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SKYLAB

OPERATIONS HANDBOOK

APOLLO TELESCOPE MOUNT

VOLUME II

SYSTEMS AND EXPERIMENTS OPERATING PROCEDURES

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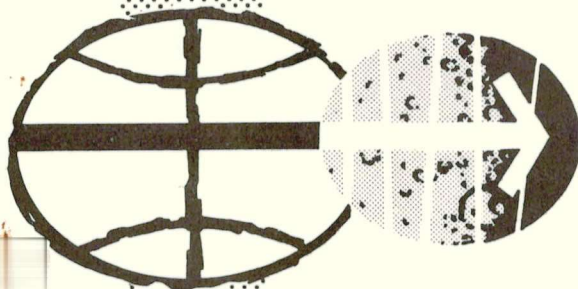
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HOUSTON, TEXAS

PREPARED UNDER DIRECTION
OF
CREW PROCEDURES DIVISION
EVA AND EXPERIMENTS BRANCH

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MANNED SPACECRAFT CENTER
HOUSTON, TEXAS



1 DECEMBER 1972

SKYLAB OPERATIONS HANDBOOK

APOLLO TELESCOPE MOUNT

(SLOH/ATM)

VOLUME II

SYSTEMS & EXPERIMENTS

OPERATING PROCEDURES

APPROVED:


for J.F. Nelson, ATM Project Engineer
Martin Marietta Corporation/Houston

NAS8-2400, MSFC-205

Prepared under direction

of

NATIONAL AERONAUTICS and SPACE ADMINISTRATION

MANNED SPACECRAFT CENTER

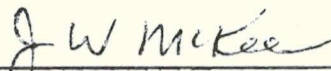
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1 Dec 1972

SKYLAB OPERATIONS HANDBOOK

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F O R E W O R D

Volume II of the SKYLAB Operations Handbook - APOLLO TELESCOPE MOUNT (SLOH-ATM) - will contain flight crew operational procedures for all manned missions utilizing the SL/ATM.

Volume II will consist of normal, backup, malfunction, and emergency procedures used to accomplish systems and experiments management required for activation, operation and deactivation of the SL/ATM. Normal procedures are used when all systems are operating normally. Backup procedures are used to accomplish the objective of the normal procedures when system failure or other anomaly prevents use of the normal procedure. Malfunction procedures utilize a logic flow chart format to provide symptoms, diagnoses and corrective actions for system/component malfunctions or failures. Emergency procedures cover situations requiring immediate action to avoid or alleviate a hazardous condition to the crew.

Volume I of the Skylab Operations Handbook is bound separately and contains the description portion of the SL/ATM systems and experiments.

Operational procedures contained in this document should be used when applicable during vehicle subsystem and integrated test and checkout.

Any request for copies of this document must be made in writing to D. C. Schultz, CG3, Chief, EVA AND EXPERIMENTS BRANCH, MANNED SPACECRAFT CENTER, HOUSTON, TEXAS 77058.

COMMENTS

NASA Comments: Direct comments or suggested changes to this handbook to D. C. Schultz, Chief, EVA AND EXPERIMENTS BRANCH, CG3, BUILDING No. 4, MSC, HOUSTON, TEXAS 77058.

MMC Comments: Direct comments or suggested changes to this handbook to V. A. Fleming, MMC, ATM SUPPORT TEAM, 1740 NASA BLVD., HOUSTON, TEXAS 77058.

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ACKNOWLEDGEMENT

The technical inputs to this document in the following ATM systems: Structures, Electrical, Thermal, Instrumentation and Communications, Controls and Displays, and Experiment S056 are provided by Martin Marietta Corporation in response to Job Output List, PL2082, Volume I Rev D, Work Breakdown Structure (WBS) No. 1550-1, Line Item No. 4 of Para 4. The C&D section was generated under the aforementioned WBS 1550-1, by Mr. Cosimo De Mitri (Bendix).

The coordination and standardization of the technical inputs that relate to the remaining ATM systems/experiments were accomplished under the supervision of the Martin Marietta Corporation, as directed under WBS 1550-1, Para 3 (a.2) and 3 (a.3).

For technical inputs and assistance in the ATM systems and experiments areas not specifically identified in para 1 above, acknowledgement is expressed to the following: Mr. Lee Huss (IBM), Mssrs. Stan Tonnessen (Bendix), Ed Purcell (Bendix), Mssrs. J. W. Knori (MDAC), John Musgrove (MDAC), and Lou Vargas (MDAC), Attitude Pointing and Control (APCS); Mr. Verald Easterly (BBRC), S052; Mssrs. John Boczenowski (AS&E) and Stanley Marrs (AS&E), S054; Messrs. John McCoy (HCO) and Vern Kotrc (BBRC), S055A; Dr. Paul Patterson (BBRC) S082A & S082B; and Mr. Henry Chesters (PE), HA1 & HA2.

CREW PROCEDURES CHANGE REQUEST

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CHANGE REQUEST INSTRUCTIONS

GENERAL - To effect complete coordination and evaluation, it is necessary to reproduce and distribute copies of each change request. In order to assure all recipients receive legible copies, please print all entries and prepare mark-ups using black ink.

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C H A N G E C O N T R O L

R E C O R D

This record reflects the publication date of the initial basic issue and all subsequent released changes.

Basic Issue 1 May 1972
Changed 1 December 1972

The 1 Dec 1972 edition will be the last issue of this document. The procedures contained herein are also found in the following checklists which will continue to be updated:

ATM EXPERIMENT C/L & DATA BOOK
ATM EXPERIMENT REFERENCE BOOK
ATM SYSTEMS C/L & DATA BOOK
ATM MALFUNCTION PROCEDURES BOOK
EVA CHECKLIST
SWS ACTIVATION C/L
SWS DEACTIVATION C/L
SWS CONTROL AND DISPLAYS C/L

Change requests should be made on Form 482B (Crew Procedures Change Request) and written against one of the above checklists.

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4.0

NORMAL/BACKUP

PROCEDURES

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INTRODUCTION

Section 4.1 is a Configuration List intended to provide a ready reference to the configuration of the ATM C&D Console (Panel 130), Back-up DAS (Panel 121), Solar Radio Noise Burst Monitor (Panels 128, 129) and Canister Control (Panel 160) at six discrete points in the mission. This section is not a sequenced procedure. The configuration listed will be obtained by procedures found elsewhere. The discrete points in the mission are defined in general terms below:

- | | |
|---------------|--|
| CLOSEOUT | - Prelaunch closeout after console power is turned off for final time. |
| POST ACTIV | - ATM equipment previously turned on by ground or IU command. On Orbit Status Verification and Systems Activation, para 4.2, complete. |
| STORAGE | - Closeout prior to crew departure after console power turned off. |
| REVISITATION | - Same as POST ACTIV except as modified by mission requirements. |
| FINAL STORAGE | - Closeout prior to final crew departure after console power is turned off. |
| MIN EMERG PWR | - All equipment turned off that is not necessary for crew survival and recovery. |

Section 4.2 through 4.5 are NORMAL/BACKUP procedures. The word "BACKUP" here denotes procedures that are normally performed by ground command or automatically by spacecraft equipment, but which may be performed by the crew, if required.

The tasks in this section are presented in numerical sequence. They are further organized, by subgroups, into related functions. The following paragraphs explain the tabular format.

The "CREWMAN" column indicates which crewmember is assigned to perform the specific procedure.

The "PNL" column indicates the location of a particular control or display, by Skylab panel number.

The "LOC" column (EVA pages only) indicates the Orbital Assembly Crew Station.

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The "PROCEDURES" column contains groups of steps, or overall tasks, involved in performing a complete operation.

The "REMARKS" column provides the rationale that supports the adjacent step and the operational procedure. The scope of the rationale will increase as the operational procedures are redefined through continued application by the flight crew during mission simulation, using Skylab mockups and simulators.

Section 5.0 will contain CONTINGENCY procedures. Section 5.1 and 5.2 will be procedures to provide work arounds for systems or experiment equipment malfunctions. Section 5.3 will contain EMERGENCY procedures required to control contingency situations involving crew safety.

In this document a shorthand method is used to call out an action to be taken, a response to be observed or a configuration to be checked on the console or panel as shown in Figures 1, 3, & 4.

The ATM C&D Console (Panel 130) is arranged such that there are 32 easily identifiable functional sections (Figure 2). Each section is identified by a title in large letters at the top or side of the section (except the ATM POWER section). To assist in the callout and location of controls and displays on the console these sections will be called out in the procedure as shown in Figure 1. The callout will use the same title appearing on the console except for the addition of the words (Control) and (Display) to distinguish between the two X-Ray SPECT sections.

For controls and displays this short form is shown below:

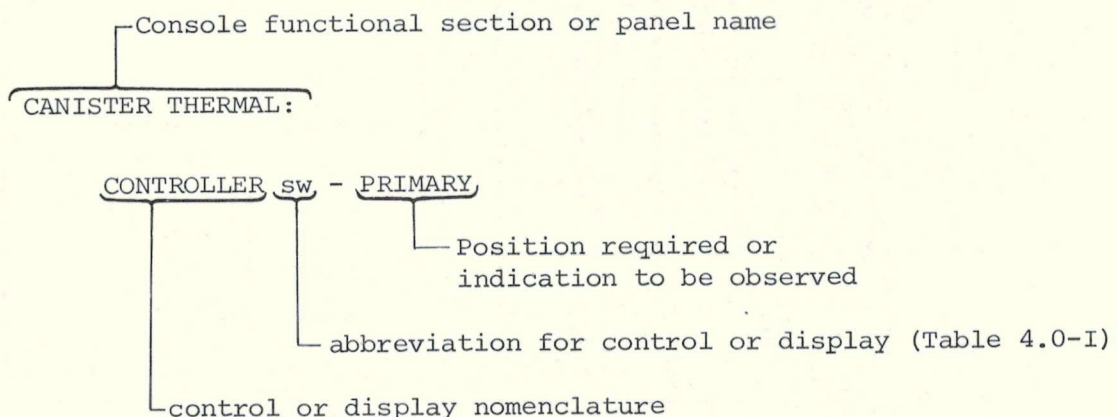


Figure 4.0-1 Console Functional Sections and Controls Callout

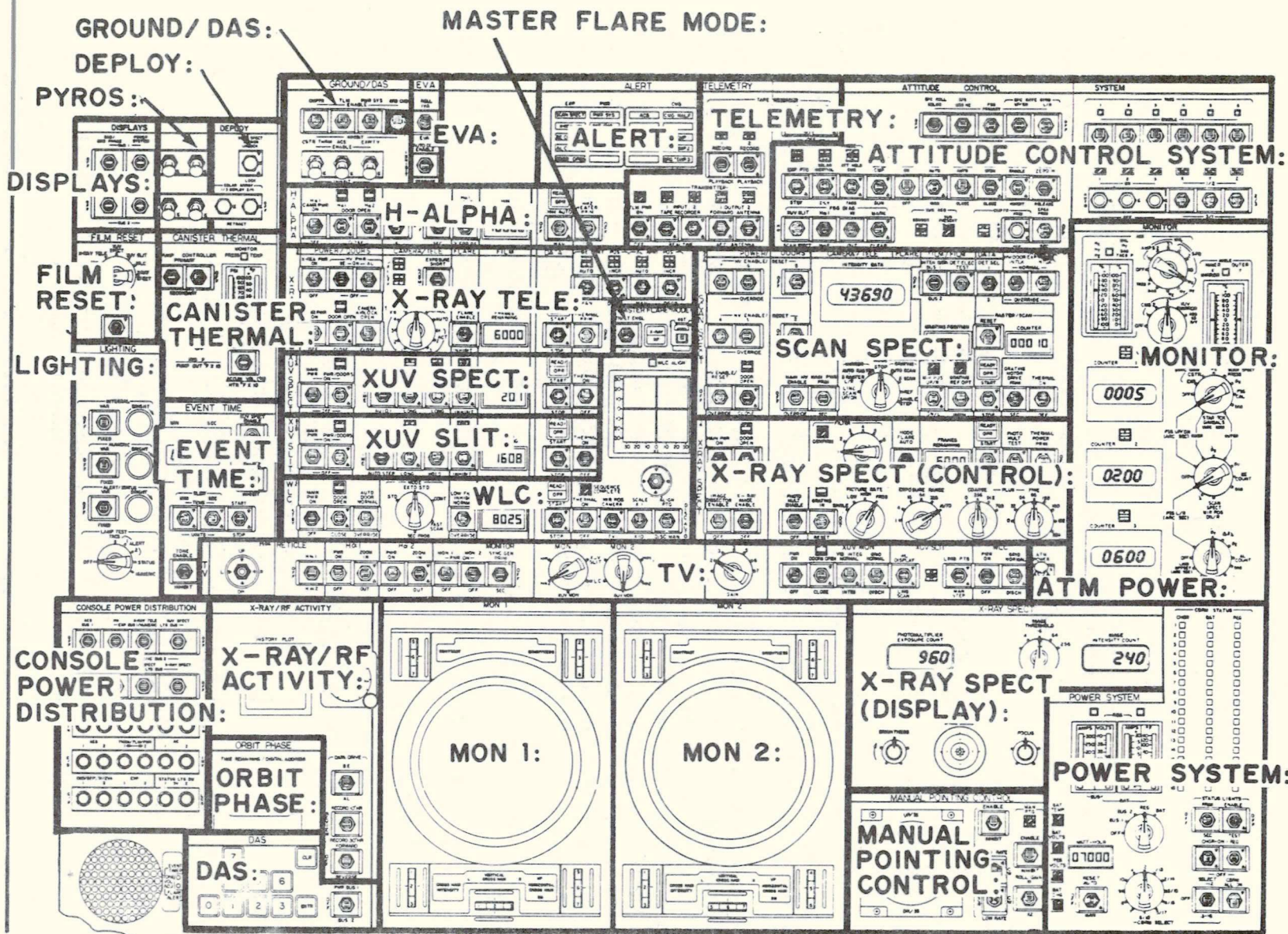


Figure 4.0-2 Console Functional Sections

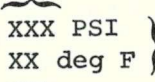
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Per Apollo standards all capital letters will be used for nomenclature appearing on the console or panel and lower case letters for other information except for standard abbreviations. The abbreviations for the control or display (Table 4.0-1) will follow the nomenclature except for circuit breakers (cb) which will precede the nomenclature. The nomenclature used in this document for switches will not include the switch position unless it is required for clarity, in which case the upper switch position only will be used to reduce nomenclature length. Satisfactory nomenclature was not available on the C&D Console for some controls and displays and the accepted nomenclature for these is shown in Table 4.0-2.

For dual scale meters this shorthand is modified as shown below:

CANISTER THERMAL:  Left scale indication (3)

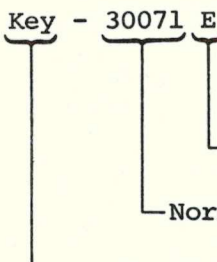
MONITOR ind =  XXX PSI
XX deg F } engineering units

Right scale indication (3)

Figure 4.0-3 Indicator (Meter) Callout

For the DAS the following shorthand notation is used.

Key - 30071 E

 ENTR (enter)

Normal octal code

input the following DAS octal code
per the DAS commanding procedure section 4.3.2.2.1

Figure 4.0-4 Digital Address System (DAS) Callout

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CAUTION and WARNING Notes in procedures column are used to identify and alert the user to system operating limitations and unique or obscure methods of system operation.

CAUTION - Identifies procedural activities or constraints which when not observed may cause temporary anomalies in subsystem or experiment operation and/or degradation of mission objectives.

WARNING - Identifies procedural activities or constraints which when not observed could cause permanent damage to the subsystem or experiment, failure to meet mission objectives and/or hazards to crew safety.

CAUTION and WARNING Notes should always precede the critical procedural activity.

Actions that may or may not be required, depending on response received, are included in a "Backup Block" as shown below. Here the word "backup" is used in a somewhat different context from that of Backup procedure.

```
*      If octal code is incorrect:
*      DAS:
*      Key - CLR
*      Key - repeat DAS code
*
```

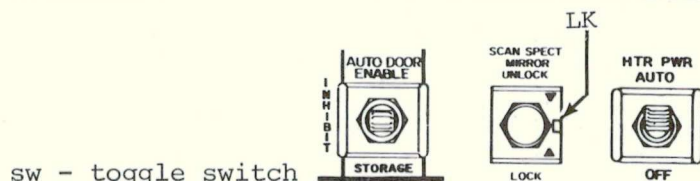
```
ORBIT PHASE:
  TIME REMAINING/DIGITAL ADDRESS ind - verify code
```

```
*      If octal code is still incorrect:
*      DAS:
*      Key - CLR
*      Key - alternate octal DAS code
*
*      ORBIT PHASE:
*      TIME REMAINING/DIGITAL ADDRESS - verify alternate code
*
```

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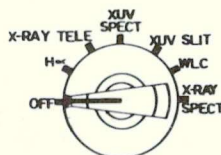
Table 4.0-1 Controls and Display Abbreviations



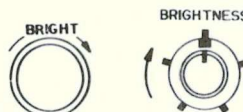
▲ = Momentary

LK = Locked

sel - rotary selector switch
(all switches are 12 position with no stops)



cont - rotary potentiometer type control



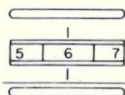
tb - talkback (flag) [all tb's are three position. They are spring loaded to the center position and powered to the other two if both are connected]



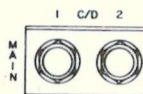
only one position powered

both positions powered

tw - thumbwheel



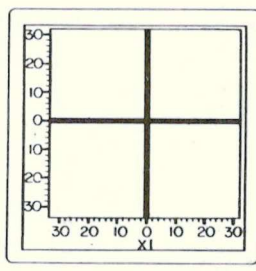
cb - circuit breaker



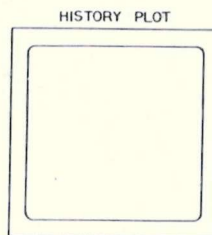
ind - indicator



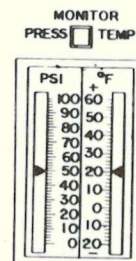
counter



crosspointer



plotter



meter

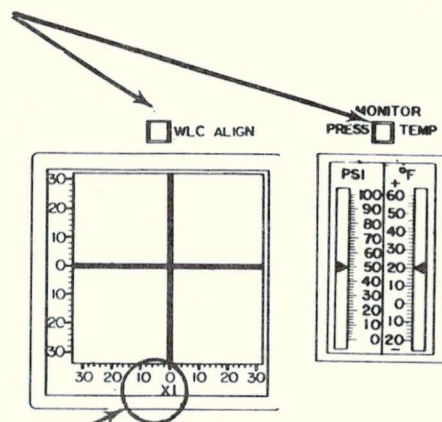
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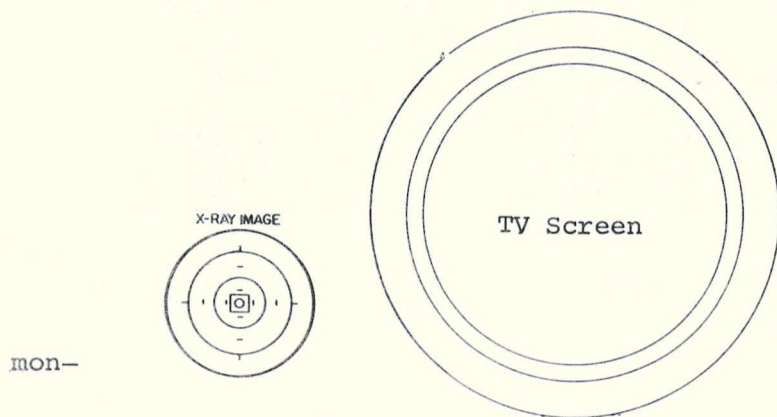
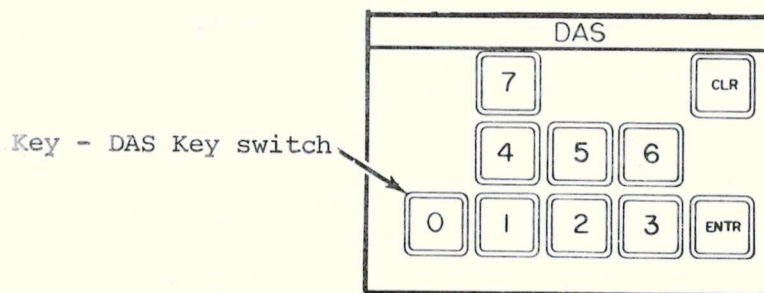
Table 4.0-1 Controls and Display Abbreviations (cont)



ind pwr fail lt - indicator power fail light



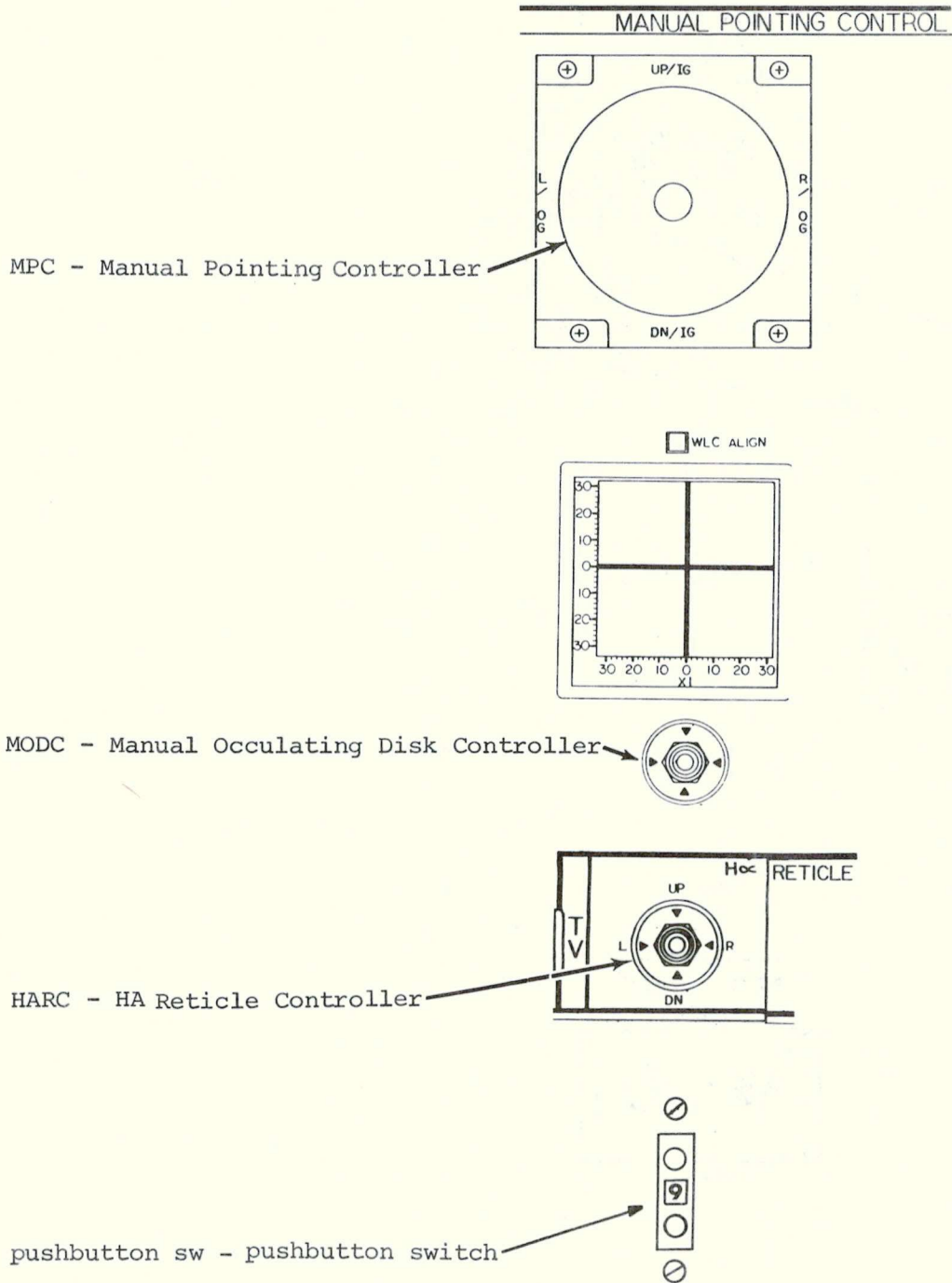
ind scale lt - indicator scale light



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Table 4.0-2 Other Nomenclature not appearing on panel

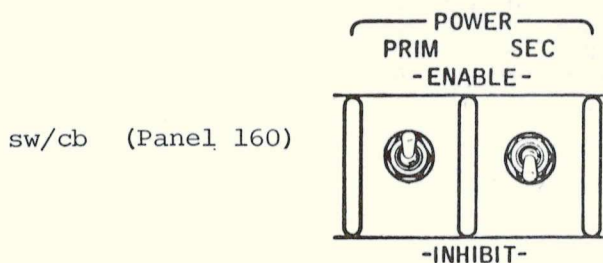
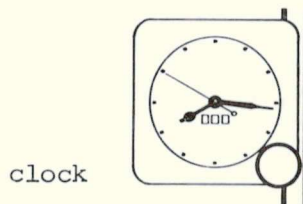
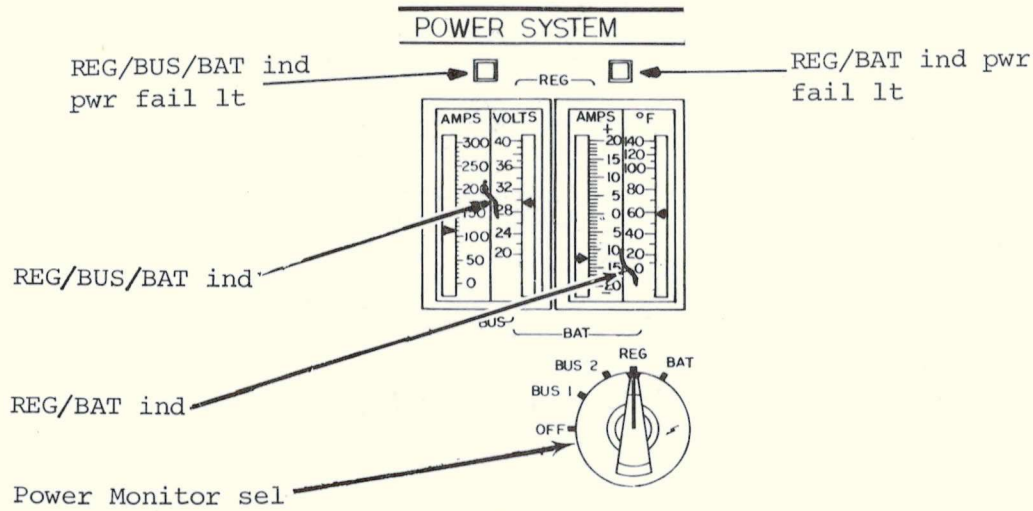


(Panel 128/129)

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Table 4.0-2 Other Nomenclature not appearing on panel (cont)



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4.1

ATM CONTROL AND DISPLAYS CONFIGURATION LIST

ATM CONTROLS AND DISPLAYS CONFIGURATION LIST

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APOLLO TELESCOPE MOUNT

PNL	NOMENCLATURE	POSITION FOR					
		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
121	ATM DAS BACKUP						
	DIGIT 1 sel	OFF	OFF	OFF	OFF	OFF	NA
	DIGIT 2 sel	OFF	OFF	OFF	OFF	OFF	NA
	DIGIT 3 sel	OFF	OFF	OFF	OFF	OFF	NA
	DIGIT 4 sel	OFF	OFF	OFF	OFF	OFF	NA
	DIGIT 5 sel	OFF	OFF	OFF	OFF	OFF	NA
	DATA TRANS sw	down	down	down	down	down	NA
	ENTER sw	down	down	down	down	down	NA
	CLEAR sw	down	down	down	down	down	NA
128/ 129	SOLAR RADIO NOISE BURST MONITOR						
	CAL NOISE SOURCE sel	AMB	AMB	AMB	AMB	AMB	NA
	SOLAR RADIO NOISE BURST MONITOR ind	0	0	0	0	0	NA
	SWITCHING MODE sel	NS/REF	NS/REF	ANT/REF	ANT/REF	NS/REF	NA
	SYSTEM GAIN cont	0	0	as desired	as desired	0	NA
	THRESHOLD cont	0	0	as desired	as desired	0	NA
	ORBIT PERIOD pushbutton sw	as desired	as desired	as desired	as desired	as desired	NA
	ON TIME pushbutton sw	as desired	as desired	as desired	as desired	as desired	NA
	REF BAL cont	0	0	as desired	as desired	0	NA
	ENABLE lt	off	off	off	off	off	NA
	START sw	down	down	down	down	down	NA
	POWER sw	OFF	OFF	OFF	OFF	OFF	OFF

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1 May 1972

CHANGE DATE

1 Dec 1972

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ATM CONTROLS AND DISPLAYS CONFIGURATION LIST

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PNL	NOMENCLATURE	POSITION FOR					
		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	DISPLAYS:						
	DAS/ORB PHASE sw	OFF	BUS 1	OFF	BUS 1	OFF	NA
	POWER SYSTEM sw	OFF	BUS 1	OFF	BUS 1	OFF	NA
	EVENT TIME sw	OFF	BUS 1	OFF	BUS 1	OFF	NA
	ACS CNTRS sw	OFF	BUS 1	OFF	BUS 1	OFF	NA
	DEPLOY:						
	SCAN SPECT MIRROR sw	center	center	center	center	center	NA
	SOLAR ARRAY 1/3 sw	OFF	OFF	OFF	OFF	OFF	NA
	SOLAR ARRAY 2/4 sw	OFF	OFF	OFF	OFF	OFF	NA
	FILM RESET:						
	FILM RESET sel	OFF	OFF	OFF	OFF	OFF	NA
	FILM RESET sw	down	down	down	down	down	NA
	CANISTER THERMAL:						
	PUMP sw	OFF	PRIMARY	PRIMARY	PRIMARY	OFF	OFF
	CONTROLLER sw	OFF	PRIMARY	PRIMARY	PRIMARY	OFF	OFF
	HTR PWR sw	OFF	AUTO	AUTO	AUTO	OFF	OFF
	MONITOR sw	<u>PUMP ΔP</u>	<u>PUMP ΔP</u>	<u>PUMP ΔP</u>	<u>PUMP ΔP</u>	<u>PUMP ΔP</u>	NA
		CSTR IN deg F	CSTR IN deg F	CSTR IN deg F	CSTR IN deg F	CSTR IN deg F	
	MONITOR ind (PSI)	XXX	XXX	XXX	XXX	XXX	NA
	MONITOR ind (deg F)	XX	XX	XX	XX	XX	NA
	MONITOR ind pwr fail lt	off	off	off	off	off	NA
	LIGHTING:						
	INTEGRAL sw	OFF	VAR	OFF	VAR	OFF	OFF
	INTEGRAL cont	CCW	as desired	as desired	as desired	CCW	NA
	NUMERIC sw	OFF	VAR	OFF	VAR	OFF	OFF
	NUMERIC cont	CCW	as desired	as desired	as desired	CCW	NA
	ALERT/STATUS sw	OFF	VAR	OFF	VAR	OFF	OFF
	ALERT/STATUS cont	CCW	as desired	as desired	as desired	CCW	NA
	LAMP TEST sel	OFF	OFF	OFF	OFF	OFF	OFF

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APOLLO TELESCOPE MOUNT

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PNL	NOMENCLATURE	POSITION FOR					
		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	EVENT TIME:						
	EVENT TIME ind	blank	xx xx	blank	xx xx	blank	NA
	XUV SPECT sw	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT	NA
	XUV SLIT sw	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT	NA
	SLEW MIN sw	center	center	center	center	center	NA
	SLEW SEC sw	center	center	center	center	center	NA
	START/STOP sw	center	center	center	center	center	NA
	TONE sw	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT	NA
	GROUND/DAS:						
	CMPTR sw	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
	TLM sw	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
	PWR SYS sw	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
	GRD CMD sw	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
	CSTR THRM sw	ENABLE	INHIBIT	ENABLE	INHIBIT	ENABLE	ENABLE
	ACS sw	ENABLE	INHIBIT	ENABLE	INHIBIT	ENABLE	ENABLE
	EXP/TV sw	ENABLE	INHIBIT	ENABLE	INHIBIT	ENABLE	ENABLE
	EVA:						
	ROLL sw	IVA	IVA	IVA	IVA	IVA	IVA
	AUTO DOOR sw	INHIBIT	INHIBIT	STORAGE	STORAGE	STORAGE	STORAGE
	H-ALPHA:						
	HA1 CAMR PWR sw	OFF	OFF	OFF	OFF	OFF	OFF
	HA1 DOOR sw	center	center	center	center	center	NA
	HA1 DOOR tb	white*	bp	bp	bp	bp	NA
	HA2 DOOR sw	center	center	center	center	center	NA
	HA2 DOOR tb	white*	bp	bp	bp	bp	NA
	HA1 FR/MIN sw	2	2	2	2	2	NA
	HA1 HEATER sw	OFF	PRIM	OFF	PRIM	OFF	OFF
	HA1 NIGHT INTLK sw	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NA
	HA1 FRAMES REMAINING ind	blank	16000	blank	16000	blank	NA
	HA1 AUTO sw	OFF	OFF	OFF	OFF	OFF	NA
	HA1 READY/OPR lt	off	off	off	off	off	NA
	HA2 HEATER sw	OFF	PRIM	OFF	PRIM	OFF	OFF
	(*) May not represent valid status.						

ATM CONTROLS AND DISPLAYS CONFIGURATION LIST

PNL	NOMENCLATURE	POSITION FOR					
		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	X-RAY TELE:						
	X-REA PWR sw	OFF	OFF	OFF	ON	OFF	OFF
	HV PWR BE sw	OFF	OFF	OFF	OFF	OFF	OFF
	HV PWR AL sw	OFF	OFF	OFF	OFF	OFF	OFF
	CAMR PWR sw	OFF	OFF	OFF	OFF	OFF	OFF
	DOOR sw	center	center	center	center	center	NA
	DOOR tb	white*	bp	bp	bp	bp	NA
	CAMERA AIRLOCK sw	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	NA
	CAMERA/TELE sel	SINGLE FR 1	SINGLE FR 1	PATROL	PATROL	PATROL	NA
	FILTER tb's (3)	gray*	gray*	gray*	gray*	gray*	NA
	EXPOSURE sw	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NA
	FLARE sw	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT	NA
	FRAMES REMAINING ind	blank	6000	blank	6000	blank	NA
	START/STOP sw	center	center	center	center	center	NA
	READY/OPR lt	off	off	off	off	off	NA
	BE APRT POS AUTO sw	AUTO	AUTO	AUTO	AUTO	AUTO	NA
	BE APRT POS INCR sw	center	center	center	center	center	NA
	BE APRT POS tb's (2)	gray*	gray*	gray*	gray*	gray*	NA
	AL APRT POS AUTO sw	AUTO	AUTO	AUTO	AUTO	AUTO	NA
	AL APRT POS INCR sw	center	center	center	center	center	NA
	AL APRT POS tb's (2)	gray*	gray*	gray*	gray*	gray*	NA
	THERMAL sw	OFF	PRIM	PRIM	PRIM	OFF	OFF
	MASTER FLARE MODE:						
	TN/LT sw	OFF	OFF	OFF	OFF	OFF	NA
	X-RAY lt	off	off	off	off	off	NA
	RF lt	off	off	off	off	off	NA
	INIT sw	down	down	down	down	down	NA
(*) May not represent valid status.							

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ATM CONTROLS AND DISPLAYS CONFIGURATION LIST

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PNL	NOMENCLATURE	POSITION FOR					
		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	XUV SPECT:						
	MAIN PWR sw	OFF	ON	ON	ON	OFF	OFF
	PWR/DOORS sw	center	center	center	center	center	NA
	PWR/DOORS tb	white*	white*	white*	white*	white*	NA
	MODE sw	TIME	TIME	TIME	TIME	TIME	NA
	WAVE LTH sw	center	center	center	center	center	NA
	WAVE LTH tb	white*	white	white*	white	white*	NA
	EXPOSURE sw	center	center	center	center	center	NA
	EXPOSURE tb	gray	gray	gray	gray	gray	NA
	FLARE sw	center	center	center	center	center	NA
	FLARE tb	bp	bp	bp	bp	bp	NA
	FRAMES REMAINING ind	blank	201	blank	201	blank	NA
	START/STOP sw	center	center	center	center	center	NA
	READY/OPR lt	off	off	off	off	off	NA
	THERMAL sw	OFF	ON	ON	ON	OFF	OFF
	XUV SLIT:						
	MAIN PWR sw	OFF	OFF	OFF	ON	OFF	OFF
	PWR/DOORS sw	center	center	center	center	center	NA
	PWR/DOORS tb	white*	white*	white*	white	white*	NA
	MODE sw	AUTO	AUTO	TIME	as desired	TIME	NA
	WAVE LTH sw	center	center	center	center	center	NA
	WAVE LTH tb	white*	white*	white*	white*	white*	NA
	AUTO SEQ sw	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NA
	FLARE sw	center	center	center	center	center	NA
	FLARE tb	bp	bp	bp	bp	bp	NA
	FRAMES REMAINING ind	blank	1608	blank	1608	blank	NA
	START/STOP sw	center	center	center	center	center	NA
	READY/OPR lt	off	off	off	off	off	NA
	THERMAL sw	OFF	ON	ON	ON	OFF	OFF
	WLC:						
	MAIN PWR sw	OFF	STBY	STBY	STBY	OFF	OFF
	DOOR sw	center	center	center	center	center	NA
	DOOR tb	white*	bp	bp	bp	bp	NA
	AUTO DOOR sw	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NA
	MODE sel	STD	STD	STD	STD	STD	NA
	LOW FILM INHIBIT sw	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NA
	(*) May not represent valid status.						

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APOLLO TELESCOPE MOUNT

ATM CONTROLS AND DISPLAYS CONFIGURATION LIST

PNL	NOMENCLATURE	POSITION FOR					
		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	WLC: (cont)						
	FRAMES REMAINING ind	blank	8025	blank	XXXX	blank	NA
	START/STOP sw	center	center	center	center	center	NA
	READY/OPR lt	off	off	off	off	off	NA
	SEQUENCE COMPLETE tb	bp*	bp*	bp*	bp*	bp*	NA
	THERMAL sw	OFF	ON	ON	ON	OFF	OFF
	MIR POS sw	center	center	center	center	center	NA
	SCALE sw	X10	X10	X10	X10	X10	NA
	ALIGN sw	PTG	PTG	PTG	PTG	PTG	NA
	MODC	center	center	center	center	center	NA
	WLC ALIGN ind	centered	centered	centered	centered	centered	NA
	WLC ALIGN ind scale lt	off	X10	off	X10	off	NA
	WLC ALIGN ind pwr fail lt	off	off	off	off	off	NA
	ALERT:						
	SCAN SPECT lt	off	off	off	off	off	NA
	X-REA HV lt	off	off	off	off	off	NA
	BE COUNT lt	off	off	off	off	off	NA
	AL COUNT lt	off	off	off	off	off	NA
	DOOR OPEN lt	off	on if in night	off	on if in night	off	NA
	PWR SYS lt	off	off	off	off	off	NA
	BAT CHG lt	off	off	off	off	off	NA
	ACS lt	off	off	off	off	off	NA
	CMPTR REJ lt	off	off	off	off	off	NA
	CMG MALF lt	off	off	off	off	off	NA
	BRG TEMP 1 lt	off	off	off	off	off	NA
	BRG TEMP 2 lt	off	off	off	off	off	NA
	BRG TEMP 3 lt	off	off	off	off	off	NA
	TELEMETRY:						
	TLM PWR sw	center	center	center	center	center	center (off)
	TLM PWR tb	bp	gray	bp*	gray	bp*	NA
	TRANSMITTER 1 INPUT sw	center	center	center	center	center	NA
	TRANSMITTER 1 INPUT tb	bp	as required	as required	as required	as required	NA
	TRANSMITTER 2 INPUT sw	center	center	center	center	center	NA
	TRANSMITTER 2 INPUT tb	bp	as required	as required	as required	as required	NA
	(*) May not represent valid status.						

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PNL	NOMENCLATURE	POSITION FOR					
		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	TELEMETRY: (cont)						
	TRANSMITTER 1 OUTPUT sw	center	center	center	center	center	NA
	TRANSMITTER 1 OUTPUT tb	white	as required	as required	as required	as required	NA
	TRANSMITTER 2 OUTPUT sw	center	center	center	center	center	NA
	TRANSMITTER 2 OUTPUT tb	white	as required	as required	as required	as required	NA
	TAPE RECORDER 1 RECORD sw	center	center	center	center	center	NA
	TAPE RECORDER 1 tb	bp	as required	bp*	as required	bp*	NA
	TAPE RECORDER 2 RECORD sw	center	center	center	center	center	NA
	TAPE RECORDER 2 tb	bp	as required	bp*	as required	bp*	NA
	TAPE RECORDER 1 OFF sw	up	up	up	up	up	NA
	TAPE RECORDER 2 OFF sw	up	up	up	up	up	NA
	ATTITUDE CONTROL SYSTEM:						
	EPC ROLL RSLVR sw	PRIMARY	PRIMARY	PRIMARY	PRIMARY	PRIMARY	PRIMARY
	EPC 800 HZ sw	OFF	PRIMARY	PRIMARY	PRIMARY	PRIMARY	OFF
	FSS sw	OFF	PRIMARY	PRIMARY	PRIMARY	OFF	OFF
	EPC RATE GYRO UP/DN sw	OFF	PRIMARY	PRIMARY	PRIMARY	OFF	OFF
	EPC RATE GYRO L/R sw	OFF	PRIMARY	PRIMARY	PRIMARY	OFF	OFF
	MODE EXP PTG sw	center	center	center	center	center	NA
	MODE EXP PTG tb	gray*	gray	EXP PTG	EXP PTG	gray	NA
	MODE SOLAR INERTIAL sw	center	center	center	center	center	NA
	MODE SOLAR INERTIAL tb	gray*	SI	gray	gray	SI	NA
	MODE ATT HOLD sw	center	center	center	center	center	NA
	MODE ATT HOLD tb	gray*	gray	gray	gray	gray	NA
	SR/SS sw	center	center	center	center	center	NA
	SR/SS tb	white	CMP	CMP	CMP	CMP	NA
	STAR TRACK POWER sw	OFF	ON	ON	ON	OFF	OFF
	STAR TRACK ACQ sw	center	center	center	center	center	NA
	STAR TRACK ACQ tb	bp	AUT	AUT	AUT	bp	NA
	STAR TRACK SHUTTER sw	AUTO	AUTO	AUTO	AUTO	AUTO	NA
	STAR TRACK SHUTTER tb	OPN*	STR	STR	STR	OPN*	NA
	FSS DOOR sw	center	center	center	center	center	NA
	FSS DOOR tb	OPN*	bp	OPN*	bp	OPN*	NA
	(*) May not represent valid status.						

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		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	ATTITUDE CONTROL SYSTEM: (cont)						
	MOMENTUM DUMP AUTO GG sw	center	center	center	center	center	NA
	MOMENTUM DUMP AUTO GG tb	gray	gray or ACT	gray or ACT	gray or ACT	gray or ACT	NA
	MOMENTUM DUMP CAGE sw	center	center	center	center	center	NA
	MOMENTUM DUMP CAGE tb	white*	gray	gray	gray	gray	NA
	FSS BIAS XUV SLIT sw	XUV SLIT	XUV SLIT	XUV SLIT	XUV SLIT	XUV SLIT	NA
	FSS BIAS HAL sw	HAL	HAL	HAL	HAL	HAL	NA
	FSS BIAS IN sw	OUT	OUT	OUT	OUT	OUT	NA
	FSS BIAS MARK sw	center	center	center	center	center	NA
	SUN ACQ SENSOR tb	gray	gray	gray	gray	gray	NA
	SUN ACQ SUN PRESENT tb	bp	gray or bp	gray or bp	gray or bp	gray or bp	NA
	CMPTR tb	white	PRI	PRI	PRI	PRI	NA
	CMPTR sw	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO
	EPEA sw	OFF	PRIM	PRIM	PRIM	OFF	OFF
	TACS 1 sw	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
	TACS 1 lt	off	off	off	off	off	off
	TACS 2 sw	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
	TACS 2 lt	off	off	off	off	off	off
	TACS 3 sw	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
	TACS 3 lt	off	off	off	off	off	off
	TACS 4 sw	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
	TACS 4 lt	off	off	off	off	off	off
	TACS 5 sw	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
	TACS 5 lt	off	off	off	off	off	off
	TACS 6 sw	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
	TACS 6 lt	off	off	off	off	off	off
	CMG SYSTEM 1 sw	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO
	CMG SYSTEM 1 tb	bp	gray	gray	gray	gray	NA
	CMG SYSTEM 2 sw	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO
	CMG SYSTEM 2 tb	bp	gray	gray	gray	gray	NA
	CMG SYSTEM 3 sw	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO
	CMG SYSTEM 3 tb	bp	gray	gray	gray	gray	NA
	RATE GYRO MONITOR X sw	1/2	1/2	1/2	1/2	1/2	NA
	RATE GYRO MONITOR X tb	bp	gray	gray	gray	gray	NA
	RATE GYRO MONITOR Y sw	1/2	1/2	1/2	1/2	1/2	NA
	RATE GYRO MONITOR Y tb	bp	gray	gray	gray	gray	NA
	RATE GYRO MONITOR Z sw	1/2	1/2	1/2	1/2	1/2	NA
	RATE GYRO MONITOR Z tb	bp	gray	gray	gray	gray	NA
	(*) May not represent valid status.						

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PNL	NOMENCLATURE	POSITION FOR					
		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	MONITOR:						
	ACS ind pwr fail lt	off	off	off	off	off	NA
	ACS sel	OFF	HZ/HT	OFF	HZ/HT	OFF	NA
	ACS ind	XXX-XXX	XXX-XXX	XXX-XXX	XXX-XXX	XXX-XXX	NA
	ANGLE ind pwr fail lt	off	off	off	off	off	NA
	ANGLE sel	OFF	ACQ SS X/Y	OFF	ACQ SS X/Y	OFF	NA
	ANGLE ind	XXX-XXX	XXX-XXX	XXX-XXX	XXX-XXX	XXX-XXX	NA
	COUNTER 1 sel	OFF	STAR TCK	OFF	STAR TCK	OFF	NA
			OUTER GIMBAL		OUTER GIMBAL		
	COUNTER 1 ind	blank	XXXX	blank	XXXX	blank	NA
	COUNTER 1 tb	white	+ or -	white	+ or -	white	NA
	COUNTER 2 sel	OFF	STAR TCK	OFF	STAR TCK	OFF	NA
			INNER GIMBAL		INNER GIMBAL		
	COUNTER 2 ind	blank	XXXX	blank	XXXX	blank	NA
	COUNTER 2 tb	white	+ or -	white	+ or -	white	NA
	COUNTER 3 sel	OFF	DAS	OFF	DAS	OFF	NA
	COUNTER 3 ind	blank	XXXX	blank	XXXX	blank	NA
	COUNTER 3 tb	white	+ or -	white	+ or -	white	NA
	SCAN SPECT:						
	HV ENABLE/RESET 1 sw	OFF	OFF	OFF	OFF	OFF	NA
	HV ENABLE/RESET 2 sw	OFF	OFF	OFF	OFF	OFF	NA
	HV ENABLE/RESET 3 sw	OFF	OFF	OFF	OFF	OFF	NA
	HV ENABLE/RESET 4 sw	OFF	OFF	OFF	OFF	OFF	NA
	HV ENABLE/RESET 5 sw	OFF	OFF	OFF	OFF	OFF	NA
	HV ENABLE/RESET 6 sw	OFF	OFF	OFF	OFF	OFF	NA
	HV ENABLE/RESET 7 sw	OFF	OFF	OFF	OFF	OFF	NA
	DOOR sw	center	center	center	center	center	NA
	DOOR tb	white*	bp	bp	bp	bp	NA
	MAIN HV sw	OFF	OFF	ENABLE	ENABLE	ENABLE	NA
	MAIN PWR sw	OFF	OFF	PRIM	PRIM	OFF	OFF
	INTENSITY DATA ind	blank	blank	blank	blank	blank	NA
	MODE sel	STOP	STOP	STOP	STOP	STOP	NA
	INTEN DATA sw	OFF	OFF	OFF	OFF	OFF	NA
	DET ELEC TEST sw	down	down	down	down	down	NA
	DET SEL sw	1	1	1	1	1	NA
	HV/DOOR INTLK sw	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NA
	EXP NIGHT INTLK sw	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NA
	GRATING POSITION ind	blank	blank	blank	blank	blank	NA
	RASTER/SCAN RESET sw	down	down	down	down	down	NA
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		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	SCAN SPECT: (cont)						
	RASTER/SCAN COUNTER ind	blank	blank	blank	blank	blank	NA
	MIR LIMIT tb	gray	gray	gray	gray	gray	NA
	0-ORDER tb	bp	bp	bp	bp	bp	NA
	MIR POS sw	center	center	center	center	center	NA
	GRATING REF sw	OPT	OPT	OPT	OPT	OPT	NA
	READY/OPR lt	off	off	off	off	off	NA
	START/STOP sw	center	center	center	center	center	NA
	GRATING MOTOR DRIVE sw	PRIM	PRIM	PRIM	PRIM	PRIM	NA
	THERMAL sw	OFF	ON	ON	ON	OFF	OFF
	X-RAY SPECT (Control):						
	MAIN PWR sw	OFF	ON	ON	ON	OFF	OFF
	DOOR sw	center	center	center	center	center	NA
	DOOR tb	white*	bp	bp	bp	bp	NA
	IMAGE DISSECTOR sw	OFF	OFF	ENABLE	ENABLE	ENABLE	NA
	X-RAY IMAGE sw	OFF	OFF	OFF	OFF	OFF	NA
	PHOTO MULT ENABLE sw	OFF	OFF	ENABLE	ENABLE	ENABLE	NA
	FILTER CONFIRM tb	bp*	bp*	bp*	bp*	bp*	NA
	FILTER sel	STORAGE	STORAGE	STORAGE	STORAGE	STORAGE	NA
	GRATING sw	OUT	OUT	OUT	OUT	OUT	NA
	GRATING tb	white	white	white	white	white	NA
	PICTURE RATE sel	SINGLE	SINGLE	SINGLE	SINGLE	SINGLE	NA
	EXPOSURE RANGE sel	256	256	256	256	256	NA
	FLARE THRESHOLD COARSE sel	768	768	per SAP	per SAP	(TBD)	NA
	FLARE THRESHOLD FINE sel	224	224	per SAP	per SAP	(TBD)	NA
	MODE sw	MANUAL	MANUAL	MANUAL	MANUAL	MANUAL	NA
	FRAMES REMAINING ind	blank	6000	blank	6000	blank	NA
	READY/OPR lt	off	off	off	off	off	NA
	START/STOP sw	center	center	center	center	center	NA
	PHOTO MULT TEST sw	center	center	center	center	center	NA
	THERMAL PWR sw	OFF	ON	ON	ON	OFF	OFF
	X-RAY SPECT (Display):						
	PHOTOMULTIPLIER EXPOSURE COUNT ind	blank	blank	blank	blank	blank	NA
	IMAGE THRESHOLD sel	256	256	256	256	256	NA
	IMAGE INTENSITY COUNT ind	blank	blank	blank	blank	blank	NA
	BRIGHTNESS cont	NA	NA	NA	NA	NA	NA
	X-RAY IMAGE mon	blank	blank	blank	blank	blank	NA
	FOCUS cont	NA	NA	NA	NA	NA	NA

(*) May not represent valid status.

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		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	CONSOLE POWER DISTRIBUTION:						
	ACS SW	OFF	BUS 1	OFF	BUS 1	OFF	OFF
	HA SW	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	OFF
	X-RAY TELE SW	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	OFF
	XUV SPECT SW	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	OFF
	XUV SLIT SW	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	OFF
	WLC SW	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	OFF
	SCAN SPECT SW	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	OFF
	X-RAY SPECT SW	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	EXP BUS 1/ NUMERIC LTG BUS	OFF	OFF
	cb MAIN C/D 1	open	close	open	close	open	open
	cb MAIN C/D 2	open	close	open	close	open	open
	cb MAIN MON 1	open	close	open	close	open	open
	cb MAIN MON 2	open	close	open	close	open	open
	cb MAIN INV/LCA 1	open	close	open	close	open	open
	cb MAIN INV/LCA 2	open	close	open	close	open	open
	cb C/D ACS 1	open	close	open	close	open	open
	cb C/D ACS 2	open	close	open	close	open	open
	cb C/D THRM/TLM/PWR 1	open	close	open	close	open	open
	cb C/D THRM/TLM/PWR 2	open	close	open	close	open	open
	cb INV AC 1	open	close	open	close	open	open
	cb INV AC 2	open	close	open	close	open	open
	cb C/D CMD/DEPLOY/EVA 1	open	close	open	close	open	open
	cb C/D CMD/DEPLOY/EVA 2	open	close	open	close	open	open
	cb C/D EXP 1	open	close	open	close	open	open
	cb C/D EXP 2	open	close	open	close	open	open
	cb LCA STATUS LTG BU 1	open	open	open	open	open	open
	cb LCA STATUS LTG BU 2	open	open	open	open	open	open

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PNL	NOMENCLATURE	POSITION FOR					
		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	X-RAY/RF ACTIVITY:						
	HISTORY PLOT	not recording	not recording	not recording	not recording	not recording	NA
	CLOCK	NA	as req	NA	as req	NA	NA
	DATA DRIVE BE sw	BE	BE	BE	BE	BE	NA
	DATA DRIVE RECORD sw	RECORD 10in/HR	RECORD 10in/HR	RECORD 10in/HR	RECORD 10in/HR	RECORD 10in/HR	NA
	DATA DRIVE FORWARD sw	OFF	OFF	OFF	OFF	OFF	NA
	ORBIT PHASE:						
	TIME REMAINING/DIGITAL ADDRESS tb	gray	DAY or NT	DAY or NT	DAY or NT	DAY or NT	NA
	TIME REMAINING/DIGITAL ADDRESS ind	blank	xx xx	blank	xx xx	blank	NA
	DAS:						
	KEYS 0-7 lts	off	on	off	on	off	NA
	CLR lt	off	on	off	on	off	NA
	ENTR lt	off	on	off	on	off	NA
	PWR sw	OFF	BUS 1	OFF	BUS 1	OFF	OFF
	TV:						
	HARC sw	center	center	center	center	center	NA
	HA RETICLE sw	OFF	OFF	OFF	OFF	OFF	NA
	HA1 PWR sw	OFF	OFF	OFF	OFF	OFF	OFF
	HA1 ZOOM sw	center	center	center	center	center	NA
	HA2 PWR sw	OFF	OFF	OFF	OFF	OFF	OFF
	HA2 ZOOM sw	center	center	center	center	center	NA
	MON 1 sw	OFF	OFF	OFF	OFF	OFF	OFF
	MON 2 sw	OFF	OFF	OFF	OFF	OFF	OFF
	SYNC GEN sw	OFF	OFF	OFF	OFF	OFF	OFF
	MON 1 sel	up	up	up	up	up	NA
	MON 2 sel	up	up	up	up	up	NA
	XUV MON GAIN sel	1	1	1	1	1	NA
	XUV MON PWR sw	OFF	OFF	OFF	OFF	OFF	OFF
	XUV MON DOORS sw	center	center	center	center	center	NA
	XUV MON DOORS tb	white*	white*	white*	white*	white*	NA
	XUV MON VID INTEG sw	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NA
	XUV MON GRID sw	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NA
	XUV SLIT WL DISPLAY sw	center	center	center	center	center	NA
	XUV SLIT LIMB PTG tb	gray	gray	gray	gray	gray	NA
	XUV SLIT LIMB PTG sw	center	center	center	center	center	NA
	WLC PWR sw	OFF	OFF	OFF	OFF	OFF	OFF
	WLC GRID sw	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NA
	(*) May not represent valid status.						

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		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	ATM POWER:						
	ATM POWER sw	up	up	up	up	up	up
	MON 1:						
	CONTRAST tw	NA	NA	NA	NA	NA	NA
	BRIGHTNESS tw	NA	NA	NA	NA	NA	NA
	CROSS HAIR INTENSITY tw	NA	NA	NA	NA	NA	NA
	VERTICAL CROSS HAIR tw	NA	NA	NA	NA	NA	NA
	HORIZONTAL CROSS HAIR tw	NA	NA	NA	NA	NA	NA
	MON 2:						
	CONTRAST tw	NA	NA	NA	NA	NA	NA
	BRIGHTNESS tw	NA	NA	NA	NA	NA	NA
	CROSS HAIR INTENSITY tw	NA	NA	NA	NA	NA	NA
	VERTICAL CROSS HAIR tw	NA	NA	NA	NA	NA	NA
	HORIZONTAL CROSS HAIR tw	NA	NA	NA	NA	NA	NA
	MANUAL POINTING CONTROL:						
	MPC	center	center	center	center	center	NA
	ROLL ENABLE sw	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT	NA
	ROLL HIGH RATE sw	center	center	center	center	center	NA
	ROLL LOW RATE sw	center	center	center	center	center	NA
	MAN PTG tb	bp	bp	bp	bp	bp	NA
	MAN PTG ENABLE sw	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT	NA
	ROLL GAIN sw	X1	X1	X1	X1	X1	NA
	POWER SYSTEM:						
	REG/BUS/BAT ind pwr fail 1t	off	off	off	off	off	NA
	REG/BUS/BAT ind	XXX-XX	XXX-XX	XXX-XX	XXX-XX	XXX-XX	NA
	REG/BAT ind pwr fail 1t	off	off	off	off	off	NA
	REG/BAT ind	XX-XXX	XX-XXX	XX-XXX	XX-XXX	XX-XXX	NA
	CBRM STATUS CHGR lts (18)	off	off	off	off	off	NA
	CBRM STATUS BAT lts (18)	off	off	off	off	off	NA
	CBRM STATUS REG lts (18)	off	off	off	off	off	NA
	BAT TEMP tb	gray	gray	gray	gray	gray	NA
	BAT VOLTS tb	gray	gray	gray	gray	gray	NA
	REG VOLTS tb	gray	gray	gray	gray	gray	NA
	BAT CHG tb	gray	gray	gray	gray	gray	NA

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		CLOSEOUT	POST ACTIV	STORAGE	REVISITATION	FINAL STORAGE	MIN EMERG PWR
130	POWER SYSTEM: (cont)						
	WATT-HOUR ind	blank	XXXXX	blank	XXXXX	blank	NA
	WATT-HOUR RESET sw	OFF	AUTO	OFF	AUTO	OFF	NA
	Power Monitor sel	OFF	BUS 1	OFF	BUS 1	OFF	NA
	CBRM SELECT sel	12	as desired	12	as desired	12	NA
	STATUS LIGHTS PRIM sw	PRIM	PRIM	PRIM	PRIM	PRIM	NA
	STATUS LIGHTS ENABLE sw	OFF	ENABLE	OFF	ENABLE	OFF	OFF
	CHGR sw	center	center	center	center	center	NA
	REG sw	center	center	center	center	center	NA
	SELECT sw	OFF	as desired	OFF	as desired	OFF	NA
	CBRM ALL ON sw	down	down	down	down	down	NA
160	CANISTER CONTROL						
	POWER PRIM sw/cb	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT
	POWER SEC sw/cb	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT
	ROLL sw	INHIBIT	INHIBIT	INHIBIT	INHIBIT	INHIBIT	NA
	S082 DOORS sw	center	center	center	center	center	NA
	S082 DOORS A lt	off	off	off	off	off	NA
	S082 DOORS B lt	off	off	off	off	off	NA
	CANISTER ROTATION cont	OFF	OFF	OFF	OFF	OFF	NA

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PROCEDURE	REMARKS
1 <u>ATM ACTIVATION</u> 2 <u>GROUND COMMAND STATUS VERIFICATION</u> 3 AOS ---:---:--- 4 <u>CAUTION</u> 5 6 Verify prior to CONSOLE POWER ACTIVATION 7 that sw positions agree with last ground/ 8 DAS command. Check with STDN for any 9 changes to following list: 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 130 CANISTER THERMAL: 33 PUMP sw - PRIMARY 34 HTR PWR sw - AUTO 35 CONTROLLER sw - PRIMARY 36 37 H-ALPHA: 38 HA1 HEATER sw - PRIM 39 HA2 HEATER sw - PRIM 40 41 X-RAY TELE: 42 THERMAL sw - PRIM 43 44 XUV SPECT: 45 MAIN PWR sw - ON 46 THERMAL sw - ON 47 48 XUV SLIT: 49 THERMAL sw - ON 50	03.02.06-00 ATM ACT November 1, 1972 Initial systems activation has been performed by IU or DCS com- mands and verified by STDN unless otherwise specified Failure to verify may result in an inadvertent command being sent to the equipment when applicable circuit breaker is closed Nominal ground commands are: CSTR THRM PUMP PRI (cmd 110) CSTR HTR PWR AUTO (cmd 105) CSTR THRM CTLR (cmd 107) CMPTR AUTO ENA (cmd 236) S052 MAIN PWR STBY (cmd 382) S052 THERM ON (cmd 384) S054 MN PWR ON (cmd 349) S054 THRM PWR PRI (cmd 352) S055A THERMAL ON (cmd 403) S056 THERMAL PRI (cmd 362) S082A MN PWR ON (cmd 425) S082A THERMAL ON (cmd 429) S082B THERMAL ON (cmd 438) (No ground command)

PROCEDURE	REMARKS
1 130 WLC: 2 MAIN PWR sw - STBY 3 4 CAUTION 5 6 Confirm via STDN that experiment temper- 7 ature is between 40 and 70 deg F before 8 turning on experiment TCS. Damage to ex- 9 periment due to differential temperature 10 stressing might otherwise result. 11 12 THERMAL sw - ON 13 14 SCAN SPECT: 15 THERMAL sw - ON 16 17 X-RAY SPECT (Control): 18 MAIN PWR sw - ON 19 THERMAL POWER sw - PRIM 20 21 SRNBM ANTENNA CONNECTION 22 23 129 Remove dust cap from J2 24 25 Remove antenna cable connector from J3 26 & connect to J2 27 28 Connect dust cap to J3 29 30 ATM C&D CONSOLE POWER ACTIVATION 31 32 130 CONSOLE POWER DISTRIBUTION: 33 34 All cb's closed except: 35 cb's LCA STATUS LTG BU 1 & 2 - open 36 37 All sw's (8) - 38 BUS 1, or EXP BUS1/NUM LTG (up) 39 40 DISPLAYS: 41 ALL sw's (4) - BUS 1 42 43 44 GROUND/DAS COMMAND INHIBIT 45 46 GROUND/DAS: 47 CSTR THRM sw - INHIBIT (locked) 48 ACS sw - INHIBIT (locked) 49 EXP/TV sw - INHIBIT (locked) 50	

PROCEDURE	REMARKS
1 <u>LIGHTING CHECK</u> 2 3 130 LIGHTING: 4 NUMERIC sw - VAR 5 INTEGRAL sw - VAR 6 (adj INTEGRAL cont as desired) 7 LAMP TEST sel - NUMERIC 8 9 ORBIT PHASE: 10 TIME REMAINING/DIGITAL ADDRESS ind = 88_88 11 12 13 MONITOR: 14 COUNTER 1 sel - ROLL EXP; ind = 8888 15 COUNTER 2 sel - FSS UP/DN; ind = 8888 16 COUNTER 3 sel - FSS L/R; ind = 8888 17 18 LIGHTING: 19 Adjust NUMERIC cont as desired 20 LAMP TEST sel - STATUS 21 ALERT/STATUS sw - VAR 22 (adj adjust ALERT/STATUS cont as desired) 23 24 ALERT: 25 DOOR OPEN lt - on (if in night) 26 27 28 29 All power fail lts (6) - on 30 31 32 33 34 35 36 37 38 All READY/OPR lts (7) - on 39 40 41 42 43 44 45 46 47 48 49 50	Interlock prevents INTEGRAL lighting from being powered before NUMERIC lighting Counters read all 8's when LAMP TEST selector is in NUMERIC Light will remain on until XUV SPECT & XUV SLIT MAIN PWR switches are placed on Yellow power fail lts are: MONITOR PRESS/TEMP ind power fail lt - on WLC ALIGN ind pwr fail lt - on ACS ind pwr fail lt - on ANGLE ind pwr fail lt - on BUS/BAT ind pwr fail lt - on REG/BUS/BAT ind pwr fail lt - on READY - green/OPR - white lts are: H-ALPHA X-RAY TELE XUV SPECT XUV SLIT WLC SCAN SPECT X-RAY SPECT

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 MASTER FLARE MODE: X-RAY/RF lt - on WLC: WLC ALIGN ind scale lt - X10 on WLC SCALE sw - X1 WLC ALIGN ind scale lt - X1 on LIGHTING: LAMP TEST sel - ALERT 2 ALERT: All APCS lts (10) - on LIGHTING: LAMP TEST sel - ALERT 1 ALERT: All EXP & PWR lts (10) - on LIGHTING: LAMP TEST sel - TACS ATTITUDE CONTROL SYSTEM: TACS lts (6) - on LIGHTING: LAMP TEST sel - OFF	X-RAY/RF lt is green WLC ALIGN ind scale lts are green Blue APCS ALERT lts are: ACS lt - on CMPTR REJ lt - on CMG MALF lt - on BRG TEMP 1 lt - on BRG TEMP 2 lt - on BRG TEMP 3 lt - on & 4 blank lts Blue EXP & PWR ALERT lts are: SCAN SPECT lt - on X-REA HV lt - on BE COUNT lt - on AL COUNT lt - on DOOR OPEN lt - on PWR SYS lt - on BAT CHG lt - on & 3 blank lts All light green

PROCEDURE	REMARKS
1 <u>EPS STATUS CHECK</u> 2 3 130 CONSOLE POWER DISTRIBUTION: 4 cb LCA STATUS LTG BU 1 - close 5 6 POWER SYSTEM: 7 STATUS LIGHTS PRIM sw - SEC 8 STATUS LIGHTS ENABLE sw - TEST and hold 9 Verify CBRM STATUS lts (54) - on (release 10 TEST) 11 12 STATUS LIGHTS PRIM sw - PRIM 13 STATUS LIGHTS ENABLE sw - TEST and hold 14 Verify CBRM STATUS lt's (54) - on (release 15 TEST) 16 STATUS LIGHTS ENABLE sw - ENABLE 17 18 BAT TEMP tb - gray 19 BAT VOLTS tb - gray 20 REG VOLTS tb - gray 21 BAT CHG tb - gray 22 23 Power Monitor sel - Bus 1 24 REG/BUS/BAT ind - BUS AMPS 20 to 100 25 - BUS VOLTS 27 to 30.5 26 27 Power Monitor sel - BUS 2 28 REG/BUS/BAT ind - BUS AMPS 20 to 100 29 - BUS VOLTS 27 to 30.5 30 31 SELECT sw - 1 - 12 32 Power Monitor sel - REG 33 CBRM SELECT sel - check 1 thru 12 34 REG/BUS/BAT ind - REG VOLTS 29 to 31 35 REG/BAT ind - REG AMPS 2 to 11 36 37 SELECT sw - 13 - 18 38 CBRM SELECT sel - check 13 thru 18 39 REG/BUS/BAT ind - REG VOLTS 29 to 31 40 REG/BAT ind - REG AMPS 2 to 11 41 42 SELECT sw - 1-12 43 Power Monitor sel - BAT 44 CBRM SELECT sel - check 1 thru 12 45 REG/BUS/BAT ind - BAT VOLTS 31 to 37 (DAY) 46 28 to 32 (NT) 47 REG/BAT ind - BAT AMPS 0 to 17 (DAY) 48 -12 to -2 (NT) 49 - BAT TEMP 30 to 90 deg 50	Lights go out upon releasing TEST sw

PROCEDURE	REMARKS
1 130 POWER SYSTEM: 2 SELECT sw - 13-18 3 CBRM SELECT sel - check 13 thru 18 4 REG/BUS/BAT ind - BAT VOLTS 31 to 37 (DAY) 5 28 to 32 (NT) 6 REG/BAT ind - BAT AMPS 0 to 17 (DAY) 7 -12 to -2 (NT) 8 - BAT TEMP 30 to 90 deg 9 10 SELECT sw - OFF 11 Power Monitor sel - BUS 1 12 13 WATT-HOUR RESET sw - MAN; ind = 00000 14 15 WATT-HOUR RESET sw - AUTO 16 17 CONSOLE POWER DISTRIBUTION: 18 cb LCA STATUS LTG BU 1 - open 19 20 <u>DAS INTERFACE CHECK</u> 21 22 GROUND/DAS: 23 CMPTR sw - ENABLE (verify) 24 CSTR THRM sw - ENABLE 25 ACS sw - ENABLE 26 EXP/TV sw - ENABLE 27 28 MONITOR: 29 COUNTER 1,2,3 sel - DAS 30 31 DAS: 32 PWR sw - PWR BUS 1 33 Key - 52002E Display Format 2 34 - 52003E Display ATMD C Data 35 - 50004E GMT Time 36 Verify displayed time 37 38 Key - 52001E Display Format 1 39 Verify displayed time 40 41 42 43 44 45 46 47 48 49 50	

PROCEDURE	REMARKS
1 Coordinate each DAS TEST with STDN 2 AOS ___:___:___ 3 DAS: 130 4 Key - 10000E (Zero Tests) 5 - 20000E 6 - 30000E 7 - 40000E 8 9 - 10377E (Register Tests) 10 - 20377E 11 - 30377E 12 - 40377E 13 14 GROUND/DAS: 15 CSTR THRM sw - INHIBIT (locked) 16 ACS sw - INHIBIT (locked) 17 EXP/TV sw - INHIBIT (locked) 18 19 <u>APCS STATUS CHECK & PANEL ACTIVATION</u> 20 21 ALERT: 22 APCS Alert lts (6) - off 23 24 ATTITUDE CONTROL SYSTEM: 25 EPEA sw - PRIM 26 EPC/FSS sw's (5) - PRIMARY 27 TACS sw's (6) - ENABLE (verify); 28 lts (6) - off 29 MODE tb - SI 30 SR/SS tb - CMP 31 STAR TRACK: POWER sw - ON 32 : SHUTTER tb - STR 33 FSS DOOR tb - SUN or bp (as approp) 34 MOMENTUM DUMP: AUTO GG tb - gray 35 : CAGE tb - gray 36 CMG SYSTEM tb's (3) - gray 37 RATE GYRO MONITOR tb (3) - gray 38 SUN ACQ: SENSOR tb - gray 39 : SUN PRESENT tb - gray or bp 40 (as approp) 41 CMPTR tb - PRI 42 43 MONITOR: 44 ACS sel - WHL AMPS (3) (30-35%) 45 - WHL SPD (3) (87-92%) 46 - HX, HY, HZ/HT (Nominal H Chart) 47 - TACS P (60 - 75%) 48 COUNTER 3 sel - ORBITAL PLANE ERROR 49 (Beta Angle Chart/ 50 Orb Plane Err Chart)	

PROCEDURE	REMARKS
130 MONITOR: COUNTER 1 & 2 sel - DAS DAS: Key - 52003E (Status Word 1) 50011E Verify COUNTER 1 ind - 1133 COUNTER 2 ind - 1100 52003E (Status Word 2) 50012E Verify COUNTER 1 ind - 0777 COUNTER 2 ind - 0000 52003E (Status Word 3) 50013E Verify COUNTER 1 ind - 0002 COUNTER 2 ind - 3100 52003E (Status Word 4) 50014E Verify COUNTER 1 ind - 0100 COUNTER 2 ind - XX00 52003E (Status Word 5) 50015E Verify COUNTER 1 ind - X0X1 COUNTER 2 ind - 0000 TCS STATUS CHECK CANISTER THERMAL: MONITOR sw - <u>PUMP-delta P.</u>; CSTR IN deg F ind - 25 to 31 PSI 50 +/- 1 deg F MONITOR sw - <u>SYS P</u>-----; PUMP OUT deg F x 10 ind - 7 to 19 PSI 49 to 58 deg F MONITOR sw - <u>ACCUM VOL (%)</u>; HTR deg F x 10 ind - 60 to 90% - 49 to 58 deg F	Thermal Control Subsystem activated by ground command approximately one (1) hour after launch to ensure temperature control of experiments until experiment activation

PROCEDURE	REMARKS
1 <u>GSE N2 PURGE FITTING DISCONNECT</u> 2 3 130 MONITOR: 4 COUNTER 3 sel - ROLL CSTR; ind = -1350 5 6 MANUAL POINTING CONTROL: 7 ROLL ENABLE sw - ENABLE 8 ROLL GAIN sw - X1 9 10 <u>WARNING</u> 11 12 Canister must be rolled CW at the slowest 13 speed to prevent GSE N2 purge fitting from 14 jamming canister or hitting exp. door handles 15 16 ROLL LOW RATE sw - CW until COUNTER 3 17 ind = -1100 18 ROLL HIGH RATE sw - CW until COUNTER 3 19 ind = 0000 20 21 ROLL ENABLE sw - INHIBIT 22 23 <u>ACCUTRON TIMER INSTALLATION</u> 24 25 157 Remove timer from storage container 26 27 M Unstow Accutron Timer set key 28 144 29 Insert point of Accutron Timer set key into 30 appropriate hole in case and push until de- 31 sired number appears in window on face. 32 Repeat as required to obtain proper setting. 33 34 130 X-RAY/RF ACTIVITY: 35 Align the three (3) holes in timer with 36 studs on panel and press timer into 37 place 38 39 M Stow Accutron Timer set key 40 144 41 42 43 44 45 46 47 48 49 50	Disconnects male half GSE N2 purge fitting from female fitting on canister allowing spring loaded swing arm to retract male fitting back against rack. This fitting is NOT disconnected at lift off or prior to lift off At roll canister zero, canister is rolled approximately 22 1/2 deg cw from launch position

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>STAR ACQ FOR CSM IMU ALIGNMENT</u> 130 1 ATTITUDE CONTROL SYSTEM: MODE tb - SI EPC 800 HZ sw - PRIMARY (verify) EPEA sw - PRIM (verify) MONITOR: COUNTER 1,2,3 sel - $\theta X, \theta Y, \theta Z$; ind less than 001.0 deg (verify) COUNTER 1 sel - STAR TCK OUTER GIMBAL (ARC MIN) COUNTER 2 sel - STAR TCK INNER GIMBAL (ARC MIN) COUNTER 3 sel - ORBITAL PLANE ERROR (.1 deg) 2 ATTITUDE CONTROL SYSTEM: STAR TRACK POWER sw - ON (verify) STAR TRACK ACQ sw - MAN; tb - MAN DAS: Key - 52012E (Select System) - 5000XE X = 0, ACHERNAR (A) X = 1, CANOPUS (C) X = 2, ALPHA CRUX (X) MANUAL POINTING CONTROL: MAN PTG ENABLE sw - ENABLE; tb - STR MPC - Manipulate gimbals to IG ----, OG ---- (STAR TRACKER Pad or P55) ATTITUDE CONTROL SYSTEM: STAR TRACK ACQ sw - AUTO; tb - AUT STAR TRACK SHUTTER tb - OPN MANUAL POINTING CONTROL: MAN PTG tb - bp or EXP * ALERT: * * ACS lt - on * * DAS: * * Key - 52003E (ATMDC Data) * * - 50001E (ALERT Conditions) * * MONITOR: * * COUNTER 1 sel - DAS; ind - 4XXX * * Return to Step 2 & Repoint Star * * Tracker *	

PROCEDURE	REMARKS
1 130 ATTITUDE CONTROL SYSTEM: 2 STAR TRACK SHUTTER tb - STAR 3 (may req 25 sec) 4 5 MONITOR: 6 COUNTER 3 sel - ORBITAL PLANE 7 ERROR (.1 deg) 8 If ORBITAL PLANE ERROR changes less 9 than 1.0 deg, return to Step 2 and 10 Repoint Star Tracker 11 12 MANUAL POINTING CONTROL: 13 MAN PTG ENABLE sw - INHIBIT; tb - bp 14 15 Record ATM STAR TRKR ANGLES: 16 ----- OG (ARC MIN) 17 ----- IG (ARC MIN) 18 19 Report STAR TRKR ANGLES to CDR 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	

PROCEDURE	REMARKS
SYSTEMS MANAGEMENT EPS BACKUP ACTIVATION 130 POWER SYSTEM: CBRM ALL ON sw - ALL ON or SELECT sw - 1-12 or 13-18 CBRM SELECT sel - as required CHGR sw - ON REG sw - ON Repeat for other desired CBRMs TELEMETRY SYSTEM BACKUP ACTIVATION TELEMETRY: TLM PWR sw - ON; tb - gray TRANSMITTER 1 INPUT sw - REALTIME; tb - RT TRANSMITTER 2 INPUT sw - REALTIME; tb - RT TRANSMITTER 1 OUTPUT sw - AFT ANTENNA; tb - AFT TRANSMITTER 2 OUTPUT sw - FORWARD ANTENNA; tb - FWD TAPE RECORDER 1 RECORD sw - RECORD; tb - RCD TAPE RECORDER 2 RECORD sw - center; tb - bp TCS BACKUP ACTIVATION CANISTER THERMAL: PUMP sw - PRIMARY HTR PWR sw - AUTO CONTROLLER sw - PRIMARY MONITOR ind pwr fail lt - off MONITOR sw - <u>PUMP_delta_P</u>; CSTR IN deg F ind - 25 to 31 PSI 50 +/- 1 deg F	04.07.06-00 EPS BU ACT November 1, 1972 Note: If CBRM ALL ON is used each CBRM must be individually selected in order to activate BAT TEMP warning. 04.07.07-00 TLM BU ACT November 1, 1972 04.07.09-00 TCS BU ACT November 1, 1972

PROCEDURE	REMARKS
1 130 CANISTER THERMAL: 2 MONITOR sw - <u>SYS P</u> _____; 3 PUMP OUT deg F x 10 4 5 ind - 7 to 19 PSI 6 49 to 58 deg F 7 8 MONITOR sw - <u>ACCUM VOL (%)</u> _____; 9 HTR deg F x 10 10 11 ind - 60 to 90% 12 - 49 to 58 deg F 13 14 15 16 <u>DAS COMMANDING</u> 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 GROUND/DAS: 36 Verify appropriate system to be addressed 37 is enabled: 38 ENABLE/INHIBIT sw - ENABLE 39 40 DAS: 41 PWR sw - BUS 1 or BUS 2 42 Key - CLR 43 44 45 Key - octal DAS code 46 47 48 49 50	12.03.18-00 DAS COMMAND November 1, 1972 The ATM command receivers and de- coders are turned on initially by the IU LVDC. Backup power control commands are provided to the re- ceivers and decoders by the AM DCS. ATM command receiver power is con- trolled manually onboard by the GROUND/ DAS GRD CMD switch. STDN commands are automatically inhibited when the first DAS key is pushed and are re-enabled when the CLR or ENTR keys are pushed There is no capability for COMMAND SYSTEM monitoring on the ATM C&D CONSOLE Assures system in reset condition and ready to accept command See Document 50M16140

PROCEDURE	REMARKS
1 130 ORBIT PHASE: 2 TIME REMAINING/DIGITAL ADDRESS ind - 3 verify code 4 (Note: If a function or data command 5 is rejected by the ATMD, an 6 octal 05111 is added to the 7 command for display and the 8 CMPTR REJ Alert lt is lit.) 11 * 12 * If octal code is incorrect: * 13 * DAS: * 14 * Key - CLR * 15 * - repeat DAS code * 16 * 17 * ORBIT PHASE: * 18 * TIME REMAINING/DIGITAL ADDRESS ind - * 19 * verify code * 20 * 21 * 22 * 23 * If octal code is still incorrect: * 24 * DAS: * 25 * Key - CLR * 26 * - Alternate octal DAS code * 27 * 28 * ORBIT PHASE: * 29 * TIME REMAINING/DIGITAL ADDRESS - * 30 * verify alternate code * 31 * 32 * 33 * 34 * DAS: * 35 * Key - ENTR * 36 * 37 * 38 * ORBIT PHASE: * 39 * TIME REMAINING/DIGITAL ADDRESS ind - * 40 * center digit flashing as DAS veri- * 41 * fication of ENTR COMMAND * 42 * 43 * (Note: If ENTR was pushed while * 44 * CMPTR REJ lt - on; Terminate * 45 * (52040E) must be commanded * 46 * prior to reattempting DAS * 47 * commands to ATMD) * 48 * 49 * 50 *	Indicator will display 00000 when first key is pushed and display verification of DAS octal code when fifth key is pushed See Document 50M16140 Executes switch selector command or function command/data com- mand entered into ATMD

PROCEDURE	REMARKS
1 2 3 4 5 6 130 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 121 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <pre> * * If ATMDC does not respond to ENTR, an * ATMDC backup enter may be performed by: * * DAS: * Key - 52050E * DAS: Key - CLR ORBIT PHASE: TIME REMAINING/DIGITAL ADDRESS ind - time remaining displayed BACKUP DAS COMMANDING GROUND/DAS: Verify appropriate system to be addressed is enabled: ENABLE/INHIBIT sw - ENABLE CLEAR sw - CLEAR DIGIT 1-5 sel - desired DAS octal code DATA TRANS sw - DATA TRANS ENTER sw - ENTER TV MONITOR ACTIVATION TV: SYNC GEN sw - PRIM HA1 PWR sw - ON HA2 PWR sw - ON MON 1 sw - PWR ON MON 2 sw - PWR ON </pre>	<pre> 12.04.01-00 DAS BU CMD November 1, 1972 Assures system in reset condition and ready to accept command See Document 50M16140 Octal code will not be displayed on TIME REMAINING/DIGITAL ADDRESS ind on ATM C&D Console 04.07.05-00 TV MON ACT November 1, 1972 SYNC GEN sw must be in PRIM or SEC to enable activation of TV System </pre>

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PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>APCS STATUS CHECK (16K)</u> 130 ALERT: APCS lt (6) - off ATTITUDE CONTROL SYSTEM: EPC sw (4)/FSS sw (1) - PRIMARY TACS sw (6) - ENABLE; lt (6) - off MODE tb - SI or EXP (as approp) SR/SS tb - CMP STAR TRACK POWER sw - ON STAR TRACK SHUTTER tb - STR or bp (as app) FSS DOOR tb - SUN or bp (as approp) MOMENTUM DUMP AUTO GG tb-bp or ACT(as app) MOMENTUM DUMP CAGE tb - gray CMG SYSTEM sw (3) - AUTO; tb - gray RATE GYRO MONITOR sw(3) - 1/2; tb(3) - gray FSS BIAS IN sw - OUT SUN ACQ SENSOR tb - gray SUN ACQ SUN PRESENT tb - gray or bp (as approp) CMPTR sw - AUTO; tb - PRI EPEA sw - PRIM EVA: AUTO DOOR sw - ENABLE	This section corresponds to Phase II Software Definition 20.03.05-00 APCS STATUS October 16, 1972 Consult APCS Malfunction Procedures in response to an ALERT indication ACS lt - off CMG MALF lt - off CMPTR REJ lt - off BRG TEMP 1, 2, & 3 lt - off EPC ROLL RSLVR sw does not have an OFF (center) position EPC ROLL RSLVR sw - PRIMARY EPC 800 HZ sw - PRIMARY FSS sw - PRIMARY EPC RATE GYRO UP/DN sw - PRIMARY EPC RATE GYRO L/R sw - PRIMARY The gray indication is for the orbit day and the bp indication is for the orbit night

PROCEDURE	REMARKS
1 130 MONITOR: 2 ACS sel - WHL AMPS (3); (30 to 35%) 3 ACS sel - WHL SPD (3); (87 to 92%) 4 ACS sel - HX, HY, HZ/HT; (Nominal H Chart) 5 ACS sel - TACS P; (TACS P Chart) 6 COUNTER 3 sel - ORBITAL PLANE ERROR; 7 (Beta Angle Chart) 8 COUNTER 1 & 2 sel - DAS 9 10 DAS: 11 Key - 52003E (Status Word 1) 12 50011E - Verify COUNTER 1 ind=1133 13 COUNTER 2 ind=1100 14 15 16 17 18 19 20 52003E (Status Word 2) 21 50012E - Verify COUNTER 1 ind=0777 22 COUNTER 2 ind=0000 23 24 25 26 27 28 29 30 31 32 52003E (Status Word 3) 33 50013E - Verify COUNTER 1 ind=0002 34 COUNTER 2 ind=3100 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	Status Word 1: 1 - CMG Control Enable 1 - TACS Cntl Capability Enable 3 - Acq SS X Axis, Pri & Sec Used 3 - Acq SS Y Axis, Pri & Sec Used 1 - Star Tracker Control Enable 1 - Self Test X Over Enable - 16K Program Status Word 2: 0 - Strapdown Control Prime Select 7 - X Axis Rate Gyros Used for Control, #1 & #2, #3 in Backup 7 - Y Axis Rate Gyros Used for Control, #1 & #2, #3 in Backup 7 - Z Axis Rate Gyros Used for Control, #1 & #2, #3 in Backup 0 - No Rate Gyro Integral Test Failure 0 - Rate Gyro All Axes Control Status Word 3: 0 - Trouble Shooting Mode not in Progress 0 - DAS Commands Normal 0 - No Computer Memory Load Activity 2 - Display Format 1 Selected 3 - FSS and Scan Spect Auto Door Control Enable 1 - ACS Control Gains Docked

PROCEDURE	REMARKS
1 130 DAS: 2 Key - 52003E (Status Word 4) 3 50014E - Verify COUNTER 1 ind=0100 4 COUNTER 2 ind=XX00 5 6 7 8 9 10 11 12 13 14 52003E (Status Word 5) 15 50015E - Verify COUNTER 1 ind=X0X1 16 COUNTER 2 ind=0000 17 18 19 20 21 22 23 24 25 26 <u>STAR ACQUISITION</u> 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	Status Word 4: 0 - No Failures or An Even Number of Interrupt Failures Have Occured 1 - Entry CMG Auto Reset Enable 0 - CMG Resolver Reference Voltage Test Normal 0 - No CMG Errors Detected by Redundancy Management XX - TACS Minimum Impulse Width in 0.01 Sec (Displayed in Octal). Status Word 5: X - A Single or Four Momentum Sample(s) Used for GG Dump 0 - Spare X - Star Selected 1 - Star Tracker Update of Orbital Plane Error Enable 0 - Acq SS X & Y Axes Test Normal 0 - Spare 20.01.10-00 STAR ACQ October 16, 1972 The Star Tracker is used as a reference for the experiment roll angle and the calculation of the orbital plane error. This procedure is used to acquire the reference star with the Star Tracker

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PROCEDURE	REMARKS
1 130 ATTITUDE CONTROL SYSTEM: 2 STAR TRACK ACQ sw - AUTO; tb - AUT 3 STAR TRACK SHUTTER tb - OPN 4 5 MANUAL POINTING CONTROL: 6 MAN PTG tb - bp or EXP 7 8 * If Termination of Wide Search Pattern* 9 * Desired in Daylight SI Attitude: * 10 * * 11 * DAS: * 12 * Key - 52011E (Enable) * 13 * 50004E (Star Track Control) * 14 * * 15 16 * ALERT: * 17 * ACS lt - on * 18 * * 19 * * 20 * * 21 * * 22 * DAS: * 23 * Key - 52003E (Cmptr Data) * 24 * 50001E (ALERT Conditions) * 25 * * 26 * MONITOR: * 27 * COUNTER 1 sel - DAS; ind = 4XXX* 28 * * 29 * Repoint Star Tracker * 30 31 ATTITUDE CONTROL SYSTEM: 32 STAR TRACK SHUTTER tb - STR 33 (may req 25 sec) 34 35 MONITOR: 36 COUNTER 3 sel - ORBITAL PLANE ERROR; 37 ind - XXX.X (deg) 38 If ORBITAL PLANE ERROR changes > 1 deg, 39 40 Repoint Star Tracker 41 42 MANUAL POINTING CONTROL: 43 MAN PTG ENABLE sw - INHIBIT; tb - bp 44 45 46 47 48 49 50	Enabling Star Track Control enables auto search timer which may cause the ALERT ACS light to illuminate If star is not located during fine search mode the ATMDC commands a Star Tracker hold and turns on the ACS ALERT lt Displaying ALERT Condition turns off ACS ALERT lt Star Tracker failure to acquire Keying in the incorrect star code or the Star Tracker locking on the wrong star will cause the ORBITAL PLANE ERROR to be cal- culated incorrectly

PROCEDURE	REMARKS
1 <u>SI/EXP OFFSET POINTING</u> 2 3 4 5 6 7 8 9 10 11 12 130 ATTITUDE CONTROL SYSTEM: 13 MODE sw - SOLAR INERTIAL or EXP PTG; 14 tb - SI or EXP 15 16 MONITOR: 17 COUNTER 1 sel - $\emptyset X$; ind - XXX.X (deg) 18 COUNTER 2 sel - $\emptyset Y$; ind - XXX.X (deg) 19 20 DAS: 21 Key - 52021E (Fine Mnvr) 22 5+/-XXxE (MANEUVER PAD or S020 23 5+/-YYE Crewman) 24 50000E (0.1 deg increments, 25 must be in octal) 26 27 28 29 NOTE: 4.0 deg - decimal (50 - octal) 30 is maximum offset 31 32 MONITOR: 33 Monitor $\emptyset X$, $\emptyset Y$ (verify proper offset) 34 35 Repeat as required 36 37 NOTE: To remove offsets, ATTITUDE CONTROL 38 SYSTEM MODE sw - SOLAR INERTIAL or 39 EXP PTG; tb - SI or EXP 40 41 42 43 44 45 46 47 48 49 50	20.01.04-00 SI OFFSET October 16, 1972 Solar Inertial Offset Pointing is used to accurately align experiment S020 (X-Ray/UV Solar Photography) to the solar disc. If performed during a gravity gradient dump, offset pointing commands will take effect during last dumping maneuver Fine Mnvr increments will be sent up on a teleprinter pad, or voiced up from the ground or from the S020 Crewman who will be directing the attitude pointing from the +Z Scientific Airlock

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PROCEDURE	REMARKS
<pre> 1 * If Repointing Star Tracker is Required * 2 * During Mnvr to ZLV: (Note: Track Ref. * 3 * Star until loss of Star or until 5 * 4 * minutes before acquiring ZLV Star) * 5 * 6 130 * ATTITUDE CONTROL SYSTEM: * 7 * STAR TRACK ACQ sw - MAN; tb - MAN * 8 * 9 * MONITOR: * 10 * COUNTER 1 sel - STAR TCK OUTER GIMBAL; * 11 * ind - XXXX. (ARC MIN) * 12 * COUNTER 2 sel - STAR TCK INNER GIMBAL; * 13 * ind - XXXX. (ARC MIN) * 14 * 15 * MANUAL POINTING CONTROL: * 16 * MAN PTG ENABLE sw - ENABLE; tb - STR * 17 * MPC - Manipulate Gimbals to OG____,IG____ * 18 * (MANEUVER PAD) * 19 * 20 * ATTITUDE CONTROL SYSTEM: * 21 * STAR TRACK SHUTTER sw - CLOSE; tb - bp * 22 * 23 * MANUAL POINTING CONTROL: * 24 * MAN PTG ENABLE sw - INHIBIT; tb - bp * 25 * 26 End of Maneuver Time 27 28 MONITOR: 29 Monitor Attitude and Rate Information 30 COUNTER 1, 2, 3 sel - ØX, ØY, ØZ; 31 ind = 000.0 or bias angles 32 33 COUNTER 1, 2, 3 sel - ØZ, ØX, ØY; 34 ind = .0000, .0000, .0645 35 (with zero biases) 36 37 * If Star Tracker Was Repointed During Mnvr* 38 * to ZLV: * 39 * 40 * At GMT __:__:__, 41 * ATTITUDE CONTROL SYSTEM: 42 * STAR TRACK ACQ sw - AUTO; tb - AUT 43 * STAR TRACK SHUTTER tb - OPEN or STR 44 * 45 Repeat Fine Mnvr as required, updating 46 Maneuver Time as appropriate 47 48 49 50 </pre>	<pre> The Star Tracker gimbal positions will appear on the MANEUVER PAD The Star Tracker time to begin search will appear on the MANEUVER PAD </pre>

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 * If Single Rate Gyro RM Was Inhibited Prior * * to the Mnvr to ZLV: * * * 130 * DAS: * * Key - 52015E (RATE GYRO RM) * * 500BBE * * 15 (X AXIS SELECT 1; RM ENABLE) * * 16 (X AXIS SELECT 2; RM ENABLE) * * 17 (X AXIS SELECT 3; RM ENABLE) * * 25 (Y AXIS SELECT 1; RM ENABLE) * * 26 (Y AXIS SELECT 2; RM ENABLE) * * 27 (Y AXIS SELECT 3; RM ENABLE) * * 35 (Z AXIS SELECT 1; RM ENABLE) * * 36 (Z AXIS SELECT 2; RM ENABLE) * * 37 (Z AXIS SELECT 3; RM ENABLE) *	

PROCEDURE	REMARKS
1 <u>MNVR TO SI/EXP</u> 2 3 * If Maneuver Time Different From Last * 4 * Entered: * 5 * 6 130 * DAS: * 7 * Key - 52030E (Maneuver Time) * 8 * 500TTE (MANEUVER PAD, minutes* * 9 * must be in octal) * 10 11 * If a Single Rate Gyro is Selected for Any* * 12 * Axis, Inhibit RM on That Axis: * 13 * 14 * DAS: * 15 * Key - 52015E (RATE GYRO RM) * 16 * 500A0E (RM INHIBIT) * 17 * 1 (X AXIS SELECT) * 18 * 2 (Y AXIS SELECT) * 19 * 3 (Z AXIS SELECT) * 20 21 At GMT __:__:__, 22 ATTITUDE CONTROL SYSTEM: 23 MODE SOLAR INERTIAL sw - SOLAR INERTIAL 24 or EXP PTG; 25 tb - SI or EXP 26 27 * If SI/EXP Offset Required: * 28 * 29 * DAS: * 30 * Key - 52021E (Fine Mnvr) * 31 * 5+/-XXE (MANEUVER PAD, 0.1 deg* * 32 * 5+/-YYE increments, must * 33 * 50000E be in octal) * 34 35 MONITOR: 36 Monitor Attitude and Rate Information 37 38 39 40 41 42 43 44 45 46 47 48 49 50	20.01.03-00 MNVR TO SI October 16, 1972 Maneuver Time indicated on MANEUVER PAD Maneuver may cause Rate Gyro RM to fail thruster firing test

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <pre> 130 * If Repointing Star Tracker Was Required * * During Mnvr to ZLV: * * * * ATTITUDE CONTROL SYSTEM: * * STAR TRACK ACQ sw - MAN; tb - MAN * * * * MONITOR: * * COUNTER 1 sel - STAR TCK OUTER GIMBAL; * * ind - XXXX. (ARC MIN) * * COUNTER 2 sel - STAR TCK INNER GIMBAL; * * ind - XXXX. (ARC MIN) * * * * MANUAL POINTING CONTROL: * * MAN PTG ENABLE sw - ENABLE; tb - STR * * MPC - Manipulate Gimbals to OG____, IG____ * * (STAR TRACKER Pad) * * * * ATTITUDE CONTROL SYSTEM: * * STAR TRACK SHUTTER sw - CLOSE; tb - bp * * * * MANUAL POINTING CONTROL: * * MAN PTG ENABLE sw - INHIBIT; tb - bp * * * End of Maneuver Time MONITOR: Monitor Attitude and Rate Information COUNTER 1, 2, 3 sel - $\dot{\theta}X$, $\dot{\theta}Y$, $\dot{\theta}Z$; ind = 000.0 or required offset COUNTER 1, 2, 3 sel - $\ddot{\theta}Z$, $\ddot{\theta}X$, $\ddot{\theta}Y$; ind = .0000 * If Star Tracker was Repointed During Mnvr* * to SI/EXP: * * * * ATTITUDE CONTROL SYSTEM: * * STAR TRACK ACQ sw - AUTO; tb - AUT * * STAR TRACK SHUTTER tb - OPN or STR * * * Repeat Fine Mnvr as required </pre>	<pre> The Star Tracker gimbal positions for each reference star appear on the STAR TRACKER Pad </pre>

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 * If Single Rate Gyro RM Was Inhibited Prior * * to the Mnvr to SI/EXP: * * * * DAS: * * Key - 52015E (RATE GYRO RM) * * 500BBE * * 15 (X AXIS SELECT 1; RM ENABLE) * * 16 (X AXIS SELECT 2; RM ENABLE) * * 17 (X AXIS SELECT 3; RM ENABLE) * * 25 (Y AXIS SELECT 1; RM ENABLE) * * 26 (Y AXIS SELECT 2; RM ENABLE) * * 27 (Y AXIS SELECT 3; RM ENABLE) * * 35 (Z AXIS SELECT 1; RM ENABLE) * * 36 (Z AXIS SELECT 2; RM ENABLE) * * 37 (Z AXIS SELECT 3; RM ENABLE) *	

PROCEDURE	REMARKS
1 <u>MNVR TO ARBITRARY ATTITUDE</u> 2 3 130 DAS: 4 Key - 52030E (Maneuver Time) 5 500TTE (MANEUVER PAD, minutes 6 must be in octal) 7 8 * If a Single Rate Gyro is Selected for Any* 9 * Axis, Inhibit RM on That Axis: * 10 * 11 * DAS: 12 * Key - 52015E (RATE GYRO RM) * 13 * 500A0E (RM INHIBIT) * 14 * 1 (X AXIS SELECT) * 15 * 2 (Y AXIS SELECT) * 16 * 3 (Z AXIS SELECT) * 17 18 At GMT __:__:__, 19 ATTITUDE CONTROL SYSTEM: 20 MODE ATT HOLD sw - CMG or TACS; 21 tb - CMG or TAC 22 (as approp) 23 24 MONITOR: 25 ACS sel - HX, HY, HZ/HT; ind - (note values 26 relative to select- 27 ed mnvr) 28 ANGLE sel - CMG 1, 2, 3; ind - (note values 29 relative to stops) 30 COUNTER 1, 2, 3 sel - $\emptyset$X, $\emptyset$Y, $\emptyset$Z; 31 ind - (note attitude) 32 33 DAS: 34 Key - 52020E (Coarse Mnvr) 35 5+/-XXxE (MANEUVER PAD) 36 5+/-YYyE (1.0 deg increments, 37 5+/-ZZZE must be in octal) 38 and/or 39 Key - 52021E (Fine Mnvr) 40 5+/-XXxE (MANEUVER PAD) 41 5+/-YYyE (0.1 deg increments, 42 5+/-ZZZE must be in octal) 43 44 45 46 47 48 49 50	20.01.02-00 MNVR TO ARB October 16, 1972 Maneuver may cause Rate Gyro RM to fail thruster firing test Maneuver start and return times will appear on the MANEUVER PAD Select Coarse Mnvr (52020E) and/or Fine Mnvr (52021E) Command as appropriate

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PROCEDURE	REMARKS																																										
130 <u>XFER TO ATM CONTROL</u> DAS: Key - 52023E (CMG Nominal Cage) MONITOR: ACS sel - HX, HY, HZ/HT; ind - (stable H) Monitor Attitude and Rate Information Wait until Rates < 0.03 deg/sec (approx. 2 min) Instruct CSM to release attitude control ATTITUDE CONTROL SYSTEM: MOMENTUM DUMP CAGE sw - RELEASE; tb - gray MODE sw - SOLAR INERTIAL or EXP PTG; tb - SI or EXP	20.01.07-00 XFR-ATM CNT October 16, 1972																																										
<u>16K ATMDC DAS COMMAND LISTING</u> <table border="0"> <tr> <td>FUNCTION AND DATA CODES TRUE (ALT)</td><td>DEFINITION</td></tr> <tr> <td colspan="2">-----</td></tr> <tr> <td colspan="2"><u>D I S P L A Y</u></td></tr> <tr> <td>52001 (55776)</td><td><u>FORMAT 1</u></td></tr> <tr> <td>52002 (55775)</td><td><u>FORMAT 2</u></td></tr> <tr> <td>52003 (55774) +1</td><td><u>CMPTR DATA</u></td></tr> <tr> <td>50000 (57777) *1</td><td>C/W CONDITIONS</td></tr> <tr> <td>50001 (57776) *2</td><td>ALERT CONDITIONS</td></tr> <tr> <td>50002 (57775)</td><td>ATT ERR (XXX.X DEG)</td></tr> <tr> <td>50003 (57774)</td><td>SI OFFSET (XXX.X DEG)</td></tr> <tr> <td>50004 (57773)</td><td>GMT (HR:MIN:SEC)</td></tr> <tr> <td>50005 (57772)</td><td>X RGS ALL (.XXXX DEG/SEC)</td></tr> <tr> <td>50006 (57771)</td><td>Y RGS ALL (.XXXX DEG/SEC)</td></tr> <tr> <td>50007 (57770)</td><td>Z RGS ALL (.XXXX DEG/SEC)</td></tr> <tr> <td>50011 (57766) *3</td><td>STATUS WORD 1</td></tr> <tr> <td>50012 (57765) *4</td><td>STATUS WORD 2</td></tr> <tr> <td>50013 (57764) *5</td><td>STATUS WORD 3</td></tr> <tr> <td>50014 (57763) *6</td><td>STATUS WORD 4</td></tr> <tr> <td>50015 (57762) *7</td><td>STATUS WORD 5</td></tr> <tr> <td>52004 (55773) +3</td><td><u>SINGLE MEMORY LOC</u></td></tr> <tr> <td>50AAA (57aaa) *8</td><td>AAABBB=MEMORY ADDRESS</td></tr> </table>	FUNCTION AND DATA CODES TRUE (ALT)	DEFINITION	-----		<u>D I S P L A Y</u>		52001 (55776)	<u>FORMAT 1</u>	52002 (55775)	<u>FORMAT 2</u>	52003 (55774) +1	<u>CMPTR DATA</u>	50000 (57777) *1	C/W CONDITIONS	50001 (57776) *2	ALERT CONDITIONS	50002 (57775)	ATT ERR (XXX.X DEG)	50003 (57774)	SI OFFSET (XXX.X DEG)	50004 (57773)	GMT (HR:MIN:SEC)	50005 (57772)	X RGS ALL (.XXXX DEG/SEC)	50006 (57771)	Y RGS ALL (.XXXX DEG/SEC)	50007 (57770)	Z RGS ALL (.XXXX DEG/SEC)	50011 (57766) *3	STATUS WORD 1	50012 (57765) *4	STATUS WORD 2	50013 (57764) *5	STATUS WORD 3	50014 (57763) *6	STATUS WORD 4	50015 (57762) *7	STATUS WORD 5	52004 (55773) +3	<u>SINGLE MEMORY LOC</u>	50AAA (57aaa) *8	AAABBB=MEMORY ADDRESS	20.03.07-00 CMP DAS LST October 16, 1972 PHASE II ATMDC SOFTWARE DEFINITION ALL CODES OCTAL SIGN + = 0; - = 1
FUNCTION AND DATA CODES TRUE (ALT)	DEFINITION																																										

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50AAA (57aaa) *8	AAABBB=MEMORY ADDRESS																																										

PROCEDURE	REMARKS
50BBB (57bbb) Y=0=DECIMAL;Y=1=OCTAL 5+/-YFF (5-/+yff) +/-FF=SCALE FACTOR +D D=NUMBER OF DATA COMMANDS REQUIRED * NOTES APPEAR FOLLOW- ING DAS LISTING	
52005 (55772) <u>MON ACQ SS PRI X/Y</u>	
52006 (55771) <u>MON ACQ SS SEC X/Y</u>	
52007 (55770) <u>CMPTR SWITCHOVER ARM</u>	
<u>C O N F I G U R A T I O N</u>	
52010 (55767) +1 <u>INHIBIT</u> 50000 (57777) CMG CONTROL 50001 (57776) TACS CNTL CAPABILITY 50002 (57775) CMG AUTO RESET 50003 (57774) AUTO GG DUMP 50004 (57773) STAR TRACK CONTROL 50005 (57772) RANDOM REACQUISITION 50006 (57771) S055/HA DOOR AUTO CONTROL 50007 (57770) FSS DOOR AUTO CONTROL 50010 (57767) SOFTWARE SWITCHOVER 50011 (57766) STAR TRACK ORBITAL PLANE ERROR UPDATE	
52011 (55766) +1 <u>ENABLE</u> (SEE INHIBIT)	
52012 (55765) +1 <u>SELECT SYSTEM</u> 50000 (57777) STAR ACHERNAR (A) 50002 (57776) STAR CANOPUS (C) 50001 (57775) STAR ALPHA CRUX (X) 50003 (57774) SR/SS CMP 50004 (57773) SR/SS SUN 50005 (57772) INITIALIZE STRAPDOWN 50006 (57771) DOCKED 50007 (57770) UNDOCKED 50010 (57767) SELECT FLIGHT OPERATIONS	
52013 (55764) +1 <u>CMG RM</u>	
<u>VOLTAGE REF SOURCE</u> 50010 (57767) 4.8 KHZ 1; RM INHIBIT 50020 (57757) 4.8 KHZ 2; RM INHIBIT 50030 (57747) RM ENABLE	

PROCEDURE			REMARKS
1		<u>CMG_1_SELECT</u>	
2	50012 (57765)	CNTL ENABLE; RM ENA	
3	50014 (57763)	CNTL INHIBIT; RM INH	
4	50016 (57761)	CNTL ENABLE; RM INH	
5		<u>CMG_2_SELECT</u>	
6	50022 (57755)	CNTL ENABLE; RM ENA	
7	50024 (57753)	CNTL INHIBIT; RM INH	
8	50026 (57751)	CNTL ENABLE; RM INH	
9		<u>CMG_3_SELECT</u>	
10	50032 (57745)	CNTL ENABLE; RM ENA	
11	50034 (57743)	CNTL INHIBIT; RM INH	
12	50036 (57741)	CNTL ENABLE; RM INH	
13			
14	52014 (55763) +1	<u>ACQ_SS_RM</u>	
15			
16		<u>X_AXIS_SELECT</u>	
17	50001 (57776)	PRI & SEC; RM ENABLE	
18	50002 (57775)	PRI; RM ENABLE	
19	50003 (57774)	SEC; RM ENABLE	
20		<u>Y_AXIS_SELECT</u>	
21	50004 (57773)	PRI & SEC; RM ENABLE	
22	50005 (57772)	PRI; RM ENABLE	
23	50006 (57771)	SEC; RM ENABLE	
24		<u>SUN_PRESENT_SELECT</u>	
25	50007 (57770)	PRI & SEC; RM ENABLE	
26	50010 (57767)	PRI; RM INHIBIT	
27	50011 (57766)	SEC; RM INHIBIT	
28		<u>INHIBIT_RM</u>	
29	50012 (57765)	X AXIS	
30	50013 (57764)	Y AXIS	
31			
32	52015 (55762) +1	<u>RATE_GYRO_RM</u>	
33			
34		<u>X_AXIS_SELECT</u>	
35	50010 (57767)	RM INHIBIT	
36	50011 (57766)	1 & 2, 3 BACKUP;	
37		RM ENABLE	
38	50012 (57765)	1 & 2; RM ENABLE	
39	50013 (57764)	1 & 3; RM ENABLE	
40	50014 (57763)	2 & 3; RM ENABLE	
41	50015 (57762)	1; RM ENABLE	
42	50016 (57761)	2; RM ENABLE	
43	50017 (57760)	3; RM ENABLE	
44		<u>Y_AXIS_SELECT</u>	
45	50020 (57757)	RM INHIBIT	
46	50021 (57756)	1 & 2, 3 BACKUP;	
47		RM ENABLE	
48	50022 (57755)	1 & 2; RM ENABLE	
49	50023 (57754)	1 & 3; RM ENABLE	
50	50024 (57753)	2 & 3; RM ENABLE	

PROCEDURE			REMARKS
1	50025 (57752)	1; RM ENABLE	
2	50026 (57751)	2; RM ENABLE	
3	50027 (57750)	3; RM ENABLE	
4		<u>Z AXIS SELECT</u>	
5	50030 (57747)	RM INHIBIT	
6	50031 (57746)	1 & 2, 3 BACKUP;	
7		RM ENABLE	
8	50032 (57745)	1 & 2; RM ENABLE	
9	50033 (57744)	1 & 3; RM ENABLE	
10	50034 (57743)	2 & 3; RM ENABLE	
11	50035 (57742)	1; RM ENABLE	
12	50036 (57741)	2; RM ENABLE	
13	50037 (57740)	3; RM ENABLE	
14			
15	52016 (57761) +1	<u>APCS MODE SELECT</u>	
16	50000 (57777)	STBY	
17	50001 (57776)	EXP PTG	
18	50002 (57775)	SOLAR INERTIAL	
19	50003 (57774)	Z-LV	
20	50004 (57773)	ATT HOLD CMG	
21	50005 (57772)	ATT HOLD TACS	
22			
23	52017 (55760) +9	<u>INITIALIZE DELAYED</u>	
24		<u>Z-LV</u>	
25	50BBB (57bbb)	B=GMT TO ENTER	
26	50BBB (57bbb)	Z-LV MODE (1 SEC)	
27	50BBB (57bbb)		
28	50EEE (57eee)	E=GMT TO ENTER	
29	50EEE (57eee)	SI MODE (1 SEC)	
30	50EEE (57eee)		
31	5+/-XXX (5-/ +xxx)	XL AXIS BIAS (1 DEG)	
32	5+/-YYY (5-/ +yyy)	YL AXIS BIAS (1 DEG)	
33	5+/-ZZZ (5-/ +zzz)	ZL AXIS BIAS (1 DEG)	
34			
35	<u>F U N C T I O N</u>		
36			
37	52020 (55757) +3	<u>COARSE MNVR</u>	
38	5+/-XXX (5-/ +xxx)	X AXIS (1 DEG)	
39	5+/-YYY (5-/ +yyy)	Y AXIS (1 DEG)	
40	5+/-ZZZ (5-/ +zzz)	Z AXIS (1 DEG)	
41			
42	52021 (55756) +3	<u>FINE MNVR</u>	
43	5+/-XXX (5-/ +xxx)	X AXIS (0.1 DEG)	
44	5+/-YYY (5-/ +yyy)	Y AXIS (0.1 DEG)	
45	5+/-ZZZ (5-/ +zzz)	Z AXIS (0.1 DEG)	
46			
47	52022 (55755) +3	<u>CMG CAGE & HOLD</u>	
48	5+/-XXX (5-/ +xxx)	X MOMENTUM (1% OF 3H)	
49	5+/-YYY (5-/ +yyy)	Y MOMENTUM (1% OF 3H)	
50	5+/-ZZZ (5-/ +zzz)	Z MOMENTUM (1% OF 3H)	

PROCEDURE	REMARKS
1 2 52023 (55754) <u>CMG NOMINAL CAGE</u>	
3 4 52024 (55753) +3 <u>CMG MOMENTUM BIAS</u> 5 5+/-XXX (5-/ +xxx) X AXIS (1% OF 3H) 6 5+/-YYY (5-/ +yyy) Y AXIS (1% OF 3H) 7 5+/-ZZZ (5-/ +zzz) Z AXIS (1% OF 3H) 8	
9 52025 (55752) +4 <u>FSS WEDGE DRIVE</u> 10 5+/-ORR (5-/ +7rr) RRRR = RIGHT/LEFT 11 5ORR0 (57rr7) (1 ARC SEC) 12 5+/-OUU (5-/ +7uu) UUUU = UP/DOWN 13 5OUU0 (57uu7) (1 ARC SEC) 14	
15 52026 (55751) <u>CMPTR SWITCHOVER</u> 16 <u>EXECUTE</u> 17	
18 52027 (55750) +2 <u>STAR TRACK OG BACKUP</u> 19 5+/-DDD (5-/ +ddd) DDDDD= MAGNITUDE OF 20 50DD0 (57dd7) OG (1 ARC MIN) 21	
22 <u>P A R A M E T E R _ _ _ U P D A T E</u>	
23 24 52030 (55747) +1 <u>MANEUVER TIME</u> 25 500TT (577tt) DELTA TIME (1 MIN) 26	
27 52031 (55746) +1 <u>DELTA ORB PLANE ERROR</u> 28 5+/-DDD (5-/ +ddd) (0.1 DEG) 29	
30 52032 (55745) +1 <u>GG DUMP 1/2 ANGLE</u> 31 50DDD (57ddd) (1 DEG) 32	
33 52033 (55744) +2 <u>TIMER A: B</u> 34 50TOC (57t7c) T=TIMER:1=A,2=B,3=A&B 35 5+/-0DD (5-/ +7dd) C=SEGMENT:0=SEC/64; 36 1=SEC; 2=MIN;3=HR; 37 4=DAY.DD=MAGNITUDE: 38 0=SEC/64;1=SEC; 39 2=MIN;3=HR;4=DAY. 40	
41 52034 (55743) +1 <u>TACS PULSE WIDTH</u> 42 500DD (577dd) FIRING TIME (10 MSEC) 43	
44 52035 (55742) +1 <u>TACS THRUST</u> 45 50DDD (57ddd) FORCE (1 NEWTON) 46	
47 52036 (55741) +2 <u>RG DRIFT COMPENSATION</u> 48 500GG (577gg) GG=GYRO:01=1X;02=2X; 49 5+/-0DD (5-/ +7dd) 03=3X;04=1Y;05=2Y; 50 06=3Y;07=1Z;10=2Z;	

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	11=3Z. DD=DRIFT COMP (DEG/SEC) 52037 (55740) +22 <u>NAVIGATION</u> 5AAAA (5aaaa) A=ORBITAL ASCENDING 50AA0 (57aa7) NODE 5BBBB (5bbbbb) B=ASCENDING NODE 50BB0 (57bb7) PERIOD 5CCCC (5cccc) C=ORBITAL 50CC0 (57cc7) INCLINATION 5DDDD (5dddd) D=RATIO EARTH TO 50DD0 (57dd7) ORBITAL RADIUS 5EEEE (5eeee) E=CHANGE TO PREVIOUS 50EE0 (57ee7) ORBITAL MIDNIGHT 5FFFF (5ffff) F=ORBITAL RATE 50FF0 (57ff7) 5GGGG (5gggg) G=MEAN ANOMALY 50GG0 (57gg7) 5HHHH (5hhhh) H=PAST MIDNIGHT 50HH0 (57hh7) VALUE OF ETA-Y 5IIII (5iiii) I=EARTH REF LONG 50II0 (57ii7) OF ORB ASC NODE 5JJJJ (5jjjj) J=FIRST ORDER SECULAR 50JJ0 (57jj7) NODAL REGRESSION 5KKKK (5kkkk) K=CHANGE TO INTERVAL 50KK0 (57kk7) BETWEEN SUCCESSIVE MIDNIGHTS <u>A T M D C O P E R A T I O N S</u> 52040 (55737) <u>TERMINATE</u> 52041 (55736) <u>CMPTR BACKUP ENTER</u> 52042 (55735) <u>INITIALIZE MEMORY</u> <u>LOAD</u> 52043 (55734) +V <u>MEMORY LOAD</u> 50AAA (57aaa) AAABBB=MEMORY LOC. 50BBB (57bbb) (LOAD SEQUENTIAL) 50XXX (57xxx) X=FIRST 16 BIT MEMORY WORD 50ZZZ (57zzz) Z=LAST 16 BIT MEMORY WORD 52044 (55733) <u>MEMORY LOAD COMPLETE</u> 52045 (55732) <u>PROGRAM IMPLEMENT</u> 52046 (55731) +2 <u>MEMORY DUMP</u>

PROCEDURE	REMARKS
5RRSS (5rrss) R=REPETITION;S=START 50EEE (57eee) BLOCK;E=END BLOCK 52047 (55730) <u>SEL_TROUBLESHOOT_MODE</u> DISPLAY NOTES *1 52003; 50000 *2 52003; 50001 C/W CONDITION DISPLAY ALERT CONDITION DISPLAY A B C D COUNTER DISPLAY A B C D COUNTER DISPLAY A = MOST RECENT A = MOST RECENT B = NEXT MOST RECENT B = NEXT MOST RECENT C = NEXT MOST RECENT C = NEXT MOST RECENT D = NEXT MOST RECENT D = NEXT MOST RECENT CODE/CONDITION: 0 = NO C/W 0 = NO ALERT #1 = THRUSTER STUCK (TEST) 1 = RATE GYRO (1ST) 2 = HI RATE (0.35 DEG/SEC) 2 = ACQ SS (1ST) #3 = SELF TEST (COMPUTER) 3 = RATE GYRO SCALE 4 = CMG SATURATION SWITCHING 5 = RATE GYRO (2ND OR 3RD) 4 = STAR TRACK NOT ACQUIRED #6 = TACS ONLY CONTROL 5 = MANEUVER TIME #7 = ACQ SS (2ND) INSUFFICIENT 6 = COMPUTER RESTART 7 = CMG FAILURE 8 = CMG REF VOLTAGE (TEST) 9 = CMG AUTO RESET #CONDITION RESET BY DISPLAY COMMAND ALL CONDITIONS RESET BY DISPLAY COMMAND *3 52003; 50011 *4 52003; 50012 STATUS WORD 1 DISPLAY STATUS WORD 2 DISPLAY A B C D 1133 NOMINAL A B C D 0777 NOMINAL E F - - 1100 DISPLAY E F - - 0000 DISPLAY CODE/STATUS: A = CMG CONTROL A = STRAPDOWN CONTROL 0 - INHIBIT 0 - PRIME SELECT 1 - ENABLE 1 - BACKUP SELECT B = TACS CONTROL B = X AXIS RATE GYROS 0 - INHIBIT USED FOR CONTROL	

PROCEDURE	REMARKS
1 - ENABLE 0 - NO STRAPDOWN UPDATE 1 - PRI USED 2 - SEC USED 3 - PRI & SEC USED D = ACQ SS Y AXIS 0 - NO STRAPDOWN UPDATE 1 - PRI USED 2 - SEC USED 3 - PRI & SEC USED E = SELF TEST X-OVER 0 - INHIBIT-16K PROGRAM 1 - ENABLE-16K PROGRAM 4 - INHIBIT-8K PROGRAM 5 - ENABLE-8K PROGRAM F = STAR TRACK CONTROL 0 - INHIBIT 1 - ENABLE *5 52003; 50013 STATUS WORD 3 DISPLAY A B C D 0002 NOMINAL E F - - 3100 DISPLAY CODE/STATUS: A = TROUBLE SHOOTING MODE 0 - NOT IN PROGRESS 1 - IN PROGRESS	0 - NO CONTROL 1 - #1 2 - #2 3 - #1 & #2 4 - #3 5 - #1 & #3 6 - #2 & #3 7 - #1 & #2, #3 BACKUP C = Y AXIS RATE GYROS USED FOR CONTROL (SEE B) D = Z AXIS RATE GYROS USED FOR CONTROL (SEE B) E = RATE INTEGRAL TEST FAILURE 0 - NO FAILURES 1 - Z AXIS 2 - Y AXIS 3 - Y & Z AXES 4 - X AXIS 5 - X & Z AXES 6 - X & Y AXES 7 - X, Y & Z AXES F = RATE GYRO CONTROL AXIS INDICATION 0 - ALL AXES CONTROL 1 - NO X CONTROL 2 - NO Y CONTROL 3 - NO X & Y CONTROL 4 - NO Z CONTROL 5 - NO X & Z CONTROL 6 - NO Y & Z CONTROL 7 - NO X, Y & Z CONTROL *6 52003; 50014 STATUS WORD 4 DISPLAY A B C D 0100 NOMINAL E F - - XX00 DISPLAY CODE/STATUS: A = INTERRUPT FAILURE (CODE CHANGES STATE FOR EACH FAILURE)

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PROCEDURE	REMARKS
1 STATUS WORD 5 DISPLAY 50BBB; 5+/-YFF 2 ATMDC MEMORY DISPLAY 3 A B C D XOx1 NOMINAL 4 E F - - 0000 DISPLAY <u>OCTAL</u> FORMAT 1 5 6 CODE/STATUS: CODE = ACCUMULATOR BITS 7 8 A = MOMENTUM SAMPLES COUNTER 1: 9 USED FOR GG DUMP S 1,2,3 4,5,6 7,8,9 10 X - 0 OR 1 11 0 - FOUR SAMPLES COUNTERS 2 & 3: 12 1 - SINGLE SAMPLE 10,11,12 13,14,14 - - 13 14 B = SPARE <u>OCTAL</u> FORMAT 2 15 16 C = STAR SELECTED COUNTER 1 = 3 17 X - 0, 1 OR 2 COUNTER 2 = 1 18 0 - ACHERNAR COUNTER 3 = NO CHANGE 19 1 - CANOPUS 20 2 - ALPHA CRUX <u>DECIMAL</u> FORMAT 1 21 22 D = STAR TRACKER UPDATE OF COUNTER 1 23 ORBITAL PLANE ERROR +/- D D D D 24 0 - INHIBIT TB INTEGER 25 1 - ENABLE 26 COUNTERS 2 & 3: 27 E = ACQ SS X & Y AXES TEST D D D D 28 0 - NORMAL FRACTION 29 1 - X AXIS DISCOMPARE 30 2 - Y AXIS DISCOMPARE <u>DECIMAL</u> FORMAT 2 31 3 - X & Y AXES 32 DISCOMPARE COUNTER 1 = FRACTION 33 COUNTER 2 = TB & INTEGER 34 F = SPARE COUNTER 3 = FRACTION 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	

PROCEDURE	REMARKS
1 <u>MOMENTUM BIASING</u> 2 3 At GMT __:__:__, 4 130 DAS: 5 Key - 52024E (CMG Momentum Bias) 6 5+/-XXxE (CMG MOM BIAS Pad, 7 5+/-YYyE 1% of 3H increments, 8 5+/-ZZZE must be in octal) 9 10 11 12 <u>INHIBIT/ENABLE GG MOMENTUM DUMP</u> 13 14 At GMT __:__:__, 15 ATTITUDE CONTROL SYSTEM: 16 MOMENTUM DUMP AUTO GG sw - INHIBIT; 17 tb - bp 18 At GMT __:__:__, 19 ATTITUDE CONTROL SYSTEM: 20 MOMENTUM DUMP AUTO GG sw - ENABLE; 21 tb - gray 22 23 24 25 <u>SPECIFIED H - CMG CAGING</u> 26 27 ATTITUDE CONTROL SYSTEM: 28 TACS sw (6) - ENABLE (verify) 29 30 At GMT __:__:__, 31 DAS: 32 Key - 52022E (CMG Cage & Hold) 33 5+/-XXxE (CMG CAGING Pad, 34 5+/-YYyE 1% of 3H increments, 35 5+/-ZZZE must be in octal) 36 37 ATTITUDE CONTROL SYSTEM: 38 MOMENTUM DUMP CAGE tb - CGE 39 40 MONITOR: 41 ACS sel - HX, HY, HZ/HT; ind = XX% 42 Monitor momentum values to those commanded 43 44 ATTITUDE CONTROL SYSTEM: 45 MOMENTUM DUMP CAGE sw - RELEASE; 46 tb - gray 47 48 49 50	20.02.02-00 MOMENT BIAS October 16, 1972 Momentum bias time, and the momentum bias values in percent, will be available from The CMG MOM BIAS pad 20.02.01-00 INH/EN DUMP October 16, 1972 GMT for inhibiting and enabling the auto GG dump will appear on the DETAIL PAD. Inhibit and enable automatic GG momentum dump maneuvers prior to subject momentum dump initiation 20.02.05-00 SPECIFIED H October 16, 1972 GMT and data available from CMG CAGING Pad When momentum values reach those commanded, CMGs may be released

PROCEDURE	REMARKS
1234567891011121314151617181920212223242526272829303132333435363738394041424344454647484950 <u>ZERO H - CMG CAGING</u> 130 ATTITUDE CONTROL SYSTEM: TACS sw (6) - ENABLE (verify) MOMENTUM DUMP CAGE sw - ZERO H; tb - CGE MONITOR: ACS sel - HX, HY, HZ/HT; ind = 0% ATTITUDE CONTROL SYSTEM: MOMENTUM DUMP CAGE sw - RELEASE; tb - gray <u>NOMINAL H - CMG CAGING</u> ATTITUDE CONTROL SYSTEM: TACS sw (6) - ENABLE (verify) DAS: Key - 52023E (CMG Nominal Cage) ATTITUDE CONTROL SYSTEM: MOMENTUM DUMP CAGE tb - CGE MONITOR ACS sel - HX, HY, HZ/HT; ind = XX% * If MODE EXP PTG tb - STY: * * * * ATTITUDE CONTROL SYSTEM: * * MOMENTUM DUMP CAGE sw - RELEASE;* * tb - gray * <u>REMOVING SI OFFSETS</u> ATTITUDE CONTROL SYSTEM: MODE sw - SOLAR INERTIAL or EXP PTG; tb - SI or EXP MONITOR: COUNTER 1 sel - ØX; ind = 000.0 deg COUNTER 2 sel - ØY; ind = 000.0 deg	20.02.04-00 ZERO H CAGE October 16, 1972 When momentum values reach zero, CMGs may be released 20.02.03-00 NOM H CAGE October 16, 1972 20.01.05-00 REMOVE SI O October 16, 1972 Offsets are removed when attitude displays are zero for each axis

PROCEDURE	REMARKS
CMPTR/SUN TIMING 130 ATTITUDE CONTROL SYSTEM: SR/SS sw - CMP or SUN (as approp); tb - CMP or SUN STANDBY ATTITUDE CONTROL SYSTEM: MODE EXP PTG sw - STBY; tb - STY CMG/TACS ATT HOLD ATTITUDE CONTROL SYSTEM: MODE ATT HOLD sw - CMG or TACS; tb - CMG or TACS (as approp) SI TO EXP PTG ATTITUDE CONTROL SYSTEM: MODE EXP PTG sw - EXP PTG; tb - EXP EXP PTG TO SI ATTITUDE CONTROL SYSTEM: MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI	20.03.06-00 CMP/SUN TIM October 16, 1972 CMP during the day phase of the orbit indicates ORBIT PHASE TIME REMAINING/DIGITAL ADDRESS ind counts down to effective sunset or dump commencement (if dump is enabled) whichever occurs first. During the night phase of the orbit, it counts down to effective sunrise or dump end (if dump enabled) whichever occurs last. SUN indicates ORBIT PHASE TIME REMAINING/DIGITAL ADDRESS ind counts down to true sunrise and sunset in the exact manner described above. 20.03.04-00 APCS STBY November 1, 1972 All ATMDc control commands to the CMGs or TACS will be ramped to zero 20.03.01-00 ATT HOLD October 16, 1972 The vehicle will maintain attitude stability under the control of the ATMDc. CMG means control commands issued only to the CMGs. TACS means control commands issued only to the TACS 20.03.02-00 SI TO EXP October 16, 1972 20.03.03-00 EXP TO SI October 16, 1972

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 <u>ROLL POSITIONING OF CANISTER</u> <u>EPC ROLL AXIS SELECTION</u> Perform one of the following steps to select the EPC roll axis: A <u>FSS</u> MANUAL POINTING CONTROL: MAN PTG tb - bp (verify) ATTITUDE CONTROL SYSTEM: FSS BIAS IN sw - OUT B <u>XUV SLIT</u> MANUAL POINTING CONTROL: MAN PTG tb - bp (verify) ATTITUDE CONTROL SYSTEM: FSS BIAS IN sw - IN FSS BIAS XUV SLIT sw - XUV SLIT C <u>SCAN SPECT</u> MANUAL POINTING CONTROL: MAN PTB tb - bp (verify) ATTITUDE CONTROL SYSTEM: FSS BIAS IN sw - IN FSS BIAS XUV SLIT sw - SCAN SPECT D <u>ZV</u> MANUAL POINTING CONTROL: MAN PTG ENABLE sw - ENABLE; tb - EXP Note: When the roll positioning of ATM canister is completed, MAN PTG ENABLE sw - INHIBIT; tb - bp	20.01.11-00 ROLL EXP October 16, 1972 FSS line-of-sight Roll Axis XUV SLIT line-of-sight Roll Axis SCAN SPECT line-of-sight Roll Axis ZV Roll Axis

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>ROLL POSITIONING</u> 130 MONITOR: COUNTER 1 sel - ROLL EXP (ARC MIN) MANUAL POINTING CONTROL: ROLL ENABLE sw - ENABLE ROLL GAIN sw - as desired ROLL HIGH RATE sw and/or LOW RATE sw - CW or CCW to desired position observing TV monitors ROLL ENABLE sw - INHIBIT	X2 position enables canister roll rate commands of 7.0 and 0.7 deg/sec, X1 position enables canister roll rate commands of 3.5 and 0.35 deg/sec ROLL ENABLE sw should be in- hibited to prevent inadvertent canister movement

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>EREP CALIBRATION MNVR</u> 130 ATTITUDE CONTROL SYSTEM: MOMENTUM DUMP AUTO GG sw - INHIBIT; tb - bp At GMT __:__:__, (MANEUVER PAD) ATTITUDE CONTROL SYSTEM: MODE ATT HOLD sw - CMG; tb - CMG DAS: Key - 52030E (Maneuver Time) 500TTE (MANEUVER PAD, minutes, must be in octal) At GMT __:__:__, (MANEUVER PAD) DAS: Key - 52021E (Fine Mnvr) 5+/-XXxE (MANEUVER PAD, 5+/-YYyE 0.1 deg increments, must 5+/-ZZzE be in octal) MONITOR: Monitor Attitude and Rate Information End of Maneuver MONITOR: COUNTER 1, 2, 3 sel - $\dot{\theta}Z$, $\dot{\theta}X$, $\dot{\theta}Y$; ind - .0000 DAS: Key - 52030E (Maneuver Time) 500TTE (MANEUVER PAD, minutes, must be in octal) At GMT __:__:__, (MANEUVER PAD) DAS: Key - 52021E (Fine Mnvr) 50000E (MANEUVER PAD, 51YYyE 0.1 deg increment, must be 50000E in octal)	20.01.15-00 EREP CAL MN October 16, 1972 Calibration of the Earth Resources Experiment Package instruments requires two attitude maneuvers, the second one a -.045 deg/sec rate maneuver Maneuver to initial position for calibration data acquisition 10 degree pitch maneuver for data acquisition

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 MONITOR: COUNTER 1, 2 sel - $\dot{\theta}_Z, \dot{\theta}_X$; ind = .0000 (deg/sec) COUNTER 3 sel - $\dot{\theta}_Y$; ind = -.0450 (deg/sec, verify) EREP Moon Scan Calibration End of Maneuver EREP Deep Space Calibration DAS: Key - 52030E (Maneuver Time) 500TTE (MANEUVER PAD, minutes, must be in octal) At GMT __:__:__, (MANEUVER PAD) ATTITUDE CONTROL SYSTEM: MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI MONITOR: Monitor Attitude and Rate Information End of Maneuver MONITOR: COUNTER 1, 2, 3 sel - $\dot{\theta}_X, \dot{\theta}_Y, \dot{\theta}_Z$; ind - 000.0 ATTITUDE CONTROL SYSTEM: MOMENTUM DUMP AUTO GG sw - ENABLE; tb - gray	

PROCEDURE	REMARKS
1 <u>MANUAL ATMDC SWITCHOVER</u> 2 3 130 ATTITUDE CONTROL SYSTEM: 4 MODE SOLAR INERTIAL sw - SOLAR INERTIAL; 5 tb - SI 6 7 Perform APCS STATUS CHECK pg. ----- 8 9 MONITOR: 10 COUNTER 1, 2, 3 sel - $\dot{\theta}X, \dot{\theta}Y, \dot{\theta}Z$; 11 ind - 000.1 (verify) 12 13 COUNTER 1, 2, 3 sel - $\ddot{\theta}Z, \ddot{\theta}X, \ddot{\theta}Y$; 14 ind - .0001 (verify) 15 COUNTER 3 sel - EXP ROLL (note value) 16 17 ORBIT PHASE: 18 TIME REMAINING/DIGITAL ADDRESS tb - note 19 TIME REMAINING/DIGITAL ADDRESS ind - MM:SS 20 [Perform Manual ATMDC 21 switchover on minute mark 22 (SS=00) for ease in deter- 23 mining time lag during 24 switchover] 25 26 ATTITUDE CONTROL SYSTEM: 27 CMPTR sw - PRIM or SEC; (as required) 28 tb - PRI or SEC (as approp) 29 30 ORBIT PHASE: 31 TIME REMAINING/DIGITAL ADDRESS tb - DAY or 32 NT (as 33 noted) 34 TIME REMAINING/DIGITAL ADDRESS ind - MM:SS 35 [SS=time lag if manual 36 switchover was performed on 37 minute mark] 38 39 Perform APCS STATUS CHECK pg. ----- 40 41 MONITOR: 42 COUNTER 1, 2, 3 sel - $\dot{\theta}X, \dot{\theta}Y, \dot{\theta}Z$; 43 ind - (decreasing) 44 45 COUNTER 1, 2, 3 sel - $\ddot{\theta}Z, \ddot{\theta}X, \ddot{\theta}Y$; 46 ind - (decreasing) 47 COUNTER 3 sel - EXP ROLL (note value) 48 49 <u>NOTE:</u> Verify with STDN that ATMDC is 50 operating properly	20.03.10-00 MAN CMP S/O October 16, 1972 Verify vehicle attitude and rates are stable Switchover requires .5 to 2 seconds The Transfer Register (TR) of ini- tialization data transferred to the backup computer will be 17 to 34 seconds behind time Verify vehicle attitude and rates are stable

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PROCEDURE	REMARKS
130 DAS: Key - 52003E (Status Word 1) 50011E - verify COUNTER 1 ind - 1111 COUNTER 2 ind - 6000 52003E (Status Word 2) 50012E - verify COUNTER 1 ind - 0XXX COUNTER 2 ind - 0000 52003E (Status Word 3) 50013E - verify COUNTER 1 ind - 0000 COUNTER 2 ind - 0100 52003E (Status Word 4) 50014E - verify COUNTER 1 ind - 0100 COUNTER 2 ind - XX00 52003E (Status Word 5) 50015E - verify COUNTER 1 ind - X000 COUNTER 2 ind - 0000	Status Word 1: 1 - CMG Control Enable 1 - TACS Control Enable 1 - ACQ SS Select, #1 1 - ACQ SS Select, #1 6 - ATMDC Power-On, 8K Program, EREP Mnvr 0 - ZLV Mode, Inhibit Status Word 2: 0 - Spare X - X Axis Rate Gyros used for Control X - Y Axis Rate Gyros used for Control X - Z Axis Rate Gyros used for Control 0 - Spare 0 - Spare Status Word 3: 0 - Spare 0 - DAS Commands Normal 0 - No Computer Memory Load Activity 0 - Buffer Capability - Sufficient 0 - Spare 1 - ACS Control Gains Docked Status Word 4: 0 - Spare 1 - Auto Entry CMG Rest Enable 0 - Spare 0 - Spare XX - TACS Pulse Width in .01 Sec (Displayed in Octal). Status Word 5: X - A Single or Four Momentum Sample(s) Used for GG Dump 0 - Spare 0 - Spare 0 - Spare 0 - Spare 0 - Spare

PROCEDURE	REMARKS
1 <u>STAR ACQUISITION</u> 2 3 4 5 6 7 8 9 10 130 ATTITUDE CONTROL SYSTEM: 11 MODE tb - SI or EXP (as appropriate) 12 EPC 800 HZ sw - PRIMARY (verify) 13 EPEA sw - PRIM (verify) 14 15 MONITOR: 16 COUNTER 1, 2, 3 sel - $\theta X, \theta Y, \theta Z$; 17 ind $\leq$ 001.0 (verify) 18 COUNTER 1 sel - STAR TCK INNER GIMBAL; 19 ind - XXXX. (ARC MIN) 20 COUNTER 2 sel - STAR TCK OUTER GIMBAL; 21 ind - XXXX. (ARC MIN) 22 23 ATTITUDE CONTROL SYSTEM: 24 STAR TRACK POWER sw - ON (verify) 25 STAR TRACK ACQ sw - MAN; tb - MAN 26 27 MANUAL POINTING CONTROL: 28 MAN PTG ENABLE sw - ENABLE, tb - STR 29 MPC - Manipulate Gimbals to IG____, OG____ 30 (STAR TRACKER Pad). 31 32 ATTITUDE CONTROL SYSTEM: 33 STAR TRACK ACQ sw - AUTO; tb - AUT 34 STAR TRACK SHUTTER tb - OPN 35 36 MANUAL POINTING CONTROL: 37 MAN PTG tb - bp or EXP 38 39 * If Star Tracker search greater than * 40 * 25 secs, repoint Star Tracker * 41 42 ATTITUDE CONTROL SYSTEM: 43 STAR TRACK SHUTTER tb - STR (may req 25 sec) 44 45 MANUAL POINTING CONTROL: 46 MAN PTG ENABLE sw - INHIBIT; tb - bp 47 48 49 50	20.04.02-00 STAR ACQ 8 October 16, 1972 The Star Tracker is used as a reference for the experiment roll angle and the calculation of the orbital plane error. This procedure is used to acquire the reference star with the Star Tracker. The Star Tracker Pad is teleprinted up approximately twice a day as needed. Star Tracker failure to acquire When star is acquired.

PROCEDURE	REMARKS
1 130 MONITOR: 2 COUNTER 2 sel - STAR TCK OUTER GIMBAL; 3 ind - XXXX 4 5 Voice OUTER GIMBAL to STDN for Verification 6 7 Star Tracker OG Backup Update 8 9 10 DAS: 11 Key - 52027E Star Track OG Backup 12 5+/-DDDE (DETAIL PAD, 1 arc min in- 13 50DD0E crements, must be in octal) 14 15 16 17 <u>SI/EXP OFFSET POINTING</u> 18 19 20 21 22 23 24 25 26 27 ATTITUDE CONTROL SYSTEM: 28 MODE sw - SOLAR INERTIAL or EXP PTG; 29 tb - SI or EXP 30 31 MONITOR: 32 COUNTER 1 sel - 0X; ind - XXX.X (deg) 33 COUNTER 2 sel - 0Y; ind - XXX.X (deg) 34 35 DAS: 36 Key - 52021E (Fine Mnvr) 37 5+/-XXXE (MANEUVER PAD or S020 Crewman) 38 5+/-YYE (0.1 deg increments, must be 39 50000E in octal). 40 41 42 MONITOR: 43 Monitor 0X, 0Y (verify proper offset). 44 Repeat as required. 45 46 Note: To remove offsets, ATTITUDE CONTROL 47 SYSTEM MODE sw - SOLAR INERTIAL or 48 EXP PTG; tb - SI or EXP 49 50	Magnitude of OG will appear on the DETAIL PAD. 20.04.03-00 SI OFFSET 8 October 16, 1972 Solar Inertial Offset Pointing is used to accurately align experiment S020 (X-Ray/UV Solar Photography) to the solar disc. If performed during a gravity gradient dump, offset pointing commands will take effect during last dumping maneuver. Fine Mnvr increments will be sent up on a teleprinter pad, or voiced up from the ground or from the S020 Crewman who will be directing the attitude pointing from the +Z Scientific Airlock.

PROCEDURE	REMARKS
1 <u>MNVR TO AND FROM ZLV</u> 2 3 Perform APCS STATUS CHECK 4 5 130 DAS: 6 Key - 52017E (Initialized Delayed ZLV) 7 50AAAE (MANEUVER PAD; Time from past 8 50BBBE orbital midnight for maneuver 9 50CCCE starts and stops; Rates about 10 50DDDE each axis for each maneuver; 11 EREP or RNDZ Maneuver and CMG 12 or TACS control) 13 5+/-EEEE 14 5+/-FFFE 15 5+/-GGGE 16 5+/-HHHE 17 5+/-IIIE 18 5+/-JJJE 19 50ROKE 20 21 22 23 24 25 26 27 At GMT __:__:__, (MANEUVER PAD) 28 Start of Mnvr to ZLV 29 ATTITUDE CONTROL SYSTEM: 30 MODE SOLAR INERTIAL tb - ZLV 31 STAR TRACK ACQ sw - AUTO; tb - AUT 32 STAR TRACK SHUTTER tb - STR 33 34 MONITOR: 35 Monitor Rate Information 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	20.04.04-00 MN TO ZLV 8 October 16, 1972 AAA = Time to start mnvr to ZLV (16 sec) BBB = Time to end mnvr to ZLV (16 sec) CCC = Time to start mnvr to SI (16 sec) DDD = Time to end mnvr to SI (16 sec) EEE = X-Axis Rate, mnvr to ZLV (.0005 deg/sec) FFF = Y-Axis Rate, mnvr to ZLV (.0005 deg/sec) GGG = Z-Axis Rate, mnvr to ZLV (.0005 deg/sec) HHH = X-Axis Rate, mnvr to SI (.0005 deg/sec) III = Y-Axis Rate, mnvr to SI (.0005 deg/sec) JJJ = Z-Axis Rate, mnvr to SI (.0005 deg/sec) R = ZLV Rendezvous Select Code; 0 = EREP Mnvr, 1 = RNDZ Mnvr K = CMG or TACS Control Select; 0 = TACS, 1 = CMG

PROCEDURE	REMARKS
<pre> 1 * If Repointing Star Tracker is Required * 2 * During Mnvr to ZLV: (Note: Track * 3 * Ref. Star until loss of Star or until * 4 * 5 minutes before acquiring Z-LV Star) * 5 * * 6 130 * ATTITUDE CONTROL SYSTEM: * 7 * STAR TRACK ACQ sw - MAN: tb - MAN * 8 * * 9 * MONITOR: * 10 * COUNTER 1 sel - STAR TCK INNER GIMBAL; * 11 * ind - XXXX. (ARC MIN) * 12 * COUNTER 2 sel - STAR TCK OUTER GIMBAL; * 13 * ind - XXXX. (ARC MIN) * 14 * * 15 * MANUAL POINTING CONTROL: * 16 * MAN PTG ENABLE sw - ENABLE; tb - STR * 17 * MPC - Manipulate Gimbals to IG____, * 18 * OG____ (MANEUVER PAD). * 19 * * 20 * ATTITUDE CONTROL SYSTEM: * 21 * STAR TRACK SHUTTER sw - CLOSE; tb - bp * 22 * 23 End of Mnvr 24 25 MONITOR: 26 Monitor Attitude and Rate Information. 27 COUNTER 1, 2, 3 sel - $\dot{\theta}X$, $\dot{\theta}Y$, $\dot{\theta}Z$; ind = 000.0 28 29 COUNTER 1, 2, 3 sel - $\ddot{\theta}Z$, $\ddot{\theta}X$, $\ddot{\theta}Y$; 30 ind - .0000, .0000, .0645 31 32 * If Star Tracker was Repointed During Mnvr* 33 * to ZLV: * 34 * * 35 * At GMT __:__:__, (MANEUVER PAD) * 36 * ATTITUDE CONTROL SYSTEM: * 37 * STAR TRACK ACQ sw - AUTO; tb - AUT * 38 * STAR TRACK SHUTTER tb - OPN or STR * 39 * MANUAL POINTING CONTROL: * 40 * MAN PTG tb - bp * 41 * * 42 * MANUAL POINTING CONTROL: * 43 * MAN PTG ENABLE sw - INHIBIT; tb - bp * 44 * 45 At GMT __:__:__, (MANEUVER PAD) 46 Start of Mnvr to SI 47 48 49 50 </pre>	<pre> The Star Tracker gibal positions will appear on the MANEUVER PAD. The Star Tracker time to begin search will appear on the MANEUVER PAD. </pre>

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 MONITOR: Monitor Attitude and Rate Information * If Repointing Star Tracker Was Required * * During Mhvr to ZLV: * * * * ATTITUDE CONTROL SYSTEM: * * STAR TRACK ACQ sw - MAN; tb - MAN * * * * MONITOR: * * COUNTER 1 sel - STAR TCK INNER GIMBAL; * * ind - XXXX. (ARC MIN) * * COUNTER 2 sel - STAR TCK OUTER GIMBAL; * * ind - XXXX. (ARC MIN) * * * * MANUAL POINTING CONTROL: * * MAN PTG ENABLE sw - ENABLE; tb - STR * * MPC - Manipulate Gimbals to IG____, * * OG____ (STAR TRACKER Pad). * * * * ATTITUDE CONTROL SYSTEM: * * STAR TRACK SHUTTER sw - CLOSE; tb - bp * * * At GMT __:__:__, (MANEUVER PAD) ATTITUDE CONTROL SYSTEM: MODE SOLAR INERTIAL tb - SI (verify) End of Mhvr MONITOR: Monitor Attitude and Rate Information. COUNTER 1, 2, 3 sel - $\dot{\theta}X$, $\dot{\theta}Y$, $\dot{\theta}Z$; ind = 000.0 COUNTER 1, 2, 3 sel - $\ddot{\theta}Z$, $\ddot{\theta}X$, $\ddot{\theta}Y$; ind = .0000	The Star Tracker gimbal positions for the reference star appear on the STAR TRACKER Pad.

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 * If Star Tracker was Repointed During Mnvr * * From ZLV: * * * * ATTITUDE CONTROL SYSTEM: * * STAR TRACK ACQ sw - AUTO; tb - AUT or bp* * * * * MANUAL POINTING CONTROL: * * MAN PTG tb - bp or EXP * * MAN PTG ENABLE sw - INHIBIT; tb - bp * * * * If SI/EXP OFFSET Required: * * DAS: * * Key - 52021E (Fine Mnvr) * * 5+/-XXxE (MANEUVER PAD) * * 5+/-YYE (0.1 deg increments, * * 50000E must be in octal) * * * * MONITOR: * * Monitor Attitude Information * * COUNTER 1, 2, 3 sel - $\emptyset$X, $\emptyset$Y, $\emptyset$Z; * * ind - required offset * Repeat Fine Mnvr as required.	If Star Tracker does not begin to search, the star is in a period of earth occultation or vehicle obscuration.

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 <u>MNVR TO ARBITRARY ATTITUDE</u> For Maneuver Less Than 20 Deg. At GMT __:__:__, (MANEUVER PAD) ATTITUDE CONTROL SYSTEM: MODE ATT HOLD sw - CMG; tb - CMG MONITOR: ACS sel - HX, HY, HZ/HT; ind - (note values relative to selected mnvr). COUNTER 1, 2, 3 sel - $\emptyset$X, $\emptyset$Y, $\emptyset$Z; ind - (note attitude). DAS: Key - 52021E (Fine Mnvr) 5+/-XXxE (MANEUVER PAD) 5+/-YYyE (0.1 deg increments, 5+/-ZZzE must be in octal). MONITOR: Monitor Attitude and Rate Information. Repeat as required. At GMT __:__:__, (MANEUVER PAD) ATTITUDE CONTROL SYSTEM: MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI MONITOR: Monitor Attitude and Rate Information. COUNTER 1, 2, 3 sel - $\emptyset$X, $\emptyset$Y, $\emptyset$Z; ind - decrease to 000.0	20.04.05-00 MN TO ARB 8 October 16, 1972 Maneuver start and return times will appear on the MANEUVER PAD.

PROCEDURE	REMARKS
<pre> 1 130 DAS: 2 Key - 52017E (Initialized Delayed ZLV) 3 50AAAE (MANEUVER PAD: Time from 4 past orbital midnight for 5 50BBBE maneuver starts and stops; 6 Rates about each axis for 7 each maneuver; EREP or 8 RNDZ maneuver and CMG or 9 TACS control) 10 50CCCE Set the 50CCC term to 670. 11 12 50000E 13 14 5+/-EEEE 15 16 5+/-FFFE 17 18 5+/-GGGE 19 20 50000E 21 22 50000E 23 50000E 24 50ROKE 25 26 27 28 29 30 31 32 33 34 35 At GMT __:__:__, (MANEUVER PAD) 36 Start of Mnvr to ARBITRARY ATTITUDE 37 38 ATTITUDE CONTROL SYSTEM: 39 MODE SOLAR INERTIAL tb - ZLV 40 41 MONITOR: 42 Monitor Rate Information 43 44 At GMT __:__:__, (MANEUVER PAD) 45 ATTITUDE CONTROL SYSTEM: 46 MODE ATT HOLD tb - CMG 47 48 End of Mnvr. 49 50 </pre>	<pre> AAA = Time to start mnvr to ZLV (16 sec) BBB = Time to end mnvr to ZLV (16 sec) CCC = Time to start mnvr to SI (16 sec) EEE = X-Axis Rate, mnvr to ZLV (.0005 deg/sec) FFF = Y-Axis Rate, mnvr to ZLV (.0005 deg/sec) GGG = Z-Axis Rate, mnvr to ZLV (.0005 deg/sec) R = ZLV Rendezvous Select Codes; 0 = EREP Mnvr, 1 = RNDZ Mnvr K = CMG or TACS Control Select; 0 = TACS, 1 = CMG Setting the CCC" term to a value greater than 7000.0 seconds will abort the ZLV Maneuver and initiate the Attitude Hold CMG Mode. An Arbitrary Attitude Maneuver using Delayed ZLV will initialize the strapdown upon completion of the maneuver. This type of maneuver is a rate command maneu- ver and not an attitude error maneuver. </pre>

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PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 8K ATMDC DAS COMMAND LISTING FUNCTION AND DATA CODES TRUE (ALT) DEFINITION ----- D I S P L A Y 52003 (55774) +1 50000 (57777) *1 50002 (57775) 50003 (57774) 50005 (57772) 50006 (57771) 50007 (57770) 50011 (57766) *2 50012 (57765) *3 50013 (57764) *4 50014 (57763) *5 50015 (57762) *6 52004 (55773) +3 50AAA (57aaa) *7 50BBB (57bbb) 5+/-YFF (5-/+yff) +D * 52005 (55772) 52006 (55771) CMPTR DATA C/W CONDITIONS ATT ERR (XXX.X DEG) SI OFFSET (XXX.X DEG) X RGS ALL (.XXXX DEG/SEC) Y RGS ALL (.XXXX DEG/SEC) Z RGS ALL (.XXXX DEG/SEC) STATUS WORD 1 STATUS WORD 2 STATUS WORD 3 STATUS WORD 4 STATUS WORD 5 SINGLE MEMORY LOC AAABBB=MEMORY ADDRESS Y=0=DECIMAL; Y=1=OCTAL +/-FF=SCALE FACTOR D=NUMBER OF DATA COMMANDS REQUIRED NOTES APPEAR FOLLOW- ING DAS LISTING MON_ACO_SS_PRI_X/Y MON_ACO_SS_SEC_X/Y	20.04.08-00 CMP DAS L 8 October 16, 1972 PRELIMINARY ATMDC SOFTWARE DEFINITION ALL CODES OCTAL SIGN + = 0: - = 1

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>C O N F I G U R A T I O N</u> 52010 (55767) +1 <u>INHIBIT</u> 50000 (57777) CMG CONTROL 50001 (57776) TACS CNTL CAPABILITY 50002 (57775) CMG AUTO RESET 50003 (57774) AUTO GG DUMP 52011 (55766) +1 <u>ENABLE</u> (SEE INHIBIT) 52012 (55765) +1 <u>SELECT SYSTEM</u> 50005 (57772) INITIALIZE STRAPDOWN 50006 (57771) DOCKED 50007 (57770) UNDOCKED 52014 (55763) +1 <u>BACK-UP RATE GYRO</u> <u>SELECT</u> (MUST BE PRECEDED BY RATE GYRO/ACQ SS SELECT) 50XYZ (57xyz) X,Y, AND Z = RATE GYRO SELECT: 0=NO SELECT 1=RG1, 2=RG2, 3=RG3 52015 (55762) +1 <u>RATE GYRO/ACQ SS</u> <u>SELECT</u> (MUST BE FOLLOWED BY BACKUP RATE GYRO SELECT) 5AXYZ (5axyz) A = ACQ SS SELECT: 0=#2, 1=#1 X,Y,AND Z = RATE GYRO SELECT: 0=NO SELECT, 1=RG1, 2=RG2, 3=RG3 52016 (57761) +1 <u>APCS MODE SELECT</u> 50000 (57777) STBY 50001 (57776) EXP PTG 50002 (57775) SOLAR INERTIAL 50004 (57773) ATT HOLD CMG	

PROCEDURE	REMARKS
1 52017 (55760) +11 <u>INITIALIZE DELAYED</u> 2 <u>Z-LV</u> 3 50AAA (57aaa) AAA = TIME TO START 4 MNVR TO ZLV (16 SEC) 5 50BBB (57bbb) BBB = TIME TO END 6 MNVR TO ZLV (16 SEC) 7 50CCC (57ccc) CCC = TIME TO START 8 MNVR TO SI (16 SEC) 9 50DDD (57ddd) DDD = TIME TO END 10 MNVR TO SI (16 SEC) 11 5+/-EEE (5-/+eee) EEE=X AXIS RATE, MNVR 12 TO ZLV (.0005 DEG/SEC) 13 5+/-FFF (5-/+fff) FFF=Y AXIS RATE, MNVR 14 TO ZLV (.0005 DEG/SEC) 15 5+/-GGG (5-/+ggg) GGG=Z AXIS RATE, MNVR 16 TO ZLV (.0005 DEG/SEC) 17 5+/-HHH (5-/+hhh) HHH=X AXIS RATE, MNVR 18 TO SI (.0005 DEG/SEC) 19 5+/-III (5-/+iii) III=Y AXIS RATE, MNVR 20 TO SI (.0005 DEG/SEC) 21 5+/-JJJ (5-/+jjj) JJJ=Z AXIS RATE, MNVR 22 TO SI (.0005 DEG/SEC) 23 50R0K (57R7K) R=ZLV RNDZ SELECT 24 CODE; 0=EREP MNVR, 25 1=RNDZ MNVR 26 K=CONTROL SELECT CODE; 27 0=TACS, 1=CMG	
28 <u>F U N C T I O N</u>	
29 52021 (55756) +3 <u>FINE MNVR</u> 30 5+/-XXX (5-/+xxx) X AXIS (0.1 DEG) 31 5+/-YYY (5-/+yyy) Y AXIS (0.1 DEG) 32 5+/-ZZZ (5-/+zzz) Z AXIS (0.1 DEG)	
33 52023 (55754) <u>CMG NOMINAL CAGE</u>	
34 52024 (55753) +3 <u>CMG MOMENTUM BIAS</u> 35 5+/-XXX (5-/+xxx) X AXIS (1% OF 3H) 36 5+/-YYY (5-/+yyy) Y AXIS (1% OF 3H) 37 5+/-ZZZ (5-/+zzz) Z AXIS (1% OF 3H)	
38 52027 (55750) +2 <u>STAR TRACK OG BACKUP</u> 39 5+/-DDD (5-/+ddd) DDDDD= MAGNITUDE OF 40 50DD0 (57dd7) OG (1 ARC MIN)	
41 52034 (55743) +1 <u>TACS PULSE WIDTH</u> 42 500DD (577dd) FIRING TIME (10 MSEC)	

PROCEDURE	REMARKS
1 52037 (55740) +6 <u>NAVIGATION</u> 2 5+/-AAA (5-/+aaa) A=CHANGE TO PREVIOUS 3 ORBITAL MIDNIGHT 4 5+/-BBB (5-/+bbb) B=CHANGE TO INTERVAL 5 BETWEEN SUCCESSIVE 6 MIDNIGHTS 7 5+/-CCC (5-/+ccc) C=CHANGE TO SWS 8 ORBITAL RATE 9 5+/-DDD (5-/+ddd) D=SOLAR ELEVATION 10 FROM ORBITAL PLANE 11 5+/-EEE (5-/+eee) E=STAR TRACKER OUTER 12 GIMBAL ANGLE 13 5+/-FFF (5-/+fff) F=ANGLE BETWEEN XEPC 14 AND SOLAR NORTH 15 16 <u>A T M D C O P E R A T I O N S</u> 17 18 52040 (55737) <u>TERMINATE</u> 19 20 52041 (55736) <u>CMPTR BACKUP ENTER</u> 21 22 52042 (55735) <u>INITIALIZE MEMORY</u> 23 <u>LOAD</u> 24 25 52043 (55734) +V <u>MEMORY LOAD</u> 26 50AAA (57aaa) AAABBB=MEMORY LOC. 27 50BBB (57bbb) (LOAD SEQUENTIAL) 28 50XXX (57xxx) X=FIRST 16 BIT 29 50XXX (57xxx) MEMORY WORD 30 50ZZZ (57zzz) Z=LAST 16 BIT 31 50ZZZ (57zzz) MEMORY WORD 32 33 52044 (55733) <u>MEMORY LOAD COMPLETE</u> 34 35 52045 (55732) <u>PROGRAM IMPLEMENT</u> 36 37 52046 (55731) <u>MEMORY DUMP</u> 38 39 57777 (50000) <u>CMPTR ALL ONES</u> 40 41 42 43 44 45 46 47 48 49 50	

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PROCEDURE	REMARKS
<u>DISPLAY NOTES</u> *1 52003; 50000 C/W CONDITION DISPLAY A B C D COUNTER DISPLAY A = MOST RECENT B = NEXT MOST RECENT C = NEXT MOST RECENT D = NEXT MOST RECENT CODE/CONDITION: 0 = NO C/W #1 = EXCESS TACS FUEL USE 2 = HI RATE (0.35 DEG/SEC) #5 = RATE GYRO #6 = TACS ONLY CONTROL #CONDITION RESET BY DISPLAY COMMAND *3 52003; 50012 STATUS WORD 2 DISPLAY A B C D 0XXX NOMINAL E F - - 0000 DISPLAY	*2 52003; 50011 STATUS WORD 1 DISPLAY A B C D 1111 NOMINAL E F - - 6000 DISPLAY CODE/STATUS: A = CMG CONTROL 0 - INHIBIT 1 - ENABLE B = TACS CONTROL 0 - INHIBIT 1 - ENABLE C = ACQ SS SELECTED 0 - NO ACQ SS 1 - ACQ SS 1 2 - ACQ SS 2 D = ACQ SS SELECTED 0 - NO ACQ SS 1 - ACQ SS 1 2 - ACQ SS 2 E = ATMDC STATUS 6 - POWER ON-8K PROGRAM ZLV MNVR INHIBIT EREP MNVR F = ZLV MODE CONTROL 0 - INHIBIT 2 - ACTIVE- TACS CONTROL 6 - ACTIVE- CMG CONTROL *4 52003; 50013 STATUS WORD 3 DISPLAY A B C D 0000 NOMINAL E F - - 0100 DISPLAY

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 CODE/STATUS: A = SPARE B = X AXIS RATE GYROS USED FOR CONTROL X - 0,1,2,3,4,5, OR 6 0 - NO CONTROL 1 - #1 2 - #2 3 - #1 & #2 4 - #3 5 - #1 & #3 6 - #2 & #3 C = Y AXIS RATE GYROS USED FOR CONTROL (SEE B) D = Z AXIS RATE GYROS USED FOR CONTROL (SEE B) E = SPARE F = SPARE *5 52003; 50014 STATUS WORD 4 DISPLAY A B C D 0100 NOMINAL E F - - XX00 DISPLAY	CODE/STATUS: A = SPARE B = COMPUTER COMMANDS 0 - NORMAL 1 - FUNCTION/DATA EXPECTED 2 - UNDEFINED FUNCTION CODE 4 - DATA/FUNCTION EXPECTED C = COMPUTER MEMORY LOAD 0 - NO LOAD ACTIVITY 2 - LOAD IN PROGRESS 4 - WAITING TO BE IMPLEMENTED D = BUFFER CAPABILITY 0 - SUFFICIENT 1 - INSUFFICIENT E = SPARE F = ACS CONTROL GAINS 0 - UNDOCKED 1 - DOCKED *6 52003; 50015 STATUS WORD 5 DISPLAY A B C D X000 NOMINAL E F - - 0000 DISPLAY

PROCEDURE	REMARKS
1 CODE/STATUS: 2 3 A = SPARE 4 5 B = AUTO ENTRY CMG RESET 6 0 - INHIBIT 7 1 - ENABLE 8 9 C = SPARE 10 11 D = SPARE 12 13 E&F= TACS PULSE WIDTH 14 (DISPLAYED IN OCTAL, 15 SCALE = 10MS) 16 04 - MINIMUM VALUE 17 OF 40 MS 18 50 - MAXIMUM VALUE 19 OF 400 MS 20 21 *7 52004; 50AAA; 22 50BBB; 5+/-YFF 23 ATMDC MEMORY DISPLAY 24 25 <u>OCTAL</u> FORMAT 26 27 CODE = ACCUMULATOR BITS 28 29 COUNTER 1: 30 S 1,2,3 4,5,6 7,8,9 31 32 COUNTERS 2 & 3: 33 10,11,12 13,14,15 - - 34 35 <u>DECIMAL</u> FORMAT 36 37 COUNTER 1: 38 39 +/- D D D D 40 TB INTEGER 41 42 COUNTERS 2 & 3: 43 44 D D D D 45 FRACTION 46 47 48 49 50	

PROCEDURE	REMARKS
130 <u>MOMENTUM_BIASING</u> At GMT __:__:__, (CMG MOM BIAS Pad) DAS: Key - 52024E CMG Momentum Bias 5+/-XXXE X AXIS (1% OF 3H) 5+/-YYYE Y AXIS (1% OF 3H) 5+/-ZZZE Z AXIS (1% OF 3H) <u>INHIBIT/ENABLE_GG_MOMENTUM_DUMP</u> At GMT __:__:__, (DETAIL PAD) ATTITUDE CONTROL SYSTEM: MOMENTUM DUMP AUTO GG sw - INHIBIT; tb - bp At GMT __:__:__, (DETAIL PAD) ATTITUDE CONTROL SYSTEM: MOMENTUM DUMP AUTO GG sw - ENABLE; tb - gray <u>SPECIFIED_H-CMG_CAGING</u> <u>SET_KZC_TO_ZERO</u> ATTITUDE CONTROL SYSTEM: TACS sw (6) - ENABLE (verify) DAS: Key - 52004E Single Memory Loc. 50000E of the KZC Term. 50254E 50001E MONITOR: COUNTER 1 sel - DAS; ind - 0001. (verify) COUNTER 2 sel - DAS; ind - .0000 (verify) DAS: Key - 52042E INITIALIZE MEMORY LOAD Key - 52043E MEMORY LOAD 50000E Change value of 50254E KZC to 0.0 50000E 50000E	20.04.09-00 MOM BIAS 8 October 16, 1972 Momentum bias time, and the momentum bias values in percent, will be available from the CMG MOM BIAS Pad. 20.04.10-00 INH/ENB DU 8 October 16, 1972 GMT for inhibiting and enabling the auto GG dump will appear on the DETAIL PAD. Inhibit and enable automatic GG momentum dump maneuvers prior to subject momentum dump initiation. 20.04.11-00 SPECIF H 8 October 16, 1972

PROCEDURE	REMARKS
1 130 DAS: 2 Key - 52044E MEMORY LOAD COMPLETE 3 Key - 52045E PROGRAM IMPLEMENT 4 Key - 52045E PROGRAM IMPLEMENT 5 6 7 MONITOR: 8 COUNTER 1 sel - DAS; ind - 0000. (verify) 9 COUNTER 2 sel - DAS; ind - .0000 (verify) 10 11 <u>LOAD/COMMAND SPECIFIED_H</u> 12 13 DAS: 14 Key - 52024E CMG MOMENTUM BIAS 15 5+/-XXxE X AXIS (1% of 3H) 16 5+/-YYE Y AXIS (1% of 3H) 17 5+/-ZZE Z AXIS (1% of 3H) 18 19 Key - 52023E CMG NOMINAL CAGE 20 21 ATTITUDE CONTROL SYSTEM: 22 MOMENTUM DUMP CAGE tb - CGE 23 24 MONITOR: 25 ACS sel - HX, HY, HZ/HT; ind - XX% 26 Monitor momentum values to those commanded. 27 Monitor Rate Information 28 29 <u>RECONFIGURE_KZC/MOMENTUM_BIASES</u> 30 31 DAS: 32 Key - 52042E INITIALIZE MEMORY LOAD 33 34 Key - 52043E MEMORY LOAD 35 50000E Change Value of 36 50254E KZC to 1.0 37 50100E 38 50000E 39 40 Key - 52044E MEMORY LOAD COMPLETE 41 42 Key - 52045E PROGRAM IMPLEMENT 43 44 Key - 52045E PROGRAM IMPLEMENT 45 46 Key - 52004E SINGLE MEMORY LOC 47 50000E of the KZC Term. 48 50254E 49 50001E 50	

PROCEDURE	REMARKS
1 130 MONITOR: 2 COUNTER 1 sel - DAS; ind - 0001. (verify) 3 COUNTER 2 sel - DAS; ind - .0000 (verify) 4 5 DAS: 6 Key - 52024E CMG MOMENTUM BIAS 7 50000E X AXIS (Set Momentum 8 50000E Y AXIS Biases Equal to 9 50000E Z AXIS 0.0) 10 11 12 13 <u>ZERO H - CMG CAGING</u> 14 15 ATTITUDE CONTROL SYSTEM: 16 TACS sw (6) - ENABLE (verify) 17 MOMENTUM DUMP CAGE sw - ZERO H; tb - CGE 18 19 MONITOR: 20 ACS sel - HX, HY, HZ/HT; ind - 0% 21 22 23 ATTITUDE CONTROL SYSTEM: 24 MOMENTUM DUMP CAGE sw - RELEASE; tb - gray 25 26 27 28 <u>NOMINAL H - CMG CAGING</u> 29 30 ATTITUDE CONTROL SYSTEM: 31 TACS sw (6) - ENABLE (verify) 32 33 DAS: 34 Key - 52023E (CMG Nominal Cage) 35 36 ATTITUDE CONTROL SYSTEM: 37 MOMENTUM DUMP CAGE tb - CGE 38 39 MONITOR: 40 ACS sel - HX, HY, HZ/HT; ind - XX% 41 42 ATTITUDE CONTROL SYSTEM: 43 MOMENTUM DUMP CAGE tb - gray 44 45 * If MODE EXP PTG tb - STY: * 46 * * 47 * ATTITUDE CONTROL SYSTEM: * 48 * MOMENTUM DUMP CAGE sw - RELEASE; tb - gray* 49 50	20.04.12-00 ZERO-H-CA 8 October 16, 1972 When momentum values reach zero, CMGs may be released. 20.04.13-00 NOM H-CA 8 October 16, 1972

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 <u>REMOVING SI OFFSETS</u> ATTITUDE CONTROL SYSTEM: MODE sw - SOLAR INERTIAL or EXP PTG; tb - SI or EXP MONITOR: COUNTER 1 sel - $\emptyset$X; ind - 000.0 deg COUNTER 2 sel - $\emptyset$Y; ind - 000.0 deg <u>STANDBY</u> ATTITUDE CONTROL SYSTEM: MODE EXP PTG sw - STBY; tb - STY <u>CMG ATT HOLD</u> ATTITUDE CONTROL SYSTEM: MODE ATT HOLD sw - CMG; tb - CMG <u>SI TO EXP PTG</u> ATTITUDE CONTROL SYSTEM: MODE EXP PTG sw - EXP PTG; tb - EXP <u>EXP PTG TO SI</u> ATTITUDE CONTROL SYSTEM: MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI <u>ROLL POSITIONING OF CANISTER</u> 1 <u>EPC ROLL AXIS SELECTION</u> Perform one of the following steps to select the EPC roll axis:	20.04.14-00 REM SI O 8 October 16, 1972 Offsets are removed when attitude display is zero for each axis. 20.04.15-00 APCS STBY 8 October 16, 1972 All ATMDC control commands to the CMGs or TACS will be ramped to zero. 20.04.16-00 ATT HOLD 8 October 16, 1972 The vehicle will maintain attitude sta- bility under the control of the ATMDC, control commands issued only to the CMGs. 20.04.17-00 SI TO EXP 8 October 16, 1972 20.04.18-00 EXP TO SI 8 October 16, 1972 20.04.19-00 ROLL EXP 8 October 16, 1972

PROCEDURE	REMARKS
130 A <u>FSS</u> MANUAL POINTING CONTROL: MAN PTG tb - bp (verify) ATTITUDE CONTROL SYSTEM: FSS BIAS IN sw - OUT B <u>XUV SLIT</u> MANUAL POINTING CONTROL: MAN PTG tb - bp (verify) ATTITUDE CONTROL SYSTEM: FSS BIAS IN sw - IN FSS BIAS XUV SLIT sw - XUV SLIT C <u>SCAN SPECT</u> MANUAL POINTING CONTROL: MAN PTG tb - bp (verify) ATTITUDE CONTROL SYSTEM: FSS BIAS IN sw - IN FSS BIAS XUV SLIT sw - SCAN SPECT D <u>ZV</u> MANUAL POINTING CONTROL: MAN PTG ENABLE sw - ENABLE; tb - EXP (When the roll positioning of ATM canister is completed: MAN PTG ENABLE sw - INHIBIT; tb - bp) 2 <u>ROLL POSITIONING</u> MONITOR: COUNTER 1 sel - ROLL EXP; ind - XXXX (ARC MIN) MANUAL POINTING CONTROL: ROLL ENABLE sw - ENABLE ROLL GAIN sw - as desired ROLL HIGH RATE sw and/or ROLL LOW RATE sw - CW or CCW to desired position observing TV monitors ROLL ENABLE sw - INHIBIT	FSS line-of-sight Roll Axis XUV SLIT line-of-sight Roll Axis SCAN SPECT line-of-sight Roll Axis ZV Roll Axis X2 position enables canister roll rate commands of 7.0 and 0.7 deg/sec. X1 position enables canister roll rate commands of 3.5 and 0.35 deg/sec. ROLL ENABLE sw should be inhibited to prevent inadvertent canister movement.

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PROCEDURE	REMARKS
130 ATTITUDE CONTROL SYSTEM: MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI DAS: Key - 52003E (CMPTR Data) 50012E (Status Word 2) MONITOR: COUNTER 1 sel - DAS; ind - 0XYZ COUNTER 2 sel - DAS; ind - 0000 Insert the rate gyro nominal configuration (XYZ) into the Status Word 2 nominal configuration in the STATUS CHECK Checklist. <u>EREP CALIBRATION MNVR</u> At GMT __:__:__, (MANEUVER PAD) ATTITUDE CONTROL SYSTEM: MODE ATT HOLD sw - CMG; tb - CMG At GMT __:__:__, (MANEUVER PAD) DAS: Key - 52021E (Fine Mnvr) 5+/-XXE (MANEUVER PAD, 5+/-YYYE 0.1 deg increments 5+/-ZZE must be in octal) MONITOR: Monitor Attitude and Rate Information End of Maneuver MONITOR: COUNTER 1, 2, 3 sel - $\dot{\theta}Z, \dot{\theta}X, \dot{\theta}Y$; ind - .0000 At GMT __:__:__, (MANEUVER PAD) DAS: Key - 52021E (Fine Mnvr) 50000E (MANEUVER PAD, 50YYYE 0.1 deg increments 50000E must be in octal)	8K program self-initializes in Att hold CMG mode. 20.04.21-00 EREP CAL M8 October 16, 1972 Calibration of the Earth Resources Experiment Package instruments requires two attitude maneuvers, the second one a .045 deg/sec rate maneuver. Maneuver to initial position for calibration data acquisition. 20 degree pitch maneuver for data acquisition.

PROCEDURE	REMARKS
1 130 MONITOR: 2 COUNTER 1, 2 sel - $\dot{\theta}Z, \dot{\theta}X$; ind = .0000 (deg/sec) 3 4 COUNTER 3 sel - $\dot{\theta}Y$; ind - .0450 (deg/sec, verify) 5 6 EREP Moon Scan Calibration 7 8 End of Maneuver 9 10 EREP Deep Space Calibration 11 12 At GMT __:__:__, (MANEUVER PAD) 13 ATTITUDE CONTROL SYSTEM: 14 MODE SOLAR INERTIAL sw - SOLAR INERTIAL; 15 tb - SI 16 17 MONITOR: 18 Monitor Attitude and Rate Information 19 20 End of Maneuver 21 22 MONITOR: 23 COUNTER 1, 2, 3 sel - $\dot{\theta}X, \dot{\theta}Y, \dot{\theta}Z$; ind = 000.0 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	

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PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>HA1 CHECKOUT</u> <u>FILM CAMERA</u> 130 H-ALPHA: HA1 NIGHT INTLK sw - OVERRIDE (if req'd) HA1 AUTO sw - AUTO; OPR lt on HA1 FRAMES REMAINING ind - decreases by one frame HA1 AUTO sw - OFF; READY lt on HA1 NIGHT INTLK sw - NORMAL <u>RETICLE CONTROL</u> TV: HA RETICLE sw - HA1 HARC - L then R MON 1 (or 2): Vertical line moves left and right TV: HARC - UP then DN MON 1 (or 2): Horizontal line moves up and down TV: HA RETICLE sw - OFF <u>HA1 OFFSET FROM FSS</u> MON 1 (or 2): View HA1 solar image TV: HA1 ZOOM sw - OUT full MONITOR: COUNTER 1 sel - ROLL EXP	

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PROCEDURE	REMARKS
1 130 MANUAL POINTING CONTROL: 2 MAN PTG ENABLE sw - ENABLE; tb - EXP 3 MPC - UP/IG as required to position hori- 4 zontal reticle line tangential to 5 upper limb of HA1 solar image on 6 MON 1 (or 2) 7 8 MONITOR: 9 COUNTER 2 ind = +0960 +/- XX 10 COUNTER 3 ind = 0000 11 12 13 ATTITUDE CONTROL SYSTEM: 14 FSS BIAS MARK sw - MARK 15 16 MONITOR: 17 COUNTER 1 ind = 0002 18 19 MANUAL POINTING CONTROL: 20 MPC - DN/IG as required to position hori- 21 zontal reticle line tangential to 22 lower limb of HA1 solar image on 23 MON 1 (or 2) 24 25 MONITOR: 26 COUNTER 2 ind = -0960 +/- XX 27 COUNTER 3 ind = 0000 28 29 ATTITUDE CONTROL SYSTEM: 30 FSS BIAS MARK sw - MARK 31 32 MONITOR: 33 COUNTER 1 ind = 0003 34 35 MANUAL POINTING CONTROL: 36 MPC - UP/IG and L/OG as required to make 37 COUNTER 2 read zero and to position 38 vertical reticle line tangential to 39 left limb of HA1 solar image on 40 MON 1 (or 2) 41 42 MONITOR: 43 COUNTER 2 ind = 0000 44 COUNTER 3 ind = -0960 +/- XX 45 46 ATTITUDE CONTROL SYSTEM: 47 FSS BIAS MARK sw - MARK 48 49 50	Indicates angular offset of upper limb from datum (FSS sun center). XX limits will include FSS/HA1 alignment error. Enters upper limb angular offset data into ATMDC. ATMDC ready for DN (lower limb) data point. Indicates angular offset to lower limb from datum (FSS sun center). Enters lower limb angular offset data into ATMDC. ATMDC ready for L (left limb) data point. Indicates angular offset of left limb from datum (FSS sun center). Enters left limb angular offset data into ATMDC.

PROCEDURE	REMARKS
1 130 MONITOR: 2 COUNTER 1 ind = 0004 3 4 MANUAL POINTING CONTROL: 5 MPC - R/OG as required to position verti- 6 cal reticle line tangential to right 7 limb of HA1 solar image on MON 1 8 (or 2) 9 MAN PTG ENABLE sw - INHIBIT; tb - bp 10 11 MONITOR: 12 COUNTER 2 ind = 0000 13 COUNTER 3 ind = +0960 +/- XX 14 15 ATTITUDE CONTROL SYSTEM: 16 FSS BIAS MARK sw - MARK 17 18 MONITOR: 19 COUNTER 1 ind = 0001 20 21 <u>READOUT OF BIAS OFFSET ANGLES</u> 22 23 Refer to page ____ and perform this 24 procedure 25 26 ----- 27 28 <u>HA2 POWER UP</u> 29 30 H-ALPHA: 31 HA2 HEATER sw - PRIM (verify) 32 33 34 35 HA2 DOOR sw - OPEN; tb - white then gray 36 37 TV: 38 HA2 PWR sw - ON 39 MON 1 (or 2) sel - HA2 40 HA2 ZOOM sw - IN full 41 42 43 44 45 46 47 48 49 50	ATMDC ready for R (right limb) data point. Angular offset of right limb from datum (FSS sun center). Enters right limb angular offset data into ATMDC. ATMDC calculates bias angles. Optical filter must be stabilized at preset temperature - 2 hours required.

PROCEDURE	REMARKS
1 <u>HA2_CHECKOUT</u> 2 3 <u>RETICLE_CONTROL</u> 4 5 130 TV: 6 HA RETICLE sw - HA2 7 HARC - L then R 8 9 10 11 12 MON 1 (or 2): 13 Vertical line moves left and right 14 15 TV: 16 HARC - UP then DN 17 18 MON 1 (or 2): 19 Horizontal line moves up and down 20 21 TV: 22 HA RETICLE sw - OFF 23 24 <u>HA2_OFFSET_FROM_FSS</u> 25 26 MON 1 (or 2): 27 View HA2 solar image and center if 28 required 29 30 TV: 31 HA2 ZOOM sw - OUT full 32 HA RETICLE sw - HA2 33 HARC - R (L), as necessary to align reticle 34 with 12 - 6 o'clock fiducial marks 35 HARC - UP (DN), as necessary, to align 36 reticle with 3 - 9 o'clock fiducial 37 marks 38 HA RETICLE sw - OFF 39 HA2 ZOOM sw - IN full 40 41 42 ATTITUDE CONTROL SYSTEM: 43 FSS BIAS sw's (4) - HA, HA2, OUT, CLEAR 44 STAR TRACK ACQ tb - AUT or bp (verify) 45 46 MONITOR: 47 COUNTER 1 sel - FSS CAL; ind = 0001 48 COUNTER 2 sel - FSS UP/DN; ind = 0000 49 COUNTER 3 sel - FSS L/R; ind = 0000 50	Note 1: The reticles may be moved through +/- 3 1/2 arc minutes, at 5 arc sec/sec. The HARC should be released as soon as the line ceases to move. Note 2: Fixed fiducial marks at the edge of the field can be seen on the monitor in the zoom-out position. These marks are positioned at the reticle zero positions and at 45 degrees to these around the field. Centers reticles on telescope axis. Enlarges picture scale to increase accuracy of positioning reticles at solar limb. ATMDC ready for up (upper limb) data point. Zeros indicate FSS sun centered with FSS BIAS IN sw - OUT.

PROCEDURE	REMARKS
1 NOTE: To prematurely terminate this pro- 2 cedure, place the FSS BIAS MARK sw - 3 CLEAR and repeat the procedure if 4 desired 5 6 130 MANUAL POINTING CONTROL: 7 MAN PTG ENABLE sw - ENABLE; tb - EXP 8 MPC - UP/IG as required to position 9 horizontal reticle line tangential 10 to upper limb of HA2 solar image 11 on MON 1 (or 2) 12 13 MONITOR: 14 COUNTER 2 ind = +0960 +/- XX 15 COUNTER 3 ind = 0000 16 17 ATTITUDE CONTROL SYSTEM: 18 FSS BIAS MARK sw - MARK 19 20 MONITOR: 21 COUNTER 1 ind = 0002 22 23 MANUAL POINTING CONTROL: 24 MPC - DN/IG as required to position 25 horizontal reticle line tangential 26 to lower limb of HA2 solar image on 27 MON 1 (or 2) 28 29 MONITOR: 30 COUNTER 2 ind = -0960 +/- XX 31 COUNTER 3 ind = 0000 32 33 ATTITUDE CONTROL SYSTEM: 34 FSS BIAS MARK sw - MARK 35 36 MONITOR: 37 COUNTER 1 ind = 0003 38 39 MANUAL POINTING CONTROL: 40 MPC - UP/IG and L/OG as required to make 41 COUNTER 2 read zero and to position 42 vertical reticle line tangential to 43 left limb of HA2 solar image on 44 MON 1 (or 2) 45 46 47 48 49 50	Indicates angular offset of upper limb from datum (FSS sun center) XX limits will include FSS/HA2 alignment error Enters upper limb angular offset data into ATMDC ATMDC ready for DN (lower limb) data point. Indicates angular offset of lower limb from datum (FSS sun center) Enters lower limb angular offset data into ATMDC. ATMDC ready for L (left limb) data point

PROCEDURE	REMARKS
1 130 MONITOR: 2 COUNTER 2 ind = 0000 3 COUNTER 3 ind = -0960 +/- XX 4 5 ATTITUDE CONTROL SYSTEM: 6 FSS BIAS MARK sw - MARK 7 8 MONITOR: 9 COUNTER 1 ind = 0004 10 11 MANUAL POINTING CONTROL: 12 MPC - R/OG as required to position 13 vertical reticle line tangential 14 to right limb of HA2 solar image 15 on MON 1 (or 2) 16 17 MONITOR: 18 COUNTER 2 ind = 0000 19 COUNTER 3 ind = +0960 +/- XX 20 21 ATTITUDE CONTROL SYSTEM: 22 FSS BIAS MARK sw - MARK 23 24 MONITOR: 25 COUNTER 1 ind = 0001 26 27 MANUAL POINTING CONTROL: 28 MPC - Manipulate as required to center 29 solar disc on MON 2 30 MAN PTG ENABLE sw - INHIBIT; tb - bp 31 32 <u>READOUT OF BIAS OFFSET ANGLES</u> 33 34 Refer to page ____ and perform this 35 procedure 36 37 ----- 38 39 <u>WLC POWER UP</u> 40 41 WLC: 42 MAIN PWR sw - STBY (verify) 43 44 45 THERMAL sw - ON (verify) 46 FRAMES REMAINING ind - 8025 (verify) 47 48 49 50	Indicates angular offset of left limb from datum (FSS sun center) Enters left limb angular offset data into ATMD C ATMD C ready for R (right limb) data point Indicates angular offset of right limb from datum (FSS sun center). Enters right limb angular offset data into ATMD C. ATMD C calculates bias angles. Applies power to experiment temperature monitor circuits only

PROCEDURE	REMARKS
130 MONITOR: COUNTER 1 sel - ROLL EXP; ind = 0000 +/- 300 <u>ATM POINTING (less than 3 ARC MIN)</u> ATTITUDE CONTROL SYSTEM: FSS BIAS IN sw - OUT MONITOR: COUNTER 2 sel-FSS UP/DN; ind = 0000 +/- 30, COUNTER 3 sel - FSS L/R; ind = 0000 +/- 30 * If COUNTERS 2 & 3 do not ind 0000 +/-30:* * * MANUAL POINTING CONTROL: * * MAN PTG ENABLE sw - ENABLE; tb - EXP * * MPC - Manipulate as required to reduce* * COUNTER 2 & 3 indicators to 0000* * +/- 30 * * MAN PTG ENABLE sw - INHIBIT; tb - bp * <u>WLC POINTING & ALIGNMENT</u> WLC: MAIN PWR sw - ON MIR POS sw - CAMERA WLC ALIGN ind pwr fail lt - off (verify) SCALE sw - X10 (verify); X10 lt on ALIGN sw - PTG (verify) DOOR sw - OPEN; tb - white then gray WLC ALIGN ind - horizontal cross pointer centered - vertical cross pointer centered	WLC pylon oriented parallel with solar equator, experiment "UP" pointing to west limb Enables FSS wedge angles only to be displayed on COUNTERS 1, 2 and 3 MAN PTG ENABLE sw is inhibited to prevent inadvertent canister movement Commands mirror to film camera position Meter range +/- 300 arc sec Displays experiment pointing error sensor outputs (pitch/yaw) on the ALIGN ind when aperture door is open and allows automatic control of D4 WLC pointing approximately within +/- 30 arc sec of center of the sun

PROCEDURE	REMARKS
130 * If WLC ALIGN indicator cross pointers * * are not centered: * * MANUAL POINTING CONTROL: * * MAN PTG ENABLE sw - ENABLE; tb - EXP * * MPC - Manipulate as required to bring * * the horizontal and vertical * * cross pointers of the WLC ALIGN * * ind to as near zero as possible * * MAN PTG ENABLE sw - INHIBIT; tb - bp * WLC: SCALE sw - X1; X1 lt on MANUAL POINTING CONTROL: MAN PTG ENABLE sw - ENABLE; tb - EXP MPC - Manipulate as required to bring the horizontal and vertical cross pointers of the WLC align ind to 0 for both up/down and right/left indications. WLC: READY/OPR lt - READY on (when both axes pointed within 20 arc sec of sun center) MANUAL POINTING CONTROL: MAN PTG ENABLE sw - INHIBIT; tb - bp Voice record FSS UP/DN, L/R readings from COUNTERS 2 & 3 when WLC ALIGN ind is centered in both axes WLC: SCALE sw - X10; X10 lt on ALIGN sw - DISC AUTO WLC ALIGN ind - horizontal cross pointer centered - vertical cross pointer centered SCALE sw - X1; X1 lt on	Up/down - horizontal cross pointer moves down/up respectively. Left/right - vertical cross pointer moves right/left respectively Meter Range +/- 30 arc sec READY CONDITIONS: WLC MAIN PWR on ATM aperture door is open WLC pointing within +/- 20 arc sec of sun center. Mirror in film camera position Enables D4 occulting disc pitch and yaw error sensor outputs to be displayed on the ALIGN ind and allows automatic control of D4 WLC internal occulting disc (D4) alignment is within +/- 30 arc sec

PROCEDURE	REMARKS
1 130 WLC ALIGN ind - horizontal cross pointer 2 less than 20; up or down 3 - vertical cross pointer 4 less than 20; left or 5 right 6 7 ----- 8 9 <u>X-RAY TELE POWER UP AND CHECKOUT</u> 10 11 X-RAY TELE: 12 THERMAL sw - PRIM (verify) 13 CAMR PWR sw - ON 14 FILTER tb - 1; FRAMES REMAINING decr by 1 15 CAMERA AIRLOCK sw - OPEN 16 17 <u>CAUTION</u> 18 19 Do not open door when CSM RCS is being 20 operated. Optics may be contaminated 21 by RCS exhaust. 22 23 DOOR sw - OPEN; tb - white then gray 24 READY lt - on 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	Internal Alignment Sensor (IAS) is in automatic mode and D4 occulting disc is aligned within +/- 20 arc sec (null position)

PROCEDURE	REMARKS
1 2 3 130 4 X-RAY TELE: 5 CAMERA/TELE sel - PATROL 6 EXPOSURE sw - SHORT 7 FRAMES REMAINING ind = 5999 approx; 8 Record ----- 9 START/STOP sw - START; OPR lt on (1 min 10 45 sec): FRAMES REMAINING 11 decr by 6. READY lt on 12 13 14 <u>SINGLE FRAME CHECKOUT</u> 15 CAMERA/TELE sel - SINGLE FR 2 16 EXPOSURE sw - NORMAL 17 START/STOP sw - START; OPR lt on 18 (34 secs): FRAMES REMAINING decr by 1; 19 READY lt on 20 EXPOSURE sw - LONG 21 START/STOP sw - START; OPR lt on (1 min 22 41 secs); FRAMES REMAINING decr by 1; 23 READY lt on 24 ----- 25 26 <u>X-REA POWER UP AND CHECKOUT</u> 27 28 X-RAY TELE: 29 BE & AL APRT POS AUTO sw's (2) - AUTO 30 (verify) 31 32 X-REA PWR sw - ON 33 BE APRT POS tb -1 34 AL APRT POS tb - 1 35 36 <u>DATA DRIVE/HISTORY PLOT/COUNTER CHECKOUT</u> 37 38 X-RAY/RF ACTIVITY: 39 DATA DRIVE sw's (3) - BE; REVIEW; FORWARD 40 Check for fast forward motion of paper 41 DATA DRIVE FORWARD sw - REVERSE 42 Check for fast reverse motion of paper 43 DATA DRIVE RECORD sw's (2) - RECORD 10 44 in/HR: FORWARD 45 Check for recording and slow forward 46 motion of paper 47 DATA DRIVE sw's (2) - AL; RECORD 30 in/HR 48 Check for recording, forward motion of 49 paper and double horizontal line at 50 bottom of paper	0.00025 AL filter X-REA PWR sw should be left on during the entire mission except during EVA

PROCEDURE	REMARKS
1 130 MONITOR: 2 COUNTER 3 sel - AL COUNT; ind = 4800 to 3 4950 4 X-RAY/RF ACTIVITY: 5 HISTORY PLOT = 2.3x10 to the fifth 6 DATA DRIVE BE sw - BE 7 8 MONITOR: 9 COUNTER 2 sel - BE COUNT; ind = 4800 to 10 4950 11 12 X-RAY/RF ACTIVITY: 13 HISTORY PLOT = 2.3x10 to the fifth 14 15 <u>WARNING</u> 16 17 Do not operate the Proportional Counters in 18 the South Atlantic Anomaly. Degradation of 19 counters may result. 20 21 X-RAY TELE: 22 DOOR sw - CLOSE; tb - bp 23 NOTE: Perform the next 4 steps over 24 a ground station 25 26 AOS ___:___:___ 27 28 HV PWR AL sw - ON 29 30 * If data does not stabilize on COUNTER 3* 31 * within 20 sec turn HV PWR AL sw - OFF * 32 * immediately and consult STDN * 33 34 HV PWR BE sw - ON 35 36 * If data does not stabilize on COUNTER 2* 37 * within 20 sec turn HV PWR BE sw - OFF * 38 * immediately and consult STDN * 39 40 BE and AL APRT POS tb's may change 41 DOOR sw - OPEN; tb - gray 42 43 X-RAY ACTIVITY: 44 DATA DRIVE RECORD sw - RECORD 10 in/HR 45 46 ----- 47 48 49 50	Calibration signal - same for all aperture positions Calibration count for AL APRT POS 1 Calibration count for BE APRT POS 1

PROCEDURE	REMARKS
130 <u>XUV SPECT POWER UP</u> XUV SPECT: PWR/DOORS tb - white THERMAL sw - ON (verify) MAIN PWR sw - ON PWR/DOORS tb - bp <u>DOOR OPENING</u> H-ALPHA: To confirm canister pointed within 24 arc min of sun center verify HA1 or HA2 DOOR tb's - gray TV: MON 2 sel - HA2 HA2 ZOOM sw - OUT full MANUAL POINTING CONTROL: MAN PTG ENABLE sw - ENABLE; tb - EXP MPC - Manipulate as required to center HA2 image on MON 2 MAN PTG ENABLE sw - INHIBIT; tb - bp <u>CAUTION</u> Do not place PWR/DOORS sw - ON until HA1 or HA2 DOOR tb's - gray. Temporary thermal distortion of the experiment case causing data degradation could result XUV SPECT: PWR/DOORS sw - ON; tb - white then gray WAVE LTH tb - ST EXPOSURE tb - gray; FLARE ENABLE tb - bp; READY lt on	THERMAL sw should be ON during entire mission MAIN PWR sw should be ON during entire mission, except during EVA All tb's should be ignored until PWR/DOORS tb - gray Ready conditions: MAIN PWR sw - ON PWR/DOORS sw - ON; tb - gray

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 <u>XUV SPECT CHECKOUT</u> XUV SPECT: MODE sw - TIME (verify) WAVE LTH sw - LONG; tb - LG EXPOSURE sw - SHORT; tb - ST START/STOP sw - STOP EXPOSURE tb - gray EXPOSURE sw - LONG; tb - LG FLARE sw - ENABLE; tb - ENA FLARE sw - INHIBIT; tb - bp X-RAY TELE: FLARE sw - INHIBIT (verify) MASTER FLARE MODE: INIT sw - INIT XUV SPECT: EXPOSURE tb - gray FRAMES REMAINING ind - 201 <u>DOOR CLOSING</u> XUV SPECT: PWR/DOORS sw - OFF; tb - white then bp READY/OPR lt - off WAVE LTH tb - white ----- <u>XUV SLIT POWER UP</u> XUV SLIT: PWR/DOORS tb - white THERMAL sw - ON (verify) MAIN PWR sw - ON ALERT: DOOR OPEN lt - out XUV SLIT: PWR/DOORS tb - bp TV: XUV MON DOORS tb - bp	Confirms automatic removal of exposure scale factor Camera has not been cycled to place first film strip in position THERMAL sw should remain on during entire mission MAIN PWR sw should remain on during entire mission except during EVA

PROCEDURE	REMARKS
130 * If XUV MON DOORS tb - white * * TV: * * XUV MON DOORS sw - CLOSE; * * tb - bp * XUV MON PWR sw - ON <u>DOOR OPENING</u> H-ALPHA: To confirm canister pointed within 24 arc min of sun center verify HA1 or HA2 DOOR tb's - gray MONITOR: COUNTER 1 sel - ROLL EXP; ind = +/- XXXX COUNTER 2 sel - FSS UP/DN; ind=0000+/-1350 COUNTER 3 sel - FSS L/R; ind=0000 +/- 1350 TV: MON 1 sel - XUV SLIT MON 2 sel - HA2 HA2 ZOOM sw - OUT full MON 2: HA image in center of screen <u>CAUTION</u> Do not place PWR/DOORS sw - ON until HA1 or HA2 DOOR tb's - gray or COUNTERS 2 and 3 indicate 0000 +/- 1350. Temporary thermal distortion of the experiment case, causing data degradation could result. XUV SLIT: PWR/DOORS sw - ON; tb - white then gray WAVE LTH tb - ST FLARE ENABLE tb - bp; READY lt on	XUV MON PWR sw should remain on during entire mission except during EVA Verifies correct EPC pointing All tb's should be ignored until PWR/DOORS tb - gray

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PROCEDURE	REMARKS
1 130 MANUAL POINTING CONTROL: 2 MAN PTG ENABLE sw - ENABLE; tb - EXP 3 4 MPC - manipulate as required to position 5 white light limb near slit in XUV 6 SLIT WHITE LIGHT DISPLAY with left 7 fiducial mark illuminated. 8 9 MAN PTG ENABLE sw - INHIBIT; tb - bp 10 11 XUV SPECT: 12 WAVE LTH sw - cycle to position opposite 13 that indicated by WAVE LTH 14 tb, wait 5 sec, and cycle 15 to original position. 16 17 MON 1: 18 Observe effect of opening XUV SPECT doors 19 and cycling XUV SPECT WAVE LTH sw on slit 20 pointing in WL DISPLAY. 21 22 XUV SLIT: 23 MODE sw - TIME 24 START/STOP sw - START 25 Wait <u>TBS</u> seconds 26 START/STOP sw - STOP 27 28 MON 1: 29 Observe effect of cycling the XUV SLIT 30 START/STOP sw on slit pointing in WL 31 DISPLAY. 32 33 <u>XUV_MON_CHECKOUT</u> 34 35 The XUV MON CHECKOUT requires that the 36 XUV MON video be recorded for playback 37 to the ground 38 39 122 Configure VTR for recording 40 41 42 43 44 45 46 47 48 49 50	

PROCEDURE	REMARKS
1 130 TV: 2 MON 2 sel - XUV MON 3 XUV MON PWR sw - ON (verify) 4 130 TV: 5 XUV MON GAIN sel - Increase from position 6 1 in single steps, re- 7 maining at each step 8 long enough to verify 9 the need for more gain, 10 until four test dots 11 are visible on MON 2. 12 Record this GAIN 13 position ----- 14 XUV MON GAIN sel - 1 15 XUV MON DOORS sw - OPEN; tb - white then 16 gray 17 18 MON 2: 19 Four test dots replaced by XUV solar 20 image and camera faceplate reticle. 21 22 TV: 23 XUV MON GAIN sel - increase from position 24 1 in single steps, re- 25 maining at each step 26 long enough to verify 27 the need for more gain, 28 until bright active re- 29 gions on the solar disc 30 can be seen on MON 2. 31 MON 2. 32 Record this GAIN 33 position ----- 34 XUV MON GAIN sel - Continue to increase 35 in steps until bright 36 limb and quiet sun 37 background features 38 are visible on MON 2 39 Record this GAIN 40 position ----- 41 42 * If quiet sun features not visible at XUV* 43 * MON GAIN sel - 7: * 44 * * * 45 * XUV SLIT: * 46 * VID INTEG sw - INTEG for 1 sec * 47 48 MON 2: 49 Bright limb and quiet sun features visible 50	

PROCEDURE	REMARKS
1 * If 1/30 see display is saturated reduce* 2 * XUV MON GAIN sel setting and repeat 1 * 3 * sec INTEG * 4 5 <u>DOOR_CLOSING</u> 6 7 130 XUV SLIT: 8 PWR/DOORS sw - OFF; tb - white then bp 9 READY/OPR lt - off 10 WAVE LTH tb - white 11 -----End Nominal 1st Orbit----- 12 13 <u>TV_CHECKOUT</u> 14 15 MANUAL POINTING CONTROL: 16 MAN PTG ENABLE sw - ENABLE; tb - EXP 17 MPC - Manipulate as required to bring 18 COUNTERS 2 & 3 to 0000 +/-5 19 20 TV: 21 WLC PWR sw - ON 22 MON 1 or 2 sel - WLC 23 24 WLC: 25 DOOR sw - OPEN; tb - white then gray 26 27 MANUAL POINTING CONTROL: 28 MPC - Manipulate as required to bring the 29 horizontal and vertical crosspoint- 30 ers of the WLC ALIGN ind to as near 31 as near zero as possible 32 MAN PTG ENABLE sw - INHIBIT; tb - bp 33 34 WLC: 35 READY/OPR lt - READY on 36 MIR POS sw - TV 37 READY/OPR lt - off 38 39 MON 1 or 2: 40 Observe acceptable contamination and 41 scattered light level 42 43 44 45 46 47 48 49 50	Excessive contamination about the ATM and scattered light within the experiment will produce data degradation

PROCEDURE	REMARKS
1 * If quality of TV monitor image does not* 2 * appear satisfactory (i.e. fogging and * 3 * negative image): * 4 * * 5 * TV: * 6 * WLC GRID sw - DISCH * 7 8 9 10 11 WLC: 12 MIR POS sw - CAMERA 13 READY/OPR lt - READY on 14 15 MON 1 or 2: 16 Loss of image 17 18 <u>WARNING</u> 19 20 The WLC Low Light Level Vidicon operating 21 life is limited, therefore, the WLC TV 22 power must be cycled off at all times when 23 it is not in direct or impending use. 24 25 TV: 26 WLC PWR sw - OFF 27 28 <u>PRIMARY PROGRAMMER CHECKOUT</u> 29 30 WLC: 31 MODE sel - STD; READY lt on 32 START/STOP sw - START 33 34 After first exposure has been completed 35 (9 sec): 36 READY/OPR lt - OPR on 37 SEQUENCE COMPLETE tb - bp 38 FRAMES REMAINING ind - decreasing 39 40 When STD MODE sequence complete 41 (5.5 min): 42 SEQUENCE COMPLETE tb - gray 43 READY/OPR lt - READY on 44 FRAMES REMAINING ind - decreased by 12 45 46 47 48 49 50	Removes excessive G5 potential (May not resolve unsatisfactory image because of experiment align- ment anomalies) Coronal image has been switched to the film camera for data acquisition

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PROCEDURE	REMARKS
1 2 2 <u>3_RASTER</u> 3 4 130 SCAN SPECT: 5 MODE sel - MIRROR 3 RASTER L/R 6 START/STOP sw - START 7 8 MONITOR: 9 COUNTER 2 ind = XXXX 10 ----- 11 12 13 14 15 16 <u>X-RAY SPECT POWER UP</u> 17 18 X-RAY SPECT (Control): 19 MAIN PWR sw - ON (verify) 20 THERMAL POWER sw - PRIM (verify) 21 22 FILTER sel - 1 23 FILTER CONFIRM tb - bp then gray 24 25 FRAMES REMAINING ind - 6000 26 DOOR - tb - bp (verify) 27 28 NOTE: The next 3 steps should be done over 29 a ground station 30 AOS ____:__ __:__ __ 31 32 IMAGE DISSECTOR sw - ENABLE 33 X-RAY IMAGE sw - ENABLE 34 PHOTO MULT ENABLE sw - ENABLE 35 FLARE THRESHOLD COARSE sel - 768 (verify) 36 FLARE THRESHOLD FINE sel - 224 (verify) 37 38 NOTE: At the above threshold settings, no 39 flare signal will occur. These set- 40 tings exceed the maximum count (960) 41 that may occur to produce a flare 42 signal. 43 44 X-RAY SPECT (Display): 45 IMAGE THRESHOLD sel - 256 (verify) 46 47 48 49 50	The 2 most significant digits will count from 0 to 60 in 5.55 min. The 2 least significant digits will count from 68 to 99 (1 less than 0) on odd numbered lines and from 99 to 68 on even numbered lines Filter in-transit time varies from 5 to 20 sec There are 7000 frames in full camera magazine. Counter will not read correctly until reset at a readout of approximately 5000 Established flare intensity threshold for automatic camera operation, Master Flare Mode, X-RAY light and audible tone alarm Selects minimum counts per resolution element needed to establish an image on the X-RAY IMAGE mon. (Display is divided into 2304 resolution elements)

PROCEDURE	REMARKS
130 X-RAY SPECT (Display): PHOTOMULTIPLIER EXPOSURE COUNT ind - 000 to 200 (Nominally 000 - 020 with door closed, however, short durations up to 200 counts may occur). IMAGE INTENSITY COUNT ind - 000 to 010 BRIGHTNESS cont - as desired FOCUS cont - as desired X-RAY SPECT (Control): MODE sw - MANUAL (verify) MASTER FLARE MODE: TN/LT sw - OFF (verify) <u>X-RAY SPECT CHECKOUT</u> <u>FILTER WHEEL</u> X-RAY SPECT (Control): FILTER sel - 2 FILTER CONFIRM tb - bp then gray in 3 to 5 sec FILTER sel - RESET/1 FILTER CONFIRM tb - bp then gray after 5 to 10 sec FILTER sel - 2 thru 6 Verify FILTER CONFIRM tb - bp then gray when each selected position is reached <u>GRATING MECHANISM</u> <u>WARNING</u> Permanent damage to gratings may result if GRATING sw - RESET is used instead of GRATING sw - OUT for normal operating con- dition. GRATING sw - RESET should be used only if grating assembly malfunctions. X-RAY SPECT (Control): GRATING sw - IN; tb - IN GRATING sw - OUT; tb - OUT	Count 000 to 200 is due to back- ground X-RAY activity and noise Backup for the Photomultiplier Exposure Count ind. The 000 to 010 count is due to background X-RAY activity Checks fail-safe mechanism Verifies operation of Grating Mechanism

PROCEDURE	REMARKS
1 <u>PHOTOMULTIPLIER AND IMAGING SUBSYSTEMS</u> 2 3 130 X-RAY SPECT (Control): 4 PHOTO MULT TEST sw - TEST and hold 5 6 7 8 9 10 11 X-RAY SPECT (Display): 12 PHOTOMULTIPLIER EXPOSURE COUNT ind - 13 fluctuates between 400 and 600 14 15 X-RAY SPECT (Control): 16 PHOTO MULT TEST sw - release 17 18 X-RAY SPECT (Display): 19 PHOTOMULTIPLIER EXPOSURE COUNT ind - 20 000 to 200 21 IMAGE THRESHOLD sel - 1 22 X-RAY IMAGE mon - test source visible at 23 top center of screen 24 25 NOTE: Test source will always be visible 26 whenever IMAGE THRESHOLD sel - 1 27 28 X-RAY SPECT (Control): 29 PHOTO MULT TEST sw - CTR TEST and hold 30 31 X-RAY SPECT (Display): 32 PHOTOMULTIPLIER EXPOSURE COUNT ind - 128 33 IMAGE INTENSITY COUNT ind - 128 34 X-RAY IMAGE mon - target displayed on 35 center of screen 36 FOCUS cont - as desired 37 BRIGHTNESS cont - as desired 38 IMAGE THRESHOLD sel - 4 39 X-RAY IMAGE mon - target barely visible 40 IMAGE THRESHOLD sel - 16 41 X-RAY IMAGE mon - target not visible 42 IMAGE THRESHOLD sel - 1 43 X-RAY IMAGE mon - target visible and well 44 defined 45 46 X-RAY SPECT (Control): 47 PHOTO MULT TEST sw - release 48 49 50	Provides an enabling signal to a light source located on the photomultiplier tube. When the light is illuminated, a check of the tube is accomplished and verified by a reading on the Photomultiplier Exposure Counter Due to variations in test lamp intensity Checks operation of Image Dissector Assembly Signal generated that displays 128 on both the Intensity and Exposure Counters and a 16 element target displayed on the X-RAY IMAGE mon with the IMAGE THRESHOLD switch in the 1 or 4 position

PROCEDURE	REMARKS
130 <u>FLARE ALARM SUBSYSTEM</u> X-RAY SPECT (Control): DOOR tb - bp (verify) FLARE THRESHOLD COARSE sel - 0 FLARE THRESHOLD FINE sel - 0 MASTER FLARE MODE: TN/LT sw - ENBL X-RAY/RF lt - X-RAY on Audible tone - on X-RAY SPECT (Control): FLARE THRESHOLD FINE sel - 224 MASTER FLARE MODE: X-RAY/RF lt - off Audible tone - off <u>CAMERA SUBSYSTEM & READY/OPR LOGIC</u> X-RAY SPECT (Control): FLARE THRESHOLD COARSE sel - 768 PICUTRE RATE sel - SINGLE (verify) EXPOSURE RANGE sel - 256 (verify) DOOR sw - OPEN: tb - white then gray PHOTO MULT ENABLE sw - ENABLE (verify) READY/OPR LT - READY on PHOTO MULT ENABLE sw - OFF READY/OPR lt - READY on EXPOSURE RANGE sel - AUTO READY/OPR lt - off EXPOSURE RANGE sel - 256 READY/OPR lt - READY on MODE sw - FLARE AUTO READY/OPR lt - off MODE sw - MANUAL READY/OPR lt - READY on	Simulates presence of a flare Verifies operation of X-Ray flare signal Sets camera logic to take one exposure sequence and stop automatically Selects exposure sequence. In this position sequence is 1/64, 1/16, 1/4, 1, 4, 16, 64 and 256 seconds <u>READY CONDITIONS</u> MAIN PWR sw - ON DOOR - OPEN PHOTOMULT ENABLE sw - ENABLE or MAIN PWR sw - ON DOOR - OPEN PHOTOMULT ENABLE sw - OFF EXPOSURE RANGE sel - not in AUTO MODE sw - MANUAL Confirms that all READY conditions are functioning properly

PROCEDURE	REMARKS
1 <u>MANUAL OPERATION</u> 130 X-RAY SPECT (Control): Record FRAMES REMAINING ind reading ----- START/STOP sw - START; OPR lt on NOTE: Camera will operate until 8 exposures have been completed (Approx 5 min and 45 sec) FRAMES REMAINING ind - decreases by 8 READY/OPR lt - READY on 2 <u>AUTOMATIC OPERATION</u> X-RAY SPECT (Control): DOOR sw - CLOSE; tb - white then bp MODE sw - FLARE AUTO PICTURE RATE sel - LOW FLARE THRESHOLD COARSE sel - 0; FINE sel - 128 READY/OPR lt - off PHOTO MULT TEST sw - CTR TEST and hold MASTER FLARE MODE: TN/LT sw - ENBL (verify) X-RAY/RF lt - X-RAY on Audible tone - on X-RAY SPECT (Control): FRAMES REMAINING ind - allow to decrease by 2 PHOTO MULT TEST sw - release MASTER FLARE MODE: X-RAY/RF lt - off Audible tone - off MASTER FLARE MODE: TN/LT sw - OFF X-RAY SPECT (Control): MODE sw - MANUAL PHOTO MULT ENABLE sw - ENABLE FLARE THRESHOLD COARSE plus FINE sel - per SAP -----	Sets camera logic for automatic operation CTR TEST position simulates a flare that would generate 128 pulses per second. Flare threshold has been previously set to 128. If the incoming pulses equal or exceed the threshold (128), a flare signal is generated initiating an automatic camera sequence READY/OPR lt off - auto camera check performed with door closed Absence of 128 pulses drops flare intensity simulation below threshold thereby stopping camera and deactivating flare alarm until another flare occurs

PROCEDURE	REMARKS
1 130 SCAN SPECT: 2 Approx 16.65 min after START: 3 RASTER/SCAN COUNTER ind = 00003 4 5 NOTE: If the spacecraft enters orbit night 6 prior to the completion of the 3 7 raster sequence the mirror will stop 8 rastering, will stow and the RASTER/ 9 SCAN COUNTER will increment one 10 count upon receipt of the door 'not 11 open' signal. Another 3 raster se- 12 quence will be automatically initi- 13 ated upon receipt of the door 'open' 14 signal 15 16 RASTER/SCAN RESET sw - RESET 17 RASTER/SCAN COUNTER ind = 00000 18 19 3 <u>AUTO_RASTER</u> 20 21 SCAN SPECT: 22 MODE sel - MIRROR AUTO RASTER 23 START/STOP sw - START 24 25 MONITOR: 26 COUNTER 2 ind = XXXX 27 28 Approx 1 min after START: 29 START/STOP sw - STOP 30 RASTER/SCAN COUNTER ind = 00001 31 RASTER/SCAN RESET sw - RESET 32 RASTER/SCAN COUNTER ind = 00000 33 34 4 <u>MIR_POS_DRIVE</u> 35 36 SCAN SPECT: 37 MODE sel - MIRROR LINE SCAN UP/DN 38 O-ORDER tb - gray 39 MIR POS sw - Pulse UP/R 5 times 40 41 MONITOR: 42 COUNTER 2 sel - SCAN SPEC MIR POS 43 DN/R (verify) 44 COUNTER 2 ind = 2531 45 46 47 48 49 50	Indicates completion of third raster. Raster will automatically stop following completion of third raster The two most significant digits will count up. The two least significant digits will count down on even numbered lines Verifies vertical raster drive

PROCEDURE	REMARKS
1 130 SCAN SPECT: 2 MIR POS sw - Pulse DN/L 5 times 3 4 MONITOR: 5 COUNTER 2 ind - 3031 6 7 SCAN SPECT: 8 MODE sel - MIRROR 3 RASTER L/R 9 MIR POS sw - Pulse UP/R 5 times 10 11 MONITOR: 12 COUNTER 2 ind = 3036 13 14 SCAN SPECT: 15 MIR POS sw - Pulse DN/L 5 times 16 17 MONITOR: 18 COUNTER 2 ind = 3031 19 20 <u>GRATING DRIVE</u> 21 22 1 <u>3_SCAN</u> 23 24 SCAN SPECT: 25 MODE sel - GRATING 3 SCAN 26 O-ORDER tb - gray 27 START/STOP sw - START 28 READY/OPR lt - off 29 RASTER/SCAN COUNTER ind = 00000 30 GRATING POSITION ind - count increases 31 at 24 pps 32 O-ORDER tb - bp at approx 00100 33 O-ORDER tb - gray at approx 05380 34 35 3 min 48 sec after START: 36 O-ORDER tb - gray 37 GRATING POSITION Ind - resets to 00000 38 39 RASTER/SCAN COUNTER ind = 00001 40 O-ORDER tb - bp at approx 00100 41 O-ORDER tb - gray at approx 05380 42 43 44 45 46 47 48 49 50	GRATING POSITION ind resets at a count of 05497 +/- 2

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PROCEDURE	REMARKS
1 3 <u>DETECTOR 4 VERIFICATION</u> 2 3 130 SCAN SPECT: 4 MAIN HV sw - ENABLE 5 MODE sel - GRATING 3 SCAN 6 HV ENABLE/RESET 4 sw - ENABLE/RESET and 7 observe (approx 8 10 sec) SCAN SPEC 9 alert light off 10 11 READY/OPR lt - READY on 12 13 14 * ALERT: * 15 * SCAN SPECT lt - on * 16 * 17 * SCAN SPEC: * 18 * MAIN HV sw - OFF * 19 * 20 * Report HV failure to STDN and await* 21 * further instructions * 22 23 SCAN SPECT: 24 If SCAN SPECT alert light remains off, 25 leave HV ENABLE/RESET 4 sw - ENABLE/ 26 RESET for remainder of orbit 27 28 4 <u>DETECTORS 2,7,3,5 and 6 VERIFICATION</u> 29 30 Turn on DETECTORS 2,7,3,5 & 6 in this order, 31 repeating the procedure used for DETECTOR 4. 32 Leave all HV ENABLE/RESET switches in 33 ENABLE/RESET for remainder of orbit 34 35 SCAN SPECT: 36 INTENSITY DATA ind - fluctuating 37 38 At end of orbit: 39 HV ENABLE/RESET 7 thru 2 sw's (6) - OFF 40 41 42 43 44 45 46 47 48 49 50	Test for HV breakdown. HV is good if SCAN SPECT alert lt remains off Light remains on as long as at least one HV system is enabled and in an operational mode HV failure - all HV will automa- tically turn off All HV will be turned off auto- matically upon entry into orbit night when door closes. DETECTORS 4,2,7,3,5 and 6 HV will be turned on automatically with door opening if their switches remain in EN- ABLE/RESET Inhibits automatic turn-on of these DETECTORS' HV at orbit day when door opens

PROCEDURE	REMARKS
1 <u>DETECTORS 4,2,7,3,5 and 6 ON SUN</u> Next orbit day: 1 <u>PRELIMINARY SETUP</u> 130 DAS: Key - 40007E (S055 GAGE ON) MONITOR: COUNTER 1 sel - SCAN SPECT PRESS (verify) COUNTER 1 ind - 3000 or less (0.00001 Torr) <u>WARNING</u> SCAN SPECT PRESS ind must be 3000 or less prior to applying HV to the detectors to prevent permanent damage to detection system. If reading is higher than 3000 notify STDN for instructions DAS: Key - 40072E (S055 GAGE OFF) TV: MON 1 sel - HA1 ATTITUDE CONTROL SYSTEM: FSS DR sw - OPEN; tb - SUN MODE EXP PTG sw - EXP PTG; tb - EXP MON 1: HORIZONTAL CROSS HAIR tw - UP or DN to center VERTICAL CROSS HAIR tw - R or L to center TV: HA1 ZOOM sw - OUT full MANUAL POINTING CONTROL: MAN PTG ENABLE sw - ENABLE; tb - EXP MPC - Manipulate to place quiet region near center of solar disc under intersection of cross hairs MAN PTG ENABLE sw - INHIBIT; tb - bp	This sequence should be accomplished when in contact with a ground station in order to obtain real time TM GAGE is source of noise in detection system

PROCEDURE	REMARKS
1 130 SCAN SPECT: 2 DOOR tb - gray 3 RASTER/SCAN COUNTER ind = 00000 4 O-ORDER tb - gray 5 6 2 <u>DETECTOR 4 VERIFICATION</u> 7 8 SCAN SPECT: 9 HV ENABLE/RESET 4 sw - ENABLE/RESET and 10 observe (approx 11 10 sec) SCAN SPECT 12 alert light off 13 14 READY/OPR lt - READY on 15 16 * ALERT: * 17 * SCAN SPECT lt - on * 18 * 19 * SCAN SPECT: * 20 * MAIN HV sw - OFF * 21 * 22 * Report HV failure to STDN and await* 23 * further instructions * 24 25 SCAN SPECT: 26 If SCAN SPECT alert light remains off, 27 leave HV ENABLE/RESET 4 sw - ENABLE/RE- 28 SET for remainder of orbit 29 30 3 <u>DETECTORS 2,7,3,5 and 6 VERIFICATION</u> 31 32 Turn on DETECTORS 2,7,3,5 & 6 in this order 33 repeating the procedure used for DETECTOR 4. 34 Leave all HV ENABLE/RESET switches in 35 ENABLE/RESET for remainder of orbit 36 37 SCAN SPECT: 38 INTENSITY DATA ind - fluctuating 39 40 At end of orbit: 41 HV ENABLE RESET 7 thru 2 sw's (6) - OFF 42 43 44 45 46 47 48 49 50	Test for HV BREAKDOWN. HV is good if SCAN SPECT alert lt remains off Light remains on as long as at least one HV system is enabled and in an operational mode HV failure - all HV will automa- tically turn off All HV will be turned off auto- matically upon entry into orbit night when door closes. DETECTORS 4,2,7,3,5 and 6 HV will be turned on automatically with door opening if their switches remain in EN- ABLE/RESET Inhibits automatic turn-on of these DETECTORS HV at orbit day by door 'not open' signal

PROCEDURE	REMARKS
1 <u>DETECTOR 1 VERIFICATION</u> 2 3 Next orbit day: 4 5 130 MANUAL POINTING CONTROL: 6 MAN PTG ENABLE sw - ENABLE; tb - EXP 7 MPC - Manipulate as required to position 8 center of solar image on MON 1 on 9 horizontal cross hair and vertical 10 cross hair approx 1200 arc sec from 11 sun center off the solar image 12 MAN PTG ENABLE sw - INHIBIT; tb - bp 13 14 SCAN SPECT: 15 DOOR tb - gray (verify) 16 DET SEL sw - 1 17 HV ENABLE/RESET 1 sw - ENABLE/RESET and 18 observe (approx 19 10 sec) SCAN SPECT 20 alert light off 21 22 READY/OPR lt - READY on 23 INTENSITY DATA ind - fluctuating 24 25 * ALERT: * 26 * SCAN SPECT lt - on * 27 * * * 28 * SCAN SPECT: * 29 * MAIN HV sw - OFF * 30 * * * 31 * Report HV failure to STDN and await* 32 * further instructions * 33 34 SCAN SPECT: 35 If SCAN SPECT alert light remains off, 36 leave HV ENABLE/RESET 1 sw - ENABLE/RESET 37 ----- 38 <u>SRNEM POWER UP AND CHECKOUT</u> 39 40 128/ CAL NOISE SOURCE sel - AMB 41 129 SWITCHING MODE sel - NS/REF 42 SYSTEM GAIN cont - 0 43 REF BAL cont - 0 44 THRESHOLD cont - 0 45 POWER sw - ON 46 ----- 47 48 49 50	This sequence should be accom- plished when in contact with a ground station in order to ob- tain real time TM Aperture door will automatically close if ATM is pointed more than 1320 +/- 30 arc sec from center of solar disc and will reopen when pointed back within this limit HV failure - all HV will automa- tically turn off

PROCEDURE	REMARKS
1 After approx 10 min: 2 3 130 MANUAL POINTING CONTROL: 4 MAN PTG ENABLE sw - ENABLE; tb - EXP 5 MPC - Slew to quiet region near center 6 of solar disc 7 8 SCAN SPECT: 9 O-ORDER tb - bp then gray 10 11 12 13 14 INTENSITY DATA ind = increasing 15 16 17 18 MANUAL POINTING CONTROL: 19 MAN PTG ENABLE sw - INHIBIT; tb - bp 20 21 SCAN SPECT: 22 READY/OPR lt - READY on 23 MODE sw - GRATING 3 SCAN 24 START/STOP sw - START; OPR lt on 25 GRATING POSITION ind = increasing 26 INTENSITY DATA ind = fluctuating 27 28 29 30 31 O-ORDER tb - gray to bp 32 33 34 After 3 min 48 sec: 35 RASTER/SCAN COUNTER ind = 00001 36 ----- 37 38 <u>SRNBM CHECKOUT (cont'd)</u> 39 After 15 minute warmup: 40 41 128/ REF BAL cont - adjust as required until 42 129 indicator reads 100 43 CAL NOISE SOURCE sel - 1845 44 SYSTEM GAIN cont - adjust as required 45 until indicator reads 46 1845 47 48 49 50	The tb should change from bp to gray as ATM canister moves onto the solar disc and direct sunlight enters instrument Intensity data increases as ATM canister moves onto the solar disc and direct sunlight enters instrument At START/STOP sw - START, GRATING POSITION ind increases from 00000 to 05497 +/-2 and resets to 00000 at end of each scan. Each scan will require 3 min 48 sec Will change from gray to bp at a count of approx 00100 and back to gray at approx 5380 Increases by one at completion of each scan. Grating will stop at 00003

PROCEDURE	REMARKS
128/ 129 CAL NOISE SOURCE sel - AMB REF BAL cont - adjust as required to re- obtain a reading of 100 on indicator CAL NOISE SOURCE sel - 1845 SYSTEM GAIN cont - adjust as required to reobtain a reading of 1845 on indicator Repeat cycle until balance is obtained Lock both REF BAL and SYSTEM GAIN controls ----- 130 SCAN SPECT: After approx 7 min 36 sec: RASTER SCAN COUNTER ind = 00002 After approx 11 min 24 sec: RASTER SCAN COUNTER ind = 00003 READY/OPR lt - READY on HV ENABLE/RESET 1 sw - OFF INTENSITY DATA ind = 00000 READY/OPR lt - off RASTER/SCAN RESET sw - RESET RASTER/SCAN COUNTER ind = 00000 <u>ALL DETECTORS</u> Next orbit day: MANUAL POINTING CONTROL: MAN PTG ENABLE sw - ENABLE; tb - EXP MPC - Slew to quiet region near center of solar disc MAN PTG ENABLE sw - INHIBIT; tb - bp SCAN SPECT: DOOR tb - GRAY MODE sel - GRATING AUTO SCAN HV ENABLE/RESET 4,2,7,3,1,5,86 sw's - ENABLE/RESET in that order INTENSITY DATA ind - fluctuating READY/OPR lt - READY on ALERT: SCAN SPECT lt - off	This sequence should be accom- plished when in contact with a ground station in order to obtain real time TM

PROCEDURE	REMARKS												
1 <u>WARNING</u> 2 3 During the sequence detectors 7,6,5,4, & 3 4 must be turned off at the steps indicated 5 or the 0-order beam can damage the detectors 6 if allowed to sweep across the entrance 7 slit 8 9 130 SCAN SPECT: 10 START/STOP - START; OPR lt on 11 GRATING POSITION ind - count increasing 12 INTENSITY DATA ind - fluctuating 13 O-ORDER tb - gray to bp at approx 00100 14 15 As the grating approaches the following 16 positions turn off the appropriate detector: 17 <table> <tr> <td>Grating Position</td><td>Detector</td></tr> <tr> <td>02150</td><td>7</td></tr> <tr> <td>02500</td><td>6</td></tr> <tr> <td>03750</td><td>5</td></tr> <tr> <td>04150</td><td>4</td></tr> <tr> <td>04400</td><td>3</td></tr> </table> 25 26 When the GRATING POSITION ind reads 27 approx 05000: 28 29 SCAN SPECT: 30 MODE sel - GRATING REF; READY lt on 31 START/STOP sw - START; OPR lt on 32 33 When grating attains OPT REF: 34 READY/OPR lt - READY on 35 GRATING POS ind = 00000 36 MODE sel - GRATING AUTO SCAN 37 HV ENABLE/RESET sw's 3,4,7,5,86 - 38 ENABLE/RESET 39 40 Repeat the above sequence for 2 more scans 41 42 At the end of the 3rd scan: 43 All HV ENABLE/RESET sw's (7) - OFF 44 MODE sel - STOP 45 READY/OPR lt - OFF 46 47 48 49 50	Grating Position	Detector	02150	7	02500	6	03750	5	04150	4	04400	3	
Grating Position	Detector												
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02500	6												
03750	5												
04150	4												
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PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 EVA: AUTO DOOR SW - ENABLE NOTE: Experiments are fully operational and ready for co-alignment procedure	

PROCEDURE	REMARKS
130 <u>S082B/FSS BIAS AND CO-ALIGNMENT WITH</u> <u>S055A, HA1, and HA2</u> To prematurely terminate this procedure, at any time, place the FSS BIAS MARK sw-CLEAR. The procedure may then be repeated from the beginning. H-ALPHA: HA1 DOOR tb - gray (verify) XUV SLIT: MAIN PWR sw - ON (verify) PWR/DOORS sw - ON; tb - white for 10 secs then gray READY/OPR lt - READY on TV: MON 1 sel - HA1 MON 2 sel - XUV SLIT XUV SLIT WL DISPLAY sw - WL DISPLAY HA1 ZOOM sw - IN full MON 1: 4.4 arc min segment of solar disk in HA MON 2: 3 arc min segment of solar disk in white light MONITOR: COUNTER 1 sel - FSS CAL; ind = 0001 COUNTER 2 sel - FSS UP/DN COUNTER 3 sel - FSS L/R MANUAL POINTING CONTROL: MAN PTG ENABLE sw - ENABLE; tb - EXP ATTITUDE CONTROL SYSTEM: FSS BIAS XUV SLIT sw - XUV SLIT FSS BIAS IN sw - OUT FSS BIAS MARK sw - CLEAR MANUAL POINTING CONTROL: MPC - Manipulate to position upper solar limb tangent to slit horizontal fiducial mark on MON 2	12.03.03-00 S082B CO-AL November 1, 1972 CLEAR only clears memory for instrument selected with FSS BIAS sw's.

PROCEDURE	REMARKS
1 130 MONITOR: 2 COUNTER 2 ind = +0960 +/- XX 3 COUNTER 3 ind = 0000 +/- 5 4 5 ATTITUDE CONTROL SYSTEM: 6 FSS BIAS MARK sw - MARK 7 8 MONITOR: 9 COUNTER 1 ind = 0002 10 11 SCAN SPECT: 12 MODE sel - MIRROR LINE SCAN UP/DN 13 0-ORDER tb - bp 14 15 * If 0-ORDER tb is not bp, pulse MIR POS* 16 * sw UP/R until tb changes to bp. If * 17 * mirror limit is reached and the 0- * 18 * ORDER tb has not changed states, S055A* 19 * and S082B cannot be co-aligned * 20 21 SCAN SPECT: 22 MIR POS sw - Pulse DN/L until 0-ORDER tb 23 changes to gray 24 25 * If mirror limit is reached and the 0-ORDER* 26 * tb has not changed state, S055A and S082B * 27 * cannot be co-aligned * 28 29 MANUAL POINTING CONTROL: 30 MPC - Manipulate off sun and slowly on sun 31 until 0-ORDER tb changes from bp to gray 32 33 MONITOR: 34 COUNTER 3 ind = 0000 +/- 5 35 36 TV: 37 HA RETICLE sw - HA1 38 HARC - Manipulate to position horizontal 39 reticle tangent to upper solar limb 40 on MON 1 41 42 MANUAL POINTING CONTROL: 43 MPC - Manipulate to position lower solar 44 limb tangent to slit horizontal 45 fiducial mark on MON 2 46 47 MONITOR: 48 COUNTER 3 ind = 0000 +/- 5 49 50	Enters UP data point into ATMDC. ATMDC ready for DN data point

PROCEDURE	REMARKS
1 130 ATTITUDE CONTROL SYSTEM: 2 FSS BIAS MARK sw - MARK 3 4 MONITOR: 5 COUNTER 1 ind = 0003 6 7 MANUAL POINTING CONTROL: 8 MPC - Manipulate off sun and slowly on 9 sun until 0-ORDER tb changes from 10 bp to gray 11 12 MONITOR: 13 Record COUNTER 2 ind reading M_____ 14 15 MANUAL POINTING CONTROL: 16 MPC - Manipulate to position horizontal 17 reticle tangent to lower solar 18 limb on MON 1 19 20 MONITOR: 21 Record COUNTER 2 ind reading N_____ 22 23 MANUAL POINTING CONTROL: 24 MPC - Manipulate off sun until COUNTER 2 25 ind = $N + \frac{M-N}{2}$ 26 27 28 TV: 29 HARC - Up to position HA1 horizontal 30 reticle tangent to lower solar 31 limb on MON 1 32 33 MANUAL POINTING CONTROL: 34 MPC - Manipulate to position left solar 35 limb tangent to slit on MON 2 36 37 MONITOR: 38 COUNTER 2 ind = 0000 +/- 5 39 COUNTER 3 ind = -0960 +/- XX 40 ATTITUDE CONTROL SYSTEM: 41 FSS BIAS MARK sw - MARK 42 43 MONITOR: 44 COUNTER 1 ind = 0004 45 46 47 48 49 50	Enters DN data point into ATMDC. ATMDC ready for L data point. Enters L data point into ATMDC. ATMDC ready for R data point

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PROCEDURE	REMARKS
130 TV: MON 2 sel - HA2 HA2 ZOOM sw - in full MANUAL POINTING CONTROL: MPC - Manipulate to position intersection of HA1 reticles at the center of a small sunspot near sun center on MON 1 TV: HA RETICLE sw - HA2 HARC - Manipulate to position each HA2 reticle so they intersect at the center of the same sun spot on MON 2 HA RETICLE sw - OFF <u>READOUT OF FSS BIAS OFFSET ANGLES</u> ATTITUDE CONTROL SYSTEM: FSS BIAS IN sw - OUT MONITOR: COUNTER 1 sel - ROLL EXP COUNTER 2 sel - FSS UP/DN COUNTER 3 sel - FSS L/R MANUAL POINTING CONTROL: ROLL ENABLE sw - ENABLE ROLL LOW RATE sw - As required to obtain COUNTER 1 ind = 0000 +/- 7 ROLL ENABLE sw - INHIBIT MAN PTG ENABLE sw - ENABLE; tb - EXP MPC - Manipulate as required to obtain COUNTER 2 and COUNTER 3 ind = 0000 MAN PTG ENABLE sw - INHIBIT, tb - bp ATTITUDE CONTROL SYSTEM: FSS BIAS XUV SLIT sw - HA, XUV SLIT or SCAN SPECT as desired If HA selected on FSS BIAS XUV SLIT sw: FSS BIAS HA1 sw - HA1 or HA2 as desired FSS BIAS IN sw - IN	12.03.07-00 RD BIAS ANG November 1, 1972

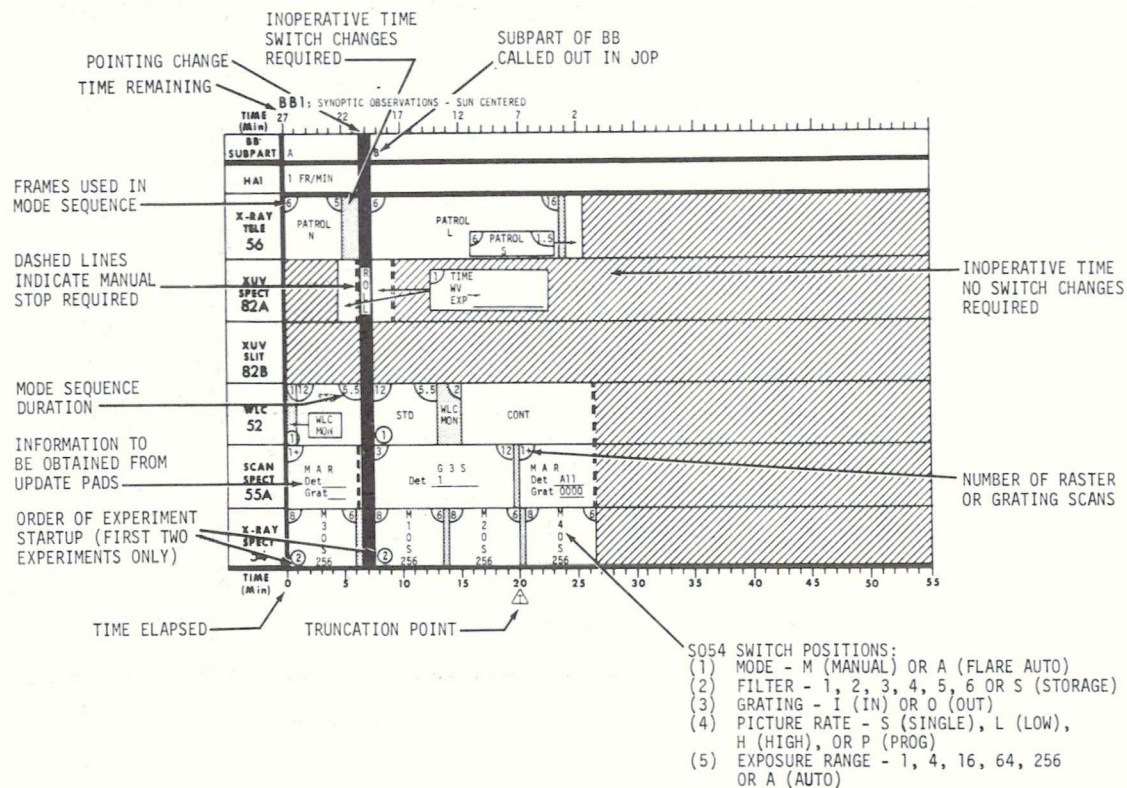
PROCEDURE	REMARKS
1 130 MONITOR: 2 COUNTER 2 ind +/- 00XX 3 4 COUNTER 3 ind +/- 00XX 5 6 7 8 <u>XUV SLIT/XUV MON OFFSET DETERMINATION</u> 9 10 ATTITUDE CONTROL SYSTEM: 11 FSS BIAS XUV SLIT sw - XUV SLIT 12 FSS BIAS IN sw - IN 13 14 MONITOR: 15 COUNTER 2 sel - FSS UP/DN: ind = 0000 16 COUNTER 3 sel - FSS L/R: ind = 0000 17 18 TV: 19 MON 1 sel - XUV MON 20 XUV MON DOORS sw - OPEN; 21 tb - white for 10 sec 22 then gray 23 24 MON 1: 25 XUV image of solar disc and XUV MON reticles 26 27 MANUAL POINTING CONTROL: 28 MAN PTG ENABLE sw - ENABLE; tb - EXP 29 MPC - Manipulate as required to center 30 solar disc in circular reticle 31 MAN PTG ENABLE sw - INHIBIT; tb - bp 32 33 MONITOR: 34 COUNTER 2 ind = +/- XXXX; Record _____ 35 COUNTER 3 ind = +/- XXXX; Record _____ 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	UP/DN offset angle in arc seconds L/R offset angle in arc seconds 12.03.17-00 SLIT/MON OF November 1, 1972 Points XUV SLIT to sun center Points XUV MON to sun center Difference between XUV SLIT and XUV MON lines-of-sight

PROCEDURE	REMARKS
1 <u>INTERNAL OCCULTING DISK (D4) CALIBRATION</u> 2 3 NOTE: This calibration procedure is to be 4 completed during a WLC TV downlink pass 5 over a ground station with video transmis- 6 sion capability. 7 8 132 VIDEO sel - ATM MON 1 or 2 as required 9 10 130 TV: 11 WLC PWR sw - ON 12 MON 1 or 2 sel - WLC 13 14 WLC: 15 MIR POS sw - TV 16 SCALE sw - X1, X1 lt on 17 ALIGN sw - DISC MAN 18 19 MODC - Manipulate to drive horizontal and 20 vertical cross pointers of the WLC 21 ALIGN ind to less than 8 arc seconds 22 for either up/down and/or left/ 23 right indications. Hold for 5 sec- 24 onds minimum. 25 26 NEXT 27 28 - Manipulate to drive horizontal and 29 vertical cross pointers of the WLC 30 ALIGN ind to 18-21 arc seconds for 31 either up/down and/or right indi- 32 cations. Hold for 5 seconds minimum 33 34 ALIGN sw - DISC AUTO or PTG 35 MIR POS sw - CAMERA 36 MAIN PWR sw - STBY 37 DOOR tb - white then bp 38 MAIN PWR sw - ON 39 DOOR sw - OPEN; tb - white then gray 40 41 42 43 44 45 46 47 48 49 50	12.03.20-00 D4 CALIBRAT November 1, 1972

PROCEDURE	REMARKS
1 <u>DARKSIDE PREPARATION</u> 2 3 4 5 (From UNATTENDED Configuration do all steps) 6 (From EREP POWERDOWN do asterisked steps 7 only) 8 9 130 DISPLAYS: 10 DAS/ORB PHASE sw - BUS 1 11 POWER SYSTEM sw - BUS 1 12 EVENT TIME sw - BUS 1 13 ACS CNTRS sw - BUS 1 14 15 GROUND/DAS: 16 EXP/TV sw - INHIBIT (locked) 17 18 LIGHTING: 19 *INTEGRAL sw - VAR 20 *NUMERIC cont - as desired 21 22 DAS: 23 PWR sw - BUS 1 24 25 X-RAY TELE: 26 *HV PWR BE sw - ON 27 *HV PWR AL sw - ON 28 *CAMERA AIRLOCK sw - OPEN 29 FLARE sw - ENABLE 30 31 MASTER FLARE MODE: 32 TN/LT sw - ENBL 33 34 ATTITUDE CONTROL SYSTEM: 35 SR/SS sw - SUN; tb - SUN 36 37 SCAN SPECT: 38 INTEN DATA sw - BUS 1 39 RASTER/SCAN RESET sw - RESET 40 HV ENABLE/RESET sw's (7) - OFF (verify) 41 GRATING REF sw - MECH (if req'd) 42 EXP NIGHT INTLK sw - OVERRIDE (if req'd) 43 Set GRATING POS (if req'd) 44 EXP NIGHT INTLK sw - NORMAL 45 46 X-RAY SPECT (Control): 47 *X-RAY IMAGE sw - ENABLE 48 FLARE THRESHOLD COARSE plus FINE sel - 49 per SAP 50	12.03.01-00 DRK SD PREP November 1, 1972 This procedure to be used on the darkside of the orbit prior to the sunside terminator when ATM ex- periment operations are to be con- ducted

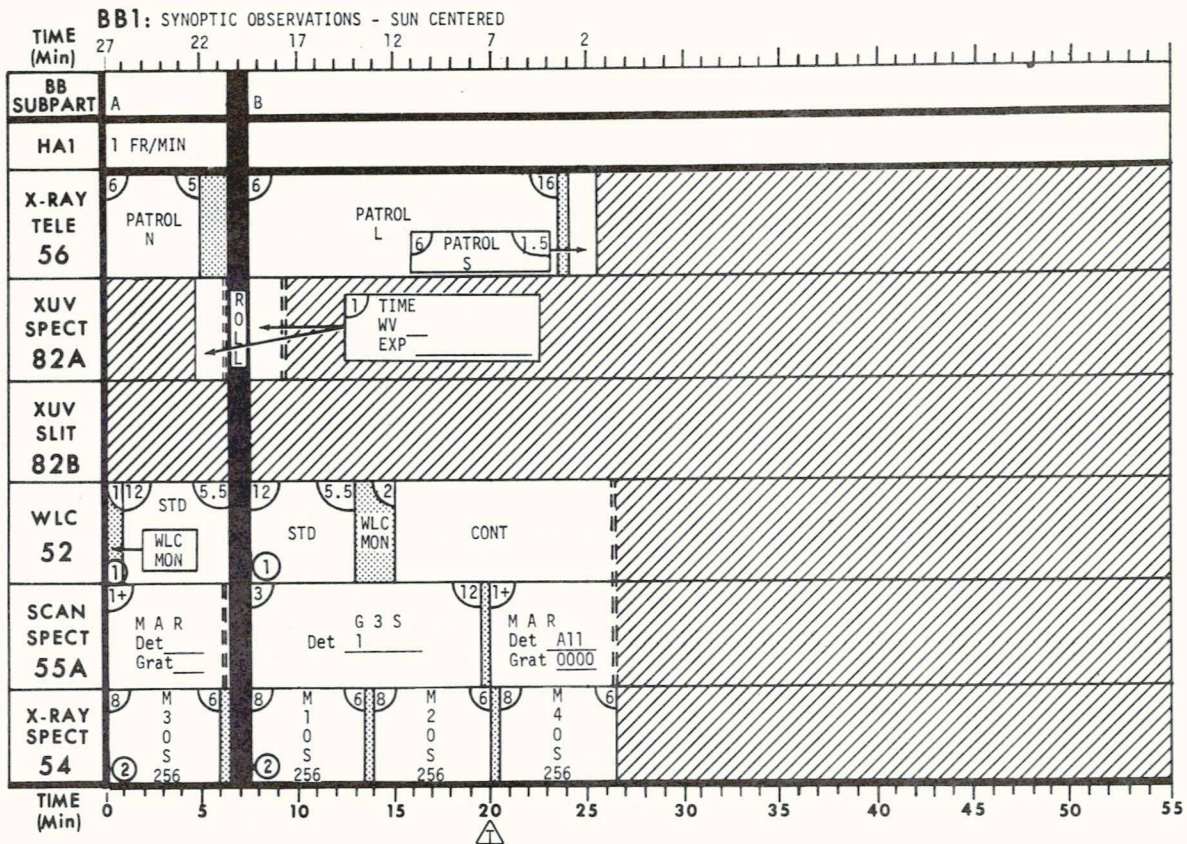
PROCEDURE	REMARKS
1 130 TV: 2 *SYNC GEN sw - PRIM 3 HA1 PWR sw - ON 4 HA2 PWR sw - ON 5 6 128 SRNBM: 7 RF THRESHOLD cont - per SAP 8 9 10 11 <u>SUNSIDE PREPARATION</u> 12 13 130 H-ALPHA: 14 HA1 READY/OPR lt - OPR on 15 16 XUV SLIT: 17 PWR/DOORS sw - ON; tb - white for 10 secs 18 then gray 19 FLARE sw - ENABLE; tb - ENA 20 21 TV: 22 XUV MON DOORS sw - OPEN 23 24 X-RAY ACTIVITY: 25 DATA DRIVE FORWARD sw - FORWARD 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	12.03.19-00 SUN SD PREP November 1, 1972 This procedures is initiated when the sunside terminator is crossed and the daylight portion of the orbit is begun

SAMPLE BUILDING BLOCK WITH EXPLANATIONS



SKYLAB OPERATIONS HANDBOOK

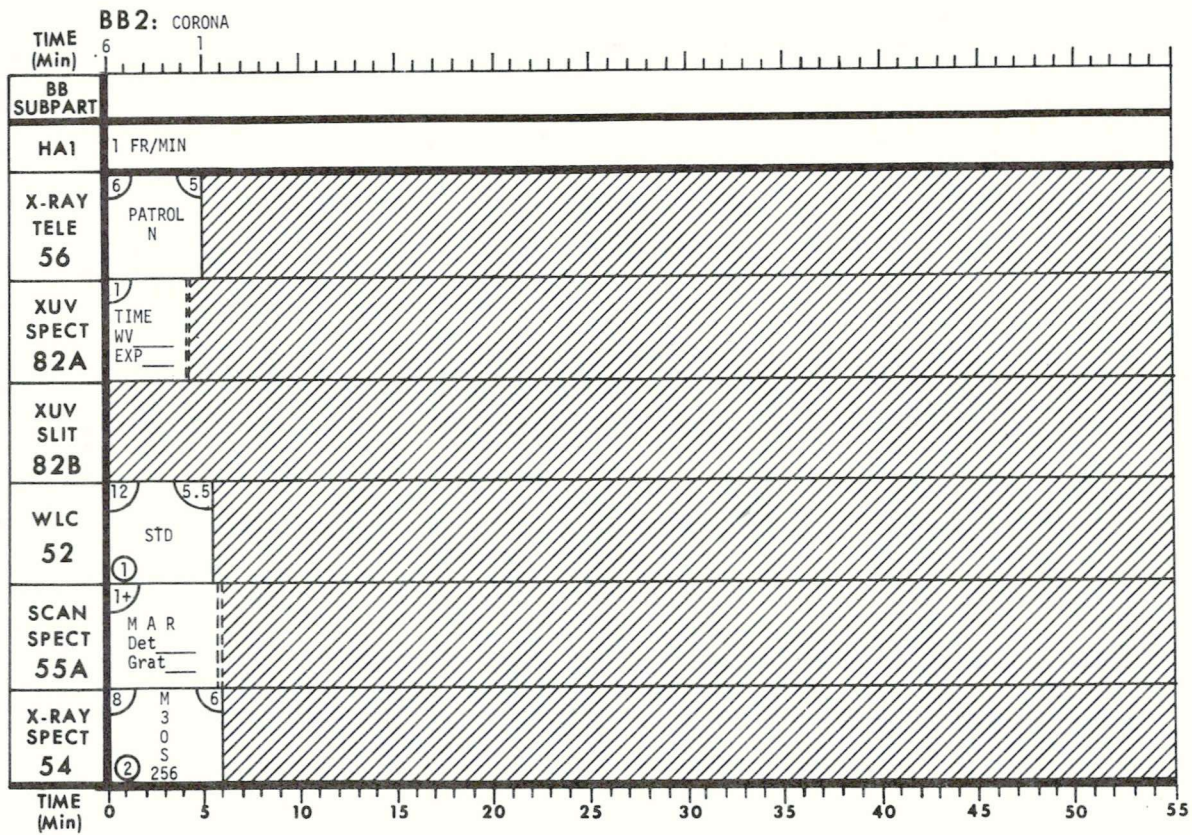
ATM



STC/CPD-3262

SKYLAB OPERATIONS HANDBOOK

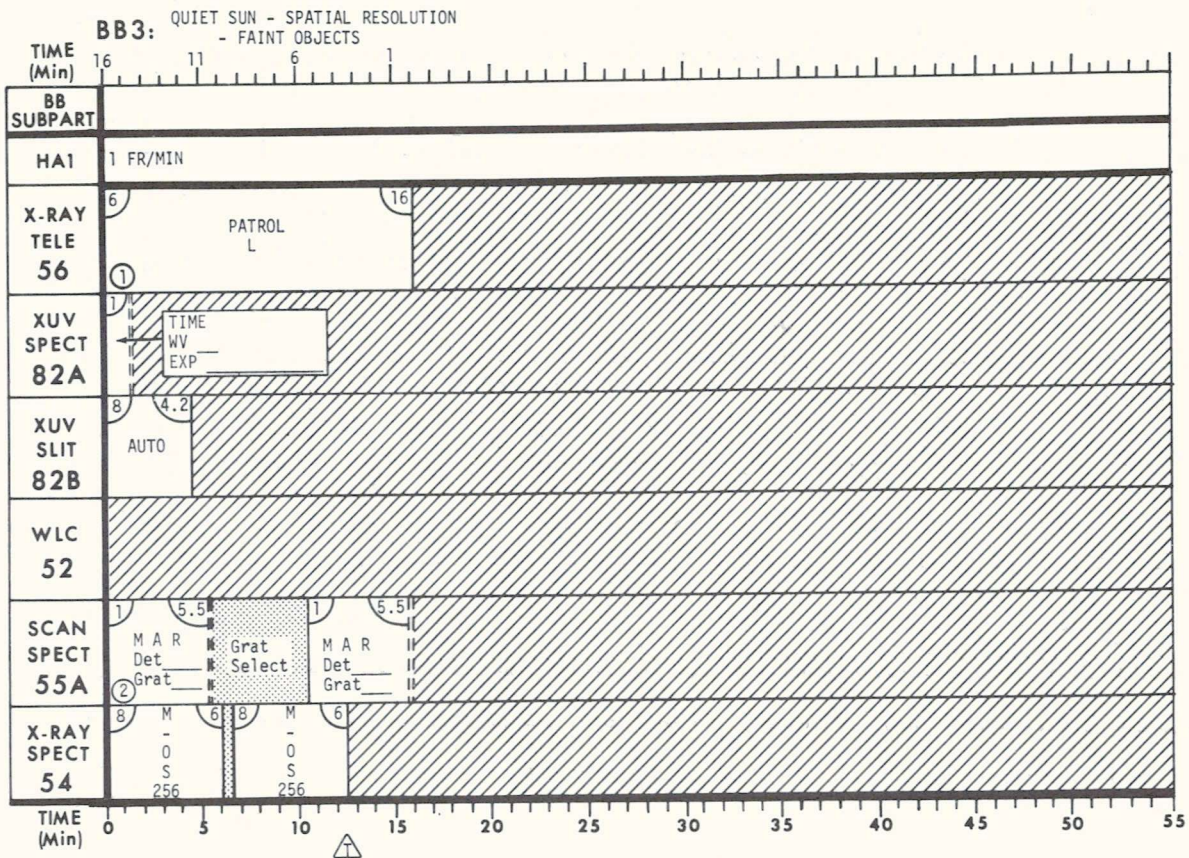
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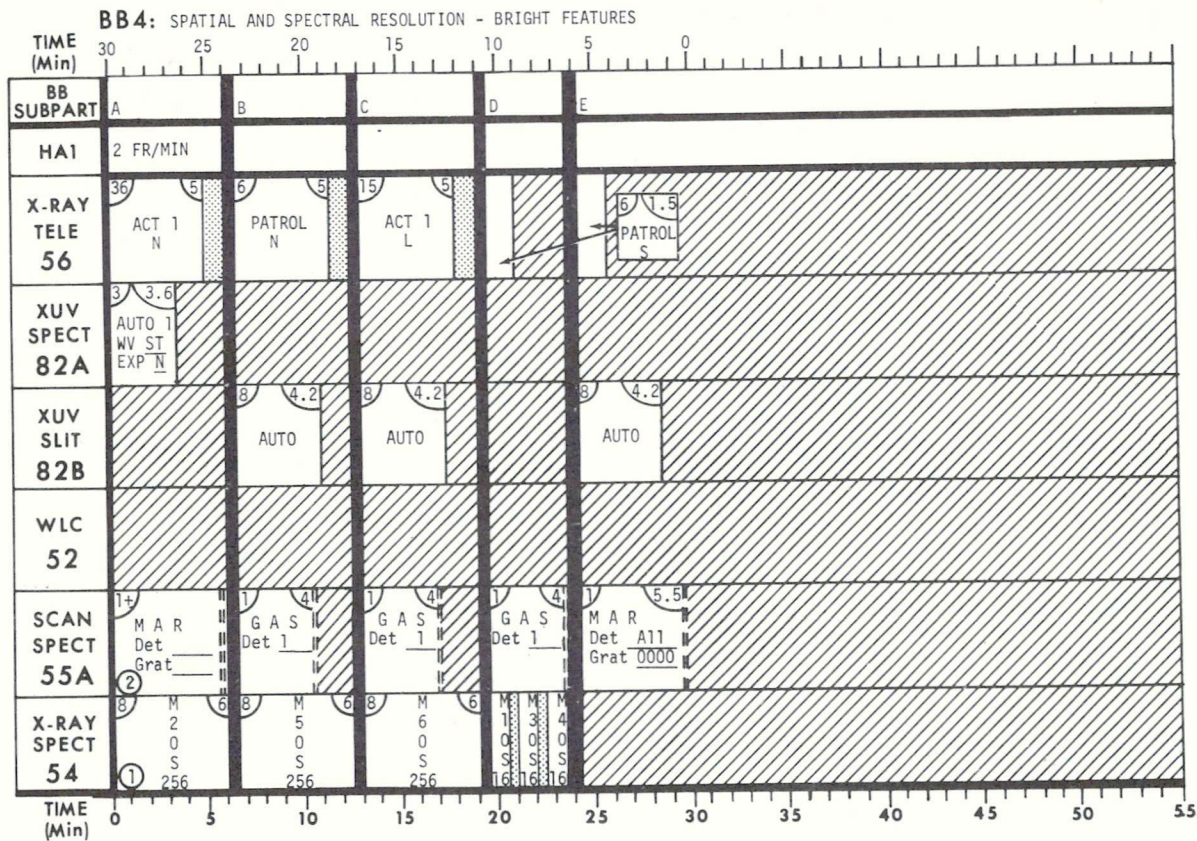


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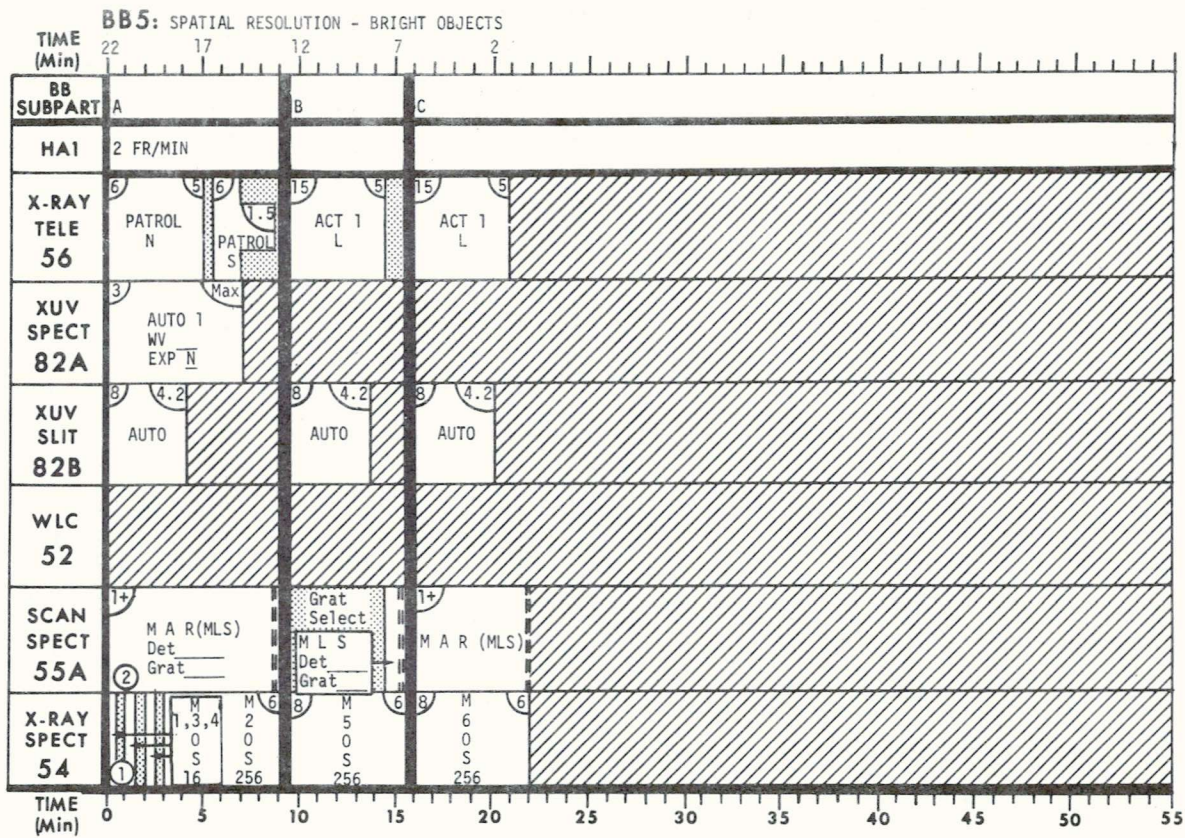
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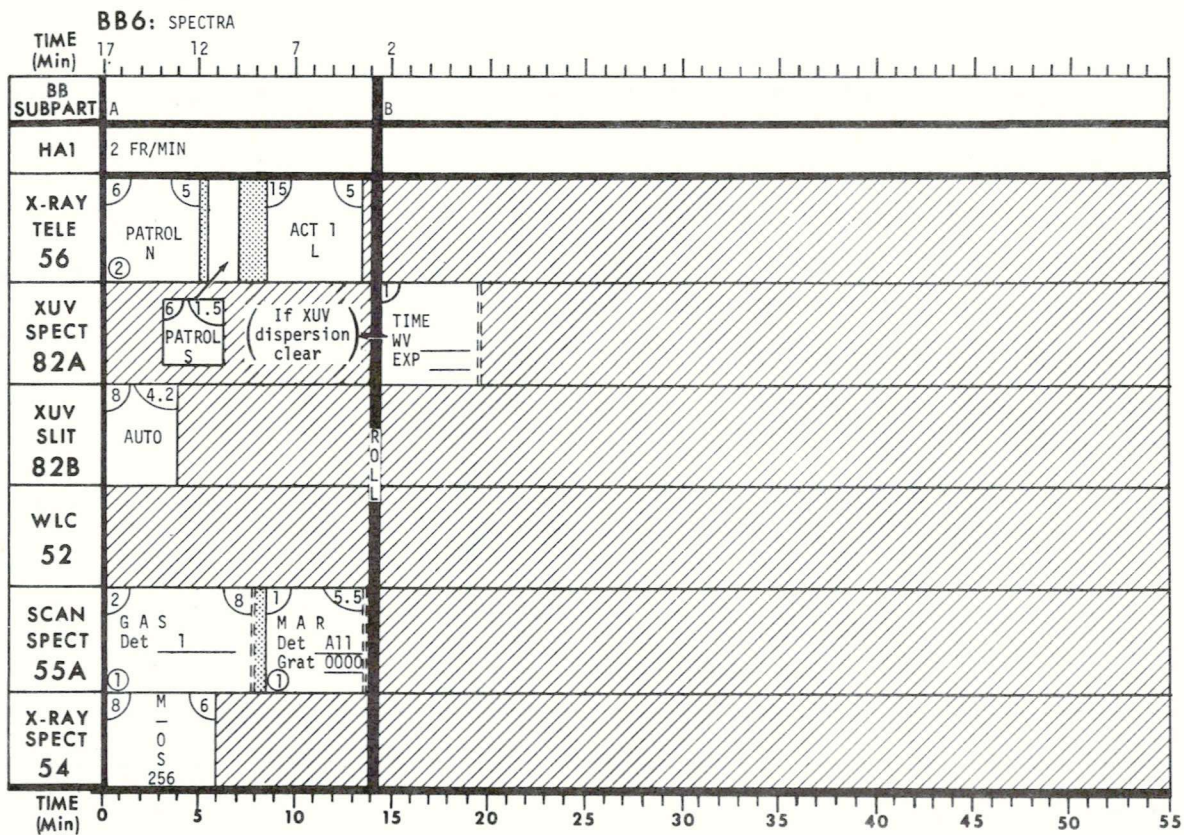
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SKYLAB OPERATIONS HANDBOOK

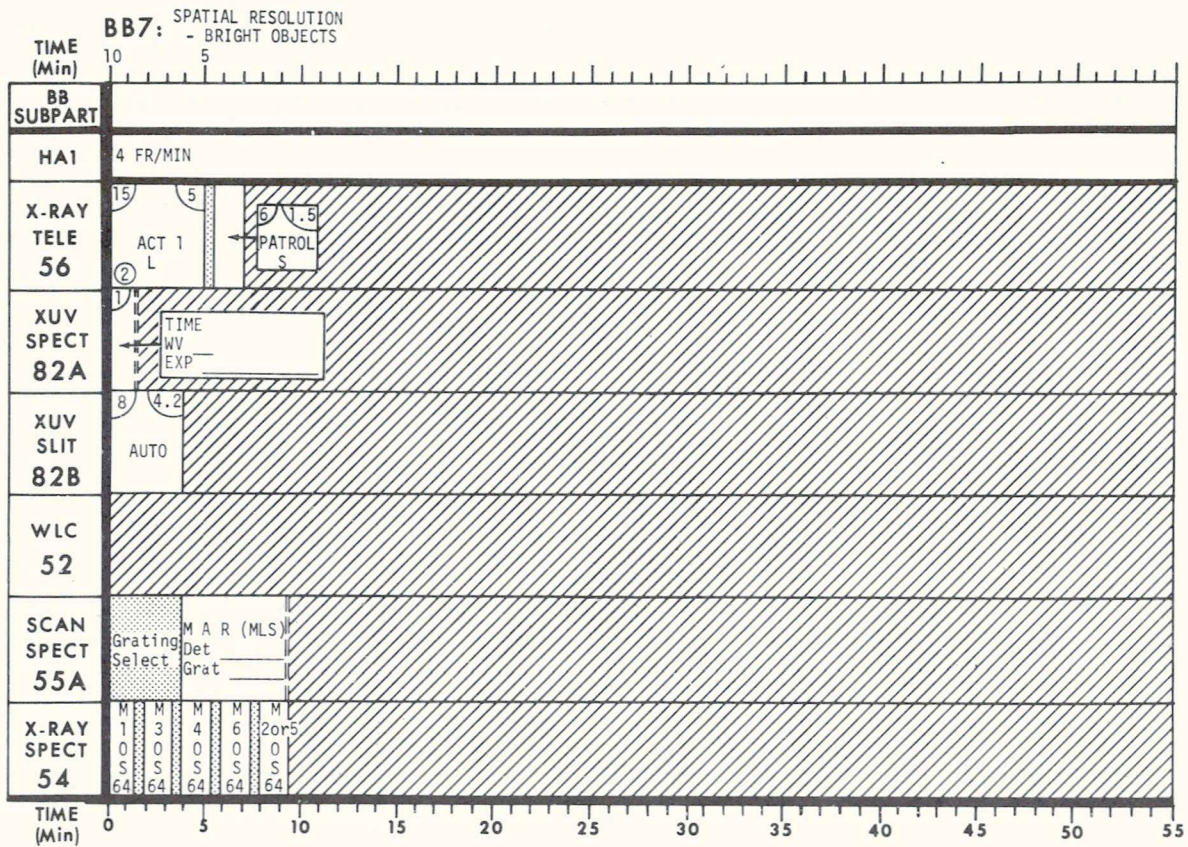
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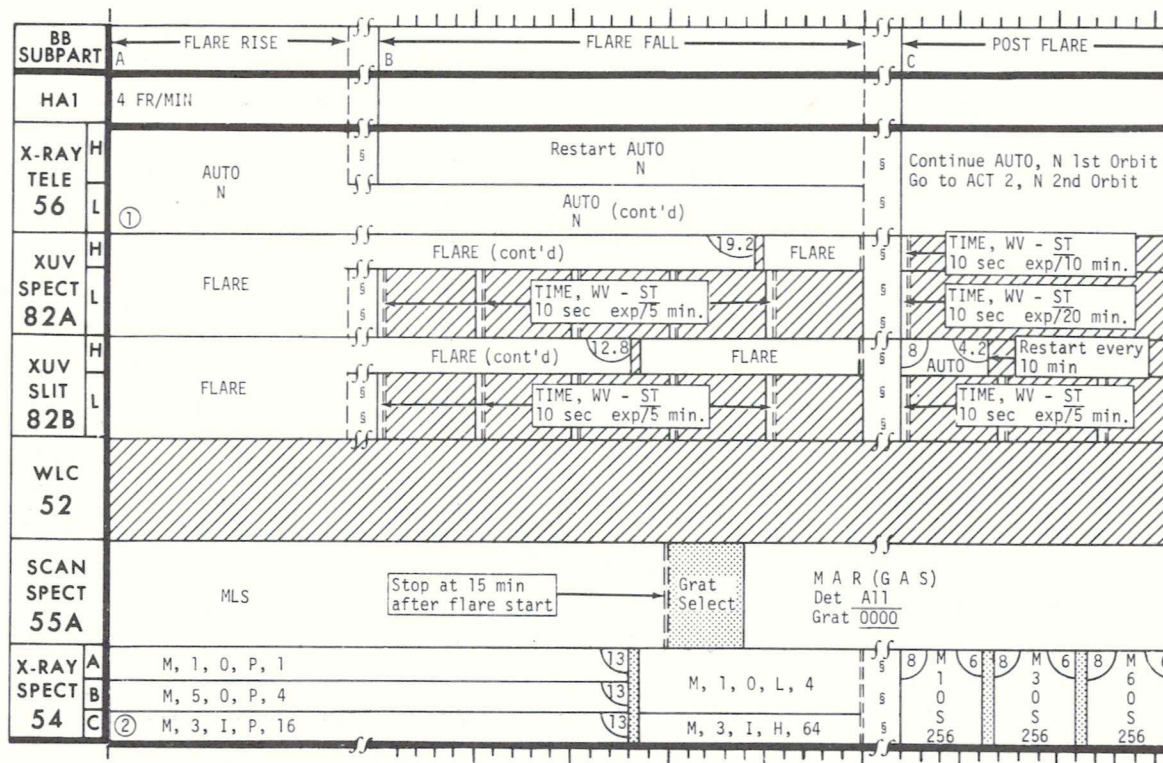
SKYLAB OPERATIONS HANDBOOK

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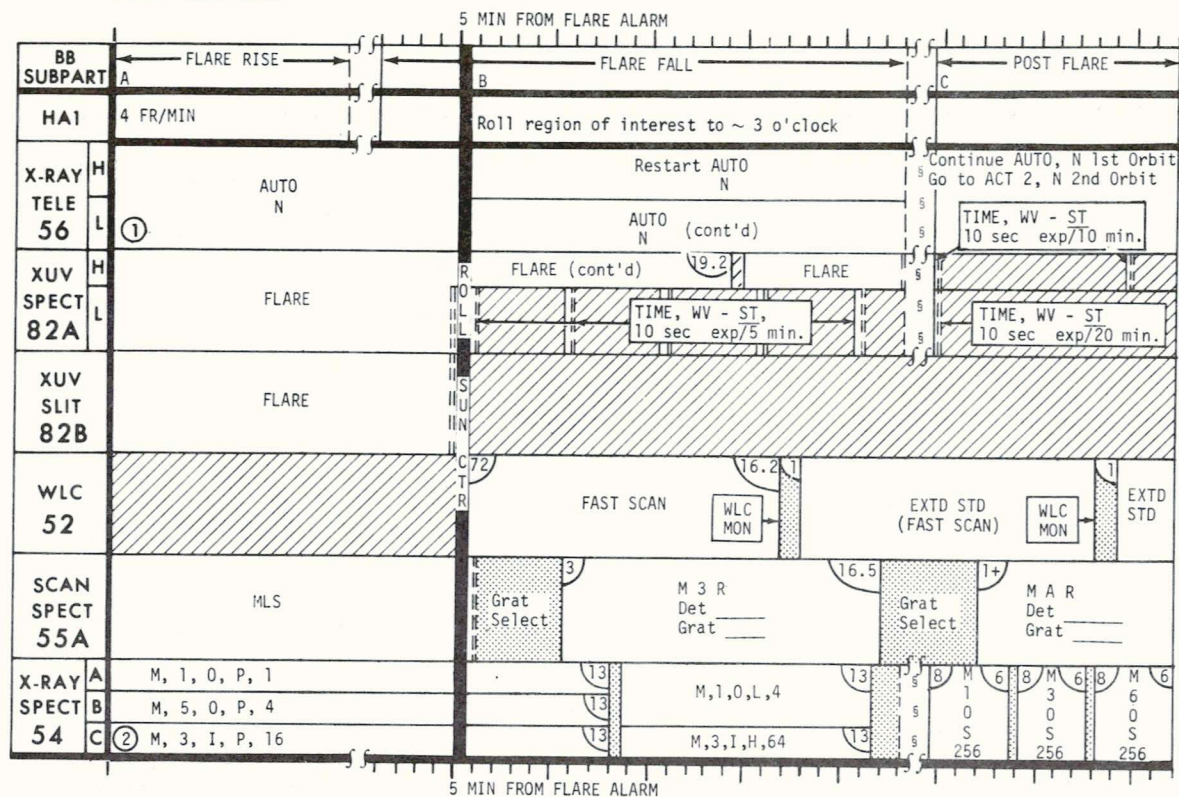
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BB8: FLARE



STC/CPD-3262

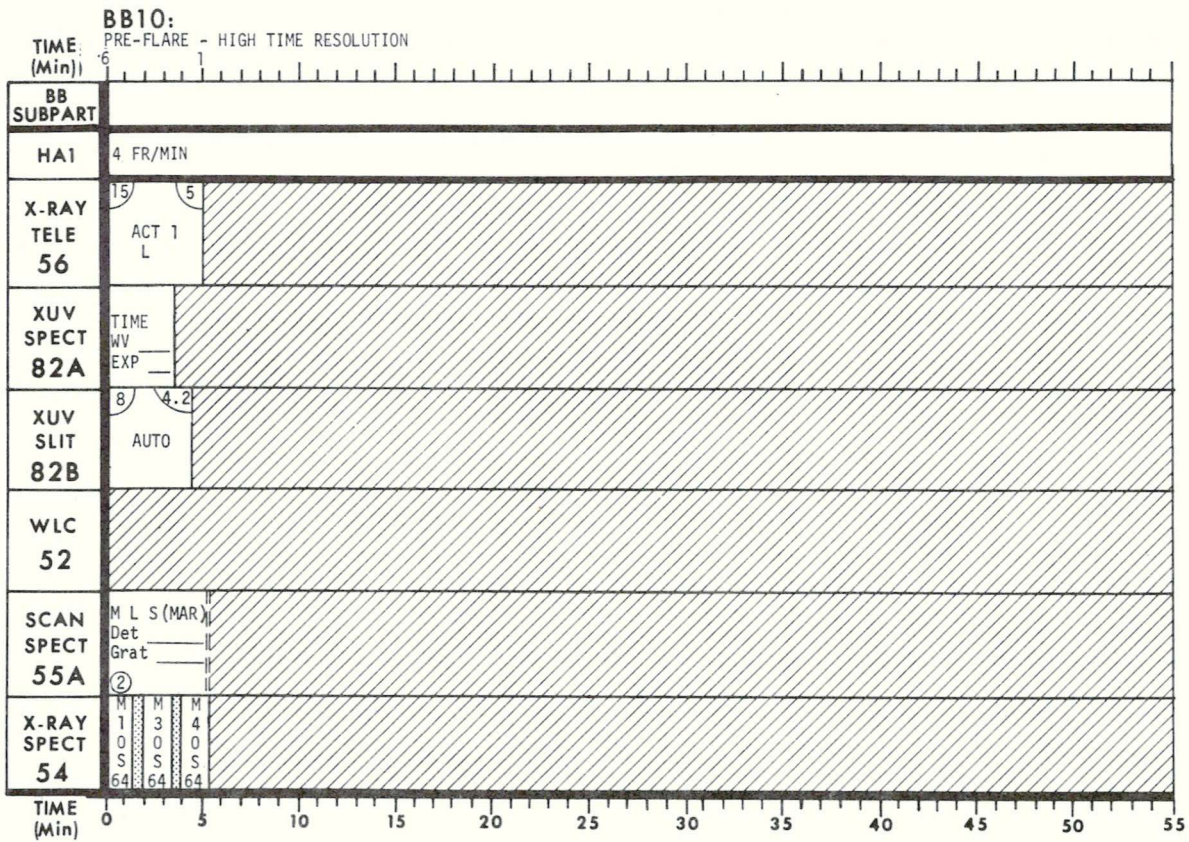
BB9: LIMB FLARE



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SKYLAB OPERATIONS HANDBOOK

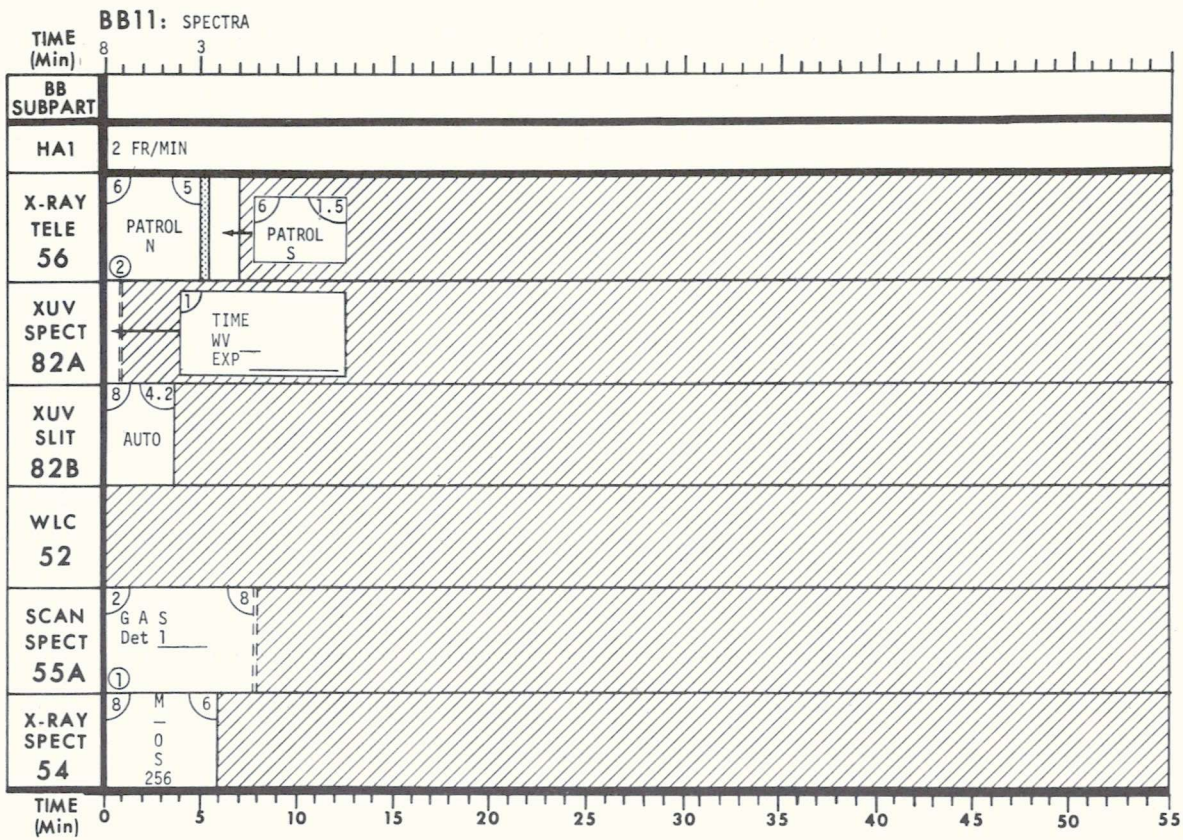
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SKYLAB OPERATIONS HANDBOOK

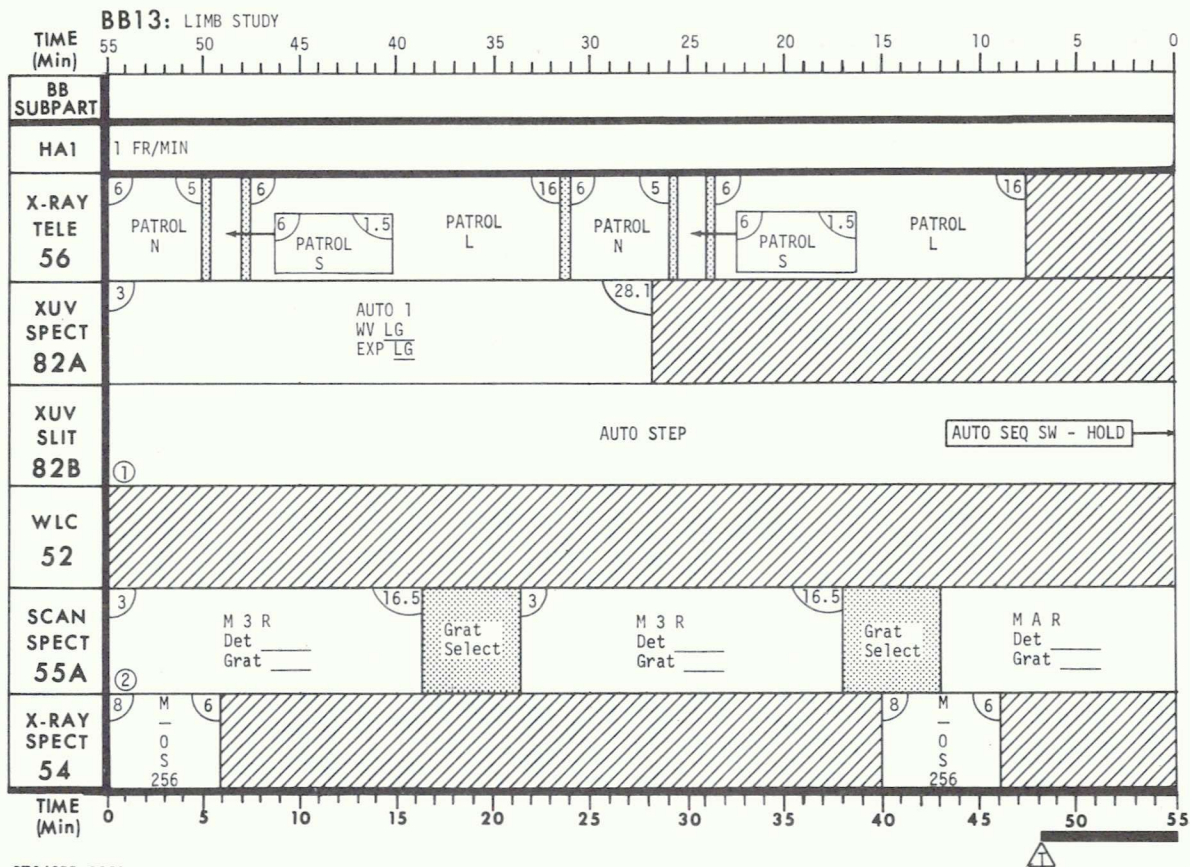
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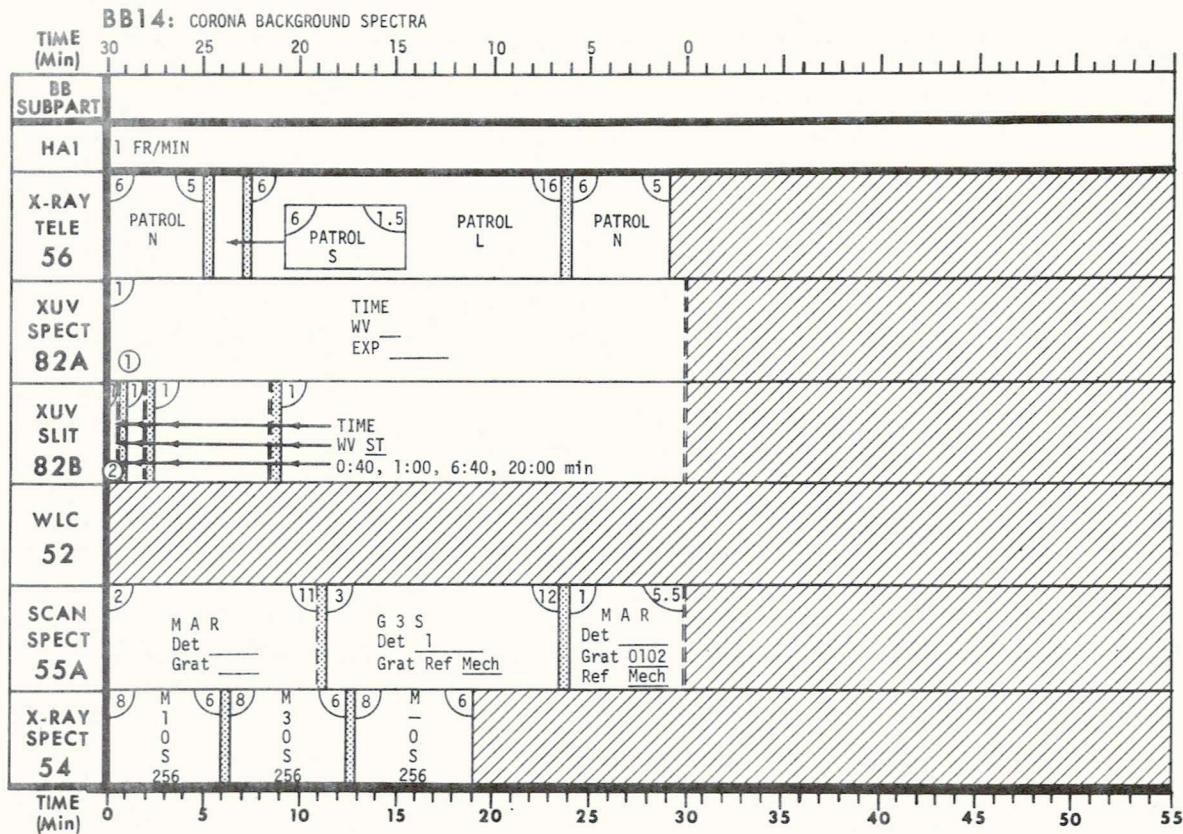
SKYLAB OPERATIONS HANDBOOK

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STC/CPD-3262

SKYLAB OPERATIONS HANDBOOK ATM



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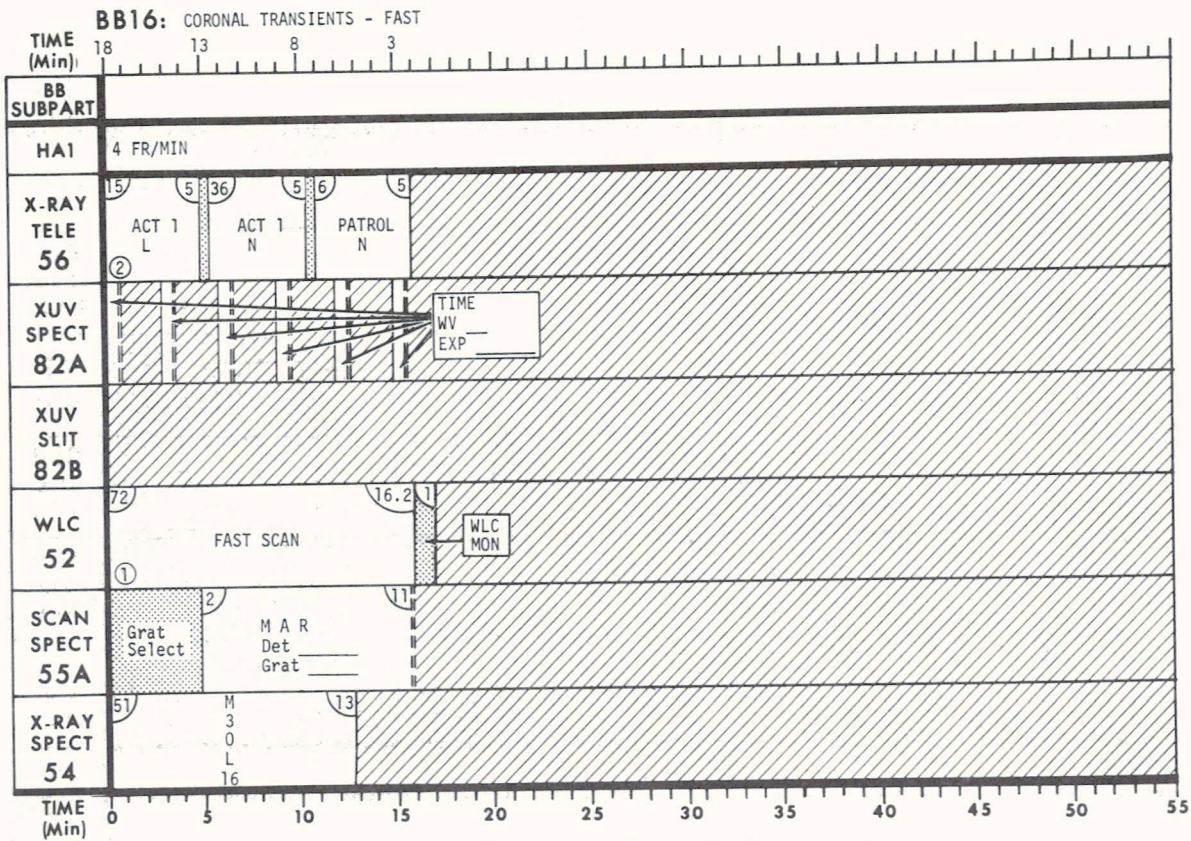
BB15: ATMOSPHERE EXTINCTION

TIME (Min)	BB SUBPART
	HA1 1 FR/MIN
	X-RAY TELE 56 Setup ACT 1, S, X-REA & HV PWR SW'S (3)-ON _____ second exposure every _____ seconds.
	XUV SPECT 82A
	XUV SLIT 82B Setup TIME WV _____ Accurate _____ second exposure every _____ seconds
	WLC 52 Perform only if sun centered START at 1 min. 25 sec. CONT (Sunset case only) START/STOP sw - STOP
	SCAN SPECT 55A STOP (M L S) Det _____ Grat _____ ①
	X-RAY SPECT 54 Setup PHOTO MULT SW - ENABLE M 3(2or4) O H 4 ② START/STOP sw - STOP

TIME (Min)

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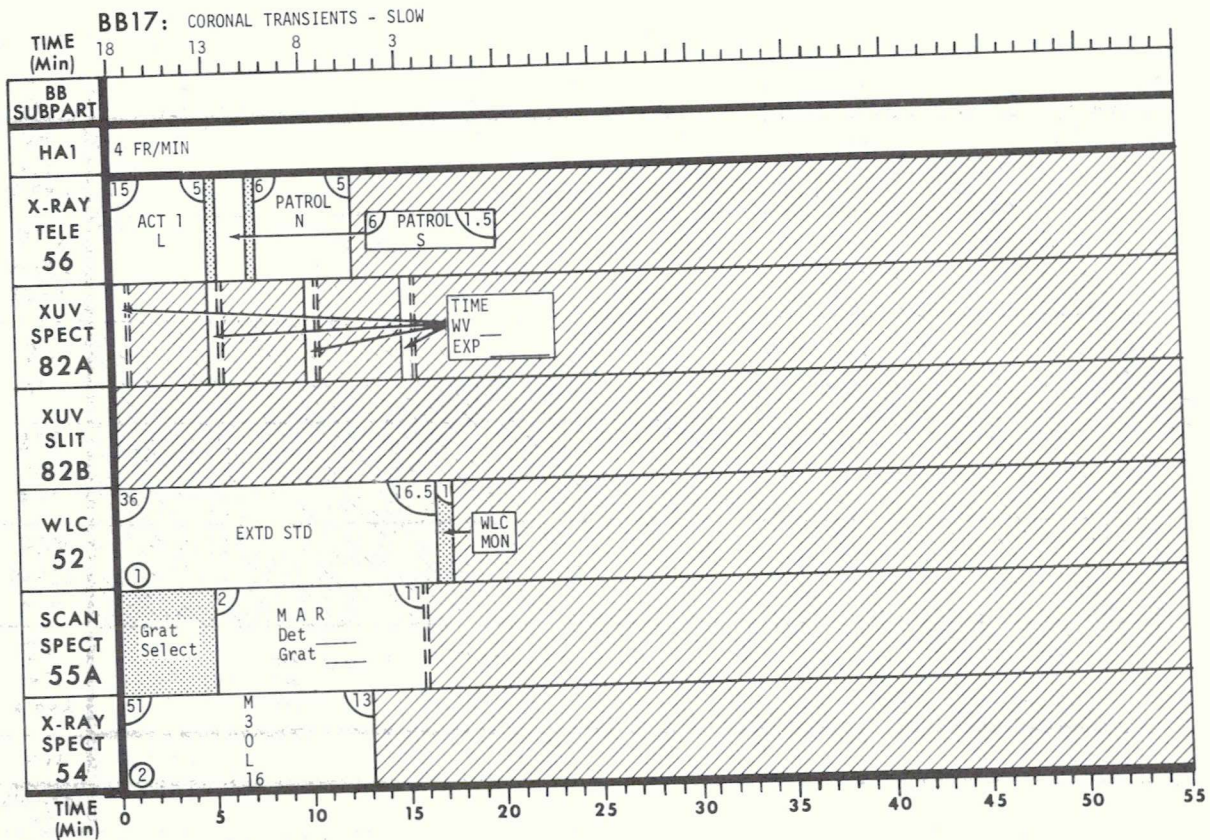
SKYLAB OPERATIONS HANDBOOK ATM



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SKYLAB OPERATIONS HANDBOOK

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BASIC DATE 1 May 1972

CHANGE DATE

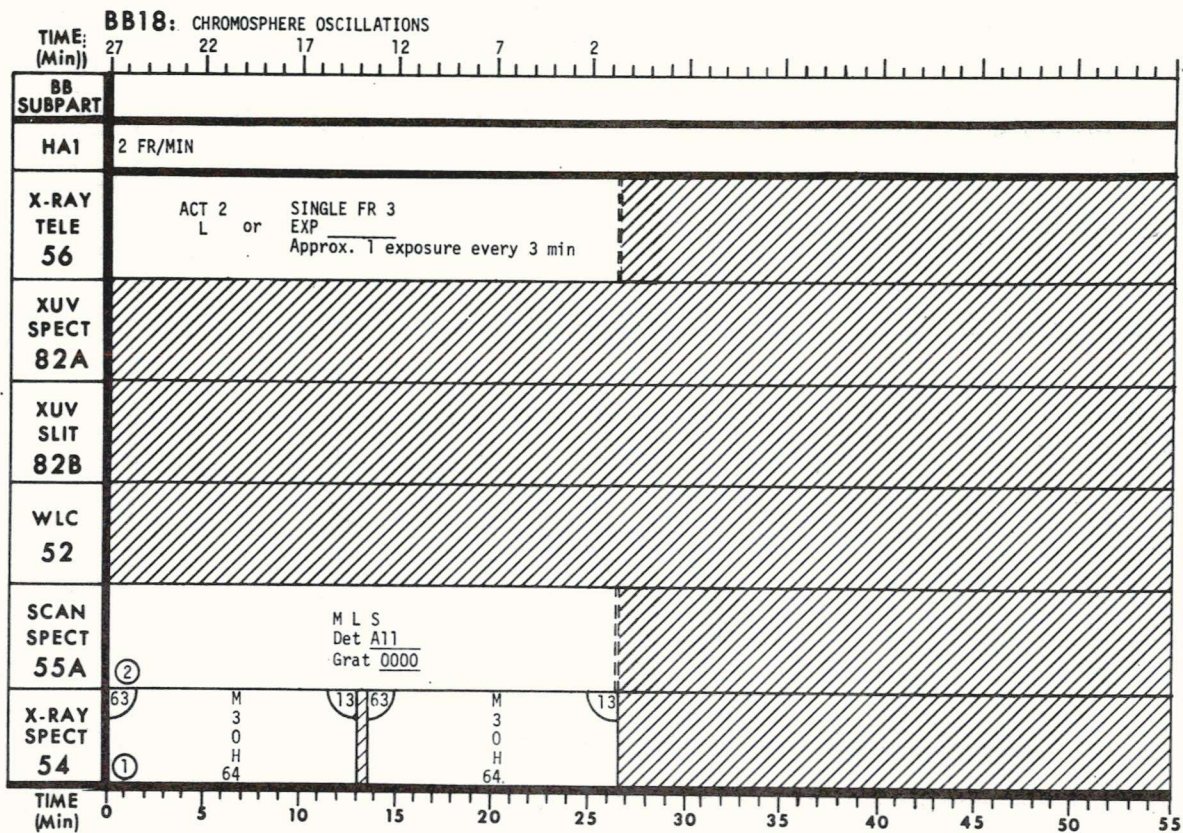
1 Dec 1972

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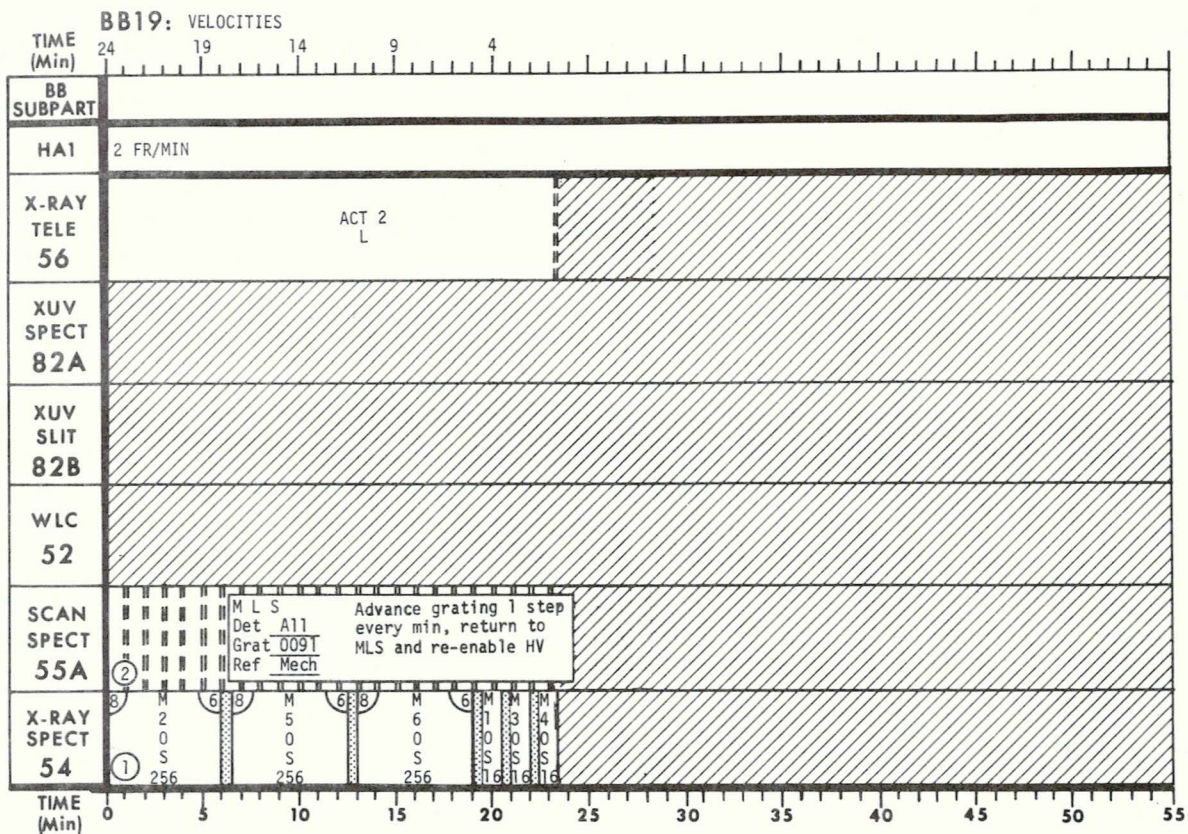
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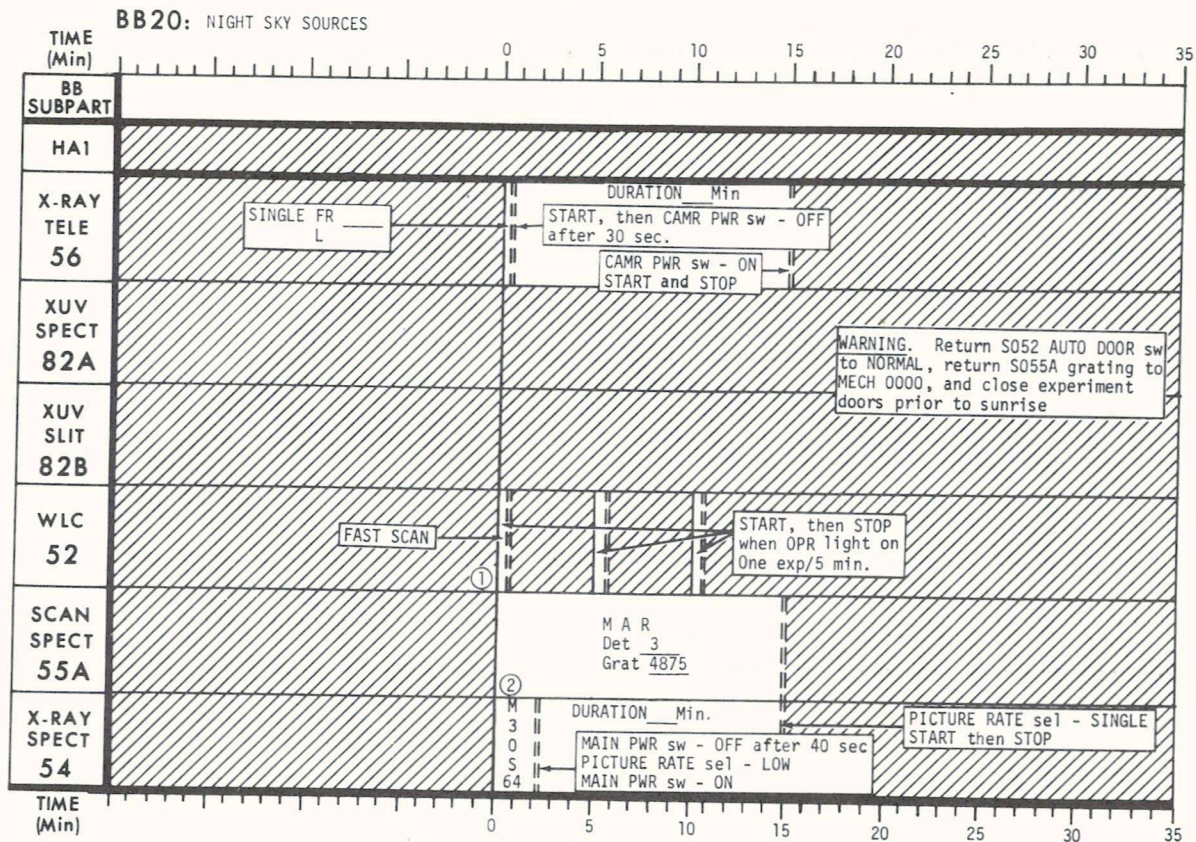
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SKYLAB OPERATIONS HANDBOOK

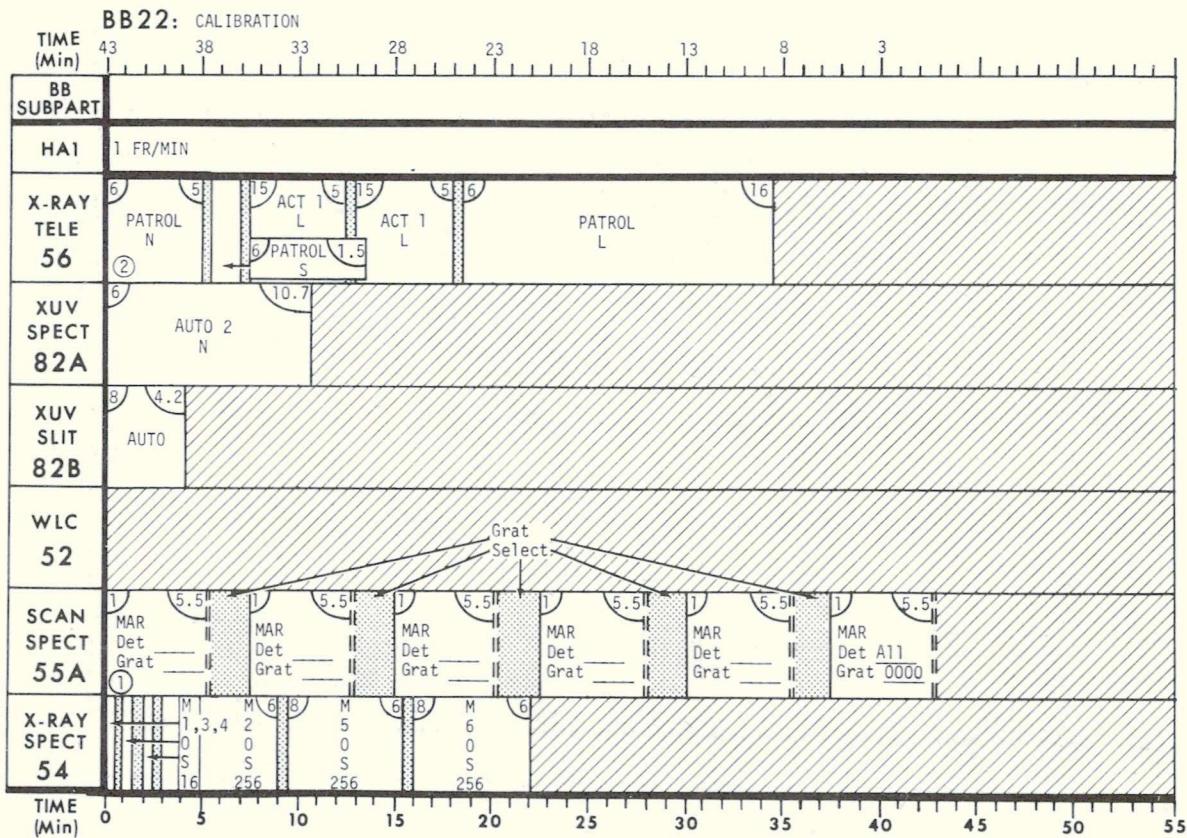
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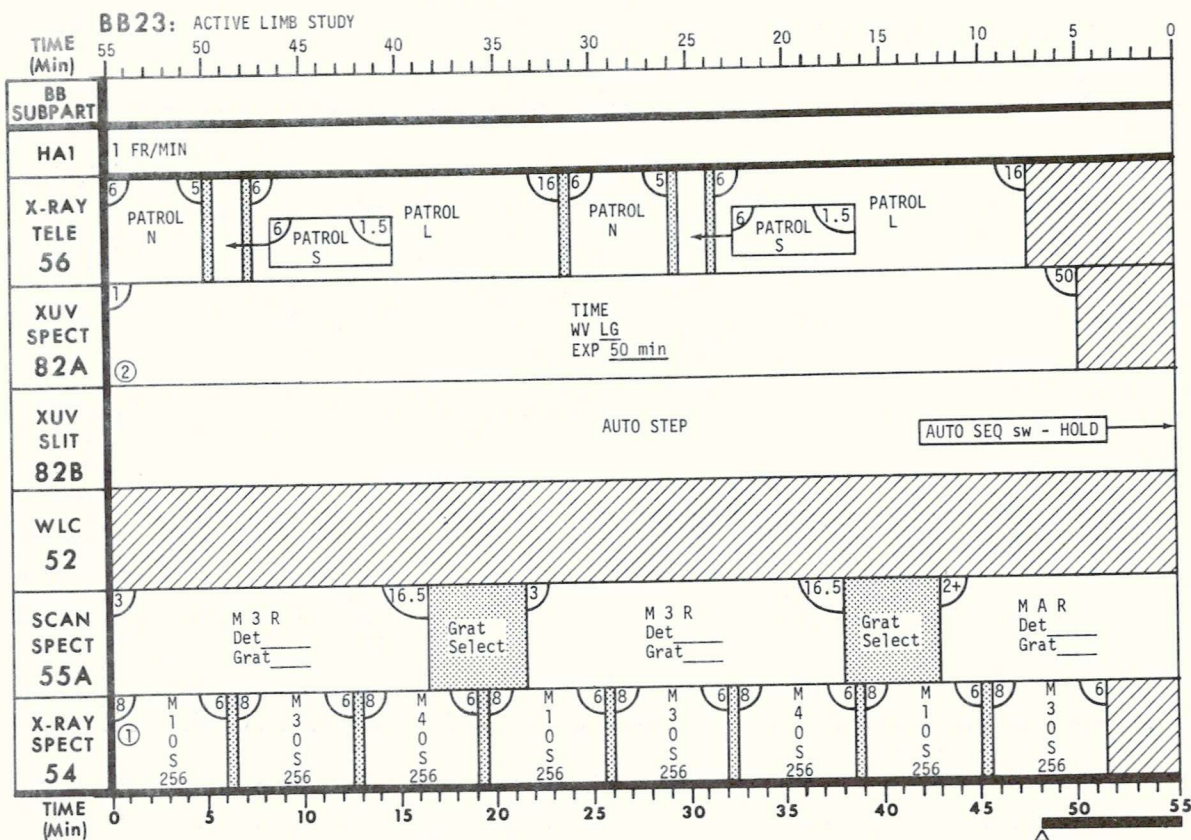
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PROCEDURE	REMARKS
1 <u>EXPERIMENT & CONSOLE POWERDOWN FOR</u> 2 <u>UNATTENDED OPERATION</u> 3 4 5 6 130 H-ALPHA: 7 HA1 FR/MIN sw - 1 8 9 X-RAY TELE: 10 HV PWR BE sw - OFF 11 HV PWR AL sw - OFF 12 CAMERA AIRLOCK sw - CLOSE 13 CAMERA/TELE sel - PATROL 14 EXPOSURE sw - NORMAL 15 FLARE sw - INHIBIT 16 17 MASTER FLARE MODE: 18 TN/LT sw - per SAP 19 20 XUV SPECT: 21 PWR/DOORS tb - bp 22 23 * If PWR/DOORS tb - gray: * 24 * XUV SPECT: * 25 * PWR/DOORS sw - OFF; tb - bp* 26 27 MODE sw - AUTO 2 28 29 XUV SLIT: 30 PWR/DOORS tb - bp 31 32 * If PWR/DOORS tb - gray: * 33 * XUV SLIT: * 34 * PWR/DOORS sw - OFF; tb - bp* 35 36 MODE sw - TIME 37 38 WLC: 39 MAIN PWR sw - STBY 40 AUTO DOOR sw - NORMAL (verify) 41 MODE sw - STD 42 ALIGN sw - PTG 43 44 X-RAY/RF ACTIVITY: 45 DATA DRIVE FORWARD sw - OFF 46 47 ATTITUDE CONTROL SYSTEM: 48 SR/SS sw - SUN (verify) 49 50	12.03.13-00 PWR DN UNAT November 1, 1972 STDN will control experiment operations

PROCEDURE	REMARKS
1 130 SCAN SPECT: 2 GRATING REF sw - OPT 3 HV ENABLE/RESET sw's (7) - OFF 4 MODE sel - STOP 5 INTEN DATA sw - OFF 6 7 X-RAY SPECT (Control): 8 MODE sw - MANUAL 9 FILTER sel - STORAGE; tb - bp 10 X-RAY IMAGE sw - OFF 11 GRATING sw - OUT; tb - OUT 12 PICTURE RATE sel - SINGLE 13 EXPOSURE RANGE sel - 256 14 FLARE THRESHOLD COARSE plus FINE sel - per SAP 15 16 TV: 17 HA RETICLE sw - OFF 18 HA1 PWR sw - OFF 19 HA2 PWR sw - OFF 20 MON 1 sel - XUV MON 21 MON 2 sel - XUV MON 22 XUV MON GAIN sel - 1 23 SYNC GEN sw - OFF 24 XUV MON DOORS tb - bp 25 26 * If XUV MON DOORS tb - gray: * 27 * TV: * 28 * XUV MON DOORS sw - CLOSE; tb - bp* 29 30 WLC PWR sw - OFF 31 32 DISPLAYS: 33 DAS/ORB PHASE sw - OFF 34 POWER SYSTEM sw - OFF 35 EVENT TIME sw - OFF 36 ACS CNTRS sw - OFF 37 38 GROUND/DAS: 39 EXP/TV sw - ENABLE (locked) 40 41 LIGHTING: 42 INTEGRAL sw - OFF 43 NUMERIC cont - fully ccw 44 45 DAS: 46 PWR sw - OFF 47 48 49 50	

PROCEDURE	REMARKS
130 <u>EXPERIMENT MODES</u> <u>H-ALPHA</u> <u>AUTO MODE</u> H-ALPHA: HA1 CAMR PWR sw - ON HA1 DOOR tb - gray (verify) HA1 FR/MIN sw - as required READY/OPR lt - READY on HA1 AUTO sw - AUTO; OPR lt on HA1 FRAMES REMAINING ind - decreases at rate selected by HA1 FR/MIN sw Note: Mode may be manually terminated by HA1 AUTO sw - OFF or the ATMDC may be allowed to terminate and restart mode automatically at ESS and ESR respectively by leaving HA1 AUTO sw - AUTO	12.01.01-00 HA1 AUTO November 1, 1972

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PROCEDURE	REMARKS
1 2 3 4 130 5 WLC: 6 START/STOP sw - STOP; READY lt on 7 8 9 10 11 12 13 14 <u>FAST_SCAN_MODE</u> 15 16 WLC: 17 MODE sel - FAST SCAN; READY lt on 18 START/STOP sw - START 19 20 After first exposure has been completed: 21 READY/OPR lt - OPR on 22	CONT MODE runs until manual stop signal is given. Duration of CONT MODE will be per applicable Building Block Frames expended is time function at 1 frame per 27.5 sec 12.01.05-00 FAST SCN 52 November 1, 1972
23 * If OPR lt does not go on, and FRAMES * 24 * REMAINING ind = 400 +/- 80: * 25 * * * 26 * WLC: * 27 * LOW FILM INHIBIT sw - OVERRIDE * 28 * * * 29 * * * 30 * * * 31 * To be used only when minimal synoptic * 32 * data observation has been completed, * 33 * and FAST SCAN operation is considered * 34 * necessary * 35 36 SEQUENCE COMPLETE tb - bp 37 FRAMES REMAINING ind - decreasing 38 39 When FAST SCAN MODE sequence is complete 40 (16.2 min): 41 SEQUENCE COMPLETE tb - gray 42 READY/OPR lt - READY on 43 FRAMES REMAINING ind - decreased by 72 44 45 46 47 48 49 50	Film remaining is 5% +/- 1% Enables low film inhibit signal to utilize remaining film with the FAST SCAN MODE

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PROCEDURE	REMARKS
1 2 <u>2 OPERATING</u> 3 When X-Ray activity exceeds the preset 4 threshold settings an automatic camera 5 sequence will begin and an indication 6 will be given by the MASTER FLARE audible 7 tone and by the MASTER FLARE MODE X-RAY 8 light. The following procedure should be 9 initiated when a flare is observed: 10 11 130 MASTER FLARE MODE: 12 X-RAY/RF lt - X-RAY on 13 Audible tone - on 14 TN/LT sw - OFF 15 16 Audible tone - off 17 X-RAY/RF lt - off 18 19 X-RAY SPECT (Control): 20 READY/OPR lt - OPR on 21 22 23 24 25 26 MANUAL POINTING CONTROL: 27 MAN PTG ENABLE sw - ENABLE; tb - EXP 28 MPC - Manipulate as required to position 29 flare image to center of X-RAY 30 IMAGE mon 31 MAN PTG ENABLE sw - INHIBIT; tb - bp 32 33 X-RAY SPECT (Display): 34 IMAGE THRESHOLD sel - as desired 35 FOCUS cont - as desired 36 BRIGHTNESS cont - as desired 37 38 <u>3 FLARE AUTO INHIBIT</u> 39 40 X-RAY SPECT (Control): 41 MODE sw - MANUAL; READY lt on 42 43 44 45 46 47 48 49 50	Enable switch can be turned off to silence audible tone once flare has activated camera sequence The experiment is now operating in a FLARE AUTO MODE. Operation is automatic until flare activity de- creases to below the Flare Threshold level or until manually terminated

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 <u>SCAN SPECT</u> <u>GRATING REF MODE</u> This mode is used to return the grating to optical reference position and automatically stop it there after use in other grating modes. Mode can only be performed during orbit day with SCAN SPECT pointed at solar disc. Mode can be enabled during orbit night, and will be started at orbit day automatically by the door 'open' signal SCAN SPECT: MODE sel - GRATING REF GRATING REF sw - OPT HV ENABLE/RESET sw's (7) - OFF START/STOP sw - START GRATING POSITION ind - increases to 05497 +/- 2 resets to 00000 and stops O-ORDER tb - gray RASTER/SCAN COUNTER ind = 00001 RASTER/SCAN RESET sw - RESET RASTER/SCAN COUNTER ind = 00000 DET SEL sw - 1 MAIN HV sw - ENABLE HV ENABLE/RESET 1 sw - ENABLE/RESET READY/OPR lt - READY on INTENSITY DATA ind = XXXXX MODE sel - STOP READY/OPR lt - off HV ENABLE/RESET 2,3,4,7,5 & 6 sw's - ENABLE/RESET	12.01.08-00 GRAT REF 55 November 1, 1972

PROCEDURE	REMARKS
1 <u>GRATING SINGLE STEP MODE (Wavelength Select)</u> 2 3 Used to make observations at discrete wave- 4 lengths not included in GRATING REF MODE 5 6 130 SCAN SPECT: 7 MODE sel - STOP 8 HV ENABLE/RESET 2,3,4,5,6,7 sw's - OFF 9 HV ENABLE/RESET 1 sw - ENABLE/RESET 10 DET SEL sw - 1 11 INTENSITY DATA ind = XXXXX 12 MODE sel - GRATING AUTO SCAN; READY lt on 13 START/STOP sw - START; OPR lt on 14 GRATING POSITION ind - increasing 15 16 When position indicator shows approx 25 17 steps fewer than step number required: 18 START/STOP sw - STOP; READY lt on 19 MODE sel - GRATING SINGLE STEP 20 READY/OPR lt - off 21 22 23 24 START/STOP sw - Pulse START until IN- 25 TENSITY DATA ind reaches 26 a peak level that holds 27 steady for about 2 steps 28 29 INTENSITY DATA ind=XXXXX(peak for 2 steps) 30 GRATING POSITION ind = XXXXX +/- 5 31 RASTER/SCAN RESET sw - RESET 32 RASTER/SCAN COUNTER ind = 00000 33 MODE sel - STOP 34 READY/OPR lt - off 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	12.01.09-00 GSS 55 November 1, 1972 Data from Detector 1 Light does not come on since GRATING SINGLE STEP is not a true operating mode XXXXX = GRATING POSITION desired The instrument is now ready to be advanced to MIRROR AUTO RASTER, MIRROR 3 RASTER L/R or MIRROR LINE SCAN UP/DN for observations in those modes

PROCEDURE	REMARKS
130 <u>GRATING AUTO SCAN MODE</u> ATTITUDE CONTROL SYSTEM: MODE EXP PTG sw - EXP PTG; tb - EXP FSS DR tb - SUN SCAN SPECT: MODE sel - GRATING AUTO SCAN HV ENABLE/RESET sw's (7) - OFF READY/OPR lt - off DET SEL sw - 1 <u>WARNING</u> Detector 1 is the only detector to be used in this mode of operation. Operation of other detectors during spectral scanning can cause them to be damaged as 0-order beam sweeps across the entrance slits SCAN SPECT: HV ENABLE/RESET 1 sw - ENABLE/RESET INTENSITY DATA ind = XXXXX READY/OPR lt - READY on START/STOP sw - START; OPR lt on RASTER/SCAN COUNTER ind = 00000 O-ORDER tb - gray GRATING POSITION ind - count increasing O-ORDER tb - bp at approx 00100 O-ORDER tb - gray at approx 05380 GRATING POSITION ind - count continues increasing to 05497 +/- 2 then resets to 00000 Every 3 min 48 sec after START, sequence above will repeat except RASTER/SCAN COUNTER ind will increase by 1	12.01.10-00 GAS 55 November 1, 1972 In the event of a failure of Detector 1, alternate Detector 3 will be utilized in a contingency mode of operation When the door 'not open' signal is received before the sequence is manually terminated, scanning will automatically stop and HV will be turned off. Scanning will automatically resume upon receipt of the door 'open' signal

PROCEDURE	REMARKS
1 When data taking is complete: 2 130 SCAN SPECT: 3 START/STOP sw - STOP; READY lt on 4 RASTER/SCAN RESET sw - RESET 5 RASTER/SCAN COUNTER ind = 00000 6 7 8 9 <u>GRATING 3 SCAN MODE</u> 10 11 Used to take sequence of 3 spectral scans 12 of target of interest 13 14 ATTITUDE CONTROL SYSTEM: 15 MODE EXP PTG sw - EXP PTG; tb - EXP 16 FSS DR tb - SUN 17 18 SCAN SPECT: 19 MODE sel - GRATING 3 SCAN 20 HV ENABLE/RESET sw's (7) - OFF 21 READY/OPR lt - off 22 DET SEL sw - 1 23 HV ENABLE/RESET 1 sw - ENABLE/RESET 24 25 <u>WARNING</u> 26 27 Detector 1 is the only detector to be used 28 in this mode of operation. Operation of 29 other detectors during spectral scanning, 30 can cause them to be damaged as 0-order 31 beam sweeps across the entrance slits. 32 33 SCAN SPECT: 34 READY/OPR lt - READY on 35 START/STOP sw - START; OPR lt on 36 O-ORDER tb - gray 37 RASTER/SCAN COUNTER ind = 00000 38 GRATING POSITION ind - count increasing 39 O-ORDER tb - bp at approx 00100 40 41 42 43 44 45 46 47 48 49 50	12.01.11-00 G3S 55 November 1, 1972 When the door 'not open' signal is received before the sequence is terminated, scanning will automatically stop and HV will be turned off. Scanning will automatically resume upon receipt of the door 'open' signal

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 SCAN SPECT: O-ORDER tb - gray at approx 05380 GRATING POSITION ind - count continues increasing to 05497 +/- 2 then resets to 00000 3 min 48 sec after START the above sequence repeats except: RASTER/SCAN COUNTER ind = 00001 Approx 7 min 36 sec after START sequence repeats except: RASTER/SCAN COUNTER ind = 00002 Approx 11 min 24 sec after START: O-ORDER tb - gray RASTER/SCAN COUNTER ind = 00003 GRATING POSITION ind - resets to 00000 READY/OPR lt - READY on RASTER/SCAN RESET sw - RESET RASTER/SCAN COUNTER ind = 00000	

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PROCEDURE	REMARKS
130 <u>X-RAY TELE</u> <u>SINGLE FR 1 MODE</u> X-RAY TELE: DOOR sw - OPEN; tb - gray CAMR PWR sw - ON (verify) CAMERA AIRLOCK sw - OPEN (verify) EXPOSURE sw - as required CAMERA/TELE sel - SINGLE FR 1 FILTER tb - 1; READY lt on START/STOP sw - START; OPR lt on When exposure sequence is complete: READY/OPR lt - READY on	12.01.15-00 SF 1 56 November 1, 1972
<u>SINGLE FR 2 MODE</u> Same as SINGLE FR 1 MODE except: X-RAY TELE: CAMERA/TELE sel - SINGLE FR 2 FILTER tb - 2	12.01.16-00 SF 2 56 November 1, 1972
<u>SINGLE FR 3 MODE</u> Same as SINGLE FR 1 MODE except: X-RAY TELE: CAMERA/TEL sel - SINGLE FR 3 FILTER tb - 3	12.01.17-00 SF 3 56 November 1, 1972
<u>SINGLE FR 4 MODE</u> Same as SINGLE FR 1 MODE except: X-RAY TELE: CAMERA/TELE sel - SINGLE FR 4 FILTER tb - 4	12.01.18-00 SF 4 56 November 1, 1972

PROCEDURE	REMARKS
1 <u>SINGLE FR 5 MODE</u> 2 3 Same as SINGLE FR 1 MODE except: 4 5 130 X-RAY TELE: 6 CAMERA/TELE sel - SINGLE FR 5 7 FILTER tb - 5 8 9 10	12.01.19-00 SF 5 56 November 1, 1972
11 <u>SINGLE FR 6 MODE</u> 12 13 Same as SINGLE FR 1 MODE except: 14 15 X-RAY TELE: 16 CAMERA/TELE sel - SINGLE FR 6 17 FILTER tb - 6 18 19 20	12.01.20-00 SF 6 56 November 1, 1972
21 <u>PATROL MODE</u> 22 23 Same as SINGLE FR 1 MODE except: 24 25 X-RAY TELE: 26 CAMERA/TELE sel - PATROL 27 28 29	12.01.21-00 PATROL 56 November 1, 1972
30 <u>AUTO MODE</u> 31 32 Same as SINGLE FR 1 MODE except: 33 34 X-RAY TELE: 35 CAMERA/TELE sel - AUTO 36 37 38	12.01.22-00 AUTO 56 November 1, 1972
39 <u>ACT 1 MODE</u> 40 41 Same as SINGLE FR 1 MODE except: 42 43 X-RAY TELE: 44 CAMERA/TELE sel - ACT 1 45 46 47	12.01.23-00 ACT 1 56 November 1, 1972
48 <u>ACT 2 MODE</u> 49 Same as SINGLE FR 1 MODE except: 50	12.01.24-00 ACT 2 56 November 1, 1972

PROCEDURE	REMARKS
1 2 3 130 X-RAY TELE: 4 CAMERA/TELE sel - ACT 2 5 6 7 <u>ACT 3 MODE</u> 8 9 Same as SINGLE FR 1 MODE except: 10 11 X-RAY TELE: 12 CAMERA/TELE sel - ACT 3 13 14 15 16 <u>X-RAY EVENT ANALYZER (X-REA) OPERATION</u> 17 18 X-RAY TELE: 19 BE APRT POS AUTO sw - AUTO (verify) 20 AL APRT POS AUTO sw - AUTO (verify) 21 X-REA PWR sw - ON (verify) 22 HV PWR AL sw - ON 23 HV PWR BE sw - ON 24 25 X-RAY/RF ACTIVITY: 26 DATA DRIVE BE sw - as required 27 DATA DRIVE RECORD sw - as required 28 DATA DRIVE FORWARD sw - FORWARD 29 30 MONITOR: 31 COUNTER 2 sel - BE COUNT; 32 ind = 1000 to 5000 approx 33 COUNTER 3 sel - AL COUNT: 34 ind = 1000 to 5000 approx 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	12.01.25-00 ACT 3 56 November 1, 1972 12.01.26-00 X-REA OPR November 1, 1972

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PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 2 INITIATE MASTER FLARE MODE: INIT SW - INIT XUV SPECT: FLARE tb - FLR * If FLARE tb - FLR does not occur:* * XUV SPECT: * FLARE SW - ENABLE * MASTER FLARE MODE: * INIT SW - INIT READY/OPR lt - OPR on (for duration of FLARE MODE) WAVE LTH tb - cycles ST and LG When 24 exposure sequence complete (19.2 minutes) READY/OPR lt - READY on FRAMES REMAINING ind - decreased by 24 FLARE tb - bp FLARE sw - as desired; tb - as selected	15 short wavelength and 9 long wave length exposures

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 <u>TIME MODE</u> XUV SPECT: MODE sw - TIME WAVE LTH tb - ST or LG WAVE LTH sw - as desired; tb - as selected READY/OPR lt - READY on <u>EVENT TIMER ENABLED</u> EVENT TIME: XUV SPECT sw - ENABLE SLEW MIN and SEC sw's - as desired TONE sw - as desired XUV SPECT: START/STOP sw - START; OPR lt on When exposure is completed: READY/OPR lt - READY on FRAMES REMAINING ind - decreased by 1 EVENT TIME: START/STOP sw - STOP XUV SPECT sw - INHIBIT <u>EVENT TIMER INHIBITED</u> EVENT TIME: XUV SPECT sw - INHIBIT XUV SPECT: START/STOP sw - START; OPR lt on When exposure is completed (as determined by astronaut): START/STOP sw - STOP; READY lt on FRAMES REMAINING ind - decreased by 1	12.01.30-00 TIME 82A November 1, 1972 Used when automatic modes are not suited for solar activity being observed, or when film supply or viewing time is limited. Timer will continue to count down from 99 min 59 sec until stopped May be omitted if additional TIME mode exposures are to be made with EVENT TIMER START/STOP sw - STOP required to end exposure when Event Timer is inhibited

PROCEDURE	REMARKS
1 <u>XUV SLIT</u> 2 3 4 The XUV SLIT can be operated in any of four 5 data taking modes: AUTO, TIME, FLARE and 6 AUTO STEP. The first three modes are opera- 7 tional in any of the three pointing states: 8 WL DISPLAY, LIMB SCAN or LIMB PTG. The 9 AUTO STEP MODE can be operated only in the 10 LIMB PTG state. START/STOP sw - STOP will 11 terminate any mode in progress at any time. 12 13 <u>CAUTION</u> 14 15 130 PWR/DOORS sw - OFF or MAIN PWR sw - OFF 16 should not be used in place of a STOP to 17 terminate an operating mode because neither 18 command issues a Master Reset to clear the 19 experiment logic circuitry. 20 21 * If WAVE LTH tb - white and READY/OPR lt-* 22 * READY on, STOP command issued while gra-* 23 * ting in transit. To correct, wait 2 * 24 * seconds and WAVE LTH sw - as desired and* 25 * repeat until TB - as selected * 26 27 <u>CAUTION</u> 28 29 Data taking modes should not be initiated 30 prior to temperature stabilization or de- 31 graded data will result. Temperature sta- 32 bilization should be confirmed by STDN. 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	12.01.31-00 AUTO 82B November 1, 1972 STOP may also be issued by 1) MODE sw - cycle 2) MASTER FLARE INIT without FLARE ENABLE

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PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>FLARE MODE</u> The FLARE MODE may be entered from any power-on condition of the experiment after FLARE sw - ENABLE; tb - ENA 130 XUV SLIT: WAVE LTH tb - ST or LG READY/OPR lt - READY on FLARE sw - ENABLE; tb - ENA <u>INITIATE</u> MASTER FLARE MODE: INIT sw - INIT XUV SLIT: FLARE tb - FLR TV: XUV SLIT LIMB POINTING tb - gray XUV SLIT: READY/OPR lt - OPR on WAVE LTH tb - cycles ST and LG When 48 exposure sequence complete (12.8 minutes after START): READY/OPR lt - READY on FRAMES REMAINING ind - decreased by 48	12.01.32-00 FLARE 82B November 1, 1972 28 short wavelength and 20 long wavelength exposures Includes two built-in two minute wait periods

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 <u>TIME MODE</u> XUV SLIT: MODE sw - TIME WAVE LTH sw - as desired; tb - as selected READY/OPR lt - READY on <u>EVENT TIMER ENABLE</u> EVENT TIME: XUV SLIT sw - ENABLE SLEW MIN and SEC sw's - as desired TONE sw - as desired XUV SLIT: START/STOP sw - START; OPR lt on When exposure is completed: READY/OPR lt - READY on FRAMES REMAINING ind - decreased by 1 EVENT TIME: START/STOP sw - STOP XUV SLIT sw - INHIBIT <u>EVENT TIMER INHIBIT</u> EVENT TIME: XUV SLIT sw - INHIBIT XUV SLIT: START/STOP sw - START; OPR lt on When exposure is completed (as determined by astronaut) START/STOP sw - STOP READY/OPR lt - READY on FRAMES REMAINING ind - decreased by 1	12.01.33-00 TIME 82B November 1, 1972 Used when automatic modes are not suited for solar activity being observed, or when film supply or viewing time is limited Timer will continue to count down from 99 min 59 sec until stopped May be omitted if additional TIME MODE exposures are desired START/STOP sw - STOP required to end exposure when event timer is inhibited

PROCEDURE	REMARKS
1 <u>AUTO_STEP_MODE</u> 2 3 4 AUTO STEP MODE can be operated only during 5 the LIMB PTG state. LIMB PTG can be en- 6 tered only from LIMB SCAN state. AUTO STEP 7 MODE requires approximately 146 minutes to 8 complete, and must be interrupted with the 9 AUTO SEQ HOLD command during night period 10 11 12 13 14 15 16 17 <u>LIMB_SCAN_STATE</u> 18 19 LIMB SCAN state is used primarily as a 20 transition to LIMB PTG state and only when 21 the slit to limb angular distance is with- 22 in 40 arc seconds. In this state the as- 23 tronaut actively controls the experiment 24 pointing with the MANUAL POINTING CONTROL. 25 Data taking modes are not normally entered 26 directly from the LIMB SCAN state, although 27 the AUTO, TIME and FLARE MODES can be oper- 28 ated in this state. 29 30 130 ATTITUDE CONTROL SYSTEM: 31 FSS BIAS sw - XUV SLIT 32 FSS BIAS IN sw - IN 33 34 TV: 35 MON 1 sel - XUV SLIT 36 MON 2 sel - HA2 37 38 MON 2: 39 Verify HA2 image in center of screen 40 41 MONITOR: 42 COUNTER 1 sel - ROLL EXP; ind = +/- XXXX 43 COUNTER 2 sel - FSS UP/DN; 44 ind = 0000 +/- 1350 45 COUNTER 3 sel - FSS L/R; 46 ind = 0000 +/- 1350 47 48 49 50	12.01.35-00 LMB SCN 82B November 1, 1972 AUTO STEP MODE is dependent on the primary mirror control system which is activated only in the LIMB PTG state. AUTO STEP MODE is terminated when the aperture door is closed unless the AUTO SEQ HOLD is initiated. Pointing Reference System is turned off by HOLD, and LIMB PTG must be re-initiated at the correct offset as indicated by MONITOR COUNTER 3 prior to AUTO SEQ sw - NORMAL

PROCEDURE	REMARKS
1 130 XUV SLIT: 2 PWR/DOORS sw - ON; tb - white for 10 sec 3 then gray 4 WAVE LTH tb - ST or LG 5 READY/OPR lt - READY on 6 7 TV: 8 XUV SLIT WL DISPLAY sw - WL DISPLAY 9 10 MON 1: 11 White Light Image 12 13 MANUAL POINTING CONTROL: 14 MAN PTG ENABLE sw - ENABLE; tb - EXP 15 ROLL ENABLE sw - ENABLE 16 ROLL LOW RATE sw - as required to obtain 17 desired COUNTER 1 ind 18 reading or to position 19 feature of interest 20 ROLL ENABLE sw - INHIBIT 21 MPC - Manipulate as required to position 22 solar limb image near slit and be- 23 tween vertical fiducial mark images 24 as observed on MON 1 and to obtain 25 a COUNTER 2 ind reading of 0000+/-5 26 27 TV: 28 XUV SLIT WL DISPLAY sw - LIMB SCAN; 29 tb - SC 30 31 MONITOR: 32 COUNTER 3 sel - LIMB OFFSET; 33 ind = 0000 +/- 40 34 Experiment is now ready to enter LIMB PTG 35 STATE 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	COUNTER 2 ind verifies slit normal to solar radial line (+) corona side of limb, (-) disc side of limb

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PROCEDURE	REMARKS
130 * If 50% limit is exceeded: * * MANUAL POINTING CONTROL: * * MAN PTG ENABLE sw - ENABLE; tb - EXP * * MPC - Manipulate L/R as required to * * obtain MIRROR ind = 00 +/- 05 * * MAN PTG ENABLE sw - INHIBIT; tb - bp * <u>AUTO STEP MODE ACTIVATION</u> XUV SLIT: MODE sw - AUTO STEP READY/OPR lt - READY on * If READY/OPR lt - off: * * TV: * * XUV SLIT LIMB PTG tb - PT (verify)* FRAMES REMAINING ind=XXXX;record FR1=____ START/STOP sw - START; OPR lt on WAVE LTH tb - cycles LG and ST MONITOR: MIRROR ind - within +/- 50% (check occasionally during mode) COUNTER 3 ind = -0012 after 04.2 min ind = -0004 for 04.2 min after 08.4 min ind = -0002 for 04.2 min after 12.6 min ind = 0000 for 04.2 min after 16.8 min ind = +0002 for 17.9 min after 34.7 min ind = +0004 for 17.9 min after 52.6 min ind = +0006 for 17.9 min after 70.5 min ind = +0008 for 17.9 min after 88.4 min ind = +0012 for 28.6 min after 117.0 min ind = +0020 for 28.6 min after 145.6 min ind = sequence is complete When 80 exposure sequence complete(146min): XUV SLIT: READY/OPR lt - READY on FRAMES REMAINING ind - decreased by 80	primary mirror to maintain selected limb to slit angular relationship. When MIRROR ind exceeds 50%, the mirror must be repositioned by repointing the canister 12.01.34-00 AUT STP 82B November 1, 1972 AUTO STEP MODE is a series of 10 consecutive AUTO MODE sequences with 10 different limb to slit angles Will be used during HOLD release

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>AUTO_SEQ_HOLD</u> <u>INITIATE</u> Interrupts any data taking mode in progress and retains logic memory. Normally used to interrupt AUTO STEP MODE before spacecraft enters orbit night but may be used to interrupt AUTO or FLARE MODES if desired. Time to sunset is indicated by TIME REMAINING/DIGITAL ADDRESS ind. AUTO SEQ HOLD should be initiated when this indicator reads 60 seconds or less 130 MONITOR: COUNTER 3 ind = +/- XXXX; record: _____ COUNTER 2 ind = +/- XXXX; record: _____ COUNTER 1 ind = +/- XXXX; record: _____ XUV SLIT: AUTO SEQ sw - HOLD READY/OPR lt - OPR on PWR/DOORS sw - OFF; tb - white for 10 secs then bp WAVE LTH tb - ST or LG READY/OPR lt - OPR on FRAMES REMAINING ind = XXXX; record: FR2 = _____	12.01.37-00 AUT HLD 82B November 1, 1972 COUNTER 3 ind must be recorded prior to AUTO seq sw - HOLD which removes LIMB OFFSET readout Required to repoint experiment prior to reactivating AUTO STEP MODE Terminates exposure in progress, encodes mission time on film strip, closes camera shutter and cycles film, stops mode in progress and stores mode status in experiment logic, returns primary mirror to null position and turns off PRS Verifies HOLD properly initiated Grating position indication with door closed will remain during HOLD When in HOLD, OPR light is 'on' even through experiment is not operating and doors are closed Used to determine number of AUTO STEP MODE exposures taken prior to AUTO SEQ HOLD initiate

PROCEDURE	REMARKS
1 To determine the COUNTER 3 LIMB OFFSET ind 2 reading to be used to repoint the experi- 3 ment, calculate delta FR where delta FR = 4 FR1 - FR2 5 6 delta FR not = mult of 8 - use COUNTER 3 7 indication 8 recorded 9 delta FR = mult of 8 - use next LIMB OFF- 10 SET position fol- 11 lowing that re- 12 corded from 13 COUNTER 3 14 See Table below: 15 16 COUNTER 3 17 Indication 18 Recorded 19 20 ind = -0012 21 ind = -0004 22 ind = -0002 23 ind = 0000 24 ind = +0002 25 ind = +0004 26 ind = +0006 27 ind = +0008 28 ind = +0012 29 ind = +0020 30 31 <u>RELEASE</u> 32 33 130 MANUAL POINTING CONTROL: 34 MAN PTG ENABLE sw - ENABLE; tb - EXP 35 MPC - Manipulate UP/DN as required to 36 re-obtain reading recorded from 37 COUNTER 2 before AUTO SEQ sw - HOLD 38 ROLL ENABLE sw - ENABLE 39 ROLL LOW RATE sw - as required to re- 40 obtain reading re- 41 corded from COUNTER 1 42 before AUTO SEQ sw - 43 HOLD 44 ROLL ENABLE sw - INHIBIT 45 46 47 48 49 50	Hold initiated during one of first seven exposures in sequence

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 TV: XUV SLIT WL DISPLAY sw - LIMB SCAN;tb-SC MONITOR: COUNTER 3 ind = +/- 00XX MANUAL POINTING CONTROL: MPC - Manipulate L/R as required to ob- tain desired COUNTER 3 LIMB OFFSET ind reading determined above MAN PTG ENABLE sw - INHIBIT; tb - bp TV: XUV SLIT LIMB PTG sw - LIMB PTG; tb - PT MONITOR: MIRROR ind - within +/- 50% XUV SLIT: AUTO SEQ sw - NORMAL	Re-initiates data taking mode at point where HOLD was initiated

PROCEDURE	REMARKS
130 <u>XUV MON OPERATION</u> TV: XUV MON GAIN sel - 1 XUV MON PWR sw - ON (verify) XUV MON DOORS tb - bp MON 2 sel - XUV MON MON 2: Displays four spots of light <u>CAUTION</u> Do not place XUV MON DOORS sw - OPEN until canister is pointed to within 22.5 arc minutes of sun center as indicated by HA1 or HA2 DOOR tb's - gray. Temporary thermal distortion could result. TV: XUV MON DOORS sw - OPEN; tb - white for 10 sec then gray MON 2: Four spots replaced by XUV solar image and camera faceplate reticle TV: XUV MON GAIN sel - as desired	12.01.38-00 XUV MON OPR November 1, 1972 Should remain on during entire mission Turns on XUV MON high voltage A white light source illuminates four apertures in an aluminum filter on the XUV MON camera faceplate and is used in this condition (MAIN PWR on, camera on, doors closed) to verify camera operation. Test image is available for transmission to ground Turns off test white light source The faceplate reticle consists of horizontal and vertical fiducial marks and a center circle which will appear slightly smaller than the solar disc GAIN sw - 1 position provides minimum camera sensitivity, increasing by a factor of 1.7 per position to maximum sensitivity at position 7

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PROCEDURE	REMARKS
1 <u>SOLAR RADIO NOISE BURST MONITOR OPERATION</u> 2 3 128/ POWER sw - ON (verify) 4 129 CAL NOISE SOURCE sel - AMB 5 SWITCHING MODE sel - ANT/REF 6 ORBIT PERIOD pushbutton sw's - set for 7 orbit time 8 ON TIME pushbutton sw's - set for desired 9 monitor time during orbit 10 START sw - START (At beginning of daylight 11 orbit) 12 13 14 After 15 Minute warmup: 15 ENABLE lt - on 16 THRESHOLD cont - cw until false signals 17 are damped 18 19 After selected ON TIME has expired: 20 ENABLE lt - off 21 22 Automatically at start of next orbit: 23 ENABLE lt - on 24 25 * If ORBIT PERIOD or ON TIME reset is * 26 * necessary: * 27 * ORBIT PERIOD pushbutton sw's - reset as * 28 * desired * 29 * ON TIME pushbutton sw's - reset as de- * 30 * sired START sw - START (At beginning of * 31 * daylight orbit) * 32 33 Repeat calibration portion of checkout pro- 34 cedure at approximately 10 day intervals or 35 or if any irregularity is noticed 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	12.04.44-00 SRNBM OPR November 1, 1972 Can be started any time, but noise will be present until emerging from earth's shadow Must be reset to start each time ORBIT PERIOD or ON TIME is changed. If START sw is depressed at any time in orbit, both ORBIT PERIOD and ON TIME are reset from time when start command was entered. If this occurs the RF alarm should be deactivated at night orbit start and the instrument restarted at the beginning of the daylight orbit.

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>MISCELLANEOUS</u> <u>EXPERIMENT FILM FRAMES REMAINING COUNTER RESET</u> This procedure will be used to reset experiment frames remaining counter(s) after a new film canister has been installed 130 FILM RESET: FILM RESET sel - experiment desired FILM RESET sw - RESET H-ALPHA: FRAMES REMAINING ind - 16000 X-RAY TELE: FRAMES REMAINING ind - 6000 XUV SPECT: FRAMES REMAINING ind - 201 XUV SLIT: FRAMES REMAINING ind - 1608 WLC: FRAMES REMAINING ind - 8025 X-RAY SPEC: FRAMES REMAINING ind - 6000 FILM RESET: FILM RESET sel - OFF	12.04.29-00 FR REM RSET November 1, 1972

PROCEDURE	REMARKS
EVENT TIMING The EVENT TIME section can be used to time events or experiments. It can also automatically time and control shutter open duration for the XUV Spectroheliograph (S082A) and the XUV Spectrograph (S082B). Maximum timing duration is 99 minutes and 59 seconds MANUAL EVENT TIME: SLEW MIN sw - Pulse TENS and/or UNITS as required to set EVENT TIME ind to minutes desired SLEW SEC sw - Pulse TENS and/or UNITS as required to set EVENT TIME ind to seconds desired TONE sw - as desired START/STOP sw - START Audible Tone - on START/STOP sw - STOP AUTOMATIC EVENT TIME: SLEW MIN sw - Pulse TENS and/or UNITS as required to set EVENT TIME ind to minutes desired SLEW SEC sw - Pulse TENS and/or UNITS as required to set EVENT TIME ind to seconds desired TONE sw - as desired XUV SPECT sw - as desired XUV SLIT sw - as desired	12.04.30-00 EVENT TIME November 1, 1972 Timer will count up to 99 min, 59 sec unless stopped Used for S082A Experiment. The timer will close shutter automatically when it times out to 00 MIN 00 SEC Used for S082B Experiment. The timer will close shutter automatically when it times out to 00 MIN 00 SEC

PROCEDURE	REMARKS
1 <u>INFLIGHT MAINTENANCE</u> 2 3 <u>DAS BACKUP CONNECTION & CHECKOUT</u> 4 5 M Unstow connector pliers 6 144 7 130 DAS: 8 PWR sw - OFF 9 10 CONSOLE POWER DISTRIBUTION: 11 cb's CMD/DEPLOY/EVA 1 and 2 - open 12 13 121 Remove dust cap 14 15 Disconnect cable J1 from shorting plug on 16 bracket below DAS Backup using connector 17 pliers if required 18 19 Connect cable J1 to connector on bottom of 20 DAS Backup 21 22 Connect dust cap to shorting plug 23 24 130 CONSOLE POWER DISTRIBUTION: 25 cb's CMD/DEPLOY/EVA 1 and 2 - close 26 27 MONITOR: 28 COUNTER 1, 2, & 3 sel - DAS 29 30 121 CLEAR sw - CLEAR 31 DIGIT 1-5 sel - 52003 (Display ATMDC data) 32 DATA TRANS sw - DATA TRANS 33 ENTER sw - ENTER 34 CLEAR sw - CLEAR 35 DIGIT 1-5 sel - 50004 (GMT time) 36 DATA TRANS sw - DATA TRANS 37 ENTER sw - ENTER 38 39 MONITOR: 40 Verify displayed time 41 42 M Stow connector pliers 43 144 44 45 46 47 48 49 50	19.14.01-00 BDAS CONNEC November 1, 1972

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 M 144 202 129 128 128 129 128 128 129 128 129 128 129 128 129 202 128 M 144 Perform POWER UP & CHECKOUT procedures 12.04.43-00	19.14.02-00 REDUN SRNBM November 1, 1972 J1 provides AM power and ATM C&D control to panel J2 provides connection to AM telemetry

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PROCEDURE	REMARKS
1 If image follows commands: 2 Tag W44 as failed 3 130 Lower MPC into mounting hole 4 Tighten 4 screws 5 6 * If image does not follow MPC commands:* 7 * * 8 * Perform 19.14.04-00 MPC REMOVAL * 9 * & REPLACEMENT * 11 M Stow 3/16 Allen bit, handle, and 12 144 connector pliers	
16 <u>MPC REMOVAL & REPLACEMENT</u> 18 130 ATTITUDE CONTROL SYSTEM: 19 EPC 800 HZ sw - OFF 21 MANUAL POINTING CONTROL: 22 Turn ring on cable W44 fully ccw until 23 connector disengages from J2 24 25 Turn ring on cable W45 fully ccw until 26 connector disengages from J1 28 157 Unstow spare MPC 30 Tag and stow failed MPC 32 130 MANUAL POINTING CONTROL: 33 Align black stripe on W44 cable connector 34 with black strip on J1 connector 35 36 Push W44 connector into J1 until bayonet 37 engages keyway 38 39 Turn ring on W44 fully cw until connector 40 mates with J1 41 42 Connect W45 to J2 43 44 Lower spare MPC into mounting hole 45 46 Tighten 4 screws	19.14.04-00 MPC REMOVAL November 1 1972 There is no alignment stripe on J2

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 ATTITUDE CONTROL SYSTEM: EPC 800 HZ sw - PRIMARY TV: MON 1 sel - HA1 or 2 (verify) MANUAL POINTING CONTROL: MAN PTG ENABLE sw - ENABLE;tb - EXP(verify) MPC - Manipulate UP/IG, DN/IG, L/OG, R/OG and verify HA1 or 2 image on MON 1 moves accordingly	

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>ACCUTRON TIMER REPLACEMENT</u> M Unstow Accutron Timer set key 144 130 Pull timer free 157 Remove spare timer Tag and stow failed timer Insert point of Accutron Timer set key into appropriate hole in case and plush until desired number appears in window on face Repeat as required to obtain proper setting 130 Align the 3 holes in timer with studs on panel and press timer into place M Stow Accutron Timer set key 144	19.14.05-00 TIMER REPL November 1, 1972

PROCEDURE	REMARKS
1 <u>EVENT TIMER/FLARE ALARM TONE VOLUME ADJUST</u> 2 3 M Unstow 1/8 blade driver 4 144 5 6 1 <u>EVENT TIMER TONE</u> 7 8 130 EVENT TIME: 9 SLEW MIN & SEC SWS - as required to set 10 EVENT TIME ind to 0002 11 TONE sw - ENABLE 12 START/STOP sw - START 13 Audible tone - on 14 15 Place 1/8 blade driver in upper hole of 16 tone generator in lower left corner of 17 console. Turn driver cw to increase 18 tone volume or ccw to decrease tone 19 volume as desired. 20 21 EVENT TIME: 22 START/STOP sw - STOP 23 TONE sw - INHIBIT 24 25 2 <u>FLARE ALARM TONE</u> 26 27 X-RAY SPECT (CONTROL): 28 DOOR tb - bp (verify) 29 FLARE THRESHOLD COARSE sel - 0 30 FLARE THRESHOLD FINE sel - 0 31 32 MASTER FLARE MODE: 33 TN/LT SW - ENBL 34 X-RAY/RF lt - X-RAY on 35 Audible tone - on 36 37 Place 1/8 blade driver in lower hole of 38 tone generator in lower left corner of 39 console. Turn dirver cw to increase 40 tone volume or ccw to decrease tone 41 volume as desired. 42 43 44 45 46 47 48 49 50	19.14.06-00 TONE ADJUST November 1, 1972

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 X-RAY SPECT (CONTROL): FLARE THRESHOLD COARSE plus FINE sel - per SAP MASTER FLARE MODE: X-RAY/RF lt - off Audible tone - off M Stow 1/8 blade driver 144	

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>BU I/LCA CONNECTION &</u> <u>CHECKOUT</u> 130 LIGHTING: INTEGRAL cont - fully ccw NUMERIC cont - fully ccw ALERT/STATUS cont ccw INTEGRAL sw - OFF NUMERIC sw - OFF ALERT/STATUS sw - OFF POWER SYSTEM: STATUS LIGHTS ENABLE sw - OFF STATUS LIGHTS PRIM sw - OFF DISPLAYS: DAS/ORB PHASE sw - OFF POWER SYSTEM sw - OFF EVENT TIME sw - OFF ACS CNTRS sw - OFF CONSOLE POWER DISTRIBUTION: cb LCA STATUS LTG BU 1 & 2 (2) - open cb INV AC 1 & 2 (2) - open cb MAIN INV/LCA 1 & 2 (2) - open 202 cb I/LCA HEATERS 1 & 2 (2) - open 119 Remove the four (4) white PATCH PLUGS from panel with a ccw turn-and-pull-off motion	19.14.07-00 B I-LCA CON November 1, 1972 Reduces electrical power to I/LCA before removing input power.

PROCEDURE	REMARKS
1 123 Remove the four (4) metallic PATCH 2 PLUGS from panel with a ccw turn- 3 and-pull-off motion 5 Connect the four (4) white PATCH 6 PLUGS, removed from Panel 119, to 7 Panel 123. The location of each 8 PATCH PLUG is determined by 9 matching the color on the panel with 10 the identical color on the PATCH PLUG. 11 Align marker on each PATCH PLUG 12 with the alignment marker on the 13 panel, push-in PATCH PLUG and twist 14 cw until locked in place. 16 119 Connect the four (4) metallic PATCH 17 PLUGS, removed from Panel 123, to 18 Panel 119. (Connection procedure is 19 same as in previous step). 21 124 INTEGRAL BRIGHT cont - ccw 22 NUMERIC BRIGHT cont - ccw 24 130 CONSOLE POWER DISTRIBUTION: 25 cb MAIN INV/LCA 1 & 2 (2) - close 26 cb INV AC 1 & 2 (2) - close 27 cb LCA STATUS LTG BU 1 & 2 (2) - close 29 130 DISPLAYS: 30 DAS/ORB PHASE sw - BUS 1 31 POWER SYSTEM sw - BUS 1 32 EVENT TIME sw - BUS 1 33 ACS CNTRS sw - BUS 1 35 LIGHTING: 36 NUMERIC sw - VAR 38 124 NUMERIC BRIGHT cont - adjust as 39 desired 40 41 42 43 44 45 46 47 48 49 50	Each PATCH PLUG connector is keyed and cannot be inter- changed if crewman fails to match colors of PATCH PLUGS to panel. Panel 130, LIGHTING: INTEGRAL BRIGHT cont, NUMERIC BRIGHT cont, and ALERT/STATUS BRIGHT cont are all inoperable with the BU I/LCA in control.

PROCEDURE	REMARKS
1 130 LIGHTING: 2 LAMP TEST sel - NUMERIC 3 4 ORBIT PHASE: 5 TIME REMAINING/DIGITAL ADDRESS ind = 88_88 6 7 MONITOR: 8 COUNTER 1 sel - ROLL EXP; ind = 8888 9 COUNTER 2 sel - FSS UP/DN; ind = 8888 10 COUNTER 3 sel - FSS L/R; ind = 8888 11 12 LIGHTING: 13 INTEGRAL sw - VAR 14 15 124 INTEGRAL BRIGHT cont - adjust as 16 desired 17 18 130 LIGHTING: 19 ALERT/STATUS sw - FIXED 20 LAMP TEST sel - STATUS 21 22 All power fail lts (6) - on 23 24 25 26 27 28 29 30 31 All READY/OPR lts (7) - on 32 33 34 35 36 37 38 39 40 X-RAY/RF lt - on 41 WLC ALIGN ind scale lt - X10 on 42 WLC SCALE sw - X1 43 WLC ALIGN ind scale lt - X1 on 44 45 46 47 48 49 50	Counters read all 8's when LAMP TEST selector is in NUMERIC ALERT/STATUS sw position "VAR" has no function with the BU I/LCA in control. Yellow power fail lts are: MONITOR PRESS/TEMP ind power fail lt - on WLC ALIGN ind pwr fail lt - on ACS ind pwr fail lt - on ANGLE ind pwr fail lt - on BUS/BAT ind pwr fail lt - on REG/BUS/BAT ind pwr fail lt - on READY - green/OPR - white lts are: H-ALPHA X-RAY TELE XUV SPECT XUV SLIT WLC SCAN SPECT X-RAY SPECT X-RAY/RF lt is green WLC ALIGN ind scale lts are green

PROCEDURE	REMARKS
1 130 LIGHTING: 2 LAMP TEST sel - ALERT 2 3 4 ALERT: 5 All APCS lts (10) - on 6 7 8 9 10 11 12 13 14 LIGHTING: 15 LAMP TEST sel - ALERT 1 16 17 ALERT: 18 All EXP & PWR lts (10) - on 19 20 21 22 23 24 25 26 27 POWER SYSTEM: 28 STATUS LIGHTS PRIM sw - SEC 29 STATUS LIGHTS ENABLE sw - ENABLE 30 31 LIGHTING: 32 LAMP TEST sel - TACS 33 34 ATTITUDE CONTROL SYSTEM: 35 TACS lts (6) - on 36 37 LIGHTING: 38 LAMP TEST sel - OFF 39 40 POWER SYSTEM: 41 STATUS LIGHTS ENABLE sw - TEST and hold 42 Verify CBRM STATUS lts (54) - on (release TEST) 43 44 45 46 47 48 49 50	Blue APCS ALERT lts are: ACS lt - on CMPTR REJ lt - on CMG MALF lt - on BRG TEMP 1 lt - on BRG TEMP 2 lt - on BRG TEMP 3 lt - on & 4 blank lts Blue EXP & PWR ALERT lts are: SCAN SPECT lt - on X-REA HV lt - on BE COUNT lt - on AL COUNT lt - on DOOR OPEN lt - on PWR SYS lt - on BAT CHG lt - on & 3 blank lts All lights green Lights go out upon releasing TEST sw

PROCEDURE	REMARKS
1 <u>BU I/LCA DISCONNECT & POWERDOWN</u> 2 3 4 124 INTEGRAL BRIGHT cont - ccw 5 NUMERIC BRIGHT cont - ccw 6 7 130 LIGHTING: 8 INTEGRAL sw - OFF 9 NUMERIC sw - OFF 10 ALERT/STATUS sw - OFF 11 12 POWER SYSTEM: 13 STATUS LIGHTS ENABLE sw - OFF 14 STATUS LIGHTS PRIM sw - OFF 15 16 CONSOLE POWER DISTRIBUTION: 17 LCA STATUS LTG BU 1 & 2 cbs - open 18 INV AC 1 & 2 cbs - open 19 MAIN INV/LCA 1 & 2 cbs - open 20 21 119 Remove the four (4) metallic PATCH PLUGS 22 from panel with a ccw turn and pull off 23 motion 24 25 123 Remove the four (4) white PATCH PLUGS from 26 panel with a ccw turn and pull off motion 27 28 Connect the four (4) metallic PATCH PLUGS, 29 removed from Panel 119, to Panel 123. The 30 location of each PATCH PLUG is determined 31 by matching the color on the panel with the 32 identical color on the PATCH PLUG. Align 33 marker on each PATCH PLUG with the alignment 34 marker on the panel, push in PATCH PLUG and 35 twist cw until locked in place. 36 37 119 Connect the four (4) white PATCH PLUGS, re- 38 moved from Panel 123, to Panel 119. Con- 39 nection procedure is same as in previous 40 step. 41 42 43 44 45 46 47 48 49 50	19.14.08-00 BI-LCA DIS November 1, 1972 Reduce electrical power to BU I/LCA Each PATCH PLUG connector is keyed and cannot be interchanged if crewman fails to match colors of PATCH PLUGS to panel

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 CONSOLE POWER DISTRIBUTION: MAIN INV/LCA 1 & 2 cbs - close INV AC 1 & 2 cbs - close LCA STATUS LTG BU 1 & 2 cbs - close POWER SYSTEM: STATUS LIGHTS PRIM sw - PRIM STATUS LIGHTS ENABLE sw - ENABLE 202 I/LCA HEATERS 1 & 2 cbs - closed	

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PROCEDURE	REMARKS
1 130 XUV SPECT: 2 PWR/DOORS tb - bp 3 MAIN PWR sw - OFF 4 5 XUV SLIT: 6 PWR/DOORS tb - bp 7 MAIN PWR sw - OFF 8 WLC: 9 DOOR tb - bp 10 MAIN PWR sw - OFF 11 12 X-RAY/RF ACTIVITY: 13 DATA DRIVE FORWARD sw - OFF 14 15 DAS: 16 PWR sw - OFF 17 18 ATTITUDE CONTROL SYSTEM: 19 FSS DOOR tb - bp 20 21 SCAN SPECT: 22 HV ENABLE/RESET sw's (7) - OFF 23 INTENSITY DATA sw - OFF 24 DOOR tb - bp 25 MAIN HV sw - OFF 26 MAIN PWR sw - OFF 27 28 X-RAY SPECT (Control): 29 DOOR tb - bp 30 MAIN PWR sw - OFF 31 THERMAL POWER sw - OFF 32 33 TV: 34 SYNC GEN sw - OFF 35 XUV MON DOORS tb - white 36 XUV MON PWR sw - OFF 37 WLC PWR sw - OFF 38 39 DISPLAYS: 40 DAS/ORB PHASE sw - OFF 41 POWER SYSTEM sw - OFF 42 EVENT TIME sw - OFF 43 ACS CNTRS sw - OFF 44 45 46 47 48 49 50	

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 GROUND/DAS: CMPTR sw - INHIBIT EXP/TV sw - INHIBIT LIGHTING: INTEGRAL sw - OFF NUMERIC cont - fully ccw	

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 160 <u>CENTER WORKSTATION CANISTER CONTROL PANEL OPERATION</u> 1 <u>ACTIVATION</u> CANISTER CONTROL: POWER PRIM sw/cb - ENABLE POWER SEC sw/cb - ENABLE ROLL sw - ENABLE 2 <u>DEACTIVATION</u> CANISTER CONTROL: ROLL sw - INHIBIT POWER SEC sw/cb - INHIBIT POWER PRIM sw/cb - INHIBIT	12.04.32-00 PNL 160 OPR November 1, 1972

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PROCEDURE	REMARKS
1 VC Close door 2 3 Lock door by pulling out on bottom of 4 handle while pushing in on crossbar. 5 6 Verify door position indicator flag is white 7 8 FILM RESET: 9 130 FILM RESET sel - H-ALPHA 10 FILM RESET sw - RESET 11 12 H-ALPHA: 13 HA1 CAMR PWR sw - ON 14 HA1 NIGHT INTLK sw - OVERRIDE 15 READY/OPR lt - OFF 16 HA1 AUTO sw - MAN 17 HA1 FRAMES REMAINING ind - decreases by 18 one (verify) 19 HA1 NIGHT INTLK sw - NORMAL 20 HA1 CAMR PWR sw - OFF 21 22 160 Perform 12.04.32-00 step 2 23 24 3 <u>POST_EVA</u> 25 26 M Remove HA1 film magazine cover from film 27 vault 28 29 Remove exposed HA1 film magazine from VC 30 tree by squeezing trigger on handle and 31 lifting 32 33 Withdraw tethered pins from magazine handle, 34 remove handle from magazine and replace 35 pins in handle 36 37 Insert magazine in cover and secure flap 38 39 Stow handle in film vault 40 41 Stow magazine in CSM 42 43 130 Perform 12.04.37-00 44 45 46 47 48 49 50	Verifies film magazine operation

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PROCEDURE	REMARKS
1 VC Close doors 2 3 Lock doors by pulling out on top of handle 4 while pushing in on crossbar 5 6 Verify door position indicator flag is 7 white 8 9 130 FILM RESET: 10 FILM RESET sel - WLC 11 FILM RESET sw - RESET 12 13 WLC: 14 MAIN PWR sw - ON 15 MODE sel - STD 16 READY/OPR lt - OFF 17 START/STOP sw - START 18 19 After first exposure has been completed: 20 FRAMES REMAINING ind - decreases by 1 21 (verify) 22 START/STOP sw - STOP 23 MAIN PWR sw - STBY 24 25 160 Perform 12.04.33-00 step 2 26 27 M Remove exposed S052 film magazine from 28 VC tree 29 30 Snap on magazine face cover over magazine 31 face 32 33 Remove handle from magazine by unscrewing 34 two wing bolts 35 36 Stow magazine (S052-1, 3 & 4 in CSM and 37 S052-2 in SWS FREEZER) 38 39 130 Perform 12.04.37-00 40 41 42 43 44 45 46 47 48 49 50	Verifies film magazine operation

PROCEDURE	REMARKS
1 <u>X-RAY SPECT (S054)</u> 2 3 1 <u>PRE-EVA</u> 4 5 * If STDN confirms that a shutter over- * 6 * ride actuator is required due to a * 7 * camera malfunction: * 8 * 9 *INSTALLATION OF SHUTTER OVERRIDE ACTUATOR* 10 * 11 M * Unstow phillips driver * 12 144 * 13 * Unstow S054 cassette return container * 14 * from top of film vault. * 15 * 16 * Open cassette container by rotating the * 17 * handle in the lower half of the contain-* 18 * er CCW as indicated by the arrow * 19 * 20 * Separate S054 shutter override actuator * 21 * by loosening two captive screws on * 22 * either side with phillips driver * 23 * 24 * Attach override actuator below the door * 25 * covering the magazine windows at the * 26 * front of the magazine (wording on actua-* 27 * tor should be readable with magazine * 28 * connector at 12 o'clock position) * 29 * 30 M * Stow phillips driver * 31 144 * 32 33 130 Perform 12.04.31-00 34 35 M Unlock handle on unexposed S054 magazine in 36 film vault by depressing striped release 37 button 38 39 Rotate handle 90 deg ccw to detent 40 41 Remove magazine from film vault 42 43 Inspect window by raising protective cover 44 on forward end of magazine and report status 45 to STDN 46 47 Place magazine on VC tree, depress latch 48 release button and rotate handle 90 deg cw 49 to detent 50	12.04.35-00 FLM REPL 54 November 1, 1972

PROCEDURE	REMARKS
1 2 <u>EVA</u> 3 160 Perform 12.04.32-00 step 1 4 5 CANISTER CONTROL: 6 CANISTER ROTATION cont-Manipulate as re- 7 required to align 8 S054 door position 9 decal with rack 10 pointer 11 12 VC Release door launch lock by pulling 'D' 13 handle out (breaking lock wire) and fold 14 down into spring clip 15 16 Unlock door by pushing in on bottom of 17 handle 18 19 Open door 20 21 Remove exposed S054 magazine by depressing 22 latch release button, rotating handle 90 23 deg ccw to detent and pulling magazine out 24 of guide rack assembly 25 26 Place exposed S054 magazine on VC tree 27 28 Insert unexposed magazine into guide rail 29 assembly 30 31 Lock magazine into place by depressing latch 32 release button and rotating handle 90 deg cw 33 to detent 34 35 Display window should indicate LATCHED 36 (Green) 37 38 Close door 39 40 Lock door by pulling out on bottom of handle 41 while pushing in on crossbar 42 43 Verify door position indicator flag is white 44 45 46 47 48 49 50	First EVA only

PROCEDURE	REMARKS
1 130 FILM RESET: 2 FILM RESET sel - X-RAY SPECT 3 FILM RESET sw - RESET 4 5 X-RAY SPECT (control): 6 MAIN PWR sw - ON 7 PICTURE RATE sel - SINGLE 8 EXPOSURE RANGE sel - 16 9 READY/OPR lt - off 10 START/STOP sw - START 11 FRAMES REMAINING ind - decreases by 6 12 (verify) 13 MAIN PWR sw - OFF 14 15 160 Perform 12.04.33-00 step 2 16 17 3 <u>POST EVA</u> 18 19 M Remove S054 exposed film magazine from VC 20 tree by depressing latch release button and 21 rotating handle 90 deg ccw to detent 22 23 Inspect window by raising cover on forward 24 end of magazine 25 26 Inspect film footage indicator 27 at top rear of magazine 28 29 Relate status of window and indicators via 30 STDN 31 32 Restrain magazine 33 34 Loosen 6 captive bolts on magazine sides 35 using 3/4 inch wrench 36 37 Unscrew 12 captive screws in film access 38 plate at rear of magazine 39 40 Remove access plate from magazine and 41 restrain 42 43 Grasp internal film transport assembly 44 using finger hole at bottom and remove it 45 from magazine housing 46 47 (The 6 captive bolts must be kept fully 48 extended for transport removal) 49 50	Verifies film magazine operation

PROCEDURE	REMARKS
1 M Position film transport assembly with 2 cassette reels up 3 4 * 5 * NOTE: Normal procedure calls for all of * 6 the film to be expended prior to * 7 EVA. However, if the circum- * 8 stances warrant the removal of * 9 S054 magazine from the experiment * 10 prior to the film being totally * 11 expended. The following proced- * 12 ure should be used * 13 * 14 Place finger on spring loaded * 15 gear to prevent its rotation when * 16 film is cut * 17 * 18 Cut film at 2 places: * 19 a) at the supply cassette * 20 b) at the takeup cassette * 21 * 22 Release the spring-loaded gear * 23 slowly to unload spring, leaving * 24 cut film threaded in the roller * 25 section of film transport mech- * 26 anism * 27 * 28 29 Rotate collar (light lock ring) approxi- 30 mately 30 deg for access to screws 31 32 Note: If screws are not visible, rotate 33 advance knob on back side of main 34 assembly for screw alignment 35 Release 3 captive screws below the exposed 36 screw cover holes 37 38 Release 2 captive screws located at inner 39 part of collar 40 41 42 43 44 45 46 47 48 49 50	

PROCEDURE		REMARKS
1	M Release 3 captive screws around the cassette flange	Spacer is only needed prior to installation of cassette to provide structural integrity
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4	Lift cassette from main assembly	
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6	Position and restrain the S054 magazine between knees	
7		
8		
9	Slide internal main assembly into magazine	
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11	Position film access plate on magazine	
12		
13	Finger tighten the 12 captive retaining screws on film access plate	
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15		
16	Finger tighten the 6 captive bolts on S054 film access plate	
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18		
19	Unstow S054 cassette return container from top of film vault	
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22	Open cassette container by rotating (ccw) the handle in the lower half of the container (as indicated by the arrow on the container)	
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27	Separate two halves and remove spacer from inside of container (around bolt part of handle) and discard	
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31	Install cassette in lower half of container	
32		
33	Place upper half of container over cassette and rotate handle (cw) to stop position	
34		
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36	Unlock handle on S054 film package body by depressing latch release button	
37		
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39	Grasp handle and rotate 90 deg cw to detent	
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41	Stow S054 film package body in CSM	
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43	130 Perform 12.04.37-00	
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PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 <u>X-RAY TELE (S056)</u> 1 <u>PRE EVA</u> 130 Perform 12.04.31-00 M Remove unexposed S056 magazine from film vault by squeezing trigger on handle and lifting out magazine Place magazine on VC tree and press down to lock Check lock by pulling handle without squeezing trigger 2 <u>EVA</u> 160 Perform 12.04.32-00 step 1 CANISTER CONTROL: CANISTER ROTATION cont - Manipulate as required to align S056 door position decal with rack pointer VC Release door launch lock by pulling 'D' handle out (breaking lock wire) and fold down into spring clip Unlock door by pushing in on bottom of handle Open door <u>MAGAZINE REMOVAL</u> Slide the launch lock pin to the unlocked position Grasp the magazine handle and depress the trigger Lift the handle until the base of the magazine clears the latch claw assembly Withdraw the magazine from the magazine guide. Place on VC tree	12.04.36-00 FLM REPL 56 November 1, 1972 First EVA only

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PROCEDURE	REMARKS
1 M Withdraw tethered pins from magazine handle, 2 remove handle from magazine and replace pins 3 in handle 4 5 Insert magazine in cover and secure flap 6 7 Stow handle in film vault 8 9 Stow magazine in CSM 10 11 130 Perform 12.04.37-00 12 13 14 15 <u>XUV SPECT (S082A) - XUV SLIT (S082B)</u> 16 17 <u>PRE-EVA</u> 18 19 M Remove 'expando grip' pins from canister in 20 film vault (MDA wall, SL 1/2) 21 22 Remove canister from film vault (MDA wall, 23 SL 1/2) by grasping handle and lifting 24 clear of pins 25 26 Install canister on VS tree, align and set 27 locks 28 29 <u>EVA</u> 30 31 160 Perform 12.04.32-00 step 1 32 33 CANISTER CONTROL: 34 35 CANISTER ROTATION cont - Manipulate as re- 36 quired to align 37 SUN END decal 38 with rack pointer 39 40 ROLL sw - INHIBIT 41 S082 DOORS sw - OPEN 42 S082 DOORS A lt - OPEN on 43 S082 DOORS B lt - OPEN on 44 45 VS Place VS tree in temporary stowage mount 46 47 Unlock canister by turning latch to UNLOCK 48 position 49 50	12.04.38-00 FILM REPL 82 November 1, 1972

PROCEDURE	REMARKS
1 VS Open canister by rotating handle 180 deg 2 and pull 3 4 Retrieve unexposed S082 magazine from 5 canister 6 7 Install magazine in VS temporary stowage 8 container 9 10 Open film retrieval door by pressing striped 11 button, rotating handle to UNLOCK and pull 12 13 Release launch lock and camera latch handle 14 15 Swing latch handle away to release magazine 16 containing exposed film 17 18 Pull magazine to detent position and fold 19 handle by pressing stripped button 20 21 Retrieve magazine from experiment guide 22 rail through film retrieval door 23 24 Install magazine in empty canister on VS 25 tree 26 27 Arrow on canister lid and magazine must 28 point in same direction 29 30 Close canister lid and rotate handle 180 deg 31 32 Lock canister by turning latch to LOCK 33 position 34 35 Retrieve magazine containing unexposed film 36 from VS temporary container 37 38 Align and install stowage magazine into ex- 39 periment guide rail and push to first detent 40 position 41 42 Unfold magazine handle by pushing striped 43 button and extending handle 44 45 Push magazine to final stop 46 47 Seat magazine against experiment by pulling 48 latch handle across and into original lock 49 position 50	SL 1/2 only

PROCEDURE	REMARKS
1 VS Verify white flag is completely vertical 2 indicating proper seating 3 4 130 FILM RESET: 5 FILM RESET sel - XUV SPECT or XUV SLIT 6 FILM RESET sw - RESET 7 8 XUV SPECT or XUV SLIT: 9 MAIN PWR sw - ON 10 PWR/DOORS tb - bp 11 PWR/DOORS sw - ON; tb - white for 10 secs 12 then gray 13 READY/OPR lt - READY on 14 MODE sw - TIME 15 START/STOP sw - START 16 START/STOP sw - STOP 17 XUV SPECT or XUV SLIT: 18 FRAMES REMAINING ind - decreases by 1 (verify) 19 READY/OPR lt - READY on 20 21 VS Close film retrieval door 22 23 Rotate film retrieval door handle to LOCK 24 position 25 26 130 XUV SPECT or XUV SLIT: 27 PWR/DOORS sw - OFF; tb - white for 10 secs 28 then bp 29 30 160 Perform 12.04.32-00 step 2 31 32 3 <u>POST-EVA</u> 33 34 130 Perform 12.04.37-00 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	Verifies film magazine operation

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 <u>POST EVA ATM C&D CONSOLE CONFIGURATION</u> (SL-2) ATTITUDE CONTROL SYSTEM: MODE EXP PTG sw - EXP PTG; tb - EXP EVA: AUTO DOOR sw - ENABLE ROLL sw - IVA WLC: MAIN PWR sw - STBY (verify) MODE sel - STD (verify) ALIGN sw - PTG (verify) MASTER FLARE MODE: TN/LT sw - OFF SCAN SPECT: MAIN PWR sw - PRIM GRATING REF sw - OPT MAIN HV sw - ENABLE MODE sel - STOP X-RAY SPECT (Control): MAIN PWR sw - ON MODE sw - MANUAL FILTER sel - STORAGE; tb - bp X-RAY IMAGE sw - OFF GRATING sw - OUT; tb - OUT PICTURE RATE sel - SINGLE EXPOSURE RANGE sel - 256 FLARE THRESHOLD COARSE plus FINE sel - per SAP THERMAL POWER sw - PRIM TV: HA RETICLE sw - OFF HA1 PWR sw - OFF HA2 PWR sw - OFF MON 1 & 2 sws (2) - XUV MON XUV MON GAIN sel - 1 GROUND/DAS: EXP/TV sw - ENABLE (locked) CMPTR sw - ENABLE	12.04.37-00 PO EVA CONF November 1, 1972

PROCEDURE	REMARKS
1 <u>SYSTEMS & EXPERIMENTS DEACTIVATION</u> 2 3 <u>STAR ACQ FOR CSM IMU ALIGNMENT</u> 4 5 130 1 ATTITUDE CONTROL SYSTEM: 6 MODE tb - EXP PTG 7 EPC 800 HZ sw - PRIMARY (verify) 8 EPEA sw - PRIM (verify) 9 10 MONITOR: 11 COUNTER 1,2,3 sel - $\theta X, \theta Y, \theta Z$; 12 ind less than 001.0 deg (verify) 13 COUNTER 1 sel - STAR TCK OUTER 14 GIMBAL (ARC MIN) 15 COUNTER 2 sel - STAR TCK INNER 16 GIMBAL (ARC MIN) 17 COUNTER 3 sel - ORBITAL PLANE 18 ERROR (.1 deg) 19 20 2 ATTITUDE CONTROL SYSTEM: 21 STAR TRACK POWER sw - ON (verify) 22 STAR TRACK ACQ sw - MAN; tb - MAN 23 24 DAS: 25 Key 52012E (Select System) 26 5000XE X = 0, ACHERNAR (A) 27 X = 1, CANOPUS (C) 28 X = 2, ALPHA CRUX (X) 29 30 MANUAL POINTING CONTROL: 31 MAN PTG ENABLE sw - ENABLE; tb - STR 32 MPC - Manipulate gimbals to IG _____, 33 OB _____ (STAR TRACKER Pad or P 55) 34 35 ATTITUDE CONTROL SYSTEM: 36 STAR TRACK ACQ sw - AUTO; tb - AUT 37 STAR TRACK SHUTTER tb - OPN 38 39 MANUAL POINTING CONTROL: 40 MAN PTG tb - bp or EXP 41 42 * ALERT: * 43 * ACS 1t - on * 44 * DAS: * 45 * Key 52003E (ATMDC Data) * 46 * 50001E (ALERT Conditions) * 47 * MONITOR: * 48 * COUNTER 1 sel - DAS;ind - 4XXX* 49 * Return to Step 2 & Repoint Star * 50 * Tracker *	12.04.39-00 STR ACQ-IMU November 1, 1972

PROCEDURE	REMARKS
1 2 130 ATTITUDE CONTROL SYSTEM: 3 STAR TRACK SHUTTER tb - STAR 4 (may req 25 sec) 5 6 MONITOR: 7 COUNTER 3 sel - ORBITAL PLANE 8 ERROR (.1 deg) 9 If ORBITAL PLANE ERROR changes less than 10 1.0 deg, return to Step 2 and repoint 11 Star Tracker 12 13 MANUAL POINTING CONTROL: 14 MAN PTG ENABLE sw - INHIBIT; tb - bp 15 16 Record ATM STAR TRKR ANGLES: 17 ----- OG (ARC MIN) 18 ----- IG (ARC MIN) 19 Report STAR TRKR ANGLES to CDR 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	

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PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 H-ALPHA: HA1 FR/MIN sw - as desired HA1 HEATER sw - OFF HA1 NIGHT INTLK sw - NORMAL HA1 CAMR PWR sw - OFF READY/OPR lt - off HA2 HEATER sw - OFF X-RAY TELE: DOOR sw - CLOSE; tb - bp READY/OPR lt - off EXPOSURE sw - NORMAL CAMERA AIRLOCK sw - CLOSE CAMERA/TELE sel - PATROL FILTER tb - 1 FLARE sw - INHIBIT CAMR PWR sw - OFF FILTER tb - gray THERMAL sw - PRIM AL APRT POS AUTO sw - AUTO BE APRT POS AUTO sw - AUTO HV PWR BE sw - OFF BE APRT POS tb - 1 HV PWR AL sw - OFF AL APRT POS tb - 1 X-REA PWR sw - OFF BE & AL APRT POS tb's - gray MASTER FLARE MODE: TN/LT sw - OFF X-RAY lt - off RF lt - off XUV SPECT: PWR DOORS sw - OFF; tb - white for 10 sec then bp READY/OPR lt - off WAVE LTH tb - white EXPOSURE tb - gray FLARE tb - bp MODE sw - AUTO 2 MAIN PWR sw - ON PWR/DOORS tb - white THERMAL sw - ON	

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PROCEDURE	REMARKS
1 130 ATTITUDE CONTROL SYSTEM: 2 FSS BIAS XUV SLIT sw - XUV SLIT 3 FSS BIAS HA1 sw - HA1 4 FSS BIAS IN sw - OUT 5 SUN ACQ SENSOR tb - gray 6 SUN ACQ SUN PRESENT tb - gray or bp 7 CMPTR tb - white 8 CMPTR sw - AUTO (locked) 9 EPEA sw - PRIM 10 TACS sw's (6) - ENABLE; lts (6) - off 11 CMG SYSTEM 1,2,3 sw's - AUTO; tb's - gray 12 RATE GYRO MONITOR X,Y,Z sw's-1/2;tb's-gray 13 14 MONITOR: 15 ACS sel - OFF 16 ACS ind pwr fail lt - on 17 ANGLE sel - OFF 18 ANGLE ind pwr fail lt - on 19 COUNTER 1,2,3 sel - OFF; tb's - white 20 21 SCAN SPECT: 22 MODE sel - STOP 23 MAIN HV sw - OFF 24 READY/OPR lt - off 25 INTENSITY DATA ind = 00000 26 INTEN DATA sw - OFF 27 INTENSITY DATA ind - blank 28 DET SEL sw - 1 29 HV/DOOR INTLK sw - NORMAL (verify) 30 EXP NIGHT INTLK sw - NORMAL (verify) 31 HV ENABLE/RESET sw's (7) - OFF 32 RASTER/SCAN RESET sw - RESET 33 RASTER/SCAN COUNTER ind = 00000 34 GRATING REF sw - OPT 35 GRATING MOTOR DRIVE sw - PRIM 36 MAIN PWR sw - PRIM 37 THERMAL sw - ON (verify) 38 39 40 41 42 43 44 45 46 47 48 49 50	

PROCEDURE	REMARKS
1 130 X-RAY SPECT (Control): 2 DOOR sw - CLOSE; tb - bp 3 READY/OPR lt - off 4 MODE sw - MANUAL (verify) 5 IMAGE DISSECTOR sw - ENABLE (verify) 6 X-RAY IMAGE sw - OFF 7 PHOTO MULT ENABLE sw - ENABLE (verify) 8 GRATING sw - OUT; tb - OUT 9 PICTURE RATE sel - SINGLE 10 EXPOSURE RANGE sel - 256 11 FLARE THRESHOLD COARSE plus FINE sel - 12 per SAP 13 MAIN PWR sw - ON 14 FILTER sel - STORAGE; tb - bp 15 THERMAL POWER sw - PRIM (verify) 16 17 X-RAY/RF ACTIVITY: 18 DATA DRIVE BE sw - BE 19 DATA DRIVE RECORD sw - RECORD 10 in/HR 20 DATA DRIVE FORWARD sw - OFF 21 22 DAS: 23 PWR sw - OFF 24 25 TV: 26 HA RETICLE sw - OFF 27 HA1 PWR sw - OFF 28 HA2 PWR sw - OFF 29 MON 1 sw - OFF 30 MON 2 sw - OFF 31 SYNC GEN sw - OFF 32 MON 1 sel - up (12 o'clock) 33 MON 2 sel - up (12 o'clock) 34 XUV MON GAIN sel - 1 35 XUV MON PWR sw - OFF 36 XUV MON DOORS tb - white 37 XUV MON VID INTEG sw - NORMAL 38 XUV MON GRID sw - NORMAL 39 XUV SLIT LIMB PTG tb - gray 40 WLC PWR sw - OFF 41 WLC GRID sw - NORMAL 42 43 ATM POWER: 44 ATM POWER sw - up (locked) 45 46 47 48 49 50	

PROCEDURE	REMARKS
1 130 MANUAL POINTING CONTROL: 2 ROLL ENABLE sw - INHIBIT 3 MAN PTG tb - bp 4 MAN PTG ENABLE sw - INHIBIT 5 ROLL GAIN sw - X1 6 7 POWER SYSTEM: 8 REG/BAT ind pwr fail lt - on 9 CBRM STATUS lts (54) - off 10 BAT TEMP tb - gray 11 BAT VOLTS tb - gray 12 REG VOLTS tb - gray 13 BAT CHG tb - gray 14 WATT-HOUR RESET sw - OFF 15 Power Monitor sel - OFF 16 REG/BUS/BAT ind pwr fail lt - on 17 REG/BAT ind pwr fail lt - on 18 CBRM SELECT sel - 12 19 STATUS LIGHTS PRIM sw - OFF 20 STATUS LIGHTS ENABLE sw - OFF 21 SELECT sw - OFF 22 23 DISPLAYS: 24 DAS/ORB PHASE sw - OFF 25 POWER SYSTEM sw - OFF 26 EVENT TIME sw - OFF 27 ACS CNTRS sw - OFF 28 29 LIGHTING: 30 INTEGRAL sw - OFF 31 NUMERIC sw - OFF 32 ALERT/STATUS sw - OFF 33 All panel lights off 34 LAMP TEST sel - OFF 35 36 CONSOLE POWER DISTRIBUTION: 37 All sw's (8) - OFF 38 39 40 41 42 43 44 45 46 47 48 49 50	The 8 switches are: ACS sw - OFF HA sw - OFF X-RAY TELE sw - OFF XUV SPECT sw - OFF XUV SLIT sw - OFF WLC sw - OFF SCAN SPECT sw - OFF X-RAY SPECT sw - OFF

PROCEDURE	REMARKS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 130 CONSOLE POWER DISTRIBUTION: All cb's (18) - open REG/BUS/BAT ind pwr fail lt - on	The 18 cb's are: cb MAIN C/D 1 cb MAIN C/D 2 cb MAIN MON 1 cb MAIN MON 2 cb MAIN INV/LCA 1 cb MAIN INV/LCA 2 cb C/D ACS 1 cb C/D ACS 2 cb C/D THRM/TLM/PWR 1 cb C/D THRM/TLM/PWR 2 cb INV AC1 cb INV AC2 cb C/D CMD/DEPLOY/EVA 1 cb C/D CMD/DEPLOY/EVA 2 cb C/D EXP 1 cb C/D EXP 2 cb LCA STATUS LTG BU 1 cb LCA STATUS LTG BU 2

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
	5.0 CONTINGENCY PROCEDURES 5.1 SYSTEM MALFUNCTIONS	

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
1 C&D LOSS OF VAR INTEGRAL LIGHTING ON PNL 130	<pre> graph TD 1[1] --> Q1{Is VAR integral lighting on?} Q1 -- YES --> 2[2] Q1 -- NO --> 3[3] 3 --> Q2{Is FIXED integral lighting on?} Q2 -- YES --> 4[4] Q2 -- NO --> 6[6] 4 --> 5[5] 6 --> 7[7] 2 --> C2[Continue to operate] 5 --> C5[Continue to operate with fixed integral lighting] 7 --> C7[Continue to operate without integral lighting] </pre> 1 LIGHTING: ● INTEGRAL cont - fully <u>CCW</u> ● INTEGRAL sw - <u>OFF</u> ● NUMERIC sw - <u>OFF</u> ● ALERT/STATUS sw - <u>OFF</u> CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 1 - <u>open</u> ● cb MAIN INV/LCA 1 - <u>closed</u> LIGHTING: ● NUMERIC sw - VAR ● INTEGRAL sw - VAR ● ALERT/STATUS sw - VAR ● INTEGRAL cont - fully <u>CW</u> Is VAR integral lighting on? 2 Continue to operate 3 LIGHTING: ● INTEGRAL cont - fully <u>CCW</u> ● INTEGRAL sw - <u>OFF</u> ● NUMERIC sw - <u>OFF</u> ● ALERT/STATUS sw - <u>OFF</u> CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 1 - <u>open</u> ● cb MAIN INV/LCA 1 - <u>closed</u> LIGHTING: ● NUMERIC sw - VAR ● INTEGRAL sw - <u>FIXED</u> ● ALERT/STATUS sw - <u>VAR</u> Is FIXED integral lighting on? 4 VARIABLE INTEGRAL LIGHTING FAILURE 5 Continue to operate with fixed integral lighting 6 BUS V_{INTG} (363D) SHORTED 7 LIGHTING: ● INTEGRAL sw - <u>OFF</u> Continue to operate without integral lighting	1 INV/LCA power supplies are being unloaded. Cb MAIN INV/LCA 1 is opened and closed to reset and reactivate INV/LCA power supplies 2 Malfunction was a transient short circuit condition 3 With INTEGRAL sw in OFF position, shorted load is isolated from its power supply source

ATM-C&D-001A

CONTROL AND DISPLAYS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
2 C&D LOSS OF FIXED INTEGRAL LIGHTING ON PNL 130	<pre> graph TD 1[1 LIGHTING: ● INTEGRAL sw - OFF CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 2 - open ● cb MAIN INV/LCA 2 - closed LIGHTING: ● INTEGRAL sw - FIXED Is FIXED integral lighting on?] -- YES --> 2[2 Continue to operate] 1 -- NO --> 3[3 ● Perform inflight maintenance procedure for the BU I/LCA CONNECTION and CHECK OUT Is VAR integral lighting on?] 3 -- YES --> 4[4 FIXED INTEGRAL LIGHTING FAILURE] 4 --> 5[5 Continue to operate using BU I/LCA] 3 -- NO --> 6[6 BUS V<sub>INTG</sub> (363D) SHORTED] 6 --> 7[7 ● Perform inflight maintenance procedure for the BU I/LCA DISCONNECT and POWER DOWN] 7 --> 8[8 LIGHTING: ● INTEGRAL sw - OFF Continue to operate without integral lighting] </pre>	1 INV/LCA power supply is unloaded. Cb MAIN INV/LCA 2 is opened and closed to reset and reactivate INV/LCA power supply 2 Malfunction was a transient short circuit condition 3 Integral lighting of pnl 130 is adjustable on pnl 124 4 Pnl 130 lighting functions are returned to the normal INV/LCA due to a shorted power bus and not an INV/LCA malfunction 5 With INTEGRAL sw in OFF position, shorted load is isolated from its power supply source

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CONTROL AND DISPLAYS

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SYMPTOM	PROCEDURE	REMARKS
3 C&D LOSS OF VAR NUMERIC LIGHT- ING ON PNL 130	10 1 1 LIGHTING: ● INTEGRAL cont - fully CCW ● INTEGRAL sw - OFF ● NUMERIC sw - OFF ● ALERT/STATUS sw - OFF CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 1 - open ● cb MAIN INV/LCA 1 - closed LIGHTING: ● NUMERIC sw - VAR ● INTEGRAL sw - VAR ● ALERT/STATUS sw - VAR ● INTEGRAL cont - adjust as desired (CW) Is VAR numeric lighting on? YES 2 Continue to operate NO 3 LIGHTING: ● INTEGRAL cont - fully CCW ● INTEGRAL sw - OFF ● NUMERIC sw - OFF ● ALERT/STATUS sw - OFF CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 1 - open ● cb MAIN INV/LCA 1 - closed LIGHTING: ● NUMERIC sw - FIXED ● INTEGRAL sw - VAR ● INTEGRAL cont - adjust as desired ● ALERT/STATUS - VAR Is FIXED numeric lighting on? YES 4 VARIABLE NUMERIC LIGHTING FAILURE NO 6 BUS V_{NUM} (364D) SHORTED YES 5 Continue to operate with fixed numeric lighting NO 7 LIGHTING: ● INTEGRAL cont - fully CCW ● INTEGRAL sw - OFF ● NUMERIC sw - OFF ● ALERT/STATUS sw - OFF 8	1 INV/LCA power supplies are being unloaded. Cb MAIN INV/LCA 1 is opened and closed to reset and reactivate INV/LCA power supplies 2 Malfunction was a transient short circuit condition

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CONTROL AND DISPLAYS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
3 C&D (Cont)	7 8 DISPLAYS: ● DAS/ORB PHASE sw - OFF ● POWER SYSTEM sw - OFF ● EVENT TIME sw - OFF SCAN SPECT: ● INTEN DATA sw - OFF CONSOLE POWER DISTRIBUTION: ● H_a sw - OFF ● X-RAY TELE sw - OFF ● XUV SPECT sw - OFF ● XUV SLIT sw - OFF ● WLC sw - OFF ● SCAN SPECT sw - OFF ● X-RAY SPECT sw - OFF MONITOR: ● COUNTER 1 sel - OFF ● COUNTER 2 sel - OFF ● COUNTER 3 sel - OFF CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 1 - open ● cb MAIN INV/LCA 1 - closed LIGHTING: ● NUMERIC sw - VAR ● INTEGRAL sw - VAR ● ALERT/STATUS sw - VAR 9 Isolate shorted circuit Sequentially power up one circuit at a time as follows, noting which circuit causes the loss of numeric lighting DISPLAYS: ● DAS/ORB PHASE sw - BUS 1 ● POWER SYSTEM sw - BUS 1 ● EVENT TIME sw - BUS 1 SCAN SPECT: ● INTEN DATA sw - BUS 1 CONSOLE POWER DISTRIBUTION: ● H_a sw - EXP BUS 1/NUM LTG BUS ● X-RAY TELE sw - EXP BUS 1/NUM LTG BUS ● XUV SPECT sw - EXP BUS 1/NUM LTG BUS ● XUV SLIT sw - EXP BUS 1/NUM LTG BUS ● WLC sw - EXP BUS 1/NUM LTG BUS ● SCAN SPECT sw - EXP BUS 1/NUM LTG BUS ● X-RAY SPECT sw - EXP BUS 1/NUM LTG BUS MONITOR: ● COUNTER 1 sel - ROLL EXP ● COUNTER 2 sel - FSS UP/DN ● COUNTER 3 sel - FSS LR 10 Open shorted circuit Place function switch(s) that cause loss of numeric lighting to OFF position 3 1	Function switch(s) in OFF position will cause the loss of the display and associated command functions

ATM-C&D-004A

CONTROL AND DISPLAYS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
4 C&D LOSS OF FIXED NUMERIC LIGHTING ON PNL 130	11 1 LIGHTING: ● NUMERIC sw - OFF CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 2 - open ● cb MAIN INV/LCA 2 - closed LIGHTING: ● NUMERIC sw - FIXED Is FIXED numeric lighting on? YES → 2 NO → 3 2 Continue to operate 3 Perform inflight maintenance procedure for the BU I/LCA connection and checkout Is VAR numeric lighting on? YES → 4 NO → 6 4 FIXED NUMERIC LIGHTING FAILURE 5 Continue to operate using BU I/LCA 6 BUS V_{NUM} (364D) SHORTED 7 Perform inflight maintenance procedure for the BU I/LCA DISCONNECT and POWER DOWN 8 LIGHTING: ● INTEGRAL cont - fully CCW ● INTEGRAL sw - OFF ● NUMERIC sw - OFF ● ALERT/STATUS sw - OFF 9 DISPLAYS: ● DAS/ORB PHASE sw - OFF ● POWER SYSTEM sw - OFF ● EVENT TIME sw - OFF SCAN SPECT: ● INTEN DATA sw - OFF CONSOLE POWER DISTRIBUTION: ● H_α sw - OFF ● X-RAY TELE sw - OFF ● XUV SPECT sw - OFF ● XUV SLIT sw - OFF ● WLC sw - OFF ● SCAN SPECT sw - OFF ● X-RAY SPECT sw - OFF MONITOR: ● COUNTER 1 sel - OFF ● COUNTER 2 sel - OFF ● COUNTER 3 sel - OFF CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 1 - open ● cb MAIN INV/LCA 1 - closed LIGHTING: ● NUMERIC sw - FIXED ● INTEGRAL sw - VAR ● ALERT/STATUS sw - VAR 10	1 INV/LCA power supply is unloaded. Cb MAIN INV/LCA 2 is opened and closed to reset and reactivate INV/LCA power supply 2 Malfunction was a transient short circuit condition 3 Numeric lighting of pnl 130 is adjustable on pnl 124

ATM-C&D-005

CONTROL AND DISPLAYS

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SYMPTOM	PROCEDURE	REMARKS
4 C&D (Cont)	9 ↓ 10 Isolate shorted circuit Sequentially power up one circuit at a time as follows noting which circuit causes the loss of numeric lighting: DISPLAYS: ● DAS/ORB PHASE sw - <u>BUS 1</u> ● POWER SYSTEM sw - <u>BUS 1</u> ● EVENT TIME sw - <u>BUS 1</u> SCAN SPECT: ● INTEN DATA sw - <u>BUS 1</u> CONSOLE POWER DISTRIBUTION: ● Hα sw - <u>EXP BUS 1/NUMERIC LTG BUS</u> ● X-RAY TELE sw - <u>EXP BUS 1/NUMERIC LTG BUS</u> ● XUV SPECT sw - <u>EXP BUS 1/NUMERIC LTG BUS</u> ● XUV SLIT sw - <u>EXP BUS 1/NUMERIC LTG BUS</u> ● WLC sw - <u>EXP BUS 1/NUMERIC LTG BUS</u> ● SCAN SPECT sw - <u>EXP BUS 1/NUMERIC LTG BUS</u> ● X-RAY SPECT sw - <u>EXP BUS 1/NUMERIC LTG BUS</u> MONITOR: ● COUNTER 1 sel - <u>ROLL EXP</u> ● COUNTER 2 sel - <u>FSS UP/DN</u> ● COUNTER 3 sel - <u>FSS L/R</u> ↓ 11 Open shorted circuit Place function switch(s) which cause loss of numeric lighting to OFF position 4 ↓ 1	4 Function switch(s) in OFF position will cause the loss of the display and associated command functions

ATM-C&D-006

CONTROL AND DISPLAYS

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SYMPTOM	PROCEDURE	REMARKS
5 C&D LOSS OF VAR ALERT/STATUS LIGHTING ON PNL 130	1 1 LIGHTING: ● INTEGRAL cont - fully <u>CCW</u> ● INTEGRAL sw - <u>OFF</u> ● NUMERIC sw - <u>OFF</u> ● ALERT/STATUS sw - <u>OFF</u> CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 1 - <u>open</u> ● cb MAIN INV/LCA 1 - <u>closed</u> LIGHTING: ● NUMERIC sw - <u>VAR</u> ● INTEGRAL sw - <u>VAR</u> ● ALERT/STATUS sw - <u>VAR</u> ● INTEGRAL cont - fully <u>CW</u> Is VAR alert/status lighting on? NO 3 LIGHTING: ● INTEGRAL cont - fully <u>CCW</u> ● INTEGRAL sw - <u>OFF</u> ● NUMERIC sw - <u>OFF</u> ● ALERT/STATUS sw - <u>OFF</u> CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 1 - <u>open</u> ● cb MAIN INV/LCA 1 - <u>closed</u> LIGHTING: ● NUMERIC sw - <u>VAR</u> ● INTEGRAL sw - <u>VAR</u> ● ALERT/STATUS sw - <u>FIXED</u> Is VAR alert/status lighting on? NO 6 BUS V_{ALERT} (371D) OR BUS V_{STATUS} (381D) SHORTED 7 LIGHTING: ● ALERT/STATUS sw - <u>OFF</u> Continue to operate without alert/status lighting YES 2 Continue to operate YES 4 VARIABLE ALERT/STATUS LIGHTING FAILURE 5 Continue to operate with FIXED alert/status lighting 1 INV/LCA power supplies are being unloaded. Cb MAIN INV/LCA 1 is opened and closed to reset and reactivate INV/LCA power supplies 2 Malfunction was a transient short circuit condition 3 With ALERT/STATUS sw in OFF position, shorted load is isolated from its power supply source	

ATM-C&D-007A

CONTROL AND DISPLAYS

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
6 C&D LOSS OF FIXED ALERT/STATUS LIGHTING ON PNL 130	<pre> graph TD 1[1 LIGHTING: ● ALERT/STATUS sw - OFF CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 2 - open ● cb MAIN INV/LCA 2 - closed LIGHTING: ● ALERT/STATUS sw - FIXED Is FIXED alert/status lighting on?] -- YES --> 2[2 Continue to operate] 1 -- NO --> 3[3 Perform inflight maintenance procedure for the BU I/LCA con- nection and checkout Is alert/status lighting on?] 3 -- YES --> 4[4 FIXED ALERT/STATUS LIGHTING FAILURE] 4 --> 5[5 Continue to operate using BU I/LCA] 3 -- NO --> 6[6 BUS V_ALERT (371D) OR BUS V_STATUS (381D) SHORTED] 6 --> 7[7 Perform inflight maintenance procedure for the BU I/LCA disconnect and powerdown] 7 --> 8[8 LIGHTING: ● ALERT/STATUS sw - OFF Continue to operate without alert/status lighting] </pre>	1 Cb MAIN INV/LCA is opened and closed to reset and reactivate INV/LCA power supplies 2 Malfunction was a transient short circuit condition ATM-C&D-008A

CONTROL AND DISPLAYS

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
7 C&D LOSS OF PRIM CBRM OR TACS STATUS LIGHTS ON PNL 130	1 POWER SYSTEM: ● STATUS LIGHTS PRIM sw - <u>SEC</u> ● STATUS LIGHTS ENABLE sw - <u>OFF</u> LIGHTING: ● LAMP TEST sel - <u>TACS</u> Is TACS status lighting on? 2 LIGHTING: ● LAMP TEST sel - <u>OFF</u> POWER SYSTEM: ● STATUS LIGHTS ENABLE sw - <u>TEST</u> Is CBRM status lighting on? 4 BUS V_{CBRM} ST (374D) SHORTED 3 PRIM TACS AND CBRM STATUS LIGHTING FAILURE 5 POWER SYSTEM: ● STATUS LIGHTS ENABLE sw - <u>ENABLE</u> Continue to operate using SEC TACS and CBRM status lighting 6 POWER SYSTEM: ● STATUS LIGHTS PRIM sw - <u>PRIM</u> ● STATUS LIGHTS ENABLE sw - <u>OFF</u> Continue to operate without CBRM status lighting 7 BUS V_{TACS} ST (372D) SHORTED 8 POWER SYSTEM: ● STATUS LIGHTS PRIM sw - <u>OFF</u> LIGHTING: ● LAMP TEST sel - <u>OFF</u> Continue to operate without TACS and CBRM status lighting	ATM-C&D-009A

CONTROL AND DISPLAYS

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ATM

SYMPTOM	PROCEDURE	REMARKS
8 C&D LOSS OF SEC CBRM OR TACS STATUS LIGHTS ON PNL 130	1 POWER SYSTEM: ● STATUS LIGHTS ENABLE sw - OFF LIGHTING: ● LAMP TEST sel - TACS Is TACS status lighting on? 2 BUS V_{CBRM} ST (374D) SHORTED 3 LIGHTING: ● LAMP TEST sel - OFF Continue to operate without CBRM status lighting 4 Perform inflight maintenance procedure BU I/LCA connection and checkout Is CBRM and TACS status lighting on? 5 SEC TACS AND CBRM STATUS LIGHTING FAILURE 7 BUS V_{TACS} ST (372D) SHORTED 6 POWER SYSTEM: ● STATUS LIGHTS ENABLE sw - <u>ENABLE</u> Continue to operate using BU I/LCA 8 Perform inflight maintenance procedure BU I/LCA disconnect and powerdown 9 POWER SYSTEM: ● STATUS LIGHTS PRIM sw - OFF ● STATUS LIGHTS ENABLE sw - OFF Continue to operate without TACS and CBRM status lighting	ATM-C&D-010A

CONTROL AND DISPLAYS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
9 C&D LOSS OF V _{ATM} AC 1 (361D) BUS 1 (The loss of V _{ATM} AC 1 (361D) BUS results in re- moval of AC supply power for the follow- ing display functions: DAS/ORB PHASE ind; MONITOR, COUNTER 1, 2, 3 inds; EVENT TIME ind; SCAN SPECT, INTEN DATA ind; X-RAY SPECT, X-RAY IMAGE mon; VAR INTEGRAL and VAR NUMERIC lighting on PNL 130)	9 1 LIGHTING: ● INTEGRAL cont - fully <u>CCW</u> ● INTEGRAL sw - <u>OFF</u> ● NUMERIC sw - <u>OFF</u> ● ALERT/STATUS sw - <u>OFF</u> CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 1 - <u>open</u> ● cb MAIN INV/LCA 1 - <u>closed</u> LIGHTING: ● NUMERIC sw - <u>VAR</u> ● INTEGRAL sw - <u>VAR</u> ● INTEGRAL cont - <u>adjust as desired (CW)</u> ● ALERT/STATUS sw - <u>VAR</u> Are indicators, monitor and lights on? YES 2 Continue to operate NO 3 DISPLAYS: ● DAS/ORB PHASE sw - <u>BUS 2</u> ● ACS CNTRS sw - <u>BUS 2</u> ● EVENT TIME sw - <u>BUS 2</u> SCAN SPECT: ● INTEN DATA sw - <u>BUS 2</u> CONSOLE POWER DISTRIBUTION: ● X-RAY SPECT sw - <u>EXP BUS 2/AC BUS 2</u> ● cb MAIN INV/LCA 1 - <u>open</u> ● cb MAIN INV/LCA 2 - <u>open</u> ● cb INV AC 1 - <u>open</u> ● cb MAIN INV/LCA 2 - <u>closed</u> LIGHTING: ● NUMERIC sw - <u>FIXED</u> ● INTEGRAL sw - <u>FIXED</u> Are indicators, monitor and lights on? YES 4 BUS V_{ATM} AC 1 (361D) FAILURE NO 6 BUS V_{ATM} AC 1 (361D) SHORTED 7 5 Continue to operate with fixed INTEGRAL and NUMERIC lighting	1 Assumes the following switches on pnl 130 in normal configuration positions: DISPLAYS: DAS/ORB PHASE sw - <u>BUS 1</u> ACS CNTRS sw - <u>BUS 1</u> EVENT TIME sw - <u>BUS 1</u> SCAN SPECT: INTEN DATA sw - <u>BUS 1</u> CONSOLE POWER DISTRI- BUTION: X-RAY SPECT sw - <u>EXP BUS 1/NUMERIC LTG BUS</u> X-RAY SPECT: X-RAY IMAGE sw - <u>ENABLE</u> LIGHTING: INTEGRAL sw - <u>VAR</u> NUMERIC sw - <u>VAR</u> 2 Malfunction was a transient short circuit condition

ATM-C&D-011

ATM-C&D-011

CONTROL AND DISPLAYS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
9 C&D (Cont)	6 7 DISPLAYS: ● DAS/ORB PHASE sw - <u>OFF</u> ● EVENT TIME sw - <u>OFF</u> ● ACS CNTRS sw - <u>BUS 1</u> SCAN SPECT: ● INTEN DATA sw - <u>OFF</u> MONITOR: ● COUNTER 1 sel - <u>OFF</u> ● COUNTER 2 sel - <u>OFF</u> ● COUNTER 3 sel - <u>OFF</u> LIGHTING: ● INTEGRAL sw - <u>OFF</u> ● NUMERIC sw - <u>OFF</u> ● ALERT/STATUS sw - <u>OFF</u> CONSOLE POWER DISTRIBUTION: ● X-RAY SPECT sw - <u>OFF</u> ● cb MAIN INV/LCA 1 - <u>closed</u> ● cb MAIN INV/LCA 2 - <u>open</u> ● cb MAIN INV/LCA 2 - <u>closed</u> LIGHTING: ● NUMERIC sw - <u>VAR</u> ● INTEGRAL sw - <u>VAR</u> ● ALERT/STATUS sw - <u>VAR</u> 8 8 Isolate shorted circuit Sequentially power up one circuit at a time as follows, noting which circuit causes the loss of BUS V_{ATM} AC1 (361D) DISPLAYS: ● DAS/ORB PHASE sw - <u>BUS 1</u> ● EVENT TIME sw - <u>BUS 1</u> SCAN SPECT: ● INTEN DATA sw - <u>BUS 1</u> MONITOR: ● COUNTER 1 sel - <u>ROLL EXP</u> ● COUNTER 2 sel - <u>FSS UP/DN</u> ● COUNTER 3 sel - <u>FSS L/R</u> CONSOLE POWER DISTRIBUTION: ● X-RAY SPECT sw - <u>EXP BUS 1/</u> - NUM LTG BUS 9 9 Open shorted circuit Place function switch(s) that cause loss of BUS V_{ATM} AC1 (361D) to OFF position 1	3 3 Function switch(s) in OFF position will cause the loss of the display and associated command functions

ATM-C&D-012

CONTROL AND DISPLAYS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
10 C&D LOSS OF V_{ATM} AC 2 (362D) BUS (Loss of V_{ATM} AC 2 (362D) BUS results in the removal of AC supply power for the follow- ing display functions: DAS/ORB PHASE ind; MONITOR, COUNTER 1, 2, 3 inds; EVENT TIME ind; SCAN SPECT, INTEN DATA ind; X-RAY SPECT, X-RAY IMAGE mon; FIXED INTEGRAL and FIXED NUMERIC LIGHTING on PNL 130)	10 1 LIGHTING: ● INTEGRAL sw - OFF ● NUMERIC sw - OFF ● ALERT/STATUS sw - OFF CONSOLE POWER DISTRIBUTION: ● cb MAIN INV/LCA 2 - open ● cb MAIN INV/LCA 2 - closed LIGHTING: ● NUMERIC sw - FIXED ● INTEGRAL sw - FIXED ● ALERT/STATUS sw - FIXED Are indicators, monitor and lights on? YES 2 Continue to operate NO 3 Perform inflight maintenance procedure for the BU I/LCA connection and checkout Are indicators, monitor and lights on? YES 4 BUS V_{ATM} AC 2 (362D) FAILURE NO 6 BUS V_{ATM} AC 2 (362D) SHORTED 7 Perform inflight maintenance procedure for the BU I/LCA disconnect and powerdown 8 5 Continue to operate using BU I/LCA	1 Assume any one or more of the following switches on pnl 130 in the backup configuration positions: DISPLAYS: ● DAS/ORB PHASE sw - BUS 2 ● ACS CNTRS sw - BUS 2 ● EVENT TIME sw - BUS 2 SCAN SPECT: ● INTEN DATA sw - BUS 2 CONSOLE POWER DISTRI- BUTION: ● X-RAY SPECT sw - EXP BUS 2/AC BUS 2 X-RAY SPECT: ● X-RAY IMAGE sw - ENABLE LIGHTING: ● INTEGRAL sw - FIXED ● NUMERIC sw - FIXED 2 Malfunction was a transient short circuit condition

ATM-C&D-013

ATM-C&D-013

CONTROL AND DISPLAYS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
10 C&D (Cont)	7 ↓ 8 DISPLAYS: ● DAS/ORB PHASE sw - <u>off</u> ● EVENT TIME sw - <u>off</u> SCAN SPECT: ● INTEN DATA sw - <u>off</u> MONITOR: ● COUNTER 1 sel - <u>off</u> ● COUNTER 2 sel - <u>off</u> ● COUNTER 3 sel - <u>off</u> CONSOLE POWER DISTRIBUTION: ● X-RAY SPECT sw - <u>off</u> LIGHTING: ● INTEGRAL sw - <u>off</u> ● NUMERIC sw - <u>off</u> CONSOLE POWER DISTRIBUTION: cb MAIN INV/LCA 2 - <u>open</u> cb MAIN INV/LCA 2 - <u>closed</u> ↓ 9 Isolate shorted circuit Sequentially power up one circuit at a time as follows, noting which circuit causes the loss of bus V_{ATM} AC 2(362D) power LIGHTING: ● NUMERIC sw - <u>fixed</u> ● INTEGRAL sw - <u>fixed</u> CONSOLE POWER DISTRIBUTION: ● X-RAY SPECT sw - EXP BUS 2/ AC BUS 2 DISPLAYS: ● DAS/ORB PHASE sw - BUS 2 ● EVENT TIME sw - BUS 2 SCAN SPECT ● INTEN DATA sw - BUS 2 MONITOR: ● COUNTER 1 sel - ROLL EXP ● COUNTER 2 sel - FSS UP/DN ● COUNTER 3 sel - FSS L/R ↓ 10 Open short circuit Place function switch(s) that cause loss of bus V_{ATM} AC 2(362D) power to OFF position ↓ 1	3 Function switch(s) in OFF position will cause the loss of the display and associated command functions ATM-C&D-014

CONTROL AND DISPLAYS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
1 EPS POWER SYSTEM ALERT BAT CHG BLUE It on if: Solar panel voltage below BATT VOLTAGE and BATT CHG not complete (third electrode signal not present)	<pre> graph TD Start([1 BAT CHG ALERT]) --> Q1{1 Is PWR SYS ALERT It on?} Q1 -- YES --> B2[2 CBRM COMPONENT OUT OF TOLERANCE] B2 --> B3[3 Consult STDN] Q1 -- NO --> B4[4 POWER SYSTEM: • Power Monitor sel - OFF BUS 1 or BUS 2] B4 --> Q2{5 Is BATT CHG tb-bp?} Q2 -- YES --> B5[5 • Turn CHG off] B5 --> Q3{6 Is BATT CHG still bp?} Q3 -- YES --> Q4{8 Is BATT CHG ALERT still on?} Q4 -- YES --> B7[7 BATT RECHG TRANSISTOR SHORTED] Q4 -- NO --> B8[8 BATT CHG TB FAILED IN BP POSITION] Q3 -- NO --> Q9{9 Is BATT CHG ALERT still on?} Q9 -- YES --> B11[11 BATT CHG LT FAILED ON] Q9 -- NO --> B13[13 Turn CHGR on and verify tb has returned to bp position POWER SYSTEM: • POWER MONITOR sel - BATT • Select sw - 1 through 12 and 13 through 18 • CBRM select - 1 through 12 and 13 through 18 Note CBRM number when tb goes to bp] B11 --> B13 B13 --> Q14{14 Is BATT CHG still on?} Q14 -- YES --> B15[15 MORE THAN ONE BATT FAILED TO CHARGE] B15 --> B16[16 Continue to select CBRMs. Note other bp positions] Q14 -- NO --> B17[17 SELECTED CBRM FAILED TO CHARGE] B17 --> B18[18 Consult STDN] </pre>	1 If BATT CHG ALERT It is a true indication, tb will be bp in one of these positions 2 A CHGR off function removes the ground from the BATT RECHG incomplete transistor and should reset BATT CHG tb to gray and BATT CHG ALERT It to off 3 Computer day signal removes ground from the BATT RECHARGE incomplete transistor and should reset BATT CHG tb to gray and BATT CHG ALERT It to off 4 BATT RECHG incomplete transistor shorted or BATT CHG It relay failed closed 5 Battery may have required two cycles to complete its charge 6 For multiple CBRM malfunctions, consult STDN for power management advice

ATM-EPS-001A

ELECTRICAL POWER SUBSYSTEM

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
2 EPS POWER SYSTEM  YELLOW REG/BUS/BAT ind pwr fail It on (It comes on if power to REG/BUS/BAT ind is removed)	① 1 POWER SYSTEM: ● Power Monitor sel - <u>BAT</u> or <u>REG</u> ● CBRM SELECT sw - (1-12) ● CBRM SEL sel - rotate through several positions Do AMPS and VOLTS indicators change readings? YES → 2 METER INTERNAL RELAY K44D HAS FAILED NO ↓ 3 Is REG/BAT ind power fail It on? YES → 4 REG/BUS/BAT METER HAS FAILED NO ↓ 5 POWER SYSTEM: ● WATT - HOUR RESET sw - <u>MAN</u> Does WATT - HOUR ind reset? YES → 8 POWER MONITOR SEL HAS FAILED IN THE OFF POSITION OR RELAY K42D HAS FAILED NO ↓ 6 CONSOLE POWER DISTRIBUTION: ● cb CMD/DEPLOY/EVA BUS 1 & 2 - closed (verify) DISPLAYS: ● POWER SYSTEM sw - <u>BUS 2</u> Is REG/BAT ind power fail It on? YES → 9 DISPLAYS: POWER SYSTEM SW CIRCUIT FAILED NO ↓ 7 PRIMARY BUS V311D (CMD/DEPLOY/BUS 1) FAILED	① Meters will not return to 0 and will not deflect without power ② Meter has input power and signals but has lost internal relay. Loss of relay will leave REG/BUS/BAT ind power fail It on but will not affect meter reading ③ Failure of relay K42D or the Power Monitor sel in the OFF position removes power to the indicators with resultant loss of crew monitoring capability ④ Failure of POWER SYSTEMS sw circuitry loses crew monitoring capability of REG/BUS/BAT ind and REG/BAT ind. TM can be used for monitoring

ATM-EPS-004A

ELECTRICAL POWER SUBSYSTEM

SKYLAB OPERATIONS HANDBOOK ATM

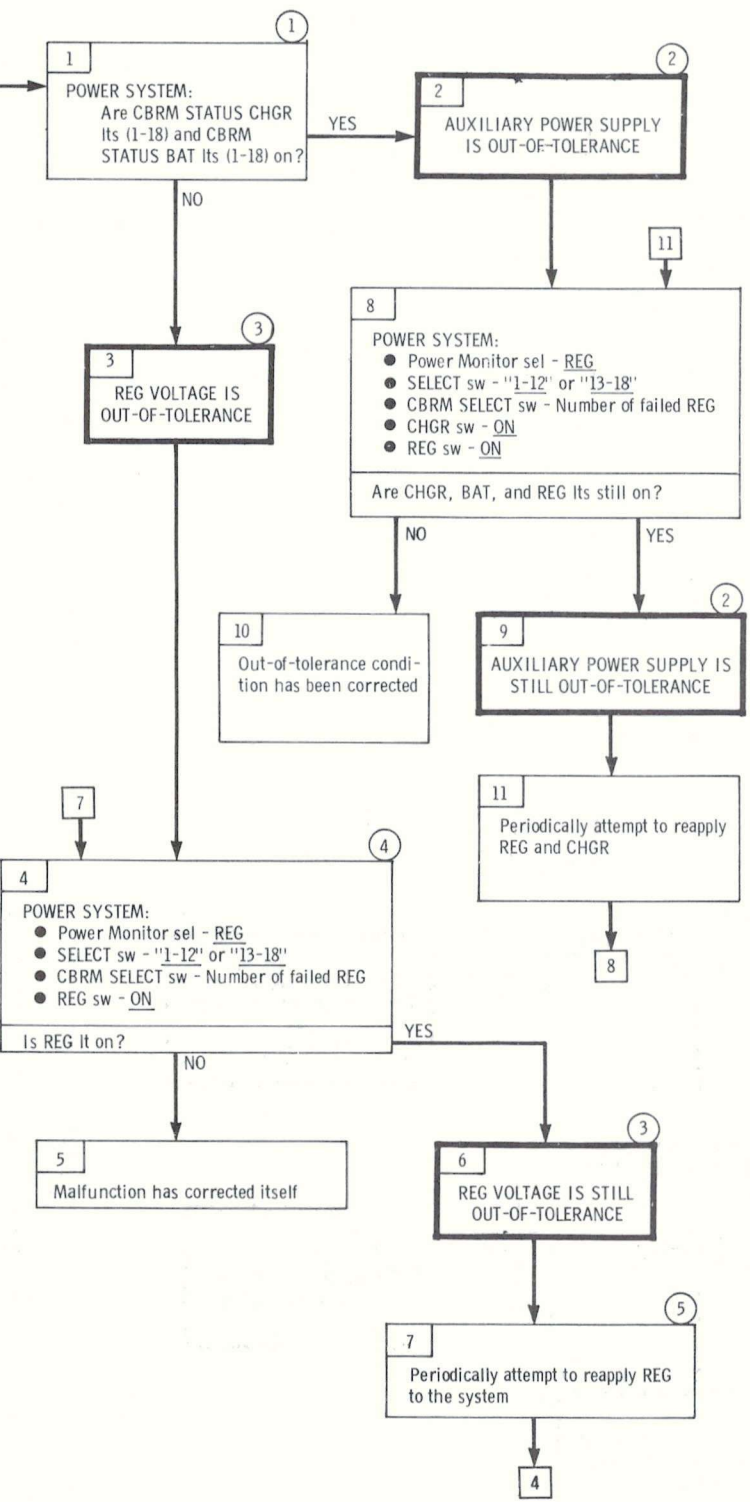
SYMPTOM	PROCEDURE	REMARKS
3 EPS POWER SYSTEM  YELLOW REG/BAT ind pwr fail It on (It comes on if power to REG/BAT ind is removed)	<pre> graph TD 1[1] --> 2[2] 1 --> 3[3] 3 --> 4[4] 3 --> 5[5] 5 --> 8[8] 5 --> 6[6] 6 --> 9[9] 6 --> 7[7] </pre> 1 POWER SYSTEM: ● Power Monitor sel - <u>BAT</u> or <u>REG</u> ● CBRM SELECT sw - (1-12) ● CBRM SEL sel - rotate through several positions Do AMPS and °F indicators change readings? YES → 2 2 METER INTERNAL RELAY K43D HAS FAILED NO → 3 3 Is REG/BUS/BAT power fail It on? YES → 5 NO → 4 4 REG/BAT METER HAS FAILED 5 POWER SYSTEM: ● WATT - HOUR RESET sw - <u>MAN</u> Does WATT - HOUR ind reset? YES → 8 NO → 6 8 POWER MONITOR SEL HAS FAILED IN THE OFF POSITION OR RELAY K42D HAS FAILED 6 CONSOLE POWER DISTRIBUTION: ● cb CMD/DEPLOY/EVA BUS 1 & 2 - closed (verify) DISPLAYS: ● POWER SYSTEM sw - <u>BUS 2</u> Is REG/BUS/BAT ind power fail It on? YES → 9 NO → 7 9 DISPLAYS: POWER SYSTEMS SW CIRCUIT FAILED 7 PRIMARY BUS V311D OR V321D (CMD/DEPLOY/EVA BUS 1 OR 2) FAILED	1 Meters will not return to 0 and will not deflect without power 2 Meter has input power and signals but has lost internal relay. Loss of relay will leave It on but will not affect meter reading 3 Failure of relay K42D or the Power Monitor sel in the OFF position removes power to the indicators with resultant loss of crew monitoring capability 4 Failure of POWER SYSTEMS sw circuitry loses crew monitoring capability of REG/BAT ind and REG/BUS/BAT ind. TM can be used for monitoring

ATM-EPS-005A

ELECTRICAL POWER SUBSYSTEM

SKYLAB OPERATIONS HANDBOOK

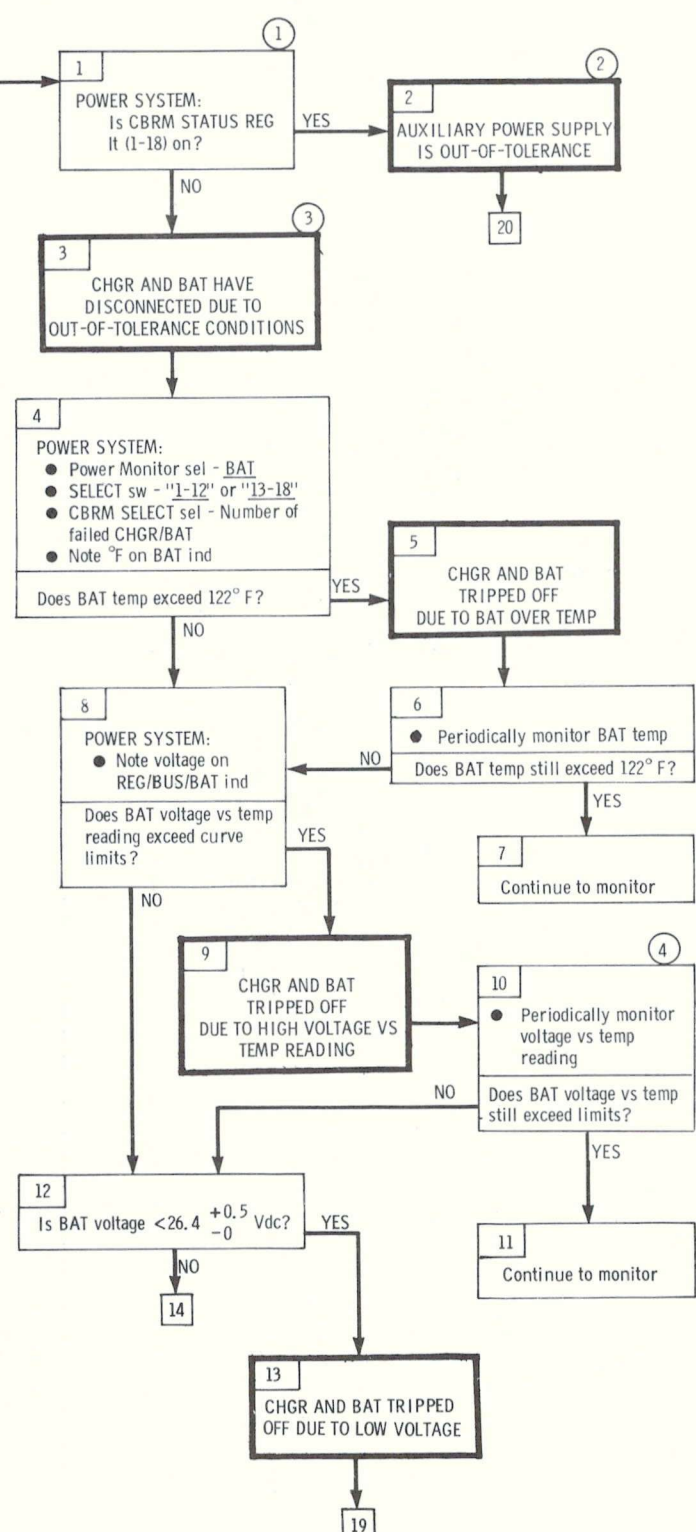
ATM

SYMPTOM	PROCEDURE	REMARKS
4 EPS POWER SYSTEM  YELLOW CBRM STATUS REG It (1-18) on (see (1) .) Lt comes on if component is removed from the system. The component is removed automatically when tolerance limits are exceeded. (See (2) and (3).) PWR SYS Alert Lt comes on as a warning It prior to CBRM STATUS REG It	 <pre> graph TD Start[4 EPS POWER SYSTEM YELLOW CBRM STATUS REG It (1-18) on] --> Q1{1 Are CBRM STATUS CHGR Its (1-18) and CBRM STATUS BAT Its (1-18) on?} Q1 -- YES --> Q2{2 AUXILIARY POWER SUPPLY IS OUT-OF-TOLERANCE} Q1 -- NO --> Q3{3 REG VOLTAGE IS OUT-OF-TOLERANCE} Q2 --> Q8{8 POWER SYSTEM: • Power Monitor sel - REG • SELECT sw - "1-12" or "13-18" • CBRM SELECT sw - Number of failed REG • CHGR sw - ON • REG sw - ON Are CHGR, BAT, and REG Its still on?} Q3 --> Q7{7} Q7 --> Q4{4 POWER SYSTEM: • Power Monitor sel - REG • SELECT sw - "1-12" or "13-18" • CBRM SELECT sw - Number of failed REG • REG sw - ON Is REG It on?} Q4 -- YES --> Q6{6 REG VOLTAGE IS STILL OUT-OF-TOLERANCE} Q4 -- NO --> Q5{5 Malfunction has corrected itself} Q8 -- NO --> Q10{10 Out-of-tolerance condition has been corrected} Q8 -- YES --> Q9{9 AUXILIARY POWER SUPPLY IS STILL OUT-OF-TOLERANCE} Q9 --> Q11{11 Periodically attempt to reapply REG and CHGR} Q11 --> Q8 Q6 --> Q7 Q7 --> Q5 </pre>	(1) CBRM STATUS It (1-18) refers to the same CBRM throughout the procedure (2) The Auxiliary Power Supply is out-of-tolerance if its voltage is <14.8 or >15.2 Vdc. All components of CBRM - CHGR, BAT, REG, and Solar Array Input Contactor will be automatically disconnected from the system removing one-eighteenth of ATM EPS power capability (3) REG voltage is out-of-tolerance (high) if it exceeds 31.8 ± 0.2 volts. REG will be automatically disconnected from the system removing one-eighteenth of ATM EPS power capability (4) REG can be reapplied to the system by placing the CBRM ALL ON sw to ON, but extra noise may be introduced into the system (5) Component will not be reapplied to the system automatically if the malfunction corrects itself. It must be reinitiated ATM-EPS-006A

ELECTRICAL POWER SUBSYSTEM

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
EPS 5 POWER SYSTEM  YELLOW CBRM STATUS CHGR It (1-18) on (see ①) and CBRM STATUS BAT It (1-18) on. CHGR and BAT com- ponents are removed from the system simultaneously when tolerance limits of BAT are exceeded (see ② and ③.) Its come on when components are removed PWR SYS Alert It comes on as a warning It prior to CBRM STATUS CHGR It and CBRM STATUS BAT It	 <pre> graph TD 1[1 POWER SYSTEM: Is CBRM STATUS REG It (1-18) on?] -- YES --> 2[2 AUXILIARY POWER SUPPLY IS OUT-OF-TOLERANCE] 2 --> 20[20] 1 -- NO --> 3[3 CHGR AND BAT HAVE DISCONNECTED DUE TO OUT-OF-TOLERANCE CONDITIONS] 3 --> 4[4 POWER SYSTEM: • Power Monitor sel - BAT • SELECT sw - "1-12" or "13-18" • CBRM SELECT sel - Number of failed CHGR/BAT • Note °F on BAT ind] 4 --> 5{Does BAT temp exceed 122° F?} 5 -- YES --> 5[5 CHGR AND BAT TRIPPED OFF DUE TO BAT OVER TEMP] 5 -- NO --> 8[8 POWER SYSTEM: • Note voltage on REG/BUS/BAT ind] 8 --> 9{Does BAT voltage vs temp reading exceed curve limits?} 9 -- YES --> 9[9 CHGR AND BAT TRIPPED OFF DUE TO HIGH VOLTAGE VS TEMP READING] 9 -- NO --> 12{Is BAT voltage < 26.4 +0.5 -0 Vdc?} 12 -- YES --> 13[13 CHGR AND BAT TRIPPED OFF DUE TO LOW VOLTAGE] 12 -- NO --> 14[14] 5[5] --> 6[6 • Periodically monitor BAT temp Does BAT temp still exceed 122° F?] 6 -- YES --> 7[7 Continue to monitor] 6 -- NO --> 8 9[9] --> 10[10 • Periodically monitor voltage vs temp reading Does BAT voltage vs temp still exceed limits?] 10 -- YES --> 11[11 Continue to monitor] 10 -- NO --> 12 13 --> 19[19] </pre>	① CBRM STATUS It (1-18) refers to the same CBRM throughout the procedure ② The Auxiliary Power Supply is out-of-tolerance if its voltage is <14.8 or >15.2 Vdc. All components of CBRM-CHGR, BAT, REG, and Solar Array Input Contactor will be disconnected removing one-eighteenth of ATM EPS power capability ③ Out-of-Tolerance conditions that will cause the CHGR and BAT to trip off are: a. BAT temp >50° C (122° F) b. BAT voltage vs temp high (trip off limit) c. BAT voltage <26.4 +0.5 -0 Vdc d. BAT discharge current >25A (Maximum discharge current reading on REG/BAT ind and on TM is 20 AMPS. Any larger current is acceptable for cutoff) ④ Out-of-tolerance condition of BAT causes loss of that CBRM's power during orbital night and degrades ATM EPS dark capability by one-eighteenth

ATM-EPS-007A

ELECTRICAL POWER SUBSYSTEM

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
5 EPS (Cont)	<pre> graph TD 14[14] -- YES --> 15[15] 14 -- NO --> 16[16] 16 -- YES --> 17[17] 16 -- NO --> 18[18] 18 --> 19[19] 19 --> 20[20] 15 --> 14 20 --> 14 </pre>	2 The Auxiliary Power Supply is out-of-tolerance if its voltage is <14.8 or >15.2 Vdc. All components of CBRM-CHGR, BAT, REG, and Solar Array Input Contactor will be disconnected removing one-eighteenth of ATM EPS power capability 4 Out-of-tolerance condition of BAT causes loss of that CBRM's power during orbital night and degrades ATM EPS dark capability by one-eighteenth 5 CHGR and BAT can be reapplied to the system by placing the CBRM ALL ON sw to ON, but extra noise may be introduced into the system 6 Components will not be reapplied to the system automatically if the malfunction corrects itself. It must be reinitiated 7 Reverify step 4 configuration

ATM-EPS-008A

ELECTRICAL POWER SUBSYSTEM

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
1 I&C NO IMAGE ON EITHER MONITOR FROM ANY CAMERA	1 PRIMARY SYNC GENERATOR CIRCUITRY FAILURE 2 TV: ● SYNC GEN sw - SEC 3 Continue normal operation	1 Loss of sync generator redundancy
2 I&C NO IMAGE ON ONE MONITOR FROM ANY CAMERA	1 DAS: ● Key - 40046E ● Key - 40167E Does monitor display camera images? YES 2 INADVERTENT POWER RELAY OPERATION 3 Continue normal operation NO 2 DAS: ● Key - 40027E Does monitor display camera images? YES 3 SWITCHER/PROCESSOR CIRCUITRY FAILURE NO 6 TV MONITOR CIRCUITRY FAILURE 7 Continue operation using remaining monitor system	1 Commands power to Switcher/Processor No. 1 (40046E) and Switcher/Processor No. 2 (40167E) 2 Commands exchange of monitor video image with Switcher/Processor No. 1 output to MON 2 and Switcher/Processor No. 2 output to MON 1 3 Loss of dual monitor capability

ATM-I&CS-008

INSTRUMENTATION AND COMMUNICATIONS SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

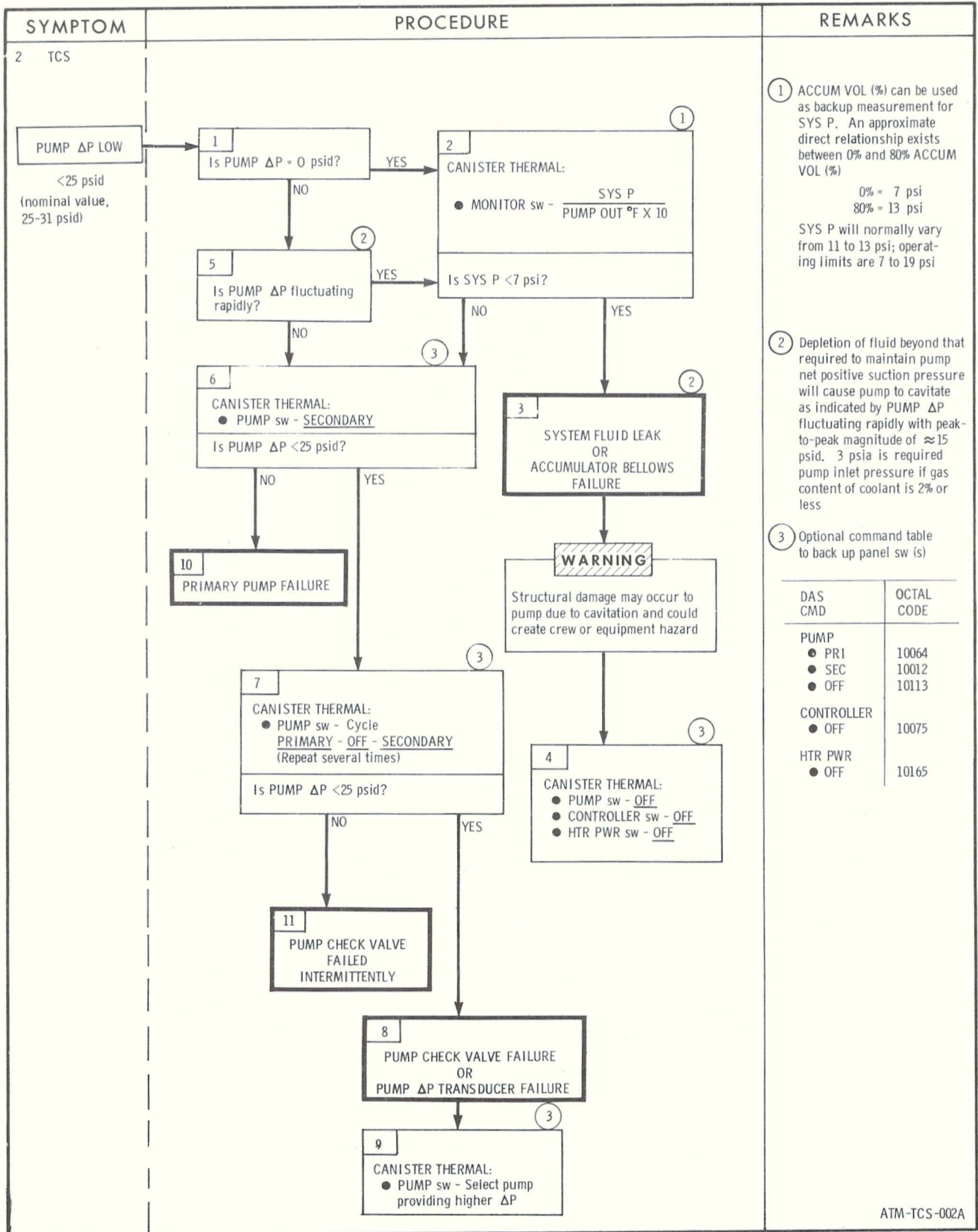
SYMPTOM	PROCEDURE	REMARKS
1 TCS Panel 207 ATM CNST THERM YELLOW Lt on if: PUMP ΔP ≤ 25 PSID COOL TEMP ≤ 45° F COOL TEMP ≥ 55° F HTR TEMP ≥ 150° F	1 Panel 207: ● ATM CNST PUMP ΔP sw - <u>down</u> (inhibit) Is ATM CNST THERM It out? YES → 2 CANISTER THERMAL: ● MONITOR sw - $\frac{\text{PUMP } \Delta P}{\text{CSTR IN } ^\circ\text{F}}$ Is PUMP ΔP ≤ 25 psid? YES → TCS 2 1 PUMP ΔP LOW NO → 3 PUMP ΔP CAUTION & WARNING INPUT CIRCUIT FAILED NO → 4 Panel 207: ● ATM CNST COOL TEMP sw - <u>down</u> (inhibit) Is ATM CNST THERM It out? YES → 5 CANISTER THERMAL: ● MONITOR sw - $\frac{\text{PUMP } \Delta P}{\text{CSTR IN } ^\circ\text{F}}$ Is CSTR IN ≤ 45° F or ≥ 55° F? YES → TCS 3 1 CSTR IN °F ABNORMAL NO → 6 CSTR IN °F CAUTION & WARNING INPUT CIRCUIT FAILED NO → 7 Panel 207: ● ATM CNST HTR TEMP sw - <u>down</u> (inhibit) Is ATM CNST THERM It out? YES → 8 CANISTER THERMAL: ● MONITOR sw - $\frac{\text{ACCUM VOL } (\%)}{\text{HTR } ^\circ\text{F} \times 10}$ Is HTR TEMP ≥ 150° F? YES → TCS 4 1 HTR °F X 10 HIGH NO → 9 HTR TEMP CAUTION & WARNING INPUT CIRCUIT FAILED NO → 10 ATM CNST THERM CAUTION & WARNING SYSTEM FAILED	

ATM-TCS-001A

THERMAL CONTROL SUBSYSTEM

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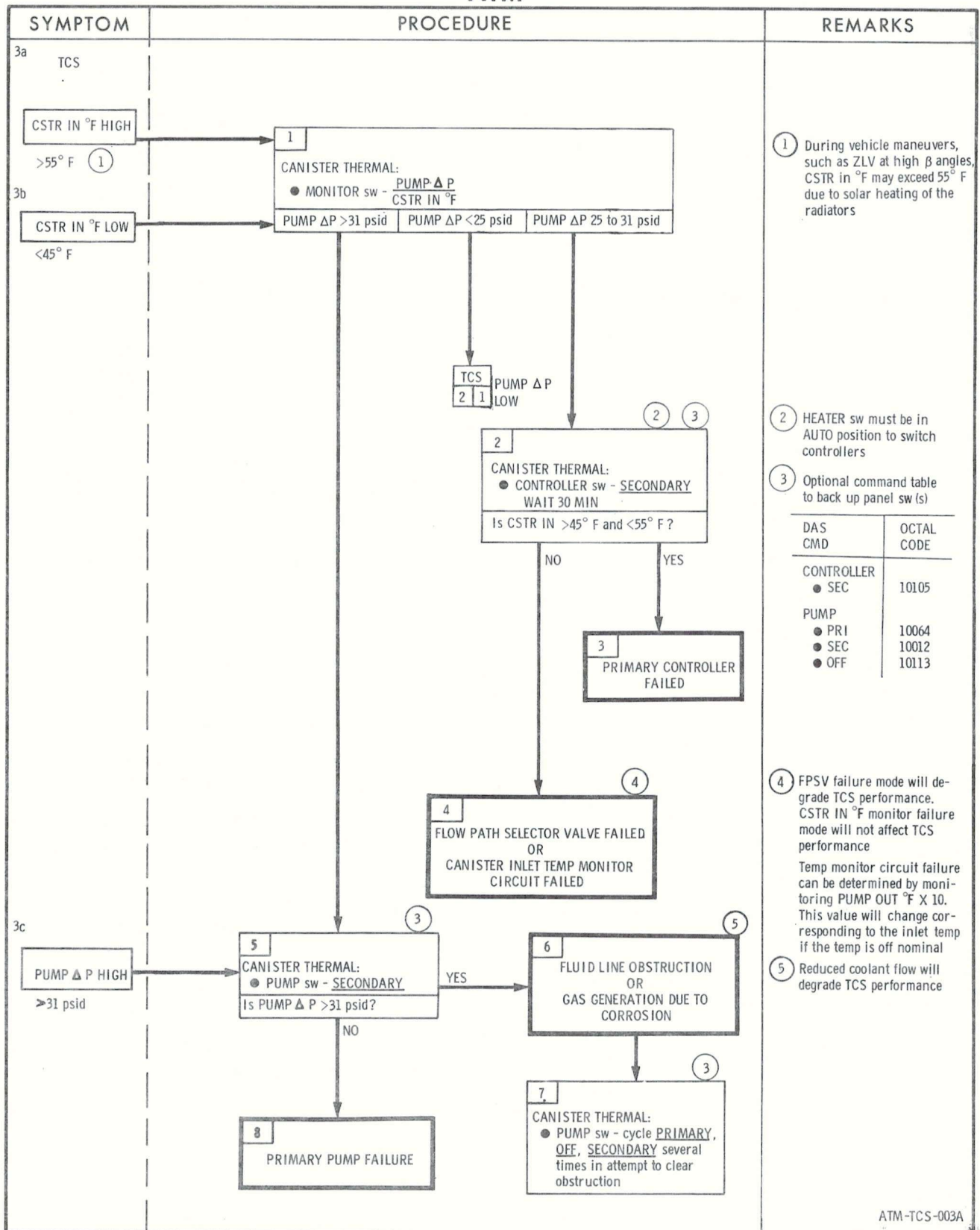


ATM-TCS-002A

THERMAL CONTROL SUBSYSTEM

SKYLAB OPERATIONS HANDBOOK

ATM



ATM-TCS-003A

THERMAL CONTROL SUBSYSTEM

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS								
4 TCS HTR °F X 10 HIGH >70° F	1 1 CANISTER THERMAL: ● HTR PWR sw - OFF - WAIT 30 MIN Is HTR TEMP decreasing? 2 2 PRIMARY TEMP CONTROLLER LOOP FAILURE 3 3 CANISTER THERMAL: ● HTR PWR sw - AUTO ● CONTROLLER sw - <u>SECONDARY</u> 4 4 HTR TEMP TRANSDUCER FAILURE 5 5 CANISTER THERMAL: ● HTR PWR sw - <u>AUTO</u>	1 Optional command table to back up panel sw (s) <table><tr><th>DAS CMD</th><th>OCTAL CODE</th></tr><tr><td>HTR PWR ● AUTO</td><td>10114</td></tr><tr><td>● OFF</td><td>10165</td></tr><tr><td>CONTROLLER ● SEC</td><td>10105</td></tr></table> 2 Does not affect performance of TCS	DAS CMD	OCTAL CODE	HTR PWR ● AUTO	10114	● OFF	10165	CONTROLLER ● SEC	10105
DAS CMD	OCTAL CODE									
HTR PWR ● AUTO	10114									
● OFF	10165									
CONTROLLER ● SEC	10105									

ATM-TCS-004A

ATM-TCS-004A

THERMAL CONTROL SUBSYSTEM

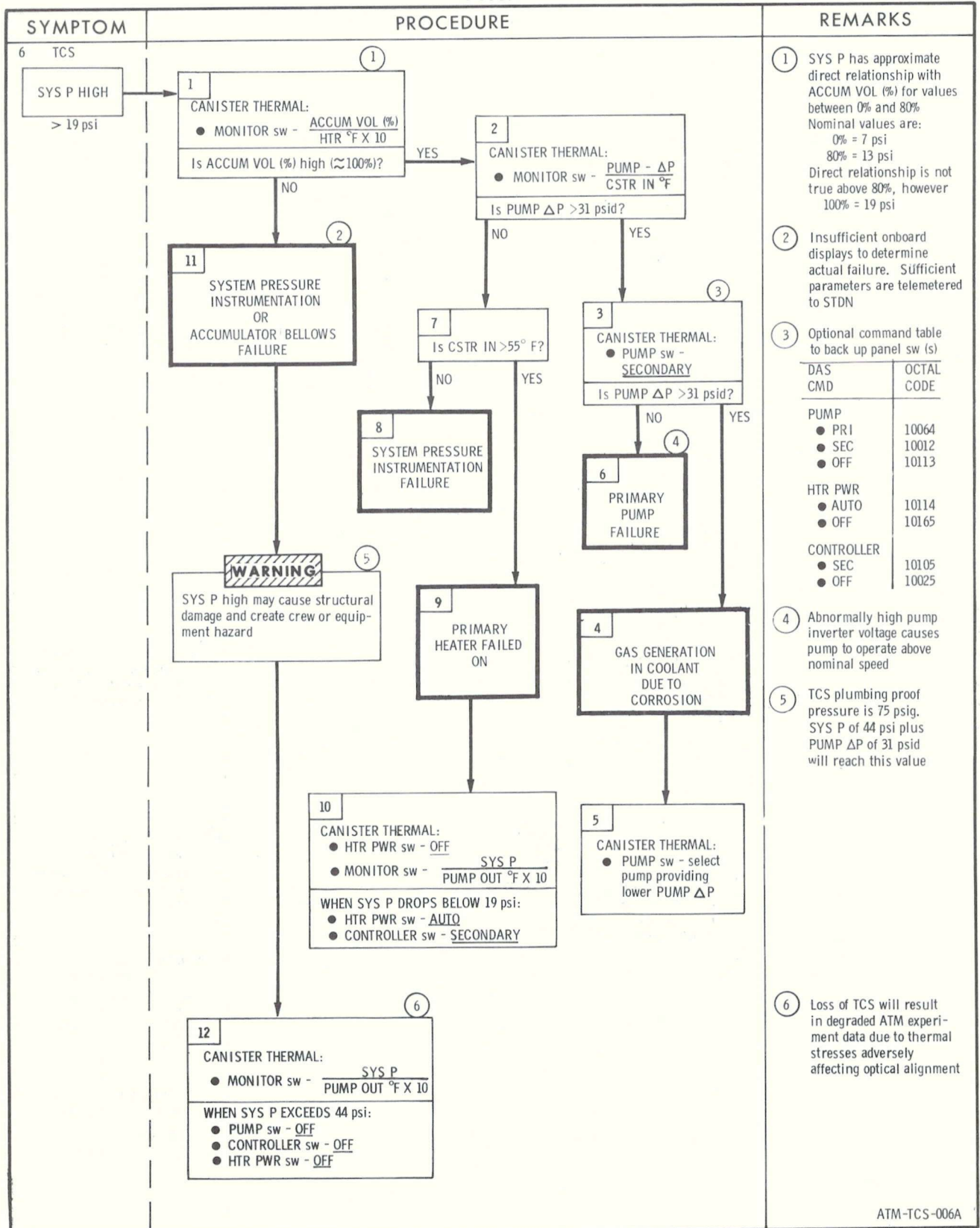
SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS							
5 TCS SYS P LOW <7 psi	1 CANISTER THERMAL: ● MONITOR sw - $\frac{\text{ACCUM VOL (\%)}}{\text{HTR } ^\circ\text{F} \times 10}$ ACCUM VOL (%) not proportional to SYS P ACCUM VOL (%) proportional to SYS P 2 SYSTEM PRESSURE TRANSDUCER OR ACCUMULATOR BELLOWS FAILED 3 Continue normal operations, maintain close observance of PUMP ΔP CANISTER THERMAL: ● MONITOR sw - $\frac{\text{PUMP} - \Delta\text{P}}{\text{CSTR IN } ^\circ\text{F}}$ 4 WARNING Pump cavitation, as indicated by PUMP ΔP fluctuating rapidly with peak-to-peak magnitude of ≈ 15 psid, may cause structural damage and create a crew or equipment hazard 5 6 4 If PUMP cavitates, shut down TCS CANISTER THERMAL: ● PUMP sw - OFF ● CONTROLLER sw - OFF ● HTR PWR sw - OFF 3 5 SYSTEM FLUID LEAK 6 Shut down TCS to reduce leak rate CANISTER THERMAL: ● PUMP sw - OFF ● CONTROLLER sw - OFF ● HTR PWR sw - OFF 5 6 WARNING Possible crew hazard condition due to vaporized fluid contaminating crew garments/faceplates during EVA 1 SYS P has approximate direct relationship to ACCUM VOL (%) between 0 and 80%, 0% = 7 psi 80% = 13 psi Nominal values: 11 to 13 psi 60 to 80% Operating limits: 7 to 19 psi 0 to 100% 2 Insufficient onboard displays to determine actual failure. STD has sufficient parameters via telemetry 3 Degraded experiment data due to optical contamination from vaporized fluid is possible. Location of fluid (i.e., inside or outside of canister) determines effects on ATM experiments vs OWS experiments 4 Pump cavitation may occur if pump inlet pressure (SYS P) falls below 3 psia 5 Optional command table to back up panel sw(s) <table><tr><th>DAS CMD</th><th>OCTAL CODE</th></tr><tr><td>PUMP ● OFF</td><td>10113</td></tr><tr><td>CONTROLLER ● OFF</td><td>10025</td></tr><tr><td>HTR PWR ● OFF</td><td>10165</td></tr></table> 6 Loss of TCS will result in degraded ATM experiment data due to thermal stresses adversely affecting optical alignment ATM-TCS-005A	DAS CMD	OCTAL CODE	PUMP ● OFF	10113	CONTROLLER ● OFF	10025	HTR PWR ● OFF	10165
DAS CMD	OCTAL CODE								
PUMP ● OFF	10113								
CONTROLLER ● OFF	10025								
HTR PWR ● OFF	10165								

ATM-TCS-005A

THERMAL CONTROL SUBSYSTEM

SKYLAB OPERATIONS HANDBOOK ATM



ATM-TCS-006A

THERMAL CONTROL SUBSYSTEM

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SYMPTOM	PROCEDURE	REMARKS							
7 TCS ACCUM VOL (%) LOW < 60%	1 CANISTER THERMAL: ● MONITOR sw - $\frac{\text{SYS P}}{\text{PUMP OUT } ^\circ\text{F} \times 10}$ SYS P not proportional to ACCUM VOL (%) SYS P proportional to ACCUM VOL (%) and decreasing with time 2 ACCUM VOL TRANSDUCER FAILED OR ACCUMULATOR BELLOWS FAILED 3 Continue normal operations, maintain close observance of SYS P 3 WARNING Do not allow SYS P to rise above 44 psi or structural damage may occur and create crew or equipment hazard 4 When SYS P rises to 44 psi: CANISTER THERMAL: ● PUMP sw - OFF ● CONTROLLER sw - OFF ● HTR PWR sw - OFF 5 TCS 5 5 SYS P LOW 1 SYS P has approximate direct relationship with ACCUM VOL (%) for values between 0% and 80%. Nominal values are: 0% = 7 psi 80% = 13 psi 2 Insufficient onboard instru- mentation to determine actual failure. STDN has sufficient parameters via telemetry 3 TCS plumbing proof pressure is 75 psig. SYS P of 44 psi plus PUMP ΔP of 31 psid will reach this value 4 Loss of TCS will result in degraded ATM experiment data due to thermal stresses adversely affecting optical alignment 5 Optional command table to back up panel sw (s) <table><tr><th>DAS CMD</th><th>OCTAL CODE</th></tr><tr><td>PUMP ● OFF</td><td>10113</td></tr><tr><td>CONTROLLER ● OFF</td><td>10064</td></tr><tr><td>HTR PWR ● OFF</td><td>10165</td></tr></table> ATM-TCS-007A	DAS CMD	OCTAL CODE	PUMP ● OFF	10113	CONTROLLER ● OFF	10064	HTR PWR ● OFF	10165
DAS CMD	OCTAL CODE								
PUMP ● OFF	10113								
CONTROLLER ● OFF	10064								
HTR PWR ● OFF	10165								

③

3

WARNING

Do not allow SYS P to rise above 44 psi or structural damage may occur and create crew or equipment hazard

ATM-TCS-007A

THERMAL CONTROL SUBSYSTEM

SKYLAB OPERATIONS HANDBOOK

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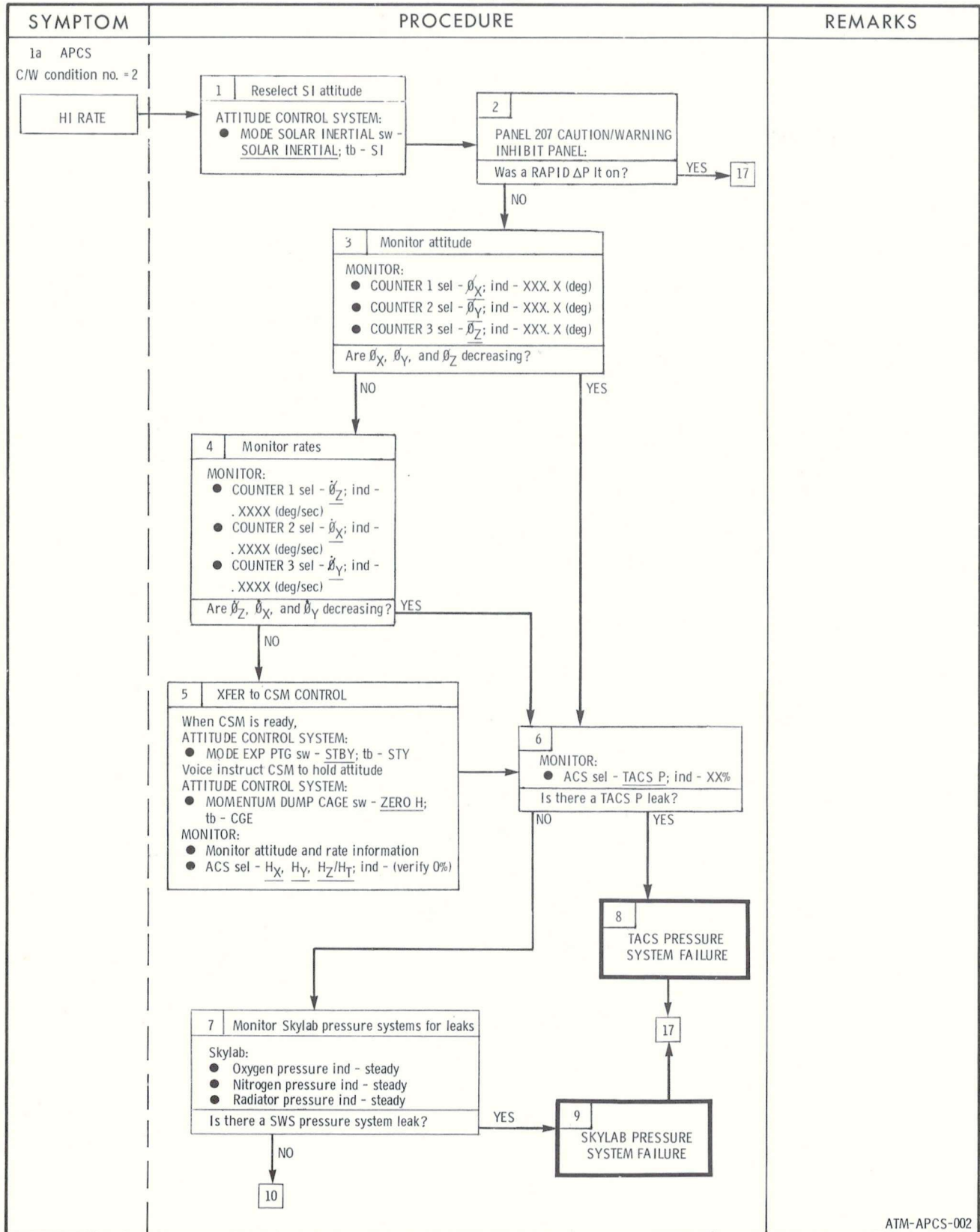
SYMPTOM	PROCEDURE	REMARKS
1 APCS C/W CLUSTER ATT RED Lt on if: HI RATE THRUSTER STUCK	<pre> graph TD Start([1]) --> Q1{Was the CLUSTER ATT It on temporarily?} Q1 -- YES --> B2[Temporary HI RATE condition C/W condition no. 2] Q1 -- NO --> B3[Determine which failure] B3 --> Q2{Is a TACS It on?} Q2 -- YES --> B4[Inhibit stuck thruster] B4 --> Q3{Is the TACS It on?} Q3 -- YES --> B5a[THRUSTER STUCK OPEN MECHANICALLY] Q3 -- YES --> B5b[THRUSTER STUCK OPEN ELECTRICALLY] B5a --> A1b[APCS 1b] B5b --> A1d[APCS 1d] Q3 -- NO --> B6[Check rates] B6 --> Q4{Are rates > 0.35 deg/sec?} Q4 -- YES --> A1a[APCS 1a HI RATE] Q4 -- NO --> Q5{Is ACS or CMG MALF ALERT It on?} Q5 -- YES --> B7[Check for rate gyro failure or CMG Auto reset] B7 --> Q6{Does A = 1 or 9?} Q6 -- YES --> B8[Reset CAUTION/WARNING conditions] B8 --> A4[APCS 4 ALERT ACS] Q6 -- NO --> B9[THRUSTER STUCK CLOSED] Q5 -- NO --> B9 B9 --> A1c[APCS 1c] </pre>	NOTE: These procedures correspond to Phase II ATMDC software definition ① The two conditions are: a. HI RATE is active when the RSS of $\dot{\theta}_X, \dot{\theta}_Y, \dot{\theta}_Z$ > 0.35 deg/sec b. THRUSTER (TACS) STUCK test failure produces this condition when the absolute value of the momentum component about any axis due to TACS firings exceeds a preset limit over 1/2 of an orbit. THRUSTER STUCK is reset by 52003, 50000 ② Thruster stuck test exceeds limit ③ HI RATE condition (RSS of vehicle rates > 0.35 deg/sec) can be caused by severe leakage ④ Full-on rate gyro failure or CMG Auto reset can cause stuck thruster test limit to be exceeded without a thruster failure

ATM-APCS-001

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
1a APCS (Cont)	<pre> graph TD 7[7] --> 10[10] 10 --> 11{11} 11 -- YES --> 11b[CSM PRESSURE SYSTEM FAILURE] 11b --> 17[17] 11 -- NO --> 12[12] 12 -- YES --> 12b[APCS 4 1 ALERT ACS] 12 -- NO --> 13[13] 13 -- YES --> 13b[APCS 5 1 ALERT CMG MALF] 13 -- NO --> 14[14] 14 --> 14b{Is the status word in an off-nominal configuration?} 14b -- YES --> 15[15] 14b -- NO --> 16[16] 16 --> 16b{Is the status word in an off-nominal configuration?} 16b -- YES --> 17 16b -- NO --> 18[18] 15 --> 17 17 --> 18 18 --> 19[19] 2[2] --> 17 8[8] --> 17 9[9] --> 17 11[11] --> 17 </pre>	1 Verify that the rate gyros for all three axes are in the proper configuration and that no rate gyro integral test failure has been detected

ATM-APCS-003

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
1a APCS (Cont)	<pre> graph TD 18[18] --> 19[19] 19 --> 20[20] 20 -- YES --> 21[21] 20 -- NO --> 22[22] 21 --> 22 </pre> 21 XFER to ATM CONTROL DAS: ● Key - 52023E CMG NOMINAL CAGE MONITOR: ● ACS sel - H_X, H_Y, H_Z/H_T; ind - (stable H) ● Monitor attitude and rate information ● Wait until rates < 0.03 deg/sec (Approximately 2 min) Instruct CSM to release attitude control ATTITUDE CONTROL SYSTEM: ● MOMENTUM DUMP CAGE sw <u>RELEASE</u>; tb - gray ● MODE sw - <u>SOLAR INERTIAL</u> or <u>EXP PTG</u> (as appropriate); tb - S1 or EXP 22 Continue with normal operations	2 The CLUSTER ATT It will turn off when the RSS of the vehicle body rates become < 0.35 deg/sec

ATM-APCS-004

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
1b APCS C/W condition no. = 1 THRUSTER STUCK OPEN MECHANICALLY	1 TACS MECHANICAL FAILURE APCS 1d 12 THRUSTER STUCK OPEN ELECTRICALLY 2 Return to solar inertial ATTITUDE CONTROL SYSTEM: ● TACS 1 (2, 3, 4, 5, 6) sw - <u>ENABLE</u> ● MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI MONITOR: ● ACS sel - <u>TACS P</u>; ind - XX% ● Monitor TACS P decrease to 0% DAS: ● Key - 52010E INHIBIT 50001E TACS CNTL CAPABILITY ● Key - 52011E ENABLE 50000E CMG CONTROL ATTITUDE CONTROL SYSTEM: ● MOMENTUM DUMP CAGE tb - gray	1 TACS will blow down to 0% within 15 min. Attitude should return to SI $\pm 3^\circ$ $\pm 2^\circ$, $\pm 2^\circ$ with the CMGs caged to a nominal momentum

ATM-APCS-005

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
1c APCS THRUSTER STUCK CLOSED	① 1 Perform +Y TACS ATT HOLD maneuver ATTITUDE CONTROL SYSTEM: ● MODE ATT HOLD sw - TACS; tb - TAC DAS: ● Key - 52030E MNVR TIME 50001E 1 MIN ● Key - 52020E COARSE MNVR 50000E 0 DEGREES, X AXIS 50007E 7 DEGREES, Y AXIS 50000E 0 DEGREES, Z AXIS Did thruster 4 lt illuminate? YES 2 Return to Solar Inertial Wait 1 min DAS: ● Key - 52020E COARSE MNVR 50000E 0 DEGREES, X AXIS 51007E -7 DEGREES, Y AXIS 50000E 0 DEGREES, Z AXIS Did thruster 1 lt illuminate? YES 3 Perform +Z TACS maneuver Wait 1 min DAS: ● Key - 52020E COARSE MNVR 50000E 0 DEGREES, X AXIS 50000E 0 DEGREES, Y AXIS 50007E 7 DEGREES, Z AXIS Did thruster lts 2 and 6 illuminate? YES 4 Return to Solar Inertial Wait 1 min DAS: ● Key - 52020E COARSE MNVR 50000E 0 DEGREES X AXIS 50000E 0 DEGREES Y AXIS 51007E -7 DEGREES Z AXIS Did thruster lts 3 and 5 illuminate? YES 5 THRUSTER STUCK SOFTWARE TEST LIMITS EXCEEDED NO 6 TACS THRUSTER STUCK CLOSED ② 7 Inhibit closed thruster For the failed thruster ATTITUDE CONTROL SYSTEM: ● TACS 1(2, 3, 4, 5, 6) sw - INHIBIT 8 Reacquire SI and inhibit C/W ATTITUDE CONTROL SYSTEM: ● MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI APCS 1d 12 THRUSTER STUCK OPEN ELECTRICALLY	① Small arbitrary attitude maneuvers will be performed about the Y and Z axes to check for a stuck closed thruster ② Inhibiting the thruster on the C&D panel reminds the crew the thruster is failed closed ③ Excessive thruster firings can cause stuck thruster test limits to be exceeded without a thruster failure

ATM-APCS-006

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
1d APCS THRUSTER STUCK OPEN ELECTRICALLY	<pre> graph TD Start[THRUSTER STUCK OPEN ELECTRICALLY] --> 1[1 Stabilize vehicle ATTITUDE CONTROL SYSTEM: • MODE ATT HOLD sw - TACS; tb - TAC] 1 --> 2[2 Determine which thruster cb bus failed For the inhibited TACS thruster: PANEL 202 THRUSTER ATTITUDE CONTROL SYSTEM: • THRUSTER 1 (2, 3, 4, 5, 6) 2 cb - off ATTITUDE CONTROL SYSTEM: • TACS 1 (2, 3, 4, 5, 6) sw - ENABLE • Monitor TACS 1 (2, 3, 4, 5, 6) It for 3 sec • TACS 1 (2, 3, 4, 5, 6) sw - INHIBIT Was a TACS It on?] 2 -- NO --> 3[3 THRUSTER CB 2 FAILURE] 2 -- YES --> 4[4 Reconfigure thruster cb's PANEL 202 THRUSTER ATTITUDE CONTROL SYSTEM: • THRUSTER 1 (2, 3, 4, 5, 6) 1 cb - off • THRUSTER 1 (2, 3, 4, 5, 6) 2 cb - on ATTITUDE CONTROL SYSTEM: • TACS 1 (2, 3, 4, 5, 6) sw - ENABLE Is a TACS It on continuously?] 4 -- YES --> 7[7 Inhibit both thruster cb's PANEL 202 THRUSTER ATTITUDE CONTROL SYSTEM: • THRUSTER 1 (2, 3, 4, 5, 6) 2 cb - off] 4 -- NO --> 6[6 THRUSTER CB 1 FAILURE] 6 --> 8[8 WCIU THRUSTER BUS FAILURE] 7 --> 9[9 Determine CMG control status Is the ATTITUDE CONTROL SYSTEM MOMENTUM DUMP CAGE tb CGE?] 8 --> 10[10 Reselect SI mode ATTITUDE CONTROL SYSTEM: • MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI] 9 -- YES --> 11[11] 9 -- NO --> 10 10 --> 12[12] </pre>	① TACS attitude hold will damp rates ② Momentary manual activation of one of the thruster cb's may be required during TACS only control to return vehicle to SI attitude ATM-APCS-007

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
1d APCS (Cont)	<pre> graph TD 6[6] --> 11 9[9] --> 11 11["11 Reestablish SI attitude ATTITUDE CONTROL SYSTEM: • MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI When attitude errors <3°: DAS: • Key - 52011E ENABLE 50000E CMG CONTROL ATTITUDE CONTROL SYSTEM: • MOMENTUM DUMP CAGE tb - gray"] --> 12 10[10] --> 12 12["12 Notify STDN of stuck thruster"] APCS1b["APCS 1b 2 THRUSTER STUCK OPEN MECHANICALLY"] --> 12 APCS1c["APCS 1c 8 THRUSTER STUCK CLOSED"] --> 12 12 --> 13 13["13 Reset CAUTION/WARNING system DAS: • Key - 52003E CMPTR DATA 50000E C/W CONDITIONS PANEL 207 CAUTION/WARNING INHIBIT PANEL: • CLUSTER ATT It - off MONITOR: • COUNTER 1 sel - DAS; ind - AXXX"] --> 14 14["14 Does A = 1 or 2?"] CWA["C/W ACS MALF"] --> 14 APCS28["APCS 2 8"] --> 14 14 -- YES --> 16 14 -- NO --> 15 15["15 Does A = 3?"] 15 -- YES --> APCS31["APCS 3 1 C/W COMPUTER MALF"] 15 -- NO --> APCS25["APCS 2 5 C/W ACS MALF"] 16["16 Continue with normal operation"] </pre>	

ATM-APCS-008

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
2 APCS C/W ACS MALF YELLOW Lt on if: CMG/SWS SATURATION Second or third rate gyro failure on the same axis TACS only control Second ACQ SS analog failure on the same axis	① 1 Was ACS MALF It on temporarily? YES → 2 Temporary CMG saturation condition (C/W condition no. 4) NO → 3 Determine C/W condition numbers DAS: ● Key - 52003E CMPTR DATA 50000E C/W CONDITIONS MONITOR: ● COUNTER 1 sel - DAS; ind - ABCD Have responses been made to conditions B, C, and D? NO → 4 Respond to the earliest condition unless a later one is more time-critical YES → C/W THRUSTER STUCK OPEN ELECTRICALLY APCS 1d 15 5 C/W condition no. = 4? YES → APCS 2a 1 CMG/SWS SATURATION NO → 6 C/W condition no. = 5? YES → APCS 2b 1 SECOND OR THIRD RATE GYRO FAILURE ON THE SAME AXIS NO → 7 C/W condition no. = 6? YES → APCS 2c 1 TACS ONLY CONTROL NO → APCS 1d 14 C/W THRUSTER STUCK OPEN ELECTRICALLY 8 C/W condition no. = 7? YES → APCS 2d 1 SECOND ACQ SS ANALOG FAILURE ON THE SAME AXIS	NOTE: These procedures correspond to Phase II ATMDC software definition ① The ACS MALF It remains on for a CMG SATURATION condition until the system momentum is desaturated
2a C/W condition no. = 4 CMG/SWS SATURATION	1 Is the PANEL 207 CAUTION/WARNING INHIBIT PANEL ACS MALF It on? YES → 3 ATTITUDE CONTROL SYSTEM: ● ATT HOLD MODE sw - TACS; tb - TAC Does a TACS It (6) illuminate? NO → 4 YES → 5 NO → 2 The system momentum is already desaturated	① System momentum = (CMG + vehicle) momentum ② At the end of a maneuver, if system momentum still saturated, a C/W CMG SATURATION alarm is issued

ATM-APCS-009

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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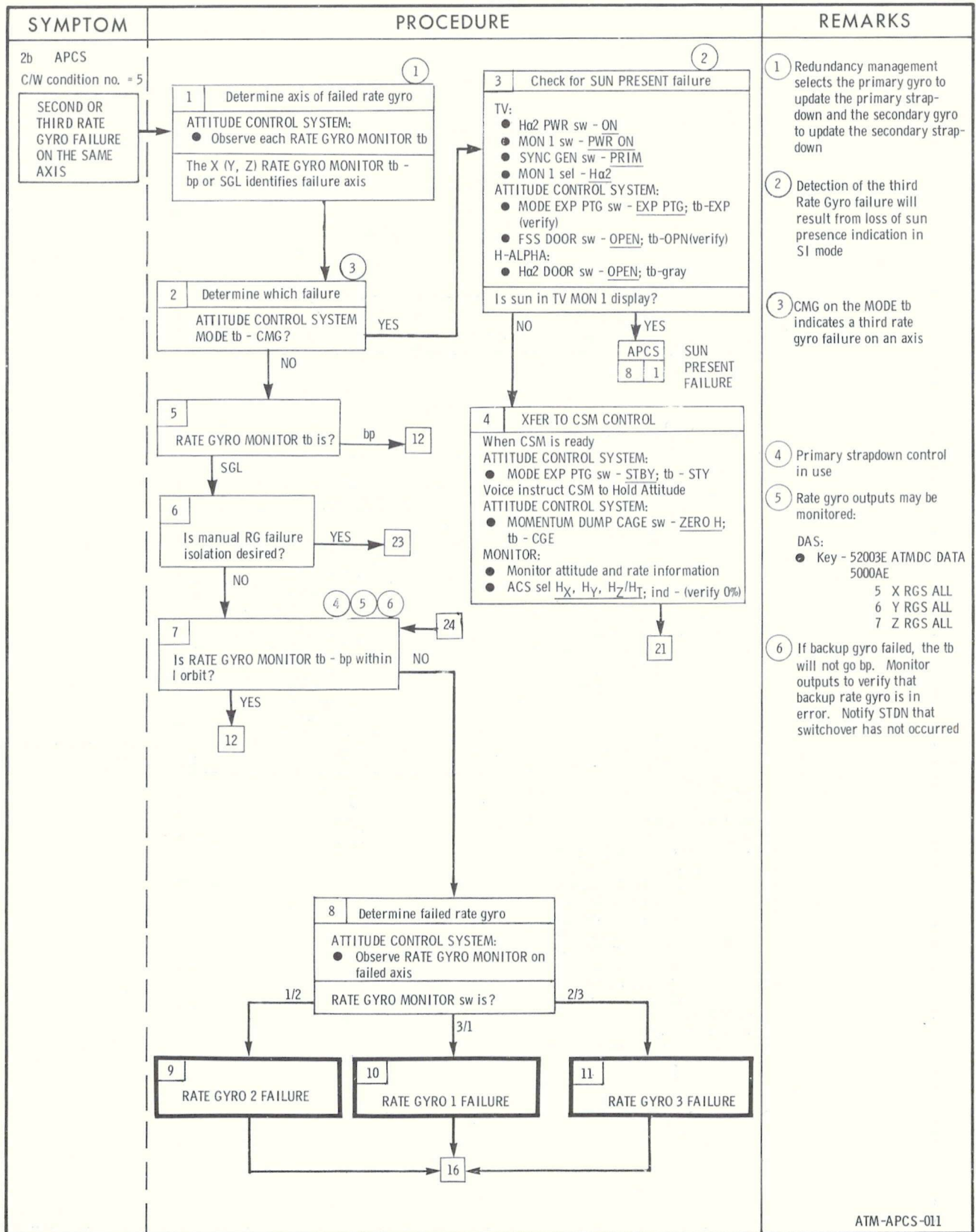
SYMPTOM	PROCEDURE	REMARKS
2a APCS (Cont)	3 4Verify TACS control NOTE: Do not turn on a THRUSTER cb that was turned off because of a previous electrical failure PANEL 202 THRUSTER ATTITUDE CONTROL SYSTEM: ● THRUSTER 1 (2, 3, 4, 5, 6) 1 cb - <u>on</u> ● THRUSTER 1 (2, 3, 4, 5, 6) 2 cb - <u>on</u> DAS: ● Key - 52011E ENABLE ● 50001E TACS CNTL CAPABILITY ATTITUDE CONTROL SYSTEM: ● TACS sw (6) - <u>INHIBIT</u> ● TACS sw (6) - <u>ENABLE</u> Is a TACS It(6) on? NO 35 Are attitudes and rates increasing? YES 6XFER to CSM CONTROL When CSM is ready, ATTITUDE CONTROL SYSTEM: ● MODE EXP PTG sw - STBY; tb - STY Voice instruct CSM to Hold Attitude ATTITUDE CONTROL SYSTEM: ● MOMENTUM DUMP CAGE sw - <u>ZERO H</u>; tb - CGE MONITOR: ● Monitor attitude and rate information ● ACS sel - <u>H_X, H_Y, H_Z/H_T</u>; ind - (verify 0%) NO 8Reacquire SI attitude ATTITUDE CONTROL SYSTEM: ● MODE SOLAR INERTIAL sw - <u>SOLAR INERTIAL</u>; tb - SI YES 7XFER TO ATM CONTROL DAS: ● Key - 52023E CMG NOMINAL CAGE MONITOR: ● ACS sel - <u>H_X, H_Y, H_Z/H_T</u>; ind - (stable H) ● Monitor attitude and rate information ● Wait until rates <0.03 deg/sec (Approximately 2 min) Instruct CSM to release attitude control ATTITUDE CONTROL SYSTEM: ● MOMENTUM DUMP CAGE sw - <u>RELEASE</u>; tb - gray ● MODE sw - <u>SOLAR INERTIAL</u> or <u>EXP PTG</u> (as appropriate); tb - SI or EXP 9Notify STDN of CMG/SWS SATURATION condition	

ATM-APCS-010

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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ATM-APCS-011

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SYMPTOM	PROCEDURE	REMARKS
2b APCS (Cont)	<pre> graph TD 5[5] --> 12 7[7] --> 12 6((6)) --> 12 12[12 Determine failed rate gyro ATTITUDE CONTROL SYSTEM: • Observe RATE GYRO MONITOR on failed axis RATE GYRO MONITOR sw is?] -- 1/2 --> 13[13 RATE GYRO 1 FAILURE] 12 -- 3/1 --> 14[14 RATE GYRO 3 FAILURE] 12 -- 2/3 --> 15[15 RATE GYRO 2 FAILURE] 13 --> 16 14 --> 16 15 --> 16 9[9] --> 16 10[10] --> 16 11[11] --> 16 16[16 Notify STDN which rate gyro failed Has STDN requested the crew to reenoble redundancy management for failed rate gyro?] -- YES --> 17 16 -- NO --> 18 17[17 Reconfigure rate gyros DAS: • Key - 52015E RATE GYRO RM 500AAE 13 X AXIS SELECT 1 & 3; RM ENABLE 14 X AXIS SELECT 2 & 3; RM ENABLE 23 Y AXIS SELECT 1 & 3; RM ENABLE 24 Y AXIS SELECT 2 & 3; RM ENABLE 33 Z AXIS SELECT 1 & 3; RM ENABLE 34 Z AXIS SELECT 2 & 3; RM ENABLE] --> 27[27] 18[18 Has STDN requested crew to inhibit wheel power on failed rate gyro?] -- YES --> 19 18 -- NO --> 20[20] 19[19 Inhibit wheel power on failed rate gyro GROUND/DAS: • ACS sw - ENABLE DAS: • Key - 30GGGE RG (ACS) POWER 151 X-1 RG WHL INH 147 X-2 RG WHL INH 011 X-3 RG WHL INH 111 Y-1 RG WHL INH 031 Y-2 RG WHL INH 154 Y-3 RG WHL INH 024 Z-1 RG WHL INH 146 Z-2 RG WHL INH 152 Z-3 RG WHL INH GROUND/DAS: • ACS sw - INHIBIT] --> 20 </pre>	(6) Secondary strapdown control in use (7) Wheel inhibited to conserve power ATM-APCS-012

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
2b APCS (Cont)	18 19 8 20 Reconfigure rate gyros DAS: ● Key - 52015E RATE GYRO RM 500AAE 15 X AXIS SELECT 1; RM ENABLE 16 X AXIS SELECT 2; RM ENABLE 17 X AXIS SELECT 3; RM ENABLE 25 Y AXIS SELECT 1; RM ENABLE 26 Y AXIS SELECT 2; RM ENABLE 27 Y AXIS SELECT 3; RM ENABLE 35 Z AXIS SELECT 1; RM ENABLE 36 Z AXIS SELECT 2; RM ENABLE 37 Z AXIS SELECT 3; RM ENABLE ● Display rate gyro outputs ● Key - 52003E CMPTR DATA 5000AE 5 X RGS ALL 6 Y RGS ALL 7 Z RGS ALL MONITOR: ● COUNTER 1 sel - DAS; ind - . XXXX (deg/sec) RG1 ● COUNTER 2 sel - DAS; ind - . XXXX (deg/sec) RG2 ● COUNTER 3 sel - DAS; ind - . XXXX (deg/sec) RG3 ● Verify output of selected gyro equals rate shown for axis of failure ATTITUDE CONTROL SYSTEM: ● Position RATE GYRO MONITOR sw - <u>1/2</u>, <u>2/3</u>, or <u>3/1</u> for tb - SGL 27 4 9 21 Reacquire SI attitude 22 Notify STDN of third (last) rate gyro failure	8 Rate gyro RM must be inhibited in all modes except SI/EXP PTG 9 Attitude will have to be maintained with CSM control

ATM-APCS-013

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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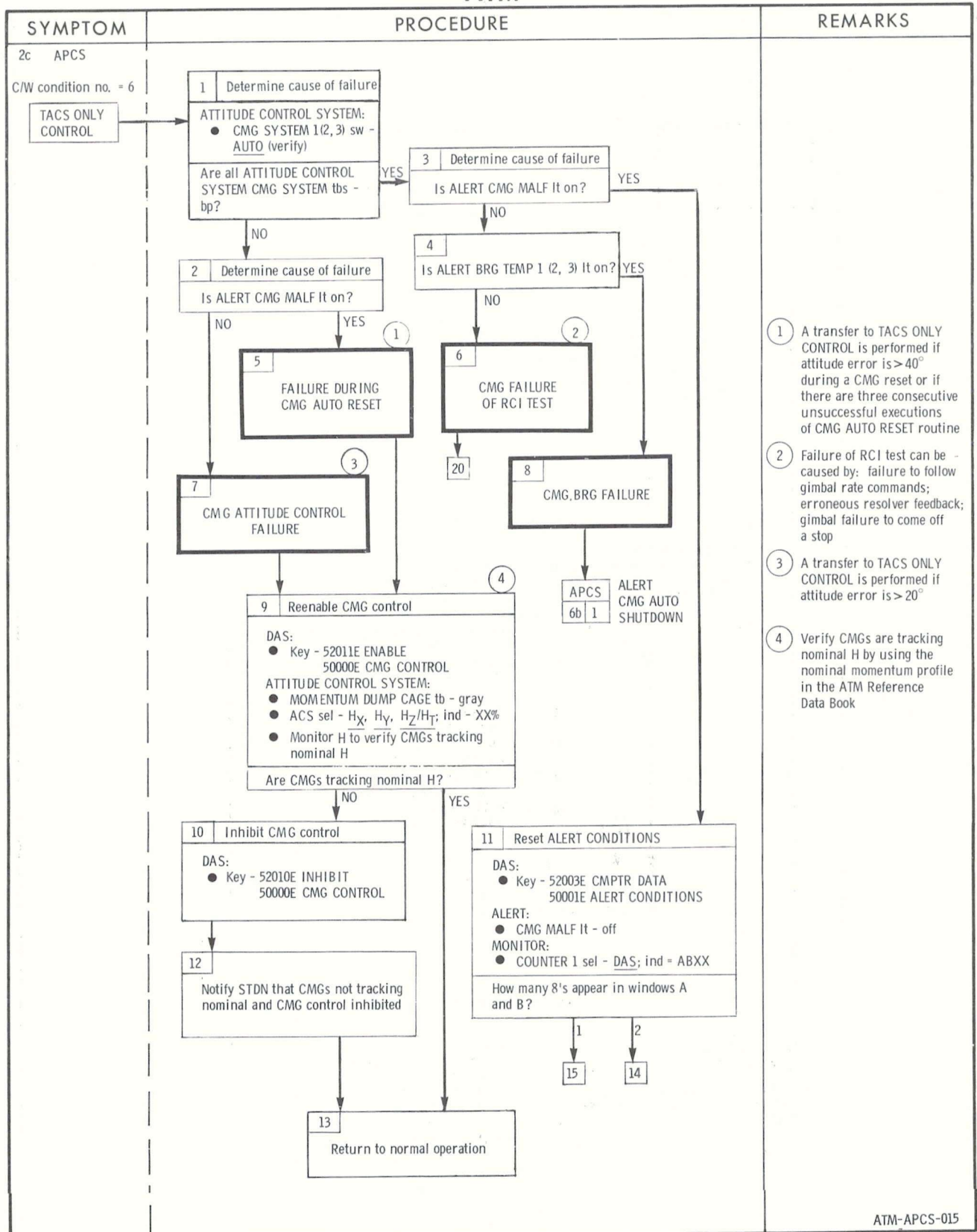
SYMPTOM	PROCEDURE	REMARKS
2b APCS (Cont)	6 10 23 Isolate RG failure manually NOTE: Remove RG drift compensation on 2 gyros on failed axis. Record change in values so compensation may be reinserted following failure isolation DAS: ● Key - 52003E CMPTR DATA 5000AE 5 X RGS ALL 6 Y RGS ALL 7 Z RGS ALL MONITOR: COUNTER 1 sel - DAS; ind - .XXXX (deg/sec) RG1 COUNTER 2 sel - DAS; ind - .XXXX (deg/sec) RG2 COUNTER 3 sel - DAS; ind - .XXXX (deg/sec) RG3 DAS: ● Key - 52036E RG DRIFT COMPENSATION 500GGE 01 1X 02 2X 03 3X 04 1Y 05 2Y 06 3Y 07 1Z 10 2Z 11 3Z 50000E ZERO DRIFT Monitor outputs and vehicle motion to determine failed rate gyro Can failed rate gyro be identified? YES 25 Select and recompensate good rate gyro DAS: ● Key - 52015E RATE GYRO RM 500AAE 15 X AXIS SELECT 1; RM ENABLE 16 X AXIS SELECT 2; RM ENABLE 17 X AXIS SELECT 3; RM ENABLE 25 Y AXIS SELECT 1; RM ENABLE 26 Y AXIS SELECT 2; RM ENABLE 27 Y AXIS SELECT 3; RM ENABLE 35 Z AXIS SELECT 1; RM ENABLE 36 Z AXIS SELECT 2; RM ENABLE 37 Z AXIS SELECT 3; RM ENABLE ● Key - 52036E RG DRIFT COMPENSATION 500GGE 01 1X 02 2X 03 3X 04 1Y 05 2Y 06 3Y 07 1Z 10 2Z 11 3Z 5 ± 0DDE DD = Negative of previously recorded change in compensation ATTITUDE CONTROL SYSTEM: ● Position RATE GYRO MONITOR sw - 1/2, 2/3, or 3/1 for tb - SGL 24 Seek assistance from STDN 7 26 Continue with normal operation 17 20 27 Notify STDN of RATE GYRO failure and reconfiguration NO 11 A maneuver may be performed to try to force rate gyro isolation. Check with STDN prior to performing maneuver 10 One function command and two data commands are required for changing the drift compensation of each gyro	

ATM-APCS-014

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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ATM-APCS-015

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
2c APCS (Cont)	11 14 CMG FAILURE BY V-REF TESTING 16 Reset MASTER ALARM and ALERT and C/W conditions PANEL 206 CAUTION & WARNING SYSTEM: ● MASTER ALARM sw - reset; It - off DAS: ● Key - 52003E CMPTR DATA 50000E C/W CONDITIONS ● Key - 52003E CMPTR DATA 50001E ALERT CONDITIONS PANEL 207 CAUTION/WARNING INHIBIT PANEL: ● ACS MALF It - off ALERT: ● CMG MALF It - off 17 Notify STDN of failure of both CMG voltage sources Has STDN requested crew to reenale both voltage sources? 18 Reconfigure CMGs DAS: ● Key - 52013E CMG RM 50012E CMG 1 SELECT CNTL ENABLE; RM ENA ● Key - 52013E CMG RM 50022E CMG 2 SELECT CNTL ENABLE; RM ENA ● Key - 52013E CMG RM 50032E CMG 3 SELECT CNTL ENABLE; RM ENA ● Key - 52011E ENABLE 50000E CMG CONTROL ● Key - 52013E CMG RM 50010E 4.8 KHZ 1; RM INHIBIT ● Key - 52013E CMG RM 50020E 4.8 KHZ 2; RM INHIBIT ● Key - 52013E CMG RM 50030E RM ENABLE 19 Return to normal operation 11 15 FAILURE OF BOTH CMG 4.8 KHZ VOLTAGE SOURCES 20 Notify STDN of failed CMG Has STDN requested crew to reenale control with last two CMGs? 21 Reselect last two CMGs DAS: ● Key - 52013E CMG RM 500AAE CNTL ENABLE; RM ENA 12 CMG 1 SELECT 22 CMG 2 SELECT 32 CMG 3 SELECT ● Key - 52013E CMG RM 500AAE CNTL ENABLE; RM ENA 12 CMG 1 SELECT 22 CMG 2 SELECT 32 CMG 3 SELECT	

ATM-APCS-016

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
2d APCS C/W condition no. = 7 SECOND ACQ SS ANALOG FAILURE ON THE SAME AXIS	1 1 Check for sun present failure TV: ● Ha2 PWR sw - ON ● MON 1 sw - PWR ON ● SYNC GEN sw - PRIM ● MON 1 sel - Ha2 ATTITUDE CONTROL SYSTEM: ● MODE EXP PTG sw - EXP PTG; tb - EXP (verify) ● FSS DOOR sw - OPEN; tb - OPN (verify) H-ALPHA: ● Ha2 DOOR sw - OPEN tb - gray Is sun in TV MON 1 display? NO APCS 8 1 SUN PRESENT FAILURE 1 2 3 2 Reestablish SI attitude NOTE: This procedure requires TBD min of time remaining in orbit phase day ATTITUDE CONTROL SYSTEM: ● MODE ATT HOLD sw - CMG ● Obtain vehicle offsets from the sun shaft through the +Z SAL MONITOR: ● COUNTER 1, 2, 3 sel - θ_X, θ_Y, θ_Z; ind - XXX.X (deg) ● Command maneuvers until sun shaft is located in SO20 at its pre-ACQ SS failure position DAS: ● Key - 52021E FINE MNVR 5±XXXE (0.1° increments, 5±YYYY must be in octal) 50000E MONITOR: ● Monitor θ_X, θ_Y to verify proper offset Is the sun properly located? NO YES 3 Command additional offsets DAS: ● Key - 52021E FINE MNVR 5±XXXE (0.1° increments, 5±YYYY must be in octal) 50000E 4 Ready for strapdown reference initialization DAS: ● Key - 52012E SELECT SYSTEM 50005E INITIALIZE STRAPDOWN MONITOR: ● COUNTER 1, 2 ind - 000.0 (verify) ATTITUDE CONTROL SYSTEM: ● MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI Notify STDN of second ACQ SS analog failure 5	1 Detection of the second ACQ SS X and/or Y axis failure will result from loss of sun presence indication 2 The SO20 experiment may be used for accurately positioning the OA if offset $< \pm 8^\circ$ 3 When the SO20 is first operated, the sun will be off-center by certain amounts, which are used to bias the attitude. When the ACQ SS fails, the sun should be located in SO20 in its original off-center location

ATM-APCS-017

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
2d APCS (Cont)	4 5 Determine axis of failure DAS: ● Key - 52003E CMPTR DATA 50011E STATUS WORD 1 MONITOR: ● COUNTER 1 sel - <u>DAS</u>; ind - <u>XXCD</u> Which window of COUNTER 1 ind = 0? C 6 X AXIS ACQ SS FAILURE 7 Y AXIS ACQ SS FAILURE 8 Have both X axis ACQ SS sensors failed? 9 Have both Y axis ACQ SS sensors failed? 10 Which Y axis ACQ SS sensor is better? 11 Which X axis ACQ SS sensor remains good? 12 Which X axis ACQ SS sensor is better? 13 Which Y axis ACQ SS sensor remains good? 14 Reconfigure ACQ SS 15 Reconfigure ACQ SS 18	4 If both sensors have failed on one axis while both are active on the other axis, one good sensor may have been turned off to activate the EPC loop 5 ACQ SS measurements on X and Y ($\sqrt{\tau_{ex}^2 + \tau_{ey}^2}$) must be $< 1.3^\circ$ to activate the experiment pointing control loop. If both sensors on a loop fail, the EPC loop may not be able to activate. Shutting off a sensor and then using it for control provides a constant 0 signal on the failed axis, allowing EPC loop activation

ATM-APCS-018

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
2d APCS (Cont)	11 12 5 16 Reconfigure ACQ SS GROUND/DAS: ● ACS sw - <u>ENABLE</u> DAS: ● Key - 30134E ACQ SS PRI ON ● Key - 30125E ACQ SS SEC OFF ● Key - 52014E ACQ SS RM 50002E X AXIS PRI SELECT; - RM ENABLE ● Key - 52014E ACQ SS RM 50006E Y AXIS SEC SELECT; - RM ENABLE ● Key - 52014E ACQ SS RM 50013E Y AXIS RM INHIBIT GROUND/DAS: ● ACS sw - <u>INHIBIT</u> 11 12 5 17 Reconfigure ACQ SS GROUND/DAS: ● ACS sw - <u>ENABLE</u> DAS: ● Key - 30047E ACQ SS SEC ON ● Key - 30107E ACQ SS PRI OFF ● Key - 52014E ACQ SS RM 50003E X AXIS SEC SELECT; - RM ENABLE ● Key - 52014E ACQ SS RM 50005E Y AXIS PRI SELECT; - RM ENABLE ● Key - 52014E ACQ SS RM 50013E Y AXIS RM INHIBIT GROUND/DAS: ● ACS sw - <u>INHIBIT</u> 14 15 18 Notify STDN of new ACQ SS configuration ↓ 19 Return to normal operations	5 ACQ SS measurements on X and Y ($\sqrt{\tau_{ex}^2 + \tau_{ey}^2}$) must be $< 1.3^\circ$ to activate the experiment pointing control loop. If both sensors on a loop fail, the EPC loop may not be able to activate. Shutting off a sensor and then using it for control provides a constant 0 signal on the failed axis, allowing EPC loop activation ATM-APCS-019

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS					
3 C/W APCS COMPUTER MALF YELLOW Lt on if: ● CMPTR X-OVER (not a continuous signal) ● CMPTR SELF-TEST ● MEMORY RECALL	1 1 ATTITUDE CONTROL SYSTEM: ● Monitor CMPTR sw - PRIM (or AUTO or SEC) CMPTR sw is positioned? PRIM or SEC APCS 3d 1 AUTO SWITCHOVER INHIBITED AUTO 2 2 Verify CMPTR switchover ATTITUDE CONTROL SYSTEM: ● CMPTR tb - PRI (or SEC) NOTE: Switchover requires 0.5 to 2 sec ● CMPTR sw - PRIM (or SEC) as per CMPTR tb PANEL 206 CAUTION/WARNING SYSTEM: ● MASTER ALARM sw - reset AUTO SWITCHOVER INHIBITED APCS 3d 3 3 3 Is MODE tb? SI 4 4 Monitor maneuver to SI MONITOR: ● COUNTER 1, 2, 3 sel - ϕ_X, ϕ_Y, ϕ_Z; ind - XXX.X deg 5 5 Has STDN requested? CREW RECONFIGURE APCS 8 6 6 Is ATMDC Flight Program? 16K 7 7 Perform ATMDC UPDATE Checklist (ATM Sys C/L & Data Book, pg 2-5) Perform APCS STATUS CHECK Checklist (ATM Sys C/L & Data Book, pg 2-3) 8 8 APCS 3d 24 AUTO SWITCHOVER INHIBITED NOTE: Phase II ATMDC software definition 1 Auto switchover is automatically requested when a hardware or software test failure is detected <table><tr><th>Failure</th><th>Auto switchover occurs when</th></tr><tr><td>Hardware test failure</td><td>AUTO X-OVER ENABLED (CMPTR sw - AUTO or 30077)</td></tr><tr><td>Software test failure</td><td>CMPTR AUTO ENA (CMPTR sw - AUTO or 30077) and SOFTWARE SWITCHOVER ENABLED (52011, 50010)</td></tr></table> ● CMPTR sw - AUTO position will be ambiguous when DAS/DCS function command 30143 (PRI SYST ON) or 30163 (SEC SYST ON) are entered without repositioning CMPTR sw ● SOFTWARE SWITCHOVER ENABLED can be verified by DAS: ● Key 52003E CMPTR DATA 50011E STATUS WORD 1 Monitor: ● COUNTER 2 - 1100 2 If CMPTR sw is positioned AUTO and computer switchover does not occur, verify SOFTWARE SWITCHOVER ENABLED (See remark 1). When the backup ATMDC/ WCUI are powered up, the SELF-TEST and X-OVER signals are driven from the new system and are unconditionally reset 3 Backup ATMDC initializes the maneuver time to 13 min. Option for reloading, DAS: ● Key - 52030E MANEUVER 5001TE TIME MIN, MUST BE IN OCTAL ATTITUDE CONTROL SYS: ● MODE ATT HOLD sw - CMG; tb - CMG ● MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI ATM-APCS-020	Failure	Auto switchover occurs when	Hardware test failure	AUTO X-OVER ENABLED (CMPTR sw - AUTO or 30077)	Software test failure	CMPTR AUTO ENA (CMPTR sw - AUTO or 30077) and SOFTWARE SWITCHOVER ENABLED (52011, 50010)
Failure	Auto switchover occurs when						
Hardware test failure	AUTO X-OVER ENABLED (CMPTR sw - AUTO or 30077)						
Software test failure	CMPTR AUTO ENA (CMPTR sw - AUTO or 30077) and SOFTWARE SWITCHOVER ENABLED (52011, 50010)						

ATM-APCS-020

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3 APCS (Cont)	<pre> graph TD 5[5] --> 8[8: Has STDN requested crew initiated diagnostics?] 8 -- YES --> 9[9: STDN requests?] 8 -- NO --> 10[10: STDN will command TSM, 16K program load and/or 8K program load via command receiver] 9 -- TSM --> 3a[APCS 3a 1] 9 -- 8K PROGRAM LOAD --> 3c[APCS 3c 1] 9 -- 16K PROGRAM LOAD --> 3b[APCS 3b 1] 10 --> 4((4)) </pre>	4 Crew remains in communication with STDN ATM-APCS-021

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

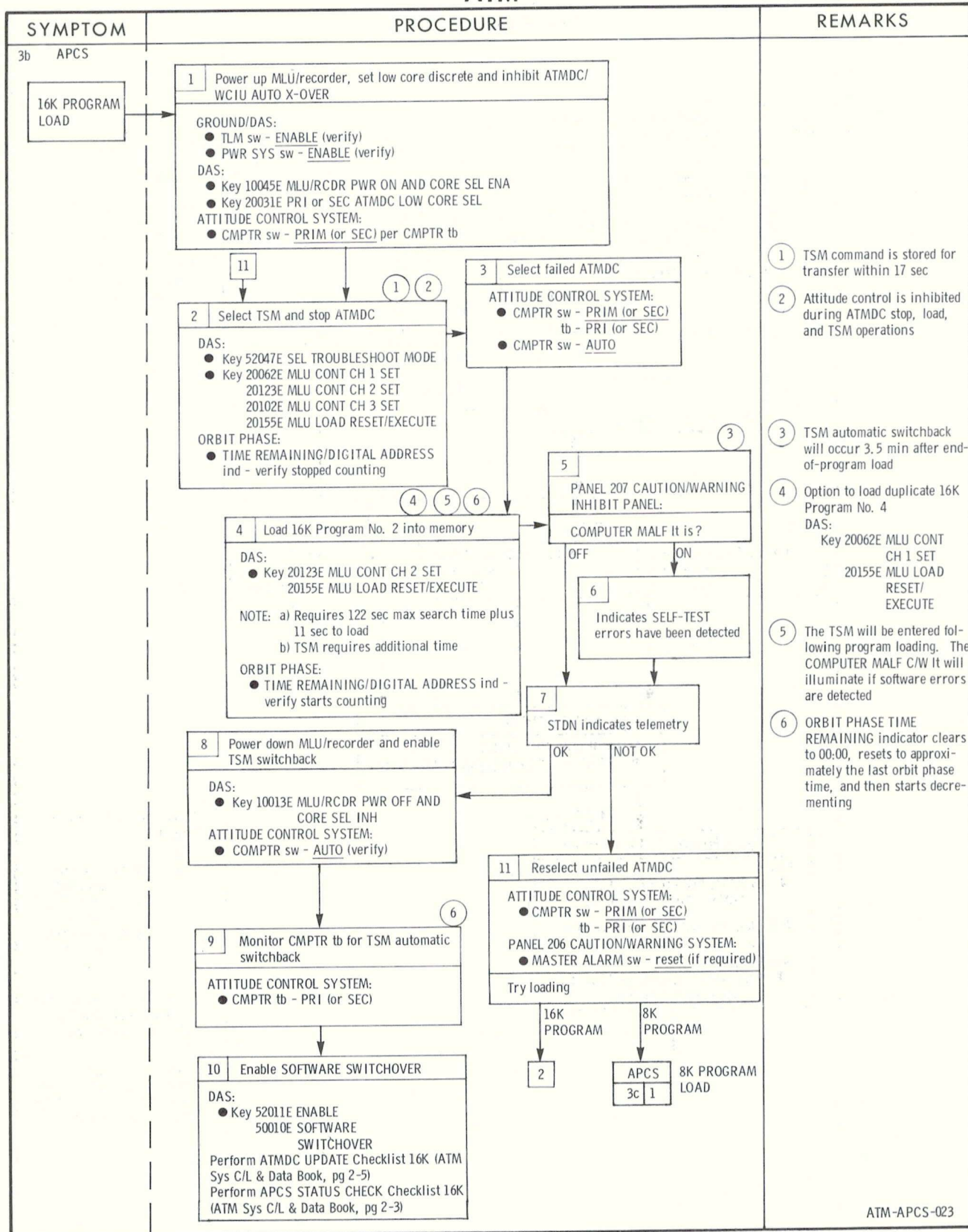
SYMPTOM	PROCEDURE	REMARKS
3a APCS	TSM (1) (2) 1 Select TSM and set event timer DAS: ● Key 52047E SEL TROUBLESHOOT MODE EVENT TIME: ● Slew timer to TSM switchback delta time (3:30 min:sec) NOTE: Wait at least 17 seconds before proceeding to block 2 2 (3) (4) (5) 2 Power up failed ATMDC ATTITUDE CONTROL SYSTEM: ● CMPTR sw - PRIM (or SEC) tb - PRI (or SEC) ● CMPTR sw - AUTO EVENT TIME: ● START/STOP sw - <u>START</u> CAUTION Manually switch back to unfailed ATMDC if TACS thrusters start firing 3 (6) 3 Monitor event time decrement to 00:00 min:sec and TSM switchback to unfailed ATMDC EVENT TIME: ● DISPLAY = 00:00 min:sec ● START/STOP sw - STOP ATTITUDE CONTROL SYSTEM: ● CMPTR tb - PRI (or SEC) (verify) PANEL 206 CAUTION/WARNING SYSTEM: ● MASTER ALARM sw - <u>reset</u> (if required) APCS 3 3 COMPUTER MALF	(1) TSM command is stored in transfer register within 17 sec (2) The timer is set for monitoring auto-matic TSM switchback to the unfailed ATMDC. (3) Attitude control is inhibited during TSM operations (4) Option for switching to failed ATMDC, DAS: ● Key - 52007E CMPTR SWITCHOVER ARM ● Key - 52026E CMPTR SWITCHOVER EXECUTE (5) Tb's may change randomly during TSM processing (6) Unfailed ATMDC timing will be in error (behind) approximately 3:30 (min:sec)

ATM-APCS-022

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM



ATM-APCS-023

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
3c APCS 8K PROGRAM LOAD	<pre> graph TD 1[1 Power up MLU/recorder and inhibit ATMDC/WCIU AUTO X-OVER] --> 2[2 Stop ATMDC using MLU] 2 --> 3[3 Which ATMDC is to be loaded?] 3 -- PRI --> 4[4 DAS: Key 20001E PRI ATMDC HIGH CORE SEL] 3 -- SEC --> 5[5 DAS: Key 20051E SEC ATMDC HIGH CORE SEL] 4 --> 7[7 Select failed ATMDC] 5 --> 7 6[6 DAS: Key 20031 PRI or SEC ATMDC LOW CORE SEL] --> 7 7 --> 8[8 Load 8K Program No. 1 into memory] 8 --> 9[9] </pre> 1 Power up MLU/recorder and inhibit ATMDC/WCIU AUTO X-OVER GROUND/DAS: ● TLM sw - <u>ENABLE</u> (verify) ● PWR SYS sw - <u>ENABLE</u> (verify) DAS: ● Key 10045E MLU/RCDR PWR ON AND CORE SEL ENA ATTITUDE CONTROL SYSTEM: ● CMPTR sw - <u>PRIM</u> (or <u>SEC</u>) per CMPTR tb 2 Stop ATMDC using MLU DAS: ● Key 20062E MLU CONT CH 1 SET ● 20123E MLU CONT CH 2 SET ● 20102E MLU CONT CH 3 SET ● 20155E MLU LOAD RESET/EXECUTE ORBIT PHASE: ● TIME REMAINING/DIGITAL ADDRESS ind - verify stops counting Select memory 3 Which ATMDC is to be loaded? 4 DAS: ● Key 20001E PRI ATMDC HIGH CORE SEL 5 DAS: ● Key 20051E SEC ATMDC HIGH CORE SEL 6 DAS: ● Key 20031 PRI or SEC ATMDC LOW CORE SEL 7 Select failed ATMDC ATTITUDE CONTROL SYSTEM: ● CMPTR sw - <u>PRIM</u> (or <u>SEC</u>);tb - PRI (or SEC) 8 Load 8K Program No. 1 into memory DAS: ● Key 20102E MLU CONT CH 3 SET ● 20155E LOAD RESET/EXECUTE NOTE: Requires 122 sec max search time plus 5.5 sec to load ORBIT PHASE: ● TIME REMAINING/DIGITAL ADDRESS ind - verify starts counting 9	1 TSM command is stored for transfer to failed ATMDC within 17 sec 2 Attitude control is inhibited during ATMDC stop, load, and TSM operations 3 STDN may advise which memory (HIGH or LOW) to try loading first 4 Option to load 8K Program No. 3 DAS: ● Key 20123E MLU CONT CH 2 SET ● 20102E MLU CONT CH 3 SET ● 20155E MLU LOAD RESET/EXECUTE 5 Program is being used when ORBIT PHASE TIME REMAINING ind is decreasing 6 ORBIT PHASE TIME REMAINING indicator clears to 00:00, resets to 93:00, and then starts decrementing

ATM-APCS-024

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3c APCS (Cont)	8 ↓ 9 STDN indicates telemetry OK NOT OK 11 Power down MLU/recorder DAS: ● Key 10013E MLU/RCDR PWR OFF AND CORE SEL INH Perform ATMDU UPDATE CHECKLIST (8K) (ATM Sys C/L and Data Book, pg A 1-2) Perform APCS STATUS CHECK Checklist (8K) (ATM Sys C/L and Data Book, pg A 1-1) Has STDN requested? ↓ 10 Reselect unfailed ATMDU ATTITUDE CONTROL SYSTEM: ● CMPTR sw - PRIM (or SEC) tb - PRI (or SEC) Try loading duplicate 8K program or other memory (high or low) 2 CREW SELECT 16K ATMDU 12 CMPTR sw - PRIM (or SEC) as requested 13 Perform ATMDU UPDATE Checklist (ATM Sys C/L and Data Book, pg 2-5) Perform APCS STATUS CHECK Checklist (ATM Sys C/L and Data Book, pg 2-3) ↓ CONTINUE OPERATIONS WITH 8K ATMDU APCS 3d 24 AUTO SWITCHOVER INHIBITED	

ATM-APCS-025

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3d APCS AUTO SWITCH-OVER INHIBITED	1 Determine if failure is hardware or software test PANEL 207 CAUTION/WARNING INHIBIT PANEL: ● Monitor COMPUTER MALF It Does COMPUTER MALF It remain on continuously? NO (hardware test failure) YES (software test failure) 2 Is a backup ATMDC/WCIU operational? YES NO 4 ATMDC/WCIU FAILURE 5 Monitor TACS Its Is ATTITUDE CONTROL SYSTEM TACS It 1 (2, 3, 4, 5, 6) on continuously? YES NO 7 Is backup ATMDC/WCIU operational? YES NO 8 Power down failed ATMDC/WCIU and transfer control to CSM GROUND/DAS: ● ACS sw - <u>ENABLE</u> DAS: ● Key 30023E CMPTR OFF GROUND/DAS: ● ACS sw - <u>INHIBIT</u> 12 Power up MLU/recorder GROUND/DAS: ● TLM sw - <u>ENABLE</u> (verify) ● PWR SYS sw - <u>ENABLE</u> (verify) DAS: ● Key 10045E MLU/RCDR PWR ON AND CORE SEL ENA 3 Manually select backup ATMDC/WCIU ATTITUDE CONTROL SYSTEM: ● CMPTR sw - PRIM (or SEC) - tb - PRI (or SEC) NOTE: Switchover is complete when tb indicates selected system APCS 3 3 COMPUTER MALF 6 Inhibit TACS ATTITUDE CONTROL SYSTEM ● TACS sw 1, 2, 3, 4, 5, 6 - <u>INHIBIT</u> 9 Verify no vehicle rate via out-of-the-window displays (sun, stars, or earth) Are vehicle rates present? NO YES 10 Perform XFER to CSM CONTROL checklist (ATM Sys C/L and data book pg 2-15) CAUTION Alert CSM pilot for possible XFER to CSM CONTROL during failed ATMDC diagnosis 11 Has STDN requested crew initiated diagnostics? YES NO 13 STDN will command telemetry, 16K program load and/or 8K program load via command receiver 14	1 YES - Software test failure. The COMPUTER MALF It will be on continuously NO - Hardware test failure. The COMPUTER MALF It will be momentarily on every 2.1 sec 2 Hardware failure in ATMDC/WCIU cannot be fixed by loading 16K or 8K program 3 Important that TACS thrusters are not increasing vehicle rates beyond design limit 4 Software failure may have major or minor impact on attitude control functions. Continue with APCS control if attitude is stable 5 Crew remains in communication with STDN

ATM-APCS-026

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3d (Cont) APCS	<pre> graph TD 12 --> 14 23 --> 14 6 --> 14 14["14 Stop ATMDC using MLU DAS: • Key 20062E MLU CONT CH 1 SET 20123E MLU CONT CH 2 SET 20102E MLU CONT CH 3 SET 20155E MLU LOAD RESET/EXECUTE ORBIT PHASE: • TIME REMAINING/DIGITAL ADDRESS ind - verify stops counting Try loading"] 14 -- 16K PROGRAM --> 15 14 -- 8K PROGRAM --> 16 15["15 Load 16K Program No. 2 into memory DAS: • Key 20123E MLU CONT CH 2 SET 20155E MLU LOAD RESET/EXECUTE NOTE: Requires 122 sec max search time plus 11 sec to load ORBIT PHASE: • TIME REMAINING/DIGITAL ADDRESS ind - verify starts counting"] 16["16 Select core"] 16 -- HIGH --> 17 16 -- LOW --> 20 17["17 Which ATMDC is to be loaded?"] 17 -- PRI --> 18 17 -- SEC --> 19 18["18 Load 8K Program into memory DAS: • Key 20001E PRI ATMDC HIGH CORE SEL"] 19["19 Select secondary ATMDC high memory DAS: • Key 20051 SEC ATMDC HIGH CORE SEL"] 20["20 Select primary and secondary ATMDC low memory DAS: • Key 20031E PRI AND SEC ATMDC LOW CORE SEL"] 21["21 Load 8K Program, No. 2, into memory DAS: • Key 20102E MLU CONT CH 3 SET 20155E MLU LOAD RESET/EXECUTE NOTE: Requires 122 sec max search time plus 5.5 sec to load ORBIT PHASE: • TIME REMAINING/DIGITAL ADDRESS ind - verify starts counting"] 22["22 Has STDN requested a program reload?"] 22 -- NO --> 26 22 -- YES --> 14 22 --> 24 24 --> 22 26 --> 22 24 --> 22 22 --> 22 </pre>	6 APCS attitude control is inhibited during ATMDC stop and program load operations. CSM may be performing attitude control function 7 Option to load 16 Program No. 4 DAS: • Key 20062E MLU CONT CH 1 SET 20155E MLU LOAD RESET/EXECUTE 8 Flight program will start upon completion of program load. No TSM operations are performed when neither ATMDC is operational 9 ORBIT PHASE TIME REMAINING indicator clears to 00:00, resets to approximately last orbit phase time, and then starts decrementing 10 STDN may advise which memory (HIGH or LOW) to try loading first 11 Option to load duplicate 8K program, No. 3, DAS: • Key 20123E MLU CONT CH 2 SET 20102E MLU CONT CH 3 SET 20155E MLU LOAD RESET/EXECUTE 12 ORBIT PHASE TIME REMAINING indicator clears to 00:00, resets to 93:00, and then starts decrementing

ATM-APCS-027

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3d APCS (Cont)	22 24 Power down MLU/recorder DAS: ● Key 10013E MLU/RCDR PWR OFF AND CORE SEL INH 25 Perform ATMDC UPDATE Checklist (8K or 16K as required) (ATM Sys C/L and Data Book, 8K pg A 1-2, 16K pg 2-5) 28 Determine if vehicle +Z axis is near sun MONITOR: ● ANGLE sel - ACQ SS X/Y; ind - XX% Are ACQ SS X/Y angles zero $\pm 2\%$? 29 Is SUN PRESENT tb? 30 Is CSM controlling? 31 CSM maneuvers OA ● Instruct CSM pilot to maneuver OA for pointing OA +Z axis near sun using out-of-window display as reference ATTITUDE CONTROL SYSTEM: ● SUN PRESENT tb - PRI or SEC (verify) 32 Is ATMDC Flight Program? 33 Is CSM controlling? 34 Monitor APCS maneuver vehicle to point +Z axis precisely at sun MONITOR: ● ANGLE sel - ACQ SS X/Y; ind - XX% (decreases to 0%) 35 Transfer control to ATM Perform XFER to ATM CONTROL Checklist (ATM Sys C/L and Data Book, pg 2-15) 36 Is ATMDC Flight Program? 23 26 ATMDC/WCIU FAILURE 27 Power down failed ATMDC/WCIU GROUND/DAS: ● ACS sw - <u>ENABLE</u> DAS: ● Key 30023E CMPTR OFF GROUND/DAS: ● ACS sw - <u>INHIBIT</u> 44 11 Option to load duplicate 8K program, No. 3, DAS: ● Key 20123E MLU CONT CH 2 SET 20102E MLU CONT CH 3 SET 20155E MLU LOAD RESET/EXECUTE 13 Must be in daylight 14 ACQ SS X/Y meter display limits are $\pm 100\%$ (± 6 deg) 15 SUN PRESENT flag will indicate PRI or SEC when vehicle +Z axis is within 9 degrees of sun	

ATM-APCS-028

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3d APCS (Cont)	32 16 37 Perform X and Y axes maneuver to point ACQ SS towards sun using out-of-window solar display as reference - Perform MNVR to ARBITRARY ATTITUDE (8) Checklist (8K) (ATM Sys C/L and Data Book, pg A 1-8) NOTE: A total maneuver greater than 20 degrees must be made using consecutive maneuvers less than 20 degrees to avoid a switchover to TACS Only Control ATTITUDE CONTROL SYSTEM: - SUN PRESENT tb - PRI or SEC (verify) 36 17 38 Initialize strapdown and select solar inertial mode immediately DAS: - Key 52012E SELECT SYSTEM 50005E INITIALIZE STRAPDOWN Immediately select ATTITUDE CONTROL SYSTEM: - MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI 43 18 39 Monitor APCS maneuver vehicle to point +Z axis precisely at sun MONITOR: - ANGLE sel - ACQ SS X/Y; ind - XX% (decreases to 0%) 40 Try Star Acquisition - Perform STAR ACQUISITION/OG BU Update Checklist (ATM Sys C/L and Data Book, pg A 1-3) Was star acquired? YES NO 34 41 Perform APCS STATUS CHECK Checklist (8K or 16K as required) (ATM Sys C/L and Data Book, 8K pg A 1-1, 16K pg 2-3) 45 42 Determine CSM Star angles for STDN - Voice instruct CSM pilot to power up the Optics Subsystem and mark on two known stars - Voice corresponding optics shaft and trunnion angles to STDN for ground calculation of Z axis maneuver angle 43	16 TACS ONLY CONTROL will be entered when an arbitrary attitude maneuver greater than 20 degrees is made 17 If the solar inertial mode is not selected immediately, the most recent arbitrary attitude angle commands are interpreted by the control system as unwanted attitude errors. The control system will zero these attitude errors by maneuvering the vehicle again 18 The ACQ SS is updating the strapdown to true solar inertial

ATM-APCS-029

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3d APCS (Cont)	<pre> graph TD 42[42] --> 43 subgraph 43 [43] direction TB 43_title[Maneuver X principal axis into orbit plane] 43_bullet[● Perform MNVR to ARBITRARY ATTITUDE Checklist (16K) (ATM Sys C/L and Data Book, 8K pg A 1-8, 16K pg 2-11) when STDN transmits Maneuver Pad] end 43_bullet --> 40[40] 8[8] --> 44 27[27] --> 44 subgraph 44 [44] direction TB 44_title[Transfer control to CSM] 44_bullet[● Perform XFER to CSM CONTROL Checklist (ATM Sys C/L and Data Book, pg 2-15)] end 44_bullet --> 45 41[41] --> 45 subgraph 45 [45] direction TB 45_title[Return to normal operations] end </pre> 42 43 Maneuver X principal axis into orbit plane ● Perform MNVR to ARBITRARY ATTITUDE Checklist (16K) (ATM Sys C/L and Data Book, 8K pg A 1-8, 16K pg 2-11) when STDN transmits Maneuver Pad 40 8 27 44 Transfer control to CSM ● Perform XFER to CSM CONTROL Checklist (ATM Sys C/L and Data Book, pg 2-15) 41 45 Return to normal operations	

ATM-APCS-030

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
4 APCS ALERT ACS BLUE Lt on if: Rate gyro failure in any axis ACQ SS analog failure in any axis Rate gyro scale switching failure Star tracker failure to acquire Maneuver time insufficient Computer restart	<pre> graph TD 1[1 Determine ALERT condition numbers] --> 2[2 Respond to the earliest condition unless a later one is more time-critical] 1 -- YES --> 3[3 ALERT condition no. = 1?] 1 -- NO --> 2 3 -- YES --> 3a[APCS 4a 1 RATE GYRO FAILURE IN ANY AXIS] 3 -- NO --> 4[4 ALERT condition no. = 2?] 4 -- YES --> 4b[APCS 4b 1 ACQ SS ANALOG FAILURE IN ANY AXIS] 4 -- NO --> 5[5 ALERT condition no. = 3?] 5 -- YES --> 5c[APCS 4c 1 RATE GYRO SCALE SWITCHING FAILURE] 5 -- NO --> 6[6 ALERT condition no. = 4?] 6 -- YES --> 7[7 Star tracker failed to acquire star] 7 --> 8[8 Repoint star tracker] 8 --> 9[9 ALERT condition no. = 5?] 9 -- YES --> 10[10 Maneuver time insufficient. Monitor attitude errors. Maneuver complete when errors equal either zero or commanded biases] 9 -- NO --> 11[11 ALERT condition no. = 6?] 11 -- YES --> 12[12 Computer restart. Computer system power has been interrupted] 11 -- NO --> 11a[APCS 5 1 ALERT CMG MALF] 12 --> 13[13 Notify STDN of computer interrupt] </pre>	NOTE: These procedures correspond to Phase II ATMD software definition 1 This step checks to see if two failures have occurred before ALERT acknowledgment 2 STAR TRACKER checklist 3 After two failures to acquire star, verify gimbal angles and star codes with STDN. If failure to acquire star continues, go to STAR TRACKER FAILURE malfunction procedure 7 4 Maneuver will not be completed on time. Vehicle maneuvers at maximum rate (0.3 deg/sec) until commanded maneuver time is sufficient 5 Computer timing and navigation will be "behind" by the length of time that the computer was interrupted

ATM-APCS-031

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
4a APCS ALERT condition no. = 1 RATE GYRO FAILURE IN ANY AXIS	<pre> graph TD Start([1]) --> Step1[1 Determine axis of failed rate gyro • Notify STDN of rate gyro failure ATTITUDE CONTROL SYSTEM: • Observe each RATE GYRO MONITOR sw position 1/2 NOTE: The X (Y, Z) RATE GYRO MONITOR tb - bp or SGL indicates axis of failure RATE GYRO MONITOR tb is?] Step1 -- bp --> Step2[2 ATTITUDE CONTROL SYSTEM: • RATE GYRO MONITOR tb - bp within 15 min?] Step1 -- SGL --> Step2 Step2 -- YES --> Step3[3 Determine controlling rate gyros(s) ATTITUDE CONTROL SYSTEM: • Position RATE GYRO MONITOR sw - 2/3 or 3/1 for tb - gray or SGL RATE GYRO MONITOR tb is?] Step2 -- NO --> Step5[5 Notify STDN that redundancy management unable to isolate failed rate gyro within time specified] Step3 -- SGL --> Step4[4 ATTITUDE CONTROL SYSTEM: • RATE GYRO MONITOR tb - gray within 20 min?] Step3 -- gray --> Step6[6 Determine failed rate gyro ATTITUDE CONTROL SYSTEM: RATE GYRO MONITOR sw is?] Step4 -- YES --> Step6 Step4 -- NO --> Step5 Step6 -- 2/3 --> Step8[8 RATE GYRO 1 FAILURE] Step6 -- 3/1 --> Step7[7 RATE GYRO 2 FAILURE] Step8 --> Step9[9 Notify STDN which rate gyro failed Has STDN requested crew to reenoble failed rate gyro?] Step7 --> Step9 Step9 -- YES --> Step10[10] Step9 -- NO --> Step11[11] </pre>	1 Verify that an axis displaying SGL has not been commanded to a single gyro configuration as the result of two previous failures on that axis 2 Rate gyro outputs may be monitored: DAS: • Key - 52003E CMPTR DATA 5000AE 5 X RGS ALL 6 Y RGS ALL 7 Z RGS ALL 3 The SGL indication will appear during the 90-sec RG3 power-up period following a RG1 and RG2 discompare. It will also appear during the period (<15 min) when RG1 or RG2 is being determined failed via comparison with RG3 4 Single rate gyro selected on this axis. Prime strapdown control in use 5 Do not change modes or switch to CMG Control from TACS Only Control during RM failure isolation 6 Backup strapdown control in use

ATM-APCS-032

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
4a APCS (Cont)	9 10 Reconfigure rate gyros ATTITUDE CONTROL SYSTEM: ● RATE GYRO MONITOR sw - 1/2; tb - bp DAS: ● Key - 52015E RATE GYRO RM 500AAE 11 X AXIS SELECT, 1 & 2, 3 BACKUP; RM ENABLE 21 Y AXIS SELECT, 1 & 2, 3 BACKUP; RM ENABLE 31 Z AXIS SELECT, 1 & 2, 3 BACKUP; RM ENABLE ATTITUDE CONTROL SYSTEM: ● RATE GYRO MONITOR tb - gray ● Continue with restored configuration 9 16 11 Has STDN requested crew to inhibit wheel power on failed rate gyro? YES → NO ↓ 12 Inhibit wheel power on failed rate gyro GROUND/DAS: ● ACS sw - <u>ENABLE</u> DAS: ● Key - 30GGGE 151 X-1 RG WHL INH 147 X-2 RG WHL INH 011 X-3 RG WHL INH 111 Y-1 RG WHL INH 031 Y-2 RG WHL INH 154 Y-3 RG WHL INH 024 Z-1 RG WHL INH 146 Z-2 RG WHL INH 152 Z-3 RG WHL INH ● Display rate gyro outputs ● Key - 52003E CMPTR DATA 5000AE 5 X RGS ALL 6 Y RGS ALL 7 Z RGS ALL GROUND/DAS: ● ACS sw - <u>INHIBIT</u> MONITOR: ● COUNTER 1 sel - DAS; ind - .XXXX (deg/sec) RG1 ● COUNTER 2 sel - DAS; ind - .XXXX (deg/sec) RG2 ● COUNTER 3 sel - DAS; ind - .XXXX (deg/sec) RG3 ● Verify outputs of selected gyros, compare within TBD ● If outputs not within TBD, prepare for C/W ACS MALF (APCS/2b/1) Notify STDN that failed rate gyro wheel inhibited 13 Continue with normal operation 9 16 11 Has STDN requested crew to inhibit wheel power on failed rate gyro? YES → NO ↓ 12 Inhibit wheel power on failed rate gyro GROUND/DAS: ● ACS sw - <u>ENABLE</u> DAS: ● Key - 30GGGE 151 X-1 RG WHL INH 147 X-2 RG WHL INH 011 X-3 RG WHL INH 111 Y-1 RG WHL INH 031 Y-2 RG WHL INH 154 Y-3 RG WHL INH 024 Z-1 RG WHL INH 146 Z-2 RG WHL INH 152 Z-3 RG WHL INH ● Display rate gyro outputs ● Key - 52003E CMPTR DATA 5000AE 5 X RGS ALL 6 Y RGS ALL 7 Z RGS ALL GROUND/DAS: ● ACS sw - <u>INHIBIT</u> MONITOR: ● COUNTER 1 sel - DAS; ind - .XXXX (deg/sec) RG1 ● COUNTER 2 sel - DAS; ind - .XXXX (deg/sec) RG2 ● COUNTER 3 sel - DAS; ind - .XXXX (deg/sec) RG3 ● Verify outputs of selected gyros, compare within TBD ● If outputs not within TBD, prepare for C/W ACS MALF (APCS/2b/1) Notify STDN that failed rate gyro wheel inhibited 13 Continue with normal operation 7 WHL INH powers down wheel motor but maintains sensor electronics and heater power	

ATM-APCS-033

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
4a APCS (Cont)	5 14 Isolate RG failure manually NOTE: Remove RG drift compensation on all 3 gyros on failed axis. Record change in values so compensation may be reinserted following failure isolation DAS: ● Key - 52003E CMPTR DATA 5000AE 5 X RGS ALL 6 Y RGS ALL 7 Z RGS ALL MONITOR: COUNTER 1 sel - DAS; ind - .XXXX (deg/sec) RG 1 COUNTER 2 sel - DAS; ind - .XXXX (deg/sec) RG 2 COUNTER 3 sel - DAS; ind - .XXXX (deg/sec) RG 3 DAS: ● Key - 52036E RG DRIFT COMPENSATION 500GGE 01 1X 02 2X 03 3X 04 1Y 05 2Y 06 3Y 07 1Z 10 2Z 11 3Z 50000E ZERO DRIFT Monitor outputs to determine failed rate gyro Can failed rate gyro be identified? YES 8 16 Select and recompensate good rate gyros DAS: ● Key - 52015E RATE GYRO RM 500AAE AXIS SELECT; RM ENABLE 13 X 1 & 3 14 X 2 & 3 23 Y 1 & 3 24 Y 2 & 3 33 Z 1 & 3 34 Z 2 & 3 ● Key - 52036E RG DRIFT COMPENSATION 500GGE 01 1X 02 2X 03 3X 04 1Y 05 2Y 06 3Y 07 1Z 10 2Z 11 3Z 5 ± 0DDE DD = Negative of previously recorded change in compensation ATTITUDE CONTROL SYSTEM ● Position RATE GYRO MONITOR sw - 1/2, 2/3, or 3/1 for tb - gray NO 9 15 Seek assistance from STDN	8 One function command and two data commands are required for changing the drift compensation of each gyro 9 A maneuver may be performed to try to force rate gyro isolation. Check with STDN prior to performing maneuver

ATM-APCS-034

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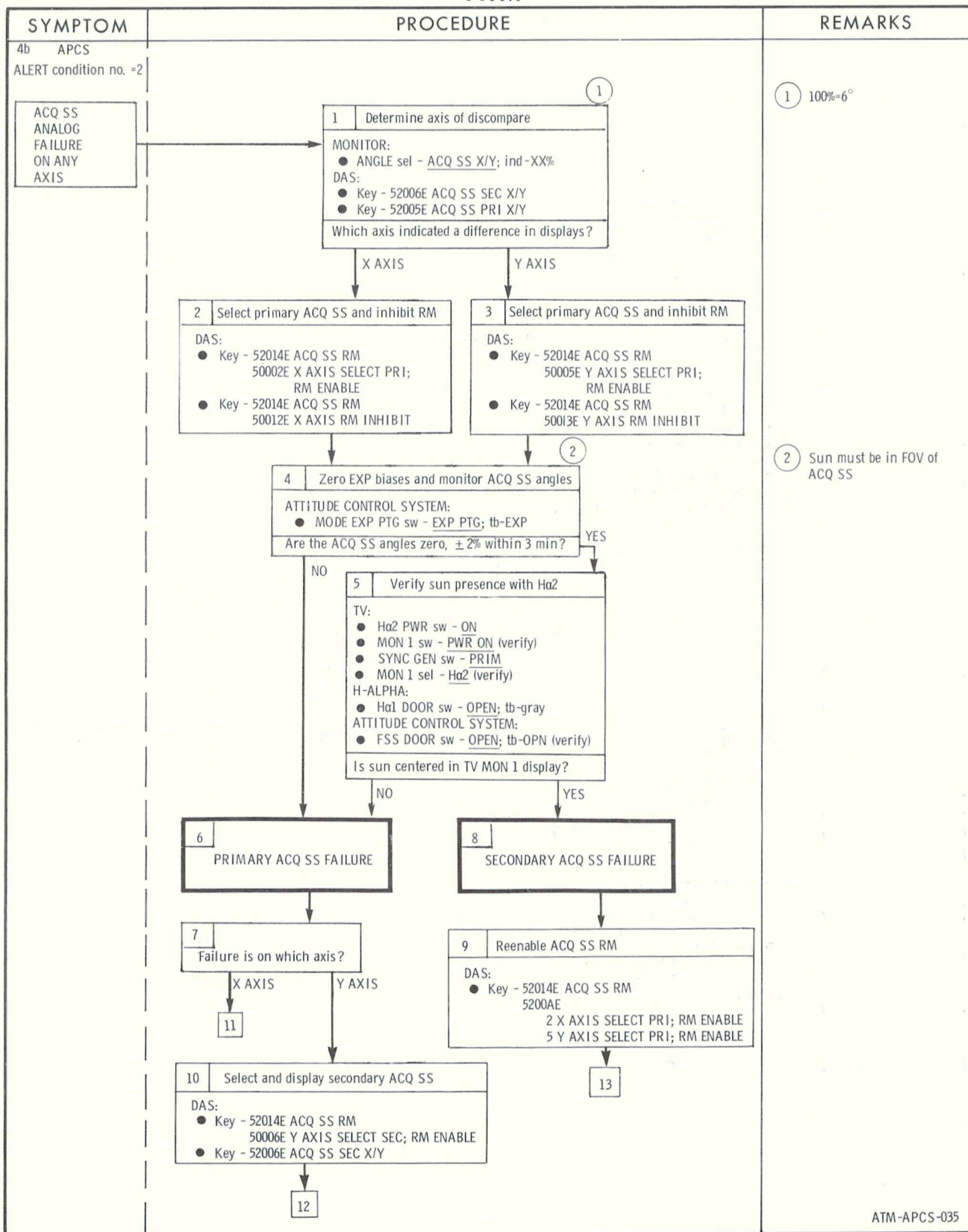
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ATM-APCS-034

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
4b APCS (Cont)	7 11 Select and display secondary ACQ SS DAS: ● Key - 52014E ACQ SS RM 50003E X AXIS SELECT SEC; RM ENABLE ● Key - 52006E ACQ SS SEC X/Y 10 12 Verify sun presence with Ha2 TV: ● Ha2 PWR sw - ON ● MON 1 sw - PWR ON (verify) ● SYNC GEN sw - PRIM ● MON 1 sel - Ha2 (verify) H-ALPHA: ● Ha2 DOOR sw - OPEN; tb-gray ATTITUDE CONTROL SYSTEM: ● FSS DOOR sw - OPEN; tb-OPN (verify) TV: ● Verify sun centered in TV MON 1 display within 3 min 9 13 Notify STDN of ACQ SS failure Is greater detail about the failure desired? YES NO 3 14 Select and display failed ACQ SS and inhibit RM DAS: ● Key - 52014E ACQ SS RM 5000AE 2 X AXIS SELECT PRI; RM ENABLE 3 X AXIS SELECT SEC; RM ENABLE 5 Y AXIS SELECT PRI; RM ENABLE 6 Y AXIS SELECT SEC; RM ENABLE ● Key - 52014E ACQ SS RM 5001BE 2 X AXIS RM INHIBIT 3 Y AXIS RM INHIBIT ● Key - 5200CE 5 ACQ SS PRI X/Y 6 ACQ SS SEC X/Y 15 18	3 FSS angles will be compared with ACQ SS angles ATM-APCS-036

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
4b APCS (Cont)	14 15Roll canister to zero MONITOR: - COUNTER 1 sel - ROLL CSTR; ind - XXXX (ARC MIN) MANUAL POINTING CONTROL: - ROLL ENABLE sw - <u>ENABLE</u> - Roll cstr to zero - ROLL ENABLE sw - <u>INHIBIT</u> ↓ 164 16Compare FSS angles with ACQ SS angles MONITOR: - COUNTER 2 sel - FSS UP/DN; ind - XXXX (ARC SEC) - COUNTER 3 sel - FSS L/R; ind - XXXX (ARC SEC) ATTITUDE CONTROL SYSTEM: - MODE EXP PTG sw - EXP PTG; tb - EXP - FSS DOOR sw - OPEN; tb - OPN - FSS BIAS IN sw - OUT (verify) MANUAL POINTING CONTROL: - MAN PTG ENABLE sw - <u>ENABLE</u>; tb - EXP - MPC - Manipulate FSS angles to 0000 - MAN PTG ENABLE sw - <u>INHIBIT</u>; tb - bp DAS: - Key - 52004E SINGLE MEMORY LOC 50AAAE AAA = 1st half of memory address 160 β_X (Select β for failed axis) 160 β_Y 50BBBE BBB = 2nd half of memory address 206 β_X (Select β for failed axis) 210 β_Y 50000E Scale factor MONITOR: - COUNTER 1 sel - DAS; ind - XXXX. - COUNTER 2 sel - DAS; ind - XXXX (pirads) - Notify STDN of difference between FSS and ACQ SS angles ↓ 17Reselect and display good ACQ SS DAS: - Key - 52014E ACQ SS RM 5000AE 2 X AXIS SELECT PRI; RM ENABLE 3 X AXIS SELECT SEC; RM ENABLE 5 Y AXIS SELECT PRI; RM ENABLE 6 Y AXIS SELECT SEC; RM ENABLE - Key - 5200BE 5 ACQ SS PRI X/Y 6 ACQ SS SEC X/Y ↓ 1318 13Return to normal operation	4 The FSS angles are zeroed to co-align the canister with the ATM rack. β_X and β_Y represent the misalignment between the FSS and ACQ SS created by the ACQ SS failure

ATM-APCS-037

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
4c APCS ALERT condition no. = 3 RATE GYRO SCALE SWITCHING FAILURE	<pre> graph TD 1[1. Notify STDN of failure and seek assistance in correcting situation] --> 2[2. Determine which set of scaling networks is in use] 2 --> D{Is B odd and C < 4?} D -- YES --> 3[3. Coarse gain scaling networks in use] D -- NO --> 4[4. Fine gain scaling networks in use] 3 --> 5[5. Notify STDN which scaling networks in use] 4 --> 5 </pre> 1 Notify STDN of failure and seek assistance in correcting situation 2 Determine which set of scaling networks is in use DAS: ● Key - 52004E SINGLE MEMORY LOC 50000E MEMORY ADDRESS 50244E OF DI REGISTER 4 50100E SCALE FACTOR MONITOR: ● COUNTER 1 sel - DAS; ind - XBCX ● COUNTER 2 sel - DAS; ind - XX00 Is B odd and C < 4? 3 Coarse gain scaling networks in use 4 Fine gain scaling networks in use 5 Notify STDN which scaling networks in use	1 STDN has telemetered information that will assist in determining which set of networks are failing to switch 2 Determination of which scale network the ATMDC is using can be read from ATMDC memory. A memory load can force it to accept either coarse gain or fine gain networks for all calculations 3 A failure to switch from low scale means all maneuvers must be kept below 0.085°/sec. A higher rate will cause maximum output and may cause hi rate C/W condition. A failure to switch from high scale means granularity and resolution will be lost in all maneuvers 4 Forcing a change in scaling networks will require a single memory load.

ATM-APCS-038

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
5 APCS ALERT CMG MALF BLUE It on if: CMG failure CMG 4.8 kHz source failure CMG AUTO reset	① 1 Determine ALERT condition numbers DAS: ● Key - 52003E CMPTR DATA 50001E ALERT CONDITIONS MONITOR: ● COUNTER 1 sel - <u>DAS</u>; ind - ABCD Has a response been made to conditions B, C, and D? YES ↓ 2 ALERT condition no. = 788X? NO ↓ 3 Respond to the earliest condition unless a later one is more time-critical ↓ 4 ALERT condition no. = 7? YES ↓ 7 BRG TEMP 1(2, 3) It on? YES ↓ APCS 6b 1 ALERT CMG AUTO SHUTDOWN NO ↓ APCS 5a 1 CMG RCI FAILURE NO ↓ 6 ALERT condition no. = 9? YES ↓ APCS 5d 1 CMG AUTO RESET NO ↓ APCS 4 1 ALERT ACS YES ↓ APCS 5c 1 CMG 4.8 KHZ SOURCE FAILURE NO ↓ 5 ALERT condition no. = 8? NO ↓ 4 ALERT condition no. = 7? NO ↓ 3 Respond to the earliest condition unless a later one is more time-critical NO ↓ 2 ALERT condition no. = 788X? YES ↓ APCS 5b 1 CMG V-REF FAILURE	NOTE: These procedures correspond to Phase II ATMDC software definition ① This step checks to see if more than one failure has occurred before ALERT acknowledgment ② If the BRG TEMP and the CMG MALF Its are on together, the condition 7 is due to automatic wheel power removal. Otherwise the condition is due to RCI failure

ATM-APCS-039

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
5a APCS ALERT condition no. = 7 CMG RCI FAILURE	<pre> graph TD Start[CMG RCI FAILURE] --> Step1 subgraph Step1 [1 Determine failed CMG] S1[ATTITUDE CONTROL SYSTEM: • CMG SYSTEM sw 1 (2, 3) - AUTO (verify) • Monitor the CMG SYSTEM 1 (2, 3) tb-bp] end Step1 --> Step2 subgraph Step2 [2 Check wheel speed of failed CMG] S2[MONITOR: • ACS sel - WHL SPD 1 (2, 3); ind - XX% Is WHL SPD > 87%?] end Step2 -- NO --> Alert1[APCS 6b 1 ALERT CMG AUTO SHUTDOWN] Step2 -- YES --> Step3 subgraph Step3 [3 CMG FAILURE OF RCI TEST] S3[CMG FAILURE OF RCI TEST] end Step3 --> Alert2[APCS 5b 3 CMG V-REF FAILURE] </pre>	① Failed CMG identified when servo power is removed: - CMG V-REF test failure - CMG RCI test failure - CMG AUTO SHUTDOWN (BRG TEMP) ② If a CMG SYSTEM switch was not in AUTO when the ALERT occurred, place the switch in AUTO. Reenable CMG RM for the CMG in question in order to see the tb-bp DAS: Key - 52013E CMG RM 500A2E CNTL ENABLE; RM ENA. 1 CMG 1 SELECT 2 CMG 2 SELECT 3 CMG 3 SELECT ③ Failure of RCI test can be caused by: failure to follow gimbal rate commands; erroneous resolver feedback; gimbal failure to come off a stop

ATM-APCS-040

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
5b APCS ALERT condition no. = 788X CMG V-REF FAILURE	<pre> graph TD Start[CMG V-REF FAILURE] --> 1[1 Determine failed CMG] 1 --> 2[2 CMG FAILURE OF V-REF TEST] 2 --> 3[3 Notify STDN which CMG failed] 3 -- YES --> 4[4 Reconfigure failed CMG] 3 -- NO --> 5[5 Has STDN requested crew to power down failed CMG wheel?] 4 --> 9[9 Continue with normal operation] 5 -- YES --> 6[6 Power down failed CMG wheel] 5 -- NO --> 7[7 Does STDN want to modify the momentum biases?] 6 --> 9 7 -- YES --> 8[8 Modify the momentum biases] 7 -- NO --> 9 8 --> 9 </pre>	① Failed CMG identified when control power is removed: - CMG V-REF test failure - CMG RCI test failure - CMG AUTO SHUTDOWN (BRG TEMP) ② If a CMG SYSTEM switch was not in AUTO when the ALERT occurred, place the switch in AUTO. Reenable CMG RM for the CMG in question in order to see the tb - bp DAS: Key - 52013E CMG RM 500AAE CNTL ENABLE; RM ENA. - CMG 1 SELECT - CMG 2 SELECT - CMG 3 SELECT ③ A momentum bias must be entered for 2 CMG control to prevent a zero H condition from occurring, causing loss of CMG control. Momentum components (1% of 3H) available from ATM Sys C/L and Data Book, Section 8, as a function of the sun angle (β). Momentum will be different depending upon which CMG failed ④ WHL PWR OFF removes power from the wheel but maintains sensor electronics

ATM-APCS-041

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
5c APCS ALERT condition no. = 8 CMG 4.8 KHZ SOURCE FAILURE	1 CMG VOLTAGE SOURCE SWITCHOVER 2 Notify STDN of voltage source switchover Has STDN requested the crew to reselect the switched voltage source? YES 4 Determine failed voltage reference source DAS: ● Key - 52004E SINGLE MEMORY LOC 50000E MEMORY ADDRESS 50242E OF DI REGISTER 3 50100E OCTAL DISPLAY MONITOR: ● COUNTER 1 sel - DAS; ind - XXXX ● COUNTER 2 sel - DAS; ind - XF00 Is F₂4? NO 5 PRIMARY 4.8 KHZ VOLTAGE SOURCE TEST FAILURE 6 Reselect primary source DAS: ● Key - 52013E CMG RM 50010E VOLTAGE REF SOURCE 4.8 KHZ; RM INHIBIT ● Key - 52013E CMG RM 50030E RM ENABLE 3 Continue with normal operations 7 SECONDARY 4.8 KHZ VOLTAGE SOURCE TEST FAILURE 8 Reselect secondary source DAS: ● Key - 52013E CMG RM 50020E VOLTAGE REF SOURCE 4.8 KHZ; RM INHIBIT ● Key - 52013E CMG RM 50030E RM ENABLE	

ATM-APCS-042

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
5d APCS ALERT condition no. = 9	CMG AUTO RESET 1 2 1 Verify reset still in progress ATTITUDE CONTROL SYSTEM: ● Is the MOMENTUM DUMP CAGE to CGE? NO 6 3 4 2 Monitor momentum components MONITOR: ● ACS sel - $H_X, H_Y, H_Z/H_T$; ind - XX% ● Monitor $H_X, H_Y, H_Z/H_T$ drive to 0% 3 5 3 Monitor momentum components MONITOR: ● ACS sel - $H_X, H_Y, H_Z/H_T$; ind - XX% ● Monitor $H_X, H_Y, H_Z/H_T$ drive to nominal momentum configuration 6 7 4 Monitor vehicle rates MONITOR: ● COUNTER 1 sel - $\dot{\theta}_Z$; ind - .XXXX (deg/sec) ● COUNTER 2 sel - $\dot{\theta}_X$; ind - .XXXX (deg/sec) ● COUNTER 3 sel - $\dot{\theta}_Y$; ind - .XXXX (deg/sec) ● Monitor control of vehicle rates by TACS 8 5 5 Monitor vehicle attitude MONITOR: ● COUNTER 1 sel - θ_X; ind - XXX.X (deg) ● COUNTER 2 sel - θ_Y; ind - XXX.X (deg) ● COUNTER 3 sel - θ_Z; ind - XXX.X (deg) ● Monitor attitude drive to zero or previous S1 offsets 6	1 The first CMG AUTO RESET will occur if a CMG gimbal is on a stop and the SWS attitude error is $>5.70002^\circ$ 2 The CMG AUTO RESET occurs only in the SI/EXP modes. If activated during momentum desaturation maneuvers, the vehicle will be returned to the nominal SI attitude 3 Vehicle HI RATE (C/W condition 2) may occur if $(\dot{\theta}_X^2 + \dot{\theta}_Y^2 + \dot{\theta}_Z^2)^{1/2} \geq 0.35^\circ/\text{sec}$ 4 The time allocated for execution and completion is 60 sec. Vehicle attitude is not controlled by CMG or TACS 5 The time allocated for execution and completion is 40 sec. Vehicle attitude is not controlled by CMG or TACS 6 Vehicle rate control by TACS is <0.02 deg/sec in X and <0.01 deg/sec in Y and Z 7 The time allocated for execution and completion is 60 sec. Vehicle attitude is not controlled by CMG or TACS 8 CMG control is automatically enabled. The time required to return to SI attitude will be a function of the attitude errors accumulated during the uncontrolled periods

ATM-APCS-043

ATM-APCS-043

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
5d APCS (Cont)	1 5 6 Monitor SWS attitude error DAS: • Key - 52003E CMPTR DATA 50002E ATT ERROR SWS attitude error? 8 Has STDN requested crew to inhibit CMG AUTO RESET? Increasing $\leq 0.18^\circ$ YES NO 10 Inhibit CMG AUTO RESET DAS: • Key - 52010E INHIBIT 50002E CMG AUTO RESET 7 CMG AUTO RESET is complete ATTITUDE CONTROL SYSTEM: • MOMENTUM DUMP CAGE tb - gray 9 Expect another CMG AUTO RESET or a switch to TACS ONLY CONTROL	8 A second and third CMG AUTO RESET will occur if a CMG gimbal is on a stop and the SWS attitude error is $>19.9^\circ$ 9 A switch (C/W condition 6) to TACS only control will occur if the CMG AUTO RESET is executed three times in succession without a successful completion or the SWS attitude error is $>60.0^\circ$ during a reset

ATM-APCS-044

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

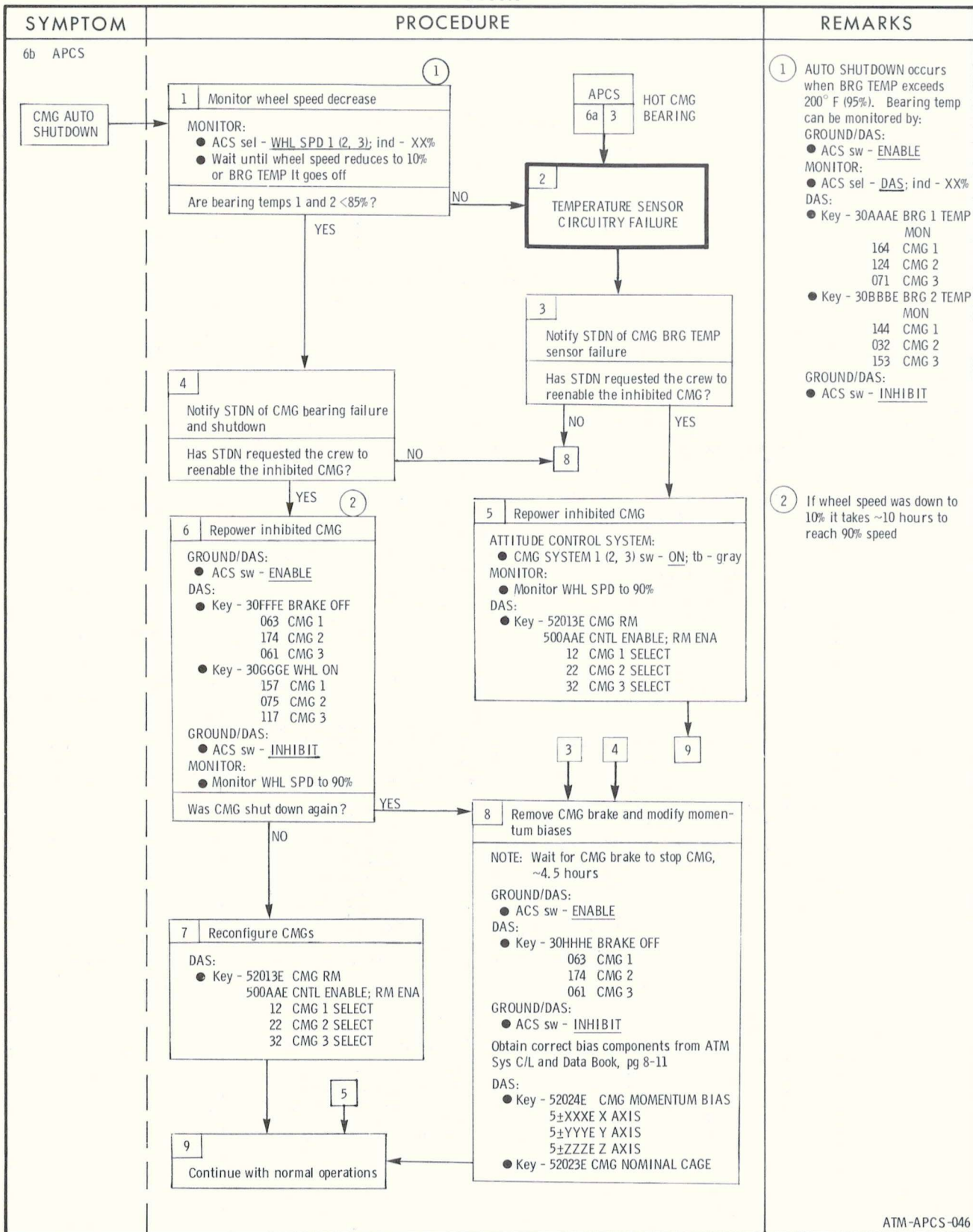
ATM

SYMPTOM	PROCEDURE	REMARKS
6 APCS ALERT BRG TEMP 1 (2, 3) BLUE Lt on if: CMG 1, 2, or 3 WHL BRG TEMP exceeds 160° F (85%)	1 Overheated CMG identified 2 Monitor CMG SYSTEM status ATTITUDE CONTROL SYSTEM: ● CMG 1 (2, 3) sw - <u>AUTO</u> (verify) Is CMG SYSTEM 1 (2, 3) tb-bp? YES APCS 6b 1 CMG AUTO SHUTDOWN NO APCS 6a 1 HOT CMG BEARING	NOTE: These procedures correspond to Phase II ATMDC software definition
6a HOT CMG BEARING	1 Monitor bearing 1 temp GROUND/DAS: ● ACS sw - <u>ENABLE</u> DAS: ● Key - 30AAAE BRG 1 TEMP MON 164 CMG 1 124 CMG 2 071 CMG 3 GROUND/DAS: ● ACS sw - <u>INHIBIT</u> Is bearing temp >85%? 3 Monitor bearing 2 temp DAS: ● Key - 30BBBE BRG 2 TEMP MON 144 CMG 1 032 CMG 2 153 CMG 3 GROUND/DAS: ● ACS sw - <u>INHIBIT</u> Is bearing temp >85%? 4 Bearing 2 temp high 5 2 Bearing 1 temp high 4 5 Monitor temp at 5-min intervals Is temp increasing? 6 Continue monitoring 7 Inhibit CMG wheel power 8 Acknowledge CMG Malf Alert APCS 6b 1 CMG AUTO SHUTDOWN 2 3 4	1 CMG bearing temp high (>160° F) 2 Stop monitoring if BRG TEMP Lt goes off, if temperature remains constant for more than 1 hr, or if temperature decreases 3 WHL PWR OFF removes power from the wheel but maintains sensor electronics 4 Removing wheel power during 3 CMG operation causes a CMG Malf Alert condition 7 ATM-APCS-045

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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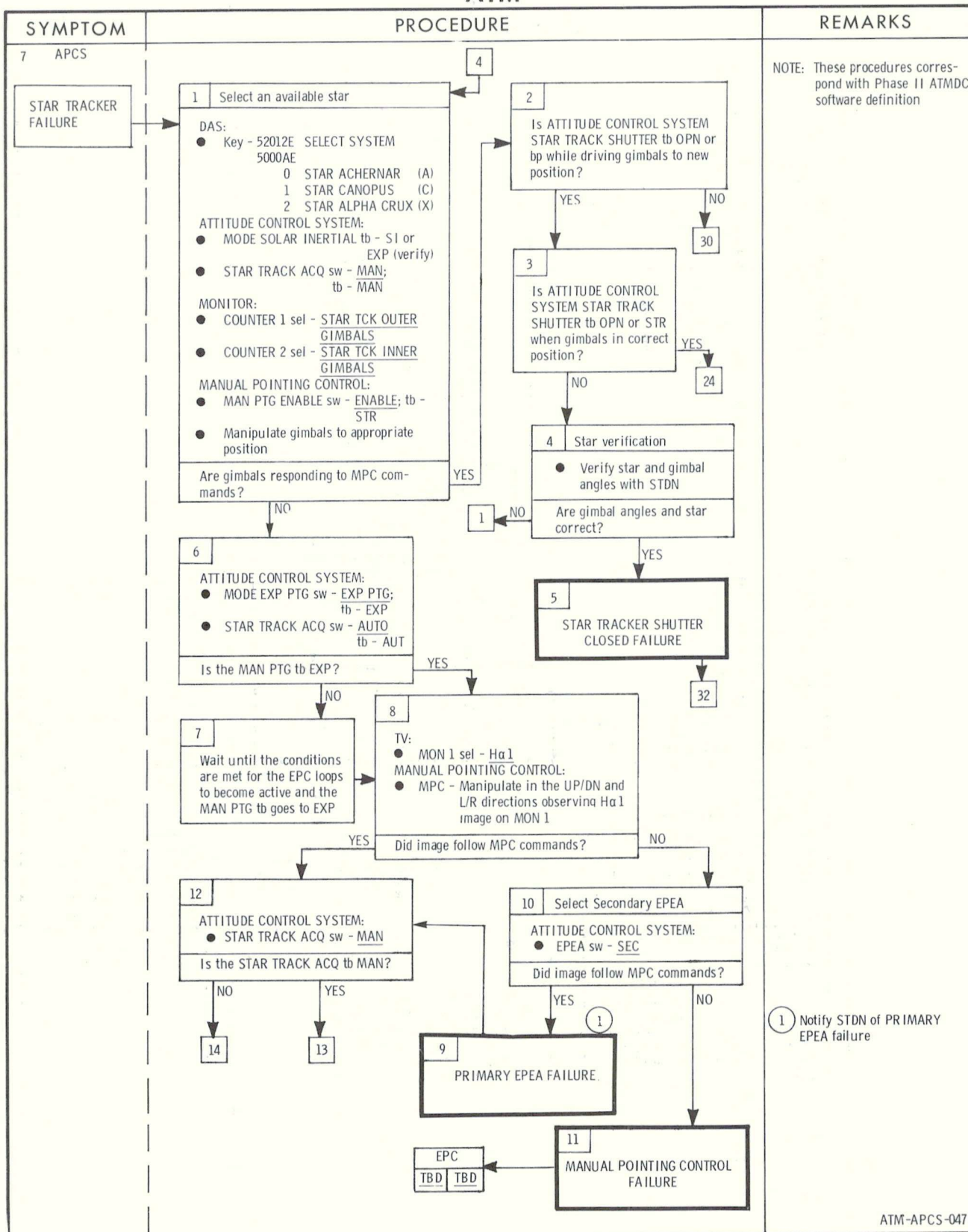


ATM-APCS-046

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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ATM-APCS-047

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
7 APCs (Cont)	<pre> graph TD 12 --> 14 14 --> Q1{Is the STAR TRACK ACQ tb - MAN?} Q1 -- YES --> 19 Q1 -- NO --> 15 15 --> 16 16 --> Q2{Do the COUNTERS reflect changes in gimbal position as the star tracker searches for a star?} Q2 -- YES --> 23 Q2 -- NO --> 17 17 --> Q3{Do the COUNTERS reflect changes in gimbal position as the star tracker searches for a star?} Q3 -- YES --> 23 Q3 -- NO --> 31 19 --> Q4{Did the star tracker respond to the MPC commands?} Q4 -- YES --> 24 Q4 -- NO --> 18 18 --> Q5{Do both gimbal displays = 0000?} Q5 -- YES --> 39 Q5 -- NO --> 19 39 --> 19 19 --> Q6{Did the star tracker respond to the MPC commands?} Q6 -- YES --> 1 Q6 -- NO --> 2 2 --> 20 20 --> 22 1 --> 21 21 --> 22 22 --> 32 32 --> 3 3 --> 16 3 --> 19 3 --> 23 </pre>	1 Notify STDN of PRIMARY EPEA FAILURE 2 The star tracker may still be useable if the automatic search is functional 3 The STAR TRACKER gimbals can be maneuvered by alternately commanding AUTO and CLOSE from the C&D panel. Each time the CLOSE command is issued the STAR TRACKER logic is initialized. Each time the AUTO command is issued, when star track control is inhibited, the gimbals sweep out a 3° X 4° search area before going to the 10° X 30° search area starting at the last held position. By observing COUNTERS 1 and 2 and issuing AUTO and CLOSE commands alternately, the star tracker may be positioned to lock onto a star

ATM-APCS-048

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
7 APCS (Cont)	<pre> graph TD 3 --> 24 13 --> 24 40 --> 24 24["24 Initiate star search ATTITUDE CONTROL SYSTEM: • STAR TRACK ACQ sw - AUTO; tb - AUT MONITOR: • Observe COUNTERS 1 and 2 Do the COUNTERS reflect changes in gimbal position as the star tracker searches for a star, if STAR TRACK SHUTTER tb - OPN?"] 24 -- YES --> 25 24 -- NO --> 26 25["25 Does star tracker find star at correct gimbal positions?"] 25 -- YES --> 27 25 -- NO --> 28 26["26 Reverse counter displays MONITOR: • COUNTER 1 sel - STAR TCK INNER GIMBALS • COUNTER 2 sel - STAR TCK OUTER GIMBALS Do the COUNTERS reflect changes in gimbal position as the star tracker searches for a star, if STAR TRACK SHUTTER tb - OPN?"] 26 -- YES --> 25 26 -- NO --> 34 27["27 Return to flight plan"] 28["28 ATTITUDE CONTROL SYSTEM: • STAR TRACK SHUTTER sw - CLOSE Is the tb bp?"] 28 -- YES --> 30 28 -- NO --> 29 29["29 STAR TRACKER SHUTTER OPEN FAILURE"] 29 -- 4 --> 30 29 -- 17 --> 31 30["30 STAR TRACKER OPTICS FAILURE"] 30 --> 32 31["31 STAR TRACKER GIMBAL DRIVE FAILURE"] 31 --> 32 32["32 STAR TRACKER HAS FAILURE"] 32 -- 5 --> 32 32 -- 22 --> 32 32 -- 5 --> 32 32 --> 33 33["33 Shut down star tracker ATTITUDE CONTROL SYSTEM: • STAR TRACK SHUTTER sw - CLOSE; tb-bp • STAR TRACK POWER sw - OFF • STAR TRACK ACQ tb-bp • STAR TRACK SHUTTER tb - OPN"] 33 -- 6 --> 35 34["34"] 35["35"] </pre>	(4) STAR TRACKER shutter failed open will burn out the STAR TRACKER optics if pointed at a bright object (5) The star tracker is not useable. STDN will update the ATMDC with a backup ST outer gimbal value (6) Tb indicates OPN because the OPN indication is the neutral (no power) position that occurs when STAR TRACKER POWER is removed. ATM-APCS-049

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
7 APCS (Cont)	26 34 STAR TRACKER AUTO SEARCH FAILURE 37 Perform manual search and acquisition ATTITUDE CONTROL SYSTEM: - STAR TRACK ACQ sw - <u>MAN</u>; tb - MAN MANUAL POINTING CONTROL: - Manipulate gimbals until STAR TRACK SHUTTER tb -STR ATTITUDE CONTROL SYSTEM - STAR TRACK ACQ sw - <u>AUTO</u>; tb - AUT 18 39 Change power sources GROUND/DAS: - ACS sw - <u>ENABLE</u> DAS: - Key - 30056E STR TRK 455 HZ PRI OFF - Key - 30016E STR TRK 455 HZ SEC ON GROUND/DAS: - ACS sw - <u>INHIBIT</u> Does the star tracker respond to MPC commands? NO 19 33 35 Update star tracker outer gimbal backup ATTITUDE CONTROL SYSTEM: - MOMENTUM DUMP AUTO GG sw - <u>INHIBIT</u>; tb-bp NOTE: Wait until next night orbit phase ORBIT PHASE: - TIME REMAINING/DIGITAL ADDRESS tb - NT (verify) ATTITUDE CONTROL SYSTEM: - MOMENTUM DUMP AUTO GG tb-bp (verify) - Instruct -Z SAL crewman to perform S019 sightings on two stars and voice angles to STDN - Receive star tracker outer gimbal backup from STDN DAS: - Key - 52027E STR TRK OG BACKUP 5± DDDE (1 arch min increment, 50DDDE must be in octal) ORBIT PHASE: - TIME REMAINING/DIGITAL ADDRESS tb - DAY (verify) ATTITUDE CONTROL SYSTEM: - MOMENTUM DUMP AUTO GG sw - <u>ENABLE</u>; tb - gray 36 Continue with normal operations 38 - Notify STDN of Auto Search failure 40 PRIMARY CMG1A 455 HZ FAILURE 24 7 STAR TRACKER updates are required before each EREP ZLV pass, and if the ground calculation of out of plane angle ν_z exceeds the onboard value by more than 5°	

ATM-APCS-050

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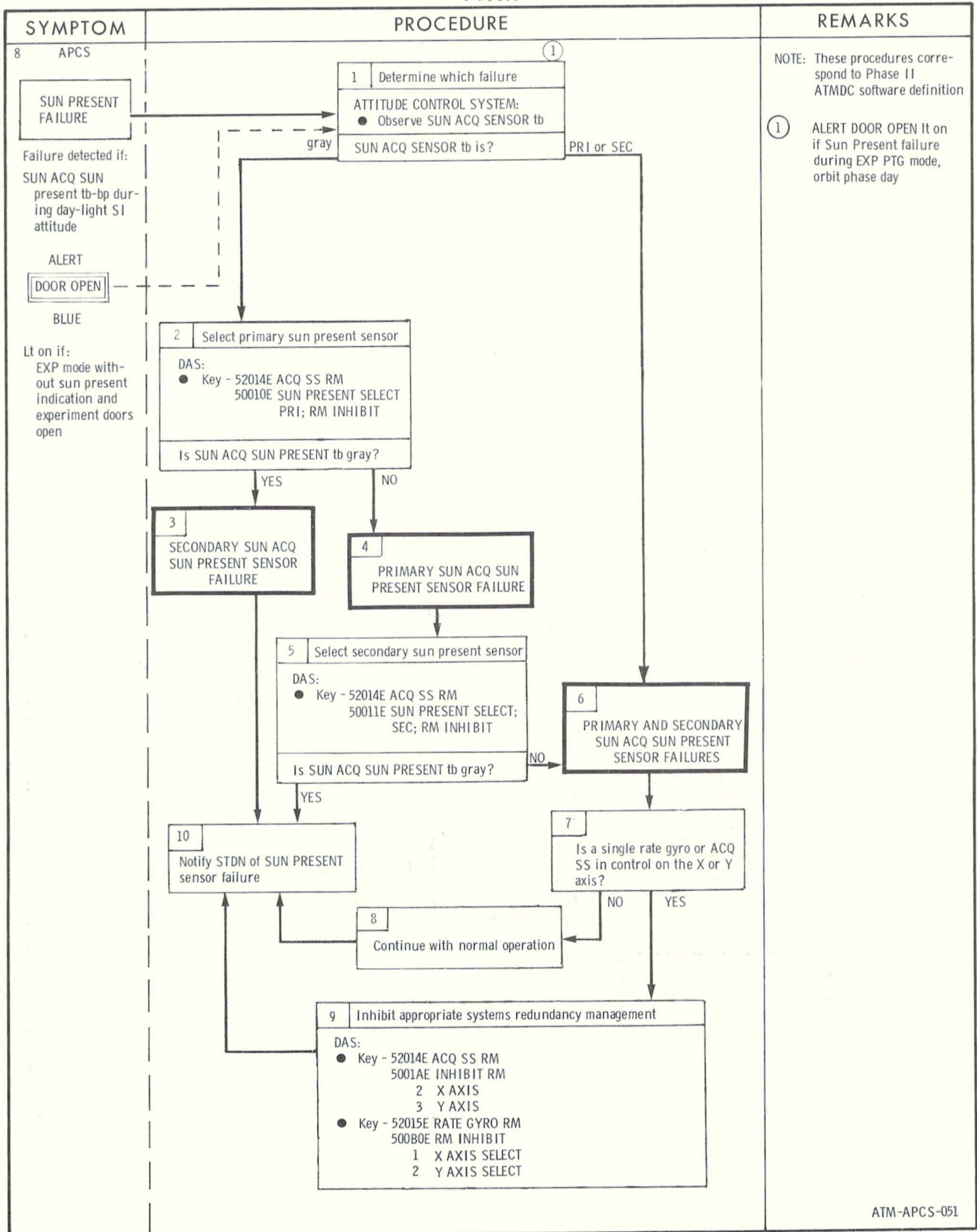
STAR TRACKER updates are required before each EREP ZLV pass, and if the ground calculation of out of plane angle ν_z exceeds the onboard value by more than 5°

ATM-APCS-050

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM



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ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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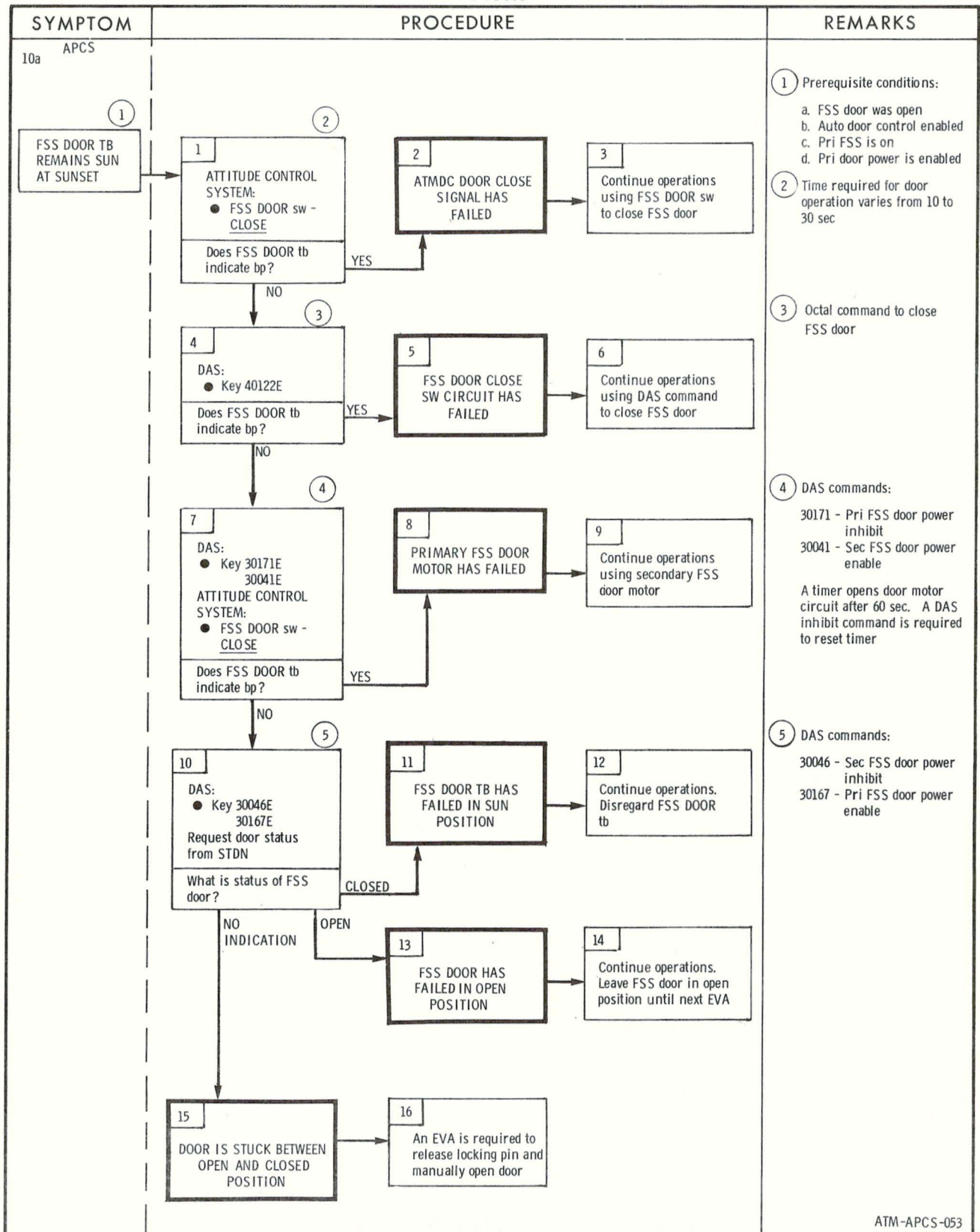
SYMPTOM	PROCEDURE	REMARKS
9 APCS ATM CANISTER DOES NOT RESPOND TO ROLL COMMANDS	① 1 ATTITUDE CONTROL SYSTEM: ● EPEA sw - <u>SEC</u> MONITOR: ● COUNTER 1 sel - ROLL CSTR ● Observe COUNTER 1 MANUAL POINTING CONTROL: ● ROLL ENABLE sw - <u>ENABLE</u> ● ROLL HIGH RATE sw - <u>CW</u> Does canister roll display follow roll command? YES 2 PRIMARY EPEA FAILURE 3 Continue operations using secondary EPEA NO 4 ATTITUDE CONTROL SYSTEM: ● EPEA sw - <u>PRIM</u> MONITOR: ● COUNTER 3 sel - ROLL CSTR ● Observe COUNTER 3 MANUAL POINTING CONTROL: ● ROLL HIGH RATE sw - <u>CW</u> Does canister roll display follow roll command? YES 5 COUNTER 1 FAILURE 6 Continue operations using counter 3 NO ② 7 ATTITUDE CONTROL SYSTEM: ● EPC ROLL RSLVR sw - <u>SECONDARY</u> MONITOR: ● COUNTER 1 sel - ROLL CSTR ● Observe COUNTER 1 MANUAL POINTING CONTROL: ● ROLL HIGH RATE sw - <u>CW</u> Does canister roll display follow roll command? YES 8 PRIMARY EPC ROLL RESOLVER FAILURE 9 Continue operations using secondary roll resolver NO 10 ATMDC DISPLAY CIRCUITRY FAILURE 11 Continue operations using TM to verify canister roll position	① The primary roll motor is connected to the primary EPEA roll channel. The secondary roll motor is connected to the secondary EPEA roll channel ② A roll resolver failure prevents the ATMDC from receiving roll position information

ATM-APCS-052

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
10b APCS ① FSS DOOR TB REMAINS BP AT SUNRISE	<pre> graph TD 1[1: ATTITUDE CONTROL SYSTEM: FSS DOOR sw - OPEN] --> Q1{Does FSS DOOR tb indicate SUN?} Q1 -- YES --> 2[2: ATMDC DOOR OPEN SIGNAL HAS FAILED] Q1 -- NO --> 4[4: DAS: Key 40063E] 4 --> Q2{Does FSS DOOR tb indicate SUN?} Q2 -- YES --> 5[5: FSS DOOR OPEN SW CIRCUIT HAS FAILED] Q2 -- NO --> 7[7: DAS: Key 30171E, 30041E; ATTITUDE CONTROL SYSTEM: FSS DOOR sw - OPEN; Wait 60 sec] 7 --> Q3{Does FSS DOOR tb indicate SUN?} Q3 -- YES --> 8[8: PRIMARY FSS DOOR MOTOR HAS FAILED] Q3 -- NO --> 10[10: DAS: Key 30167E, 30046E, 30041E; ATTITUDE CONTROL SYSTEM: FSS DOOR sw - OPEN; Wait 30 sec; DAS: Key 30046E] 10 --> Q4{Does FSS DOOR tb indicate SUN?} Q4 -- YES --> 11[11: FSS DOOR HAS FAILED TO OPEN ON SINGLE MOTOR] Q4 -- NO --> 13[13:] 2 --> 3[3: Continue operations using FSS DOOR sw to open FSS door] 5 --> 6[6: Continue operations using DAS command to open FSS door] 8 --> 9[9: Continue operations using secondary FSS door motor] 11 --> 12[12: Continue operations using both motors to open FSS door] </pre>	① Prerequisite conditions: a. Door was closed b. Auto door control enabled c. Pri FSS is on d. Pri FSS aperture door power is enabled ② Time required for door operation varies from 10 to 30 sec ③ Octal command to open FSS door ④ DAS commands: 30171 - Pri FSS door power inhibit 30041 - Sec FSS door power enable A timer opens door motor circuit after 60 sec. A DAS inhibit command is required to reset timer ⑤ DAS commands: 30167 - Pri FSS door power enable 30046 - Sec FSS door power inhibit 30041 - Sec FSS door power enable Sec door power is inhibited after door opens to prevent door closing with both motors

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ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
10b APCS (Cont)	<pre> graph TD 10 --> 13 13 -- OPEN --> 14 13 -- NO INDICATION --> 18 13 -- CLOSED --> 16 14 -- YES --> 15 15 --> 17 16 --> 19 18 --> 21 19 --> 20 20 --> 21 21 --> 21 </pre>	

ATM-APCS-055

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
11 APCS	ATM CANISTER DOES NOT RESPOND TO OFFSET POSITION COMMANDS 1 MANUAL POINTING CONTROL: ● MAN PTG ENABLE sw - <u>ENABLE</u> (verify) Is MAN PTG tb - EXP? 2 The EPC LOOP is not active Wait for MAN PTG tb - EXP 6 ATTITUDE CONTROL SYSTEM: ● EPC 800 HZ sw - <u>PRIMARY</u> ● FSS sw - <u>SECONDARY</u> MANUAL POINTING CONTROL: ● Manipulate MPC in UP/DN and L/R directions observing image on MON 1 Does image on MON 1 follow MPC commands? 9 ATTITUDE CONTROL SYSTEM: ● FSS sw - <u>PRIMARY</u> ● EPEA sw - <u>SEC</u> MANUAL POINTING CONTROL: ● Manipulate MPC in UP/DN and L/R directions observing image on MON 1 Does image on MON 1 follow MPC commands? 12 ATTITUDE CONTROL SYSTEM: ● MODE SOLAR INERTIAL sw - <u>S1</u> ● EPEA sw - <u>PRIM</u> ● EPC RATE GYRO UP/DN or L/R sw - <u>SECONDARY</u> ● Wait 90 sec ● MODE EXP PTG sw - <u>EXP PTG</u> MANUAL POINTING CONTROL: ● Manipulate MPC in UP/DN and L/R directions observing image on MON 1 Does image on MON 1 follow MPC commands? 3 ATTITUDE CONTROL SYSTEM: ● EPC 800 HZ sw - <u>SECONDARY</u> TV: ● MON 1 sel - <u>Hα1</u> MANUAL POINTING CONTROL: ● Manipulate MPC in UP/DN and L/R directions observing image on MON 1 Does image on MON 1 follow MPC commands? 4 PRIMARY EPC 800 HZ FAILURE 5 Continue operations using secondary EPC 800 HZ 7 PRIMARY FSS FAILURE 8 Continue operations using secondary FSS 10 PRIMARY EPEA FAILURE 11 Continue operations using secondary EPEA 13 PRIMARY EPC RATE GYRO UP/DN OR L/R FAILURE 14 Continue operations using secondary EPC rate gyros 15	1 The conditions for an active EPC LOOP are a. EXP PTG MODE b. Orbit day c. Acquisition Sun Sensor X&Y errors $\leq 1.3^\circ$ 2 When switching FSS's, the FSS UP/DN and L/R readouts will be random until the FSS wedges are driven through zero

ATM-APCS-056

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
11 APCS (Cont)	<pre> graph TD 12 --> 15 15 --> D1{Does image on MON 1 respond to DAS commands?} D1 -- YES --> 16 D1 -- NO --> 19 16 --> D2{Does image on MON 1 follow MPC commands?} D2 -- YES --> 17 D2 -- NO --> 24 19 --> D3{Does image on MON 1 respond to DAS command?} D3 -- YES --> 20 D3 -- NO --> 22 20 --> 21 21 --> 21 22 --> 23 24 --> 25 25 --> 26 17 --> 18 18 --> 18 23 --> 23 </pre>	3 The DAS commands shown will align the TV monitor cross hairs with the limb of the solar disc in the up and right direction 4 See spare cable replacement procedure 5 Octal command to select secondary 455 Hz power 6 See spare MPC removal and replacement procedures 7 This is a degraded mode of operation

ATM-APCS-057

ATTITUDE AND POINTING CONTROL SUBSYSTEMS

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SYMPTOM	PROCEDURE	REMARKS
	5.2 EXPERIMENT MALFUNCTIONS	

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
1 Ha1 ① Ha1 PICTURE ON TV MON 1 LACKS DETAIL	<pre> graph TD 1[1] --> 1a[1 TV: • MON 2 sel - Ha1 Is detail present?] 1a -- YES --> 2[2 TV MONITOR 1 IS DEGRADED] 1a -- NO --> 3[3 H-ALPHA: • Ha1 HEATER sw - SEC TV: • MON 1 sel - Ha2 Wait 1 hour Are Ha1 and 2 pictures approaching similarity?] 3 -- YES --> 4[4 PRIMARY HEATER CONTROLLER FAILURE OR HEATER FAILURE] 3 -- NO --> 5[5 Select secondary heater controller DAS: • Key - 40003E Wait 1 hour Are pictures approaching similarity?] 5 -- YES --> 6[6 Ha1 HEATER SELECT CIRCUITRY FAILURE] 5 -- NO --> 7[7 Ha1 FILTER FAILURE] 7 --> 8[8 Is detail adequate for pointing S055A and S082B?] 8 -- YES --> 9[9 Continue using Ha1] 8 -- NO --> 10[10 Use Ha2 for pointing S055A and S082B, and continue filming with Ha1] </pre>	① Sunspots remain visible, but filaments, plages, and granulation lose contrast with background. Compare with Ha2 picture on MON 2 ② STDN can confirm temps of heater, and surroundings are within limits ③ Accept lack of detail when pointing with Ha1. Film camera records point of aim, if not the precise feature

ATM-Ha1-001A

H ALPHA I

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
2 Ha1 ① DOOR OPEN ALERT LT ON AND Ha1 DOOR TB WHITE	① H-ALPHA: ● Ha2 DOOR tb - <u>gray</u> (verify) ● Ha1 DOOR sw - <u>CLOSE</u> TV: ● MON 1 sel - <u>Ha1</u> ● MON 2 sel - <u>Ha2</u> ● Ha1 ZOOM sw - <u>OUT</u> full MANUAL POINTING CONTROL: ● MPC - manipulate as required to center sun on MON 2 Is the sun visible on MON 1? YES → ② Ha1 DOOR FAILED OPEN NO → ③ Ha1 DOOR CLOSED SENSOR FAILED ② → ③ Continue to operate ③ → ⑤ Continue to operate	① Diagnosis must wait for a daylight pass ② If TM indicates a telescope temperature out-of-limit, a change of procedure may be relayed by STDN ③ The door may be incompletely closed, but effect is similar to sensor failure

ATM-Ha1-002A

H ALPHA I

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
3 Ha1 (1) OPR LT DOES NOT LT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET	<pre> graph TD 1[1] -- YES --> 2[2] 1 -- NO --> 5[5] 2 --> 3[3] 3 --> 4[4] 5 -- YES --> 6[6] 5 -- NO --> 8[8] 6 --> 7[7] 8 -- YES --> 9[9] 8 -- NO --> 11[11] 9 --> 10[10] 11 -- YES --> 12[12] 11 -- NO --> 14[14] 12 --> 13[13] 14 --> 15[15] </pre>	(1) Prerequisite conditions: Ha1 DOOR tb - gray Ha1 HEATER sw - PRIM or SEC Ha1 CAMR PWR sw - ON Ha1 AUTO sw - AUTO (2) Computer door open command had not reached the camera (3) FRAMES REMAINING ind indicates camera is operating (4) There is no way to isolate these failures except by checking operation with a new film magazine

ATM - Ha1 - 003A

H ALPHA I

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
4 Ha1 ① Hα1 DOOR TB REMAINS BP AT EFFECTIVE SUNRISE (ESR)	<pre> graph TD 1[1 Is Hα1 OPR It ON?] -- YES --> 2[2 Hα1 DOOR TB FAILURE] 1 -- NO --> 4[4 H-ALPHA: ● Hα1 DOOR sw - OPEN Does Hα1 DOOR tb go white then gray?] 4 -- YES --> 5[5 ATMDC DOOR OPEN SIGNAL FAILURE] 4 -- NO --> 8[8 Hα1 DOOR FAILED CLOSED] 2 --> 3[3 Continue to operate] 5 --> 6[6 H-ALPHA: ● Hα1 NIGHT INTLK sw - OVERRIDE Confirm Hα1 OPR It ON and Hα1 FRAMES REMAINING ind decrements at frame rate selected] 6 --> 7[7 Continue to operate] 8 --> 9[9 Use Ha2 for pointing S055A and S082B Open door manually during next EVA] </pre>	① Assumes: EVA: AUTO DOOR sw - ENABLE ② If door fails to close automatically (tb remains gray), it must be closed manually. Camera must be stopped manually

ATM-Hα1-004A

H ALPHA I

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS		
5 Ha1	AT OR BEFORE COALIGNMENT, Ha1 RETICLE (S) FAILS TO MOVE WHEN HaRC IS MANIPULATED 1 Is one Ha1 reticle capable of operation? YES 2 Perform S082B/FSS BIAS AND COALIGNMENT WITH S055A, Ha1, AND Ha2 procedure with Ha2 reticles. Place operational Ha1 reticle coincident with Ha2 reticle. 3 Use Ha2 reticles to point S082B and S055A. Use aligned Ha1 reticle to point S055A and S082B in one axis when better resolution is desired. NO 4 Perform S082B/FSS BIAS AND COALIGNMENT WITH S055A, Ha1, AND Ha2 procedure replacing Ha1 reticle with Ha2 reticle 5 Use Ha2 to point S082B and S055A 1 Position of Ha1 reticles when Ha2 reticles are coaligned at the limbs will be recorded on film and used in postflight analysis <tr><td></td><td></td><td></td></tr>			

ATM-Ha1-005A

1

H ALPHA I

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
I Ha2 ① Ha2 PICTURE ON TV MON 1 LACKS DETAIL	<pre> graph TD 1[1 TV: • MON 2 sel - Ha2 Is detail present?] -- YES --> 2[2 TV MONITOR 1 IS DEGRADED] 1 -- NO --> 3[3 H-ALPHA: • Ha2 HEATER sw - SEC TV: • MON 1 sel - Ha1 Wait 1 hour Are Ha1 and Ha2 pictures approaching similarity?] 3 -- YES --> 4[4 PRIMARY HEATER CONTROLLER FAILURE OR HEATER FAILURE] 3 -- NO --> 5[5 Ha2 HEATER SELECT CIRCUITRY FAILURE OR Ha2 FILTER FAILURE] </pre>	① Sunspots remain visible, but filaments, plages, and granulation lose contrast with background. Compare with Ha1 picture on MON 2 ② STDN can confirm temps of heater, and surroundings are within limits

ATM-Ha2-001

H ALPHA II

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
2 Hα2 1 DOOR OPEN ALERT LT ON AND Hα2 DOOR TB WHITE	1 H-ALPHA: ● Hα1 DOOR tb - gray (verify) ● Hα2 DOOR sw - <u>CLOSE</u> TV: ● MON 1 sel - <u>Hα2</u> ● MON 2 sel - <u>Hα1</u> ● Hα2 ZOOM sw - <u>OUT</u> full MANUAL POINTING CONTROL: ● MPC - Manipulate as required to center sun on MON 2 Is the sun visible on MON 1? YES 2 Hα2 DOOR FAILED OPEN NO 4 3 Hα2 DOOR CLOSED SENSOR FAILURE 5 Continue to operate	1 Diagnosis must wait for a daylight pass 2 If TM indicates a telescope temperature out-of-limit, a change of procedure may be relayed by STDN 3 The door may be incompletely closed, but effect is similar to sensor failure

ATM-H α 2-002

H ALPHA II

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
3 Ha2 ① Hα1 DOOR TB REMAINS BP AT EFFECTIVE SUNRISE (ESR)	<pre> graph TD 1["1 H-ALPHA: • Ha2 DOOR sw - <u>OPEN</u> Does Ha2 DOOR tb go white then gray?"] 2["2 ATMDC DOOR OPEN SIGNAL FAILURE"] 3["3 Continue to operate"] 4["4 Ha2 DOOR FAILED CLOSED"] 5["5 Use Hα1 for pointing S082B and S055A"] 1 -- YES --> 2 2 --> 3 1 -- NO --> 4 4 --> 5 </pre>	① Assumes: EVA: AUTO DOOR sw - ENABLE ATM-Ha2-003A

H ALPHA II

SKYLAB OPERATIONS HANDBOOK

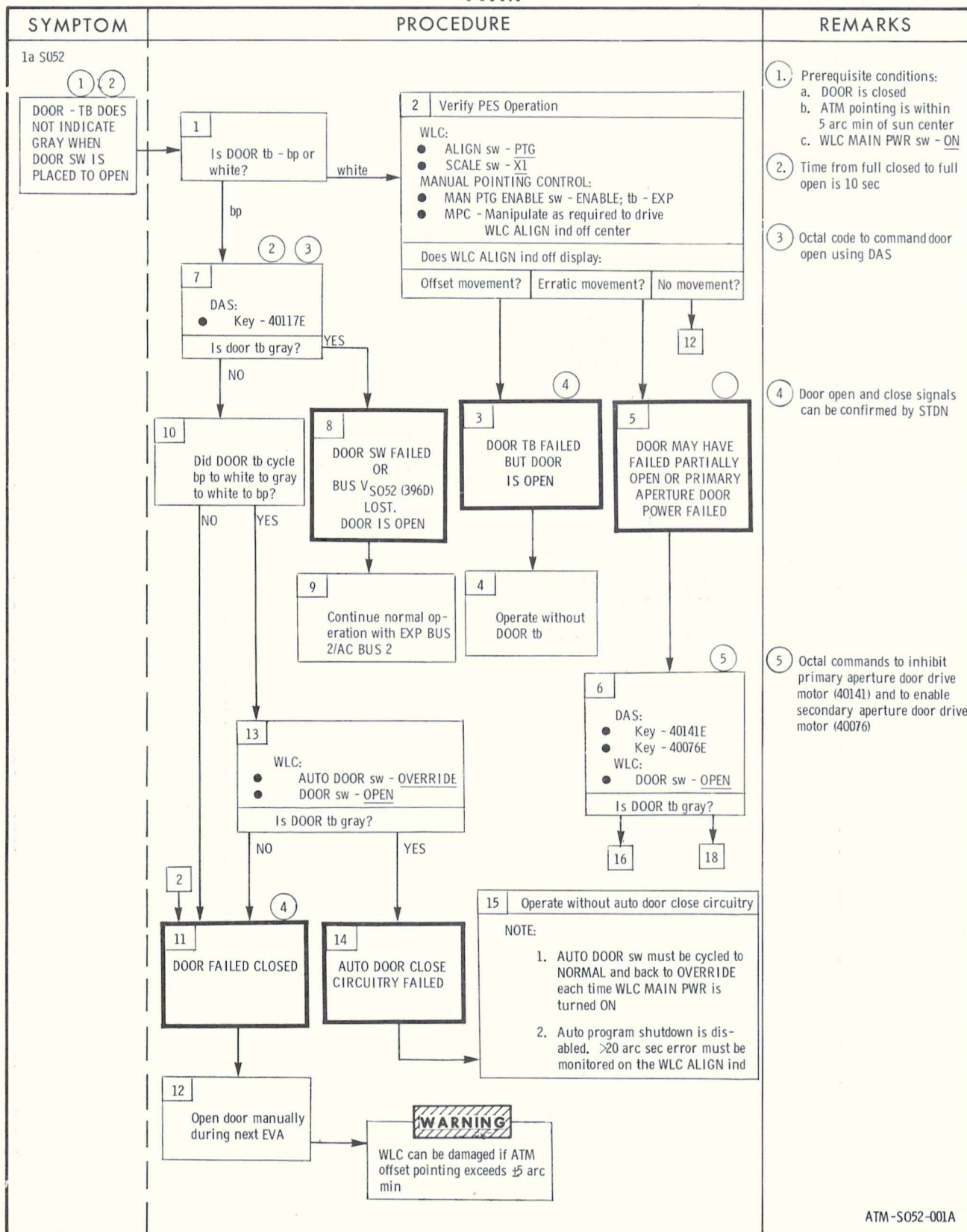
ATM

SYMPTOM	PROCEDURE	REMARKS
4 Ha2 AT OR BEFORE COALIGNMENT, Ha2 RETICLE(S) FAILS TO MOVE WHEN HaRC IS MANIPULATED	<pre> graph TD 1[1 Is one Ha2 reticle capable of operation?] -- YES --> 2[2 Align Ha1 reticles with S082 and S055A per S082B/FSS BIAS AND COALIGNMENT WITH S055A, Ha1, and Ha2 procedure. Place operational Ha2 reticle coincident with Ha1 reticle] 1 -- NO --> 4[4 Align Ha1 reticles with S082B and S055A per S082B/FSS BIAS AND COALIGNMENT WITH S055A, Ha1, and Ha2 procedure] 2 --> 3[3 Use Ha1 reticles to point S055A & S082B in two axes. Ha2 can be used for coarse pointing] 4 --> 5[5 Use Ha1 reticles to point S055A & S082B in two axes] </pre>	ATM-Ha 2-004A

H ALPHA II

SKYLAB OPERATIONS HANDBOOK

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ATM-S052-001A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

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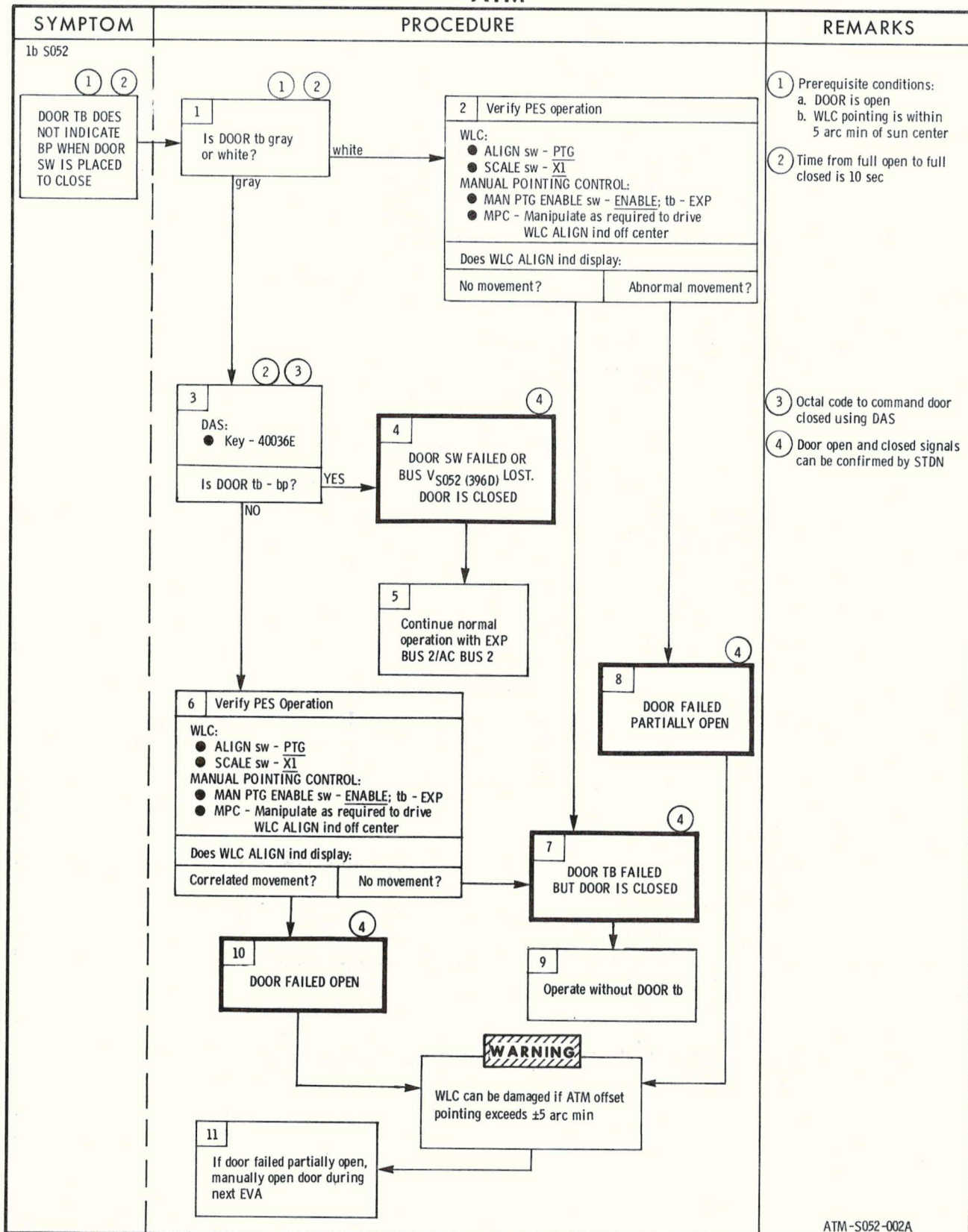
SYMPTOM	PROCEDURE	REMARKS
1a S052 (Cont)	6 16 DOOR FAILED PARTIALLY OPEN ↓ WARNING WLC can be damaged if ATM offset pointing exceeds ± 5 arc min ↓ 17 Open door manually during next EVA 6 18 PRIMARY APERTURE DOOR POWER FAILED ↓ 19 Continue operation using secondary aperture door power	

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WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

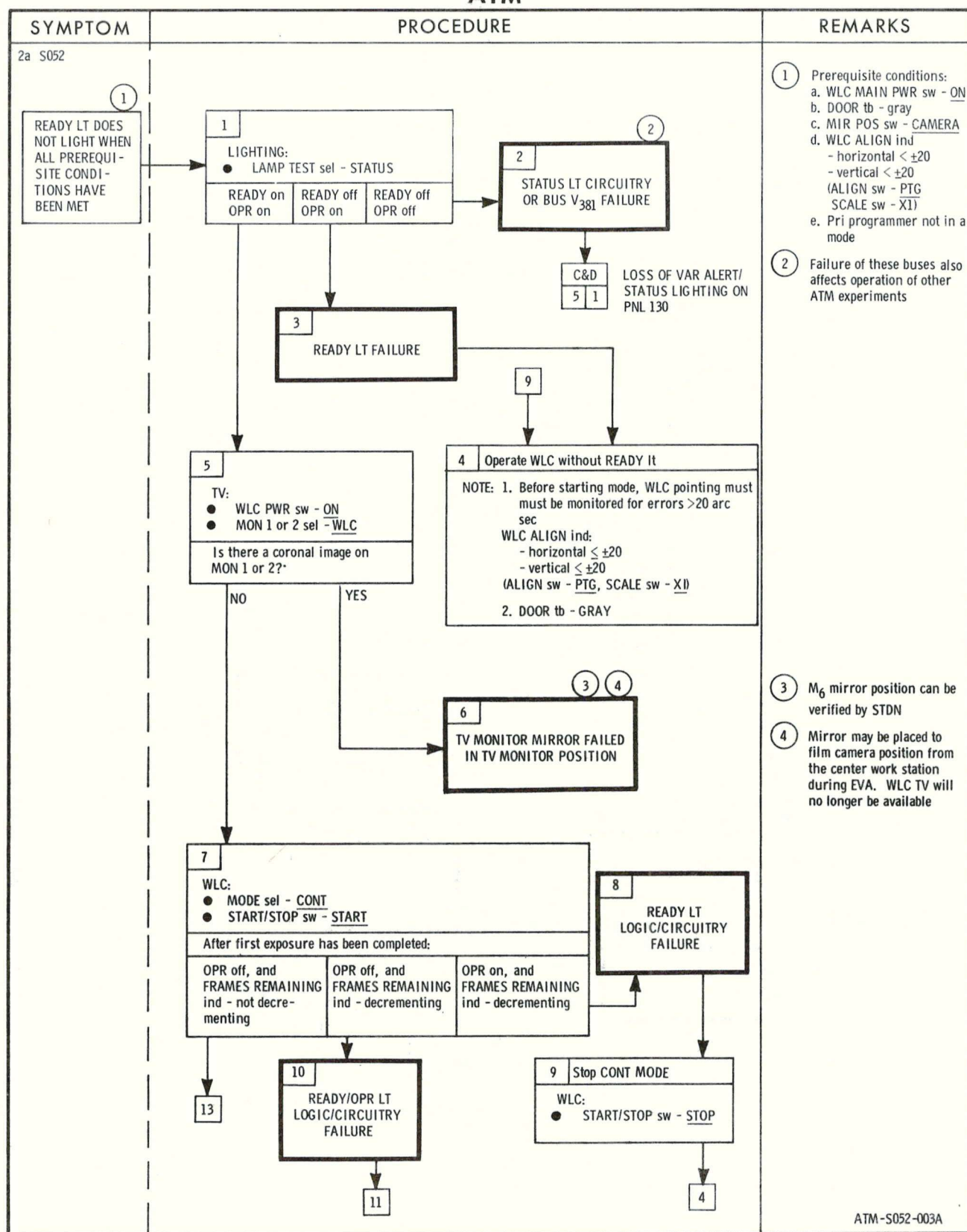
ATM



ATM-S052-002A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK ATM



WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
2a S052 (Cont)	10 11 Stop CONT MODE WLC: ● START/STOP sw - <u>STOP</u> 12 Operate WLC without READY/OPR Its NOTE: Automatic command to switch the TV monitor mirror to the film camera position is disabled TV monitor mirror film camera position must be commanded manually before taking data 7 13 Override 20 arc sec discriminator WLC: ● AUTO DOOR sw - <u>VERRIDE</u> ● MODE sel - <u>CONT</u> ● START/STOP sw - <u>START</u> After first exposure has been completed; is OPR It on and FRAMES REMAINING ind decrementing? NO YES 17 Remove 20 arc sec override and check D4 operation WLC: ● AUTO DOOR sw - <u>NORMAL</u> ● SCALE sw - <u>X10</u> ● ALIGN sw - <u>DISC MAN</u> ● MODC - <u>UP</u> Is there any movement of WLC ALIGN horizontal indicator? YES NO 14 20 ARC SEC DISCRIMINATOR FAILURE 15 Stop CONT MODE WLC: ● START/STOP sw - <u>STOP</u> 16 18 VAMP 1 AND VAMP 2 BUS FAILURE 19	2 Failure of these buses also affects operation of ther ATM experiments 5 20 arc sec discriminator failure can be confirmed by STDN

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WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
2a S052(Cont)	17 19 WLC PRI POWER SUPPLY OR BUS V₅₃ FAILURE 20 Activate secondary converter WLC: ● MAIN PWR sw - <u>OFF</u> DAS: ● KEY - 40123E WLC: ● MAIN PWR sw - <u>STBY</u> momentarily then <u>ON</u> 15 16 Override 20 arc sec discriminator and continue WLC operation WLC: ● AUTO DOOR sw - <u>VERRIDE</u> NOTE: 1. AUTO DOOR sw must be cycled to NORMAL and back to <u>VERRIDE</u> each time WLC MAIN PWR is turned back ON 2. Automatic programmer shutdown for WLC pointing errors > 20 arc sec is disabled. WLC pointing errors > 20 arc sec must be monitored on the WLC ALIGN ind and the programmer must be manually stopped when exceeded 3. Automatic command to close the aperture door is disabled. WLC pointing errors > 5 arc min must be monitored on the WLC ALIGN ind, and the door closure must be commanded manually	5 WLC can be operated with the 20 arc sec inhibit signal override 6 WLC internal power status can be verified by STDN 7 Secondary converter selection can be verified by STDN 8 Octal command to select secondary converter

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WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
2b S052 (1) READY LT DOES NOT GO OFF WHEN PRIMARY PROGRAMMER MODE IS INITIATED	<pre> graph TD 1[1 After first exposure has been completed is OPR It on?] -- YES --> 2[2 READY LT LOGIC CIRCUITRY FAILED] 1 -- NO --> 3[3 Is FRAMES REMAINING ind decrementing?] 2 --> S052_2a_4[S052 2a 4] S052_2a_4 --> 4[4 PRIMARY PROGRAMMER- IN-MODE CIRCUITRY FAILED] 3 -- YES --> 4 3 -- NO --> 5[5 PRIMARY PROGRAMMER FAILED] 4 --> 6[6 Activate WLC secondary programmer.] 6 --> S052_2a_12[S052 2a 12] </pre> READY LT DOES NOT LIGHT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET PRIMARY PROGRAMMER- IN-MODE CIRCUITRY FAILED PRIMARY PROGRAMMER FAILED Activate WLC secondary programmer. WLC: ● MODE sel - <u>SEC P ROG</u> ● READY It - on, OPR It - off ● START/STOP sw - <u>START</u> ● READY It - remains on ● OPR It - remains off ● SEQUENCE COMPLETE tb - remains bp ● FRAMES REMAINING ind - decrements - NOTE: SEC PROG mode must be stopped manually ● MODE sel - CCW to first unmarked detent position	(1) Prerequisite conditions: - READY It - on - MODE sel - <u>STD</u>, <u>EXTD STD</u>, <u>CONT</u>, <u>FAST SCAN</u> - START/STOP sw - <u>START</u> (2) Secondary programmer activation can be verified by STDN

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WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS							
3a S052	1 OPR LT DOES NOT LIGHT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET 1 After first exposure has been completed: <table><tr><td>READY It on, OPR It off, and FRAMES REMAINING ind decrementing</td><td>READY It on, OPR It off, and FRAMES REMAINING ind not decrementing</td><td>READY It off, OPR It off, and FRAMES REMAINING ind decrementing</td><td>READY It off, OPR It off, and FRAMES REMAINING ind not decrementing</td></tr></table> 6 PRIMARY PROGRAMMER-IN-MODE CIRCUITRY FAILURE S052 2a 12 READY LT DOES NOT LIGHT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET 2 LIGHTING: ● LAMP TEST sel - STATUS <table><tr><td>READY off OPR off</td><td>READY on OPR on</td><td>READY on OPR off</td></tr></table> 3 STATUS LT CIRCUITRY OR BUS V₃₈₁ FAILURE C&D 5 1 LOSS OF VAR ALERT/STATUS LIGHTING ON PNL 130 4 OPR LT FAILURE 5 OPR LT LOGIC/CIRCUITRY FAILURE S052 2a 12 READY LT DOES NOT LIGHT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET 7 START/STOP SWITCH OR PRIMARY PROGRAMMER FAILURE 8 Bypass START/STOP sw DAS: ● Key - 40155 Is READY It off, OPR It on, FRAMES REMAINING ind decrementing? YES 10 START/STOP SWITCH FAILURE 4 Operate WLC using DAS/DCS NO 9 PRIMARY PROGRAMMER FAILURE S052 2b 5 READY LT DOES NOT GO OFF WHEN PRIMARY PROGRAMMER MODE IS INITIATED 1 Prequisite conditions: a. FILM CAMERA CHECK-OUT procedure completed satisfactorily b. READY It - on c. WLC ALIGN ind - horizontal < ±20 - vertical < ±20 (ALIGN sw - PTG SCALE sw - X1) d. MODE sel - STD, EXT, STD, CONT, or FAST SCAN e. If FAST SCAN - FRAMES REMAINING ind >400 f. START/STOP sw - START 2 Programmer operation can be verified by STDN 3 Failure of this bus also affects operation of other ATM experiments 4 WLC can only be operated in the STD and FAST SCAN modes using the DAS/DCS	READY It on, OPR It off, and FRAMES REMAINING ind decrementing	READY It on, OPR It off, and FRAMES REMAINING ind not decrementing	READY It off, OPR It off, and FRAMES REMAINING ind decrementing	READY It off, OPR It off, and FRAMES REMAINING ind not decrementing	READY off OPR off	READY on OPR on	READY on OPR off	ATM-S052-006A
READY It on, OPR It off, and FRAMES REMAINING ind decrementing	READY It on, OPR It off, and FRAMES REMAINING ind not decrementing	READY It off, OPR It off, and FRAMES REMAINING ind decrementing	READY It off, OPR It off, and FRAMES REMAINING ind not decrementing						
READY off OPR off	READY on OPR on	READY on OPR off							

ATM-S052-006A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3a S052 (Cont)	<pre> graph TD 1[1] --> 12[12] subgraph 12 [12] WLC12["WLC: • AUTO DOOR sw - <u>OVERRIDE</u> • MODE sel - <u>CONT</u> • START/STOP sw - <u>START</u>"] end 12 --> 13[13] 12 --> 15[15] subgraph 13 [13] 13_text["20 ARC SEC DISCRIMINATOR FAILURE"] end 13 --> 14[14] subgraph 14 [14] WLC14["WLC: • START/STOP sw - <u>STOP</u>"] end 14 --> 16a[S052 2a 16] 16a --> 16a_text["READY LT DOES NOT LIGHT WHEN ALL PREQUISITE CONDI- TIONS HAVE BEEN MET"] subgraph 15 [15] 15_text["FILM MAGAZINE OR EXPOSURE CONTROL LOGIC FAILURE"] end 15 --> 16[16] subgraph 16 [16] 16_text["Continue to operate as long as all other WLC indications are normal"] end 16 --> 17[WARNING] subgraph 17 [WARNING] 17_text["Broken film could cause magazine to overheat as a result of driving exposed film into the transport mechanism"] end </pre>	2 Programmer operation can be verified by STDN 5 20 arc sec discriminator failure can be confirmed by STDN 6 Do not operate WLC if film magazine temperature exceeds 90° F. Temperature can be verified by STDN 7 Film magazine can be replaced by EVA

ATM-S052-020

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3b S052	1 OPR LT GOES OFF DURING DATA TAKING MODE 1 Experiment status READY It on, OPR It off, and FRAMES REMAINING ind decre-menting READY It on, OPR It off, and FRAMES REMAINING ind not decrementing READY It off, OPR It off, and FRAMES REMAINING ind not decrementing FRAMES REMAINING ind decre-menting and READY It off 11 2 PRIMARY PROGRAMMER-IN-MODE CIRCUITRY FAILURE 3 Operate WLC without READY/OPR lights 4 Reinitiate mode READY It off, OPR It on, and FRAMES REMAINING ind decrementing READY It on, OPR It off, and FRAMES REMAINING ind not decrementing 5 Transient anomaly, continue WLC operation 6 PRIMARY PROGRAMMER FAILURE S052 2b 5 READY LT DOES NOT GO OFF WHEN PRIMARY PROGRAMMER MODE IS INITIATED 7 Override 20 arc sec discriminator WLC: - AUTO DOOR sw - <u>VERRIDE</u> - MODE sel - <u>CONT</u> - START/STOP sw - <u>START</u> After time duration for first exposure READY It off, OPR It on, and FRAMES REMAINING ind decrementing READY It off, OPR It off, and FRAMES REMAINING ind not decrementing 8 20 ARC SEC DISCRIMINATOR FAILURE 9 Stop CONT MODE WLC: - START/STOP sw - <u>STOP</u> S052 2a 16 READY LT DOES NOT LIGHT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET 10 EXPOSURE CONTROL OR FILM MAGAZINE OR PRI POWER SUPPLY OR VAMP 1 AND VAMP 2 BUS FAILURE 1 Prerequisite conditions: - FILM CAMERA CHECK-OUT procedure completed satisfactorily - MODE sel - <u>STD</u>, <u>EXTD</u>, <u>STD</u>, <u>CONT</u>, or <u>FAST</u> SCAN mode initiated, and OPR It initially on - SEQUENCE COMPLETE tb - bp - If FAST SCAN mode selected, FRAMES REMAINING ind >400 - WLC ALIGN ind - horizontal < ±20 - vertical < ±20 (ALIGN sw - <u>PTG</u> SCALE sw - <u>X1</u>) 2 20 arc sec discriminator failure can be confirmed by STDN 3 Failure of these buses also affects operation of other ATM experiments 4 WLC exposure control and internal power status can be verified by STDN 5 VAMP 1 or VAMP 2 bus power status can be determined by TBS 6 Film magazine can be replaced by EVA 7 WLC can be operated with 20 arc sec inhibit signal overridden ATM-S052-007A	

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3b S052 (Cont)	1 11 LIGHTING: ● LAMP TEST sel - STATUS READY on OPR on READY on OPR off READY off OPR off 12 OPR LT LOGIC CIRCUITRY FAILURE 13 OPR LT FAILURE 14 STATUS LT CIRCUITRY OR BUS V₃₈₁ FAILURE S052 2a 12 READY LT DOES NOT LIGHT WHEN ALL PREREQUISITE CON- DITIONS HAVE BEEN MET C&D 5 1 LOSS OF VAR ALERT/STATUS LIGHTING ON PNL 130	3 Failure of these buses also affects operation of other ATM experiments ATM-S052-021

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
4a S052 ① SEQUENCE COMPLETE TB DOES NOT INDICATE BP UPON INITIATION OF PRIMARY PROGRAM MODE	② 1 Is WLC operating - READY It - off, OPR It - on, FRAMES REMAINING ind - decrementing? YES → 2 MODE COMPLETE CIRCUITRY OR SEQUENCE COMPLETE TB CIRCUITRY FAILURE NO → S0 52 3a 1 OPR LT DOES NOT LIGHT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET ③ 3 After program mode is terminated (READY It on/OPR It off), reset WLC electronics WLC: ● MAIN PWR sw - <u>STBY</u> ● MAIN PWR sw - <u>ON</u> ● DOOR sw - <u>OPEN</u>; tb - gray Is SEQUENCE COMPLETE tb - bp? YES → 6 Restart WLC WLC: ● MODE sel - <u>STD</u> ● READY It - on ● START/STOP sw - <u>START</u> After 5.5 min, is SEQUENCE COMPLETE tb - gray? NO → 7 MODE COMPLETE CIRCUITRY FAILURE 5 ③ 4 SEQUENCE COMPLETE TB CIRCUITRY FAILURE 7 5 Continue to operate WLC without SEQUENCE COMPLETE tb ③ 8 INTERMITTENT TRANSIENT IN MODE COMPLETE CIRCUITRY OR SEQUENCE COMPLETE TB 9 9 Continue normal operation	① Prerequisite conditions: a. READY It - on b. MODE sel - <u>STD</u>, <u>EXTD</u>, <u>STD</u>, <u>CONT</u>, or <u>FAST SCAN</u> c. START/STOP sw - <u>START</u> ② WLC programmer operation can be verified by STDN ③ Normal mode operation: a. STD Exposures - 12 Duration - 5.5 min b. EXTD STD Exposures - 36 Duration - 16.2 min c. FAST SCAN Exposures - 72 Duration - 16.2 min ATM-S052-008A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
4b S052 ① ② SEQUENCE COMPLETE TB DOES NOT INDICATE GRAY AFTER NORMAL COMPLETION OF AUTOMATIC MODE	③ 1 Verify primary programmer automatic - mode operation If mode in operation when symptom observed was: ● STD - First run EXT D STD, then FAST SCAN ● EXT D STD - First run STD, then FAST SCAN ● FAST SCAN - First run STD, then EXT D STD Did WLC operate properly in the modes that were run? NO YES 2 MODE COMPLETE CIRCUITRY OR SEQUENCE COMPLETE TB FAILURE Continue to operate without SEQUENCE COMPLETE tb Partial Failure Total Failure 4 Does operation indicate partial failure or total failure? 5 Stop WLC operation manually with START/STOP sw 6 PRIMARY PROGRAMMER FAILURE S052 2b 5 READY LT DOES NOT GO OFF WHEN PRIMARY PROGRAMMER IS INITIATED	① Prerequisite conditions: - MODE sel - <u>STD</u>, <u>EXT D STD</u> or <u>FAST SCAN</u> - OPR It - on - FRAMES REMAINING - ind decrementing ② WLC programmer operation can be verified by STDN ③ Normal mode operation: - STD Exposures - 12 Duration - 5.5 min - EXT D STD Exposures - 36 Duration - 16.2 min - FAST SCAN Exposures - 72 Duration - 16.2 min

ATM-S052-009A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
5 S052 ① FRAMES REMAINING DOES NOT DECREMENT WHEN ALL PREREQUISITES HAVE BEEN MET	1 After first exposure has been completed, is READY lt off and OPR lt on? YES → 2 FIRST OR SECOND ONE SHOTS MAY HAVE FAILED NO → S052 3a 1 OPR LT DOES NOT LIGHT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET ① Prerequisite conditions: - FILM CAMERA CHECKOUT procedure completed satisfactorily - READY lt on - WLC ALIGN ind - horizontal $< \pm 20$ - vertical $< \pm 20$ (ALIGN sw - <u>PTG</u> SCALE sw - <u>X1</u>) - MODE sel - <u>STD</u>, <u>EXTD</u> <u>STD</u>, <u>CONT</u> or <u>FAST</u> <u>SCAN</u> - If FAST SCAN - FRAMES REMAINING ind > 400 - START/STOP sw - <u>START</u> 3 WLC: • START/STOP sw - <u>STOP</u> (Wait 90 sec) • START/STOP sw - <u>START</u> Does OPR lt go on as soon as START command is initiated? YES → 4 After first exposure has been completed, is FRAMES REMAINING ind decrementing? NO → 9 After first exposure has been completed: OPR lt on, and FRAMES REMAINING ind not decrementing OPR lt on, and FRAMES REMAINING ind decrementing NO → 10 FRAMES REMAINING IND FAILED OR MAGAZINE FILM BREAKAGE WITH FRAME ADVANCE REED SWITCH CLOSED → 11 YES → 5 SECOND ONE SHOT (60 SEC) FAILED ON NO → 8 FIRST ONE SHOT FAILED ON → 6 Reset WLC electronics WLC: • MAIN PWR sw - <u>STBY</u> momentarily, then <u>ON</u> • Repeat blocks 3 & 4 Do same yes conditions of blocks 3 & 4 exist? NO → 7 Intermittent transient in OPR lt logic. Continue normal operation YES → S052 2a 12 READY LT DOES NOT LIGHT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET	

ATM-S052-010A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
5 (Cont) S052	10 11 2 Continue normal WLC operation monitoring FRAMES REMAINING ind to determine if only one element (i. e. units, tens, hundreds, or thousands) has failed WARNING If film broke, magazine could overheat as a result of driving exposed film into the transport mechanism. Camera temperature can be determined <u>only</u> by STDN Is the film magazine temperature abnormal? YES NO 12 MAGAZINE FILM BREAKAGE WITH FRAME ADVANCE REED SWITCH CLOSED 13 FRAMES REMAINING IND FAILURE 14 Stop WLC operation. Replace film magazine during next EVA 15 3 Continue to operate WLC without FRAMES REMAINING ind	2 Film breakage can be determined only after repeated runs of the WLC and repeated reset of the FRAMES REMAINING ind 3 Film consumed is recorded by STDN

ATM-S052-011A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
6 S052 (1) (2) WLC ALIGN IND DISPLAYS ABNORMAL SIGNALS WHEN ALIGN SW IS IN PTG POSITION	<pre> graph TD 1[1] -- YES --> 2[2] 1 -- NO --> 9[9] 2 --> 3[3] 3 -- YES --> 4[4] 3 -- NO --> 6[6] 4 --> 5[5] 5 --> 7[7] 6 -- YES --> 7 6 -- NO --> 9 7 --> 8[8] </pre> 1 Is WLC ALIGN ind pwr fail It on? 2 BUS V_{S052} (V396D) POWERING WLC ALIGN IND IS LOST 3 CONSOLE PWR DISTR: ● WLC sw - EXP BUS 2/ AC BUS 2 Is WLC ALIGN ind pwr fail It on? 4 RELAY K32-D-A12 FAILED 5 Operate WLC without WLC ALIGN ind for PES readout. Use FSS error readouts on COUNTERS 2 & 3 for WLC pointing NOTE: ATM sun center pointing may be determined grossly by monitoring H_a TV images 6 Does the WLC ALIGN ind display normal signals? (ALIGN sw - PTG) 7 EXP BUS 1 DISTRIBUTION CIRCUITRY TO V_{S052} (V396D) BUS FAILURE 8 Continue normal operation using EXP BUS 2/AC BUS 2 9	(1) Prerequisite conditions: - DOOR tb - gray - MONITOR: CTR 2 sel - <u>FSS UP/DN</u> CTR 2 ind - $\leq \pm 0180$ CTR 3 sel - <u>FSS L/R</u> CTR 3 ind - $\leq \pm 0180$ - H_a TV monitor image approximately sun centered - FSS BIAS sw - OUT (2) Bias errors between FSS error signals and WLC error signals are determined per TBS and are verified by STDN

ATM-S052-012A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
6 S052 (Cont)	<pre> graph TD Start([1]) --> Box9[9] Box9 --> Dec1[Is READY lt on?] Dec1 -- YES --> Box10[10: COORDINATE CONVERSION CIRCUITRY OR WLC ALIGN IND CIRCUITRY FAILURE] Dec1 -- NO --> Box14[14: PES CIRCUITRY FAILURE] Box10 --> Box11[11: WLC: ALIGN sw - DISC AUTO, SCALE sw - X1] Box11 --> Dec2[Does the WLC ALIGN ind display normal signals?] Dec2 -- YES --> Box12[12: COORDINATE CONVERSION CIRCUITRY FAILURE] Dec2 -- NO --> Box13[13: WLC ALIGN IND CIRCUITRY FAILURE] Box12 --> Box15[15] Box13 --> Box15 Box14 --> Box15 Box15 --> End[READY LT DOES NOT LIGHT WHEN ALL PRE-REQUISITE CONDITIONS HAVE BEEN MET] </pre> 9 MANUAL POINTING CONTROL: ● MAN PTG ENABLE sw - <u>ENABLE</u>; tb - EXP ● MPC - Manipulate as required to reduce COUNTERS 2 & 3 indicators to 0000 ±10 ● MAN PTG ENABLE sw - <u>INHIBIT</u>; tb - bp Is READY lt on? 10 COORDINATE CONVERSION CIRCUITRY OR WLC ALIGN IND CIRCUITRY FAILURE 11 WLC: ● ALIGN sw - <u>DISC AUTO</u> ● SCALE sw - <u>X1</u> Does the WLC ALIGN ind display normal signals? 12 COORDINATE CONVERSION CIRCUITRY FAILURE 13 WLC ALIGN IND CIRCUITRY FAILURE 14 PES CIRCUITRY FAILURE 15 Operate WLC without WLC ALIGN ind, and override 5 arc min and 20 arc sec discriminators. Use FSS for WLC pointing S052 2a 16 READY LT DOES NOT LIGHT WHEN ALL PRE-REQUISITE CONDITIONS HAVE BEEN MET	② Bias errors between FSS error signals and WLC error signals are determined per TBS and are verified by STDN ③ PES signals can be verified by STDN ATM-S052-013A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
7 S052	1 WLC ALIGN IND DISPLAYS ABNORMAL SIGNALS WHEN ALIGN SW IS IN DISC AUTO OR DISC MAN 1 Is WLC ALIGN ind pwr fail It on? YES 2 BUS V_{S052} (396D) POWERING WLC ALIGN IND IS LOST WLC ALIGN IND DISPLAYS ABNORMAL SIGNALS WHEN ALIGN SW IS IN PTG POSITION 6 3 7 4 WLC ALIGN IND CIRCUITRY FAILURE 2 3 Monitor WLC coronal image TV: ● WLC PWR sw - <u>ON</u> ● MON 1 or 2 sel - <u>WLC</u> WLC: ● MIR POS sw - <u>TV</u> Does D₄ visual alignment appear satisfactory? YES 6 Verify D₄ manual control operation WLC: ● ALIGN sw - <u>DISC MAN</u> ● SCALE sw - <u>X1</u> ● MODC - manipulate up/down and right/left as required to drive cross pointers through zero, and leave in any quadrant with error readout >±25 Does D₄ TV image movement respond to the MODC commands? YES 7 Does D₄ visual movement agree with WLC ALIGN ind cross pointer movement ? NO 4 YES 10 NO 8 D₄ DRIVE MECHANISM FAILURE 9 Transmit WLC TV picture to ground for STDN evaluation 3 PANEL 132: ● VIDEO sel - ATM MON 1 or 2, as required TV: ● WLC PWR sw - <u>ON</u> ● MON 1 or 2 sel - <u>WLC</u> WLC: ● MIR POS sw - <u>TV</u> 1 Prerequisite conditions: a. D₄ MANUAL CONTROL CHECKOUT procedure completed satisfactorily b. DOOR tb - gray c. MONITOR: CTR 2 sel - <u>FSS UP/DN</u> CTR 2 ind - ≤20 CTR 2 tb - + or - CTR 3 sel - <u>FSS L/R</u> CTR 3 ind - ≤20 CTR 3 tb - + or - 2 IAS signals can be verified by STDN 3 STDN must configure CM for downlink TV	ATM-S052-014A

1 Prerequisite conditions:

- D₄ MANUAL CONTROL CHECKOUT procedure completed satisfactorily
- DOOR tb - gray
- MONITOR:
 - CTR 2 sel - FSS UP/DN
 - CTR 2 ind - ≤20
 - CTR 2 tb - + or -
 - CTR 3 sel - FSS L/R
 - CTR 3 ind - ≤20
 - CTR 3 tb - + or -

② IAS signals can be verified by STDN

③ STDN must configure CM for downlink TV

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
7 S052 (Cont)	7 ↓ 10 2 Manually drive D₄ to any quadrant: WLC ALIGN ind - horizontal $> \pm 25$ - vertical $> \pm 25$ Reset WLC electronics WLC: ● ALIGN sw - <u>DISC AUTO</u> ● MAIN PWR sw - <u>STBY</u> ● MAIN PWR sw - <u>ON</u> ● DOOR sw - <u>OPEN</u> ● DOOR tb - <u>gray</u> Does D₄ return to null position with respect to the WLC TV coronal image? NO YES → 12 11 14 13 CAUTION	(2) IAS signals can be verified by STDN

ATM-S052-015A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
8a S052 (1) TV CORONAL IMAGE IS LOST OR CANNOT BE OBTAINED	<pre> graph TD 1[1] --> Q1{Does coronal image appear on C&D monitors?} Q1 -- YES --> 2[2] Q1 -- NO --> 4[4] 2[2] --> 3[3] 4[4] --> 5[5] 3[3] --> End1[] 5[5] --> End2[] </pre> 1 WLC: ● MIR POS sw - TV Does coronal image appear on C&D monitors? 2 Temporary failure in mirror position circuitry 3 Continue normal operation 4 LOW LIGHT LEVEL CAMERA NO. 6 OR MIRROR POSITION CIRCUITRY FAILED 5 WLC: ● MIR POS sw - CAMERA Operate WLC without TV monitors	(1) Prerequisite conditions: a. WLC ALIGN ind: - horizontal $\leq \pm 300$ - vertical $\leq \pm 300$ (ALIGN sw - PTG SCALE sw - X10) b. DOOR tb - gray c. FRAMES REMAINING ind not decrementing d. CONSOLE PWR DISTR: H α sw - EXP BUS 1 or 2 e. TV: SYNC GEN sw - PRIM or SEC MON 1 or 2 sw - PWR ON MON 1 or 2 sel - WLC WLC PWR sw - ON f. WLC: MIR POS sw - TV (2) TV monitor mirror position can be verified by STDN (3) TV camera operation can be verified by STDN
8b S052 (1) TV CORONAL IMAGE IS UNSATISFACTORY	<pre> graph TD 1[1] --> Q1{Does image display: Fogging, bright spots, negative image Bright crescent around edge of D4 shadow} Q1 --> 2[2] Q1 --> 3[3] 2[2] --> End1[] 3[3] --> 4[4] 3[3] --> 6[6] 4[4] --> 7[7] 6[6] --> End2[] 7[7] --> End3[] </pre> 1 Does image display: Fogging, bright spots, negative image Bright crescent around edge of D4 shadow 2 Remove excess grid charge TV: ● WLC GRID sw - DISCH 3 Verify ATM pointing Monitor: ● COUNTER 2 sel - FSS UP/DN; ind $\leq \pm 20$ ● COUNTER 3 sel - FSS L/R; ind $\leq \pm 20$ Is ATM pointing $< \pm 20$ arc sec? 4 D4 AUTO CONTROL FAILURE 6 WLC ALIGN IND DISPLAYS ABNORMAL SIGNALS WHEN ALIGN SW IS IN PTG POSITION 7 WLC ALIGN IND DISPLAYS ABNORMAL SIGNALS WHEN ALIGN SW IS IN DISC AUTO OR DISC MAN	(1) Prerequisite conditions: a. WLC ALIGN ind - horizontal $\leq \pm 20$ - vertical $\leq \pm 20$ (ALIGN sw - PTG SCALE sw - X1) ATM-S052-016A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS			
8c S052 ① TV CORONAL IMAGE IS NOT REMOVED AUTOMATICALLY WHEN PRIMARY MODE IS INITIATED	① After first exposure has been completed: <table border="1" style="width: 100%;"> <tr> <td>OPR It off, and FRAMES REMAINING ind decrementing</td><td>OPR It off, and FRAMES REMAINING ind not decrementing</td><td>OPR It on, and FRAMES REMAINING ind decrementing</td></tr> </table> S052 3a 1 ② OPR LT DOES NOT LIGHT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET ② OPR LT CIRCUITRY FAILED ② MIR POS RESET CIRCUITRY OR TV MONITOR MIRROR DRIVE ASSY FAILED ③ WLC: MIR POS sw - CAMERA Did coronal image disappear? NO YES ③ TV MONITOR MIRROR DRIVE ASSEMBLY FAILED ④ MIR POS RESET CIRCUITRY FAILED ③ Discontinue WLC data taking until M₆ mirror can be placed to film camera position ④ Continue WLC operation, but TV monitor mirror (M₆) must be manually commanded to the film camera position before initiating any data-taking mode ⑤ WARNING WLC pointing must be less than ±3 arc min before WLC TV activation	OPR It off, and FRAMES REMAINING ind decrementing	OPR It off, and FRAMES REMAINING ind not decrementing	OPR It on, and FRAMES REMAINING ind decrementing	① Prerequisite conditions: - WLC coronal image is displayed on monitors 1 or 2 - MODE sel - <u>STD</u>, <u>EXTD</u>, <u>STD</u>, <u>CONT</u>, <u>FAST SCAN</u> - START/STOP sw - <u>START</u> - Time duration for first exposure elapsed ② TV monitor mirror (M₆) will not be commanded automatically to the film camera position after completion of the first exposure ③ WLC may be used for real time coronal viewing ④ Mirror may be placed to film camera position from the center work station during EVA. WLC TV will no longer be available ⑤ WLC ALIGN ind: - horizontal ≤ ±300 - vertical ≤ ±300 ALIGN sw - <u>PTG</u> SCALE sw - <u>X1</u>
OPR It off, and FRAMES REMAINING ind decrementing	OPR It off, and FRAMES REMAINING ind not decrementing	OPR It on, and FRAMES REMAINING ind decrementing			

ATM-S052-017A

WHITE LIGHT CORONAGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
1 S054 NO IMAGE ON X-RAY IMAGE MONITOR	<pre> graph TD Start[NO IMAGE ON X-RAY IMAGE MONITOR] --> 1{Are counts present on IMAGE INTENSITY count ind?} 1 -- YES --> 5{X-RAY SPECT (display): • IMAGE THRESHOLD sel - 1 Does image appear on monitor?} 1 -- NO --> 2{2 IMAGE DISSECTOR FAILURE OR ID LOGIC FAILURE} 5 -- YES --> 9{9 FAILURE IN INTENSITY MODULATION CIRCUITRY} 5 -- NO --> 6{6 X-RAY SPECT (Control): • PHOTO MULT TEST sw - CTR TEST and hold Does target appear at center of monitor?} 6 -- YES --> 11{11 FAILURE IN GATING LOGIC} 6 -- NO --> 1{1 FAILURE IN X-RAY IMAGE OR GATING LOGIC} 2 --> 3{3 X-RAY SPECT (Control): • IMAGE DISSECTOR sw - OFF • X-RAY IMAGE sw - OFF} 11 --> 3 3 --> 4{4 Use H-ALPHA TELESCOPE to point to regions of S054 interest} 1 --> 10{10 Leave IMAGE THRESHOLD sel in 1 position} 9 --> 10 10 --> 11 11 --> 3 </pre>	① Intensity count data to telemetry may still be valid. In this case the IMAGE DISSECTOR sw should be left in the ENABLE position

ATM-S054-001A

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
2 S054 NO COUNTS ON PHOTOMULTIPLIER EXPOSURE COUNT IND	<pre> graph TD 1["1 X-RAY SPECT (Control): • PHOTO MULT TEST sw - TEST and hold Are there 400-600 counts on PHOTOMULTIPLIER EXPOSURE COUNT ind?"] 2["2 X-RAY SPECT (Control): • PHOTO MULT TEST sw - CTR TEST and hold Are there 128 counts on the PHOTOMULTIPLIER EXPOSURE COUNT ind?"] 3["3 MASTER FLARE MODE: • TN/LT sw - ENBL X-RAY SPECT (Control): • FLARE THRESHOLD COARSE sel - 0 • FLARE THRESHOLD FINE sel - 128 • PHOTO MULT TEST sw - CTR TEST and hold Are X-RAY/RF it - X-RAY ON, and audible tone-ON?"] 4["4 PHOTOMULTIPLIER SUB-SYSTEM LOGIC FAILURE"] 5["5 X-RAY SPECT (Control): • PHOTO MULT ENABLE sw - OFF"] 6["6 PHOTOMULTIPLIER CRYSTAL FAILURE OR OBSTRUCTION OF PHOTOMULTIPLIER'S FIELD OF VIEW"] 7["7 PHOTOMULTIPLIER TUBE, LOG AMP, OR POWER SUPPLY FAILURE"] 8["8 PHOTOMULTIPLIER EXPOSURE COUNT IND FAILURE"] 1 -- YES --> 6 1 -- NO --> 2 2 -- YES --> 7 2 -- NO --> 3 3 -- YES --> 8 3 -- NO --> 4 4 --> 5 6 --> 5 7 --> 5 8 --> 5 </pre>	① Photomultiplier system is no longer usable, and no corrective action is possible for this failure ② Photomultiplier output to ATM C&D Console not functioning. Check with STDN to determine if valid scientific data is still available via TM ③ Indicator failure does not preclude use of threshold switches for X-RAY FLARE ALARM and FLARE AUTO MODE of camera operation

ATM-S054-002A

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
3 S054 (1) GRATING TB NOT INDICATING PROPERLY	<pre> graph TD 1["(1) X-RAY SPECT (Control): ● GRATING sw - RESET"] 1 -- "tb is OUT" --> 2["(2) GRATING SUBSYSTEM FAILURE. GRATING REPOSITIONED PROPERLY WHEN MOTOR CLUTCH DISENGAGED"] 1 -- "tb is IN" --> 4["(4) GRATING FAILED IN"] 1 -- "tb is white" --> 6["(6) GRATING SUBSYSTEM OR TB FAILURE"] 2 --> 3["(3) Do not attempt to use grating unless advised by STDN"] 4 --> 5["(5) Continue operations. Consult STDN for procedure modifications"] 6 --> 7["(7) Do not take any further photographic data until position of grating has been confirmed"] </pre>	(1) Assumption: Both "IN" and "OUT" positions of GRATING sw have been attempted (2) Allow 10 sec for grating to reposition (3) GRATING tb should be tapped before going to RESET position (4) Further troubleshooting must be coordinated with STDN (5) It cannot be confirmed at this point if grating is in "in-transit" position and blocking photographic field of view

ATM-S054-003A

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
4 S054 ① NO READY LT WHEN READY CONDITIONS MET	<pre> graph TD 1["1 LIGHTING: ● LAMP TEST sel - STATUS READY It - ON?"] -- YES --> 3["3 LIGHTING: ● LAMP TEST sel - OFF X-RAY SPECT (Control): ● PICTURE RATE sel - LOW ● START/STOP sw - START Does operate It illuminate?"] 1 -- NO --> 2["2 STATUS BUS OR LAMP FAILURE"] 2 --> CD["C&D 5 1 LOSS OF VAR ALERT/STATUS LIGHTING ON PNL 130"] 3 -- YES --> 7["7 X-RAY SPECT (Control): ● START/STOP sw - STOP"] 3 -- NO --> 4["4 POSSIBLE LOSS OF READY/OPR CIRCUIT OR LOSS OF DOOR OPEN CONDITION FOR READY/OPR LT"] 4 --> 5["5 X-RAY SPECT (Control): ● START/STOP - STOP"] 5 --> 6["6 With no READY/OPR It the FRAMES REMAINING ind will have to be monitored closely to provide a status of when a mode is in progress or terminated"] 7 --> 8["8 READY CONDITIONS ARE PROPER AND SYSTEM IS OPERATING CORRECTLY. HOWEVER, SIGNAL TO READY LT HAS FAILED"] 8 --> 9["9 Close monitoring of READY conditions will be necessary to ensure good data when operating"] </pre>	① READY conditions: MAIN PWR sw - <u>ON</u> DOOR sw - <u>OPEN</u> PHOTO MULT ENABLE sw - <u>ENABLE</u> OR PHOTO MULT ENABLE sw - <u>OFF</u> MODE sw - <u>MANUAL</u> EXPOSURE RANGE sel - any exposure except AUTO ② Confirm via STDN that READY conditions are met before further data taking on S054 ATM-S054-004A

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
5 S054	1 NO OPR LT WHEN START CMD IS ISSUED 1 Is FRAMES REMAINING ind DECREASING? YES 2 LIGHTING: ● LAMP TEST sel - <u>STATUS</u> Is OPR Lt on? YES 4 FAILURE IN CIRCUITRY DRIVING OPR LT NO 2 3 STATUS BUS OR LAMP FAILURE 5 Continue to operate using FRAMES REMAIN- ING ind instead of OPR Lt NO S054 6a 2 CAMERA DOES NOT RESPOND TO START COMMAND FROM START/STOP SW 1 Assumptions: a. Ready conditions met and READY indication present b. MODE sw - MANUAL 2 If STATUS BUS has failed see C&D 5 1	

ATM-S054-005A

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
6a S054 ① CAMERA DOES NOT RESPOND TO START COMMAND FROM START/STOP SW	② 1 READY It on 2 OPR It on 2 X-RAY SPECT (Control): ● MAIN PWR sw - OFF then ON ● START/STOP sw - STOP ● READY/OPR It - READY on ● PICTURE RATE sel - SINGLE ● EXPOSURE RANGE sel - 1 ● START/STOP - START Does READY/OPR It go to OPR then back to READY in ≈ 2.5 sec? NO 3 PROBABLE FAILURE IN EITHER START LOGIC OR CAMERA. NO FURTHER DETERMINATION POSSIBLE WITHOUT TM DATA YES 3 4 FRAMES REMAINING IND FAILURE 5 5 Use READY/OPR It to determine operating status 4 6 DAS: ● 40015E ● 40162E Is OPR It on and FRAMES REMAINING decreasing? YES 7 X-RAY SPECT (Cont): ● START/STOP sw - STOP Is READY It on? NO 8 FAILURE IN START/STOP SW 9 9 Use DAS for START/STOP functions YES 10 FAILURE IN START POSITION OF SWITCH 11 11 Use DAS for START command. STOP position of sw may still be used NO 12	① ASSUMPTIONS - Ready conditions met and READY It on prior to start - MODE sw - MANUAL ② Indication is no FRAMES REMAINING ind response ③ Periodic frames update may be obtained from STDN ④ If possible, actions should be coordinated with STDN to verify instrument response ⑤ Octal command to stop camera sequence (40015) and octal command to start camera sequence (40162)

ATM-S054-006A

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
6a S054 (Cont)	<pre> graph TD 6[6] --> 12[12] 12 --> D1{Is FRAMES REMAINING ind DECREASING?} D1 -- YES --> 13[13] D1 -- NO --> 15[15] 13 --> 14[14] 15 --> 16[16] 16 --> 17[17] </pre> Step 12: MASTER FLARE MODE: ● TN/LT sw - <u>OFF</u> X-RAY SPECT (Control): ● PHOTO MULT sw - <u>ENABLE</u> ● PICTURE RATE sel - <u>SINGLE</u> ● EXPOSURE RANGE sel - <u>4</u> ● FLARE THRESHOLD FINE sel - <u>0</u> ● COARSE sel - <u>0</u> ● MODE sw - <u>FLARE AUTO</u> Is FRAMES REMAINING ind DECREASING? Step 13: FAILURE OF MANUAL START LOGIC. FLARE AUTO MODE MUST BE USED FOR REMAINDER OF MISSION TO OPERATE CAMERA Step 14: Backup operation in FLARE AUTO MODE X-RAY SPECT (Control): ● SET PICTURE RATE sel, EXPOSURE RANGE sel, GRATING sw, and FILTER sel per BUILDING BLOCK MASTER FLARE MODE: ● TN/LT sw - <u>OFF</u> X-RAY SPECT (Control): ● FLARE THRESHOLD COARSE sel - <u>0</u> ● FINE sel - <u>0</u> ● MODE sw - <u>FLARE AUTO</u> After sequence complete: ● MODE sw - <u>MANUAL</u> Step 15: FAILURE OF ALL START LOGIC Step 16: X-RAY SPECT (Control): ● MODE sw - <u>MANUAL</u> ● FLARE THRESHOLD COARSE sel - <u>As req'd</u> ● FINE sel - <u>As req'd</u> MASTER FLARE MODE: ● TN/LT sw - <u>ENABLE</u> Step 17: PHOTO MULT, IMAGE DISSECTOR & X-RAY IMAGE should remain on to provide photo electric data to TM and pointing & flare alarm to crew	3 Periodic frames update may be obtained from STDN 6 Before further checking of Start Logic, consult with STDN 7 Check with STDN to determine if procedure modifications are required ATM-S054-007A

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
6b S054 1 STOP COMMAND DOES NOT EXTINGUISH OPR LT	2 1 Is FRAMES REMAINING ind decreasing? NO 6 FAILURE IN OPERATE LT CIRCUIT 7 With no READY/OPR It, the FRAMES REMAINING ind will have to be monitored closely to provide a status of when a mode is in progress or terminated 2 3 4 GROUND/DAS: ● EXP/TV sw - <u>ENABLE</u> DAS: ● Key - 40015E Is OPR It off and READY It on? NO 3 X-RAY SPECT (Control): ● START/STOP sw - <u>START</u> Is OPR It on? YES 4 FAILURE IN START/STOP SW 5 5 Use DAS for START/STOP commands NO 8 FAILURE IN STOP POSITION OF START/STOP SW 5 9 Use DAS for STOP command YES 10 X-RAY SPECT (Control): ● MAIN PWR sw - <u>OFF</u> then <u>ON</u> Is OPR It off and READY It on? YES 11 FAILURE OF STOP COMMAND LOGIC 12 Camera may be stopped by momentarily re-cycling MAIN PWR sw NO 13 START/STOP LOGIC FAILURE 6 14 X-RAY SPECT: ● MAIN PWR sw - <u>OFF</u>	1 Assumption: MODE sw - <u>MANUAL</u> 2 Wait as many secs as the exposure range selector position for counter to decrement. If time does not permit, proceed to block 2 3 If possible, actions should be coordinated with STDN to verify instrument response 4 Octal command to stop camera sequence (40015E) 5 Check with STDN to determine if procedure modifications are required 6 Check with STDN for further malfunction determination

ATM-S054-010

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
6c S054 ① OPR LT ON AFTER SINGLE SEQUENCE SHOULD HAVE TERMINATED	① 1 X-RAY SPECT (Control): ● START/STOP sw - <u>STOP</u> Is OPR It off and READY It on? NO S054 6b 2 STOP COMMAND DOES NOT EXTINGUISH OPR LT YES 5 FAILURE OF SINGLE SEQUENCE STOP LOGIC 2 X-RAY SPECT (Control): ● EXPOSURE RANGE sel - 1 ● PICTURE RATE sel - <u>SINGLE</u> ● START/STOP sw - <u>START</u> Does camera take sequence of four exposures and then stop? NO 3 EXPERIMENT ANOMALY THAT MAY OCCUR OCCASIONALLY YES 4 Use START/STOP sw to terminate next sequence NO 6 Stop single sequence with START/STOP sw	① Assumption: FRAMES REMAINING ind is decrementing
6d S054 ① OPR LT ON AFTER 13 MIN IN LOW, HIGH OR PROGRAM PICTURE RATE	① 1 X-RAY SPECT (Control): ● START/STOP sw - <u>STOP</u> Is OPR It off and READY It on? NO S054 6b 2 STOP COMMAND DOES NOT EXTINGUISH OPR LT YES 2 FAILURE OF 13 MIN TIMING LOGIC 3 Stop camera with START/STOP sw after approximately 13 min	① Assumption: FRAMES REMAINING ind is decrementing ATM-S054-011

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
7 S054	FILTER CONFIRM TB INDICATES ABNORMAL 1 tb indicates gray while filter in transit tb indicates bp after selected filter should have been reached 2 STICKY TALKBACK OR LINE DRIVER FAILURE 3 Continue operation and allow ≈20 sec after selecting filter before issuing START com- mand 4 X-RAY SPECT (Control): ● FILTER sel - previous filter tb - gray immediately tb - gray ≈ 5-12 sec tb - bp 5 FILTER FAILED TO MOVE FROM PREVIOUS POSITION 6 POSSIBLE FILTER WHEEL FAILURE BETWEEN POSITIONS 7 FAILURE IN EITHER TB CIRCUITRY OR FILTER WHEEL MECHANISM 8 If filter malfunction is confirmed to be filter wheel between positions: X-RAY SPECT (Control): ● FILTER sel - <u>RESET/1</u> 1 Failure in a filter position other than 1 requires coordination with STDN to determine future observing program modifications 2 Filter wheel position may be confirmed via STDN The RESET/1 position must NOT be used until S054 data collection in the failed filter position has been satisfied	

ATM-S054-008A

ATM-S054-008A

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
8 S054 NO COUNTS ON IMAGE INTENSITY COUNT IND	<pre> graph TD Start[NO COUNTS ON IMAGE INTENSITY COUNT IND] --> Step1 subgraph Step1 [1] S1[X-RAY SPECT (Control) • IMAGE THRESHOLD sel - 1] Q1{Is test source visible at top of X-RAY IMAGE mon?} end Q1 -- YES --> Step2 Q1 -- NO --> S054[NO IMAGE ON X-RAY IMAGE MONITOR] subgraph Step2 [2] S2[X-RAY SPECT (Control) • PHOTO MULT TEST sw - CTR TEST and hold] Q2{Are there 128 counts on the IMAGE INTENSITY COUNT ind?} end Q2 -- YES --> Step3 Q2 -- NO --> Step4 subgraph Step3 [3] S3[FAILURE IN GATING LOGIC] end subgraph Step4 [4] S4[IMAGE INTENSITY COUNT IND FAILURE] end S054 --> S054Box[S054 1 2] </pre>	① Intensity count data to telemetry may still be valid. Check with STDN for confirmation ② Indicator inoperative does not preclude use of X-RAY IMAGE monitor ATM-S054-009A

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
9a S054 (1) X-RAY LT AND AUDIBLE TONE ARE INOPERATIVE	1 X-RAY SPECT (Control): ● MODE sw - <u>MANUAL</u> ● FLARE THRESHOLD CLOARSE sel - <u>0</u> FINE sel - <u>0</u> X-RAY It off Audible tone off X-RAY It on Audible tone on 3 PROBABLE FAILURE IN EITHER FLARE DISCRIMINATOR BINARY OR FLARE THRESHOLD LOGIC 4 X-RAY SPECT (Control): ● FLARE THRESHOLD COARSE sel - <u>0</u> FINE sel - <u>32</u> Is X-RAY It on, and is Audible Tone on? 2 POSSIBLE FAILURE IN FLARE DISCRIMINATOR 5 BINARY FAILURE. NO X-RAY ALERT IS AVAILABLE 6 X-RAY SPECT (Control): ● PHOTO MULT TEST sw - <u>TEST</u> and hold ● Note PHOTOMULTIPLIER EXPOSURE ● COUNT ind is 224 or greater ● FLARE THRESHOLD COARSE sel - <u>0</u> FINE sel - start at 0 and step through each position Is X-RAY It on for each position? 8 7 FAILURE IN ONE FLARE THRESHOLD FINE SEL POSITION OR ASSOCIATED LOGIC. DO NOT USE THAT POSITION. ALL OTHER FINE AND COARSE SEL POSITIONS ARE USEABLE	(1) Assumptions: Photomultiplier exposure count exceeds FLARE THRESHOLD (2) Use SRNBM for FLARE ALERT (3) Backup operation of camera in FLARE AUTO mode is still available (4) Check with STDN for further malfunction determination ATM-S054-012

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
9a S054 (Cont)	<pre> graph TD 6[6] --> 8 8["8 X-RAY SPECT (Control): ● PHOTO MULT TEST sw - TEST and hold ● NOTE if PHOTOMULTIPLIER EXPOSURE COUNT ind is 256 or greater ● FLARE THRESHOLD FINE sel - 0 ● COARSE sel - 256 Is X-RAY It on?"] 8 -- YES --> 10 8 -- NO --> 9 10["10 X-RAY SPECT (Control): ● PHOTO MULT TEST sw - TEST AND hold Does PHOTOMULTIPLIER EXPOSURE COUNT ind equal or exceed 512?"] 10 -- YES --> 12 10 -- NO --> 11 12["12 X-RAY SPECT (Control): ● FLARE THRESHOLD FINE sel - 0 COARSE sel - 512 Is X-RAY It on?"] 12 -- YES --> 14 12 -- NO --> 13 9["9 FAILURE IN FLARE THRESHOLD COARSE SEL 256 POSITION OR ASSOCIATED LOGIC. DO NOT USE THIS POSITION. ALL OTHER COARSE SEL POSITIONS ARE USEABLE"] 11["11 No further fault isolation possible. Maximum reliable FLARE THRESHOLD: COARSE sel - 256 FINE sel - 224"] 13["13 FAILURE IN FLARE THRESHOLD COARSE SEL 512 POSITION OR ASSOCIATED LOGIC. DO NOT USE THIS POSITION. ALL OTHER COARSE SEL POSITIONS ARE USEABLE"] 14["14 No further fault isolation possible: Maximum reliable FLARE THRESHOLD: COARSE sel - 512 FINE sel - 224"] 9 -- 5 --> 11 11 -- 5 --> 13 13 -- 5 --> 14 14 -- 5 --> 11 </pre>	5 Check with STDN for FLARE THRESHOLD settings

ATM-S054-013

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
9b S054 1 X-RAY LT AND AUDIBLE TONE ARE ON WITH-OUT FLARE CONDITIONS SATISFIED	<pre> graph TD S1["1 X-RAY LT AND AUDIBLE TONE ARE ON WITH-OUT FLARE CONDITIONS SATISFIED"] --> D1["1 X-RAY SPECT (Control): ● PHOTO MULT TEST sw - CTR TEST and hold Does PHOTOMULTIPLIER EXPOSURE COUNT ind read exactly 128?"] D1 -- YES --> F4["4 FAILURE IN FLARE ALARM SYSTEM OR FLARE DISCRIMINATOR"] D1 -- NO --> B2["2 PHOTOMULTIPLIER EXPOSURE COUNT IND FAILURE"] B2 --> B3["3 Initiate flare program"] B3 --> D5["5 Before initiating flare program, check IMAGE INTENSITY COUNT ind, X-RAY/RF ACTIVITY HISTORY PLOT, X-RAY IMAGE, XUV MON, Hα 1 and 2 displays, and AL and BE COUNT for positive flare indications Are there positive flare indications?"] D5 -- YES --> B3 D5 -- NO --> B6["6 X-RAY SPECT (Control): ● FLARE THRESHOLD COARSE sel and FINE sel - unmarked positions Are X-RAY Lt and audible tone off?"] B6 -- YES --> F7["7 FAILURE IN FLARE DISCRIMINATOR"] F7 --> B10["10"] B6 -- NO --> F8["8 FAILURE IN FLARE ALARM SYSTEM"] F8 --> B9["9 MASTER FLARE MODE: ● TN/LT sw - OFF"] </pre>	1 Assumptions: a. TN/LT sw - ENBL b. PHOTOMULTIPLIER EXPOSURE COUNT below selected FLARE THRESHOLD 2 As time permits 3 Coordinate further mal-function procedure with STDN. If not possible, proceed as indicated 4 Check with STDN for possible procedure changes and more detailed mal-function determination

ATM-S054-014

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
9b S054 (Cont)	7 10 X-RAY SPECT (Control): ● DOOR sw - CLOSE; tb - bp ● PHOTO MULT TEST sw - CTR TEST and hold ● FLARE THRESHOLD COARSE sel - 256 FINE sel - 0 Is X-RAY It on? NO YES → 11 FLARE THRESHOLDS 768 AND 256 UNUSEABLE 2 12 X-RAY SPECT (Control): ● PHOTO MULT TEST sw - CTR TEST and hold ● FLARE THRESHOLD COARSE sel - 512 FINE sel - 0 Is X-RAY It on? NO YES → 13 FLARE THRESHOLDS 768 AND 512 UNUSEABLE 2 14 X-RAY SPECT (Control): ● PHOTO MULT TEST sw - CTR TEST and hold ● FLARE THRESHOLD COARSE sel - 0 FINE sel - 128 Is X-RAY It on? NO YES → 15 FLARE THRESHOLDS 224, 192, 160, AND 128 UNUSEABLE 2 16 Is PHOTOMULTIPLIER EXPOSURE COUNT ind below 064? NO YES → 17 X-RAY SPECT (Control): ● FLARE THRESHOLD COARSE sel - 0 FINE sel - 64 Is X-RAY It on? NO YES → 18 FLARE THRESHOLDS 32, 96, 160 AND 224 UNUSEABLE 2 19 FLARE THRESHOLDS 64, 96, 192 AND 224 UNUSEABLE 2 20 FLARE THRESHOLDS 32, 64, 96, 160, 192, AND 224 UNRELIABLE 2 21 No further fault isolation possible	2 Check with STDN for FLARE THRESHOLD settings

ATM-S054-015

X-RAY SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
2 S055 ① ABNORMALLY LOW SCAN SPECT PRESS READING ON COUNTER 1	<pre> graph TD Start([1]) --> Q1{Is PRESS reading > 0?} Q1 -- YES --> S2[2 SCAN SPECT: • MAIN PWR sw - OFF for 2 sec min • MAIN PWR sw - SEC] S2 --> Q2{Is PRESS reading > 0?} Q2 -- YES --> F4[4 FAILURE IN PRIM MAIN PWR SYSTEM] Q2 -- NO --> F3[3 FAILURE OF PRESS GAGE OR COUNTER CIRCUITRY] F3 --> S5[5 SCAN SPECT: • MAIN PWR sw - PRIM DAS: • Key - 40072E] S5 --> E10[10 Continue with activation and checkout] F4 --> Q6[6 SCAN SPECT: • DOOR sw - CLOSE Is PRESS reading > 0200 after 10 min?] Q6 -- YES --> S7[7 SCAN SPECT: • DOOR sw - OPEN] S7 --> E9[9 Continue with activation and pressure profile] Q6 -- NO --> F7[7 FAILURE OF PRESS GAGE] F7 --> E10 </pre>	① May take several minutes after DAS: Key - 40007E SCAN SPECT PRESS gage on before pressure gage powered up and reading pressure ② Pressure will build up rapidly for 10 min and then level off. The gage fires more readily at higher pressure ③ Octal command to turn SCAN SPECT PRESS gage off (40072E) ④ Pressure data to telemetry may be valid. If so, leave SCAN SPECT PRESS gage on during pressure profile or until DETECTOR HV turn-on ⑤ Acceptability of pressure for operation will be determined on the ground prior to DETECTOR HV turn-on

ATM-S055-003A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3 S055 ① READY LT DOES NOT LT WHEN ALL PREREQUISITE CONDITIONS HAVE BEEN MET	<pre> graph TD 1[1 LIGHTING: ● LAMP TEST sel - STATUS] --> 15[15 FAILURE OF BUS V381D OR STATUS LT CIRCUITRY] 1 --> 8[8 FAILURE OF READY LT] 1 --> 2[2 LIGHTING: ● LAMP TEST sel - OFF SCAN SPECT: ● MODE sel - MIRROR LINE SCAN UP/DN ● START/STOP sw - START] 15 --> CD[C&D 5 1] CD --> LOSS[LOSS OF VAR ALERT/ STATUS LIGHTING ON PNL 130] 8 --> 9[9 LIGHTING: ● LAMP TEST sel - OFF Operate without READY lt] 2 --> Q2{Does OPR lt come on?} Q2 -- YES --> 10[10 FAILURE IN READY LT CIRCUITRY] Q2 -- NO --> 3[3 MONITOR: ● COUNTER 2 sel - SCAN SPECT MIR POS DN/R] 10 --> 11[11 Operate without READY lt] 3 --> Q3{Is COUNTER 2 incrementing and decrementing alternately?} Q3 -- YES --> 4[4 SCAN SPECT: ● START/STOP sw - STOP ● HV ENABLE/RESET sw - ENABLE/RESET ● DET SEL sw - 1] Q3 -- NO --> 12[12 SCAN SPECT: ● EXP NIGHT INTLK sw - OVERRIDE] 4 --> Q4{Is there an INTENSITY DATA count?} Q4 -- YES --> 18[18 FAILURE IN READY/ OPERATE LOGIC CIRCUITRY] Q4 -- NO --> 5[5 Is SCAN SPECT ALERT lt on?] 18 --> 19[19 Operate without READY/OPR lt] 5 -- YES --> 6[6 FAILURE IN POWER LATCH] 5 -- NO --> 12 6 --> 7[7 SCAN SPECT: ● MAIN HV sw - OVERRIDE] 12 --> 16[16 FAILURE OF DOOR OPEN SIGNAL TO INSTRUMENT] 16 --> 17[17 Operate the instrument with EXP NIGHT INTLK and HV/DOOR INTLK in OVERRIDE] 12 --> 13[13 FAILURE OF PRIMARY POWER SUPPLY] 13 --> 14[14 SCAN SPECT: ● MAIN PWR sw - OFF for minimum of 2 sec ● MAIN PWR sw - SEC] </pre>	① Prerequisite conditions - MAIN PWR sw - PRIM - DOOR tb - gray - MAIN HV sw - ENABLE - At least one - HV ENABLE/RESET sw - ENABLE/RESET - MODE sel - MIRROR AUTO RASTER - or MIRROR 3 RASTER L/R - or MIRROR LINE SCAN UP/DN - or GRATING AUTO SCAN - or GRATING 3 SCAN - or GRATING REF - or GRATING AUTO SCAN NO INTLK

ATM-S055-013A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
4 S055 OPR LT DOES NOT COME ON WHEN A MODE IS INITIATED	<pre> graph TD Start[OPR LT DOES NOT COME ON WHEN A MODE IS INITIATED] --> 1{1 Did READY It go off?} 1 -- YES --> 2[2 FAILURE OF OPR LT OR OPR LT CIRCUITRY] 2 --> 3[3 Operate without OPR It] 1 -- NO --> 4{4 Was initiated mode a GRATING MODE or a MIRROR MODE?} 4 -- GRATING --> 5{5 Is GRATING POSITION ind - incrementing?} 5 -- YES --> 6[6 FAILURE OF THE MODE LOGIC] 5 -- NO --> 5a[SCAN SPECT 6a 1] 5a --> 5a_text[GRATING POSITION IND DOES NOT INCREMENT WHEN PREREQUISITES ARE MET] 4 -- MIRROR --> 8{8 MONITOR: COUNTER 2 sel - SCAN SPECT MIR POS DN/R Does COUNTER 2 indicate the mirror is moving?} 8 -- YES --> 6 8 -- NO --> 8a[SCAN SPECT 7a 1] 8a --> 8a_text[RASTER SCAN COUNTER IND DOES NOT INCREMENT 5.5 MIN AFTER INITIATION OF A MIRROR RASTER MODE] 6 --> 7[7 Operate without OPR It] </pre>	ATM-S055-014A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
5a S055 DOOR TB DOES NOT INDICATE GRAY AT EFFECTIVE SUNRISE (ESR) DOOR TB DOES NOT INDICATE GRAY WHEN DOOR IS COMMANDED OPEN FROM PNL 130	<pre> graph TD 1[1 Is DOOR tb bp or white?] -- white --> 2[2 SCAN SPECT: MODE sel - GRATING AUTO SCAN START/STOP sw - START Does GRATING POSITION ind increment?] 1 -- bp --> 3[3 SCAN SPECT: DOOR sw - OPEN Does DOOR tb indicate gray?] 2 -- NO --> 4[4 FAILURE OF ATMDc DOOR OPEN COMMAND SIGNAL] 2 -- YES --> 6[6 DOOR TB FAILED BUT DOOR IS OPEN] 3 -- YES --> 4 3 -- NO --> 8[8 Is DOOR tb bp or white?] 4 --> 5[5 Continue to operate using DOOR sw to open the door] 6 --> 7[7 Continue to operate without DOOR tb] 8 -- White --> 2 8 -- bp --> 9[9 Does DOOR tb indicate gray at ESR?] 9 -- YES --> 10[10 FAILURE OF DOOR SW] 9 -- NO --> 12[12 DAS: Key - 40164 E Does DOOR tb indicate gray?] 10 --> 11[11 Continue to operate without DOOR sw] 12 -- YES --> 20[20 FAILURE OF DOOR OPEN CIRCUITRY] 12 -- NO --> 13[13 SCAN SPECT DOOR FAILED CLOSED] 20 --> 21[21 Continue to operate using DAS command to open the door] 13 --> 14[14 Open door manually during next EVA] 15[15 SCAN SPECT: DOOR sw - CLOSE Does DOOR tb change from white to bp in approx 10 sec?] 4 --> 15 15 -- NO --> 16[16 DOOR FAILURE] 15 -- YES --> 18[18 FAILURE OF DOOR OPEN INDICATION SIGNAL] 16 --> 17[17 Open door manually during next EVA] 18 --> 19[19 Continue to operate without DOOR tb] </pre>	① Door status indications can be confirmed by STDN via TM ② Octal command to open SCAN SPECT aperture door ATM-S055-015A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
5b S055 DOOR TB DOES NOT INDICATE BP AT EFFECTIVE SUNSET (ESS) DOOR TB DOES NOT INDICATE BP WHEN DOOR IS COMMANDED CLOSED FROM PNL 130	<pre> graph TD 1[1 Is DOOR tb gray or white?] -- white --> 14[14 Is DOOR OPEN ALERT It on?] 1 -- gray --> 2[2 SCAN SPECT: DOOR sw - CLOSE] 2 -- YES --> 3[3 FAILURE OF ATMD C DOOR CLOSE COMMAND SIGNAL] 2 -- NO --> 6[6 Does DOOR tb indicate bp at ESS?] 6 -- YES --> 7[7 FAILURE OF DOOR SW] 6 -- NO --> 9[9 DAS: Key - 40144E] 9 -- YES --> 12[12 FAILURE OF DOOR CLOSE CIRCUITRY] 9 -- NO --> 10[10 SCAN SPECT DOOR FAILED OPEN] 10 --> 11[11 Consult STDN] 12 --> 13[13 Continue to operate using DAS command to close the door] 14 -- YES --> 15[15 SCAN SPECT: DOOR sw - OPEN] 14 -- NO --> 18[18 DOOR TB FAILED BUT DOOR IS CLOSED] 15 -- YES --> 20[20 FAILURE OF DOOR CLOSED INDICATION SIGNAL] 15 -- NO --> 16[16 DOOR FAILURE] 16 --> 17[17 Open door manually during next EVA] 17 --> 18 18 --> 19[19 Continue to operate without DOOR tb] 20 --> 21[21 Continue to operate without DOOR tb] 21 --> 22[22 Continue to operate without DOOR tb] </pre>	① Door status indications can be confirmed by STDN via TM ② Octal command to close SCAN SPECT aperture door ATM-S055-016A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
6a S055 (1) GRATING POSITION IND DOES NOT INCREMENT WHEN PREREQUISITES ARE MET	<pre> graph TD 1[1] --> 1a[1] 1a --> D1{Does RASTER/SCAN COUNTER ind increment one count within 4 min from START?} D1 -- YES --> 3[3] D1 -- NO --> 2[2] 2 --> D2{GRATING POSITION ind does not increment in any of these MODES} 2 --> D3{GRATING POSITION ind increments in all 3 MODES} 2 --> D4{GRATING POSITION ind does not increment in 1 of these MODES} D2 --> 9[9] D3 --> 7[7] D4 --> 5[5] 9 --> D5{Does GRATING POSITION ind increment by one count?} D5 -- YES --> 12[12] D5 -- NO --> 11[11] 7 --> 8[8] 5 --> 6[6] 3 --> 4[4] 4 --> 10[10] 10 --> 5a[5] 12 --> 5a </pre>	(1) Prerequisite conditions: ATM pointed at sun if in OPT REF MAIN PWR sw - PRIM or SEC DOOR tb - gray MODE sel - GRATING REF or - GRATING 3 SCAN or - GRATING AUTO SCAN or - GRATING AUTO SCAN NO INTLK or - GRATING SINGLE STEP START/STOP sw - START (2) GRATING POSITION can be determined by STDN via TM (3) Grating advances 24 steps per sec (4) The grating and mirror will no longer automatically stop operating when door closes (5) Desirable grating position for continued operation will be determined by P1 from STDN data

ATM-S055-004A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
6a S055 (Cont)	<pre> graph TD 9[9] --> 11[11] 11 --> Q1{Does GRATING POSITION ind increment by one count?} Q1 -- YES --> 14[14] Q1 -- NO --> 13[13] 14 --> 15[15] 15 --> 16[16] 16 --> 19[19] 13 --> Q2{Does GRATING POSITION ind increment by one count?} Q2 -- YES --> 16 Q2 -- NO --> 17[17] 17 --> 18[18] 18 --> 8[8] </pre>	6 Octal command to start MIRROR/GRATING (40051E) 7 Octal command to select GRATING SINGLE STEP MODE (40067E) 8 Continued operation of the instrument will depend on the acceptability of the data with the grating in failed position and will be determined by the PI from STDN data

ATM-S055-017A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
6b S055 ① GRATING POSITION IND COUNTS BUT DOES NOT RESET IN GAS, G 3 S, OR GAS NO INTLK	1 Is the grating moving as indicated by large fluctuations in the intensity of Det 1? YES 3 SCAN SPECT: ● START/STOP sw - STOP ● MODE sel - GRATING REF ● GRATING REF sw - OPT ● START/STOP sw - START Does RASTER/SCAN COUNTER ind increment one count within 4 min from START? YES 4 FAILURE OF GRATING POSITION INDICATOR 5 Operate the grating using the advance of the RASTER/SCAN COUNTER ind to indicate when grating is at REF 3 Grating advances 24 steps per second NO 6 Did GRATING POSITION ind stop incrementing? YES 7 FAILURE OF COUNTER RESET CIRCUITRY 8 Operate the grating using the O-ORDER tb to indicate grating at REF 4 O-ORDER tb changes from bp to gray at approximately the same time the grating attains MECH REF position. Grating will automatically stop at REF position NO 9 SCAN SPECT: ● GRATING REF sw - MECH Does GRATING POSITION ind reset within 4 min from switching to MECH REF? YES 10 FAILURE OF OPTICAL REFERENCE 11 Operate with GRATING REF sw - MECH NO 12 FAILURE IN REFERENCE ELECTRONICS 13 For grating scan operate grating using START/STOP sw to STOP grating at REF position when O-ORDER tb changes from bp to gray 5 Grating position can be determined by STDN via TM for positioning grating to operate in the mirror modes 2 FAILURE OF GRATING DRIVE PRIMARY SEQUENCE	① COUNTER should reset after approximately 5500 steps ② Notify ground for verification of malfunction before attempting to operate in SEC GRATING MOTOR DRIVE ③ Grating advances 24 steps per second ④ O-ORDER tb changes from bp to gray at approximately the same time the grating attains MECH REF position. Grating will automatically stop at REF position ⑤ Grating position can be determined by STDN via TM for positioning grating to operate in the mirror modes

ATM-S055-005A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
6c S055 GRATING POSITION IND COUNTS AND RESETS BUT DOES NOT STOP IN REF MODE	<pre> graph TD 1[1 SCAN SPECT: ● START/STOP sw - STOP Does GRATING POSITION ind stop incrementing?] -- YES --> 2[2 FAILURE OF RESET LOGIC CIRCUITRY] 2 --> 3[3 SCAN SPECT: ● START/STOP sw - START ● GRATING POSITION ind - continue to count and at 5450; ● START/STOP sw - STOP ● MODE sel - GRATING SINGLE STEP ● START/STOP sw - pulse until GRATING POSITION ind resets. GRATING is now at REF position. Repeat the procedure to return to REF position after operating in AUTO SCAN] 1 -- NO --> 4[4 SCAN SPECT: ● MAIN PWR sw - OFF ● MAIN PWR sw - PRIM Does GRATING POSITION ind resume incrementing after power is reapplied?] 4 -- YES --> 5[5 GRATING FAILED IN A CONSTANT AUTO SCAN MODE] 5 --> 6[6 Data taking will be limited to SPECTRAL SCANS] 4 -- NO --> 7[7 FAILURE OF RESET LOGIC GATE] 7 --> 8[8 Operate GRATING in 3 SCAN MODE. GRATING will stop in the REF position at the completion of the third scan] </pre>	ATM-S055-006A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
7a S055 ① RASTER/SCAN COUNTER IND DOES NOT INCREMENT 5.5 MIN AFTER INITIATION OF A MIRROR RASTER MODE	② 1 Determine if MIRROR is driving MONITOR ● COUNTER 2 sel - SCAN SPECT MIR POS DN/R Are the two most significant digits incrementing approximately once every 5 sec? YES → 2 FAILURE OF RASTER/SCAN COUNTER IND OR LOSS OF RASTER COMPLETE SIGNAL 3 MIRROR is driving. Continue to operate without RASTER/SCAN COUNTER ind NO → 4 Determine if MIRROR is driving (azimuth) Are the two least significant digits changing? YES → 6 FAILURE IN THE AUTOMATIC ELEVATION MIRROR DRIVE ELECTRONICS 4 7 MIRROR is driving in azimuth only. Continue to operate the MIRROR in LINE SCAN only. Use MIR POS sw to position MIRROR in elevation NO → 5 SCAN SPECT: ● MODE sel - alternate MIRROR RASTER mode ● START/STOP sw - START Are the two least significant digits changing? YES → 8 FAILURE IN AUTO OR 3 RASTER ELECTRONICS 9 Operate MIRROR in alternate RASTER and LINE SCAN modes NO → 10	① Prerequisite conditions: - SCAN SPECT MIRROR unlocked - MAIN PWR sw - PRIM or SEC - DOOR tb - gray ② Movement of MIRROR can be verified by STDN via TM ③ Number of rasters completed can be determined by manually timing mirror operation. Each raster takes 5.55 min ④ Desirable Y-axis position for future observing and required number of steps to move the MIRROR will be determined by P. I. and STDN

ATM-S055-007A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
7a S055 (Cont)	<pre> graph TD 5[5] --> 10[10] 10 -- YES --> 11[11] 10 -- NO --> 13[13] 11 --> 12[12] 13 -- YES --> 14[14] 13 -- NO --> 16[16] 14 --> 15[15] 16 -- YES --> 17[17] 16 -- NO --> 19[19] 17 --> 18[18] 19 -- YES --> 20[20] 19 -- NO --> 22[22] 20 --> 21[21] 22 --> 23[23] </pre>	(4) Desirable Y-axis position for further observing and acquired number of steps to move the mirror will be determined by P. I. and STDN (5) The grating and mirror will no longer automatically stop operating when door closes (6) Octal command to start Mirror/Grating (40051E) (7) Octal command to select MIRROR AUTO RASTER MODE (40052E) (8) STDN will verify the Mirror is in stow position or a position that will allow taking data ATM-S055-008A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
7b S055 RASTER/SCAN COUNTER IND DOES NOT INCREMENT WHEN GRATING POSITION IND RESETS TO ZERO	1 SCAN SPECT: ● MODE sel - MIRROR AUTO RASTER ● START/STOP sw - <u>START</u> Does RASTER/SCAN COUNTER ind increment at the completion of one raster (5.55 min)? 2 FAILURE OF END OF SCAN SIGNAL TO COUNTER 3 Operate the grating without the RASTER/SCAN COUNTER ind 4 FAILURE OF RASTER/SCAN COUNTER IND 5 Operate instrument without RASTER/SCAN COUNTER ind	① Number of grating scans completed can be determined by manually timing grating operation. Each scan takes 3 min and 48 sec ② Number of mirror rasters completed can be determined by manually timing the mirror operation. Each raster takes 5.55 min

ATM-S055-009A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
8 S055 (1) O-ORDER TB DOES NOT CHANGE STATE DURING ONE FULL GRATING SCAN	(2) 1 SCAN SPECT: • MODE sel - <u>GRATING REF</u> • GRATING REF sw - <u>OPT</u> • START/STOP sw - <u>START</u> 2 Does the GRATING POSITION ind reset and stop incrementing within 4 min from START? 2 FAILURE OF O-ORDER DETECTOR 3 • Operate with GRATING REF sw - <u>MECH</u> 4 FAILURE OF O-ORDER IND OR CIRCUITRY 5 • Operate without O-ORDER ind	(1) Prerequisites: DOOR tb - gray Pointed at sun Mirror unlocked (2) Grating will not start in REF MODE when already at REF position

ATM-S055-010A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
9a S055 ① MIR LIMIT TB INDICATES BP PRIOR TO PULSING THE MIR POS SW UP/R OR DN/L FROM INITIAL POSITION	1 ATTITUDE CONTROL: ● FSS tb - <u>SUN</u> (verify) SCAN SPECT: ● DOOR tb - <u>gray</u> (verify) ● MODE sel - <u>STOP</u> TV: ● MON 1 sel - <u>H α 1</u> ● H α 1 ZOOM sw - <u>OUT full</u> MANUAL POINTING CONTROL: ● MAN PTG ENABLE sw - <u>ENABLE</u> ● MAN PTG tb - <u>EXP</u> ● MPC - manipulate as required so that the vertical cross hair bisects the solar image and the horizontal cross hair is above the upper limb, i. e. O-ORDER tb is bp. Slowly move horizontal cross hair toward the limb until O-ORDER tb changes to gray ● MAN PTG ENABLE sw - <u>INHIBIT</u> SCAN SPECT: ● MIR POS sw - pulse <u>UP/R</u> 10 steps O-ORDER tb - gray MIRROR LIMIT tb - bp O-ORDER tb - bp MIRROR LIMIT tb - gray O-ORDER tb - bp MIRROR LIMIT tb - bp 2 MANUAL POINTING CONTROL: ● MAN PTG ENABLE sw - <u>ENABLE</u> ● MAN PTG tb - <u>EXP</u> ● MPC - slowly move horizontal cross hair off the disc until O-ORDER tb changes to bp ● MAN PTG ENABLE sw - <u>INHIBIT</u> SCAN SPECT: ● MIR POS sw - pulse <u>DN/L</u> 10 steps Do the O-ORDER and MIRROR LIMIT tbs change to gray? NO 3 FAILURE OF THE UP/DOWN COUNTER OR SWITCH 4 Continue to operate MIRROR in RASTER MODES. It can be operated in LINE SCAN MODE but line cannot be selected 5 FAILURE OF UP/DOWN COUNTER INITIAL SET 6 Continue to operate, pulsing the MIR POS sw - UP/R, until the desired line is reached counting backward from 60 when the MIRROR LIMIT tb changed from bp to gray 7 FAILURE OF UP/DOWN COUNTER INITIAL SET 8 Continue to operate, pulsing the MIR POS sw - DN/L, until the desired line is reached counting from 1 when the MIRROR LIMIT tb changed from bp to gray 9 FAILURE OF THE MIRROR LIMIT TB 10 Operate without the MIRROR LIMIT tb	① The up/down counter is set initially at line 30 when power is applied to the instrument ② Actual mirror position will be monitored by STDN via TM ATM-S055-011A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
9b S055		
1 MIRROR LIMIT TB DOES NOT INDICATE BP WHEN MIR POS SW IS PULSED UP/R OR DN/L 30 STEPS FROM INITIAL POSITION	1 ATTITUDE CONTROL : ● FSS tb - <u>SUN</u> (verify) SCAN SPECT: ● DOOR tb - <u>gray</u> (verify) ● MODE sel - <u>STOP</u> TV : ● MON 1 sel - <u>H α 1</u> ● H α 1 ZOOM sw - <u>OUT</u> full MANUAL POINTING CONTROL : ● MAN PTG ENABLE sw - <u>ENABLE</u> ● MAN PTG tb - <u>EXP</u> ● MPC - manipulate as required so that the vertical cross hair bisects the solar image and the horizontal cross hair is above the upper limb, i.e., O-ORDER tb is bp. Slowly move horizontal cross-hair toward the limb until O-ORDER tb changes to gray ● MAN PTG ENABLE sw - <u>INHIBIT</u> SCAN SPECT: ● MIR POS sw - pulse <u>UP/R</u> 10 steps Does the O-ORDER tb change to bp? NO 2 FAILURE OF THE UP/DOWN COUNTER OR SWITCH 3 Continue to operate MIRROR in RASTER MODES. It can be operated in LINE SCAN MODE but line cannot be selected YES 4 FAILURE OF THE MIRROR LIMIT TB 5 Operate without the MIRROR LIMIT tb 2	1 The up-down counter is initially set at line 30 2 Actual MIRROR position will be monitored by STDN via TM

ATM-S055-012A

UV SCANNING POLYCHROMATOR-SPECTROHELIOMETER

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
1 S056 ALERT X-REA HV BLUE	<pre> graph TD 1["1 X-RAY TELE: ● HV PWR BE sw - OFF ● HV PWR AL sw - OFF Is X-REA HV ALERT It off?"] 2["2 X-REA HV ALERT LT CIRCUITRY FAILURE"] 3["3 X-RAY TELE: ● HV PWR BE sw - ON Does X-REA HV ALERT It come on?"] 4["4 BE HIGH VOLTAGE POWER SUPPLY FAILURE"] 5["5 X-RAY TELE: ● HV PWR BE sw - OFF ● HV PWR AL sw - ON"] 6["6 X-RAY TELE: ● HV PWR BE sw - OFF ● HV PWR AL sw - ON Does X-REA HV ALERT It come on?"] 7["7 AL HIGH VOLTAGE POWER SUPPLY FAILURE"] 8["8 X-RAY TELE: ● HV PWR AL sw - OFF ● HV PWR BE sw - ON"] 9["9 MOMENTARY LINE TRANSIENT"] 10["10 Continue normal operation"] 11["11 Continue normal operation"] 1 -- YES --> 4 1 -- NO --> 2 2 --> 10 3 -- YES --> 4 3 -- NO --> 6 4 --> 5 5 --> 7 6 -- YES --> 7 6 -- NO --> 9 7 --> 8 9 --> 11 </pre>	① Select AL on HISTORY PLOT ② Select BE on HISTORY PLOT ATM-S056-001A

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
2 S056	ALERT BE COUNT BLUE 1 1 MONITOR: - COUNTER 2 sel - BE COUNT X-RAY/RF ACTIVITY: - DATA DRIVE BE sw - BE Observe COUNTER 2 and HISTORY PLOT. Verify high count rate COUNTER 2 and HISTORY PLOT indicate nominal count rate COUNTER 2 and HISTORY PLOT verify high count rate 2 2 BE ALERT DETECTOR FAILURE 8 Continue to operate 13 2 ARE X-RAY TELE: BE APRT POS tbs - 1, gray? YES 5 3 X-RAY TELE: - HV PWR BE sw - OFF MONITOR: - COUNTER 2 sel - as desired - COUNTER 3 sel - AL COUNT X-RAY/RF ACTIVITY: - DATA DRIVE BE sw - AL 4 4 X-RAY TELE: - BE APRT POS AUTO sw - MAN - BE APRT POS INCR sw - DECR Do BE APRT POS tbs respond to MAN DECR? NO 6 YES 7 4 FAILURE IN APERTURE AUTO DECREASE DRIVE LOGIC 13	1 BE COUNT rate > 4,506 V (2048 cnts/sec) 2 Disregard alert light 3 Crew may elect to request STDN GO/NO GO recom- mendation for continuation of experiment based upon evaluation of PCM prior to turning BE HV POWER off 4 Auto increase capability may still exist. Manual mode will be required to decrease aper- ture size

ATM-S056-002A

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
2 S056 (Cont)	4 ↓ 6 X-RAY TELE: ● BE APRT POS INCR sw - <u>INCR</u>, <u>DECR</u>, <u>DECR</u> Do BE APRT POS tbs respond to MAN CMD? INCR only INCR, DECR only tbs respond to all manual commands 9 FAILURE IN APERTURE MOTOR OR DRIVE LOGIC 10 X-RAY TELE: ● HV PWR BE sw - <u>OFF</u> 12 APERTURE WHEEL MOMENTARILY FROZEN 11 APERTURE WHEEL OBSTRUCTION 13 Does BE count ALERT It remain on? YES → 2 NO 14 14 Continue normal operations	5 BE HV power should be procedurally turned off during periods of high count rate ATM-S056-003A

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
3 S056 ALERT AL COUNT BLUE	① 1 MONITOR: ● COUNTER 3 sel - <u>AL COUNT</u> X-RAY/RF ACTIVITY: ● DATA DRIVE BE sw - <u>AL</u> OBSERVE COUNTER 3 AND HISTORY PLOT. VERIFY HIGH COUNT RATE COUNTER 3 and HISTORY PLOT indicate nominal count rate COUNTER 3 and HISTORY PLOT verify high count rate ② 3 AL ALERT DIRECTOR FAILURE Continue to operate ③ 5 X-RAY TELE: ● HV PWR AL sw - <u>OFF</u> MONITOR: ● COUNTER 3 sel - as desired ● COUNTER 2 sel - <u>BE COUNT</u> X-RAY/RF ACTIVITY: ● DATA DRIVE BE sw - <u>BE</u> ② 2 ARE X-RAY TELE: AL APRT POS tbs - 1, gray? YES → [5] NO → [4] ③ 13 ④ 4 X-RAY TELE: ● AL APRT POS AUTO sw - <u>MAN</u> ● AL APRT POS INCR sw - <u>DECR</u> DO AL APRT POS tbs RESPOND TO MAN DECR? NO → [6] YES → [7] ④ 7 FAILURE IN APERTURE AUTO DECREASE DRIVE LOGIC → [13]	AL COUNT rate > 4,500 V (2048 cnts/sec) Disregard alert It Crew may elect to request STDN GO/NO GO recommendation for continuation of experiment based upon evaluation of PCM prior to turning AL HV POWER off Auto increase capability may still exist, manual mode will be required to decrease aperture size

ATM-S056-004A

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS			
3 S056 (Cont)	4 ↓ 6 X-RAY TELE: ● AL APRT POS INCR sw - <u>INCR</u>, <u>DECR</u>, <u>DECR</u> Do AL APRT POS tbs RESPOND TO MAN CMDS? <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 33%;">INCR only</td><td style="width: 33%;">INCR, DECR only</td><td style="width: 33%;">tbs RESPOND TO ALL MANUAL COMMANDS</td></tr> </table> 9 FAILURE IN APERTURE MOTOR OR DRIVE LOGIC 10 X-RAY TELE: ● HV PWR AL sw - <u>OFF</u> 12 APERTURE WHEEL MOMENTARILY FROZEN 13 Does AL count ALERT it remain on? NO YES → 2 14 Continue normal operations	INCR only	INCR, DECR only	tbs RESPOND TO ALL MANUAL COMMANDS	5 AL HV power should be procedurally turned off during periods of high count rate ATM-S056-005A
INCR only	INCR, DECR only	tbs RESPOND TO ALL MANUAL COMMANDS			

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
4 S056 (1) READY LT NOT ON WHEN ALL READY CONDITIONS SATISFIED	<pre> graph TD 1[1 X-RAY TELE: ● CAMERA/TELE sel - Cycle through each mode Is READY It on in any mode?] -- YES --> 7[7 "FILTER IN POSITION INDICATION" FAILURE OF MODE(S) SELECTED WHEN READY LT DID NOT COME ON] 1 -- NO --> 2[2 X-RAY TELE: ● START/STOP sw - START Do OPR It and FRAMES REMAINING ind verify selected mode operation?] 2 -- YES --> 9[9 READY LT CIRCUIT FAILURE] 2 -- NO --> 3[3 AUTOMATIC FILM LOGIC OVERRIDE X-RAY TELE: ● START/STOP sw - STOP Do OPR It and FRAMES REMAINING ind verify selected mode operation?] 3 -- YES --> 11[11 DIGITAL LOGIC FAILURE TO PROCESS FILM ADVANCED PULSE] 3 -- NO --> 4[4 X-RAY TELE: ● CAMERA AIRLOCK sw - CLOSE ● CAMERA AIRLOCK sw - OPEN Does READY It come on?] 4 -- YES --> 12[12 AIRLOCK DOOR FAILED TO FULLY OPEN ON PREVIOUS ATTEMPT] 4 -- NO --> 5[5 AIRLOCK DOOR, FILTER WHEEL OR DIGITAL LOGIC FAILURE] 5 --> 6[6 Discontinue experiment operation] 7 --> 8[8 Continue to operate in unaffected modes] 9 --> 10[10 Continue normal operations] 11 --> 14[14 Continue normal operations] 12 --> 13[13 Continue normal operations] </pre>	(1) READY conditions: CAMR PWR sw - ON DOOR sw - OPEN CAMERA AIRLOCK sw - OPEN (2) Absence of OPR It may be substituted for READY It (3) Automatic film logic override procedure (Block 3) may be required to return to normal operations after experiencing momentary line transient (4) Could be caused by reed switch failure. STDN can evaluate

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X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
5 S056 ① OPR LT DOES NOT LT WHEN ALL OPR CONDITIONS HAVE BEEN MET	<pre> graph TD 1[1] --> Q1{Is FRAMES REMAINING ind decrementing and FILTER tbs responding correctly for selected mode?} Q1 -- YES --> 2[2] Q1 -- NO --> 4[4] 2[2] --> 3[3] 3[3] --> 3[3] 4[4] --> Q2{Do OPR It and FRAMES REMAINING ind verify selected mode operation?} Q2 -- YES --> 5[5] Q2 -- NO --> 7[7] 5[5] --> 6[6] 6[6] --> 6[6] 7[7] --> Q3{Do OPR It and FRAMES REMAINING ind verify selected mode operation?} Q3 -- YES --> 8[8] Q3 -- NO --> 10[10] 8[8] --> 9[9] 9[9] --> 11[11] 10[10] --> Q4{Do OPR It and FRAMES REMAINING ind verify selected mode operation?} Q4 -- YES --> 11[11] Q4 -- NO --> 13[13] 11[11] --> 12[12] 13[13] --> 14[14] </pre> 1 2 3 4 5 6 7 8 9 10 11 12 13 14	① Operate conditions a. READY It - ON b. START/STOP sw - START ② Verify camera operation utilizing FRAMES REMAINING ind and FILTER tbs ③ If X-RAY TELE START/STOP sw STOP function is desired and has also failed, reposition CAMERA/TELE sel to generate override stop function

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X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
6 S056 FRAMES REMAINING IND FAILS TO DECREMENT	<pre> graph TD 1[1 Is the OPR It on?] -- YES --> 2[2 FRAMES REMAINING IND OR INDICATOR DRIVER CIRCUIT FAILURE] 2 --> 3[3 Continue to operate] 3 --- 1C((1)) 1 -- NO --> 4[4 X-RAY TELE: ● START/STOP sw - START Do OPR It and FRAMES REMAINING ind verify selected mode operation?] 4 -- YES --> 5[5 MOMENTARY POWER INTERRUPTION OR DIGITAL LOGIC TRANSIENT] 5 --> 6[6 Continue normal operation] 4 -- NO --> 7[7 AUTOMATIC FILM LOGIC OVER?IDE X-RAY TELE: ● START/STOP sw - STOP ● START/STOP sw - START Do OPR It and FRAMES REMAINING ind verify selected mode operation?] 7 -- YES --> 8[8 MOMENTARY DIGITAL LOGIC TRANSIENT] 8 --> 9[Continue normal operations] 7 -- NO --> 10[10 DIGITAL LOGIC, CAMERA MOTOR/MOTOR DRIVE FAILURE OR SHUTTER FAILURE] 10 --> 11[11 X-RAY TELE: ● CAMERA AIRLOCK sw - CLOSE ● Discontinue operation] </pre>	① STDN required to maintain FRAMES REMAINING count utilizing real time and playback telemetry ② Mode sequence should be initiated immediately as camera shutter may be open

ATM-S056-008A

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
7 S056 ① HISTORY PLOT FAILS TO DRIVE	<pre> graph TD 1[1] --> 2[2] 2 --> 3[3] 2 --> 4[4] 4 --> 5[5] 4 --> 7[7] 7 --> 8[8] 7 --> 9[9] 8 --> 6[6] 9 --> 6 9 --> 10[10] 10 --> 11[11] </pre> 1 X-RAY/RF ACTIVITY: ● DATA DRIVE RECORD sw - <u>RECORD 30" HR</u> Does HISTORY PLOT drive? 2 FAILURE OF DIVIDE BY 10 COUNTER OR RATE SELECTOR GATE 3 Continue to operate at 30" HR drive rate 4 X-RAY RF ACTIVITY: ● DATA DRIVE RECORD sw - <u>REVIEW</u> Does HISTORY PLOT drive? 5 FAILURE OF DIVIDE BY 20 COUNTER 6 X-RAY/RF ACTIVITY: ● DATA DRIVE FORWARD sw - <u>OFF</u> 7 X-RAY/RF ACTIVITY: ● DATA DRIVE FORWARD sw - <u>REVERSE</u> Does HISTORY PLOT drive? 8 FAILURE OF FWD/REV CONTROL 9 X-RAY/RF ACTIVITY: ● DATA DRIVE FORWARD sw - <u>FORWARD</u> Does HISTORY PLOT drive? 10 PAPER MOMENTARILY JAMMED 11 Continue normal operation	① Assumptions: X-RAY/RF ACTIVITY: a. DATA DRIVE RECORD sw - RECORD 10" HR b. DATA DRIVE FORWARD sw - FORWARD c. DATA DRIVE BE sw - BE or AL

ATM-S056-009A

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
8a S056 1 DOOR TB INDICATES >11 SEC REQUIRED FOR APERTURE DOOR TO OPEN OR CLOSE	2 DAS: ● Key 40012E X-RAY TELE: ● DOOR sw - cycle through <u>OPEN</u> and <u>CLOSE</u> Does aperture door respond to switch commands? YES → 2 FAILURE OF APERTURE DOOR PRIMARY DRIVE MOTOR 3 Continue to operate using secondary motor NO → 4 FAILURE OF APERTURE DOOR SECONDARY DRIVE MOTOR 3 5 DAS: ● Key 40113E ● Key 40023E 6 Continue to operate using primary motor	1 Both primary and secondary drive motors assumed to be enabled 2 Octal code to command S056 door primary motor inhibit using DAS 3 Octal codes to command S056 door primary motor enable and secondary motor inhibit using DAS

ATM-S056-010A

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
8b S056 (1) DOOR TB DOES NOT INDICATE GRAY AT EFFECTIVE SUN-RISE (ESR)	<pre> graph TD 1[1] --> Q1{Is DOOR tb-bp or white?} Q1 -- white --> 2[2] Q1 -- bp --> 5[5] 2 --> Q2{Is DOOR tb gray?} 5 --> Q3{Is DOOR tb gray?} Q2 -- YES --> 3[3] Q2 -- NO --> 7[7] Q3 -- YES --> 6[6] Q3 -- NO --> 5 3 --> 4[4] 6 --> 4 7 --> Q4{Is X-REA count nominal?} Q4 -- YES --> 10[10] Q4 -- NO --> 8[8] 4 --> 11[11] 10 --> 11 8 --> 9[9] </pre> 1 Is DOOR tb-bp or white? 2 X-RAY TELE: ● DOOR sw - OPEN and hold for 20 sec 3 FAILURE OF DOOR OPEN RELAY LATCHING CIRCUITRY 4 Continue to operate by using DOOR sw to open aperture door 5 X - RAY TELE: ● DOOR sw - OPEN 6 FAILURE OF WCIU DOOR OPEN SIGNAL CIRCUIT 7 Is X-REA count nominal? 8 DOOR FAILED 9 Open door manually during next EVA 10 DOOR TB FAILURE 11 Continue normal operations	1 Assumes: EVA: AUTO DOOR sw - ENABLE Both primary and secondary drive motors enabled

ATM-S056-011A

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
8c S056 ① DOOR TB DOES NOT INDICATE BP AT EFFECTIVE SUNSET (ESS)	② 1 Is DOOR OPEN alert It on? 2 DOOR TB FAILURE 3 Continue normal operations 4 X-RAY TELE; DOOR sw - <u>CLOSE</u> Is DOOR tb - bp? 5 DOOR FAILED 6 Continue to operate with door open 7 FAILURE OF WCIU "DOOR CLOSED" SIGNAL CIRCUIT 8 Continue to operate using DOOR sw to close door	① Assumes: EVA: AUTO DOOR sw - <u>ENABLE</u> Both primary and secondary drive motors enabled ② Absence of door closed indication is required for DOOR OPEN alert

ATM-S056-012A

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
9 S056 FILTER TB'S CONTINUE CYCLING	1 X-RAY TELE: ● CAMERA/TELE sel - SINGLE FR 1 Does filter tb remain at selected position? 2 PARTIAL FAILURE OF FILTER POSITION FEEDBACK LOOP 3 ● Operate in SINGLE FR NO 4 FAILURE OF FILTER POSITION FEEDBACK LOOP 5 Discontinue operation	1 Attempt restart over ground station at later time ATM-S056-013

X-RAY TELESCOPE

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
1a S082A WAVE LTH TB DOES NOT INDICATE POSITION COMMANDED WITH WAVE LTH SW Assumption: READY It on when at least one position of WAVE LTH sw commanded	1 XUV SPECT: ● WAVE LTH sw - cycle at 3-sec intervals Is WAVE LTH tb white when READY It on? YES → 2 WAVE LTH TB FAILURE → 3 Continue to operate without WAVE LTH tb NO → 4 GRATING/HEAT REJECTION MIRROR OR SW COMMAND CIRCUITRY FAILURE → 5 XUV SPECT: ● Continue to operate using TIME or AUTO 1 MODES only with WAVE LTH position that gives READY It on until advised by STDN	1 Operation of the instrument in the other wave length may damage the instrument
1b S082A WAVE LTH TB DOES NOT CYCLE PROPERLY DURING AUTO 2 OR FLARE MODE	1 XUV SPECT: ● START/STOP sw - STOP ● WAVE LTH sw - cycle at 3-sec intervals Do WAVE LTH tb and READY It cycle normally? YES → 2 MODE WAVE LTH SELECT COMMAND CIRCUITRY FAILURE → 3 Discontinue operation in failed mode. Monitor next AUTO 2 or FLARE to check for failure NO → S082A 1a 1 WAVE LTH TB DOES NOT INDICATE POSITION COMMANDED WITH WAVE LTH SW	

ATM-S082A-001A

XUV SPECTROHELIOGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
2a S082A PWR/DOORS TB IS NOT GRAY WHEN PWR/DOORS SW - ON	<pre> graph TD 1[1 Is READY It on?] -- YES --> 2[2 PWR/DOORS TB FAILED] 2 --> 3[3 Use READY It in lieu of PWR/DOORS tb] 1 -- NO --> 4[4 DAS: Key 40147E PWR/DOORS tb position?] 4 -- gray --> 5[5 PWR/DOORS SW FAILURE] 5 --> 6[6 Use DAS in lieu of PWR/DOORS sw] 4 -- bp --> 7[7 DOORS FAILED CLOSED] 4 -- white --> 9[9 ONE DOOR HAS FAILED TO INDICATE OPEN] 7 --> 8[8 Discontinue operation until advised by STDN] 9 --> 8 </pre>	① Octal code to command PWR/DOORS ON ATM-S082A-003A

XUV SPECTROHELIOGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
2b S082A PWR/DOORS TB REMAINS GRAY WHEN PWR/DOORS SW - OFF PWR/DOORS TB WHITE WHEN PWR/DOORS SW - OFF	<pre> graph TD S1[PWR/DOORS TB REMAINS GRAY WHEN PWR/DOORS SW - OFF] --> D1{1 Is READY It off?} D1 -- YES --> B2[PWR/DOORS TB FAILURE] D1 -- NO --> D2{4 PWR/DOORS tb position?} S2[PWR/DOORS TB WHITE WHEN PWR/DOORS SW - OFF] -.-> D2 D2 -- white --> B7[7 ONE DOOR HAS FAILED IN OPEN OR INTERMEDIATE POSITION] D2 -- gray --> B8[8 BOTH DOORS HAVE FAILED OPEN] B2 --> B3[3 Use READY It in lieu of PWR/DOORS tb] B5[5 PWR/DOORS SW FAILURE] --> B6[6 Use DAS in lieu of PWR/DOORS sw] B7 --> B9[9 Continue to operate. Instrument optical contamination and/or thermal problems] B8 --> B9 </pre> ① Octal code to command PWR/DOORS OFF	ATM-S082A-008

XUV SPECTROHELIOGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
3 S082A FLARE TB FAILS TO INDICATE FLR Assumptions: a. XUV SPECT: READY It on, or OPR It on if another mode was in progress before flare initiate b. XUV SPECT: FLARE sw - <u>ENABLE</u> c. MASTER FLARE MODE: INIT sw - <u>INIT</u>	<pre> graph TD Start([Start]) --> Q1{1 Is the OPR It on?} Q1 -- YES --> Q2{2 Is WAVE LTH tb LG interval 1.7 or 3.5 min?} Q1 -- NO --> Q5{5 Is FLARE tb FLR?} Q2 -- YES --> S3[3 FLARE TB FAILURE] Q2 -- NO --> Q5 S3 --> S4[4 Continue normal operation without FLARE tb] Q5 -- YES --> S6[6 FAILURE OF WAVE LENGTH LOGIC TO COMMAND THE GRATING TO ST WHEN FLARE MODE INITIATED] Q5 -- NO --> S8[8 FAILURE OF EXPERIMENT FLARE MODE] S6 --> S7[7 Continue to operate] S8 --> S9[9 Discontinue FLARE MODE operation. Substitute XUV SPECT: • MODE sw - AUTO 2 • EXPOSURE sw - ST • START/STOP sw - START Repeat as necessary during flare event] </pre>	1 WAVE LTH tb cycling interval verifies that FLARE MODE is operational 2 FLARE MODE is in progress 3 Command WAVE LTH sw - ST before FLARE MODE initiate ATM-S082A-004A

XUV SPECTROHELIOGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
4 S082A READY LT NOT ON WHEN CONDITIONS HAVE BEEN MET	<pre> graph TD 1[1 LIGHTING ● LAMP TEST sel - STATUS Is READY Lt on?] -- YES --> 6[6 LIGHTING ● LAMP TEST sel - OFF] 1 -- NO --> 2[2 Is OPR Lt on?] 2 -- YES --> 7[7 XUV SPECT ● WAVE LTH sw - cycle at 3 sec intervals Is WAVE LTH tb white continuously?] 2 -- NO --> 5[5 STATUS LT CIRCUITRY OR VSTATUS BUS FAILURE] 7 -- YES --> 8[8 FAILURE OF GRATING/HEAT REJECTION MIRROR MOTORS IN INTERMEDIATE POSITION] 7 -- NO --> 9[9 Does WAVE LTH tb cycle normally?] 9 -- YES --> 11[11 Is READY Lt on in ST or LG WAVE LTH position?] 9 -- NO --> 10[10 Discontinue operations until advised by STDN] 11 -- YES --> 12[12 FAILURE OF HEAT REJECTION MIRROR CIRCUITRY OR FAILURE OF POSITION INDICATOR SW IN EITHER ST OR LG] 11 -- NO --> 13[13 FAILURE OF THE READY/OPR CIRCUITRY OR FAILURE OF THE HEAT REJECTION MIRROR IN AN INTERMEDIATE POSITION] 13 --> 15[15 Discontinue operation until advised by STDN] 5 --> 14[14 Continue to operate using TIME or AUTO 1 modes only with WAVE LTH position that gives READY Lt on until advised by STDN] 8 --> 10 12 --> 14 </pre> 3 READY LT FAILURE 4 Continue normal operation without READY Lt 10 Discontinue operations until advised by STDN 12 FAILURE OF HEAT REJECTION MIRROR CIRCUITRY OR FAILURE OF POSITION INDICATOR SW IN EITHER ST OR LG 14 Continue to operate using TIME or AUTO 1 modes only with WAVE LTH position that gives READY Lt on until advised by STDN 15 Discontinue operation until advised by STDN 1a 1 WAVE LTH TB DOES NOT INDICATE POSITION COMMANDED WITH WAVE LTH SW 5 STATUS LT CIRCUITRY OR VSTATUS BUS FAILURE C & D 5 1 LOSS OF VAR ALERT/STATUS LIGHTING ON PANEL 130	1 Operation of the experiment with the Grating/Heat Rejection mirror motors in the intermediate position may damage the instrument 2 Operation of the instrument in the other wave length may damage the instrument

ATM-S082A-005A

XUV SPECTROHELIOGRAPH

SKYLAB OPERATIONS HANDBOOK

ATM

SYMPTOM	PROCEDURE	REMARKS
5 S082A OPR LT NOT ON AFTER START/STOP SW - START	<pre> graph TD Start([Start]) --> 1{1 Was TIME mode selected?} 1 -- YES --> 2[2 XUV SPECT: • MODE sw - AUTO 1 Did FRAMES REMAINING ind decrease?] 1 -- NO --> 5{5 Did FRAMES REMAINING ind decrease?} 2 -- YES --> 3[3 LIGHTING: • LAMP TEST sel - STATUS Is OPR Lt on?] 2 -- NO --> 7[7 Continue to operate without OPR Lt] 3 -- YES --> 4[4 FAILURE OF OPR LT CIRCUITRY] 3 -- NO --> 6[6 FAILURE OF OPR LT] 4 --> 7 6 --> 7 7 --> 9[9 XUV SPECT: • START/STOP sw - START Is FRAMES REMAINING ind decreasing?] 9 -- YES --> 11[11 FAILURE OF EXPERIMENT TIME MODE] 9 -- NO --> 10[10 XUV SPECT: • MODE sw - AUTO 2 • START/STOP sw - START Is FRAMES REMAINING ind decreasing?] 11 --> 13[13 Continue to operate. At earliest opportunity check other modes for operational status] 10 -- YES --> 14[14 FAILURE OF CIRCUITRY COMMON TO TIME & AUTO 1 MODES] 10 -- NO --> 15[15] 14 --> 13 5 -- YES --> 3 5 -- NO --> 8[8 XUV SPECT: • MODE sw - TIME • START/STOP sw - START Wait 5 secs • START/STOP sw - STOP Did FRAMES REMAINING ind decrease?] 8 -- YES --> 12[12 FAILURE OF AUTOMATIC MODE SELECTED] 8 -- NO --> 15 12 --> 13 15 --> 13 </pre>	① Changing MODE sw sends stop command to experiment ATM-S082A-006A

XUV SPECTROHELIOGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
5 (Cont) S082A	<pre> graph TD 8[8] --> 15 10[10] --> 15 15["15 DAS: • Key - 40107E Is FRAMES REMAINING ind decreasing?"] 15 -- YES --> 16["16 FAILURE OF START/STOP SW CIRCUITRY"] 15 -- NO --> 18 16 --> 17["17 Continue to operate using DAS to start AUTO 2 MODE"] 18["18 XUV SPECT: • FLARE sw - <u>ENABLE</u> MASTER FLARE MODE: • INIT sw - <u>INIT</u> • Wait 5 secs XUV SPECT: • START/STOP sw - <u>STOP</u> Did FRAMES REMAINING ind decrease?"] 18 -- YES --> 19["19 FAILURE OF COMMON AUTO 1, AUTO 2, AND TIME MODE START CIRCUITRY"] 18 -- NO --> 21 19 --> 20["20 Operate in FLARE MODE only"] 21["21 FAILURE OF CAMERA OR INSTRUMENT ELECTRONICS"] 21 --> 22["22 Discontinue XUV SPECT operations until advised by STDN"] </pre>	2 Octal command to start AUTO 2 MODE 3 FLARE MODE should still be operational. Verify per block 18 at first opportunity

ATM-S082A-009

XUV SPECTROHELIOGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
6 S082A EXPOSURE TB DOES NOT RESPOND TO EXPOSURE SW WHEN READY LT IS ON	<pre> graph TD 1["1 XUV SPECT: • START/STOP sw STOP • EXPOSURE sw LONG Is EXPOSURE tb LG?"] 2["2 XUV SPECT: • EXPOSURE sw SHORT Is EXPOSURE tb ST?"] 3["3 Continue normal operation"] 4["4 XUV SPECT: • MODE sw AUTO 1 • WAVE LTH sw SHORT; tb - ST • START/STOP sw - START, OPR It - on Is OPR It on for more than 4.0 min?"] 5["5 XUV SPECT: • MODE sw AUTO 1 • WAVE LTH sw - SHORT; tb - ST • START/STOP sw - START, OPR It - on Is OPR It on for 1.0 min?"] 6["6 EXPOSURE TB FAILURE"] 7["7 XUV SPECT: • START/STOP sw - STOP Continue to operate without EXPOSURE tb"] 8["8 FAILURE OF EXPOSURE SWITCH/COMMAND LONG FUNCTION"] 9["9 FAILURE OF EXPOSURE SWITCH/COMMAND SHORT FUNCTION"] 10["10 Continue to operate using SHORT exposure durations only"] 11["11 Continue to operate using LONG exposure durations only"] 1 -- YES --> 2 1 -- NO --> 4 2 -- YES --> 3 2 -- NO --> 5 4 -- YES --> 6 4 -- NO --> 8 5 -- YES --> 6 5 -- NO --> 9 6 --> 7 8 --> 10 9 --> 11 </pre>	① When both SHORT and LONG commands are issued, EXPOSURE tb will indicate ST regardless of the order in which commands were issued. Exposures will be SHORT duration

ATM-S082A-007A

XUV SPECTROHELIOGRAPH

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SYMPTOM	PROCEDURE	REMARKS
7 S082A ANY APPARENT LOGIC LATCH UP, i.e., CONTINUOUS OPR LT ON, FLARE TB - FLR OR ANY APPARENT INTERMITTENT POWER DROP	<pre> graph TD 1["1 XUV SPECT: ● START/STOP sw - STOP Is symptom removed?"] -- YES --> 2["2 Continue operation using START/STOP sw to remove symptom"] 1 -- NO --> 3["3 XUV SPECT: ● MODE sw - Select alternate mode Is symptom removed?"] 3 -- YES --> 4["4 Continue operation using MODE sw to remove symptom"] 3 -- NO --> 5["5 XUV SPECT: ● PWR/DOORS sw - OFF ● Wait 10 secs ● PWR/DOORS sw - ON ● Wait 10 secs ● PWR/DOORS tb - gray Is symptom removed?"] 5 -- YES --> 6["6 Continue operation using PWR/DOORS sw to remove symptom"] 5 -- NO --> 7["7 Discontinue use until advised by STDN"] </pre>	ATM-S082A-010

XUV SPECTROHELIOGRAPH

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SYMPTOM	PROCEDURE	REMARKS
8 S082A FRAMES REMAINING IND DOES NOT COUNT DOWN Assumptions: READY It - on before START/STOP sw - START OPR It - on after START/STOP sw - START	<pre> graph TD 1[1 Was TIME MODE initiated?] -- YES --> 2[2 Is OPR It on after STOP command?] 1 -- NO --> 3[3 XUV SPECT: START/STOP sw - STOP, MODE sw - select mode in operation when failure occurred, START/STOP sw - START, Wait for FRAMES REMAINING ind to decrement (max of 2 min), START/STOP sw - STOP. Did FRAMES REMAINING ind decrement?] 2 -- YES --> 7[7 FAILURE OF FRAMES REMAINING IND OR FILM TRANSPORT SWITCH/MECHANISM] 2 -- NO --> 6[6 XUV SPECT: MODE sw - TIME, START/STOP sw - START, Wait 10 seconds, START/STOP sw - STOP. Did FRAMES REMAINING ind decrement?] 3 -- YES --> 4[4 MOMENTARY LOGIC LATCHUP] 4 --> 5[5 Continue Operation] 3 -- NO --> 6 6 -- YES --> 9[9 FAILURE OF MODE SELECTED] 9 --> 10[10 Continue operation using TIME MODE] 6 -- NO --> 7 7 --> 8[8 Continue operation] 7 -- 1 --> R1[1 STDN will be able to determine if the failure is the FRAMES REMAINING ind] 7 -- 2 --> R2[2 The other automatic modes may still be operational] </pre>	1 STDN will be able to determine if the failure is the FRAMES REMAINING ind 2 The other automatic modes may still be operational

ATM-S082A-011

XUV SPECTROHELIOGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
1 S082B WAVE LTH TB DOES NOT CYCLE PROPERLY	<pre> graph TD Start([1 S082B WAVE LTH TB DOES NOT CYCLE PROPERLY]) --> D1{1 Does WAVE LTH tb remain white?} D1 -- YES --> E1[S082B 7 1 ANY APPARENT LOGIC LATCHUP, i.e. CONTINUOUS OPR LT ON, FLARE TB - FLR OR ANY INTERMITTENT PWR DROP] D1 -- NO --> D2{2 Does WAVE LTH tb re main ST or LG?} D2 -- YES --> E2[3 PROBABLE FAILURE OF GRATING IN POSITION INDICATED] D2 -- NO --> D4{4 Does WAVE LTH tb cycle white to ST repeatedly?} D4 -- YES --> E3[5 PROBABLE FAILURE OF LG WAVE LTH POSITION INDICATOR] D4 -- NO --> D6{6 Does WAVE LTH tb cycle from white to LG repeatedly?} D6 -- YES --> E4[7 PROBABLE FAILURE OF ST WAVE LTH POSITION INDICATOR] D6 -- NO --> E5[S082B 7 1 ANY APPARENT LOGIC LATCHUP, i.e. CONTINUOUS OPR LT ON, FLARE TB - FLR OR ANY INTERMITTENT PWR DROP] E2 --> E8[8 Continue to operate until advised via STDN] E3 --> E8 E4 --> E8 </pre>	ATM-S082B-001A

XUV SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
2a S082B PWR/DOORS TB DOES NOT GO GRAY WHEN PWR/DOORS SW - ON	<pre> graph TD 1[1] Is READY It on? -- YES --> 2[2] PWR/DOORS TB FAILURE --> 3[3] Use READY It in lieu of PWR/DOORS tb 1 -- NO --> 4[4] PWR/DOORS tb position? 4 -- gray --> 5[5] PWR/DOORS SW FAILURE --> 6[6] Use DAS in lieu of PWR/DOORS sw 4 -- bp --> 7[7] DOORS FAILED CLOSED --> 8[8] Discontinue operation until advised by STDN 4 -- white --> 9[9] ONE DOOR HAS FAILED TO INDICATE OPEN --> 10[10] Is the slit visible on mon? 10 -- YES --> 11[11] Continue to operate 10 -- NO --> 8 </pre>	① Octal code to command PWR/DOORS ON
2b S082B PWR/DOORS TB REMAINS GRAY WHEN PWR/DOORS SW - OFF PWR/DOORS TB REMAINS WHITE WHEN PWR/DOORS SW - OFF	<pre> graph TD 1[1] Is READY It off? -- YES --> 2[2] PWR/DOORS TB FAILURE --> 3[3] Use READY It in lieu of PWR/DOORS tb 1 -- NO --> 4[4] PWR/DOORS tb position? 4 -- bp --> 5[5] PWR/DOORS SW FAILURE --> 6[6] Use DAS in lieu of PWR/DOORS sw 4 -- white --> 7[7] ONE DOOR HAS FAILED IN OPEN OR INTERMEDIATE POSITION 4 -- gray --> 8[8] BOTH DOORS HAVE FAILED OPEN --> 9[9] Continue to operate. Instrument optical contamination or thermal problems may result </pre>	① Octal code to command PWR/DOORS OFF ATM-S082B-002A

XUV SPECTROGRAPH

SKYLAB EXPERIMENT OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
3 S082B FLARE TB FAILS TO INDICATE FLR Assumptions: a. XUV SLIT: FLARE sw - <u>ENABLE</u> b. MASTER FLARE MODE: INIT sw - <u>INIT</u>	<pre> graph TD Start([1]) --> Q1{Is the OPR It on?} Q1 -- YES --> Q2{Is WAVE LTH tb ST interval 55 sec?} Q1 -- NO --> Box5[5] Q2 -- YES --> Box3[3] Q2 -- NO --> Box5 Box3 --> Box4[4] Box5 --> Q3{Is FLARE tb FLR?} Q3 -- YES --> Box6[6] Q3 -- NO --> Box7[7] Box6 --> Box8[8] Box7 --> Box9[9] </pre>	① WAVE LTH tb cycling requires correct camera operation ② FLARE MODE is in progress

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XUV SPECTROGRAPH

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SYMPTOM	PROCEDURE	REMARKS
4 S082B (1) READY LT NOT ON WHEN CONDITIONS HAVE BEEN MET	<pre> graph TD 1[1 LIGHTING: ● LAMP TEST sel - STATUS Is READY It ON?] -- YES --> 2[2 LIGHTING: ● LAMP TEST sel - OFF] 1 -- NO --> 5[5 Is OPR It ON?] 2 --> 3[3 READY LT CIRCUITRY FAILURE] 3 --> 4[4 Continue operation disregarding READY It] 5 -- YES --> 6[6 READY LT FAILURE] 5 -- NO --> 7[7 STATUS LT CIRCUITRY OR VSTATUS BUS FAILURE] 6 --> 8[8 Continue normal operation without READY It] 7 --> CD[C&D 5 1] </pre>	(1) Ready conditions: XUV SLIT: MAIN PWR sw - ON PWR/DOORS sw - ON PWR/DOORS tb - gray AUTO SEQ sw - NORMAL ATM-S082B-004A

XUV SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
5 S082B OPR LT NOT ON AFTER START/STOP SW - START	<pre> graph TD 1[1 Was TIME MODE selected?] -- YES --> 2[2 XUV SLIT: MODE sw - AUTO Did FRAMES REMAINING ind decrease?] 2 -- YES --> 4[4 LIGHTING: LAMP TEST sel - STATUS Is OPR It on?] 2 -- NO --> 12[12 Continue to operate without OPR It] 4 -- YES --> 5[5 FAILURE OF OPR LT CIRCUITRY] 4 -- NO --> 12 1 -- NO --> 3[3 Did FRAMES REMAINING ind decrease?] 3 -- YES --> 4 3 -- NO --> 8[8 XUV SLIT: MODE sw - TIME START/STOP sw - START Wait 5 sec START/STOP sw - STOP Did FRAMES REMAINING ind decrease?] 8 -- YES --> 9[9 FAILURE OF AUTOMATIC MODE SELECT] 8 -- NO --> 11[11 XUV SLIT: FLARE sw - ENABLE MASTER FLARE MODE: INIT sw - INIT Wait 5 sec XUV SLIT: START/STOP sw - STOP Did FRAMES REMAINING ind decrease?] 11 -- YES --> 14[14 FAILURE OF START/STOP SW CIRCUITRY] 11 -- NO --> 16[16 FAILURE OF CAMERA OR INSTRUMENT ELECTRONICS] 14 --> 15[15 Operate in FLARE MODE only] 16 --> 17[17 Discontinue XUV SLIT operations until advised by STDN] 9 --> 10[10 Continue to operate. At earliest opportunity check other modes for operational status] 10 --> 13[13 FAILURE OF EXPERIMENT TIME MODE] 13 --> 10 12 --> 10 15 --> 10 17 --> 10 </pre>	① Changing MODE sw sends STOP command to experiment ATM-S082B-005A

XUV SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
6a S082B	XUV MON DOORS TB DOES NOT RESPOND TO XUV MON DOORS SW - OPEN 1 1 TV: ● MON 1 sel - <u>XUV MON</u> ● GAIN sel - <u>4</u> MON 1 display is? XUV solar image four test lts blank 2 Internal door open DAS: ● Key - 40104E Is XUV MON DOORS tb gray? YES NO 3 FAILURE OF XUV MON THERMAL DOOR/COMMAND TO OPEN 5 Manually open door during next EVA 4 Internal door closed DAS: ● Key - 40104E Is XUV MON DOORS tb - gray? YES NO 6 FAILURE OF XUV MON DOORS TALKBACK 9 Continue normal operation without XUV MON DOORS tb 7 FAILURE OF XUV MON INTERNAL DOOR/COMMAND TO OPEN 10 Discontinue operation until advised via STDN 8 FAILURE OF XUV MON DOORS SWITCH 11 Continue operation using DAS commands to control XUV MON doors 1 DAS is not used immediately to reduce possibility of com- manding doors to positions they are already in 2 Do not command to open XUV MON doors	
ATM-S082B-006A		

7
FAILURE OF
XUV MON INTERNAL
DOOR/COMMAND
TO OPEN

10
Discontinue operation
until advised via
STDN

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XUV SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
6b S082B XUV MON DOORS TB DOES NOT RESPOND TO XUV MON DOORS SW - CLOSE	<pre> graph TD 1[1 DAS: • Key - 40126E] --> D1{Is XUV MON DOORS tb - bp?} D1 -- YES --> 2[2 FAILURE OF XUV MON DOORS SWITCH] D1 -- NO --> 4[4 TV: • MON 1 sel - XUV MON • GAIN sel - 4] 2 --> 3[3 Continue operation using DAS commands] 4 --> D2{MON 1 display is?} D2 -- XUV solar image --> 7[7 FAILURE OF BOTH XUV MON DOORS TO CLOSE OR FAILURE OF XUV MON DOORS CLOSE COMMAND] D2 -- four test lts --> 6[6 FAILURE OF XUV MON DOOR TB OR XUV MON THERMAL DOOR/COMMAND TO CLOSE] D2 -- blank --> 5[5 FAILURE OF XUV MON INTERNAL DOOR/COMMAND TO CLOSE] 7 --> 8[8 Continue operation until advised via STDN] 6 --> 8 5 --> 8 </pre>	① Octal command to close XUV MON doors ② Resolve via STDN ATM-S082B-007A

XUV SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
7 S082B ANY APPARENT LOGIC LATCH UP, i.e., CONTINUOUS OPR LT ON, FLARE TB - FLR, OR ANY APPARENT INTERMITTENT POWER DROP	<pre> graph TD 1["1 XUV SLIT: ● START/STOP sw - STOP Is symptom removed?"] -- YES --> 2["2 Continue operation using START/STOP sw to remove symptom"] 1 -- NO --> 3["3 XUV SLIT: ● MODE sw - Select alternate mode Is symptom removed?"] 3 -- YES --> 4["4 Continue operation using MODE sw to remove symptom"] 3 -- NO --> 5["5 XUV SLIT: ● AUTO SEQ sw - HOLD Is symptom removed?"] 5 -- YES --> 6["6 Continue operation using HOLD command to remove symptom"] 5 -- NO --> 7["7 XUV SLIT: ● AUTO SEQ sw - NORMAL ● PWR/DOORS sw - OFF ● Wait 10 sec ● PWR/DOORS sw - ON ● Wait 10 sec ● PWR/DOORS tb - gray Is symptom removed?"] 7 -- YES --> 8["8 Continue to operate normally until advised by STDN"] 7 -- NO --> 9["9 Discontinue use until advised by STDN"] </pre>	① To continue operation the AUTO SEQ sw will have to be placed back to the NORMAL position ATM-S082B-008.

XUV SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
8 S082B FRAMES REMAINING IND DOES NOT COUNT DOWN Assumptions: READY It - on before START/STOP sw - START OPR It - on after START/STOP sw - START	<pre> graph TD 1[1 Was TIME MODE initiated?] -- YES --> 2[2 Is OPR It on after STOP command?] 1 -- NO --> 3[3 XUV SLIT: START/STOP sw - STOP, MODE sw - select mode in operation when failure occurred, START/STOP sw - START, Wait for FRAMES REMAINING ind to decrement (max of 2 min), START/STOP sw - STOP] 2 -- YES --> S082B[S082B 7 1 ANY APPARENT LOGIC LATCHUP, i.e. CONTINUOUS OPR LT ON, FLARE TB - FLR OR ANY INTERMITTENT PWR DROP] 2 -- NO --> 7[7 FAILURE OF FRAMES REMAINING IND OR FILM TRANSPORT SWITCH/MECHANISM] 3 --> D3{Did FRAMES REMAINING ind decrement?} D3 -- YES --> 4[4 MOMENTARY LOGIC LATCHUP] 4 --> 5[5 Continue operation] D3 -- NO --> 6[6 XUV SLIT: MODE sw - TIME, START/STOP sw - START, Wait 10 sec, START/STOP sw - STOP] 6 --> D6{Did FRAMES REMAINING ind decrement?} D6 -- YES --> 9[9 FAILURE OF MODE SELECTED] 9 --> 10[10 Continue operation using TIME MODE] D6 -- NO --> 7 7 --> 8[8 Continue operation] </pre>	1 STDN will be able to determine if the failure is the FRAMES REMAINING ind 2 The other automatic modes may still be operational ATM-S082B-009

XUV SPECTROGRAPH

SKYLAB EXPERIMENT OPERATIONS HANDBOOK

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SYMPTOM	PROCEDURE	REMARKS
9 S082B XUV MONITOR LACKS IMAGE INTENSITY Assumptions: a. XUV MON GAIN sel - 7 b. XUV MON VID INTEG sw - INTEG for 10 sec	<pre> graph TD 1["1 TV: • XUV MON DOOR sw - CLOSE; tb - bp • XUV MON GAIN sel - 4 Are four test points visible after 10 secs?"] 2["2 Low intensity due to loss of efficiency in XUV/white It conversion layer"] 3["3 TV: • XUV MON DOOR sw - OPEN; tb - gray • Increase integration time in 5-sec steps up to a maximum of 60 sec Does XUV MON image lack intensity?"] 4["4 TV: • XUV MON GAIN sel - 7 Are test points visible?"] 5["5 Low intensity due to degradation of camera system"] 6["6 Is raster noise evident on TV display?"] 7["7 FAILURE OF CAMERA TUBE OR HIGH VOLTAGE POWER SUPPLY"] 8["8 Continue to operate TV TV: • XUV MON VID INTEG sw - INTEG and hold up to 60 secs"] 9["9 FAILURE IN CAMERA AMPLIFIER CIRCUIT"] 10["10 Discontinue use until advised via STDN"] 1 -- YES --> 2 1 -- NO --> 4 2 --> 3 4 -- YES --> 5 4 -- NO --> 6 5 --> 3 6 -- YES --> 7 6 -- NO --> 9 7 --> 10 9 --> 10 3 -- YES --> 10 3 -- NO --> 8 </pre>	

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XUV SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK ATM

SYMPTOM	PROCEDURE	REMARKS
10 S082B		
LIMB PTG TB FAILS TO INDICATE SC	1 TV: ● XUV SLIT LIMB PTG sw - LIMB PTG Is XUV SLIT LIMB PTG tb - PT? YES ↓ NO ↓ 2 FAILURE OF XUV SLIT LIMB PTG TB TO INDICATE SC 3 Continue to operate without XUV SLIT LIMB PTG tb 4 MONITOR: ● COUNTER 3 sel - LIMB OFFSET TV: ● XUV SLIT LIMB PTG sw - MAN STEP Does COUNTER 3 change by + 2 sec? YES ↓ NO ↓ 5 FAILURE OF XUV SLIT LIMB PTG TB 6 Continue to operate. Monitor LIMB PTG with LIMB OFFSET ind and MIRROR ind 7 FAILURE OF EXPERIMENT TO ENTER LIMB PTG STATE 8 MONITOR: ● COUNTER 3 sel - LIMB OFFSET MANUAL POINTING CONTROL: ● MPC - Manipulate, as required to determine if COUNTER 3 ind responds Does COUNTER 3 ind respond? YES ↓ NO ↓ 9 Experiment will not enter LIMB PTG state. Servo system is disabled. Discontinue use of LIMB PTG and AUTO STEP MODES until advised via STDN 10 FAILURE OF EXPERIMENT TO ENTER LIMB SC 11 Discontinue use of LIMB SCAN, LIMB PTG, and AUTO STEP MODES until advised via STDN	

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XUV SPECTROGRAPH

SKYLAB OPERATIONS HANDBOOK

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APPENDIX A SYMBOLS AND ABBREVIATIONS

<u>Symbol or Abbreviation</u>	<u>Definition</u>
A	Airlock Module
ACCUM	Accumulator
ACQ	Acquisition
ACQ SS	Acquisition Sun Sensor
ACS	Attitude Control System
ACT	Active
AL	Aluminum
alert lt	Alert Annunciator
ALIGN	Alignment
AM	Airlock Module
AMPS	Amperes
APCS	Attitude and Pointing Control System
APRT	Aperture
ASAP	Auxiliary Storage and Playback Assembly
ATM	Apollo Telescope Mount
ATMDC	ATM Digital Computer
ATT	Attitude
AUTO or AUT	Automatic
BAT	Battery
BE	Beryllium
bp	Barber pole
BRG	Bearing
bu	Backup
deg C	Degrees Centigrade
CAMR	Camera
cb	DC circuit breaker
CBRM	Charger Battery Regulator Module
CCW	Counter Clockwise
C&D	Controls and Displays
CGE	Cage
CHAN	Channel
CHG	Charge
CHGR	Charger
CLR	Clear
CM	Command Module
CMD	Command
CMG	Control Moment Gyro

SKYLAB OPERATIONS HANDBOOK

ATM

APPENDIX A (cont)

Symbol or Abbreviation	Definition
CMPTR or CMP	Computer Computer
CNT	Control
CNTRS	Counters
CONT	Continuous Patrol Mode
cont	Continuous Rotary Control
CRT	Cathode Ray Tube
CSM	Command and Service Module
CSTR	Canister
CTR	Counter
CW	Clockwise
DAS	Digital Address System
DC	Direct Current
DCS	Digital Command System
DECR	Decrease
DET	Detector
DISCH	Discharge
DN	Down
DR	Door
E	Enter
ELEC	Electronics
EMERG	Emergency
ENA	Enable
ENTR	Enter
EPC	Experiment Pointing and Control Subsystem
EPEA	Experiment Pointing Electronics Assembly
EPS	Electrical Power System
ESR	Effective Sunrise
ESS	Effective Sunset
EVA	Extra Vehicular Activity
EXP or exp	Experiment
EXTD STD	Extended Standard Patrol Mode
deg F	Degrees Fahrenheit
FLR	Flare
FM	Frequency Modulation
FPM or FR/MIN	Frames per Minute
FR	Frames
FSS	Fine Sun Sensor
FWD	Forward
GEN	Generator
GG	Gravity Gradient
GRD	Ground

SKYLAB OPERATIONS HANDBOOK

ATM

APPENDIX A (cont)

<u>Symbol or Abbreviation</u>	<u>Definition</u>
H	Momentum
HA	Hydrogen Alpha
HARC	HA Reticle Controller
HR	Hour
HTR	Heater
HV	High Voltage
Hz	Hertz (Cycles per second)
I&C	Instrumentation and Communications
IG	Inner Gimbal
IN	Inlet
INCR	Increase
ind	Meter or digital display
ind pwr fail lt	Indicator power fail light
ind scale lt	Indicator scale light
INH	Inhibit
INIT	Initiate
INTEG	Integrate
INTEN	Intensity
INV	Inverter
IU	Instrument Unit
IVA	Intra Vehicular Activity
L	Left
LCA	Lighting Control Assembly
LG	Long (wavelength)
LK	Locked
lt	Light
LTG	Lighting
LTH	Length
LV	Low Voltage
LVDC	Launch Vehicle Digital Computer
M	Multiple Docking Adapter or Momentary (on Switch)
MAN	Manual
MCC	Mission Control Center
MDA	Multiple Docking Adapter
MET	Mission Elapsed Time
MIN	Minute
MIR	Mirror
MODC	Manual Occulting Disc Controller

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APPENDIX A (cont)

<u>Symbol or Abbreviation</u>	<u>Definition</u>
MON	Monitor
MPC	Manual Pointing Hand Controller
MULT	Multiplier
NMI	Nautical Miles
NT	Night
OA	Orbital Assembly
OG	Outer Gimbal
OPN	Open
OPR	Operate
OPT	Optical
ORB	Orbit
OUT	Outlet
OVRD	Override
OWS	Orbital Workshop
P or PRESS	Pressure
PB	Playback
PCM/DDAS	Pulse Code Modulation/Digital Data Acquisition System
POS	Position
PRI or PRIM	Primary
PROG	Program
psia	Pounds per square inch - absolute
psid or ΔP	Pounds per square inch - differential
psig	Pounds per square inch - gauge
PT	Pointing (limb) mode
PTG	Pointing
PWR or pwr	Power
R	Right
RCD or REC	Record
RCS	Reaction Control System
Re/RV	Radius of Earth/Radius of Vehicle
REF or ref	Reference
REG	Regulator
REJ	Reject
RF	Radio Frequency
RG	Rate Gyro

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APPENDIX A (cont)

<u>Symbol or Abbreviation</u>	<u>Definition</u>
RGP	Rate Gyro Package
RPM	Revolutions per minute or Roll Positioning Mechanism
RSLVR	Resolver
RT	Real Time
SAP	Solar Activity Pad
SC	Scan (Limb) mode
SCAN SPECT	Scanning Spectroheliograph
SEC	Secondary
sec	Second(s)
SEL or sel	Selector
SEQ	Sequence
SI	Solar Inertial
SPD	Speed
SRNBM	Solar Radio Noise Burst Monitor
ST	Star Tracker or Short (wavelength)
STBY or STY	Standby
STD	Standard Patrol Mode
STDN	Spaceflight Tracking and Data Network
STR	Star
Sw	Switch
SWS	Saturn Workshop
SYNC GEN	Sync Generator
SYS	System
t	Time
tb	Talkback
TACS or TAC	Thruster Attitude Control System
TBD	To be determined
TBS	To be supplied
TCS	Thermal Control System
TELE	Telescope
TEMP or temp	Temperature
THRM	Thermal
TLM or TM	Telemetry
TV	Television
tw	Thumbwheel control
UHF	Ultra High Frequency
UV	Ultra Violet
V	Volts
VAR	Variable
VC	Center Work Station
VDC	Volts, Direct Current

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APPENDIX A (cont)

<u>Symbol or Abbreviation</u>	<u>Definition</u>
VF	Fixed Airlock Shroud Work Station
VHF	Very High Frequency
VID	Video
VOL	Volume
VS	Sun End Work Station
VT	Transfer Work Station
WCIU	Workshop Computer Interface Unit
WHL	Wheel
WL	White Light
WLC	White Light Coronagraph
X-REA	X-Ray Event Analyzer
XUV	Extreme Ultra Violet
Z-LV or ZLV	Z axis to Local Vertical

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APPENDIX B

PANEL ARRANGEMENT

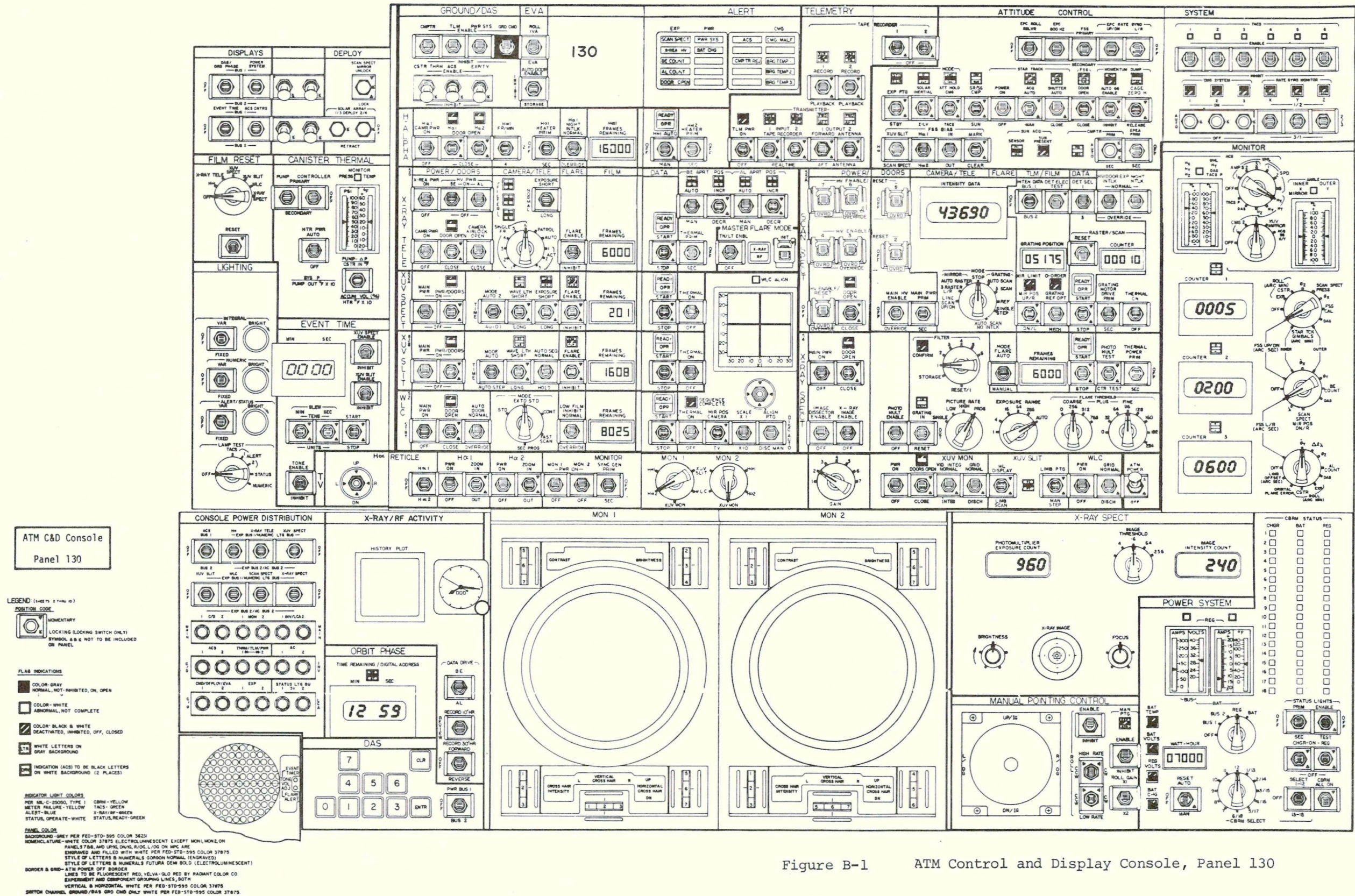


Figure B-1 ATM Control and Display Console, Panel 130

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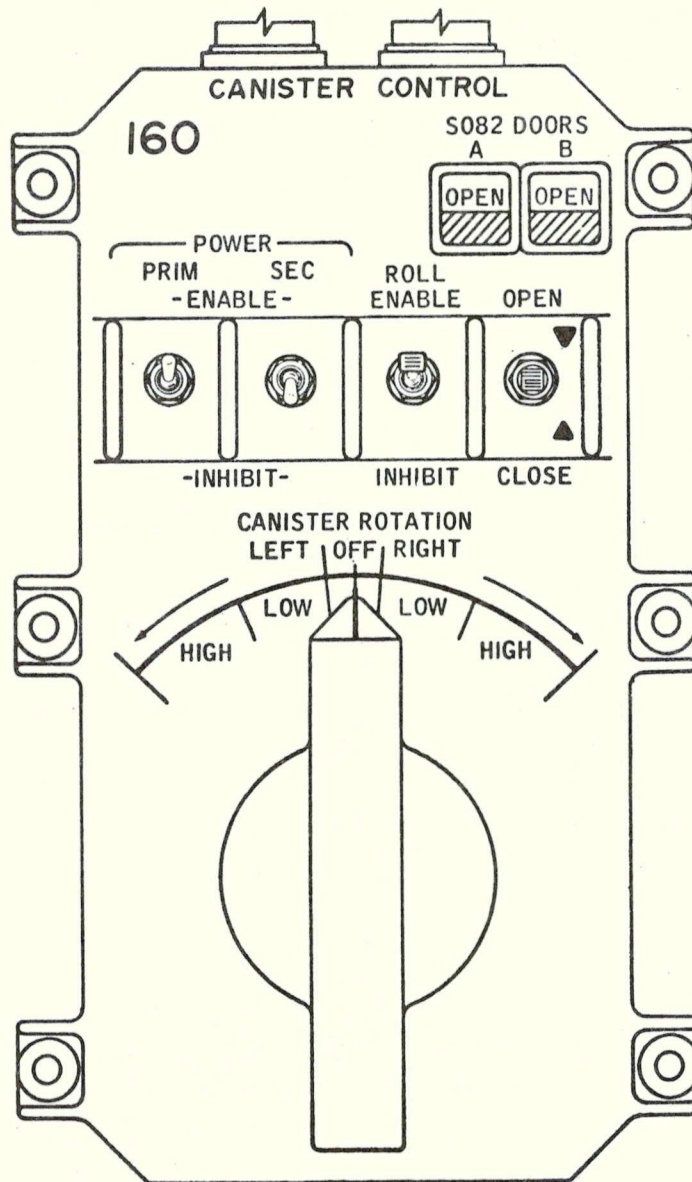


Figure B-2 ATM Center Workstation Rotation Control
(Panel 160)

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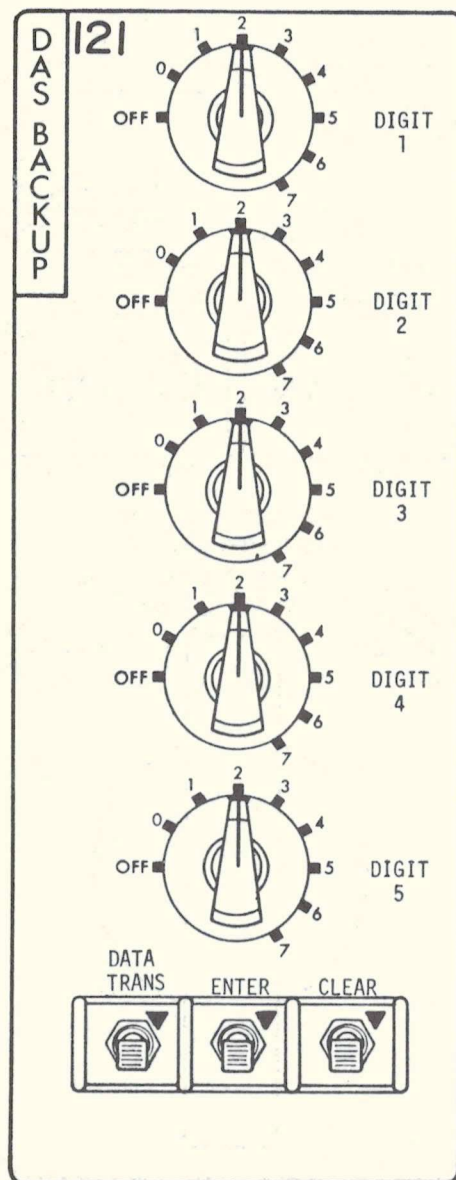


Figure B-3 ATM Backup Digital Address System (DAS)
(Panel 121)

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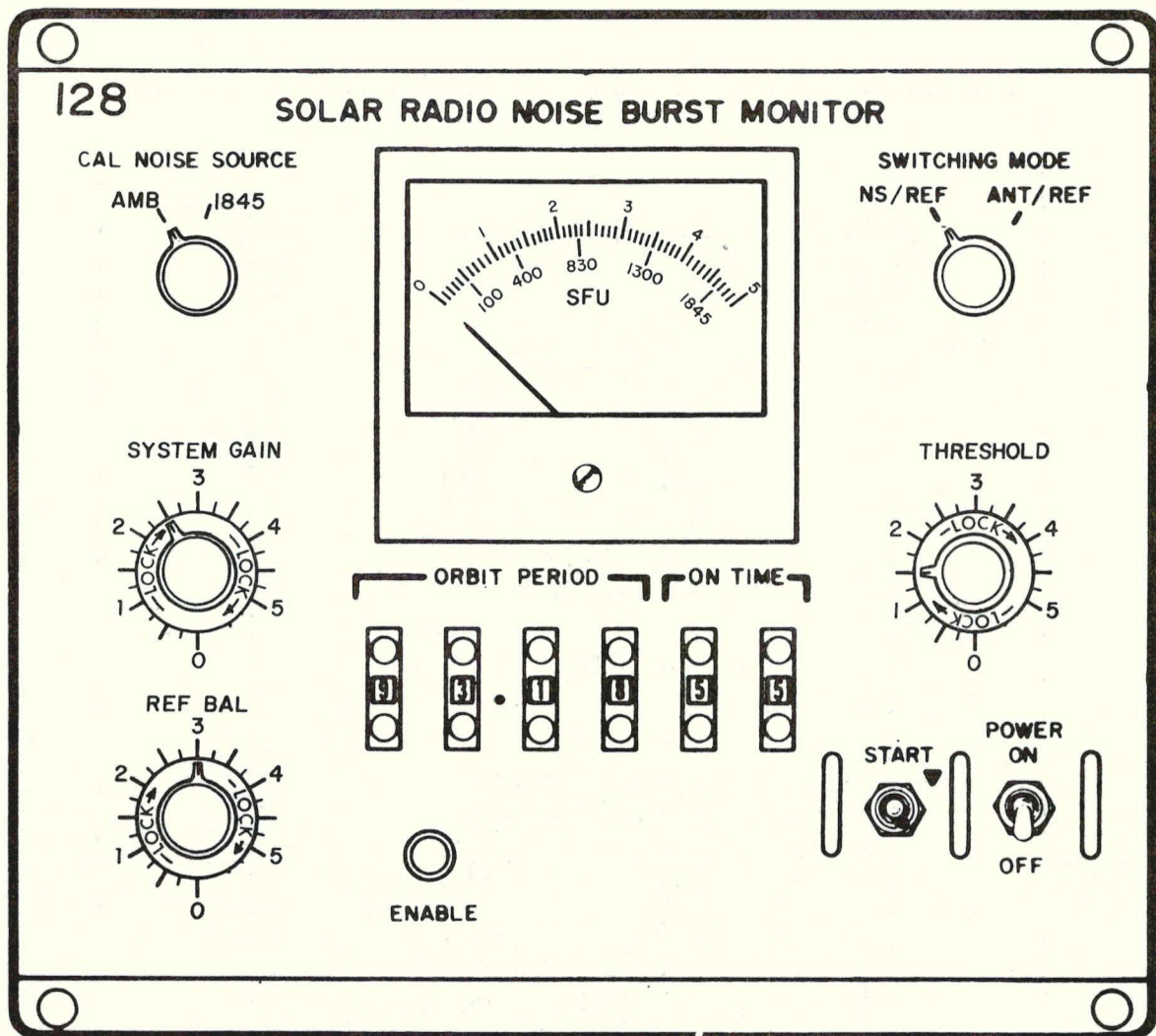


Figure B-4. Solar Radio Noise Burst Monitor (2),
Panels 128 (Upper) and 129 (Lower)

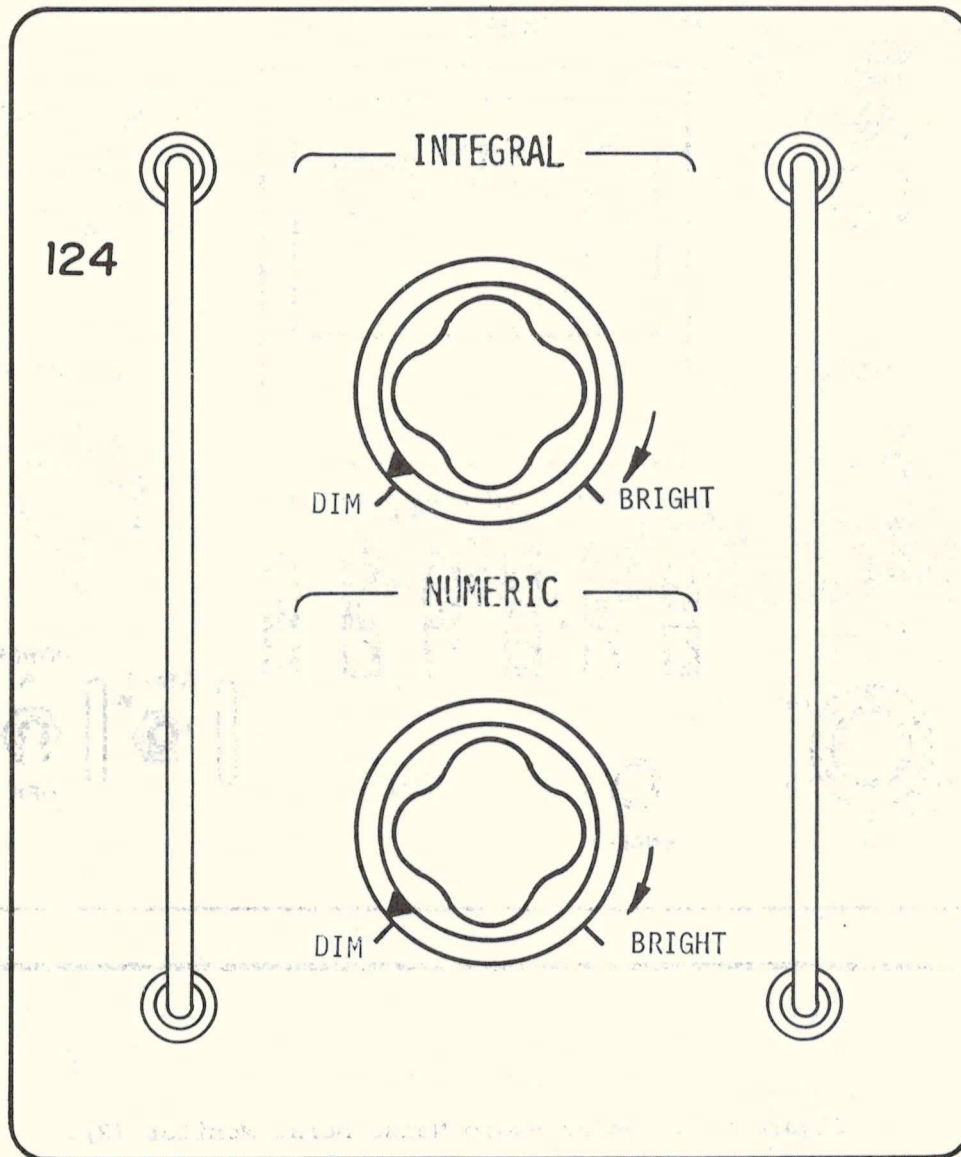


Figure B-5 BU I/LCA Control Panel
(Panel 124)

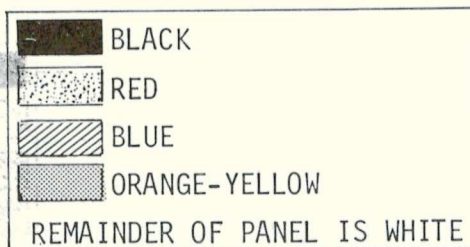
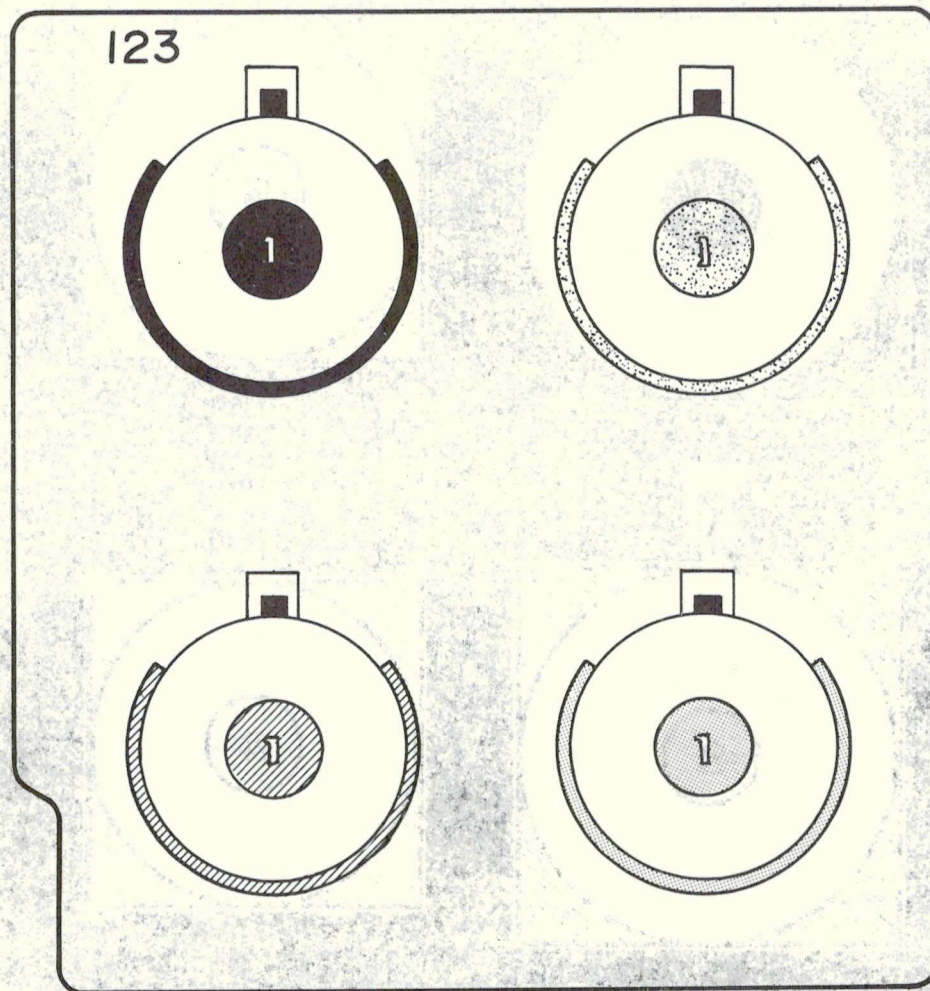
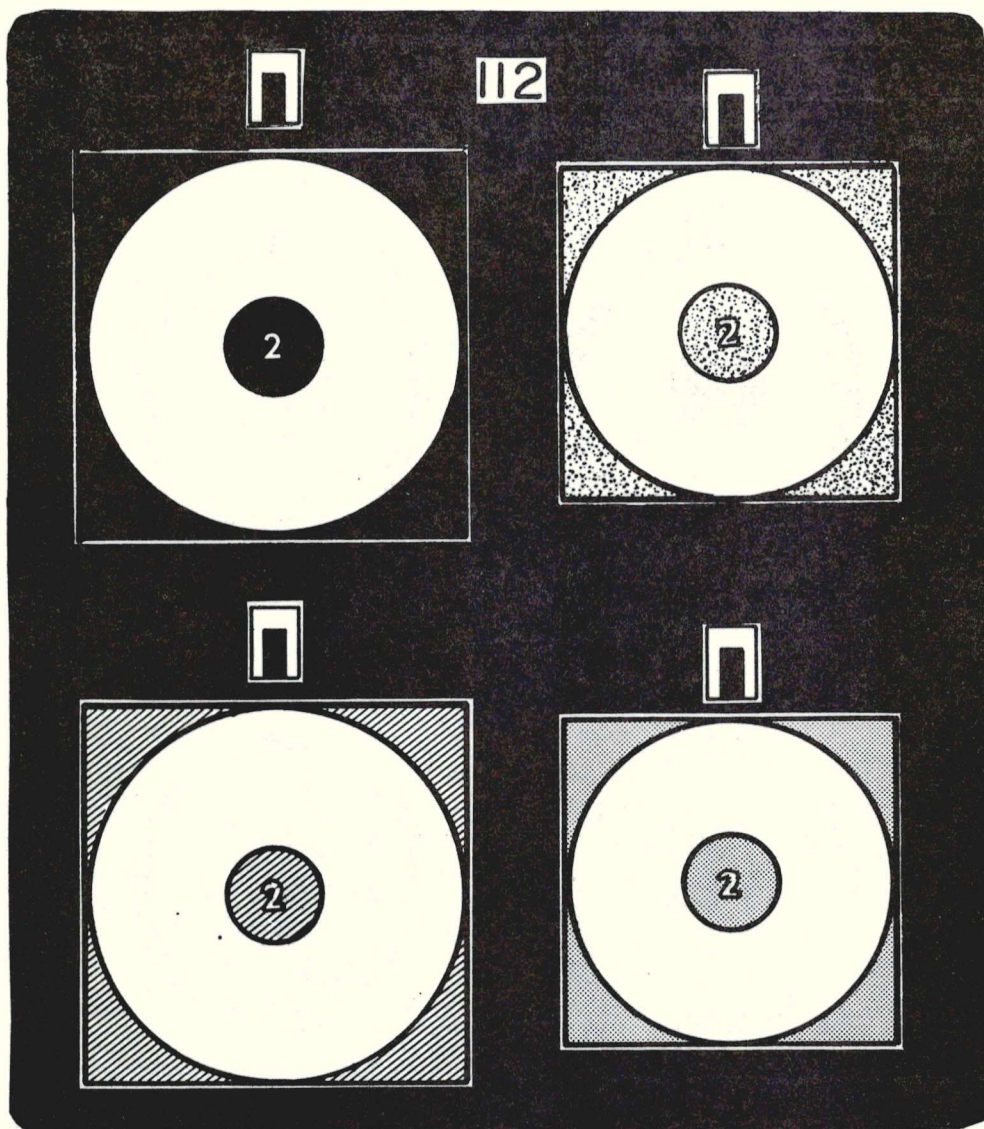


Figure B-6 BU I/LCA Connector Panel
(Panel 123)

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	BLACK
	RED
	BLUE
	ORANGE-YELLOW
REMAINDER OF PANEL IS BLACK	

Figure B-7 BU I/LCA Patch Plug Stowage Panel
(Panel 112)