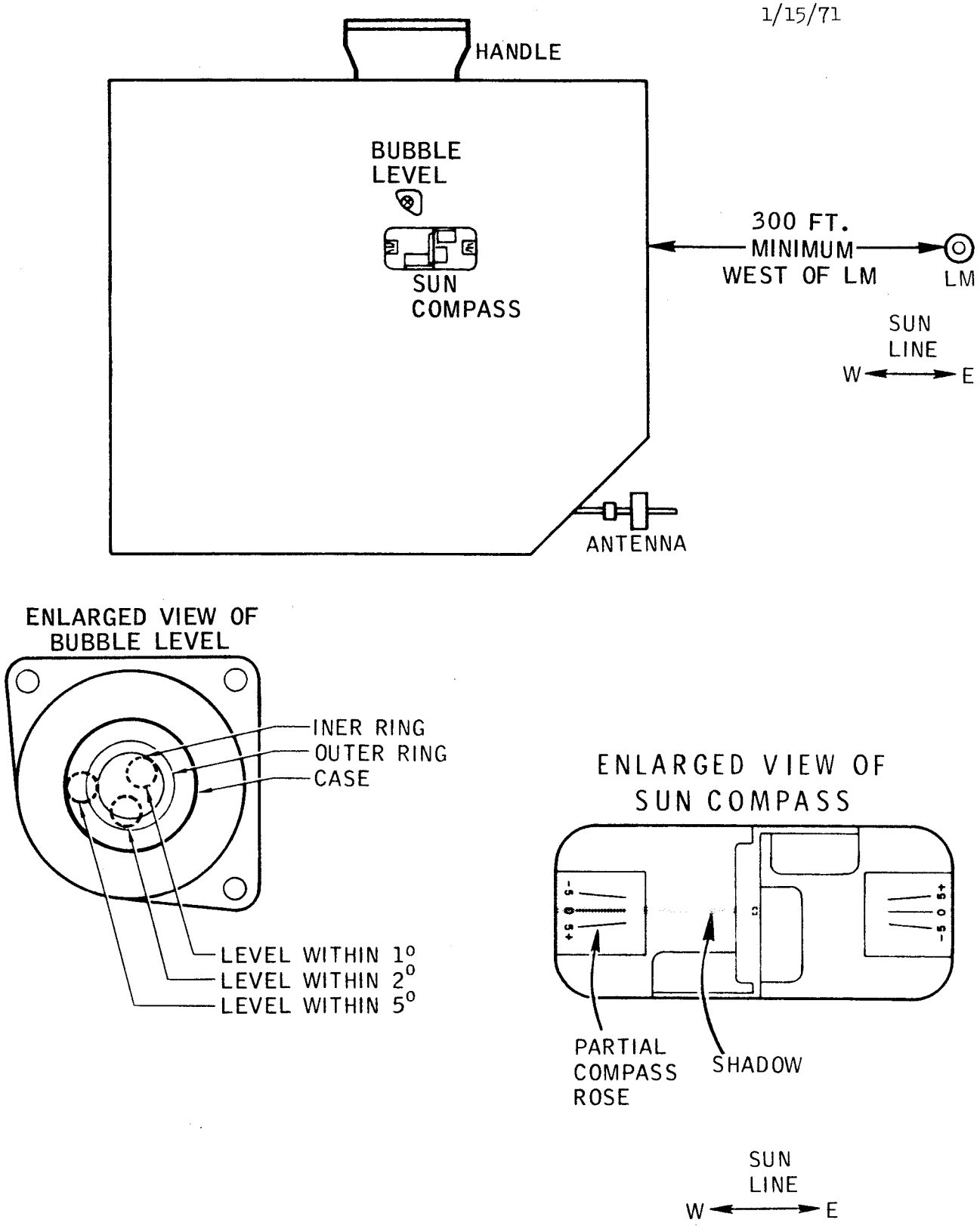


Figure 4.1-1 CENTRAL STATION LEVELING AND ALIGNMENT

TABLE 4.1-2 CENTRAL STATION ANTENNA DEPLOYMENT CONSTRAINTS

PARAMETER	CONSTRAINT
Antenna Level Setting	Within 0.5° of vertical. Astronaut will use bubble level to adjust. Level setting interacts with alignment.
Antenna Alignment	$\pm 0.5^{\circ}$ of East-West line, with reference to sun line. Astronaut will use sun dial to align.
Antenna Azimuth Setting	Astronaut will set azimuth dial to value indicated on his cuff check-list, within one mark on the vernier scale.
Antenna Elevation Setting	Astronaut will set elevation dial to value indicated on his cuff check-list within one mark on the vernier scale.

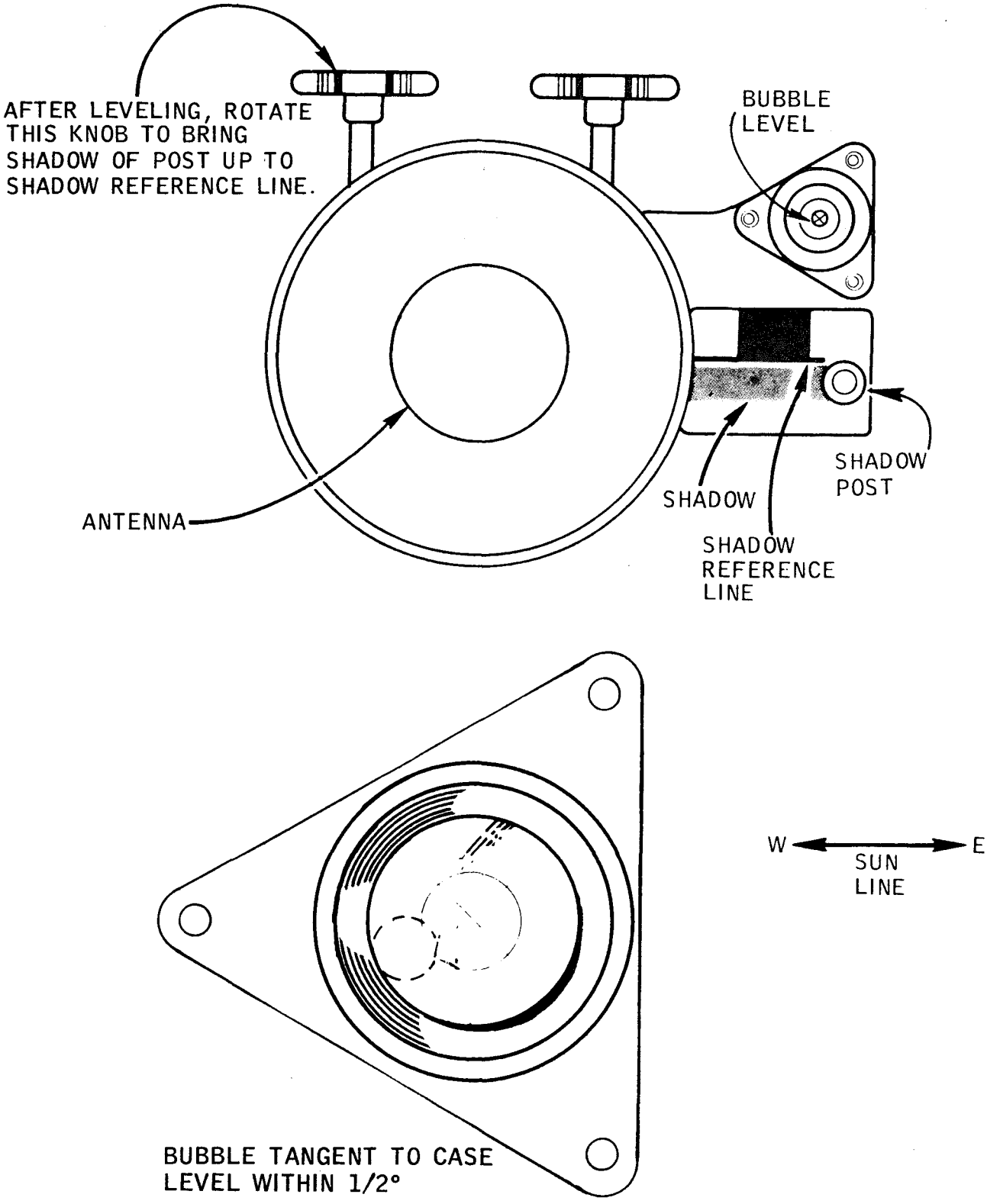


Figure 4.1-2 CENTRAL STATION ANTENNA LEVELING AND ALIGNMENT

TABLE 4.1-3 RTG DEPLOYMENT CONSTRAINTS

PARAMETER	CONSTRAINT
Separation between RTG and Central Station	9 to 12 feet, limited by 13-foot cable with about 1 foot of slack. Hot RTG should be away from Central Station to avoid contact with astronaut, and to provide maximum heat radiation to free space
RTG Orientation from Central Station	East of Central Station $\pm 20^{\circ}$, visually determined by astronaut to minimize thermal load on Central Station.
RTG Deployment Site	Horizontal site. Pallet must be horizontal $\pm 10^{\circ}$, visually determined by astronaut. No mechanical provisions for astronaut to level RTG. Astronaut will avoid craters and slopes which impede dissipation of heat from RTG. RTG requires maximum view of space to maximize heat radiation.
RTG Alignment	No constraint, but astronaut will align so that RTG cable exit points toward Central Station
Interrelation	Astronaut will read ammeter on shorting switch box, then connect RTG to Central Station, actuate switch.

be utilized only during those periods when the Active Seismic Experiment is being actively operated. When the Data Processor is set to the high bit rate, ASE data are gated On and transmitted; other experiment data are gated Off and not transmitted.

4.1.11 Diplexer Switch

In the normal initial condition when Transmitter A is selected, the diplexer switching coil is de-energized. When Transmitter B is selected the diplexer switching coil is energized by + 12 vdc and is therefore a less reliable state for the diplexer switch. Isolation provided by the circulators is approximately 30 db.

4.1.12 Dust Detector

Dust Detector operation can be controlled only by On and Off ground commands 027 and 031 respectively. The Dust Detector must not be commanded On unless there is adequate reserve power available.

4.2 PASSIVE SEISMIC EXPERIMENT (PSE)

4.2.1 PSE Turn-On Constraints

Constraints on the deployment of the PSE are listed in Table 4.2-1.

The normal turn-on sequence for the PSE automatically puts certain command functions into a preset state. However, before leveling, the following prerequisite modes must be verified:

(a) Feedback Filter: Out. Command 101
(b) Coarse Level Sensor: In. Command 102. Check AL-5.
(c) Level Mode: Automatic. Command 103. Check AL-5.
(d) Thermal Control Mode: Off. Command 076. Check AL-6.
(e) Reserve Power: Adequate per PSE Power Profile, Figure 3.3-1.

Note for mode (a) that the verification of Feedback Filter Out is a comparison of the long period seismic and long period tidal data on the recorders. However, if the PSE is initially off level, this check cannot be made.

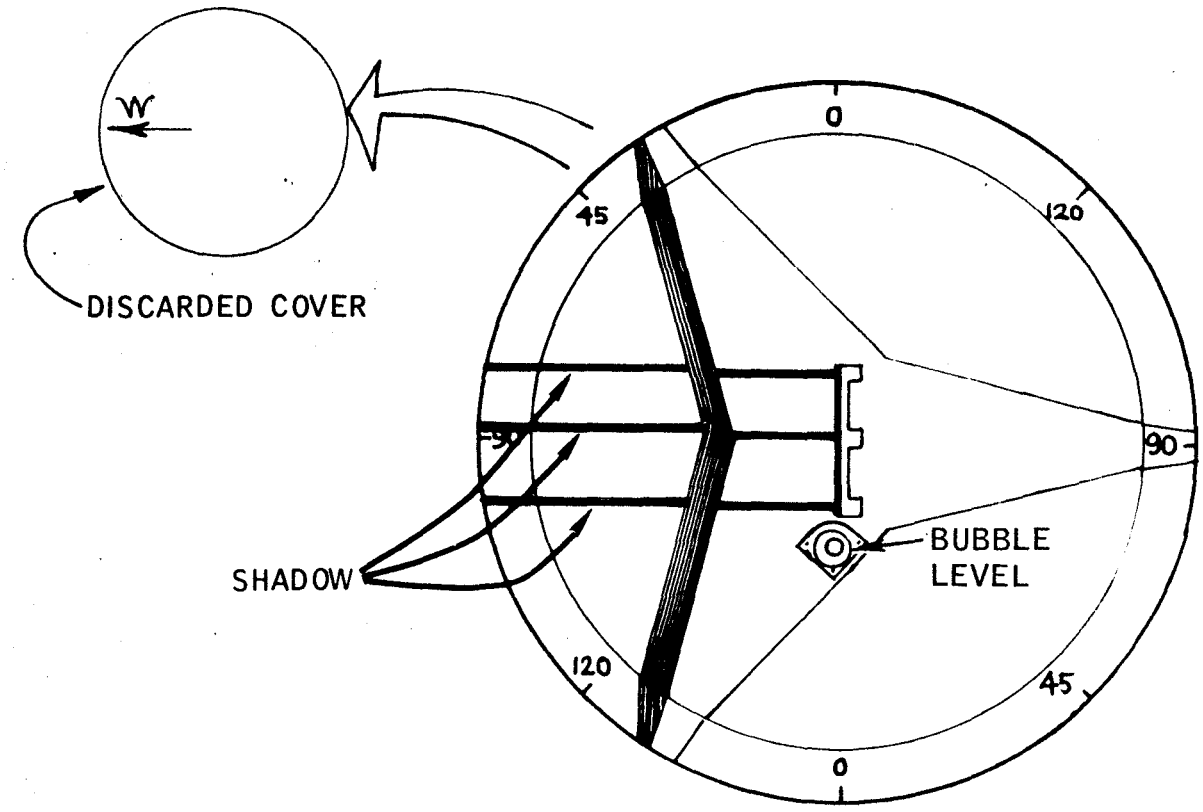
Survival thermal control power must be provided to the PSE within 90 minutes after removal of the ALSEP from the LM. Activation of the functional portion of the PSE may be delayed as long as 5 days after removal from the LM.

4.2.2 PSE Thermal Constraints

The temperature of the PSE must be maintained at 126°, $+2^{\circ}$ -0°F. Normally, this is accomplished by the automatic PSE thermal control subsystem consisting essentially of a proportional heater and a superinsulating thermal shroud. The backup capability consists of manual and automatic command operation of the PSE heater. Heater power demand, in the Auto mode, is a function of the sensor temperature deviation from the control set point of 126°F. While it is true that more power will be drawn during the lunar night, it is not expected that the heater power will fluctuate over the total available span of 0.20 watts to 2.35 watts between day and night. However, during deployment and initial operation, the sensor temperature is expected to be below the set point regardless of the solar angle. This will result in a maximum available power demand of 2.35 watts for several hours after initial turn-on of the PSE.

The PSE sensor heater must be turned Off every time a leveling motor is activated. Simultaneous operation of the heater and a leveling motor should be considered only in a contingency situation. Only one leveling motor must be operated at a time. The order of leveling is X-axis, Y-axis, and Z-axis, sequentially. A leveling motor should not be allowed to run past its stop.

If command 037 is sent to put the PSE in Standby, then Command 076 will no longer control the sensor heater. Note that at no time does Command 076 control the heater for the PSE electronics module in the Central Station.



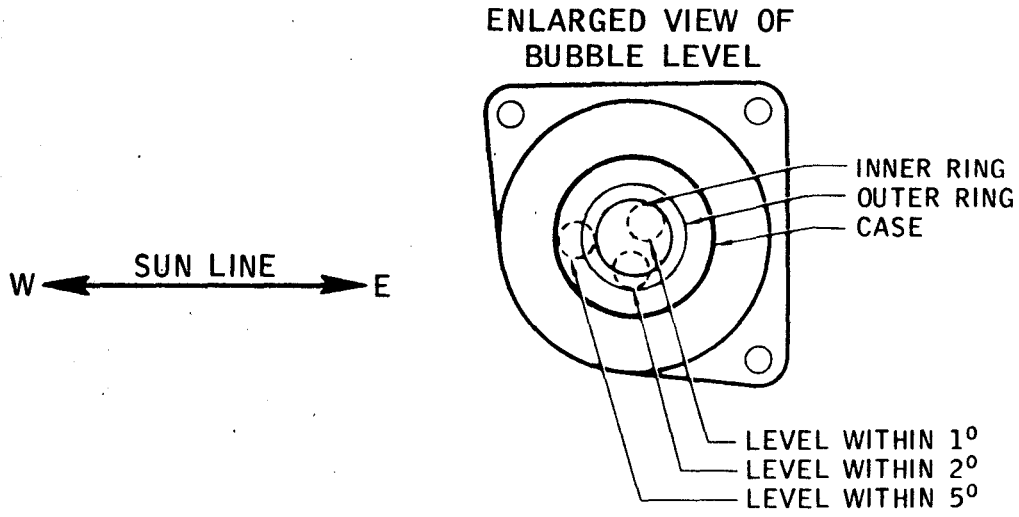
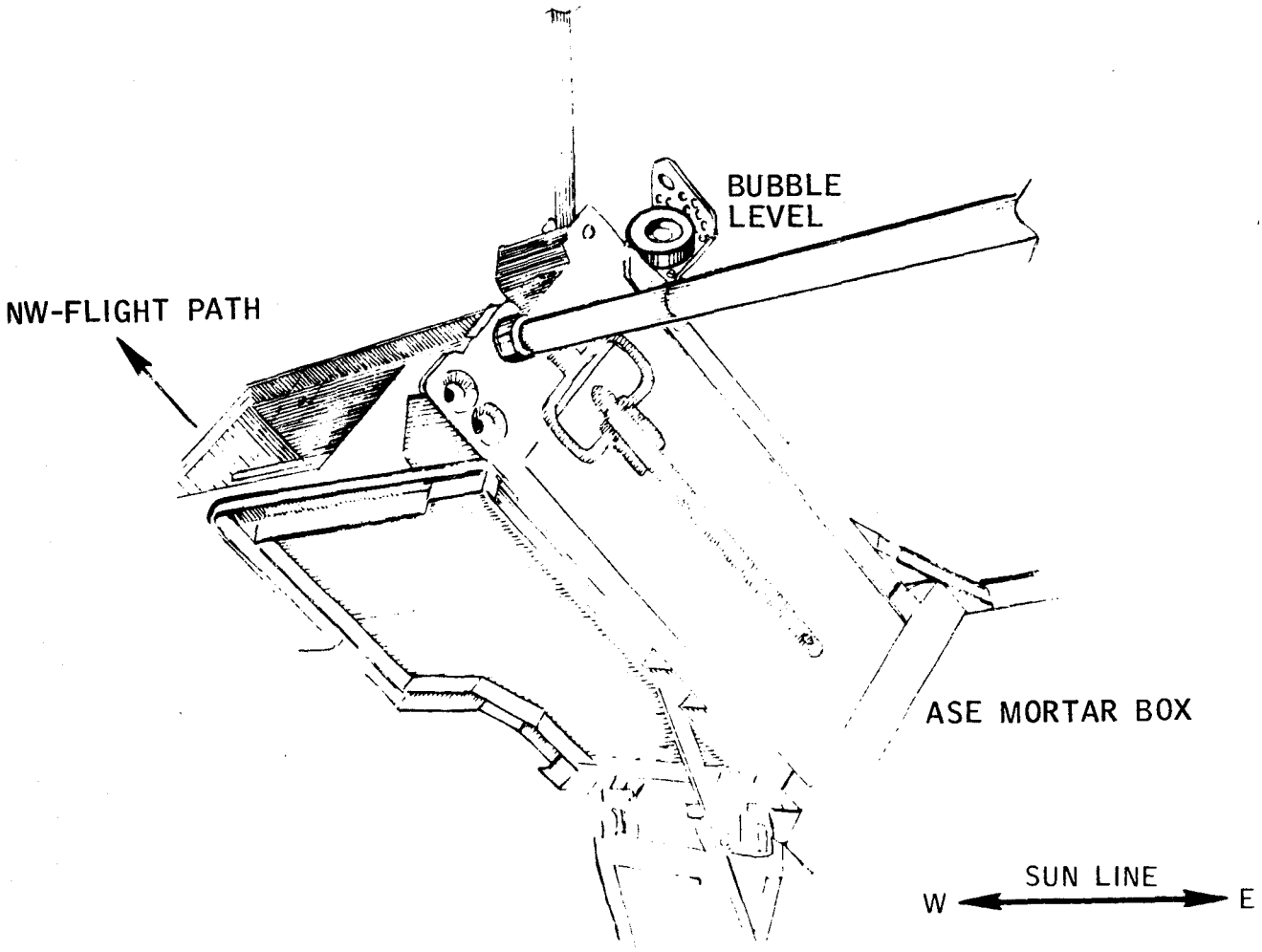


Figure 4.2-1 PSE LEVELING AND ALIGNMENT



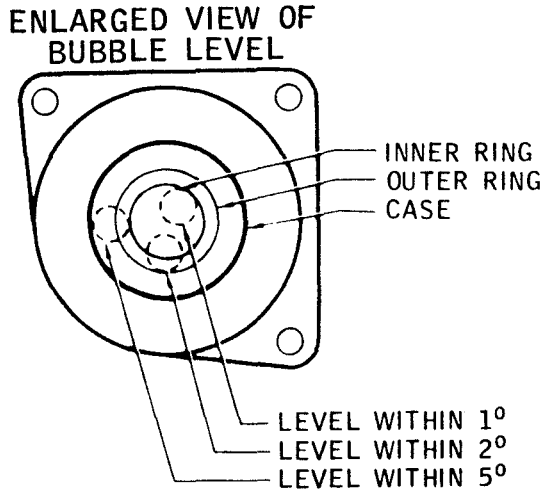


Figure 4.3-1 ASE LEVELING AND ALIGNMENT

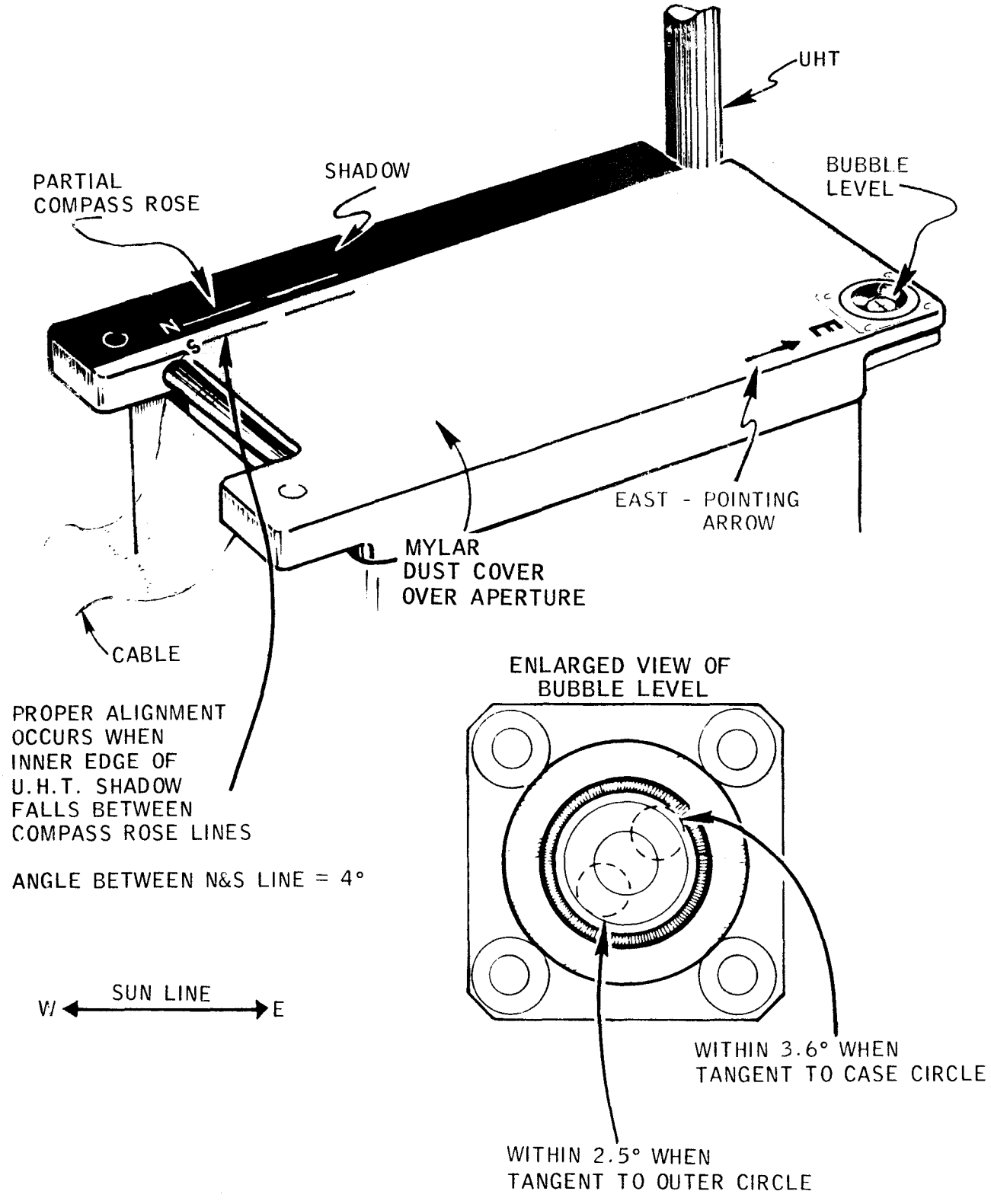


Figure 4.4-1 CPLEE LEVELING AND ALIGNMENT

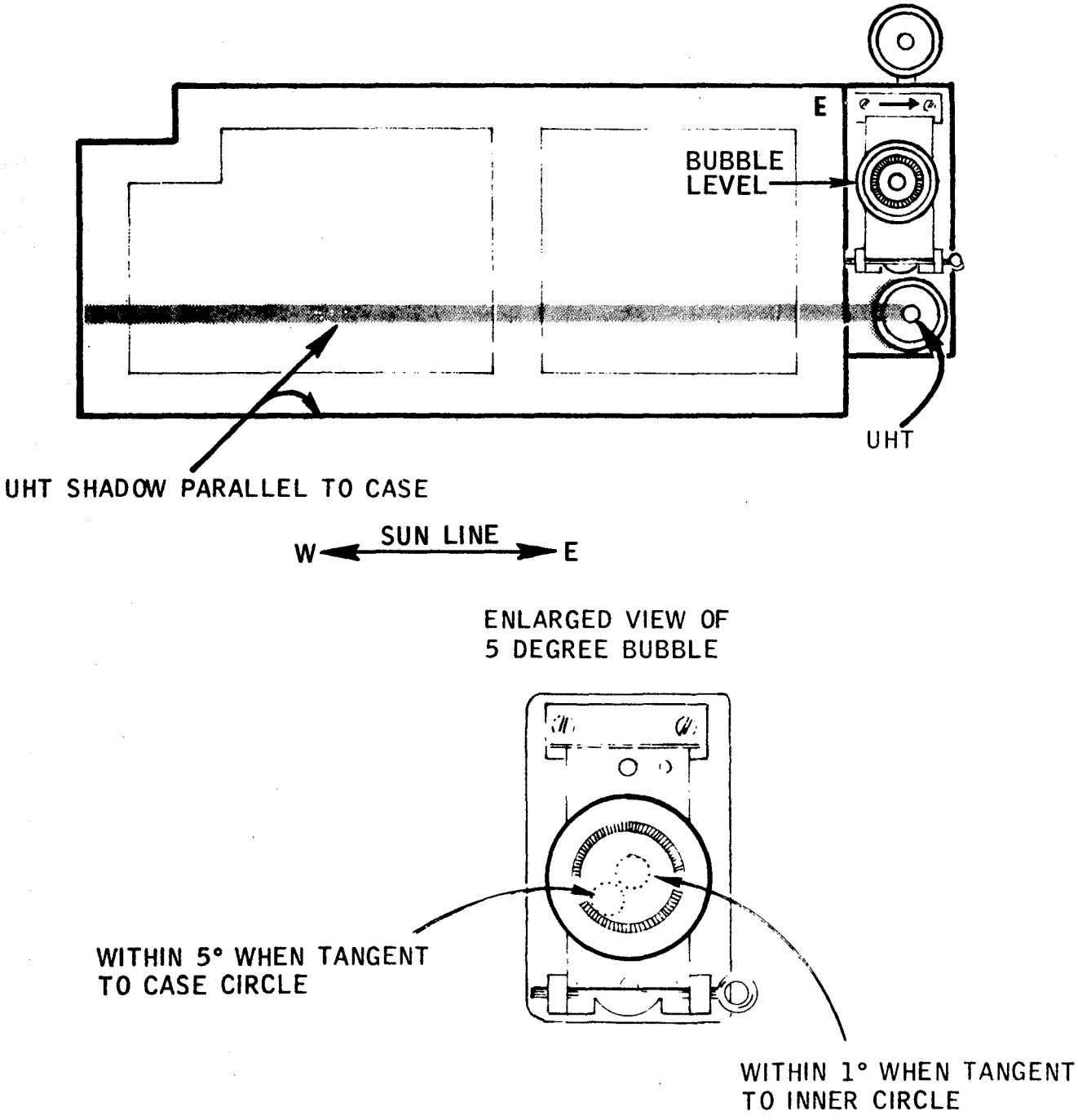
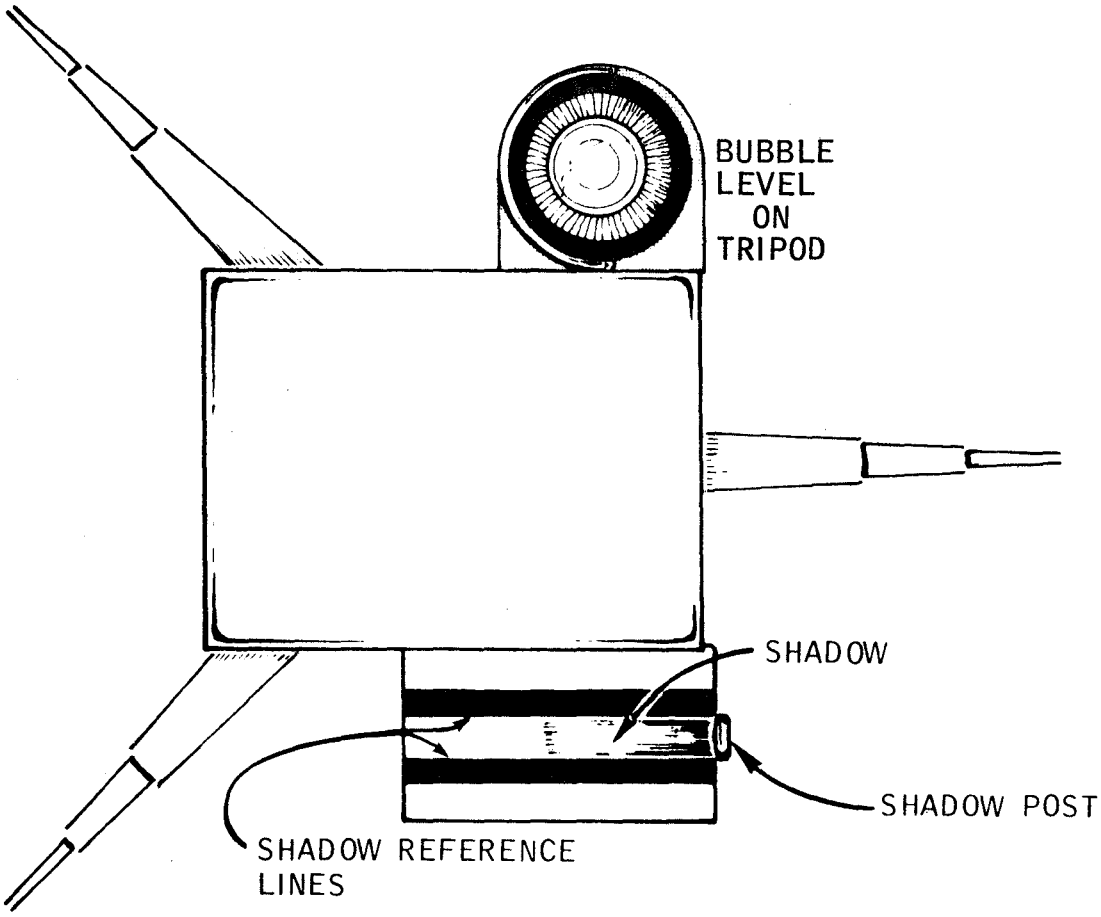


Figure 4.5-1 SIDE LEVELING AND ALIGNMENT



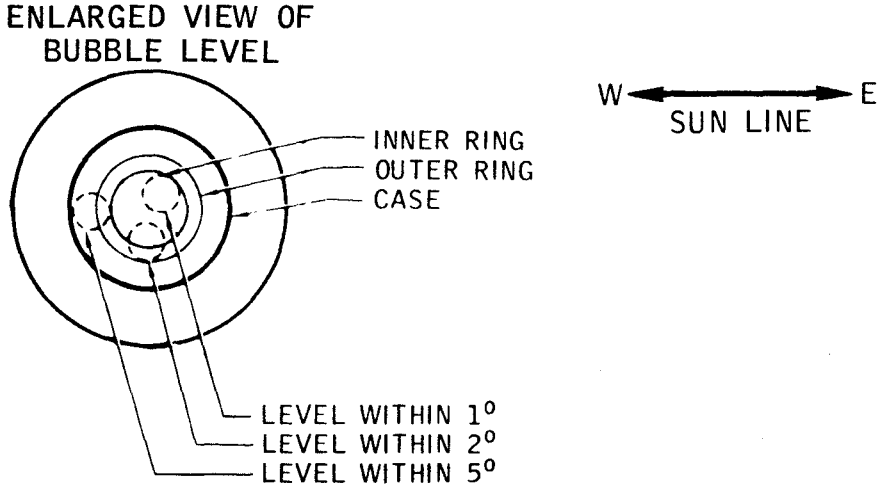


Figure 4.6-1 LPM LEVELING AND ALIGNMENT

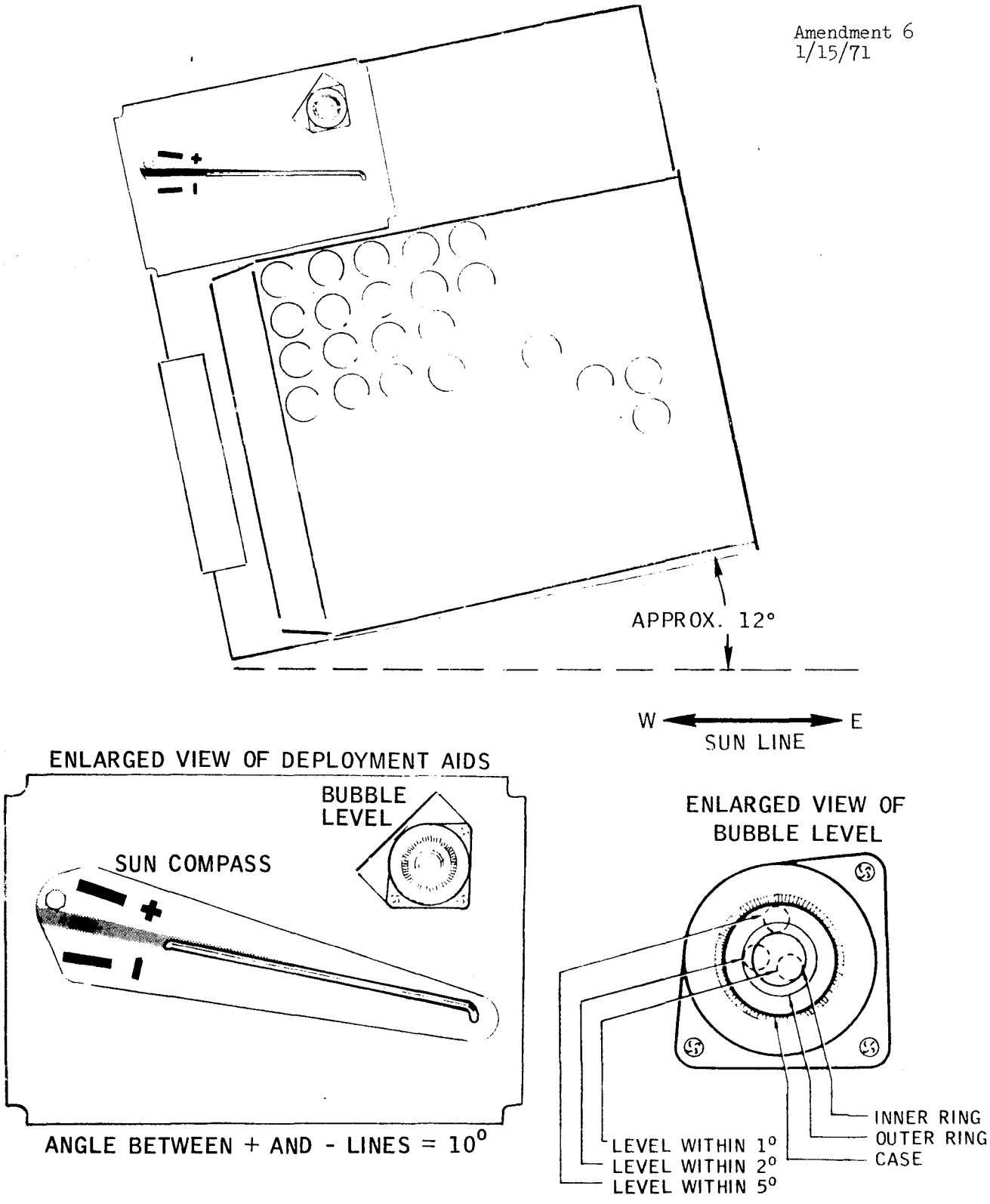


Figure 4.7-1 LRRR LEVELING AND ALIGNMENT

TABLE 5.2-6 SIDE/CCGE COMMAND DESCRIPTIONS

OCTAL COMMAND NUMBER	COMMAND TITLE	COMMAND DESCRIPTION	REMARKS
	One-Time Commands		
105 110	Break CCGE Seal	Irreversibly breaks CCGE Seal and simultaneously initiates the reset SIDE Frame Counter at frame 10 mode.	Also generated by the Delayed Command Sequencer at hour 96.
107, 110	Blow SIDE Dust Cover	Irreversibly blows SIDE Dust Cover and simultaneously activates the SIDE master reset.	Also generated by the Delayed Command Sequencer at hour 96.
	Operating Commands		
1. 104, 110	Ground Plane Step Programmer On/Off	Two-state command turns programmer On or Off to start or stop stepping sequence.	Steps through 24 voltage levels; one step per SIDE cycle. See Figure 3.6-2. Preset condition: On.
2. 105, 110	Reset SIDE Frame Counter at 10	Mode command that steps SIDE Frame Counter to frame 10, then resets to zero.	Activated by same code that breaks CCIG Seal.
3.	Reset SIDE Frame Counter at 39	Mode command that steps SIDE Frame Counter to frame 39, then resets to zero.	
4. 106, 110	Reset Velocity Filter at 9	Mode command that causes the Velocity Filter to execute only 10 of the normal 20-step programs.	
5. 104, 106, 110	Reset SIDE Frame Counter at 79	Mode command that steps SIDE Frame Counter to frame 79, then resets to zero.	

TABLE 5.2-6 SIDE/CCGE COMMAND DESCRIPTIONS

OCTAL COMMAND NUMBER	COMMAND TITLE	COMMAND DESCRIPTION	REMARKS
6. 105, 106, 110	Reset SIDE Frame Counter at 79, Velocity Filter Counter at 9	Mode command that simultaneously performs operations normally performed separately by commands 106, 110 and 104, 106, 110.	
7. 104	X10 Accumulation Interval On/Off	A two-state command which selects one of the two accumulation time periods. The On command selects X10 (12 seconds) and the Off command selects X1 (1.2 seconds).	The time period is the interval for the accumulation of the high and low energy curved plate analyzer output pulses at each analyzer.
8. 107, 110	Master Reset	Mode command to return SIDE to the normal operational mode.	Activated by same commands that blow Dust Cover (i.e., 107,110).
9. 104, 107, 110	Velocity Filter Voltage On/Off	Two-state command to enable or disable Velocity Filter step voltages. On enables; Off disables. Preset condition: On.	Upon retransmitting the command, the Velocity Filter assumes the voltage level of the SIDE frame in progress.
10. 105, 107, 110	Low Energy CPA High Voltage On/Off	Two-state command to enable or disable Low Energy Curved Plate Analyzer (LECPA) step voltages. On enables; Off disables. Preset condition: On.	Upon retransmitting the command, the LECPA assumes the voltage level of the SIDE frame in progress.