NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SL-3

SECOND SKYLAB MISSION

FINAL

ATM JOP SUMMARY SHEETS

PREPARED BY
EVA & EXPERIMENTS BRANCH
CREW PROCEDURES DIVISION

National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER
Houston, Texas

JULY 9, 1973

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DAS

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Building Blocks	Denis L. Dahms	483-4371 Bldg. 4, Rm. 213A
JOP 13	Tony Calvello	483-3433 Bldg. 35
DAS Codes DAS FUNCTIONAL ATMDC PROG LOGIC ALERT, C/W, TB, ST TRK ATMDC PROG OVERVIEW C&D BUSSES CONTROL LAWS, CONTROL LOOP	William B. Leverich	483-2651 Bldg. 4, Rm. 450

CHANGE CONTROL RECORD

SL 3 ATM JOP SUMMARY SHEETS CHECKLIST

CONTROL NO.	FDF EDITION INCORPORATED		DISAPPROVED OR OTHER DISPOSITION
	TITLE	DATE	
001 THRU 030	FINAL CHANGE C SL-2	5/1/73	
031	ATM DC PROG OVERVIEW	6/13/73	
032	ATM CONTROL LAWS	6/13/73	
033	CHGS TO ATM PROG OVERVIEW	7/2/73	
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SKYLAB
ATM JOP SUMMARY SHEETS

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Summary Sheet Guidelines

1. Setup times have been developed according to the following guidelines and have subsequently been verified by crew simulations.

   a. Grating selection - average 3 min. (Selection time usually begins prior to start of pointing).

   b. Fine pointing (and roll) at a target from an arbitary pointing and roll requires 2 min. Network cells and bright spots require an additional 3 or 4 min for search time.

   c. Maximizing or minimizing DET 1 or 3 requires 1 minute.

   d. Nearly all JOP's assume that each step may be accomplished independently of any other. In those cases where steps are performed back to back with little change in pointing, roll and grating position the setup time can be reduced accordingly (never below 1 min).

   The results of future crew simulations or mission experience will be used to modify the setup time if necessary.

2. Generally if a BB must be deleted or truncated it should be the last one scheduled for that pass. The P.I.'s will attempt to schedule the highest priority Building Blocks at the beginning of the pass.

3. If the scheduled operations are interrupted for any reason, the crew and P.I. will not attempt to reschedule that day those BB's which were not completed. BB1 is an exception. The crew will complete BB1 in the next orbit, if possible.

4. At times the P.I.s will schedule a BB in a JOP which is not listed on that JOP Summary Sheet. In that case the ATM Schedule Pad will indicate the BB desired and the JOP and step number for pointing and roll information. The following notation will appear in the COMMENTS section:

   SUB 23 FOR 13
   PTG, ROLL SAME
   AS JOP 5 (6)

   The crewman will use the BB cue cards if necessary.

   For BB additions requiring changes to pointing and roll information of a particular JOP, the pointing and roll required must be completely specified in the COMMENTS section.

5. All coordinates given on the ATM Schedule and Solar Activity Pads will be assumed to be suggested coordinates unless the words "PRECISE COORD" accompanies them.

6. JOP 1
   The BB sequences in 1A and 1B should be performed by the same crewman to insure that the same network cell boundary is relocated.

   JOP 1 coordinates given on the PAD for JOPS 1A,1B and 1D will give the crewman the region within which to find a network cell.

7. JOPS 2 and 4
   Repetitions of BB's or pointings on a target will be accomplished at different positions unless specified otherwise by the summary sheets or PADS.

8. JOP 5
   The same crewman should perform as many of the BBs composing a latitude scan as possible.

9. JOP 8
   JOP 8A will be initiated on any eruptive prominence, disappearing filament, or surge (Hα or XUV) (outside .7R) that the crewman considers to be significant based on previous crew training.

   JOP 8B will be initiated by the crewman whenever a white light structure moving out through the corona is observed. Significant changes in the shape of a white light structure occuring over the period of 1 or 2 orbits will result in crew initiation of JOP 8B. Other changes in shape noted will be reported to the ground prior to JOP 8B initiation.

10. JOP 12
    The Scientist Pilot should be scheduled for this JOP when possible.

11. JOP 13
    The Scientist Pilot must be scheduled for this JOP.

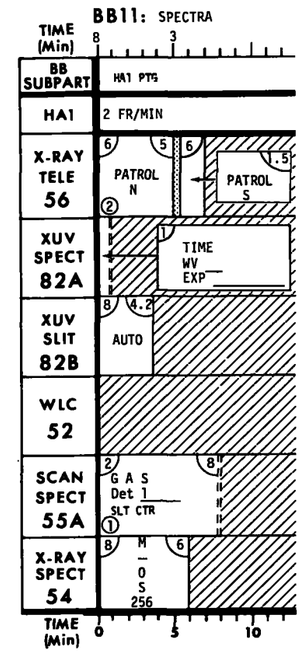
12. JOPS 15 and 17
    The BB sequences in 15A and 17A/B should be performed by the same crewman to insure that the bright spot is relocated and the coronal hole pointings sample the areas desired. Unless the PAD indicates that the coordinates are exact, the crewman will assume the coordinates are suggested (See 5.) and improve the pointing using XUV MON photographs and Image Persistence Scope (IPS).

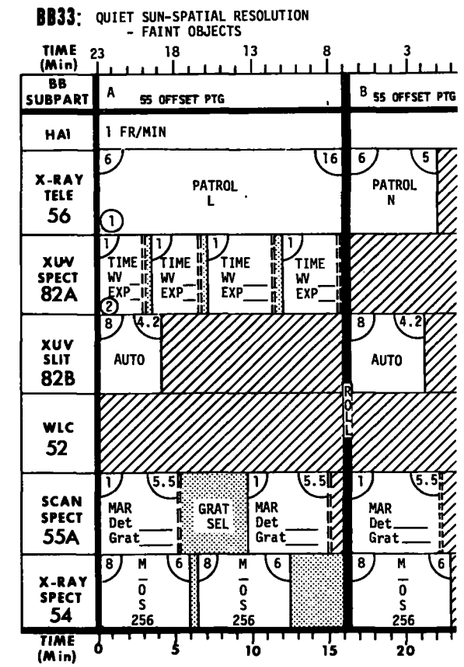
13. JOP 16
    JOP 16 will be initiated by the crewman based on previous crew training.

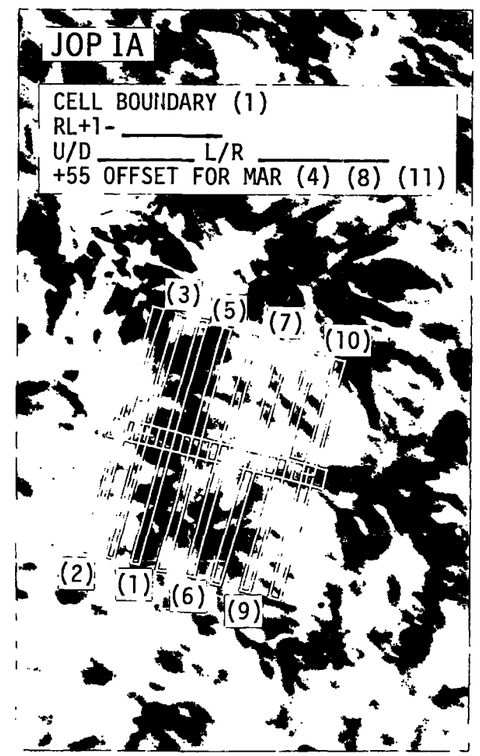
14. Permanent changes to the JOP Summary Sheets will be made via a special teleprinter change message with the change formatted such that the change can be taped on the summary sheet, if necessary. The change message should indicate all FDF material affected.

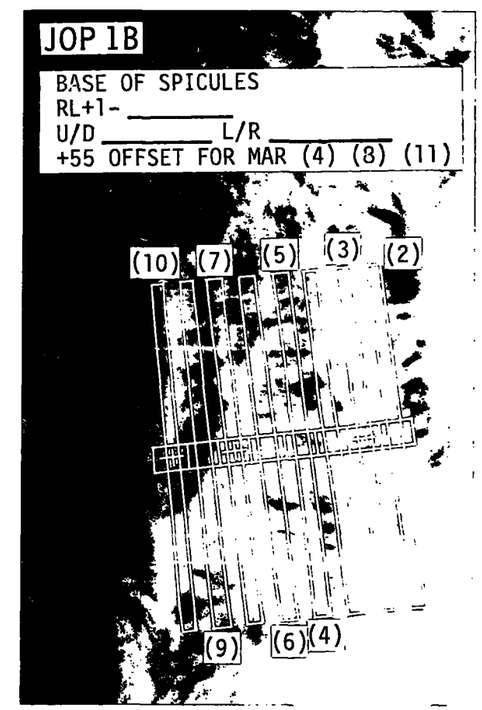
JOP 1A - CHROMOSPHERIC NETWORK: NETWORK STRUCTURE NEAR SUN CENTER (R <.5 R⊙)
1B - CHROMOSPHERIC NETWORK: WITHIN 2 ARC MIN OF LIMB

Step	BB	TARGET	ΔT/ΣΔT
		1A NEAR SUN CENTER The network cell should be centered in a quiet area (R <.5R⊙) A network cell having a long straight boundary approximately 1 arc min long. If the selected cell disappears between daylight passes or cannot be relocated select a nearby boundary and continue observations. (free of plages, filaments, or other signs of activity) or near an Active Region (see PAD for approximate pointing coordinates). 1B WITHIN 2 ARC MIN OF LIMB The network cell should be in a quiet area (free of plages, filaments, or other signs of activity) or near an Active Region (See PAD for approximate pointing coordinates).	
(1)	11	•1A-Point Hα1 at the boundary of a well defined network cell (dark and bushy clumps in Hα) •1B-Point Hα1 at the base of selected cell boundary which is nearest sun center. •Roll 82B slit for uniform dark Hα mottling along slit. •Maximize DET 1 or 3 by slewing left and right. •Log pointing coordinates (on photograph) and sketch position of 82B slit with respect to cell boundary.	SU: 8 8/16
(2)	11	•Point Hα1 to a position 10 arc secs off boundary and away from cell interior (toward suncenter for 1B). • Roll same as (1).	SU: 2 8/10
(3)	11	•Point Hα1 to a position 5 arc sec off boundary and away from cell interior (toward suncenter for 1B). •Roll same as (1).	SU: 2 8/10
(4)	33B	•Point 55 OFFSET up approximately 85 arc sec to center 55 MAR on network cell. •Roll same as (1).	SU: 3 6/9
(5)	11	•Use pointing coordinates in (1) to locate and point Hα1 at cell boundary. •Roll same as (1). •Maximize DET 1 or 3 by slewing left and right •Point Hα1 to a position 5 arc sec off boundary and towards cell interior (toward limb for 1B).	SU: 5 8/13
(6)	11	•Point Hα1 to a position 10 arc secs off boundary and towards selected cell interior (toward limb for 1B). •Roll same as (1).	SU: 2 8/10
(7)	11	•Point Hα1 to a position 15 arc secs off boundary and towards selected cell interior. •Roll same as (1).	SU: 2 8/10
(8)	33B	•Point 55 OFFSET up approximately 85 arc secs to center 55 MAR on network cell. •Roll same as (1).	SU: 3 6/9
(9)	11	•Use pointing coordinates in (1) to locate and point Hα1 at cell boundary. •Roll same as (1). •Maximize DET 1 or 3 by slewing left and right. •Point Hα1 to a position 20 arc secs off boundary and towards cell interior (toward limb for 1B).	SU: 5 8/13
(10)	11	•Point Hα1 to a position 25 arc secs off boundary and towards cell interior (toward limb for 1B). •Roll same as (1).	SU: 2 8/10
(11)	33A	•Roll 82A XUV dispersion clear of network cell. •Point 55 OFFSET up approximately 85 arc secs to center 55 MAR on network cell.	SU: 3 16/19



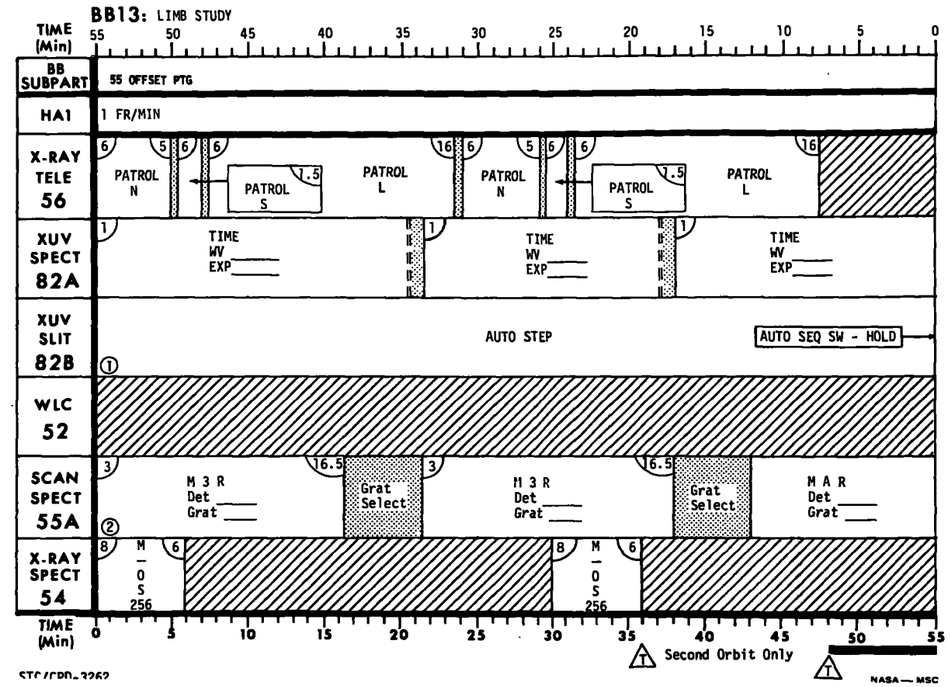






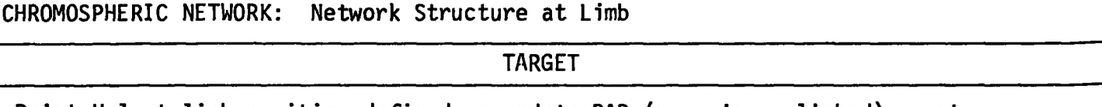
JOP 1C - CHROMOSPHERIC NETWORK: Network Structure at Limb

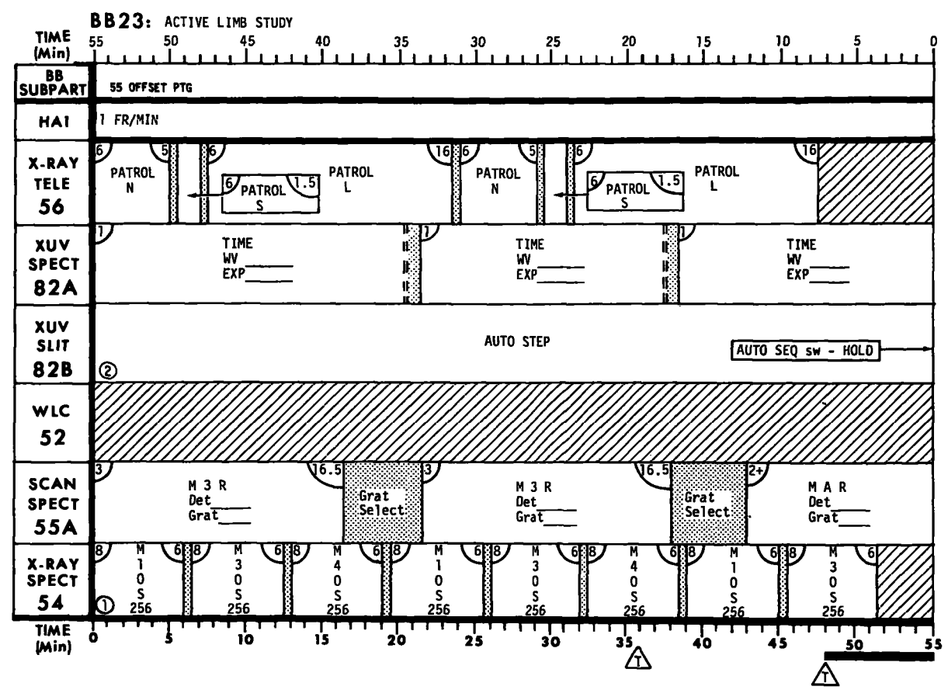
Step	BB	TARGET	ΔT/ΣΔT
(1)	13 or 23	• Point Hα1 at limb position defined on update PAD (or voice uplinked) or at a position on the Hα inner limb where spicules are undisturbed by active regions. • Roll 82B slit tangent to white light limb (U/D 0000, R/L = R⊙). • Record pointing coordinates RL+_____ U+/D-_____ L-/R+_____ if JOP 1C is to be continued in the next orbit. • Select LIMB SCAN, MPC to LIMB OFFSET - 0000±5, then select LIMB PTG. • Record 82B FRAMES REMAINING before AUTO STEP initiation. _____ • Start 82B AUTO STEP • Go to AUTO SEQ - HOLD before ESS and record FRAMES REMAINING. _____ FRAMES DELTA _____ • After SUNSIDE PREP, repoint slit tangent to white light limb, select LIMB SCAN and using MPC point to LIMB OFFSET position determined from FRAMES DELTA (See 82B LIMB SCAN DIAGRAM). • Select LIMB PTG and AUTO SEQ - NORMAL.	SU: 4 48/52



82B LIMB SCAN DIAGRAM

Frames used:	0-7	8-15	16-23	24-31	32-39	40-47	48-55	56-63	64-71	72-80
New LIMB OFFSET:	-12"	-4"	-2"	+0"	+2"	+4"	+6"	+8"	+12"	+20"
Time (minutes):	4.2	4.2	4.2	4.2	17.9	17.9	17.9	17.9	28.6	28.6



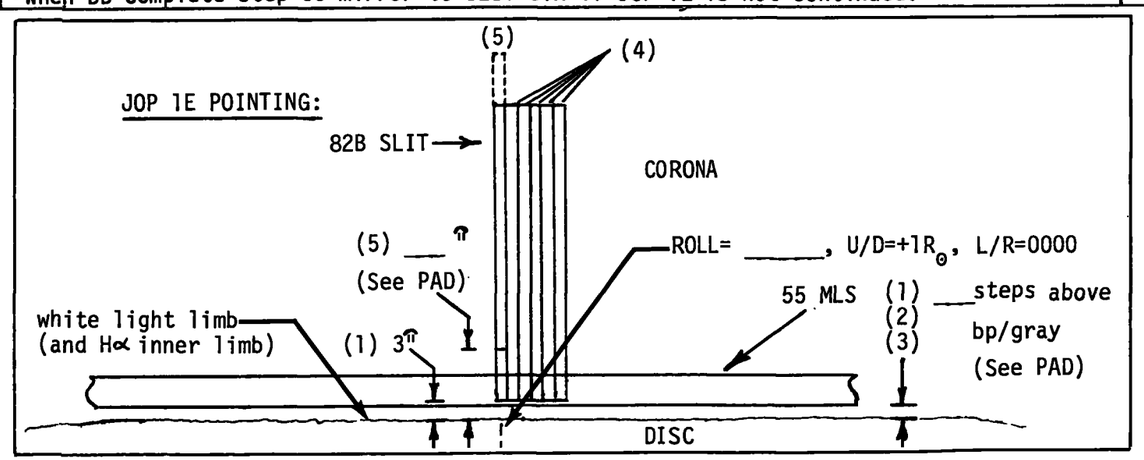


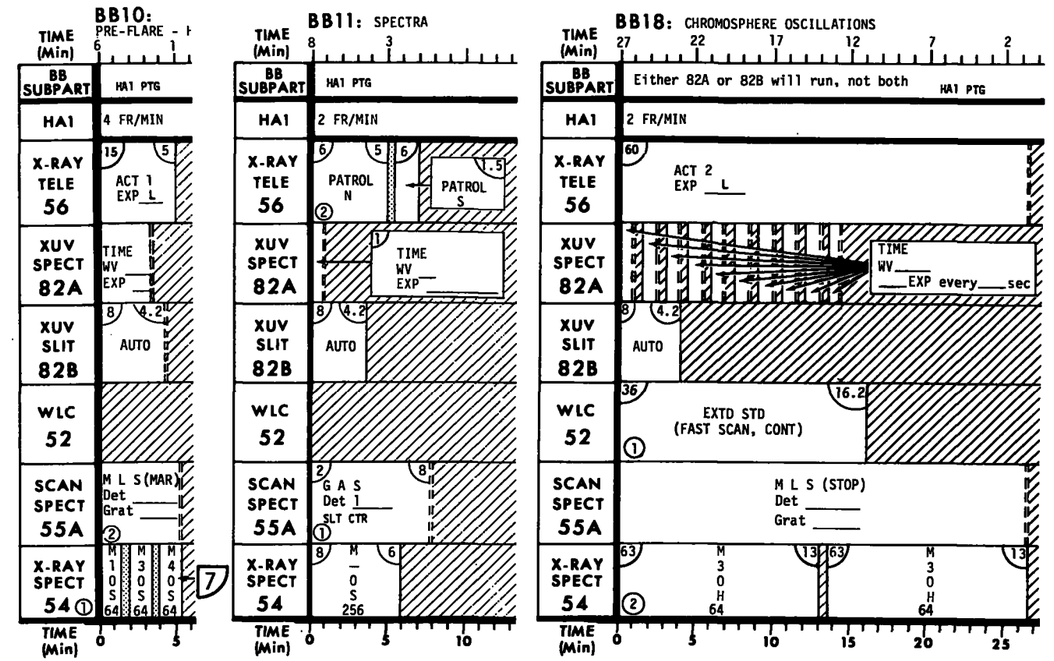
JOP 1D - CHROMOSPHERIC NETWORK: Short Term Evolution

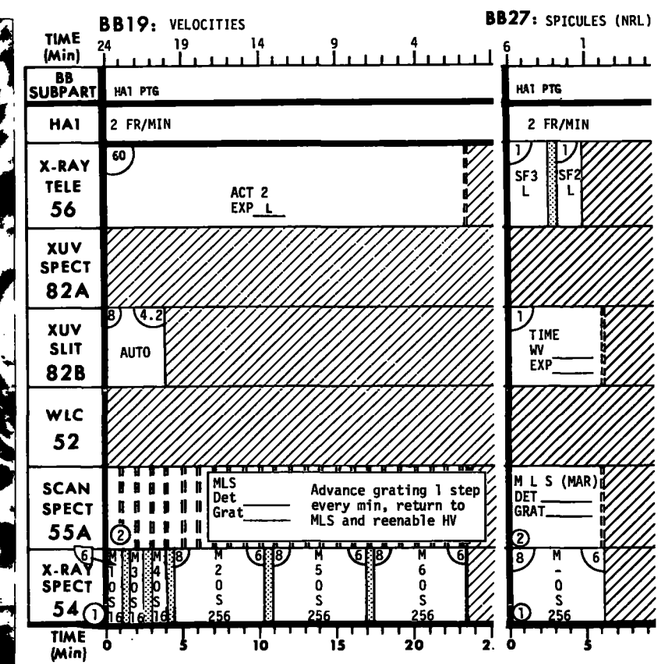
Step	BB	TARGET	ΔT/ΣΔT
(1)	11	•Point Hα1 at the boundary of a well-defined network cell boundary (dark and bushy clumps in Hα). •Roll 82B slit for uniform dark Hα mottling along slit. •Maximize DET 1 or 3 by slewing left and right.	SU: 6 8/14
(2)	11	•Do not adjust pointing or roll from (1) and repeat BB11.	SU: 2 8/10

JOP 1E - SPICULES AT THE LIMB

Step	BB	TARGET	ΔT/ΣΔT
(1)	10	•Point Hα1 at limb position defined on PAD (placing 82B slit perpendicular to the limb where spicules are distinct). •Place end of 82B slit tangent to white light limb, then point 3 arc secs off limb. Record RL +/- _____ U/D 1R L/R 0000 •Step 55 aperture on to disk (about +/- 6 steps from slit center, o-order flag gray), then step back off limb _____ steps (See PAD).	SU: 6 8/14
(2)	18 or 19	•Pointing and roll same as (1). •Omit 52 from BB18. •When BB complete step 55 mirror to SLIT CTR if JOP 1E is not continued.	SU: 3 26/29 or SU: 3 24/27
(3)	10 or 27	•Pointing and roll same as (1). •When BB complete step 55 mirror to SLIT CTR if JOP 1E is not continued.	SU: 3 6/9
(4)	27	•Pointing and mirror position same as (1). •Change roll (Sun center roll) - 7 arc min clockwise (CW) from last performance of steps 1 or 4. This roll moves 82B slit 2 arc secs around limb. •When BB complete step 55 mirror to SLIT CTR if JOP 1E is not continued.	SU: 3 6/9
(5)	27	•Point radially oriented 82B slit 3 arc secs above coordinate last used in step(1)or(5). •Roll same as (1). •When BB complete step 55 mirror to SLIT CTR if JOP 1E is not continued.	SU: 3 6/9

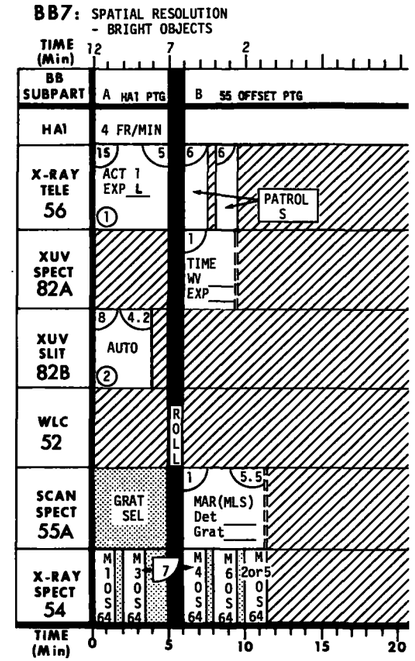




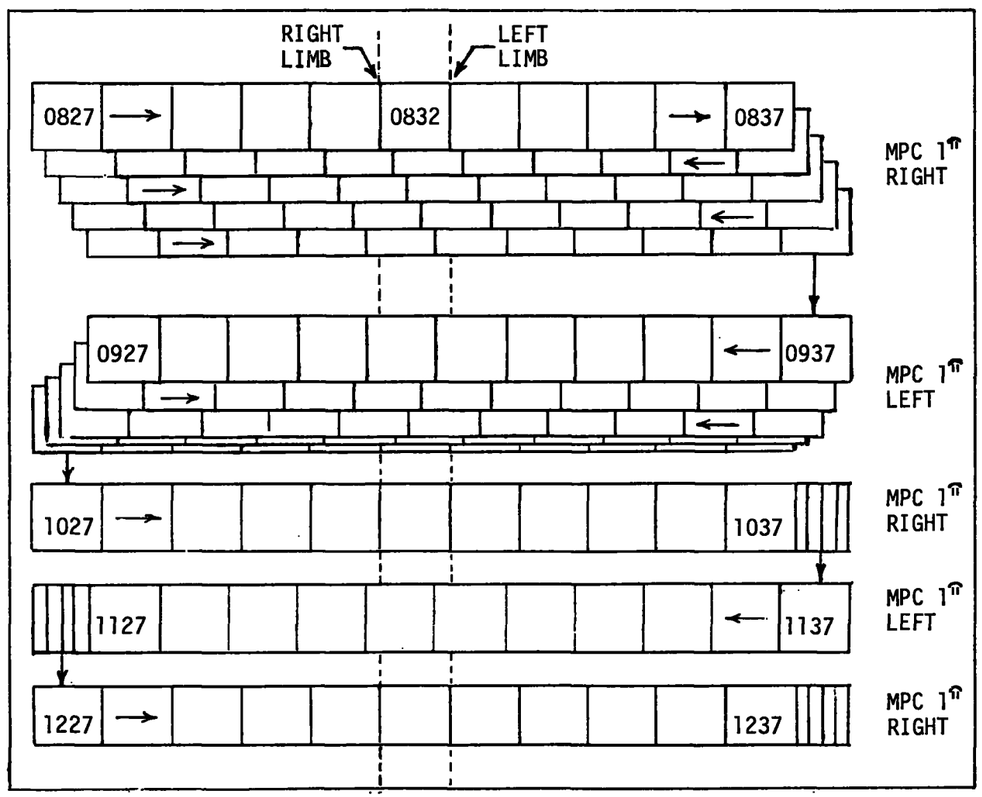


JOP 1F - CHROMOSPHERIC NETWORK: Coronal Transition Region - S055A

Step	BB	new TARGET	ΔT/ΣΔT
(1)	7B	•Point Hα1 at the limb near a quiet or active region (See PAD) RL _____ U/D 0000 L/R 1R •Slowly slew left and right to 55 bp to gray change and record L/R _____	SU:4 6/10
In step		(2) only 55 operates with DET and GRAT same as (1).	
(2)		•Pointing and roll same as (1). •"Ready" light remains on for entire procedure. •Step 55 mirror to 0827. a) Step 55 mirror across the limb to 0837 pausing approximately 1 sec at each step. b) Repoint Hα1 right 1 arc sec and step 55 mirror back to 0827, pausing 1 sec at each step. c) Repoint Hα1 arc sec right and repeat parts a) and b) until limb has been crossed 5 times. d) Step 55 mirror to 0937, repeat scan procedure moving left in 1 arc sec increments. e) Repeat the procedure stepping the 55 mirror along lines 10, 11, and 12. Repoint right for lines 10 and 12, and left for line 11 in 1 arc sec increments.	SU:1 20/21

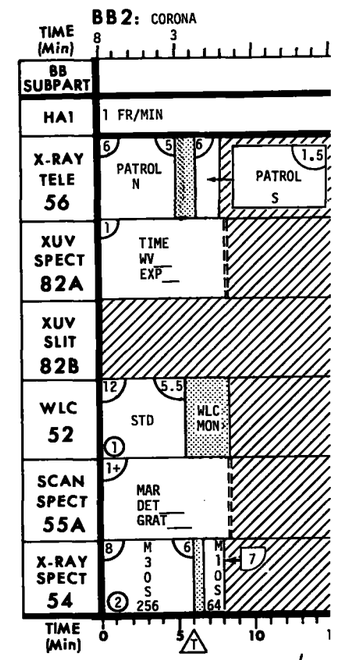


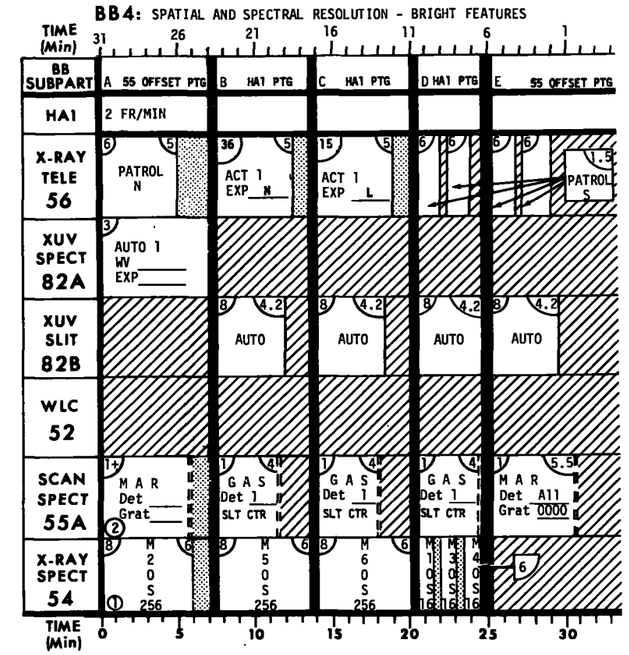
55 MINI-MAR DIAGRAM



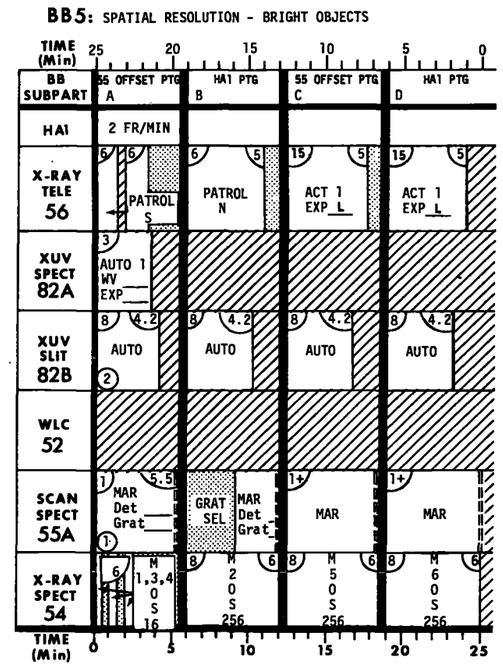
JOP 2A - ACTIVE REGIONS: Rapidly Developing

Step	BB	TARGET	ΔT/ΣΔT
(1)	4A	• Roll 82A XUV dispersion clear of active region. • Point 55 OFFSET so that 55 MAR covers points most likely to flare in active region. • Record pointing coordinates RL+/- _____ U+/D-_____ L-/R+_____.	SU: 4 7/11
	B	• Point Hα1 at Hα bright point in a XUV bright area likely to flare. • Roll 82B slit for uniform Hα emission (and parallel to the neutral line, if possible). • Maximize DET 1 or 3.	SU: 3 6/20
	C	• Repeat B at second Hα bright point in a XUV bright area likely to flare.	SU: 3 6/29
	D	• Point Hα1 at a third Hα bright point in a XUV bright area likely to flare.	SU: 2 6/37
	E	• Pointing and roll same as A. • Repoint 82B slit for uniform emission.	SU: 2 6/45
(2)	5A	• Roll 82A XUV dispersion clear of active region and 82B slit for Uniform emission (plage or quiet backgound), if possible. • Point 55 OFFSET so that 55 MAR covers points most likely to flare. • Record pointing coordinates RL+/- _____ U+/D- _____ L-/R+ _____.	SU: 4 6/10
	B	• Point Hα1 at a bright point in a XUV bright area likely to flare. • Roll 82B slit for uniform emission (and parallel to neutral line, if possible).	SU: 2 6/18
	C	• Pointing and roll same as 5A. • Repoint 82B slit for uniform emission.	SU: 2 6/26
	D	• Point Hα1 at a bright point in an XUV bright area likely to flare. • Roll 82B slit for uniform emission (and parallel to neutral line, if possible).	SU: 2 6/34
(3)	2	• Point 52 to sun center. • Roll to position active region at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of active region (if possible).	SU: 3 8/11

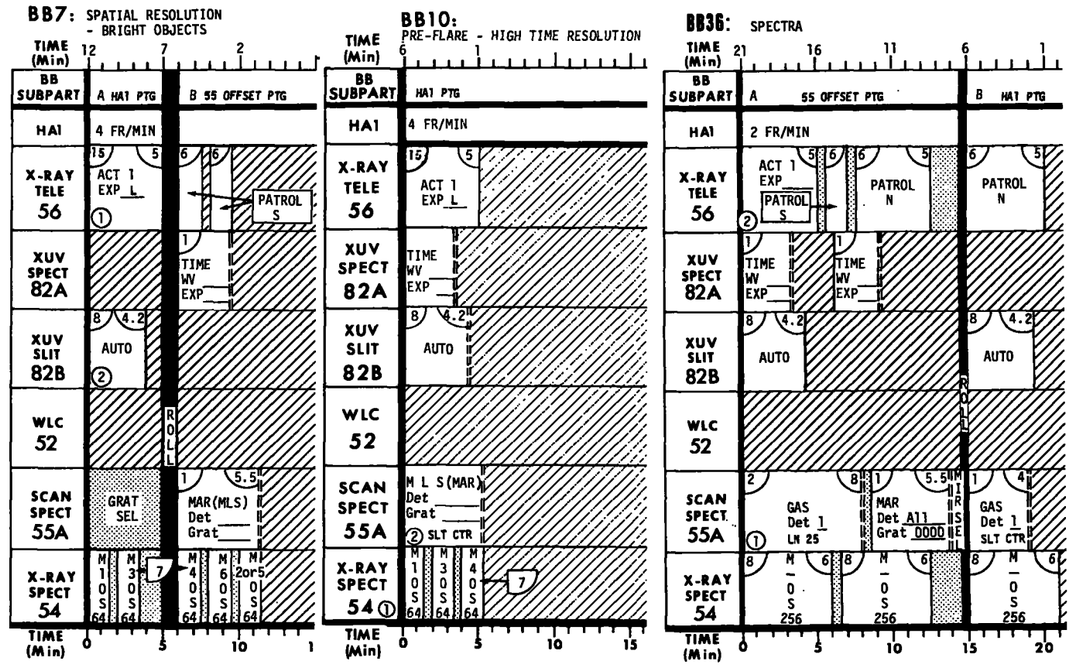


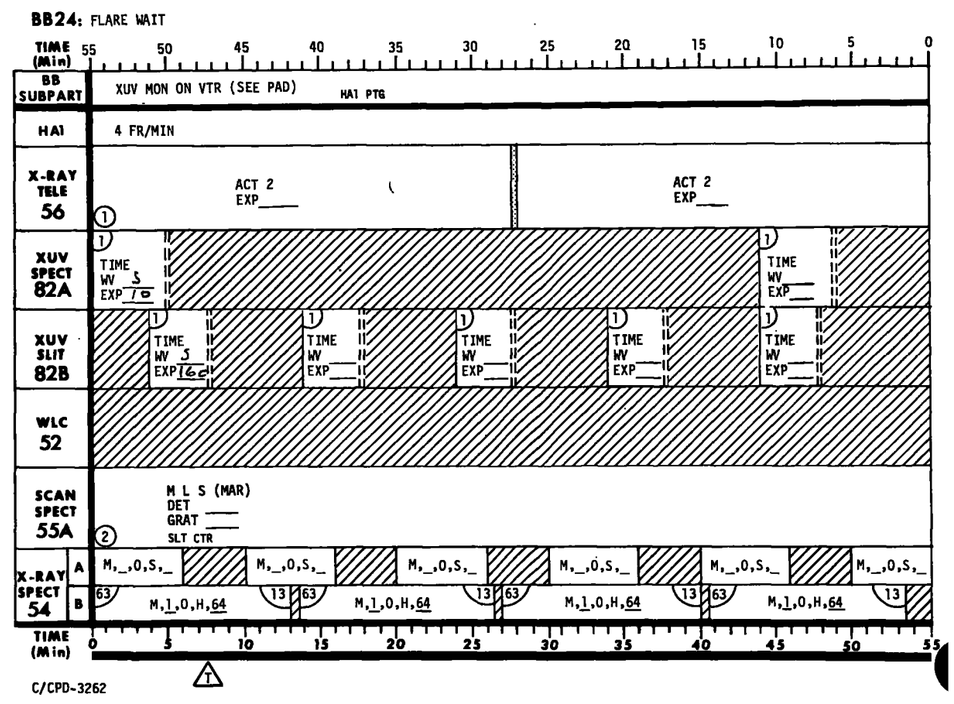


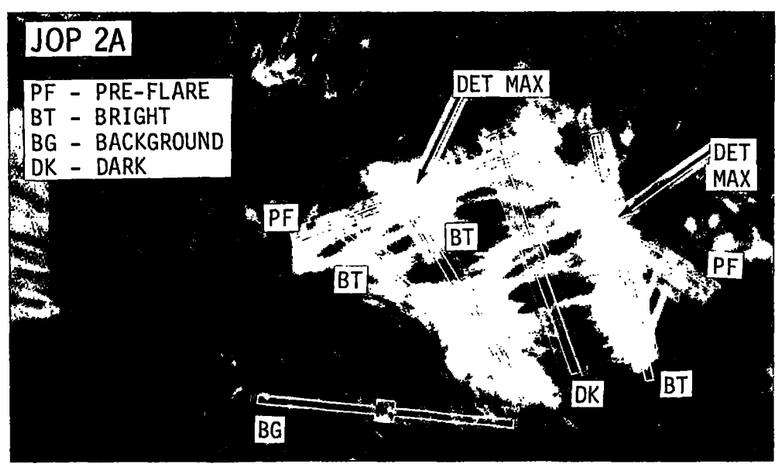
4 better-than 5 for NRL



(4)	36A	• Step 55 mirror to line 25. • Roll 82A XUV dispersion clear of active region. • Point 55 OFFSET AT Hα bright spot (or at PAD coordinates). • Maximize DET 1 or 3. • After 55 MAR, step 55 mirror to SLIT CTR.	SU: 4 14/18
	B	• Point Hα1 at the same Hα bright spot. • Roll 82B slit for uniform emission. • Maximize DET 1 or 3.	SU: 3 6/27
(5)	36B	• Point Hα1 at an area adjacent to (4) with uniform Hα background (or at • PAD coordinates). • Roll for uniform emission along 82B slit.	SU: 3 6/9
(6)	7A	• Point Hα1 at a Hα area likely to flare. • Roll 82B slit for uniform Hα emission (and 82A XUV dispersion clear of active regions if possible).	SU: 3 5/8
	B	• Roll 82A XUV dispersion clear of active region. • Point 55 OFFSET so that 55 MAR covers points most likely to flare in an active region.	SU: 2 6/16
		<u>If BB10s are scheduled sccessively on the PAD do not change pointing</u>.	
(7)	10	• Point Hα1 at Hα area likely to flare. • Roll 82B slit for uniform emission (and 82A XUV dispersion clear of active region if possible).	SU: 3 6/9
(8)	24	• Point Hα1 at neutral line in active region at a point likely to flare. • Roll 82B slit parallel to neutral line and for uniform Hα emission (if possible). • Turn VTR or (See PAD or contact MCC to verify VTR availability) and begin to record XUV MON. If no flare has occurred, turn VTR off at the end of the orbit. • Perform XUV MON integrations occassionally. • If a flare triggers the alarm, truncate BB24 and initiate JOP 3A. • Turn off VTR 15 minutes from flare alarm or at the end of the orbit, whichever comes first.	



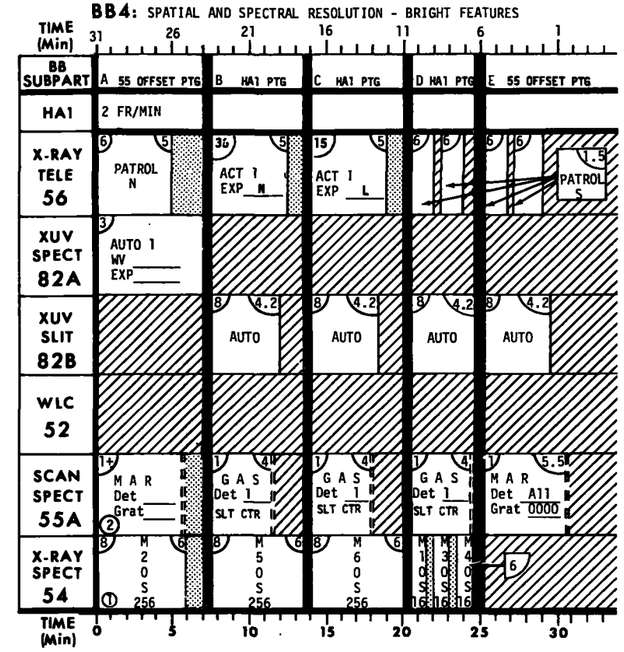




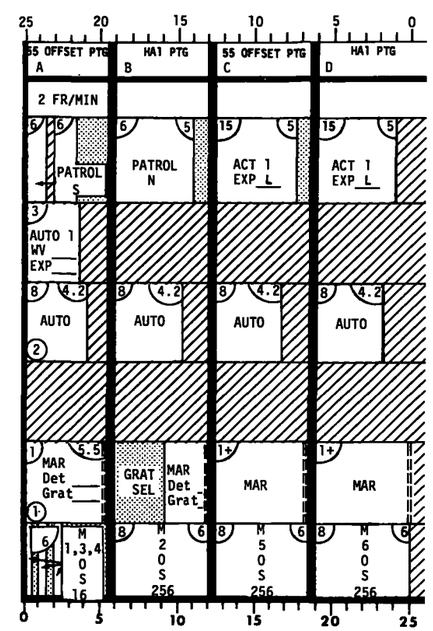
JOP 2B - ACTIVE REGIONS: Long Term Evolution - Disc (R<.9R⊙)

Step	BB	TARGET	ΔT/ΣΔT
	4A	• Roll 82A XUV dispersion clear of active region. • Point 55 OFFSET so that 55 MAR covers most of active region. • Record pointing coordinates RL+/- _____ U+/D- _____ L-/R+_____.	SU: 4 7/10
	B	• Point Hα1 at a Hα bright point. • Roll slit for uniform emission. • Maximize DET 1 or 3.	SU: 3 6/20
	C	• Repeat B at a second Hα1 bright point.	SU: 3 6/29
	D	• Point Hα1 at a relatively dark Hα area. • Roll 82B slit for uniform emission.	SU: 2 5/36
	E	• Pointing and roll same as 4A. • Repoint 82B slit for uniform emission.	SU: 2 6/44
(2)	5A	• Roll 82A XUV dispersion clear of active region and 82B slit for uniform emission (plage or quiet background), if possible. • Point 55 OFFSET so that 55 MAR covers most interesting features of active regions. • Record pointing coordinates RL+/-_____ U+/D-_____ L-/R+_____.	SU: 4 6/10
	B	• Point Hα1 at a bright Hα area. • Roll 82B slit for uniform emission.	SU: 2 6/18
	C	• Pointing and roll same as 5A. • Repoint 82B for uniform emission.	SU: 2 6/26
	D	• Point Hα1 at a second Hα bright area. • Roll 82B slit for uniform emission (and parallel to neutral line, if possible).	SU: 2 6/34
(3)	7A	• Point Hα1 at a relatively bright Hα area. • Roll 82B slit for uniform emission (and 82A XUV dispersion clear of active region if possible).	SU: 3 5/8
	B	• Roll 82A XUV dispersion clear of active region. • Point 55 OFFSET so that 55 MAR covers most interesting features of active regions.	SU: 2 6/16

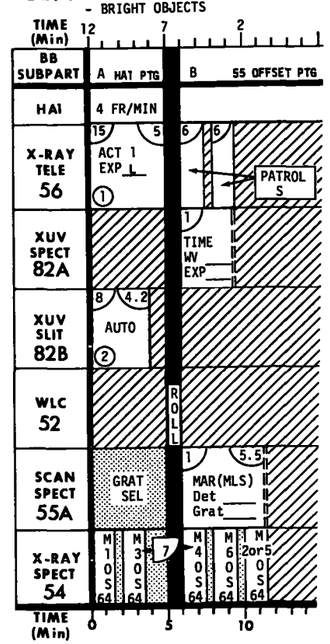
BB4: SPATIAL AND SPECTRAL RESOLUTION - BRIGHT FEATURES

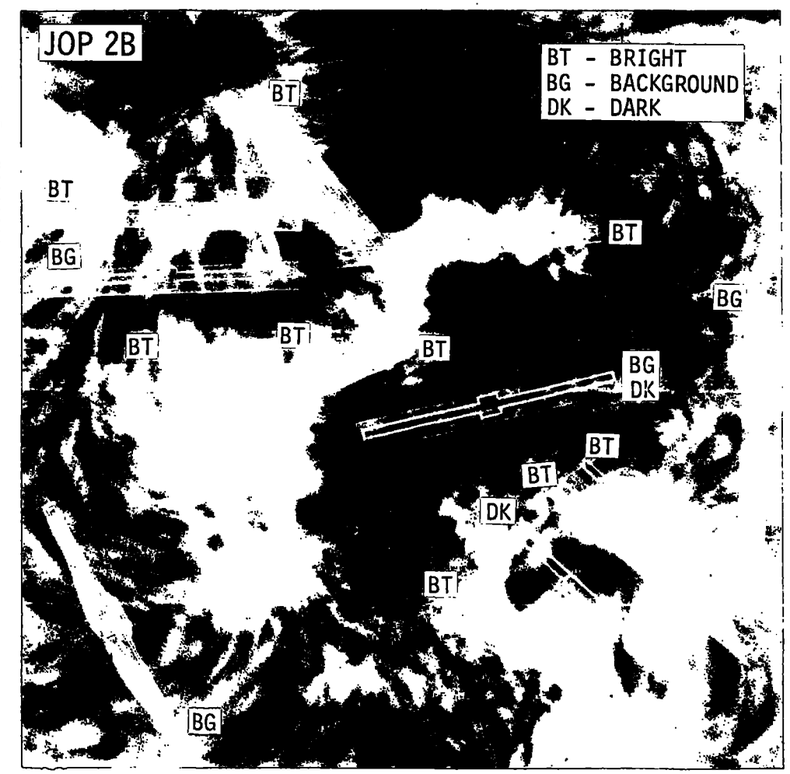


BB5: SPATIAL RESOLUTION - BRIGHT OBJECTS



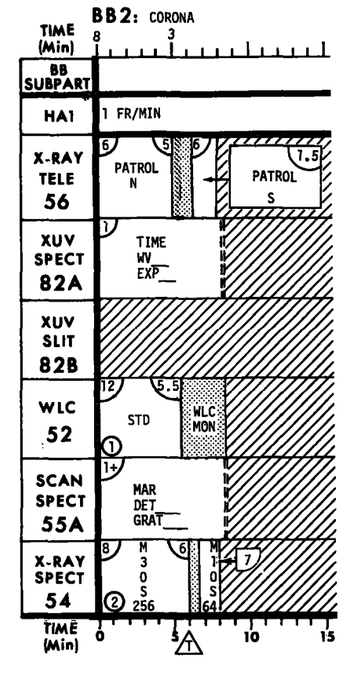
BB7: SPATIAL RESOLUTION - BRIGHT OBJECTS

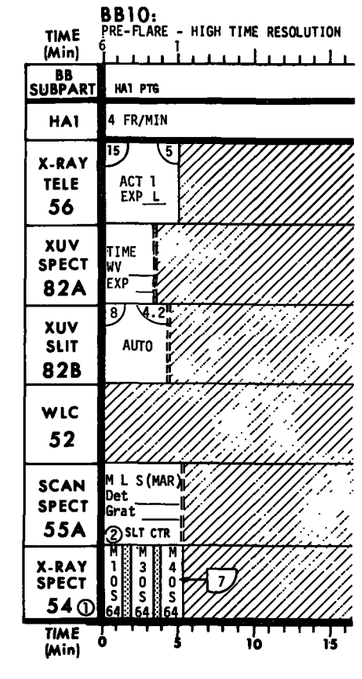




2B (CON'T)

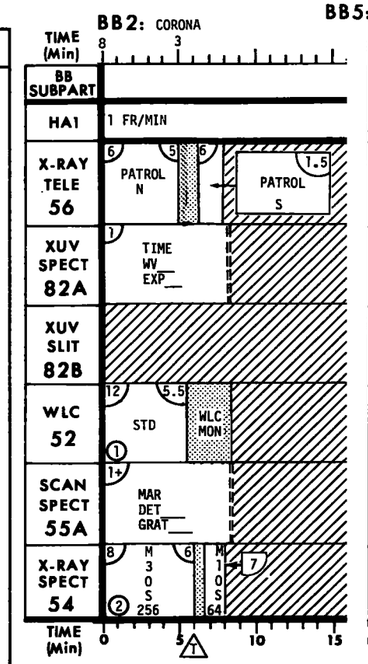
(4)	2	• Point 52 to sun center. • Roll to position feature of interest at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of active region (if possible).	SU: 3 8/11
(5)	10	• Point Hα1 at a relatively bright Hα area. • Roll 82B slit for uniform emission (and 82A XUV dispersion clear of active region, if possible).	SU: 3 6/9

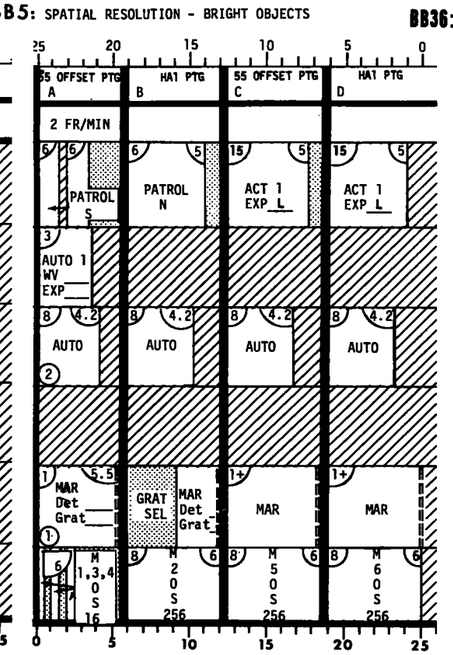


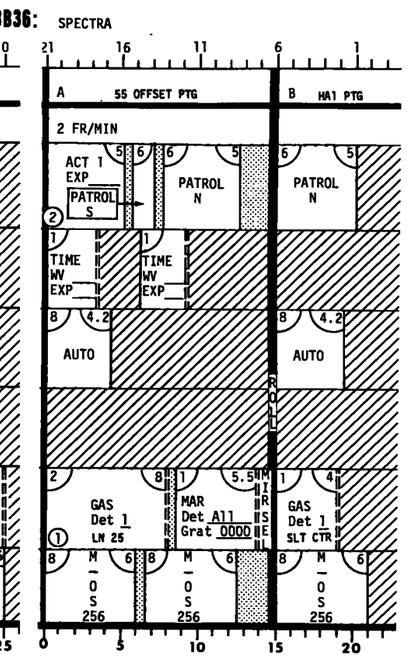


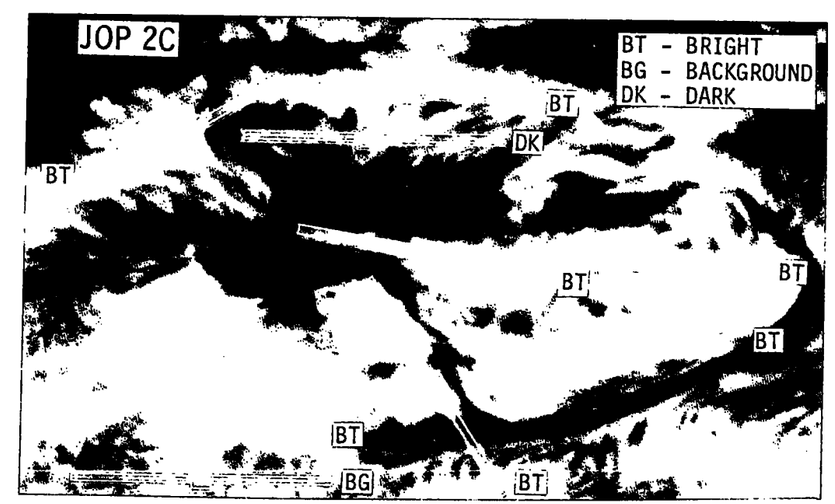
JOP 2C - ACTIVE REGIONS: Long Term Evolution - Limb (R≥ .9R⊙)

Step	BB	TARGET	ΔT/ΣΔT
(1)	2	• Point 52 to sun center. • Roll to position active region at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of active region, if possible.	SU: 3 6/9
(2)	5A	• Roll 82A XUV dispersion clear of active region and 82B slit for uniform emission (plage or quiet background), if possible. • Point 55 OFFSET so that 55 MAR covers most interesting features of active regions. • Record pointing coordinates RL+/-_____ U+/D-_____ L-/R+_____. B • Point Hα1 at a Hα1 bright area. • Roll 82B slit for uniform emission. C • Pointing and roll same as 5A. • Repoint 82B for uniform emission. D • Point Hα1 at a second Hα bright area. • Roll 82B slit for uniform emission (and parallel to neutral line, if possible).	SU: 4 6/10 SU: 2 6/18 SU: 2 6/26 SU: 2 6/34
(3)	36A	• Step 55 mirror to line 25. • Roll 82A XUV dispersion clear of active region. • Point 55 OFFSET at Hα bright spot in XUV bright area. • Maximize DET 1 or 3. • After 55 MAR, step 55 mirror to SLIT CTR. B • Point Hα1 at the same Hα bright spot. • Roll 82B slit for uniform emission (or tangent to limb). • Maximize DET 1 or 3	SU: 4 14/18 SU: 2 6/26
(4)	36A	• Step 55 mirror to line 25. • Roll 82A XUV dispersion clear of active region. • After 55 MAR, step 55 mirror to SLIT CTR. B • Point Hα1 10 to 30 arc secs above the limb near the active region. • Roll 82B slit tangent to the limb.	SU: 4 14/18 SU: 2 6/26



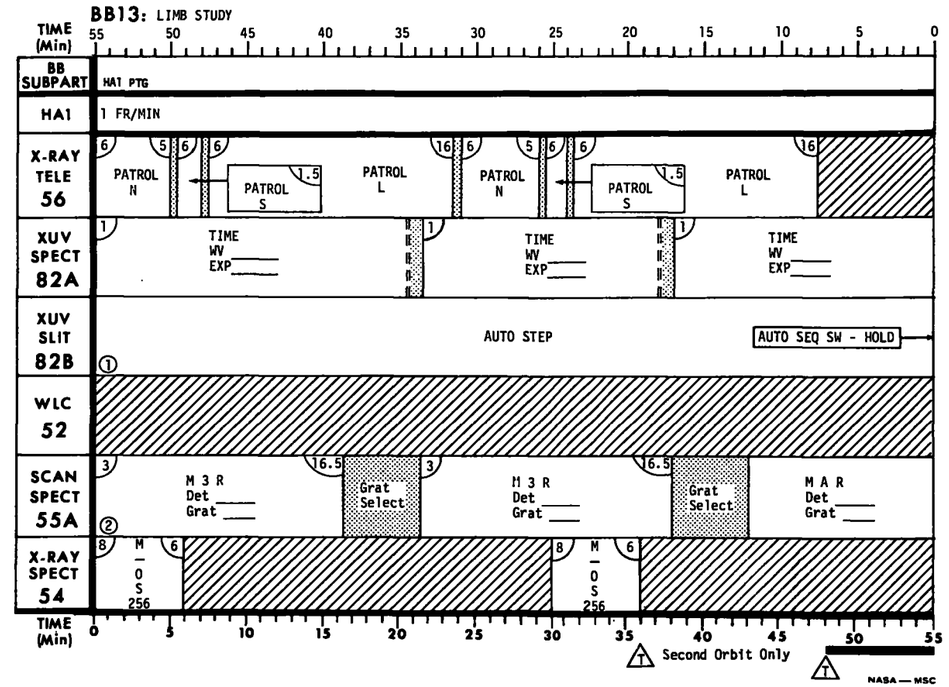






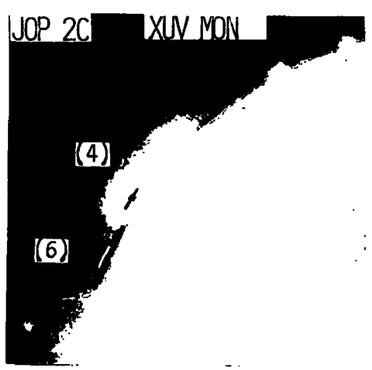
2C (CON'T)

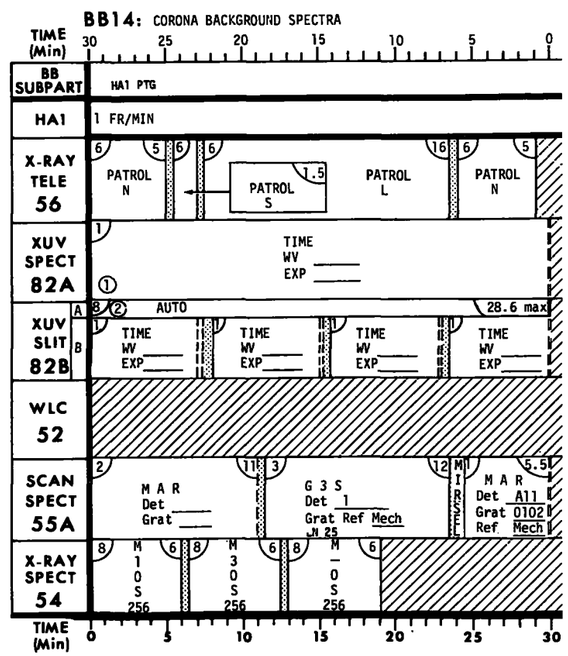
(5)	23 or 13	• Point Hα1 at inner Hα limb near the most intense XUV emission in active region. • Roll 82B slit tangent to white light limb (U/D-0000, L/R = 1R⊙) • Select LIMB SCAN, MPC to LIMB OFFSET = 0000+5, then select LIMB PTG. • Record 82B FRAMES REMAINING before AUTO STEP initiation. _____ • Start 82B AUTO STEP • Go to AUTO SEQ - HOLD before ESS and record FRAMES REMAINING. _____ FRAMES DELTA _____ • After SUNSIDE PREP, repoint slit tangent to white light limb, select LIMB SCAN and using MPC point to LIMB OFFSET position determined from FRAMES DELTA. (See 82B LIMB SCAN DIAGRAM). • Select LIMB PTG and AUTO SEQ - NORMAL	SU: 4 48/52
(6)	14	• Step 55 mirror° to line 25. • Point Hα1 10-30 arc secs above the limb adjacent to active region observed in (4). • Roll 82B slit tangent to limb. • Roll (about sun-center) so that both Hα1 and 55 OFFSET are in background corona adjacent to active region. • Select 82B LIMB PTG. • After 55 G3S, step 55 mirror to SLIT CTR.	SU: 4 30/34

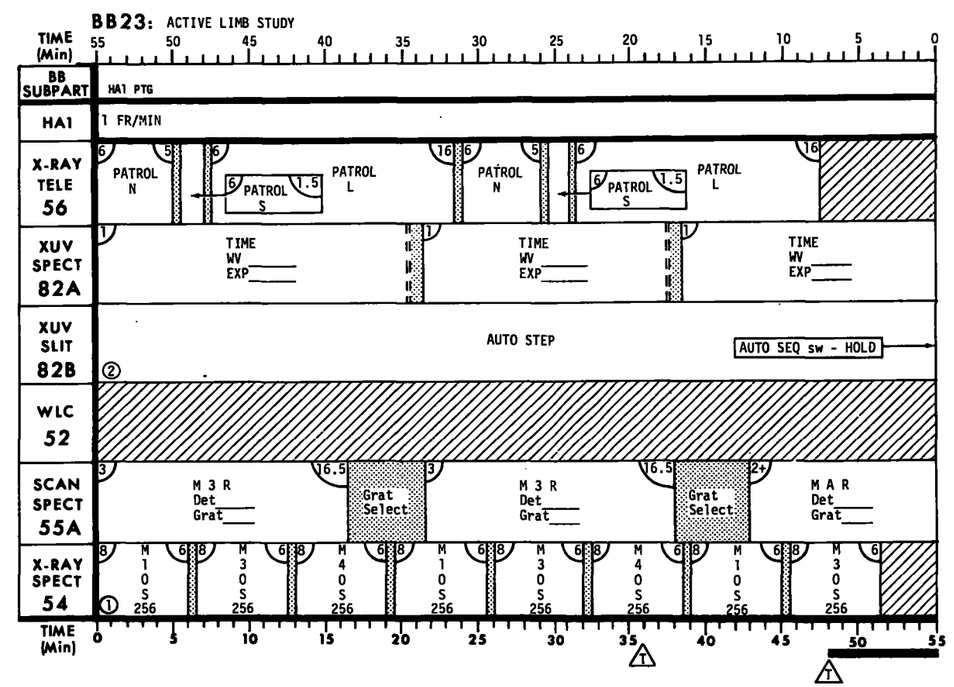


82B LIMB SCAN DIAGRAM

Frames used:	0-7	8-15	16-23	24-31	32-39	40-47	48-55	56-63	64-71	72-80
New LIMB OFFSET:	-12"	-4"	-2"	+0"	+2"	+4"	+6"	+8"	+12"	+20"
Time (minutes):	4.2	4.2	4.2	4.2	17.9	17.9	17.9	17.9	28.6	28.6

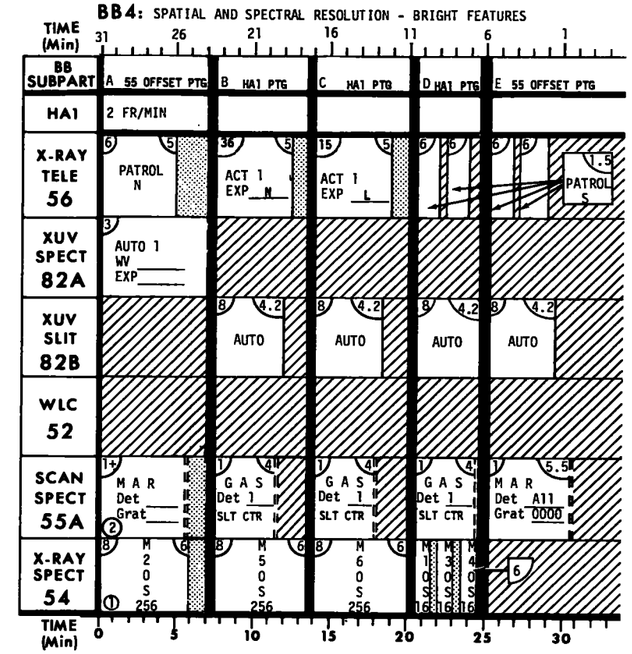


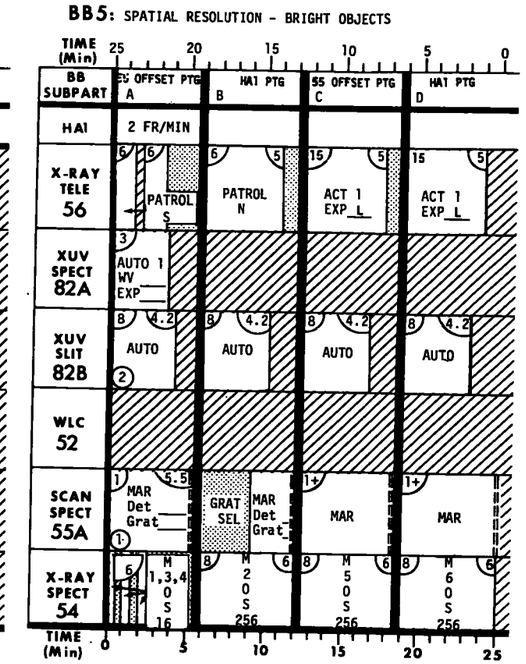


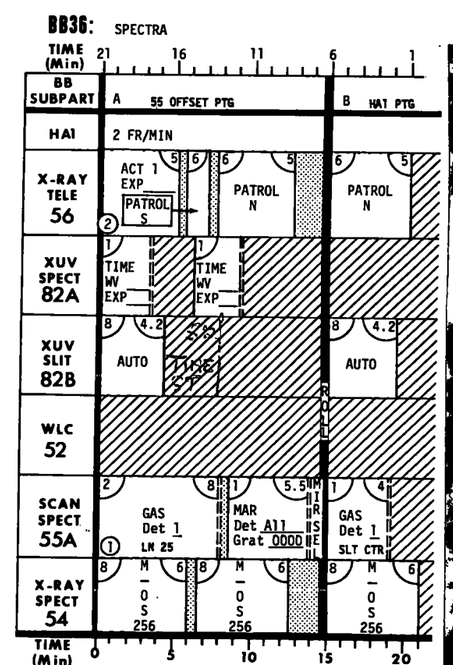


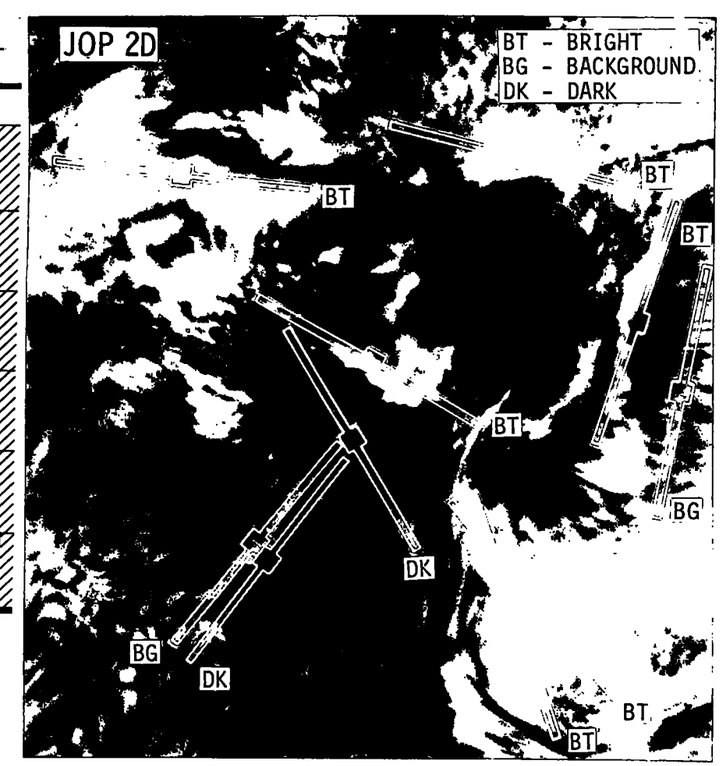
JOP 2D - ACTIVE REGIONS: Structure

Step	BB	TARGET	ΔT/ΣΔT
	4A	• Roll 82A XUV dispersion clear of active region. • Point 55 OFFSET so that 55 MAR covers most of active region. • Record pointing coordinates RL+/- _____ U+/D- _____ L-/R+_____.	SU: 4 7/10
	B	• Point Hα1 at a Hα bright point. • Roll 82B slit for uniform emmission. • Maximize DET 1 or 3.	SU: 3 6/20
	C	• Repeat B at a second Hα1 bright point.	SU: 3 6/29
(2)	5A	• Roll 82A XUV dispersion clear of active region and 82B slit for uniform emission (plage or quiet background), if possible. • Point 55 OFFSET so that 55 MAR covers most interesting features of active regions. • Record pointing coordinates RL +/-_____ U+/D-_____ L-/R+_____.	SU: 4 6/10
	B	• Point Hα1 at a Hα1 bright area. • Roll 82B slit for uniform emission.	SU: 2 6/18
	C	• Pointing and roll same as 5A. • Repoint 82B for uniform emission.	SU: 2 6/26
	D	• Point Hα1 at a second Hα bright area. • Roll 82B slit for uniform emission (and parallel to neutral line, if possible).	SU: 2 6/34
(3)	36A	• Step 55 mirror to line 25. • Roll 82A XUV dispersion clear of active region. • Point 55 OFFSET at Hα bright spot (or at PAD coordinates). • Maximize DET 1 or 3. • After 55 MAR, step 55 mirror to SLIT CTR.	SU: 4 14/18
	B	• Point Hα1 at the same Hα bright spot. • Roll 82B slit for uniform emission. • Maximize DET 1 or 3.	SU: 2 6/26
(4)	36A	• Step 55 mirror to line 25. • Roll 82A XUV dispersion clear of active region. • Point 55 OFFSET at Hα dark area (or at PAD coordinates). • Maximize DET 1 or 3. • After 55 MAR, step 55 mirror to SLIT CTR.	SU: 4 14/18
	B	• Point Hα1 at the same Hα dark area. • Roll 82B slit for uniform emission. • Maximize DET 1 or 3.	SU: 2 6/26

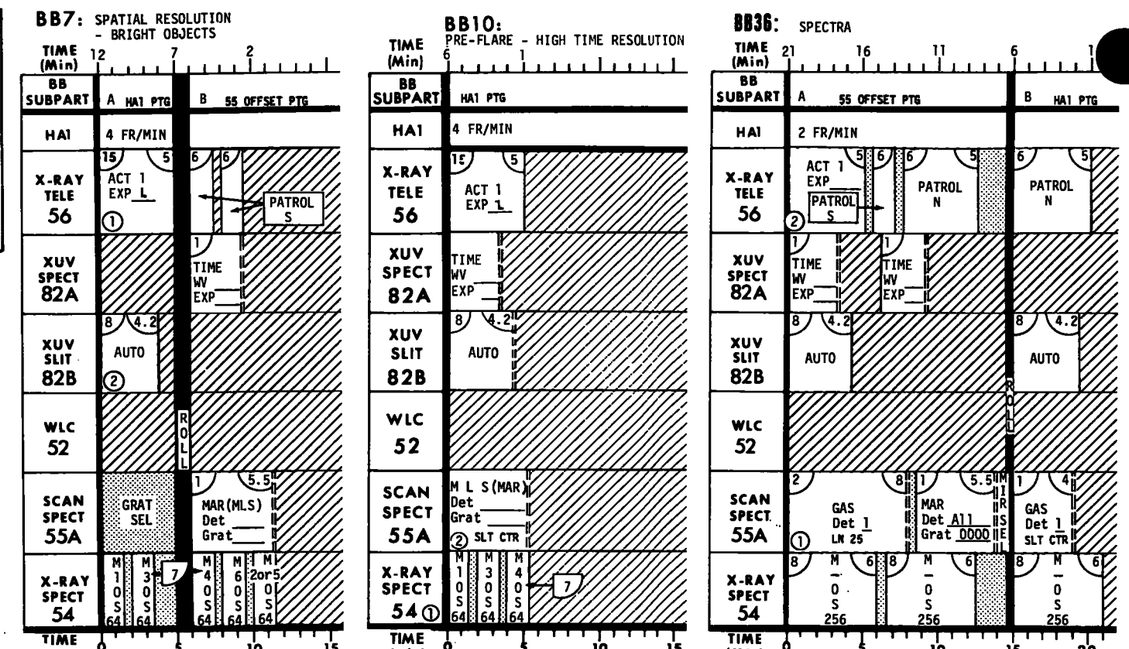






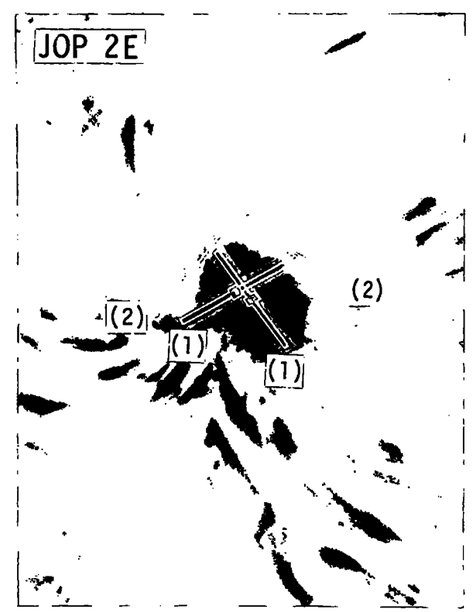


(5)	7A	• Point Hα1 at a relatively bright Hα area. • Roll 82B slit for uniform emission (and 82A XUV dispersion clear of active region if possible).	SU: 3 5/8
	B	• Roll 82A XUV dispersion clear of active region. • Point 55 OFFSET so that 55 MAR covers most interesting features of active regions.	SU: 2 6/16
(6)	10	• Point Hα1 at a relatively bright Hα area. • Roll 82B slit for uniform emission (and 82A XUV dispersion clear of active regions, if possible).	SU: 3 6/9



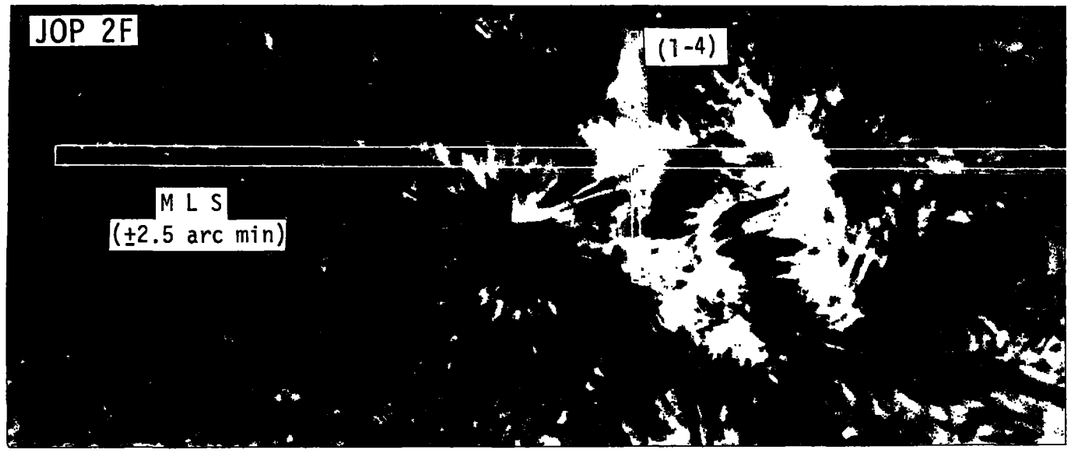
JOP 2E - ACTIVE REGIONS: Sunspots

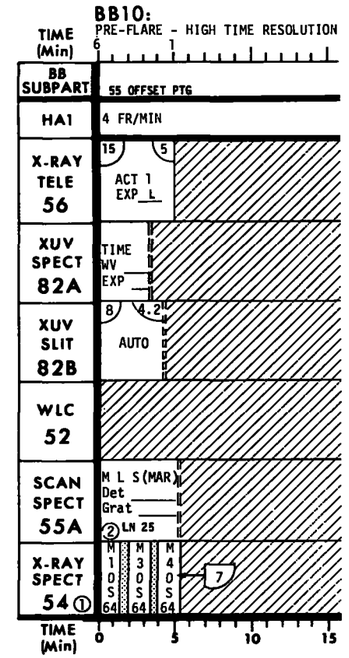
Step	BB	TARGET	ΔT/ΣΔT
(1)	36A	• Step 55 mirror to line 25. • Roll 82A XUV dispersion clear of sunspot. • Point 55 OFFSET at dark core of umbra (82B WL DISPLAY) • After 55 MAR, step 55 mirror to SLIT CTR.	SU: 3 14/17
	B	• Point 82B slit (82B WL DISPLAY) at the dark core of the umbra. • Roll 82B slit for uniform emission.	SU: 2 6/25
(2)	36A	• Step 55 mirror to line 25. • Roll 82A XUV dispersion clear of sunspot. • Point 55 OFFSET at penumbra (82B WL DISPLAY AND Hα1) • After 55 MAR, step 55 mirror to SLIT CTR.	SU: 3 14/17
	B	• Point 82B slit (82B WL DISPLAY) at the penumbra and fill 82B slit if possible. • Roll 82B for uniform emission.	SU: 2 6/25

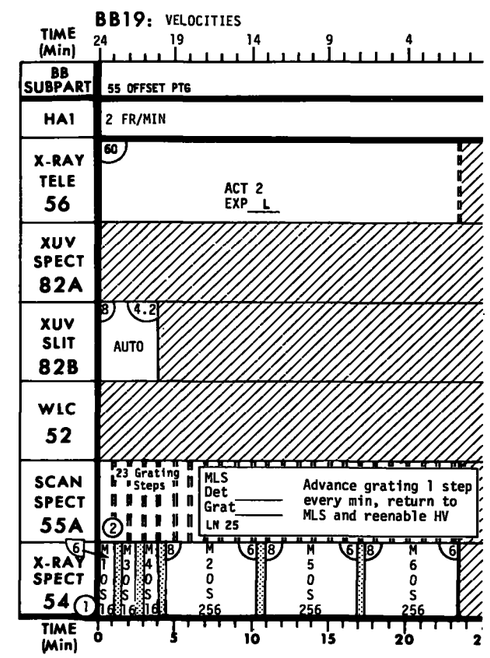


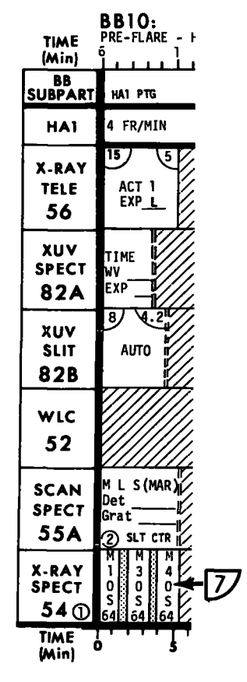
JOP 2F - ACTIVE REGIONS: Chromospheric Velocities

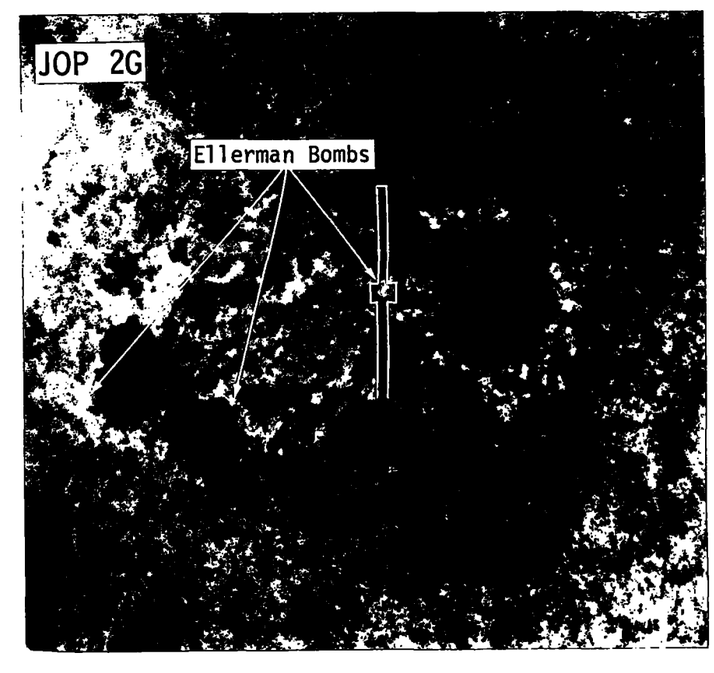
Step	BB	5055 TARGET	ΔT/ΣΔT
(1)	10	• Step 55 mirror to line 25. • EXP ROLL - 0 or 10800 arc min. • Point 55 OFFSET so that 55 MAR covers both Hα active and quiet areas.	SU: 3 6/9
(2)	19	• Pointing and roll same as (1).	SU: 4 25/29
(3)	10	• Pointing and roll same as (1). • After 55 MAR, step 55 mirror to SLIT CTR.	SU: 2 6/8
(4)	10	• Pointing and roll same as (1). • 55 DET ALL, GRAT 0020 (red wing of Lyman β) • SINGLE STEP 55 grating from 0020 until maximum intensity _____ is observed on DET 3. • Continue stepping until DET 3 intensity is approximately half the maximum value (blue wing of Lyman β). • Perform 55 MLS at that grating position in BB10.	SU: 5 6/11











JOP 2G - ACTIVE REGIONS: Ellerman Bombs

Step	BB	TARGET	ΔT/ΣΔT
		•Ellerman bombs are small, bright points (∿2 arc secs in diameter) which generally appear in or near the penumbra of a large sunspot (above an isolated magnetic region). The lifetimes of the bombs average 15 minutes (can vary from 5 min. to 1 hr.). •Attempt to locate Ellerman bomb near suggested PAD coordinates or near sunspot. If bomb is sighted proceed with steps (1). •When bomb has disappeared perform step (2) for background data. •If a bomb is not sighted after 5 minutes of observing go on to next scheduled ATM activity.	
(1)	10	•Point Hα1 at Ellerman bomb. •Roll 82B slit for uniform emission (and 82A XUV dispersion clear of active region, if possible). •Record pointing coordinates RL +/- _____ U/D _____ L/R _____	SU: 5 6/11
(2)	10	•Same pointing and roll as (1).	SU: 3 6/9

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JOP 3 FLARES - SLEW

BB8

(7) •Omit the following experiments _____, _____, _____ (See SAP).

(8) •Monitor flare rise on PMEC, BE COUNTS(BE APT 1),and IIC
•If the H/L Threshold is exceeded, reset 56 AUTO N immediately.
•The pointing will be maintained at the initial brightest point even though other points may subsequently become brighter. If a much greater flare occurs in another part of the active region or in another region, move to the new flare in the absence of ground advice. Reinitiate JOP 3,step(3).

(9) •When the PMEC, BE COUNTS (BE APT 1), and IIC begins to decrease, go to flare fall section of BB 8B.

(10) •Initiate post flare program when flare indicators are substantially below peak value and falling slowly.

(11) •Continue post flare for a full second orbit unless other instructions are received from STDN.

Step		PMEC _____
(1)	START:	WATCH
(2)	CONFIRM:	•BE APT 1 _____, IIC _____, X-RAY, XUV MON, Hα
(3)	STOP/RESTART:	•56 - AUTO N (This experiment may be started on any flare indicator) •54 - M _____ P _____ •82A WV-ST, MAN EXP:02 •H/L FLARE THRESHOLD COARSE _____ FINE _____ •55 - If in Mirror Mode, reset to MLS If in Grating Mode, reset to REF
(4)	LOCATE FLARE:	•X-RAY, XUV, Hα2, and Hα1 (In this order) •Slew to SC to locate flare (if necessary)
(5)	SLEW:	•Point Hα1 at brightest Hα point.
(6)	START:	•82A and B FLARE - ENA •MASTER FLARE - INIT •If in MLS step 55 mirror to SLIT CTR (0832). •If in Grating Mode (now in REF) Check grating position. •If in GRAT 0000 (optical), go to MLS and turn on all detectors. •If not in GRAT 0000 (optical), stop at GRAT 0766 | 1153 | 1941 | 2665 and turn on DETS 1 thru 5. •Step 55 mirror to SLIT CTR (0832).

BB9

(7) •Omit the following experiments _____, _____, _____ (See SAP).

(8) •Monitor flare rise on PMEC, BE COUNTS(BE APT 1),and IIC
•If the H/L Threshold is exceeded (alarm activated 2nd time), restart 56 AUTO N immediately.
•The pointing will be maintained at the initial brightest point even though other points may subsequently become brighter. If a much greater flare occurs in another part of the active region or in another region, move to the new flare in the absence of ground advice. Reinitiate JOP 3,step(3).

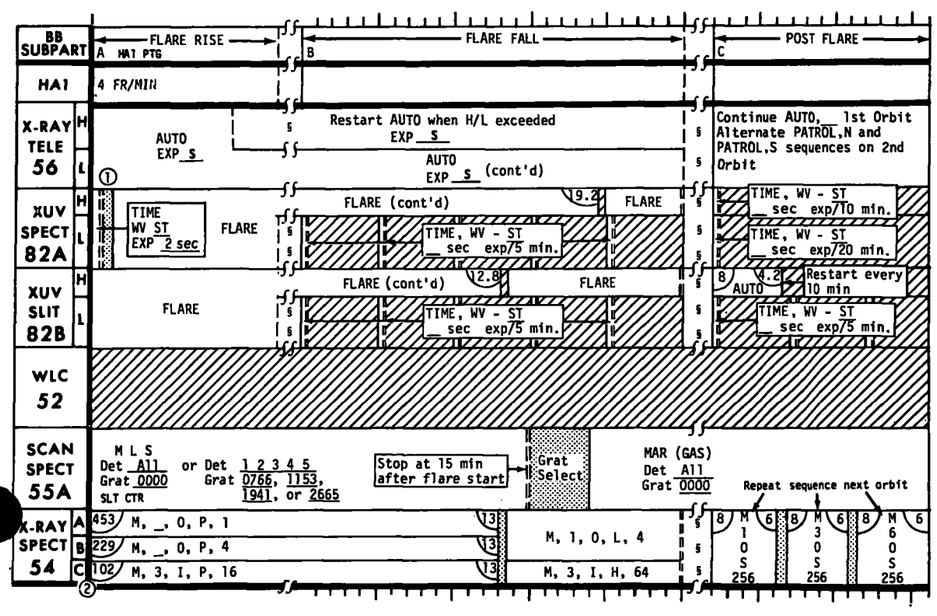
(9) •At approximately 5 minutes, repoint 52 to sun center.
•Roll to position region of interest at approximately 3 o'clock and clear 82A XUV dispersion if possible.
•Go to BB9B.

(10) •If motion is observed on the WLC display, repeat 52 FAST SCAN instead of EXTD STD.

(11) •Initiate post flare program when flare indicators are substantially below peak value and falling slowly.

(12) •Continue post flare for a full second orbit unless other instructions are received from STDN.

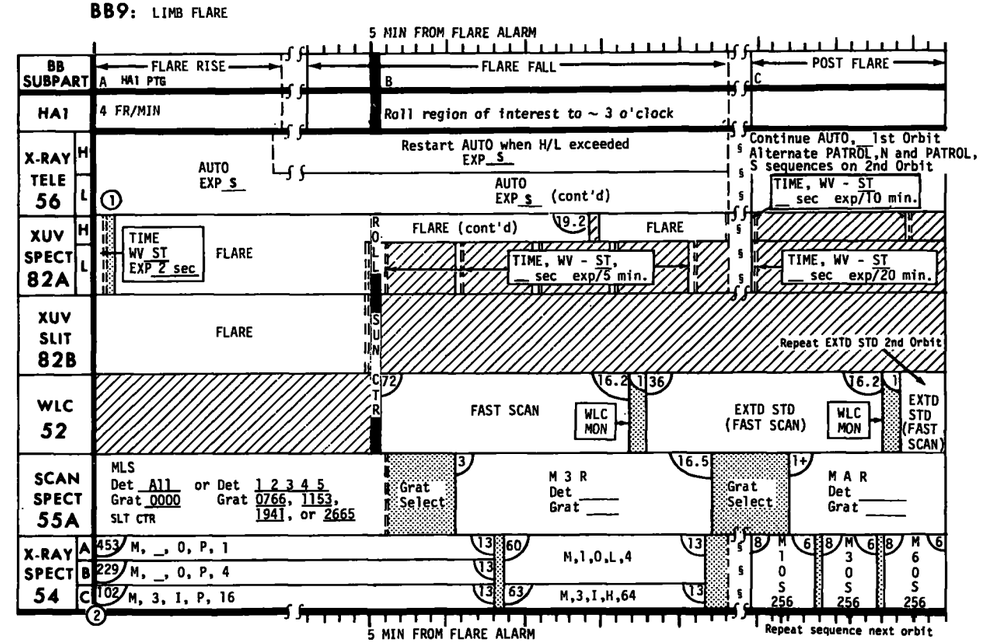
BB8: FLARE



DISK FLARE

LIMB FLARE

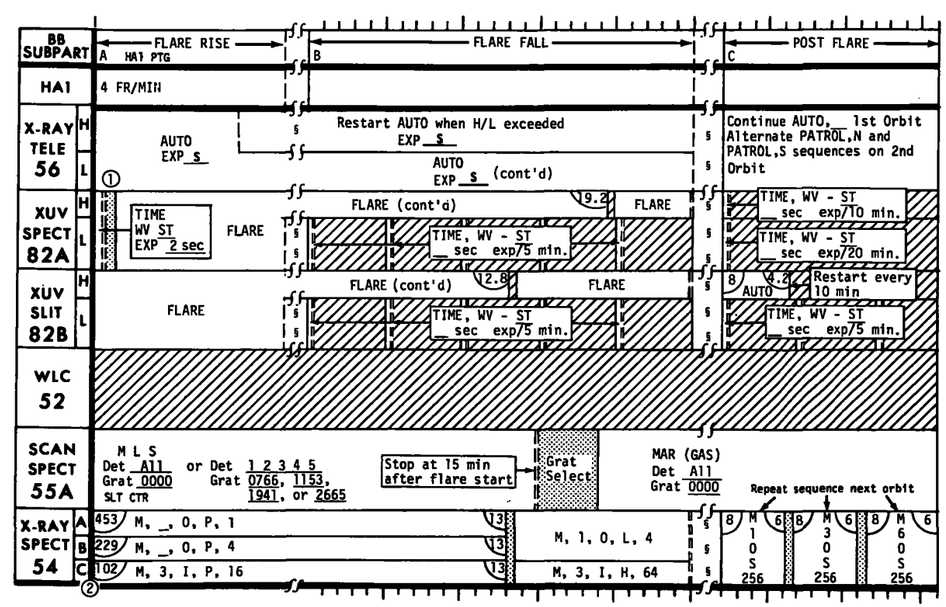
BB9: LIMB FLARE



JOP 3 FLARES - NON-SLEW

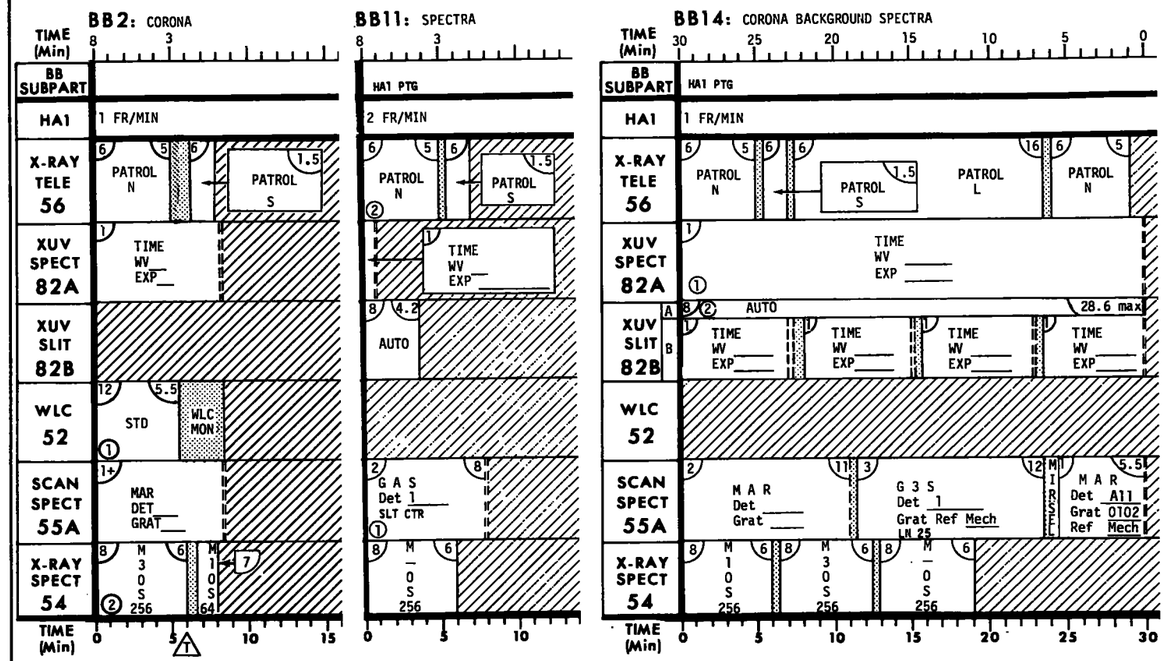
Step		PMEC _____
(1)	START:	WATCH
(2)	CONFIRM:	•BE APT 1 _____, IIC _____, X-RAY, XUV MON, and/or Hα.
(3)	STOP/RESTART:	•56-AUTO N (This experiment may be started on any flare indicator). •54-M _____ P _____ •82A FLARE-ENA, MASTER FLARE - INIT •H/L FLARE THRESHOLD COARSE _____ FINE _____ •55 - If in Mirror Mode, reset to MLS If in Grating Mode, reset to REF
(4)	LOCATE FLARE:	•X-RAY, XUV, Hα2, and Hα1 (In this order). •If flare is visible on any display, stay put. •If 82B slit is pointed at the flare: •82B FLARE - ENA, MASTER FLARE - INIT •If flare is not visible on any display: •Slew towards sun center to locate flare and point Hα1 at brightest Hα point. •82B FLARE - ENA, MASTER FLARE - INIT
(5)	START:	•If in MLS step 55 mirror to SLIT CTR (0832). •If in Grating Mode (now in REF) Check grating position. •If in GRAT 0000 (optical), go to MLS and turn on all detectors. •If not in GRAT 0000 (optical), stop at GRAT [0766 | 1153 | 1941 | 2665] and turn on DETS 1 thru 5. •Step 55 mirror to SLIT CTR (0832).
(6)		•Omit the following experiments _____, _____, _____ (SEE SAP)
(7)		•Monitor flare rise on PMEC, BE COUNTS (BE APT 1), and IIC •If the H/L threshold is exceeded restart 56 AUTO N immediately.
(8)		•When the PMEC, BE APT 1, and IIC begins to decrease, to flare fall section of BB8B.
(9)		•Initiate post flare program when flare indicators are substantially below peak value and falling slowly.
(10)		•Continue post flare for a full second orbit unless other instructions are received from STDN. •Point Hα1 at brightest Hα1 point. •Initiate all experiments except those omitted in (6).

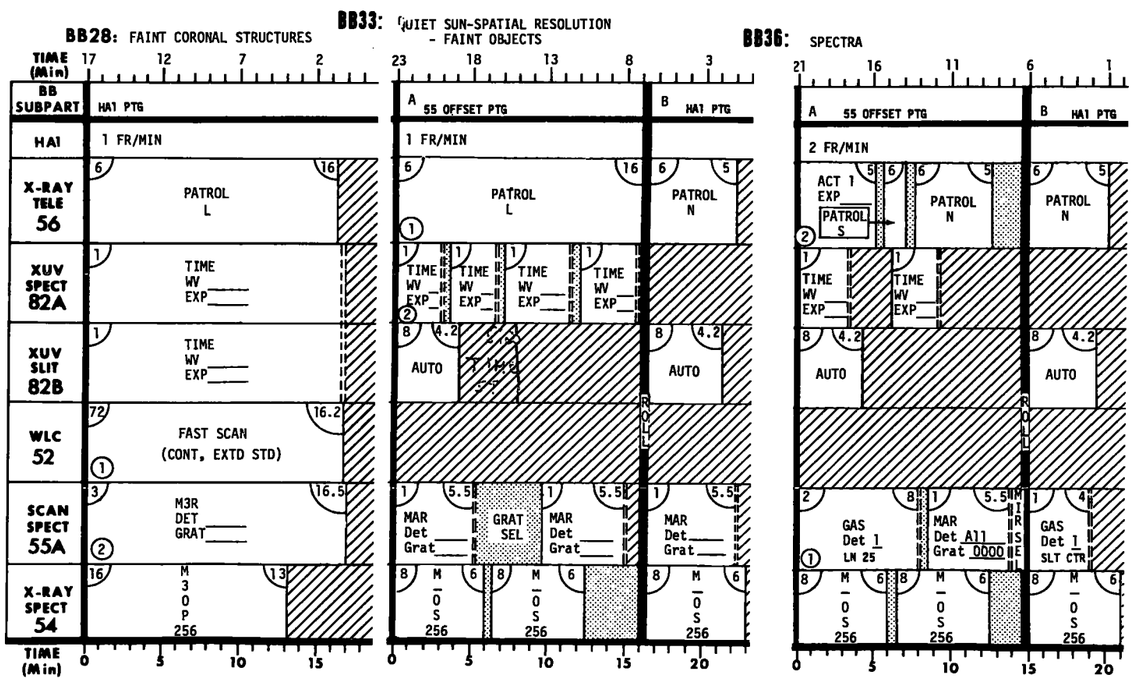
BB8: FLARE

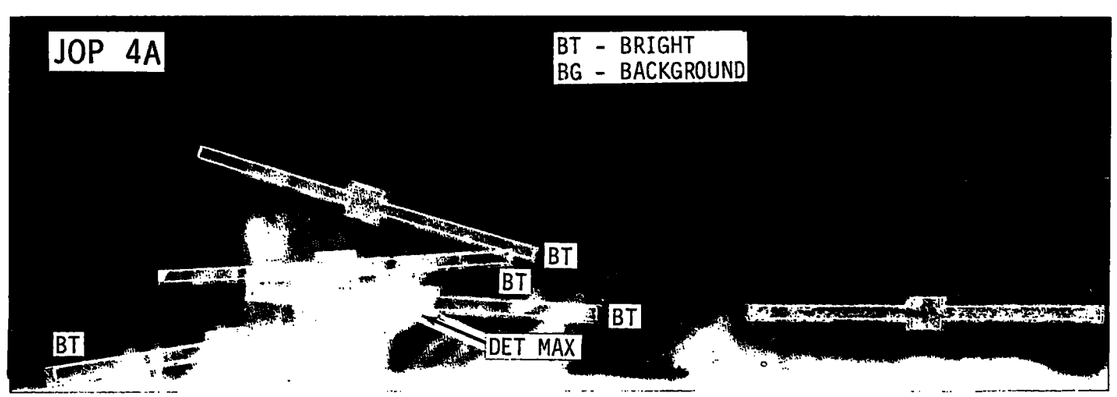


JOP 4A - PROMINENCES

Step	BB	TARGET	ΔT/ΣΔT
(1)	2 or 28	• Point 52 to sun center. • Roll to ± 5400 arc min.	SU: 3 8/11 or SU: 3 17/20
(2)	33A B	• Roll 82A XUV dispersion clear of prominence. • Point 55 OFFSET so that 55 MAR covers features of interest in prominence. • Point Hα1 at a bright Hα linear element. • Roll 82B slit for uniform emission.	SU: 3 16/19 SU: 2 6/8
(3)	36A B	• Step 55 mirror to line 25. • Roll 82A XUV dispersion clear of prominence. • Point 55 OFFSET at Hα bright spot. • Maximize DET 3 if GRAT is at 0000. • After 55 MAR, step 55 mirror to SLIT CTR. • Point Hα1 at a bright Hα linear element. • Roll 82B slit for uniform emission. • Maximize DET 3 if GRAT is at 0000.	SU: 4 14/18 SU: 3 6/27
(4)	11	• Hα1 at a bright Hα linear element. • Roll 82B slit for uniform emission. • Maximize DET 3 if GRAT is at 0000.	SU: 4 8/12
(5)	28	• Point Hα1 at a bright Hα linear element. • Roll 82B slit for uniform emission. • Omit 52.	SU: 3 17/20
(6)	14	• Step 55 mirror to line 25. • Point Hα1 at a position in the prominence which is at the approximate height of observations in steps (2), (3), or (4). • Roll 82B slit parallel to the limb. • Roll (about suncenter) so that Hα1 and 55 OFFSET are centered in a quiet region adjacent to the prominence. • After 55 G3S, step 55 mirror to SLIT CTR.	SU: 4 30/34
(7)	28	• Point Hα1 at a quiet region of the corona adjacent to the prominence which is at the approximate height of observations in steps (2), (3), and (4). • Roll 82B slit parallel to the limb (U/D-0000). • Omit 52.	SU: 3 17/20

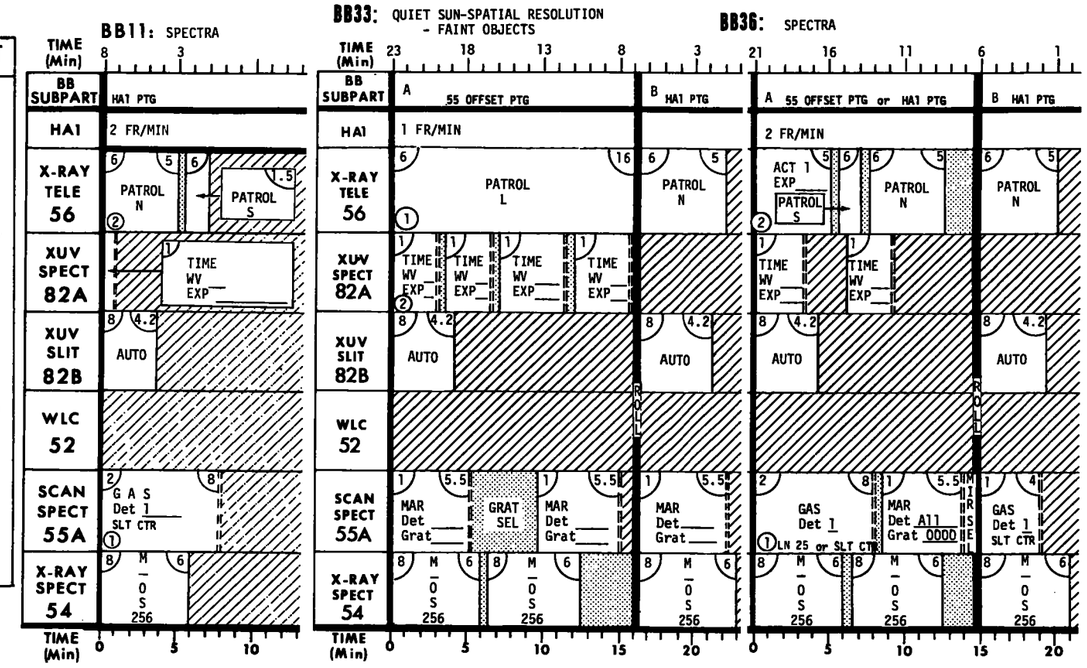






JOP 4B - Filaments

Step	BB	TARGET	ΔT/ ΔT
(1)	33A	• Roll 82A XUV dispersion clear of filament. • Point 55 OFFSET so that 55 MAR covers features of interest in filament.	SU: 3 16/19
	B	• Point Hα1 at a dark Hα linear element • Roll 82B slit for uniform emission.	SU: 2 6/27
(2)	36A	• Step 55 mirror to line 25. • Roll 82A XUV dispersion clear of filament. • Point 55 OFFSET at a Hα dark feature in the filament. • After 55 MAR, step 55 mirror to SLIT CTR.	SU: 3 14/17
	B	• Point Hα1 at a dark Hα linear element. • Roll 82B slit for uniform emission.	SU: 2 6/25
(3)	36A or 11	• Point Hα1 at a uniform Hα quiet area adjacent to the filament. • Roll 82A XUV dispersion clear of filament (and 82B slit for quiet uniform emission, if possible).	SU: 3 14/17 or SU: 3 8/11
(4)	11	• Point Hα1 at a dark Hα linear element. • Roll 82B slit for uniform emission.	SU: 3 8/11



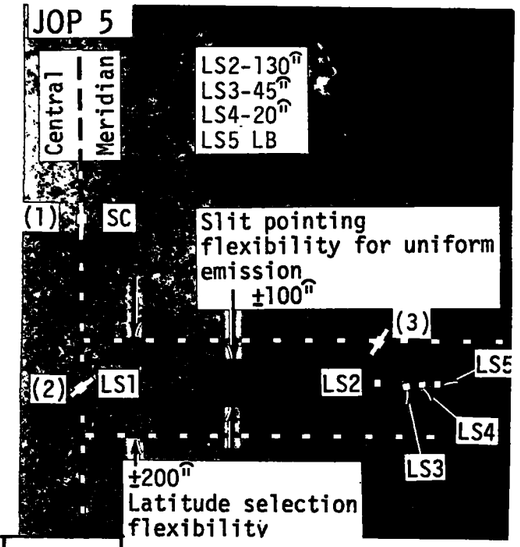
JOP 5 - LIMB PROFILE STUDIES

5A - Variation of XUV Spectrum Along Constant Latitude Lines
Target areas: Quiet areas, enhanced regions (region at limb where XUV emission in the chromosphere are slightly above normal), and depressed region (region at limb where XUV emission is less than normal, coronal hole). 1,2,

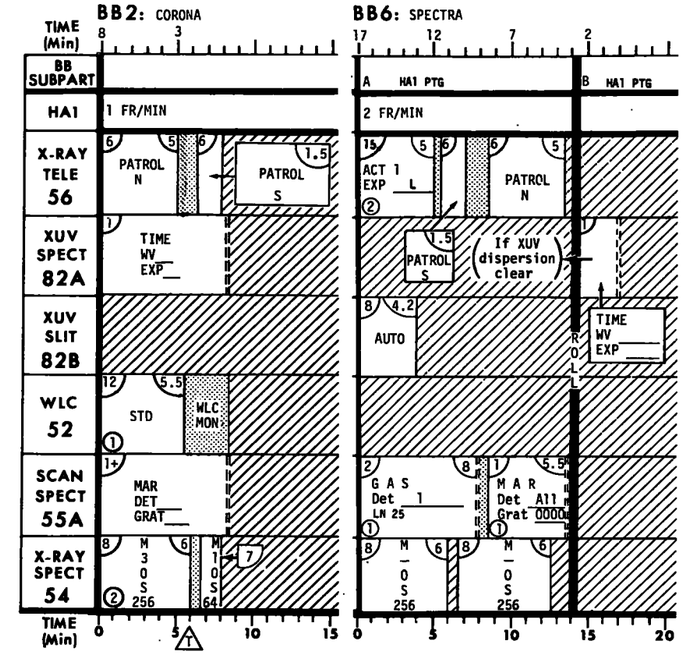
5B - Variation of XUV Spectrum at the North and South Poles 1 3,

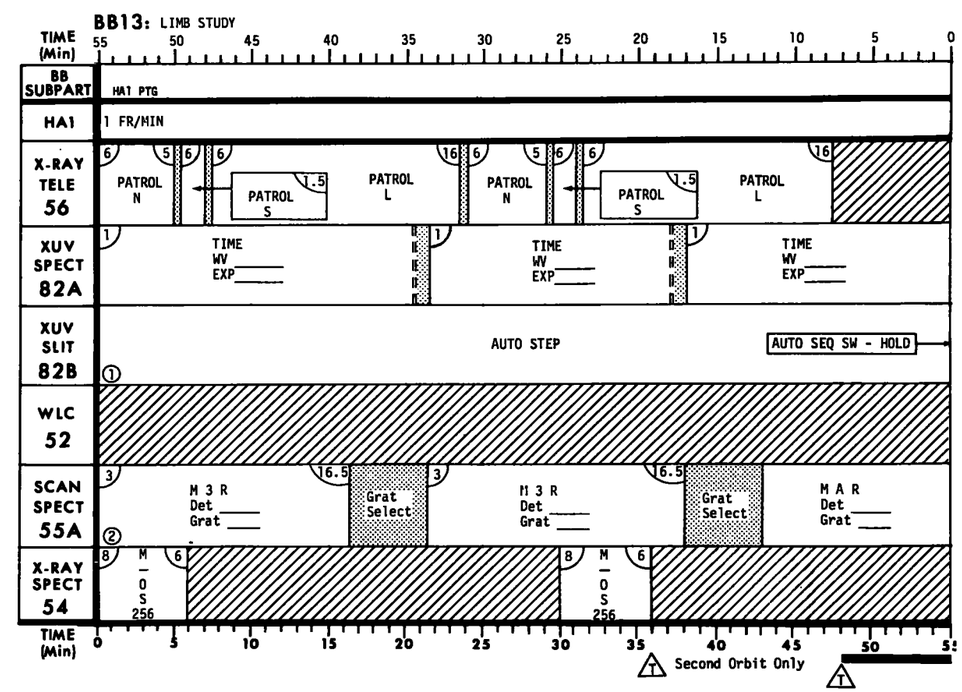
5C - Limb Scans 4 at different positions
Crew will select one of the following features:
Active regions, quiet regions, depressed coronal and chromospheric regions, gaps in XUV images at the limb, XUV bright spot at the limb, equator, 45 degree north and south, and sector boundary at west limb.

In the performance of constant latitude studies, steps (2) and (3), uniformity of the area covered by the 82B slit is more important than the exact position. If necessary, repoint by moving the 82B slit U/D along the slit axis, by no more than ± 100 arc sec from the point specified by the update pad.



Step	BB	TARGET	ΔT/ΣΔT
(1)	2	• Point 52 sun center. • Roll ±5400 arc min. • Verify latitude suggested (See PAD) meets target criteria: quiet, enhanced, and depressed (XUV MON, Hα). If not select another latitude within +/- 200 arc sec. • If a new latitude is selected record new coordinate (U/D _____) and see Limb Scan Pointing table for new coordinates for steps (2) and (3).	SU: 3 6/9
	6A	• Step 55 mirror to line 25. • Point Hα1 to position on Central Meridian (PAD coordinates - L/R 0000). • Perform 6B simultaneously with 6A. • Roll (line of sight) 82A XUV dispersion clear of pointing position. • After 55 MAR, step 55 mirror to SLIT CTR unless step 3 follows immediately.	SU:3 14/17
(3)	6A	• Step 55 mirror to line 25. • Point Hα1 to position on latitude line (PAD coordinates - U/D-0000, L/R -130 (±20), -45 (±6), and -20 (±4) arc sec from limb). • Perform 6B simultaneously if 82A XUV dispersion is clear.	SU: 3 14/17
	B	• Roll (line of sight) 82A XUV dispersion clear of pointing position. • After 55 MAR, step 55 mirror to SLIT CTR unless step 3 is repeated immediately.	SU: 1 2/20
(4)	13 or 23	• Point Hα1 at the Hα inner limb (PAD coordinates - U/D 0000, L/R = 1R⊙). • Verify 82B slit tangent to white light limb. • Select LIMB SCAN, MPC to LIMB OFFSET = 0000 ±5, then select LIMB PTG. • Record 82B FRAMES REMAINING before AUTO STEP initiation. _____ • Start 82B AUTO STEP. • Go to AUTO SEQ - HOLD before ESS and record FRAMES REMAINING. _____ FRAMES DELTA _____ • After SUNSIDE PREP, repoint slit tangent to white light limb, select LIMB SCAN and using MPC point to LIMB OFFSET position determined from FRAMES DELTA (See 82B LIMB SCAN DIAGRAM). • Select LIMB PTG and AUTO SEQ - NORMAL.	SU: 4 48/52



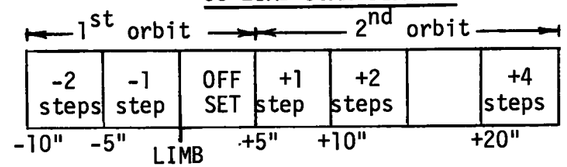


(5)	29	• Point 55 OFFSET vertical reticle tangent to the Hα inner limb (PAD coordinates U/D 0085). • Step 55 mirror to line 25, step _____ • Record 55 OFFSET mirror position (_____._____). • Position 55 mirror on limb using 0-order talkback and MPC (bp to grey change). • Select mirror positions as indicated on 55 limb scan diagram. • After completion of BB29, step 55 mirror to SLIT CTR unless BB24 will be performed again in the next daylight pass.	SU: 5 48/53

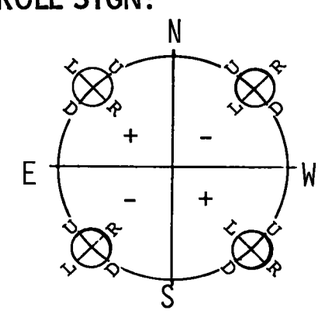
LIMB SCAN POINTING COORDINATES

LATITUDE U/D. (@ROLL=0000)	LIMB POSITION, ‖ROLL				LAT
	-130±20"	-45±6"	-20±4"	LB	
(‖)	(‖)	(‖)	(‖)	(‖)	(°)
0000	0000	0000	0000	0000	0
	10800	10800	10800	10800	
0050	0207	0188	0183	0179	3
	10593	10612	10617	10621	
0100	0415	0376	0366	0359	6
	10385	10424	10434	10441	
0150	0625	0566	0551	0539	9
	10175	10234	10249	10261	
0200	0837	0758	0737	0721	12
	9963	10042	10063	10079	
0250	1052	0951	0925	0906	15
	9748	9848	9875	9894	
0300	1271	1148	1117	1092	18
	9529	9652	9683	9708	
0350	1496	1349	1312	1283	21
	9304	9451	9488	9517	
0400	1729	1555	1511	1477	25
	9071	9245	9289	9322	
0450	1970	1768	1716	1677	28
	8830	9032	9084	9123	
0500	2222	1981	1928	1883	31
	8578	8813	8872	8917	
0550	2490	2217	2149	2097	35
	8310	8583	8651	8703	
0600	2778	2458	2380	2321	39
	8022	8342	8420	8479	
0650	3093	2716	2625	2557	43
	7707	8084	8175	8243	
0700	3450	2994	2888	2809	47
	7350	7806	7912	7991	
0750	3878	3303	3175	3082	51
	6922	7497	7624	7718	
0800	4473	3658	3500	3386	56
	6327	7142	7300	7414	
POLAR SCAN	5400	5400	5400	5400	

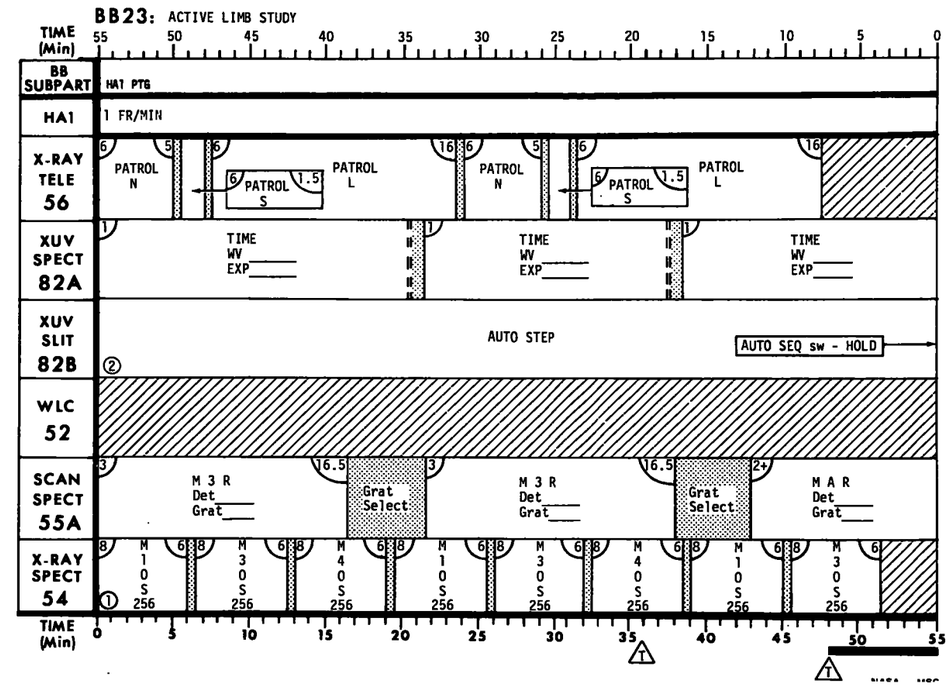
55 LIMB SCAN DIAGRAM



ROLL SIGN:

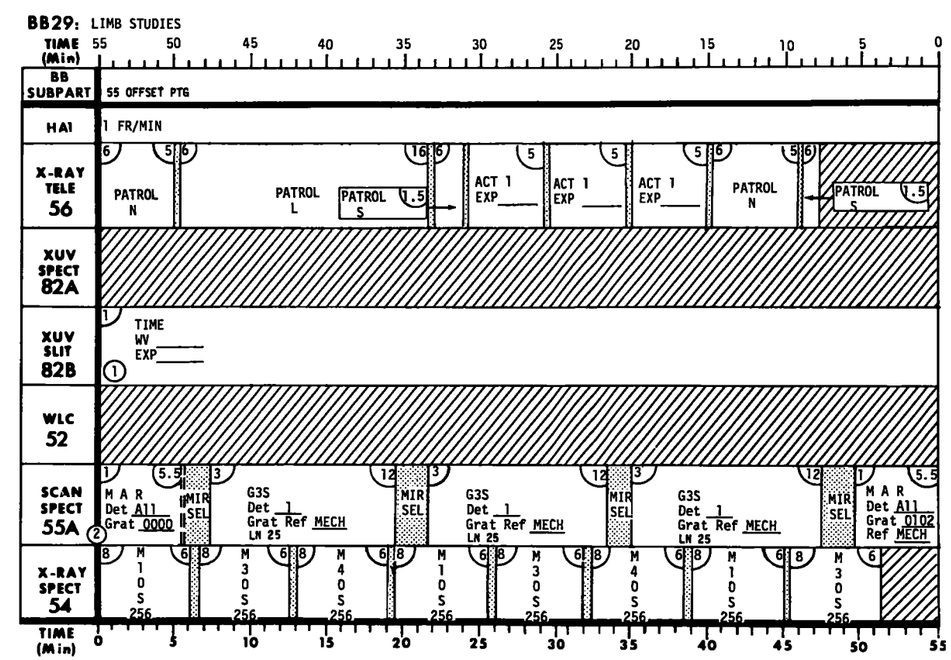


For 180° roll, use opposite sign.



82B LIMB SCAN DIAGRAM

Frames used:	0-7	8-15	16-23	24-31	32-39	40-47	48-55	56-63	64-71	72-80
New LIMB OFFSET:	-12"	-4"	-2"	+0"	+2"	+4"	+6"	+8"	+12"	+20"
Time (minutes):	4.2	4.2	4.2	4.2	17.9	17.9	17.9	17.9	28.6	28.6

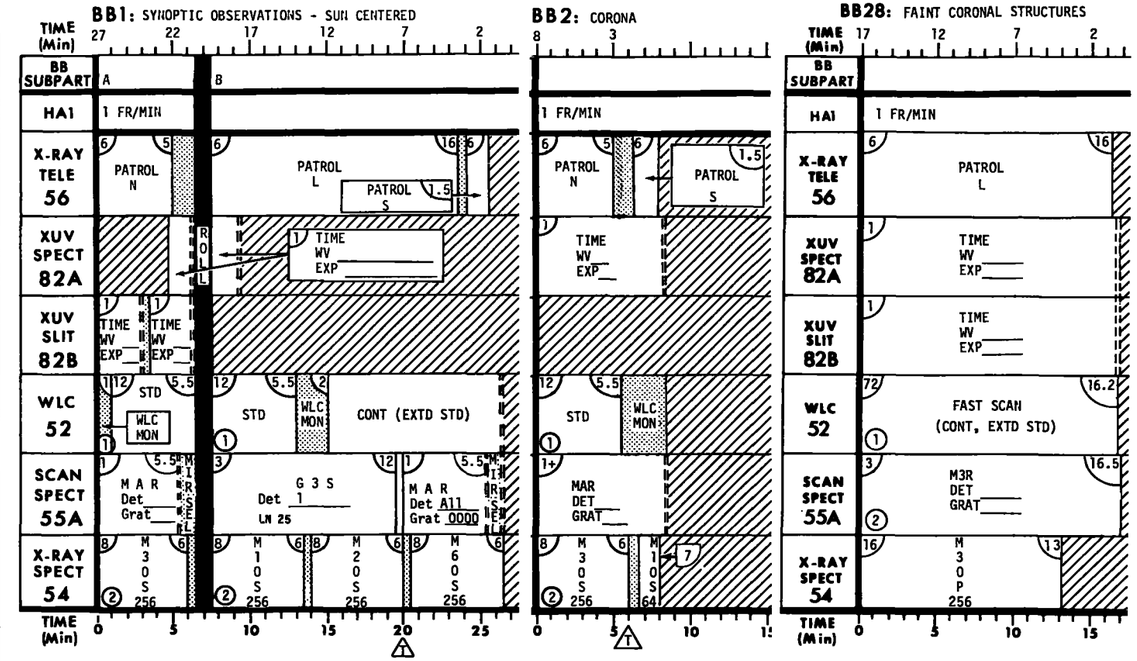


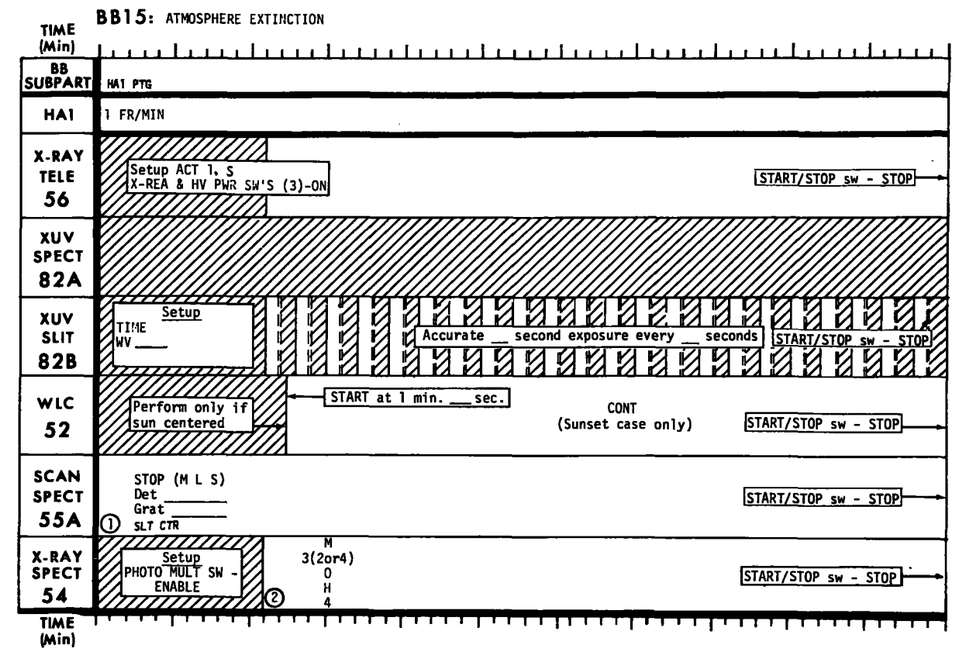
JOP 6 - SYNOPTIC OBSERVATIONS

Step	BB	TARGET	ΔT/ΣΔT
(1)	1A	• Point 52 to sun center. • Roll to 0000 or 10800 arc min. • After 55 MAR step 55 mirror to line 25.	SU: 3 7/10
	B	• Pointing same as A. • Roll to ±5400 arc min. • After 55 MAR, step 55 mirror to SLIT CTR If BB1 is interrupted, repeat it on the subsequent orbit (if possible).	SU: 1 19/30
(2)	2 or 28	• Point 52 to sun center. • Roll to ±5400 arc min (or 82A XUV dispersion clear of active region, see PAD). • Observe WLC MON prior to or after completion of BB.	SU: 3 6/9 or SU: 3 17/20

JOP 7 - ATMOSPHERE EXTINCTION

Step	BB	TARGET	ΔT/ΣΔT
		• The 55 portion of BB15 may be used as a "filler" at the beginning or end of any orbit, if it does not infringe on scheduled solar observations. • Point Hα1 at a bright plage, sun center or at last pointing position. • STOP (MLS), at DET ALL, GRAT 0000 or at last DET and GRAT selection.	
(1)	15	• 55 only operates. • Point Hα1 at a bright plage. • Start and stop times maybe given on PAD.	SU: 4 2/6
(2)	15	Sunset Setup • Point to bright plage or if 52 operates, to sun center. • Roll to PAD coordinate (if provided). • START 54, 56 and then START 82B at time given on PAD. • STOP BB15 at ____ secs. Time Remaining.	SU: 4 2/6
(3)	15	Sunrise Setup • Open 82B Doors prior to sunrise. • START BB15 at time given on PAD. • STOP 82B, 56 and 54 at time given on PAD.	SU: 4 2/6





JOP 9 - SOLAR WIND

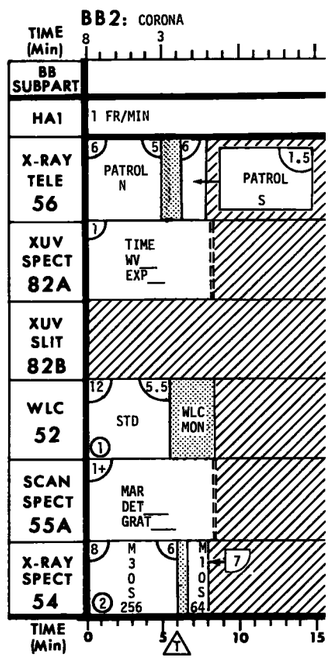
Step	BB	TARGET	ΔT/ΣΔT
(1)	2 or 28	• Point 52 to sun center. • Roll to ± 5400 arc min. • Observe WLC MON after completion of BB2 or 28.	SU: 3 6/9 or SU: 3 17/20
(2)	3 or 28	• Select 82B limb scan. • Point Hα1 so that 82B limb offset is 2-8 arc sec above the limb at position defined on PAD. • Select 82B LIMB PTG. • Omit 52.	SU: 3 16/19 or SU: 3 17/20

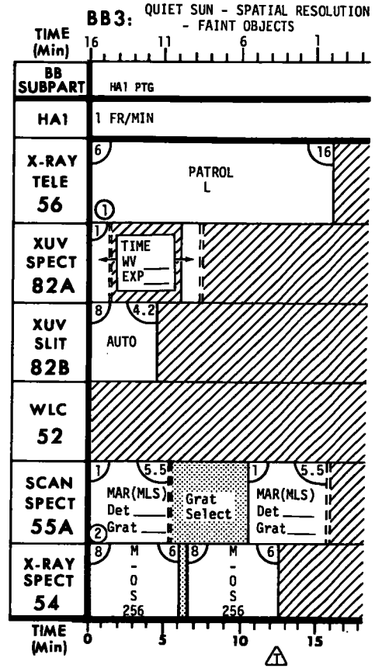
JOP 10 - LUNAR LIBRATION CLOUDS

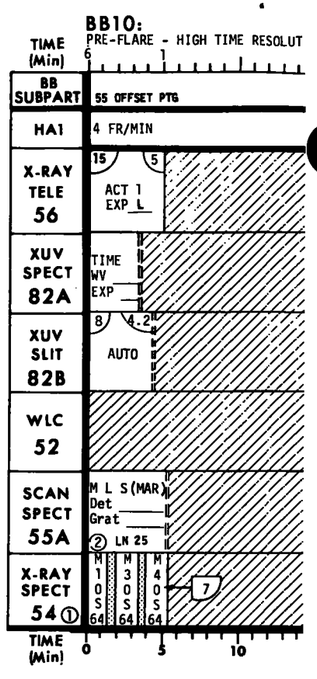
Step	BB	TARGET	ΔT/ΣΔT
(1)	2	• Point 52 to sun center. • See PAD for roll. • Observe WLC MON after completion of BB2.	SU: 3 6/9

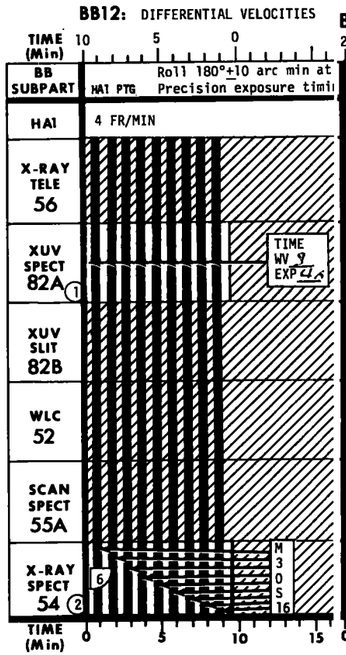
JOP 11 - CHROMOSPHERIC OSCILLATIONS AND HEATING: Quiet or Active Region

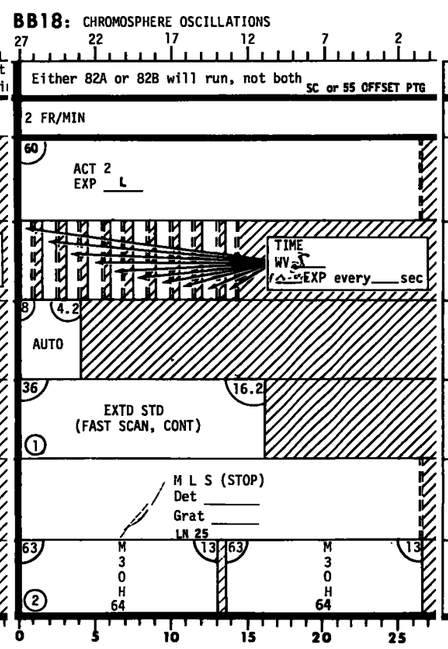
Step	BB	TARGET	ΔT/ΣΔT
(1)	2	• Point 52 to sun center. • Roll to 0000 or 10800 arc min.	SU: 3 6/9
(2)	10	• Point 55 OFFSET so 55 MAR is centered on a Hα quiet region which has a diameter of at least 5 arc min, preferably close to sun center; or at the center of an active region (See PAD). • Roll to 0000 or 10800 arc min.	SU: 3 6/9
(3)	18	• Pointing and roll same as (1) or (2). • Omit 52 if not pointed at sun center. • Step 55 mirror to line 25. • After 55 MLS, step 55 mirror to SLIT CTR.	SU: 2 27/29
(4)	2	• Point 52 to sun center. • Roll to ± 5400 arc min.	SU: 3 6/9
(5)	10	• Pointing same as (3). • Roll 82A XUV dispersion clear of active region.	SU: 2 6/8
(6)	12	• Point Hα1 at sun center. • Canister roll = 0000. • Between successive exposures, alternate the roll between CSTR ROLL = +5400 and CSTR ROLL = -5400 (± 10).	SU: 3 9/12

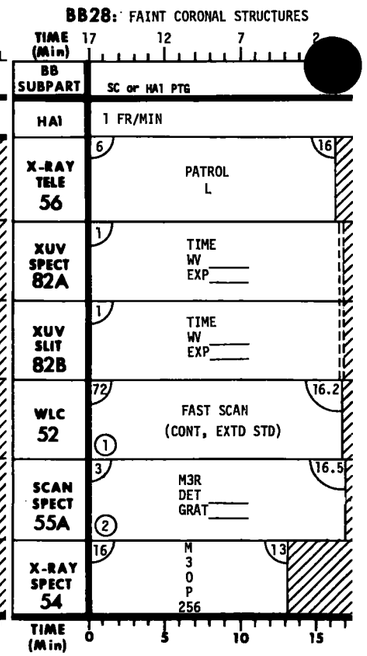












JOP 8/16 CORONAL AND DISK TRANSIENTS

8A/16 HYDROGEN ALPHA (Hα) CREW DETECTED TRANSIENT EVENTS

•If surge, spray, eruptive prominence or disappearing filament is observed > .7R⊙ perform steps __ and 3 (See SAP).

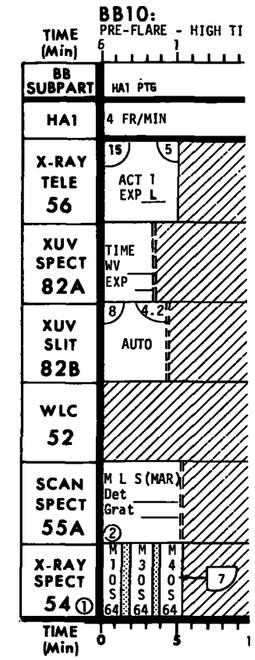
•If a surge, disappearing filament, or winking filament is observed < .7R⊙ perform step (4) for the duration of the transient or at least 3 times.

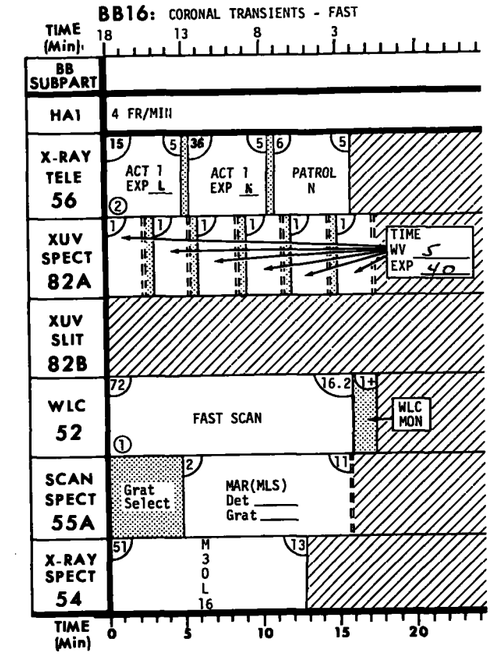
Step	BB	TARGET	ΔT/ΣΔT
(1)	10	•Point 82B slit at the Hα moving material or its last position each time. •Roll 82B slit for uniform emission along the slit (and 82A XUV dispersion clear of transient event if possible) and perform BB10. •Perform BB10 4 times if there is sufficient time remaining in the orbit. •Perform 82A on the first BB10 only.	SU: 3 6/9
(2)	16	•Point 52 to sun center. •Roll to position feature of interest at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of transient event (if possible) and perform BB16.	SU: 3 18/21
(3)	17	•Point 52 to sun center. •Roll to position feature of interest at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of transient event (if possible) and perform BB17. •For the remainder of the orbit and during the following orbit perform BB 17 repetitively.	SU: 3 18/21
(4)	10	•Point Hα1 at transient phenomena where structural changes or movement is observed. •Roll 82B slit for uniform emission and for maximum coverage by 55 MAR. •55 MAR, DET ALL, GRAT 0000 or if transient is changing or moving very rapidly (noticeable change and movement in 1 min) 55 MLS mode may be selected.	SU: 3 6/9

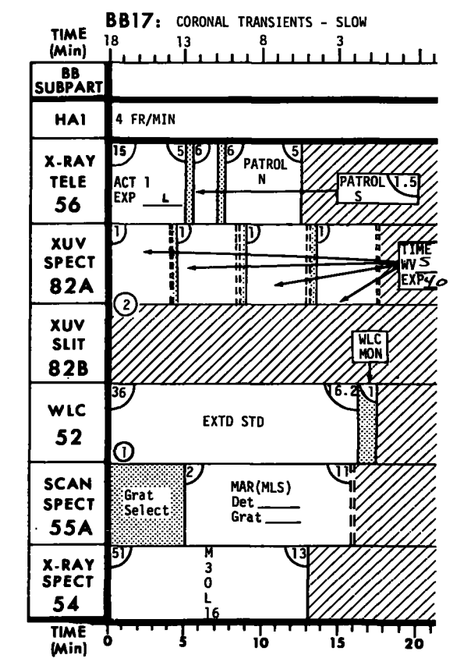
8B WHITE LIGHT CORONAGRAPH (WLC) CREW DETECTED TRANSIENT EVENTS

•If Any Motion Is Observed, Perform Step (1), BB16.
•If No Motion Is Observed, Perform Step (2), BB17.

Step	BB	TARGET	ΔT/ΣΔT
(1)	16	•Point 52 to sun center. •Roll to position feature of interest at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of transient event (if possible) and perform BB16. •At the conclusion of BB16, view the WLC TV again. If the speed of the event is greater than 0.1 R⊙/minute, (use overlay, waiting 1 min) continue to perform step BB16. If the speed is less, perform step (2), BB17.	SU: 3 16/19
(2)	17	•Point 52 to sun center. •Roll to position feature of interest at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of transient event (if possible). •Continue to perform BB17 for the remainder of the orbit and all of the following orbit.	SU: 3 17/20



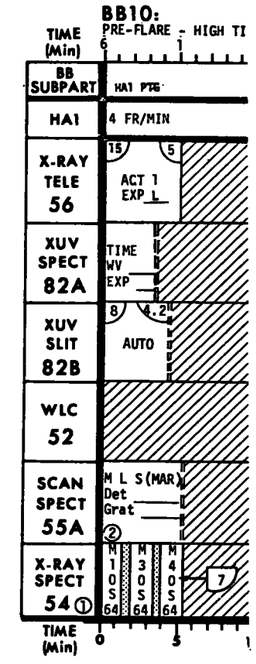


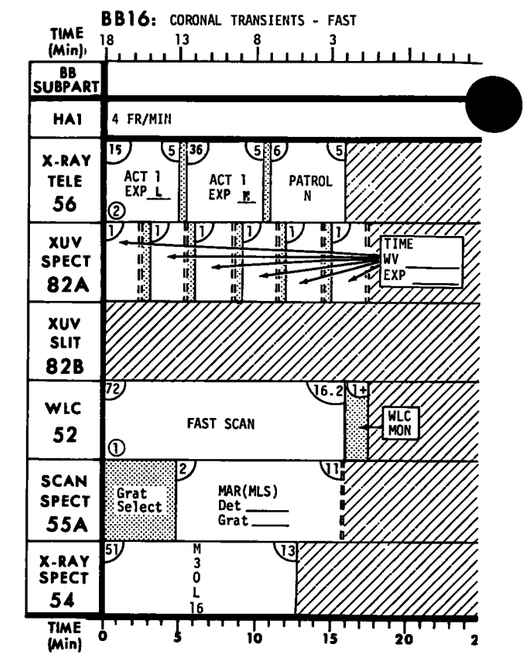


8C GROUND DETECTED TRANSIENT EVENTS

- Perform steps (1), (2) and/or (3) suggested by MCC for the remainder of the orbit and during the following orbit.

Step	BB	TARGET	ΔT/ΣΔT
(1)	10	• Point 82B slit at the Hα moving material or its last position each time. • Roll 82B slit for uniform emission along the slit (and 82A XUV dispersion clear of transient event if possible) and perform BB10. • Perform BB10 4 times if there is sufficient time remaining in the orbit. • Perform 82A on the first BB10 only.	SU: 3 6/9
(2)	16	• Point 52 to sun center. • Roll to position feature of interest at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of transient event (if possible) and perform BB16.	SU: 3 18/21
(3)	17	• Point 52 to sun center. • Roll to position feature of interest at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of transient event (if possible) and perform BB17. • For the remainder of the orbit and during the following orbit perform BB 17 repetitively.	SU: 3 18/21





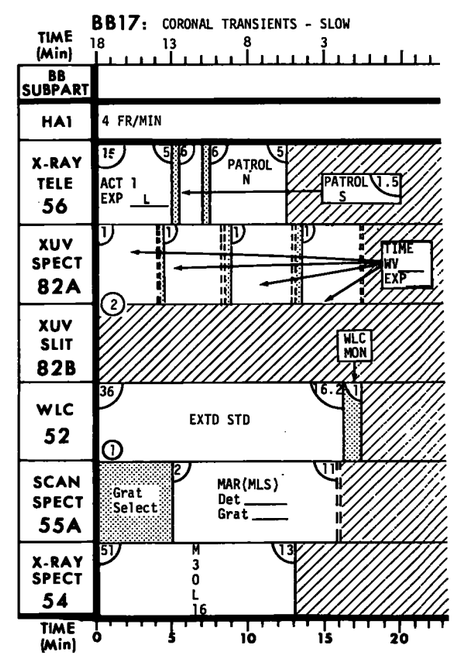
8D CORONAL TRANSIENT WAIT

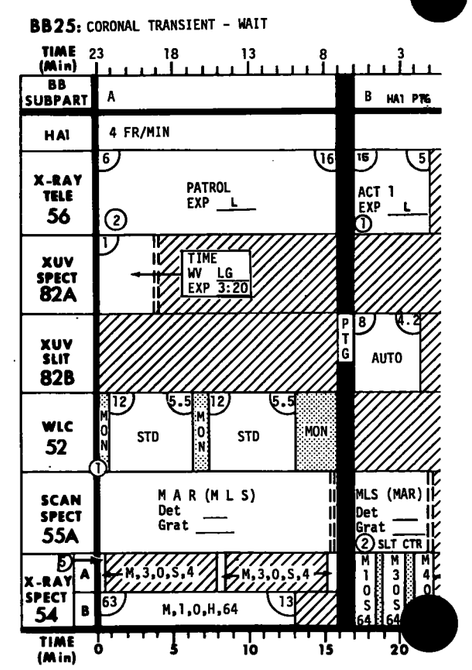
- If the probability of a coronal transient is high, BB25 will be scheduled on the PAD or requested realtime. The feature of interest and number of BB repetitions will be specified.

- If a Hα CREW DETECTED TRANSIENT EVENT is observed terminate BB25 and go to Hα CREW DETECTED TRANSIENT EVENT on back side of this sheet.

- If a WLC CREW DETECTED TRANSIENT EVENT is observed terminate BB25 and go to WLC CREW DETECTED TRANSIENT EVENT on back side of this sheet.

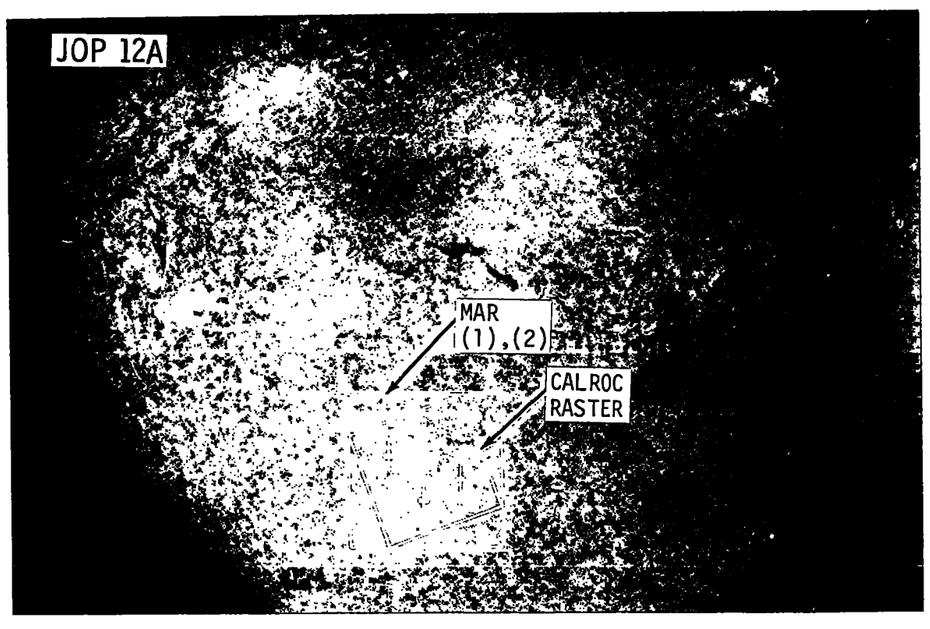
Step	BB	TARGET	ΔT/ΣΔT
(1)	25A	• Point 52 to sun center. • Roll to position feature of interest at approximately 3 o'clock (105 o'clock) and 82A XUV dispersion clear of transient event (if possible).	SU: 3 16/19
	B	• Point 82B slit at Hα feature of interest. • Roll 82B slit for uniform emission along the slit.	SU: 3 6/9

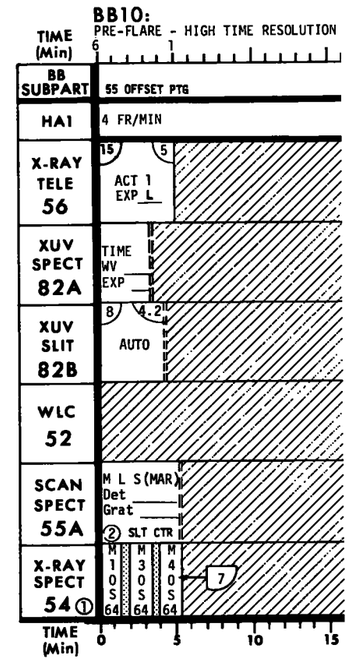


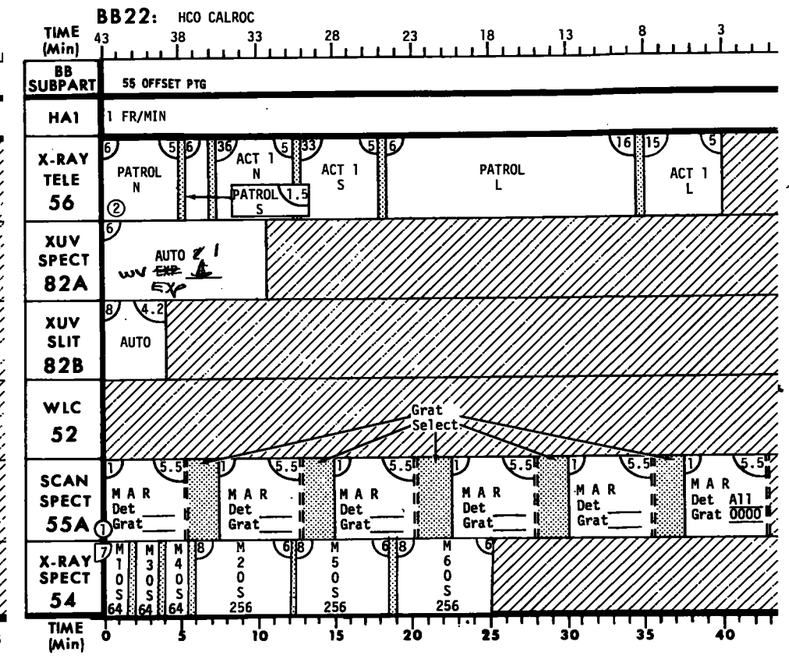


JOP 12A - 55 ROCKET CALIBRATION

Step	BB	TARGET	ΔT/ΣΔT
		• A three orbit sequence of the following will be performed as near as possible to the launch of the HCO calibration rocket. • For successive BB-26's repoint at least 1 arc min away, remaining within field of view of calibration rocket (4.4 arc min^2).	
(1)	22	• Roll and point at PAD coordinates. These coordinates center 55 MAR on the region scanned by the calibration rocket. This region should be a quiet XUV and Hα area.	SU: 3 43/46
(2)	10	• Pointing and roll same as (1).	SU: 2 6/8
(3)	26	• Step 55 mirror to line 25. • Point Hα1 to a position within the field of view of the calibration rocket (See PAD coordinates for center of rocket FOV). (For successive BB26's point U/D, L/R approximately 1 arc min from center of FOV.) • 55 GAS NO INTLK, DET ALL-For each scan turn respective detectors off when grating indicator reaches number on decal. • Stop the grating between 5370 and 5390. Reenable all detectors, wait 10 secs and then START. • Omit 52 if not sun centered. • For successive BB26s repoint to a position at least 1 arc min away. • After GAS, step 55 mirror to SLIT CTR if BB26 is not immediately repeated.	SU: 3 9/12

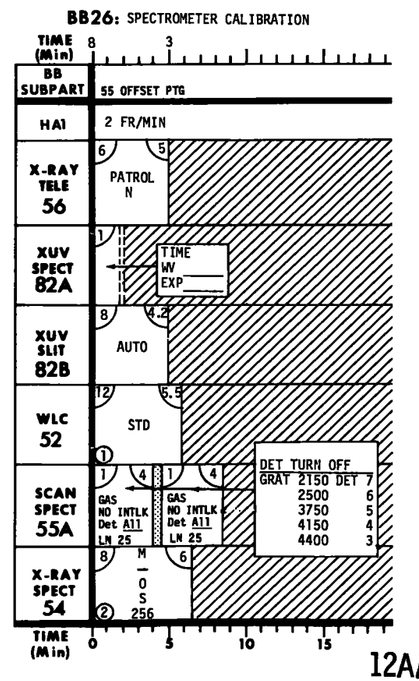






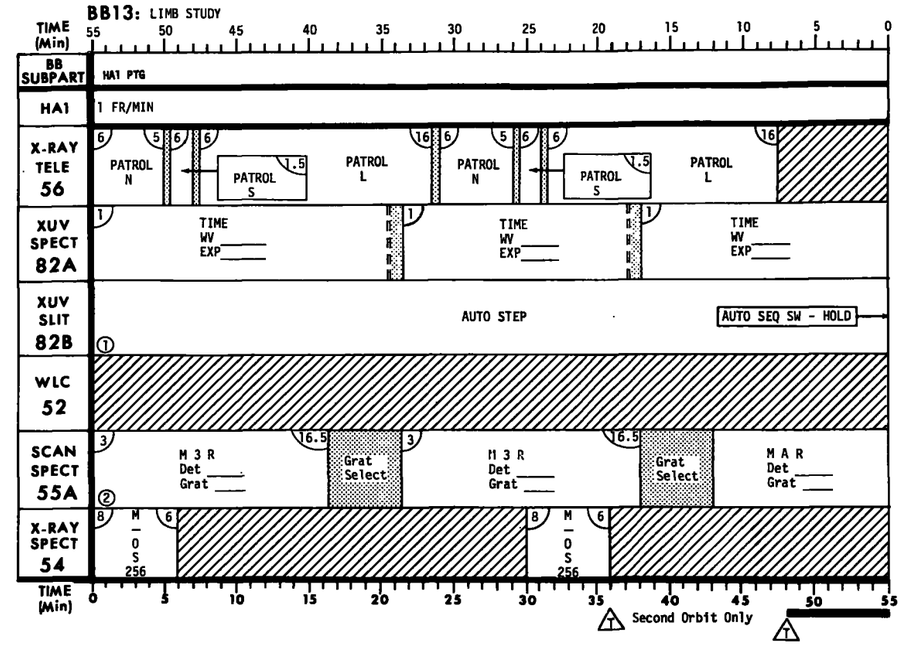
BB22 55 MAR, DET/GRAT SELECT

SEQ 1	DET ALL GRAT 0426	DET ALL GRAT 0620	DET ALL GRAT 2063	DET 12345 GRAT 2665	DET 12345 GRAT 2999
SEQ 2	DET ALL GRAT 0162	DET ALL GRAT 0200	DET ALL GRAT 1200	DET ALL GRAT 1423	DET 12345 GRAT 2897



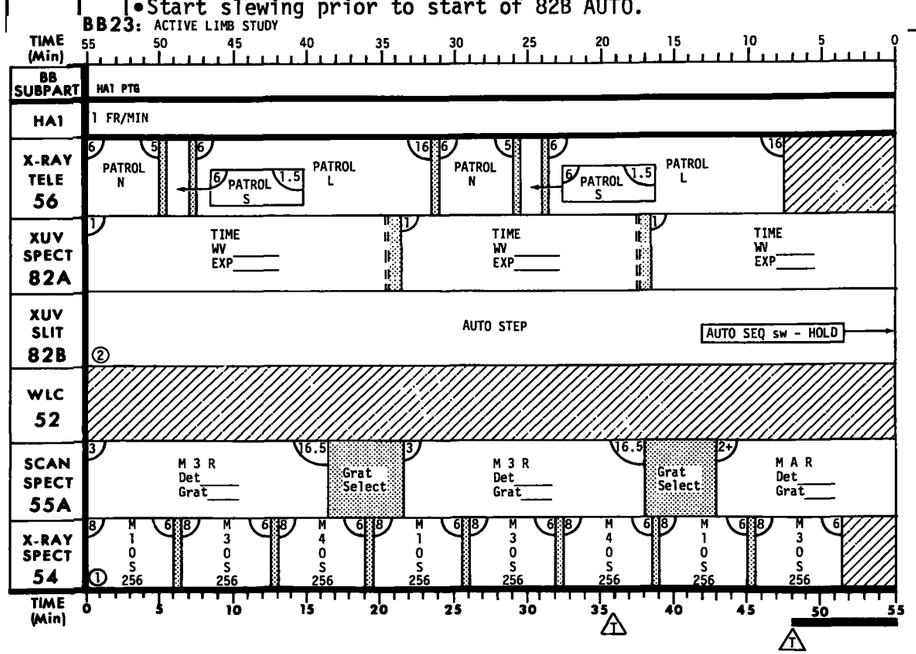
12A/12B

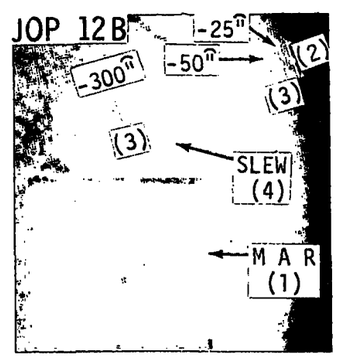
Step	BB	TARGET	ΔT/ΣΔT
		A sequence of the following BB's will be performed as soon as possible after the NRL rocket flight.	
(1)	21A	•Roll to PAD coordinate (82A XUV dispersion parallel to CALROC dispersion). •Point 55 OFFSET at a quiet Hα and XUV area near an active region (See PAD for approximate coordinates) such that the 55 MAR pattern will encompass both quiet and active areas (<.7R⊙).	SU: 4 44/47
	21B	•Roll 82B slit for uniform emission and then repoint 55 OFFSET to original position.	
(2)	13 or 23	•Point Hα1 at a position on the Hα inner limb (See PAD - U/D0000, L/R = 1R⊙) •Verify 82B slit tangent to white light limb. •Select LIMB SCAN, MPC to LIMB OFFSET = 000±5, then select LIMB PTG. •Record 82B FRAMES REMAINING before AUTO STEP initiation. _____ •Start 82B AUTO STEP sequence. •Go to AUTO SEQ - HOLD before ESS and then record FRAMES REMAINING. _____ FRAMES DELTA _____ •After SUNSIDE PREP, repoint slit tangent to white light limb, select LIMB SCAN and using MPC point to LIMB OFFSET position determined from FRAMES DELTA. (See 82B LIMB SCAN DIAGRAM). •Select LIMB PTG and AUTO SEQ - NORMAL	SU: 4 48/52
(3)	6A	•Point Hα1 at position along radial line (See PAD coordinates - U/D-0000). •Perform 6B simultaneously if 82A XUV dispersion is clear.	SU: 3 14/17
	6B	•Roll 82A XUV dispersion clear of position in A. •Pointing same as A.	SU: 1 2/20
(4)		•82B AUTO •Point and roll Hα1 at a quiet region (See PAD coordinates). •Slew Hα1 left and right approximately ±30 arc secs during the 82B AUTO mode. •Start slewing prior to start of 82B AUTO.	SU: 2 4/6

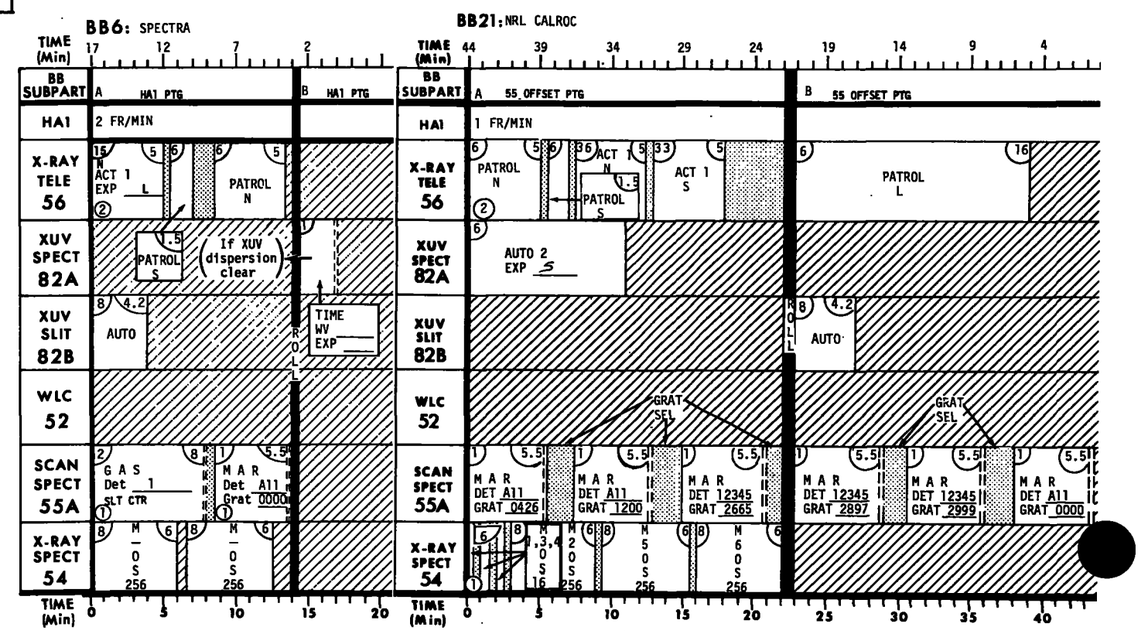


82B LIMB SCAN DIAGRAM

Frames used:	0-7	8-15	16-23	24-31	32-39	40-47	48-55	56-63	64-71	72-80
New LIMB OFFSET:	-12"	-4"	-2"	+0"	+2"	+4"	+6"	+8"	+12"	+20"
Time (minutes):	4.2	4.2	4.2	4.2	17.9	17.9	17.9	17.9	28.6	28.6







JOP 12C - FILM CANISTER

Step	BB	TARGET	ΔT/ΣΔT
[redacted]	16	• Point 52 to sun center. • Roll to ±5400 arc min. • Omit 82A.	SU: 3 16/19

JOP 12D - 82B SLEW CALIBRATION

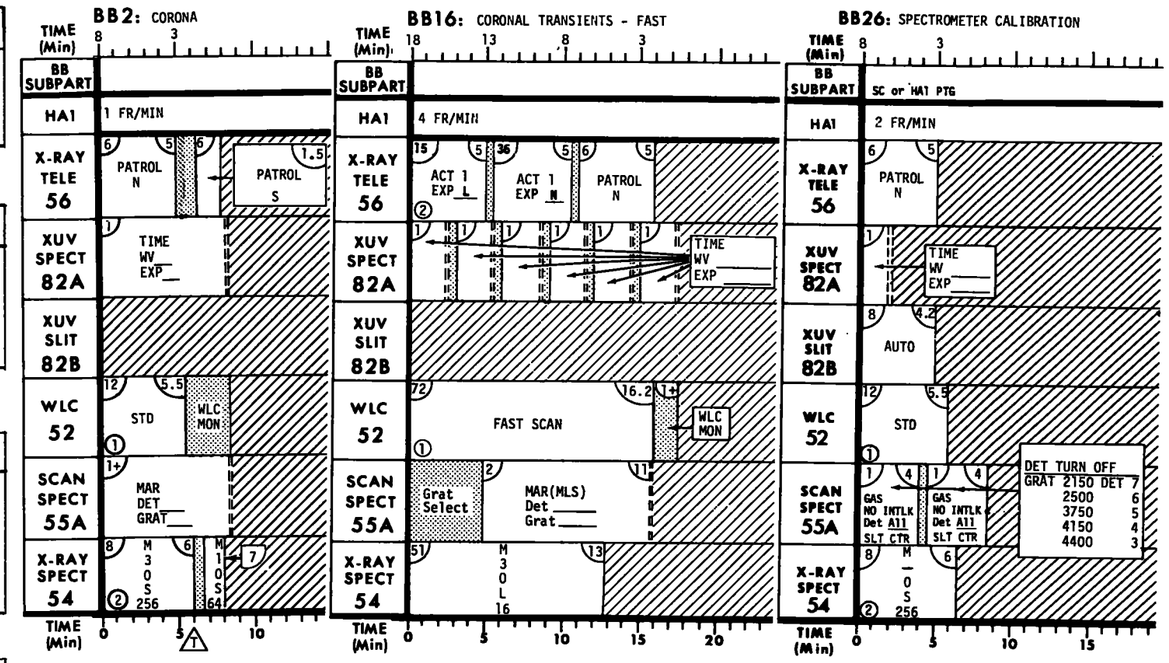
Step	BB	TARGET	ΔT/ΣΔT
(1)		• 82B TIME MODE, EXP 10 EXP 40 (See PAD). 160 @ 57 • Point and roll Hα1 at a quiet region (See PAD coordinates). • Slew Hα1 left and right approximately ±30 arc secs during each 82B TIME exposure. • Start slewing prior to start of each 82B ~~AUTO~~ TIME exposure.	SU: 2 4/6

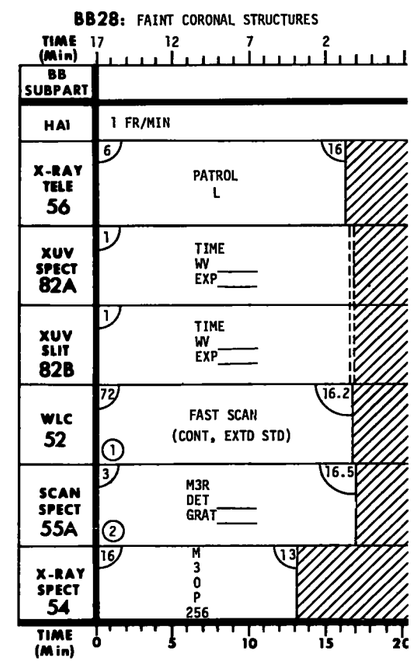
JOP 12E - LUNAR CALIBRATION

Step	BB	TARGET	ΔT/ΣΔT
(1)	2 or 28	• Point 52 to sun center. • See PAD for roll. • Observe WLC MON after completion of BB2.	SU: 3 6/9 or SU: 3 17/20

JOP 12F - 55 Calibration

Step	BB	TARGET	ΔT/ΣΔT
[redacted]	26	• Point 52 at suncenter or Hα1 at active region (See PAD). • Roll 82A XUV dispersion clear of active regions. • Omit 52 if not pointed at suncenter.	SU: 3 9/12





12C,D,E,F

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Step

(1) PWR DN - OPR NEXT PASS SU: 5 50/55

(2) Record gimbal angles of star OG _____ IG _____

(3) Verify MOMENTUM DUMP AUTO GG sw - INHIBIT

(4) DAS:
Key - 52010E (Inhibit)
50004E (Star Track Control)
52010E (Inhibit)
50011E (Star Track OG Plane Error Update)
52030E (Maneuver Time)
500TTE (MANEUVER PAD, minutes, must be in octal) _____

(5) Canister roll - 0000

(6) At GMT __:__:__, (MANEUVER PAD)
ATTITUDE CONTROL SYSTEM:
MODE ATT HOLD sw - CMG; tb - CMG

(7) DAS:
Key - 52020E (Coarse Mnvr)
5+/-XXXE (MANEUVER PAD, _____
5+/-YYYE 1.0 deg. increments, _____
5+/-ZZZE must be in octal) _____

and/or

Key - 52021E (Fine Mnvr)
5+/-XXXE (MANEUVER PAD, _____
5+/-YYYE 0.1 deg. increments, _____
5+/-ZZZE must be in octal) _____

During Mnvr perform steps (8) through (14)

(8) DAS:
Key - 52030E (Maneuver Time)
50000E (Set Maneuver Time to zero)

(9) Monitor Attitude and Rates

(10) ATTITUDE CONTROL SYSTEM:
STAR TRACK ACQ sw - MAN; tb - MAN

(11) MANUAL POINTING CONTROL:
MAN PTG ENABLE sw - ENABLE; tb - STR
MPC - Manipulate Gimbals to OGP1, IGP1 (MANEUVER PAD)

(12) ATTITUDE CONTROL SYSTEM: OGP1 _____
STAR TRACK SHUTTER sw - CLOSE; tb - bp IGP1 _____

(13) 55 GRATING SELECT
NIGHT INTLK sw - OVERRIDE
MAR DET_____, GRAT_____

(14) BB20 PREP (Perform only in ORB PHASE - night)

56 DOOR sw - OPEN
SINGLE FR ____ L (READY lt on)
52 MAIN PWR sw - ON
DOOR sw - OPEN (READY lt on)
FAST SCAN
55 DOOR sw - OPEN (READY lt on)
54 M,3,0,S,256
XUV MON DOOR sw - OPEN

(15) When attitude is stable and rates are small.
DAS:
Key - 52012E (Select System)
50005E (Initialize Strapdown)
Verify ØX,Y,Z = 0 and immediately select
ATTITUDE CONTROL SYSTEM:
MODE SOLAR INERTIAL sw - SOLAR INERTIAL; tb - SI

STAR TRACK ACQ sw - AUTO; tb - AUT
STAR TRACK SHUTTER tb - OPN or STR

(16) Record IGA1 (star 1) below

ATTITUDE CONTROL SYSTEM:
STAR TRACK ACQ sw - MAN; tb - MAN

MANUAL POINTING CONTROL:
MPC - Manipulate Gimbals to OGP2, IGP2 (MANEUVER PAD)

ATTITUDE CONTROL SYSTEM:
STAR TRACK ACQ sw - AUTO; tb - AUT OGP2 _____
STAR TRACK SHUTTER tb - OPN or STR IGP2 _____

(17) Record IGA2 (star 2) below

MANUAL POINTING CONTROL:
MAN PTG ENABLE sw - INHIBIT; tb - bp

(18) Perform the following calculations:

Delta ØX=C11[IGP1-IGA1]+C12[IGP2-IGA2]
Delta ØY=C21[IGP1-IGA1]+C22[IGP2-IGA2]

(IGP1) _____ (MNVR PAD) (IGP2) _____ (MNVR PAD)

-(IGA1) _____ -(IGA2) _____

=(P1-A1)_____ =(P2-A2)_____

C11=_____ (MNVR PAD) C21=_____ (MNVR PAD)

C12=_____ (MNVR PAD) C22=_____ (MNVR PAD)

(C11)x(P1-A1)=_____ (C21)x(P1-A1)=_____

+(C12)x(P2-A2)=_____ +(C22)x(P2-A2)=_____

Delta ØX=_____ (XXX.XXX°) Delta ØY=_____ (XXX.XXX°)

* If Delta ØX or Delta ØY > 0.05, round off to nearest*
* 0.1°, convert to octal, and change cluster att by:*
*
* DAS: *
* Key - 52021E (Fine Mnvr) 0+ *
* 5+/-XXXE (0.1 deg. increments, 1- *
* 5+/-YYYE must be in octal) *
* 50000E *
* Verify that rates are small. *
* Note IGA2 after completion of maneuver. *

(19) Perform BB20 as follows:

START SEQUENCE

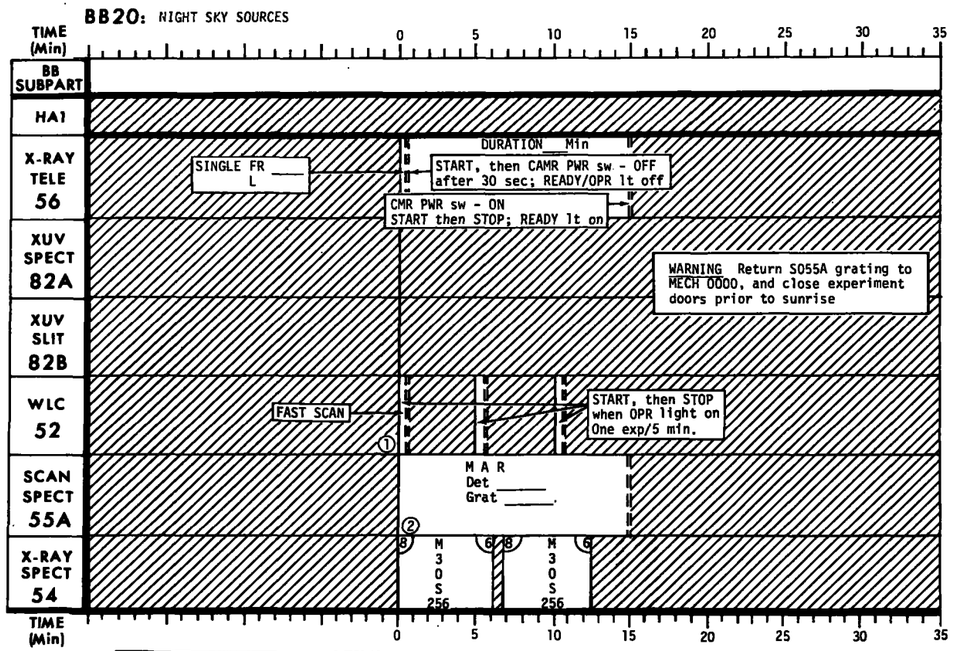
(a) 52 START
When OPR light is on, STOP
Take 1 exp every 5 min.

(b) 55 START (OPR lt on)
54 START

(c) 56 START (OPT lt on)
After 30 sec, CAMR PWR sw - OFF
(READY/OPR lt - off)

(d) Note time _____.

(e) XUV MON:
Observe display with integration.



STOP SEQUENCE

(a) 56 CAMR PWR sw - ON
START then STOP (READY lt on)
DOOR sw - CLOSE

(b) 52 DOOR sw - CLOSE
MAIN PWR sw - STBY

(c) 55 STOP
DOOR sw - CLOSE
MECH REF, GRAT 0000

(d) XUV MON Door sw - CLOSE

(20) DAS:
Key - 52030E (Maneuver Time)
500TTE (MANEUVER PAD, minutes, must be in octal) _____
At GMT __:__:__, (MANEUVER PAD)
ATTITUDE CONTROL SYSTEM:
MODE ATT HOLD sw - CMG; tb - CMG

(21) DAS:
Key - 52020E (Coarse Mnvr)
5+/-XXXE (MANEUVER PAD, _____
5+/-YYYE 1.0 deg. increments, _____
5+/-ZZZE must be in octal) _____
and/or
Key - 52021E (Fine Mnvr)
5+/-XXXE (MANEUVER PAD, _____
5+/-YYYE 0.1 deg. increments, _____
5+/-ZZZE must be in octal) _____

During Mnvr perform steps (22) through (26)

(22) DAS:
Key - 52030E (Maneuver Time)
50000E (Set Maneuver Time to zero)

(23) Monitor Attitude and Rates

(24) ATTITUDE CONTROL SYSTEM:
STAR TRACK ACQ sw - MAN; tb - MAN

(25) MANUAL POINTING CONTROL:
MAN PTG ENABLE sw - ENABLE; tb - STR
MPC - Manipulate Gimbals to OG, IG
(Initially recorded values or STAR TRACKER PADS)

(26) ATTITUDE CONTROL SYSTEM:
STAR TRACK SHUTTER sw - CLOSE; tb - bp

End of Mnvr

(27) When attitude is stable
DAS:
Key - 52012E (Select System)
50005E (Initialize Strapdown)
Verify ØX,Y,Z = 0000 and immediately select
ATTITUDE CONTROL SYSTEM:
MODE EXP PTG sw - EXP PTG; tb - EXP

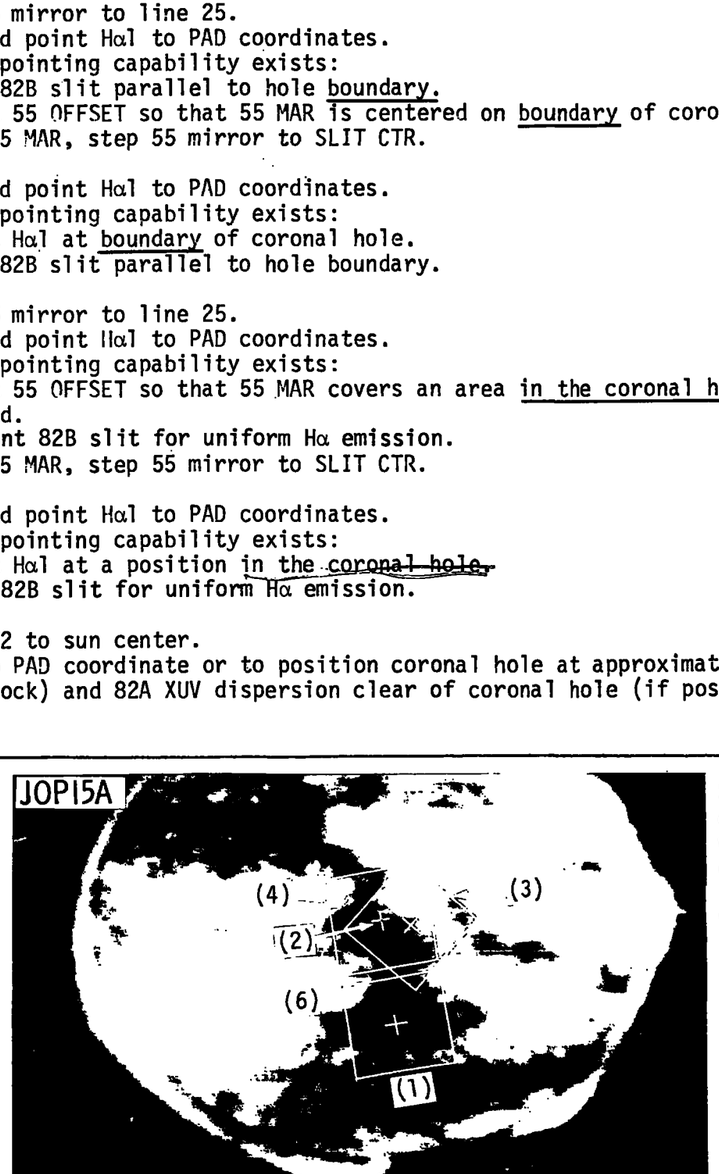
(28) DAS:
Key - 52011E (Enable)
50004E (Star Track Control)
52011E (Enable)
50011E (Star Track OG Plane Error Update)
52030E (Maneuver Time)
50015E (13 Minutes)

STAR TRACK ACQ sw - AUTO; tb - AUT
STAR TRACK SHUTTER tb - OPN or STR

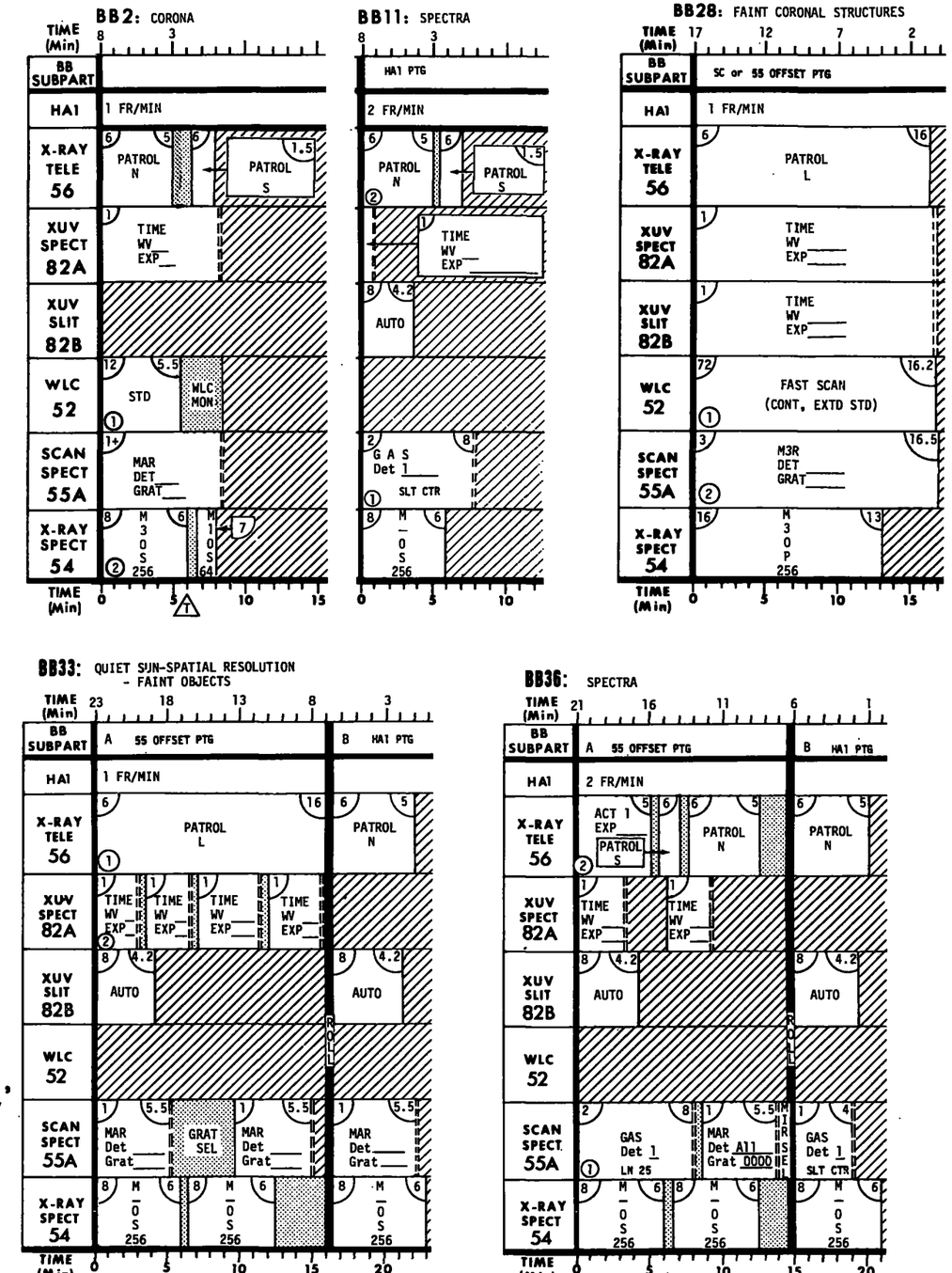
(29) SUNSIDE PREP or PWR DN for Unattended

(30) MOMENTUM DUMP AUTO GG sw - ENABLE

Step	BB	TARGET	ΔT/ΣΔT
(1)	28	•Roll and point Hα1 to PAD coordinates. •If XUV pointing capability exists: •Roll 82A XUV dispersion clear of coronal hole (and 82B slit for uniform emission, if possible). •Point 55 OFFSET so that 55 MAR is centered on the coronal hole.	SU: 5 17/22
(2)	33A	•Roll and point Hα1 to PAD coordinates •If XUV pointing capability exists. •Roll 82A XUV dispersion clear of coronal hole. •Point 55 OFFSET so that 55 MAR covers an area in the coronal hole not previously viewed.	SU: 3 16/19
(3)	36A	•Step 55 mirror to line 25. •Roll and point Hα1 to PAD coordinates. •If XUV pointing capability exists: •Roll 82B slit parallel to hole boundary. •Point 55 OFFSET so that 55 MAR is centered on boundary of coronal hole. •After 55 MAR, step 55 mirror to SLIT CTR.	SU: 4 14/18
(4)	11	•Roll and point Hα1 to PAD coordinates. •If XUV pointing capability exists: •Point Hα1 at boundary of coronal hole. •Roll 82B slit parallel to hole boundary.	SU: 3 8/11
(5)	36A	•Step 55 mirror to line 25. •Roll and point Hα1 to PAD coordinates. •If XUV pointing capability exists: •Point 55 OFFSET so that 55 MAR covers an area in the coronal hole not previously viewed. •Repoint 82B slit for uniform Hα emission. •After 55 MAR, step 55 mirror to SLIT CTR.	SU: 4 14/18
(6)	11	•Roll and point Hα1 to PAD coordinates. •If XUV pointing capability exists: •Point Hα1 at a position in the coronal hole. •Roll 82B slit for uniform Hα emission.	SU: 3 8/11
(7)	2 or 28	•Point 52 to sun center. •Roll to PAD coordinate or to position coronal hole at approximately 3 o'clock (1-5 clock) and 82A XUV dispersion clear of coronal hole (if possible).	SU: 3 9/12 or SU: 3 16/19



Steps (1) and (2) form "picture" of large area around coronal hole, while steps (3) and (4) primarily obtain spectra near boundary of hole, steps (5) and (6) spectra within the hole.



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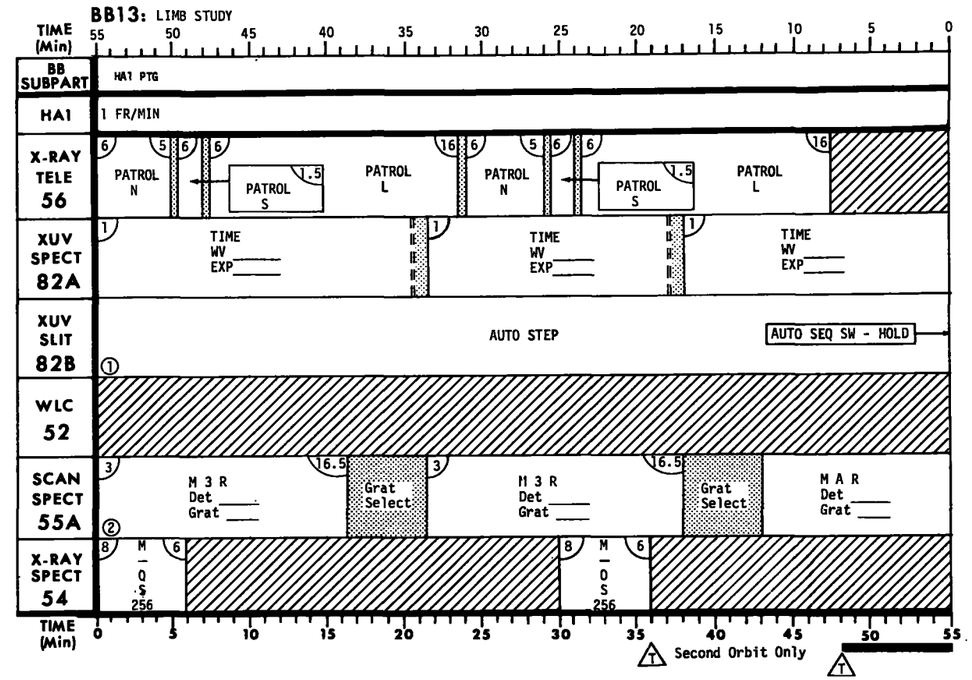
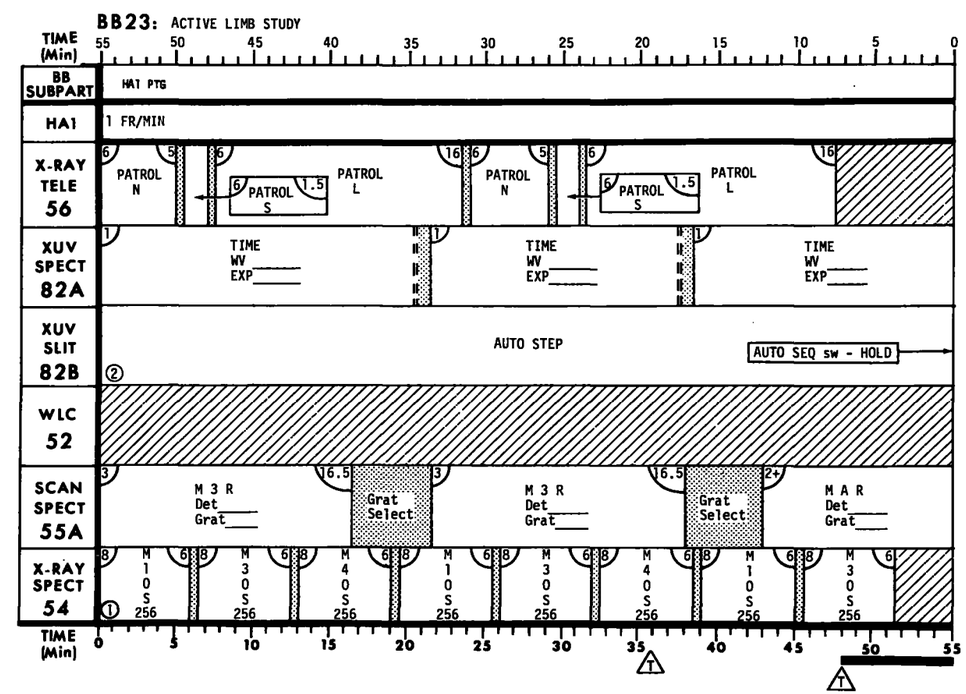
JOP 15B - CORONAL HOLE ON THE LIMB

Step	BB	TARGET	ΔT/ΣΔT
(1)	13 or 23	• Point Hα1 at coronal hole on the limb or see PAD. • Roll 82B slit tangent to white light limb. (U/D 0000, R/L = 1R). • Record pointing coordinates RL +/- _____ U+/D- _____ L-/R+ _____ if JOP 15B is to be continued in the next orbit. • Select LIMB SCAN, MPC to LIMB OFFSET - 0000+5, then select LIMB PTG. • Record 82B FRAMES REMAINING before AUTO STEP initiation. _____ • Start 82B AUTO STEP • Go to AUTO SEQ - HOLD before ESS and record FRAMES REMAINING. _____ FRAMES DELTA _____ • After SUNSIDE PREP, repoint slit tangent to white light limb. • Select LIMB SCAN and using MPC point to LIMB OFFSET position determined from FRAMES DELTA (See 82B LIMB SCAN DIAGRAM). • Select LIMB PTG and AUTO SEQ - NORMAL.	SU: 4 48/52

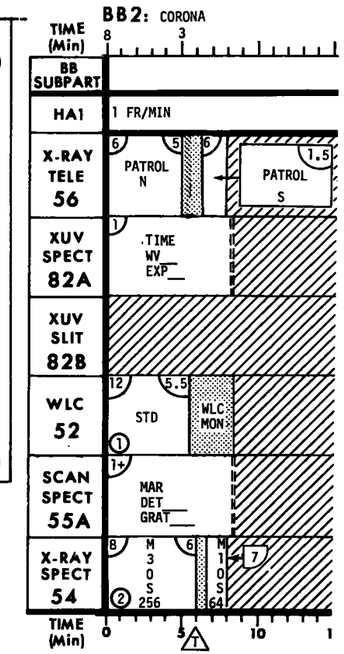


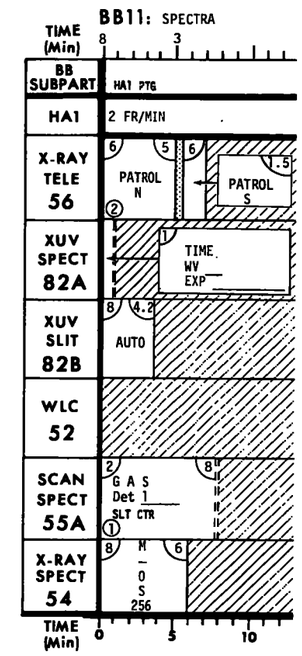


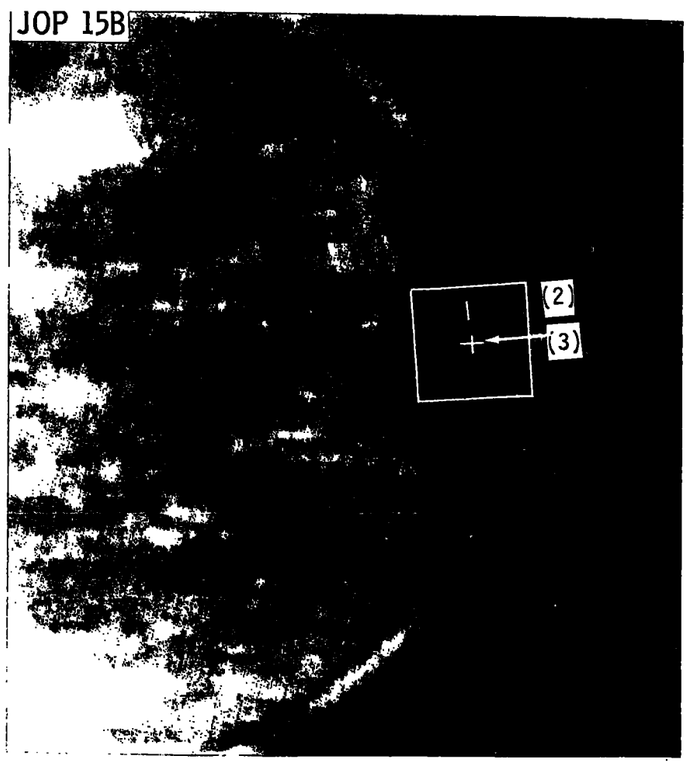
JOP 15B (Cont'd)

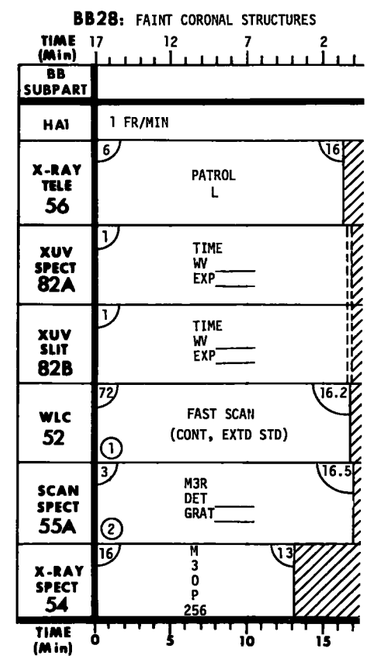
(2)	36A	• Step 55 mirror to line 25.
		• Roll and point Hα1 to PAD coordinates (10 or 20 arc secs above limb, See PAD).
		• If XUV pointing capability exists:
		  • Roll 82B slit parallel to the limb.
		  • Point 55 OFFSET so that 55 MAR is centered on a position 10 - 20 arc secs above the limb and coronal hole.
		• After 55 MAR, step 55 mirror to SLIT CTR
			SU: 5
			14/19

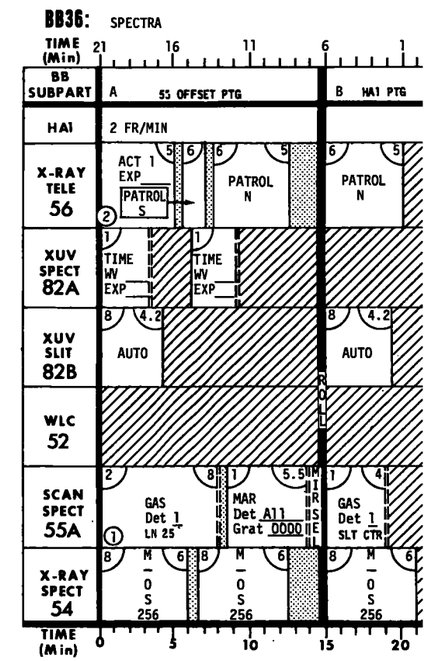
(3)	11	• Roll suncentered 300 arc minutes to position 82B slit at approximate • location of 55 OFFSET in step (2).	SU: 3 8/11
(4)	2 or 28	• Point 52 to sun center. • Roll to PAD coordinate or to position coronal hole at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of coronal hole (if possible).	SU: 3 8/12 or SU: 3 16/19









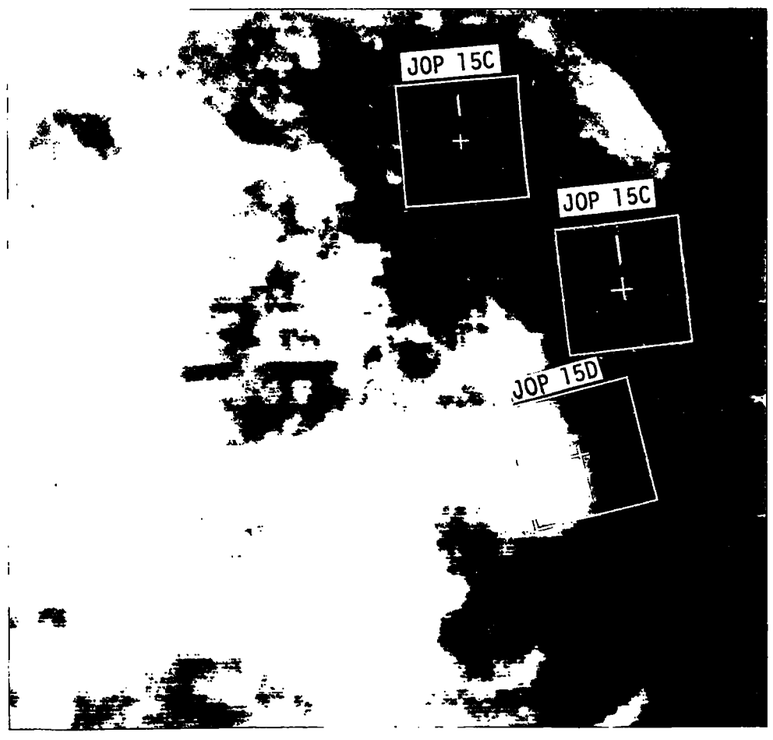


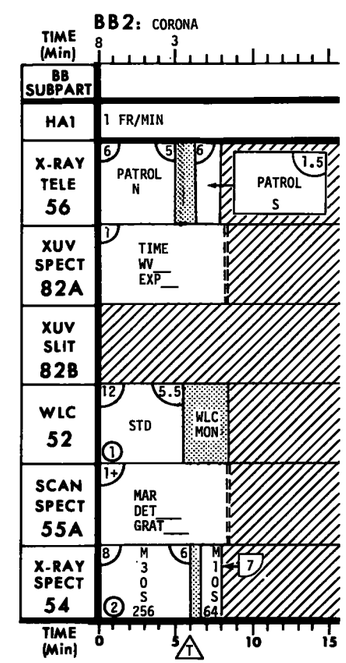
JOP 15C - EVOLUTION OF A CORONAL HOLE

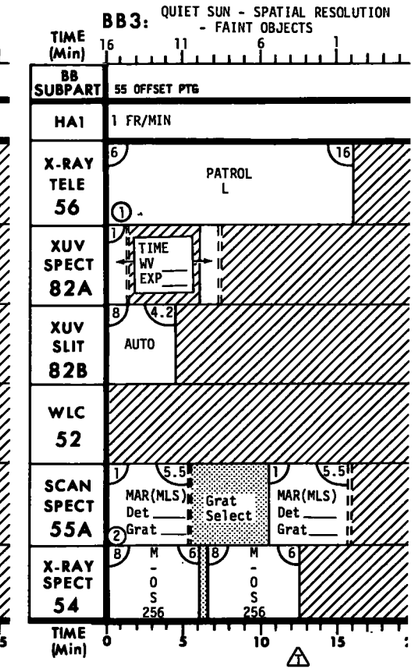
Step	BB	TARGET	ΔT/ΣΔT
	28 or 3	• Point Hα1 at coronal hole (See PAD). • Roll 82A XUV dispersion clear of coronal hole (and 82B slit for uniform emission, if possible). • Point 55 OFFSET so that MAR is centered on a position in the coronal hole.	SU: 4 16/20
(2)	2 or 28	• Point 52 to sun center. • Roll to PAD coordinate or to position coronal hole at approximately 3 o'clock (1-5 o'clock) and 82A XUV dispersion clear of coronal hole (if possible).	SU: 3 8/12 or SU: 3 16/19

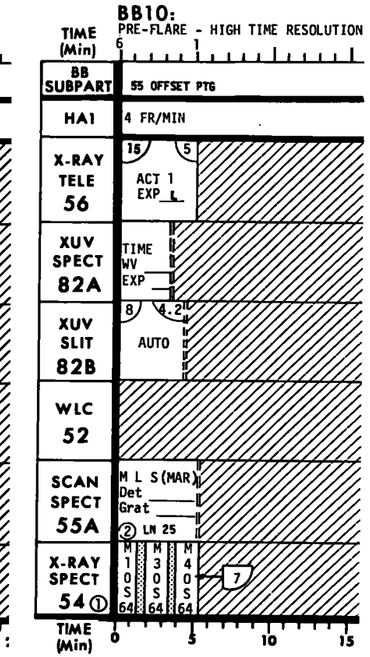
JOP 15D - CORONAL HOLE VELOCITIES

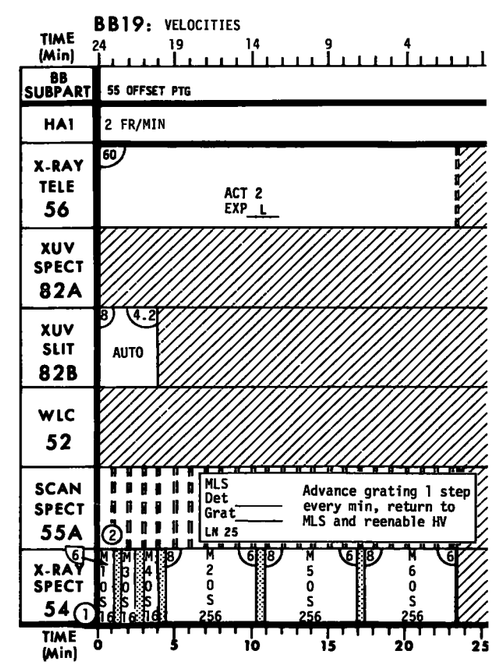
Step	BB	TARGET	ΔT/ΣΔT
(1)	10	• Roll and point Hα1 to PAD coordinates (maintain PAD roll at 0000 or 10800). • Point 55 OFFSET so that 55 MAR is centered at boundary of coronal hole and 82B slit for uniform emission, if possible.	SU: 4 6/10
(2)	19	• Step 55 mirror to line 25. • Point and roll same as (1). • After 55 MLS, step 55 mirror to SLIT CTR	SU: 3 24/27
(3)	10	• Same pointing and roll as (1).	SU: 3 6/9

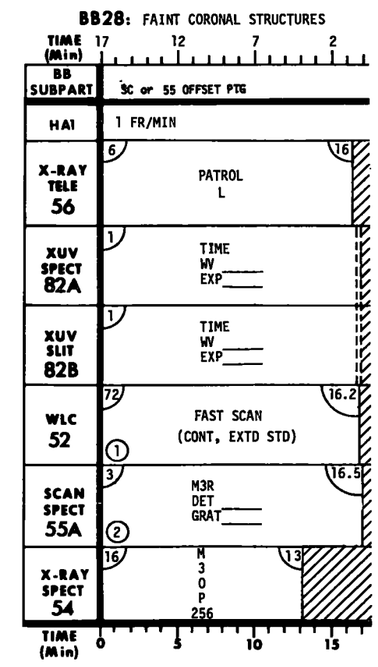












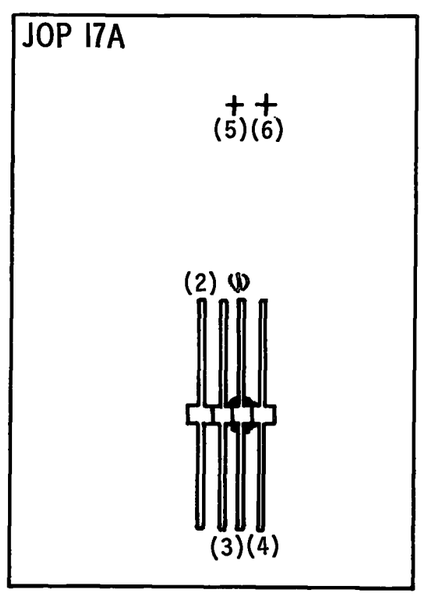
JOP 17A - STRUCTURE OF XUV AND X-RAY BRIGHT SPOT

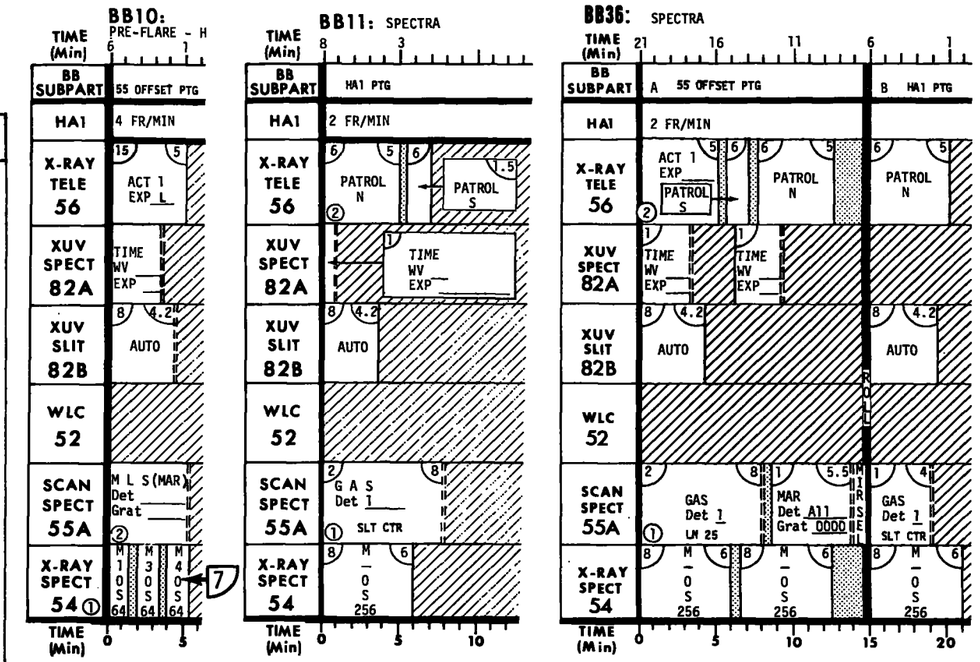
- XUV bright spots range from 3-10 arc secs in diameter and may persist for periods of days.
- These bright spots may or may not correlate with X-ray bright spots or intense bipolar fields observed on magnetograms.

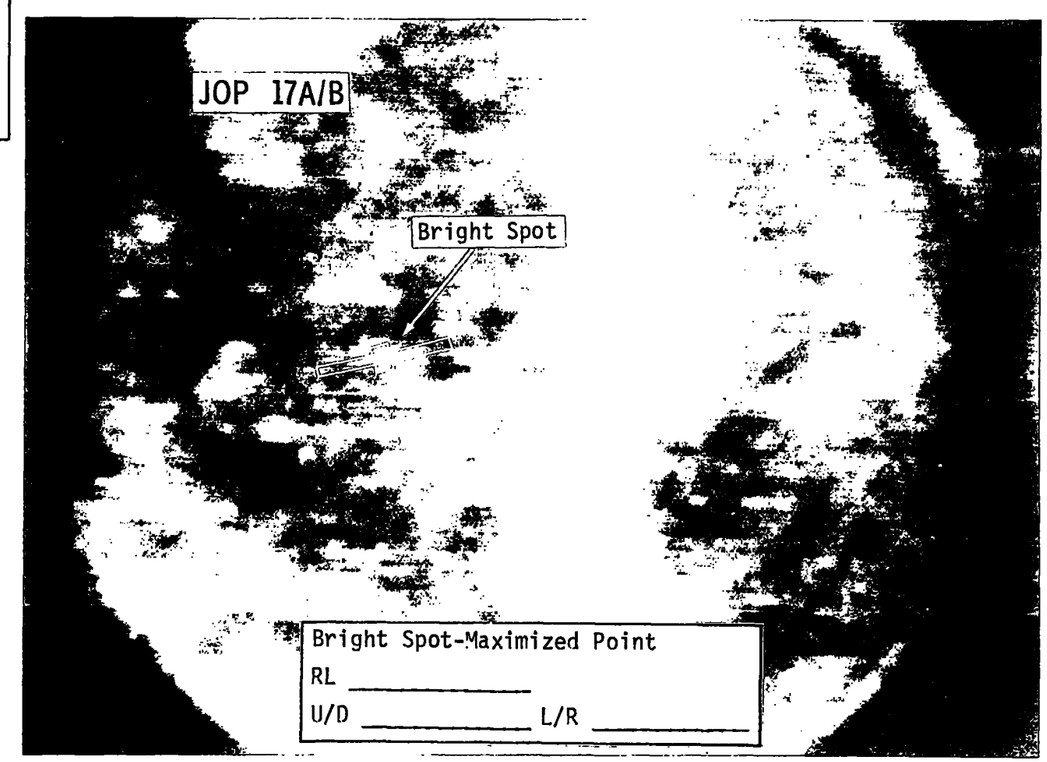
Step	BB	TARGET	ΔT/ΣΔT

(1)	11	• Roll and point Hα1 to PAD coordinates if provided.
		• Roll 82A XUV dispersion clear of bright spot and minimize emission in slit from XUV sources other than bright spot, if possible.
		• If XUV pointing capability exists:
		  • Point at center of bright spot.
		  • Maximize DET 1 or 3
		• Log and voice down pointing coordinates (on photograph) and sketch position of 82B slit.
			SU: 6
			8/14

(2)	11	• Point Hα1 to a position 10 arc sec to the left of (1). • Roll same as (1).	SU: 3 8/11
(3)	11	• Point Hα1 to a position 5 arc sec to the left of (1) • Roll same as (1).	SU: 3 8/11
(4)	11	• Point Hα1 to a position 5 arc sec to the right of (1). • Roll same as (1).	SU: 3 8/11
(5)	10	• Point 55 OFFSET up approximately 85 arc secs from (1) to center 55 MAR on bright spot. • Roll same as (1).	SU: 3 6/9
(6)	36A	• Step 55 mirror to line 25. • Roll same as (1). • Point 55 OFFSET up exactly 85 secs from pointing in (1). • Maximize DET 1 or 3 • After 55 MAR, step 55 mirror to SLIT CTR.	

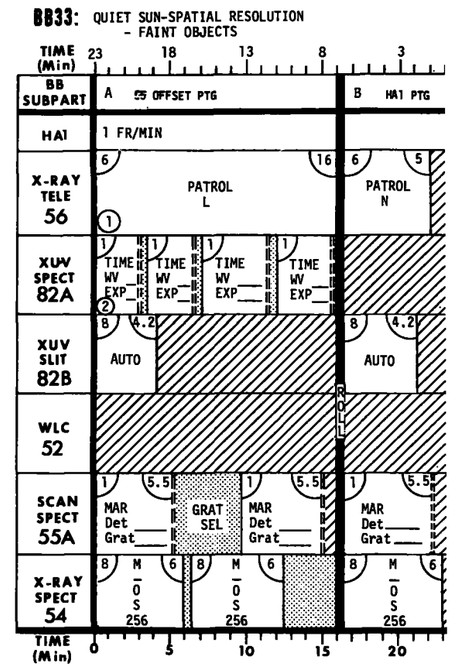


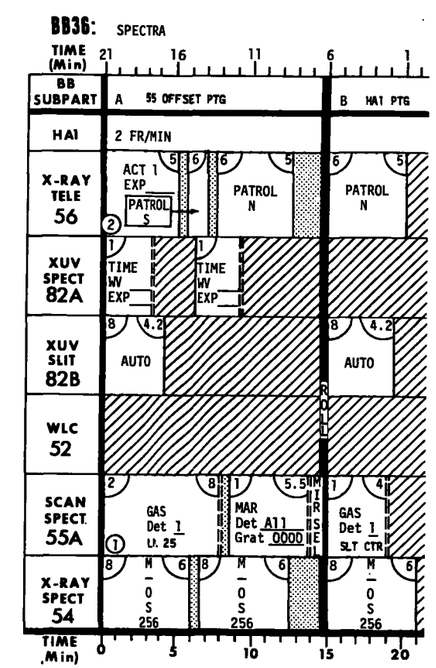




JOP 17B - SHORT AND LONG TERM EVOLUTION OF XUV OR X-RAY BRIGHT SPOT

STEP	BB	TARGET	ΔT/ΣΔT
(1)	33A	• Roll and point Hα1 to PAD coordinates. • Roll 82A XUV dispersion clear of bright spot. • Point 55 OFFSET up 85 arc secs to center 55 MAR on bright spot.	SU: 5 16/21
	33B	• Point Hα1 down 85 arc secs to bright spot. • Roll 82B slit to minimize emission in slit from XUV sources other than bright spot. • Maximize DET 1 or 3. • Record pointing coordinates RL+/-_____ U+/D-_____ L-/R+_____ and sketch position of Hα1 reticle relative dark and bushy clumps.	SU: 2 6/29
(2)	36A	• Step 55 mirror to line 25. • Roll and point Hα1 to PAD coordinates • Roll 82A XUV dispersion clear of bright spot. • Point 55 OFFSET up exactly 85 arc secs. • Maximize DET 1 or 3. • After 55 MAR, step 55 mirror to SLIT CTR.	SU: 4 14/18
	36B	• Point Hα1 down 85 arc secs. • Roll 82B slit to minimize emission in slit from XUV sources other than bright spot. • Maximize DET 1 or 3 • Log and voice down pointing coordinates RL+/-_____ U+/D-_____ L-/R+ _____ and sketch position of Hα1 reticle relative to dark and bush clumps.	SU: 2 6/26





16K ATMDC DAS CODES (520+)

01-07: DISPLAY

01 FORMAT 1

02 FORMAT 2

03 + D (500)

(00)C&W
(01)ALRT
(02)ATT ERR*
(03)SI OFST*
(04)GMT
(05)X } RG RTS
(06)Y } .XXX1
(07)Z } DEG/S
(11)1
(12)2 } STATUS
(13)3 } WORDS
(14)4
(15)5
*XXX.1 DEG

04+3D SINGLE
MEM LOC:
50AAA } AAAAAA
50AAA } = ADD
5XXXX:
OCT:50100
DEC:5±0GG
GG(OCT) =
SCLE FCTR

MON ACQ SS
05 X/Y PRI
06 X/Y SEC

07 CMPTR XOVER ARM

10-17: CONFIG ACS

10+D (500)INH
11+D (500)ENA
(00)CMG CONT
(01)TACS CONT
(02)CMG AUT RST
(03)AUT GG DUMP
(04)STR TK CONT
(05)RANDM REACQ
(06)S055/HA DR AUT
(07)FSS DR AUT
(10)CMPTR XOVER FOR SELF TEST
(11)STR TRK UPDT

12+D (500)SELCT
(00)ACHERNAR
(01)CANOPUS
(02)α CRUX
(03)SR/SS CMPTR
(04)SR/SS SUN
(05)INIT STRPDN
(06)DOCKED
(07)UNDOCKED
(10)SEL FLT OPS

13+D(500) CMG REDUN MGMT:
-VREF RM
(10)CMGIA 1;RM INH
(20)CMGIA 2;RM INH
(30)VREF RM ENA
-CONFG CMG'S
(C=1→CMG1;ETC)
(C2)CONT&RM ENA
(C4)CONT&RM INH
(C6)CONT ENA;
RM INHIBIT

14+D(500)ACQ SS REDUN MGMT:
-X AXIS CONFG-
(01)P&S;RM ENA
(02)PRI;RM ENA
(03)SEC;RM ENA
(12)RM INH
-Y AXIS CONFG-
(04)P&S;RM ENA
(05)PRI;RM ENA
(06)SEC;RM ENA
(13)RM INH
- SUN PRES
(07)P&S;RM ENA
(10)PRI;RM INH
(11)SEC;RM INH

15+D(500)RG REDUN MGMT:
-CNFG RG AXS-
R=1:X,2:Y,3:Z
(R0)RM INH
(R1)1&2;3BU;RM ENA
(R2)1&2;RM ENA
(R3)1&3;RM ENA
(R4)2&3;RM ENA
(R5)1;RM ENA
(R6)2;RM ENA
(R7)3;RM ENA

16+D(500)SEL APCS MODE
(00)STBY
(01)EXP PTG
(02)SI
(03)ZLV
(04)ATT HLD CMG
(05)ATT HLD TACS

17+9D INIT DLY ZLV
50BBB } GMT:MNVR
50BBB } SI→ZLV
50BBB } LSB=1SEC
50EEE } GMT:MNVR
50EEE } ZLV→SI
50EEE } LSB=1SEC
5±XXX } ZLV ATT
5±YYY } BIAS:
5±ZZZ } LSB=1°

20-27: MNVR, CMG, FSS, ST OG

20+3D(5±)CRS MNVR
(XXX)(YYY)(ZZZ)1°

21+3D(5±)FN MNVR
(XXX)(YYY)(ZZZ)0.1°

22+3D(5±)CMG CG&HLD
(XXX)(YYY)(ZZZ)
LSB=1% 3H

23 CMG NOM CGE

24+3D(5±)BIAS MOM
(XXX)(YYY)(ZZZ)
LSB=1% 3H

25+4D FSS WG DR
5±0RR } R/L DRV
50RR0 } LSB=1"
5±0UU } U/D DRV
50UU0 } LSB=1"

26 CMPTR XOVER EXECUTE

27+2D STR TKR OG BU
5±DDD } DDDDD=OG
50DD0 } LSB=1'

30-37: UPDATE

30+D MNVR TIME
500TT:LSB=1MIN

31+D ORB PL ERR
5±DDD:LSB=0.1°

32+D GG DMP1/2
50DDD LSB=1°

33+2D TIMER A;B
50TOC T=1 2 3
5±0DD TMR A B A&B
C= 0 1 2 3 4
D=1/64 1s 1m 1h 1d

34+D TACS WIDTH
500DD LSB=10MS

35+D TACS THRST
50DDD LSB=1NWT

36+2D RG DRIFT
500GG GG=01 02 03
RG=X1 X2 X3
04 05 06 07 10 11
Y1 Y2 Y3 Z1 Z2 Z3
5±0DD
GG = RG FOR DFT UD
DD = DFT LSB∿.0001°/S

37+22D NAV DATA
5NNNN } 11DATA WD
50NNO } IN SEQ
N NAV ELEMENT
1 ORB ASC NDE
2 ASC NDE T
3 ORB INCL
4 R⊕:RORB
5 ΔORB M'NITE
6 ORB RATE
7 MN ANOMALY
8 η_Y PREV MNT
9 λ ASC NDE(⊕)
10 NODAL RGRSS
11 ΔΔT M'NITES

40-47: ATMDC

40 TERMINATE

41 CMPTR BU ENTR

42 INIT LOAD

43 +xD MEM LD
50AAA } AAAAAA=
50AAA } MEM LOC
50MMM } MMMMMM=1ST
50MMM } 16 BIT WD
-R'PEAT FOR n WDS

44 MEM LD CMPL

45(TWICE)IMPLMNT

46+2D MEM DUMP
50RSS } R=REPS,S=
50OEE } START BLK
E=END BLK

47 TRBLSHOOT

ST WD 1

52003;50011
ABCDN 0 1133
EF 0 M1100
CODE:STATUS

A→CMG CONT
0: INH
1: ENA

B→TACS CONT
0: INH
1: ENA

CD→XY ACQSS
0:NO STRPDN UPDT
1:PRI USED
2:SEC USED
3:P&S USED

E→SLF TEST PRG XOVER
0:16K INH
1:16K ENA
4:8K INH
5:8K ENA

F→ST TK CNT
0: INH
1: ENA

ST WD 2

52003;50012
ABCDN 0 0XXX
EF 0 M0000
CODE:STATUS

A→STRPDN CNT
0:SEL PRIME
1:SEL BU

B(C,D)→X(Y,Z)RG'S USED TO CNT

B(CD)	B(CD)
0:NIL	4:3
1:1	5:1,3
2:2	6:2,3
3:1,2	7:1,2;3-BU

E→RG TEST FAIL
0:NO FAIL'RS
1: Z FAIL
2: Y FAIL
3: Z&Y FAIL
4: X FAIL
5: Z&X FAIL
6: Y&X FAIL
7:Z,Y,&X FAIL

F→CONT FAIL
0:ALL AX OK
1:NO X CONT
2:NO Y CONT
3:NO X&Y CONT
4:NO Z CONT
5:NO X&Z CONT
6:NO Y&Z CONT
7:NO X,Y,&Z CONT

ST WD 3

52003;50013
ABCDN 0 0002
EF 0 M3100
CODE:STATUS

A→TBLSHT MD
0:NOT ACTIV
1:ACTIVE

B→DAS INPUT
0:NORMAL(OK)
1:FUNC ONLY
2:FUNC UNDF
4:DATA ONLY

C→MEM LD-TSM TR
0:NOT ACT-RST
1:NOT ACT-SET
2:IN PROG-RST
3:IN PROG-SET
4:IMPL REQ-RST
5:IMPL REQ-SET

D→LD OFLOW &F'MAT SLCT
0:F'MT2
1:F'MT2&0'FLO
2:F'MT 1
3:F'MT1&0'FLO

E→AUTO DOOR CONTROL
0:FSS,55-INH
1:FSS-ENA 55-INH
2:FSS-INH 55-ENA
3:FSS,55-ENA

F→ACS GAINS
0:UNDOCKED
1:DOCKED

ST WD 4

52003;50014
ABCDN 0 0000
EF 0 MXX00
CODE:STATUS

A→INRPT FAIL
0:NONE,2,4
1:1ST,3,5

B→CMG R'SET
0:INH
1:ENA

C→CMG RSLVR V-REF TEST
0:NORM
1:FAIL TEST

D→CMG FOUND IN ERR (RM)
0:NONE
1:CMG 1
2:CMG 2
3:CMG 1&2
4:CMG 3
5:CMG1&3
6:CMG 2&3
7:CMG 1,2&3

EF→TACS PLSE WIDTH(OCT)
04:40MS(MIN)
06:60MS
...
10:80MS
...
50:400MS(MAX)

ST WD 5

52003;50015
ABCDN 0 00X1
EF 0 M0000
CODE:STATUS

A→#MOM SMPL
0:4 SAMPLES
1:1 CONT SAMPI

B→SPARE

C→STAR USED
0:ACHERNAR
1:CANOPUS
2:α CRUX

D→ST OG UPDT
0:INH
1:ENA

E→X&Y ACQSS COMPARE
0:NORM
1:X DISCOMP
2:Y DISCOMP
3:X&Y DISCOMP

F→SPARE

C&W

52003;50000
ABCD=CODES
A=LAST C&W
D=1ST C&W
CODE:CONDTN
0:NO C&W
*1:TACS STUCK
2:HI RATE
*3:SELF TEST
4:CMG SAT
*5:RG(2NDOR3RD)
*6:TACS ONLY
*7:ACQSS(2ND)
*DSPLY RESET

ALERT

52003;50001
ABCD=CODES
A=LAST ALRT
D=1ST ALRT
CODE:CONDTN

ACS +:
0:NO ALRT
1:ANY RG
2:X(Y)ACQ SS
3:RG SCL SW
4:NO ST TK
5:T-MNVR<REQ
6:CMPTR RSTRT

CMG MALF +:
7:CMG FAIL
8:CMG V-REF
9:CMG AUTO RST
(ALRT CMD RS ALL LITES)

8K ATMDC DAS CODES (520+)

01-07: DISPLAY

03+D(500)
(00)C&W
(02)ATT ERR*
(03)SI OFST*
(05)X } RG RTS
(06)Y } .XXX1
(07)Z } DEG/S
(11)1
(12)2 } STATUS
(13)3 } WORDS
(14)4
(15)5
*XXX.1 DEG

04+3D SINGLE
MEM LOC:
50AAA } AAAAAA
50AAA } =ADD
5XXXX:
OCT:50100
DEC:5±0GG
GG(OCT)=
SCLE FCTR

MON ACQ SS
05 X/Y PRI
06 X/Y SEC

10-17: CONFIG ACS

10+D(500)INH
11+D(500)ENA
(00)CMG CONT
(01)TACS CONT
(02)CMG AUT RST
(03)AUT GG DUMP

12+D(500)SELCT
(05)INIT STRPDN
(06)DOCKED
(07)UNDOCKED

RG/ACQSS SEL

15+D (5AXYZ)
A=ACQ } 0:SEC
SS } 1:PRI
XYZ=RG SEL FOR
EA AXIS
0:NO CH 2:RG2
1:RG1 3:RG3

14+D(50XYZ)BU
RG SEL FOR
EA AXIS (ABOVE)

16+D(500)SEL
APCS MODE
(00)STBY
(01)EXP PTG
(02)SI
(04)ATT HLD CMG

17+11D INIT DLY ZLV
50AAA GMT STRT
SI→ZLV*
50BBB GMT END
SI→ZLV*
50CCC GMT STRT
ZLV→SI*
50DDD GMT END
ZLV→SI*
5±XXX } X,Y,Z AX
5±YYY } RATE
5±ZZZ } SI→ZLV**
5±XXX } Z,Y,Z AX
5±YYY } RATE
5±ZZZ } ZLV→SI**
50ROK R=0 EREP
=1 RNDZ
K=0 TACS
=1 CMG
*LSB=16 SEC
**LSB=.0005 °/S

20-27: MNVR, CMG, ST OG

21+3D (5±)FN MNVR
(XXX)(YYY)(ZZZ).1°

23 CMG NOM CGE

24+3D(5±)BIAS MOM
(XXX)(YYY)(ZZZ)
LSB=1%3H

27+2D(5±)STR TKR
OG BU
5±DDD } DDDDD=OG
50DDO } LSB=1°

30-37: UPDATE

34+D TACS WIDTH
500DD LSB=10MS

37+6D NAV DATA
5±NNN IN SEQ
N NAV ELEMENT
1 ΔORB M'NITE
2 ΔΔT M'NITES
3 ΔORB RATE
4 SOL ELEV FRM
ORB PL
5 STR TK OG
6 EPC X/SOL N }

40-47: ATMDC

40 TERMINATE

41 CMPTR BU ENTR

42 INIT MEM LD

43+xD MEM LD
50AAA } AAAAAA=
50AAA } MEM LOC
50MMM } MMMMMM=1ST
50MMM } 16 BIT WD
-REPEAT FOR n WDS

44 MEM LD CMPL

45 (TWICE)IMPLMNT

46 MEM DUMP

ST WD 1

52003;50011
ABCDN 0 11
EF 1 Mdd00
CODE:STATUS

A→CMG CONT
0:INH
1:ENA

B→TACS CONT
0:INH
1:ENA

CD→ ACQSS
0:NO SD UPDT
1:PRI USED
2:SEC USED

E→ATMDC STATUS
6:ON,8K SEL
7:RNDZ

F→ZLV MODE
0:INH
2:ZLV TACS
6:ZLV CMG

ST WD 2

52003:50012
ABCDN 0 0XXX
EF 1 M0000
CODE:STATUS

A→SPARE

B(C,D)→X(Y,Z)RG'S
USED TO CNT

B(CD)	B(CD)
0:NIL	4:3
1:1	5:1,3
2:2	6:2,3
3:1,2	

E,F→SPARE

ST WD 3

52003;50013
ABCEN 0 0000
EF 1 M0100
CODE:STATUS

A→SPARE

B→DAS INPUT

0:NORMAL
1:FUNC ONLY
2:FUNC UNDF
4:DATA ONLY

C→MEM LD
0:NOT ACTIV
2:IN PROG
4:IMPL REQ

D→LD O'FLOW
0:OK
1:O'FLOW

E→SPARE

F→ACS GAINS
0:UNDOCKED
1:DOCKED

ST WD 4

52003;50014
ABDCN 0 0000
EF 1 MXX00
CODE:STATUS

A→SPARE

B→CMG RESET
0:INH
1:ENA

CD→SPARE

EF→TAC PLSE
WIDTH(OCT)
04:40MS(MIN)
...
50:400MS(MAX)

ST WD 5

52003;50015
ABCDN 0 0000
EF 1 M0000
CODE:STATUS

A→# MOM SMPL
0:4SAMPL
1:1SMPL

BCDEF→SPARE

C&W

52003;50000
ABCD=CODES
A=LAST C&W
D=1ST C&W
CODE:CONDTN
0:NO C&W
*1:TACS STUCK
2:HI RATE
*5:RG(2NDOR3RD)
*6:TACS ONLY
*DSPLY RESET

8K/16K

EPS

BUS SW 10

XP BUS

1&2 ON	146
1 OFF	166
2 OFF	152

APCS BUS

1&2 ON	172
1 OFF	026
2 OFF	005

C/D LOG BUS

1&2 ON	073
1 OFF	033
2 OFF	006

TV SYS BUS

1 ON	131
OFF	134
2 ON	011
OFF	107

TM SYS BUS

1 ON	151
OFF	125
2 ON	047
OFF	065

TCS BUS

1 ON	147
OFF	171
2 ON	066
OFF	167
1&2 OFF	046

PWR SHR

P&S OFF	132
PRI ON	104
SEC ON	126

CBRM 10

NO.	CHGR ON	CHGR OFF	REG ON	REG OFF
• 1	137	142	141	055
• 2	035	077	023	143
• 3	163	115	162	015
• 4	157	021	037	063
• 5	122	156	101	121
• 6	042	022	075	175
• 7	135	174	074	003
• 8	043	103	034	117
• 9	036	076	061	017
•10	057	116	136	176
•11	062	123	102	155
•12	054	014	161	016
•13	056	041	164	144
•14	124	032	071	153
•15	133	044	112	007
•16	072	052	111	067
•17	031	051	154	027
•18	173	053	024	106

APCS

RG ACS

POWER 30

	X	Y	Z
ALL ON	172	007	027
RG1 OFF	026	052	053
RG2 OFF	131	067	106
RG3 OFF	127	051	166

WHEEL 30

ALL ENA	005	072	173
RG1 INH	151	111	024
RG2 INH	147	031	146
RG3 INH	011	154	152
FINE GAIN	-044-	-044-	-044-
CRSE GAIN	-112-	-112-	-112-

REDUN MGMT

52015+500RA
(RA=10 THRU 37)
-CNFG RG AXS-
R=1:X,2:Y,3:Z

(R0)	INH RM	(R4)	2&3
(R1)	1&2;3BU	(R5)	1
(R2)	1&2	(R6)	2
(R3)	1&3	(R7)	3

UDRG DRIFT*

52036+2D:
500GG GG=01 02 03
RG=X1 X2 X3
04 05 06 07 10 11
Y1 Y2 Y3 Z1 Z2 Z3
5±ODD; DD=PAD

DISPLAY

52003+	500
C&W	00
ALERT	01*
S-WD 2	12
X } RG RTS	05
Y } .XXX1	06
Z } DEG/S	07

ST WD 2

B(C,D)→X(Y,Z)
RGS USED TO CONT

B(CD)	B(CD)
0:NIL	4:3
1:1	5:1,3
2:2	6:2,3
3:1,2	7:1,2;* 3-BU

ATMDC/WCIU

OPERATIONS 520

TERMINATE	40
BU ENTR	41
INIT LD	42
MEM LD	43
TERM MEM LD	44
PROG IMPLMT	45
MEM DMP	46
T'SHOOT	47*

DI,DO RGSTRS
52004, 5XXXX,
5XXXX
50100 (SEE
CHECKLIST)

POWER 30

PRI ON	143
SEC ON	163
AUT XOVR	077
P&S OFF	023

HTRS 10

ENA	004**
PRI INH	177
SEC INH	002

MN TMR 30

TMR: A 055
B 035

MLU PWR 10

ON/MEM ENA	045
OFF/MEM INH	013
HTR OFF	127

MEM SEL 20

P/S HI:	001 / 051
P&S LO	031

MLU CONT 20

BIT 1/2/3:
062 / 123 / 102
EXECUTE 155

ACQ SS

PWR 30

	ON	OFF
PRI	134	107
SEC	047	125

R MGMT*

52014+500DD

X	Y	S	S=S PRES
01	04	07	P&S+RM
02	05		P+RM
03	06		S+RM
		10	P(NO RM)
		11	S(NO RM)
12	13		NO RM

DISPLAY:

52003+	500
C&W	00*
ALRT	01*
S-WD 1	11
S-WD 5	15
ACQSS } 'S X/Y:	520
PRI	05
SEC	06

STR TRK

PWR 30

	ON	OFF
	136	176

455 HZ

PRI OFF	056
PON/S OFF	161
POFF/S ON	016

CONFIG ST TK

5201A+5000B

	A	B	
ENA ST TK	1	4	*
INH ST TK	0	4	*
ACHERNAR	2	0	*
CANOPUS	2	1	*
αCRUX	2	2	*

OUT GMBL BU:
52027+5±DDD,
50DDO

DISPLAY: 52003+

ALERT	50001*
S-WD 1	50011*
S-WD 5	50015*

FSS

POWER 30

28 VDC

PRI ON	104
SEC ON	126
P&S OFF	132

455-HZ

PRI OFF	056
PON/S OFF	161
POFF/S ON	016

DR MTR

PRI ENA	167
PRI INH	171
SEC ENA	041
SEC INH	046

WDGE DR 52025+*

5±0RR } R/L	DRV
50RR0 } LSB=1"	
5±0UU } U/D	DRV
50UU0 } LSB=1"	

DISPLAY

52003+50013
S-WD 3

DR CONT 40

OP/CLS: 063 / 122

FSS DR AUTO *
ENA 52011+
INH 52010+ 50007

CMG

POWER 30

	1	2	3
CMGIA PWR, BRG HTR ON, AUTO INH	115	042	103
WHL PWR ON	157	075	117
BRAKE OFF	063	174	061
GMBL SRVO ON	122	074	017
CMGIA PWR OFF, AUTO INH	162	022	034
WHL PWR OFF	021	175	036
BRAKE ON	037	135	076
SERVO AMP OFF	156	003	057
AUT SHTDN ENA	137	142	141
EVAC VLV OPN**	101	043	116
EVAC VLV CLS	-121-	-121-	-121-
CMGIA HTRS ON**	-004-	-004-	-004-
CMGIA HTR INH	177	002	001
BRG 1 TEMP MON	164	124	071
BRG 2 TEMP MON	144	032	153
BRG TEMP MONS OFF	-133-	-133-	-133-
BRG HTRS INH	-015-	-015-	-015-
ISOL DSAT RSVR (4.8)	-165-	-165-	-165-
CON DSAT RSVR (4.8)	145	105	025

V REF 4.8 30

	SRCE	INPUT
PRI	064	113
SEC	012	114

CONFIG MGMT 52

CON ENA 011+
CON INH 010+ (500)
CMG CON (00)
CMG AUT RST (02)
AUT GG DMP (03)
CGE/HLD* 022+(5±)
(XXX()YYY)(ZZZ)
LSB=1% 3H
NOM CGE 023
BIAS MOM 024+(5±)
(XXX)(YYY)(ZZZ)
LSB=1% 3H

DISPLAY

52003+D

C&W*	50000
ALERT*	50001
S-WD 1	50011
S-WD 4	50014

REDUN MGMT*

52013+ (500)
-V-REF -
VREF-1 RM INH (10)
VREF-2 RM INH (20)
RM ENA (30)
-CONFG CMG'S-
(C=1→CMG1; ETC)
CON&RM ENA (C2)
CON&RM INH (C4)
CON ENA;RM INH(C6)

TACS

DISPLAY: 52003+

C&W	50000
S-WD 1	50011
S-WD 4	50014

CNFIG MGMT

520AA+50BBB
CONT ENA: 11+001
CONT INH: 10+001
UPDT P/W: 34+0TT
UPDT F : 35+NNN*

EPEA POWER 30

PRI ON	062
SEC ON	102
P&S OFF	123
U/D PRI	155
L/R PRI	054
RLL PRI	014
MPC PRI	066

RG(EPC) POWER 30

	PRI ON	SEC ON	BOTH OFF
L/R	065	013	045
U/D	073	006	033

MODE SEL 16 + (500)

00	STBY	03	ZLV*
01	EXP	04	ATT HOLD (CMG)
02	SI	05	ATT HOLD (TACS)*

I&C

TM REDUN 20

ASA: PRI/SEC

72 KHZ		
EXP	122	156
ASAP	101	121
3.6 KHZ A		
EXP	137	142
ASAP	035	077
MUX	141	055
3.6 KHZ B		
MUX	143	023
4 PPS A		
EXP	163	115
ASAP	157	021
MUX	162	015
4 PPS B		
MUX	037	063
1 PPS		
EXP	042	022
1/15 PPS		
EXP	075	175
RT DATA TO		
ASAP	074	003
XMTR	135	174
PB DATA TO		
XMTR	043	103
CONV	061	017
SYNC (1 PPS & 1/15 PPS)	054	014

MEAS SUP (P/S)

ON	064	012
OFF	113	113

ASAP

DUMP TMR (P/S)		
ON	161	056
OFF	016	041
CNTR BYP:		
ACT	052	
DACT	111	
AMA REPROG	004	

TCS

BUS PWR 10

	ON	OFF
1	147	171
2	066	167
1&2		046

HTR PWR

AUTO	114
OFF	165

PUMP

PRI	064
SEC	012
OFF	113

CONT

PRI	145
SEC	105
OFF	025

TM PWR 20

SIG COND

-ALL ON: 132-
-TURN OFF-

1:	066	6:	165
2:	046	7:	145
3:	171	8:	105
4:	167	9:	025
5:	114		

RASM

-ALL ON 146-
-TURN OFF-

1:	166	4:	005
2:	152	5:	026
3:	172	6:	151

270 MUX

-ALL ON 027-

A1 OFF	173
A2 OFF	053
A3 OFF	024
B0 OFF	106

RDM

-ALL ON 071-
-TURN OFF-

J:	153	N:	112
K:	133	Y:	007
M:	044	Z:	072

PCM/DDAS

PRI ON	164
PRI OFF	144
SEC ON	124
SEC OFF	032

XMTR

1 ON	047
1 OFF	125
2 ON	126
2 OFF	065

ASA

ON	045
OFF	013

DSIU

ON	067
OFF	154

MEAS SUP

PRI ON	064
SEC ON	012
SUP OFF	113

RASM HTR

ON	177
OFF	002

EXP

Hα 40

HA1 HTR-P/S	074 /	003
HA1 HTR-OFF		043

DOOR MTR ENA/INH:

1 PRI,2 SEC	103 /	034
1 SEC,2 PRI	174 /	135

Hα DR AUTO *
ENA 52011+
INH 52010+ 50006

TV SYS CONT

BUS 10

	1	2
ON	131	011
OFF	134	107

CONT 40

VID SW ADDR 1/2:

ON	046 /	167
OFF	171 /	114

SYNC GEN
•PRI/SEC: 165/145
MON MODE:
NORM/BU 175/027

TM CONT

BUS PR 10

	ON	OFF
1	151	125
2	047	065

XMTR 20

		1	2
INPUT	RCDR	034	036
RL	TIME	117	076
OUTPUT	FWD	033	104
	AFT	073	006

RCDR 20

	1	2
RCD	131	011
PB	147	134
•OFF	127	107

DCS CONT 20

	ON	OFF
1	057	116
2	136	176

X-RAY TELE 40

THRM-PRI	156
THRM-SEC	101
THRM-OFF	121
CAM PWR-ON	042
CAM PWR-OFF	022
PRI DR MTR:	
ENA/INH	113 / 012
SEC DR MTR:	
ENA/INH	064 / 023

XUV SPECT 40

MN PWR-ON	151
MN PWR-OFF	131
THRM-ON	011
THRM-OFF	134
PWR/DRS-ON	147
PWR/DRS-OFF	127
PRI DR MTR:**	
ENA/INH	124 / 032
SEC DR MTR:**	
ENA/INH	125 / 047
•MODE-AUTO 2	107

XUV SLIT 40

MN PWR-ON	065
MN PWR-OFF	045
THRM-ON	033
THRM-OFF	006
PWR/DRS-ON	013
PWR/DRS-OFF	073
PRI DR MTR:**	
ENA/INH	005 / 026
SEC DR MTR:**	
ENA/INH	132 / 066

WLC 40

MN PWR-ON	017
MN PWR-OFF	116
MN PWR-STBY	057
THRM-ON	136
THRM-OFF	176
DOOR-OPEN	117
DOOR-CLOSE	036
PRI DR MTR:**	
ENA/INH	055 / 141
SEC DR MTR:**	
ENA/INH	076 / 061
CONV-PRI	062
CONV-SEC	123
•MODE-STD	155
•MODE-FAST SCAN	102
ALIN CNTRLR	
UP/DN	014 / 161
LFT/RT	016 / 056
STOP	041
•ALIN-DISC MAN	054

SCAN SPECT 40

MN PWR - PRI	071
MN PWR - SEC	153
MN PWR - OFF	133
THRM-ON/OFF	044 / 112
DOOR - OPEN	164
DOOR - CLOSE	144
PRI DR MTR:**	
ENA/INH	124 / 032
SEC DR MTR:**	
ENA/INH	125 / 047
HV ENA/RST	
•1: 173 •2: 053	
•3: 024 •4: 106	
•5: 146 •6: 166	
•7: 152	
HV PWR SUP OFF	172
MODE-SELECT	
•MAR 052 •GAS 111	
•GREF 031 •GSS 067	
START-STOP	051
STOP-STOP	154
PRES GAGE-ON	007
PRES GAGE-OFF	072
SCAN SPECT DR AUTO *	
ENA 52011+ (50006)	
INH 52010+	

X-RAY SPECT 40

MN PWR-ON	035
MN PWR-OFF	077
THRM PWR-PRI	143
THRM PWR-SEC	163
THRM PWR-OFF	115
DOOR - OPEN	137
DOOR - CLOSE	142
PRI DR MTR:**	
ENA/INH	076 / 061
SEC DR MTR:**	
ENA/INH	055 / 141
FILTER:	
•1/2/3: 157 / 021 /	037
1,2,3 RSET:	075
START-START	162
STOP-STOP	015
MN EA HTRS:	100
ENA/INH	04 / 01

XUV MON 40

DRS-OPEN	104
DRS-CLOSE	126
PRI DR MTR:**	
ENA/INH	132 / 066
SEC DR MTR:**	
ENA/INH	005 / 026

EVA 40

LTS ENA	002
INH	177
** RCP HTRS ENA	30004
INH	40001

P = PRIMARY
S = SECONDARY
PWR OR PR = POWER
DSPY = DISPLAY
CON = CONTROL
OP = OPEN
CL = CLOSE
ENA = ENABLE
INH = INHIBIT

ALT CODE:
1 4: SUBTR LAST 3 NUM FROM 377
(EX: 30157, ALT = 30220)
5: SUBTR LAST 4 NUM FROM 7777
(EX: 52011, ALT = 55766)

* 16K PROG ONLY
** MULTI FUNCTION COMMAND (SEE LIST)

ATMDC PROGRAM OVERVIEW

ATTITUDE REFERENCE AND CONTROL

Strapdown -
A calculated reference of OA attitude with respect to Solar Inertial based on selected Rate Gyro outputs. Selected Acquisition Sun Sensor outputs are also used during the DAY phase of the orbit, while in SI or EXP PTG, for control about the X and Y axes. The Star Tracker outer gimbal output is used to calculate position of the Z axis wrt orbit plane when in SI or EXP, but it is not used for control. The strapdown is initiated by issuing DAS commands 52012E and 50005E.

Rate Gyro Scale Factor -
The Rate Gyros have two scales (Fine - 0 to 0.1 deg/sec and coarse - to 1.0 deg/sec). The scale factor is switchea on all gyros at once. It is set to coarse for any sensea rate greater than .088 deg/sec and fine when all sensed rates less than .078 deg/sec. A failure to indicate a switch results in the following:
1. Reselects the previous good scale
2. Sets the ACS ALERT (Condition 3)
3. Inhibits future scale switching
4. Limits future maneuvers to .085 deg/sec if fine is selected.

CMG/TACS Control -
TACS firing is used only for the following:
1. Provide CMG momentum desaturation when the "System Momentum" requirement exceeds 96% of 3H (3CMGs) or 2H (2 CMGs). The firing time will be an integral multiple of the MIB firing time and based on the momentum deficiency.
2. Reduce vehicle rates in the event of a CMG Reset Routine after the nominal momentum configuration is established. This rate reduction is provided by rate error deadbands (No Attitude Deadbands), X and Z axes 0.02 deg/sec; Y axis 0.01 deg/sec.

TACS Only Control -
1. Selected manually by MODE ATT HOLD-TACS or inhibiting CMGs with DAS codes 52010E and 50000E.
2. Selected automatically (ACS MALF C&W, C&W Code 6) by loss of 2 CMGs, an attitude error of >20 deg (60 deg during a CMG reset), or if more than three consecutive CMG reset routines are required.
3. TACS only control (not maneuvering) deadbands are: Attitude - X, 3.0 deg; Y & Z, 2.0 deg. RATE - X, 0.3 deg/sec; Y & Z, 0.2 deg/sec.
4. TACS only control (maneuvering) deadbands are: Attitude - None. Rate X & Z, 0.03 deg/sec; Y axis, 0.015 deg/sec.

STAR TRACKER

If Star Tracker Control is enabled, (52011E & 50004E) the computer will control the STR TRK while in SI or EXP PTG mode and attitude. If the STR TRK is in AUTO, the computer will issue a search command. It will issue a hold if the search function continues for 25 sec. It will issue a hold if navigation indicates the star will be occulted by the earth and issue a search when it is unocculted. It will also issue a hold if any other APCS mode is selected. No ATMDC control is provided in any other mode.

If use of the STR TRK outer gimbal angle is enabled in the computer program, this value will be used as a reference of the vehicle Z-axis orientation wrt the orbital plane. This is only applicable in SI or EXP PTG mode and attitude.

If computer control is not provided, STR TRK search (ACQ AUTO) and hold (SHUTTER CLOSED) commands must be issued via C&D switches. Search mode will continue through the Fine Search (3° X 4°) to Coarse Search (10° X 30°) and continue the search until a star is acquired or the hold mode is selected. Albedo sensors still provide automatic shutter closure (and/or hold) to protect the STR TRK from Earth and Sun light.

CMG SPECIAL ROUTINES

CMG Reset Routine -
1. This routine places the momentum state at the nominal for the vehicle's position in orbit.
2. It can be entered manually, when the CMGs are enabled, with DAS code 52023E (CMG Nominal Cage).
3. Automatic entry is enabled with DAS codes 52011E & 50002E and inhibited with DAS codes 52010E & 50002E.
4. Automatic entry (ACS Alert Condition 9) results when all of the following occur:
   a. SI or EXP Mode (not maneuvering)
   b. Vehicle has been in SI attitude for at least 200 sec.
   c. Auto reset is enabled
   d. Caging is not active
   e. A CMG gimbal is on a stop
   f. The attitude error is greater than 5.7 deg.
5. The sequence of events during CMG reset is:
   a. (0 to 60 sec) suspends TACS and drives CMGs to Zero H
   b. (60 to 100 sec) drives CMGs to nominal H values.
   c. (100 to 160 sec) TACS enabled to reduce rates.
   d. (160 to ATT recovery) CMGs enabled to remove attitude error.
   e. Note - If the gimbal remains on a stop and the attitude error is greater than 20 deg, the Reset is repeated. If more than 3 consecutive Resets are required, control reverts to TACS only (C&W Condition 6)

CMG Outer Gimbal Drive Logic (OGDL) -
OGDL is outer gimbal stop avoidance logic that is active when CMGs are controlling for:
a. The first and last minute of any maneuver to SI, ZLV, or any ATT HLD maneuver.
b. ZLV attitude from 300 sec after ZLV acquisition until another mode is selected.

It is active for only one CMG at a time. It detects any time an outer gimbal command would possibly cause impact with a gimbal stop. If such a condition is detected the inner gimbal is held and the outer gimbal is driven to the 0% meter position. Driving of the gimbal may momentarily produce attitude and rate pertubations, but normally the other two CMGs will absorb this.

MANEUVERING

SI and ZLV Acquisition -
Commanded whenever SI, EXP PTG, or ZLV mode is selected. It uses the previously loaded Maneuver Time (52030E & 500TTE) to establish the maneuver rate which is limited to 0.3 deg/sec.

Attitude Offsets -
Fine (0.1 deg increments to ± 51.1 deg) and course maneuvers (1.0 deg increments to 255 deg) can be performed in ZLV or ATT HOLD modes. Maneuvers requested in the ZLV mode are entered based on ZLV attitude or the last requested ZLV offset attitude. All offsets are removed upon a new mode selection. Maneuvers requested in the ATT HOLD mode are all relative to the previously requested attitude, i.e., accumulative. Each maneuver uses the previously loaded Maneuver Time (52030E & 500TTE) to establish the maneuver rate which is limited to 0.3 deg/sec.

SI Offsets -
Fine (0.1 deg increments to 4.0 deg) and coarse maneuvers (1.0 deg increments to 4.0 deg) can be performed in SI or EXP PTG modes about the vehicles X and Y axes only. Each maneuver is based on SI attitude or the last requested offset SI attitude maneuvers are not based on maneuver time but introduced as attitude error into the control law. Hence rates are limited by the CMG rate ledges (X-0.080, Y-.030, Z-.037 deg/sec).

CMG Desaturation Maneuvers -
In the SI or EXP PTG modes dump maneuvers are automatically performed (unless inhibited) during the night phase of the orbit. Maneuvers are based on four samples taken at 90°, 135°, 225° & 270° past dump midnight. If any of those samples is considered invalid, dump is based on a sample taken at dump commence.

REDUNDANCY MANAGEMENT (RM)

Acquisition Sun Sensor Analog Signal -
In the Solar Inertial Attitude on the DAY side of the orbit, the PRI and SEC Acq SS outputs for each axis are compared with one another for both the X and Y axes. If they differ by 2 deg for five seconds, the ACS Alert Light (Alert Condition 2) is lit and correction to the strapdown calculation for both axes is inhibited.

If a single ACQ SS is being used in an axis, RM examines the sun presence tb, if bp, strapdown correction is inhibited, and if bp for 30 sec the ACS MALF C&W (C&W Condition 7) is lit.

Rate Gyros (RG) -
For 3 gyros - The integrals of RG 1 and 2 are compared. If they differ by a time dependent test constant, Rate Gyro 1 only is then used in the prime strapdown calculation, which controls the SWS attitude, and Rate Gyro 2 only is used in a backup strapdown calculation. A signal is sent to spin up Rate Gyro 3. 90 sec is allowed for spinup. The ACS ALERT (Condition 1) is lit.

During the 90 sec spinup period, system momentum is monitored. If the momentum exchanged becomes excessive (CMG Control: .75H-X, 1.5H-Y, 1.5H-Z in 150 sec. TACS Control: 3.0-X, 7.0H-Y, 10.0-Z in 1000 sec.), control is switched to the backup strapdown. If the test fails while on the backup strapdown, CMG and TACS control is inhibited for the failed AXIS, Mode ATT HOLD CMG is entered, and C&W ACS MALF (C&W Condition 5) is lit.

After 90 sec the integrals of RGs 1&2 are compared with that of RG3. The nearest RG is selected as good and two gyro control with it and RG 3 is begun.

For 2 gyros - The tests are the same as those for 3 RGs except after initial detection the 90 sec for spinup does not apply. Also sun presence is monitored for X & Y axes and excessive orbital plane error test for Z and the C&W ACS MALF (Condition 5) is lit rather than the ACS alert. The momentum exchange test and Sun presence (X&Y) or excessive orbital plane error (Z) tests are then continuous unless RM is inhibited. If either of these tests fails control reverts to the backup strapdown, and the sun presence and excessive orbital plane error test is discontinued. The ACS MALF C&W (Condition 5) is also issued.

For 1 gyro - The failure detection tests are those used for isolation in the 2 RG case, i.e. momentum exchange and Sun presence (X&Y) or excessive orbital plane error (Z). If either of these tests fails, CMG and TACS control is inhibited for the failed axis, mode ATT HOLD CMG is entered, and C&W ACS MALF (C&W Condition 5) is lit.

NOTE: If rate gyros are reconfigured while operating on backup strapdown, the program takes the prime strapdown as its attitude reference, except if the reconfiguration selects the single gyro which is driving the backup strapdown. This can result in large attitude errors and subsequent excessive use of TACS. If the vehicle is in solar inertial attitude this can be avoided by commanding strapdown initialization (52012E, 50005E) which initializes both the prime and backup strapdown. Then the desired gyro configuration can be selected. If the vehicle is in any other attitude the strapdown disagreement can be avoided by selecting first the single gyro that is controlling and then selecting the desired gyro configuration.

CMG Voltage Reference (V_{REF}) Test - 4.8 KHZ -
V_{REF} RM compares V_{REF} to a test value. If these values differ by approximately ±.8 volts the following switching is performed in seq until a good V_{REF} is found:
a. Switch input lines to WCIU
b. Switch to opposite CMGIA (1 or 2) which is providing the V_{REF}, ACS Alert (Condition 8)
c. Remove V_{REF} from all CMG resolvers.
d. Test for good V_{REF}
   (1) If good - applies V_{REF} individually to each CMG resolver and eliminates the one with a short.
   (2) If bad - Shuts off CMG servo power to all CMGs and switches to TACS ONLY CONTROL, C&W ACS MALF (Condition 6).

CMG control is interrupted during this sequence.

CMG Rate Command Integral (RCI) Test -
This test compares the integrals of the commanded gimbal rates with the measured position change to insure the gimbals are driving correctly. When a gimbal is indicated on a stop the X, Y, & Z components of the appropriate CMG are summed to determine if this sum is within ± .15 of 1H. If not, a failure of the CMG is declared. If this test is passed a gimbal-on-stop failure test is perform. The appropriate gimbal rate command is integrated. If this integral indicates the gimbal should have moved off the stop by 15 deg but the gimbal is still on a stop the CMG is assumed failed.

If any of these tests are failed, the servo power for that CMG is turned off, and it is taken out of the control loop.

ATMDC/WCIU Mechanical Switchover -
Three 2.1 second timers in the WCIU are continuously counting. If two of the three time out, power will be taken off the computer in use and applied to the other computer if the CMPTR switch is in AUTO. When they time out a momentary pulse is issued to the C&W CMPTR MALF (CMPTR X OVER) light. After reaching zero the timers reset to 2.1 and again count down.

The computer program normally resets the timers every second thereby preventing switchover. If anything in the program or in the hardware prevent this update, a switchover signal will occur.

ATMDC Self Test -
Self test is executed as an integral part of the program to verify proper operation. The following tests are performed:
a. Sum checks of fixed memory, ripple checks of variable memory, and instruction execution checks.
b. A check of the transfer register for proper information.
c. A test to determine the program is cycling through the program properly.
d. A check of the timers against one another.
e. WCIU Analog Wrap test where the program sends out various values through the D/A converters then looks at the same values transferred back through the A/D converters to insure the values come back ± 0.05 volts of the original value.
f. TACS wrap test.

ALERT

SCAN SPECT
- HV OVERCURRENT (ANY OF 7)

X-REA HV
- BE or AL HV PWR SPLY FAIL

BE COUNT
- BE COUNT RATE >2048

AL COUNT
- AL COUNT RATE >2048

DOOR OPEN
- ANY DOOR OPEN AT SUNSET

BAT CHG
- + BAT CHG tb - bp
  - SLR PNL VOLTS < BAT VOLTS AND CHG INCOMPLETE

PWR SYS
- + BAT TEMP tb - bp
  - BAT TEMP >95°F
- + BAT VOLTS tb - bp
  - BAT VOLTS <27.5
  - AUTO DISC (BAT or CHGR)
  - BAT VOLTS VS TEMP HI
- + REG VOLTS tb - bp
  - REG VOLTS >31.8 or <20.0
  - CBRM PWR SUPPLY OUT OF TOL

ACS*
- RG FAIL
- ACQSS DISCOMPARE
- RG SCALE SW FAIL
- ST FAIL TO ACQUIRE (25 SEC)
- INSUFFICIENT MNVR TIME
- CMPTR RESTART

CMPTR REJ*
- INVALID DAS CMD (5XXXX)

CMG MALF*
- CMG FAIL
- CMG 4.8 KHZ FAIL
- AUTO CMG RESET

BRG TEMP 1,(2),(3)
- WHL BRG TEMP >85% (160°F)

*16K PROG ONLY

ATM C/W

CLUSTER ATT
- VEHICLE RATE >.35°/SEC
- TACS STUCK

ACS MALF
- CMG SATURATION* (>96%), (>98% FOR 2 CMG)
- 2ND or 3RD RG FAIL, ANY AX
- 2ND ACQSS FAIL, ANY AX*
- TACS ONLY CONTROL

COMPUTER MALF*
- SELF TEST FAIL (& XOVER IF ENABLED)

ATM CNSTR THERM
- PUMP ΔP <25 PSID
- COOLANT TEMP <45°F or >55°F
- HTR TEMP >150°F

*16K PROG ONLY

TB SUMMARY

MODE
- STY- NO ATT CONT
- EXP- SI+EPC AUTO
- SI - SI ATT CONT
- ZLV- ZLV ATT
- CMG- ATT HLD CMG
- TAC- ATT HLD TAC

SR/SS
- CMP- ATMOSPHERE
- SUN- EARTH SHAD

STAR TRACK
- AUT- SRCH & TRACK
- bp- GMBLS HOLD
- MAN- MPC DR GMBL
- OPN- SHTR OPN, NO STR
- bp- SHTR CLSD
- STR- ACQ & TRACKING

FSS
- OPN- DOOR OPN, NO SUN
- bp- DOOR CLSD
- SUN- SUN ACQD

MOMENTUM DUMP
- ACT- NOW DUMPING
- gr- DUMP ENABLD
- bp- DUMP INHBTD
- gr- CMG'S RELSD
- wh- ABNORMAL
- CGE- CMG'S CAGING

CMG SYSTEM
- gr - WHL & SRVO ENA
- bp- WHL AND/OR SRVO INH

RATE GYRO MON
- gr- SLCTD RG'S IN CONTROL
- bp- RG'S NOT AVG
- SGL- SLCT SGL RG IN CONTROL

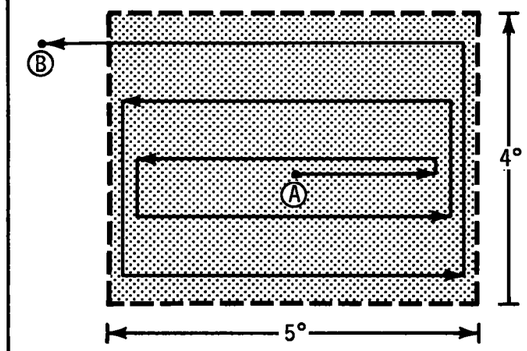
SUN ACQ
- PRI- PRI FOR STPDN UPDT
- gr- BOTH SNSRS
- SEC- SEC FOR STPDN UPDT
- gr- SUN ACQD
- bp- NOT ACQD

CMPTR
- PRI- PRI ACTIVE
- wh- ABNORMAL
- SEC- SEC ACTIVE

MAN PTG
- EXP-MPC DR WGE
- bp- MPC INH
- STR- MPC DR STR TRK

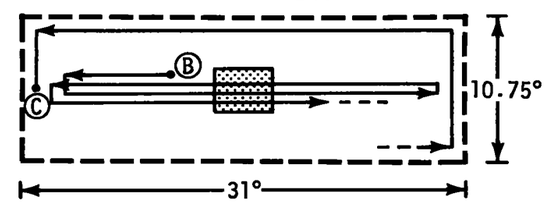
STAR TRACKER SEARCH PATTERNS

FINE PATTERN

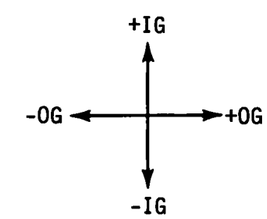


Ⓐ START FINE SRCH (STR TRK ACQ sw-AUTO)
Ⓑ IF STR TRK CONT ENA AND NO STR (0:25), ACS ALERT, SRCH TERM. IF STR TRK CONT INH AND NO STR, START CRSE SRCH.

COARSE PATTERN



Ⓑ START CRSE SRCH
Ⓒ (7:00) END CRSE SRCH AND START ANOTHER



ATMDC PROGRAM LOGIC

CMGs:

1. CONTROL:
   a. ENABLE, ST WD 1A=1 (52011+50000)
   b. INHIBIT, ST WD 1A=0 DUE TO INHIBIT CMD (52010+50000), ATT ERROR >20 DEG (60 DEG DURING AUTO RESET), OR THREE AUTO RESET ROUTINES, OR TOTAL CMG FAILURE
2. OUTER GIMBAL DRIVE LOGIC:
   a. ENABLED IF:
      (1) CMG CONTROL ENABLED, ST WD 1A=1 +
      (2) NO CAGE +
      (3) MODE SI, EXP, ATT HOLD CMG, Z-LV +
      (4) FIRST/LAST MIN OF SI ACQ, Z-LV OR ATT HOLD CMG MNVR OR 5 MIN AFTER Z-LV ACQ & 5 MIN FROM EACH OG DR AT ZLV ATT
   b. LOGIC:
      (1) STOP ANTICIPATED (ATT ERR >.2° AT ZLV)
      (2) OG DRIVEN TO 20%, IG HELD, OTHER CMGs HOLD ATTITUDE
      (3) NORMAL GIMBAL CMDDS REENABLED
3. CAGING: PRECEDENCE OVER NORM CONTROL EXCEPT AUTO RESET
   a. ZERO H CGE:
      (1) CAGE ZERO H SWITCH TO CGE
      (2) OG DRIVEN TO 20%, IG TO 0% AND HELD
      (3) RELEASED BY SWITCH OR CMG CONTROL ENABLE
   b. NOMINAL H CAGE:
      (1) 52023 (AUTO RESET IF CMG CONTROL ENA) OR ATT ERROR >20 DEG
      (2) GIMBALS DRIVEN TO ZERO H THEN NOM H
      (3) RELEASED AS IN (a)EXC CMG RSET
   c. SPECIFIED H:
      (1) 52022 + 3 DATA CMDS
      (2) GIMBALS DRIVEN TO ZERO H THEN SPEC H
      (3) RELEASED AS IN (a)
4. AUTO RESET ROUTINE:
   a. ENTERED WHEN:
      (1) SI OR EXP MODE, 200 SEC AT SI ATT
      (2) NO CGE
      (3) RESET ENABLED, ST WD 4B=1 (52011+50002)
      (4) GIMBAL ON A STOP
      (5) ATT ERROR >5.7 DEG
   b. SEQUENCE:
      (1) SETS CGE TB + ACS ALERT 9
      (2) SUSPENDS TACS FOR 100 SEC
      (3) GIMBALS DRIVEN TO ZERO H THEN NOM H
      (4) TACS REDUCES RATES
      (5) ZERO H TB GRAY, CMGs REDUCE ATT ERROR
      (6) RELEASE: ATT ERROR <0.18 DEG OR INHIBIT RESET ROUTINE ONLY
      (7) IF GIMBAL STILL ON A STOP + ATT ERROR >20 DEG, REPEAT 2X THEN
      (8) GOES TACS ONLY (ACS 6)

TACS:

1. CONTROL ENABLE: 52011+50001, ST WD 1B=1
2. CONTROL INHIBIT: 52010+50001, ST WD 1B=0
3. TACS PULSE WIDTH: UPDATE WITH 52034+1
4. TACS THRUST: UPDATE WITH 52035+1
5. TACS ONLY CONTROL: MODE SW OR CMG FAIL OR ATT ERROR >20 DEG (60 DEG DURING AUTO RESET) OR THREE AUTO RESETS(CONSECUTIVE)
6. DESAT FIRINGS IF:
   a. CMG AND TACS CONTROL ENABLED +
   b. MODE NOT STBY OR ATT HOLD TACS +
   c. NOT CAGING +
   d. NOT DUMPING (NOMINAL) +
   e. SYSTEM H >96%
7. STUCK THRUSTER: 750 lb-SEC IMPULSE (AVERAGE)
   EXPENDED IN AN AXIS PER HALF REV

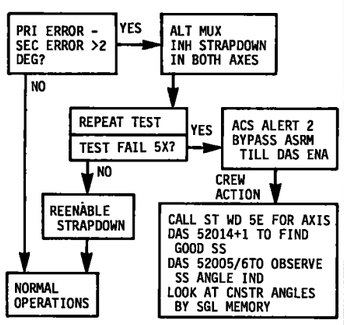
MANEUVERS:

1. SI OFFSETS: ADDITIVE TO 4 DEG, SET TO ZERO IF ANY MODE SELECTED
2. Z-LV OFFSETS: ADDITIVE, NO LIMIT, SET TO ZERO IF ANY MODE SELECTED
3. MOMENTUM DUMP:
   a. SAMPLES VALID IF:
      (1) SI OR EXP MODE +
      (2) NO SI ACQ MNVR +
      (3) CMG CONTROL ENABLED SINCE tS2 +
      (4) NOT CAGED SINCE FIRST DUMP SAMPLE +
      (5) NOT RECONFIGURED SINCE t_{S2}
      (6) NO AUTO RESET OCCURRED SINCE t_{S2}
   b. IF NOT, CONTINGENCY SAMPLE AT t_{DC} IF ALL ABOVE + DUMP ENABLED
   c. DUMP HALF ANGLE NOM 63 DEG, MAY BE REDUCED TO 40 DEG PRIOR TO t_{DC}
   d. H_T NOMINALLY 27.5% AT t_{DE}
   e. Z AXIS CORRECTION LIMITED TO 5 DEG PER ORBIT, DONE EVEN IF DUMP IS INHIBITED AFTER START (IF NO MODE CHANGE)
   f. NO TACS FIRINGS EXPECTED, MNVRS SCALED

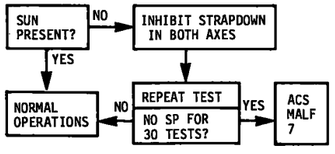
REDUNDANCY MGT:

ACQ SS
1. SUN PRESENCE (SP)
   a. SIGNAL USED IN RGRM, ASRM, FSS DOOR LOGIC AND DOOR OPEN ALERT
   b. IF BOTH ENA + 1 FAILS OR IF 1 SELECTED + 1 FAILS, SP tb bp, FSS DOOR CLOSES + FSS LOSES SOLAR REFERENCE + DR ALERT
   c. CREW MUST SELECT GOOD SENSOR (52014+1)
2. ANALOG SIGNAL RM PERFORMED WHEN:
   a. SI OR EXP MODE
   b. NOT MANEUVERING
   c. ORB PHASE tb DAY
   d. SP tb = SUN OR X&Y<3.25 DEG FROM SI

DUAL SENSOR ROUTINE



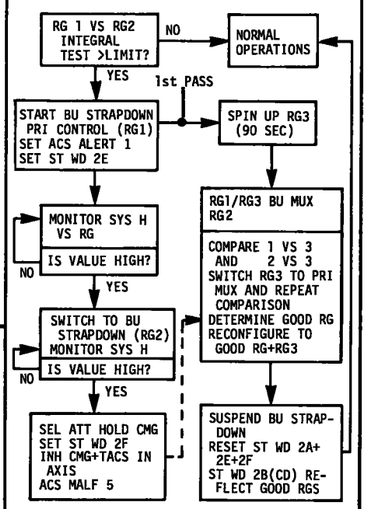
SINGLE SENSOR ROUTINE



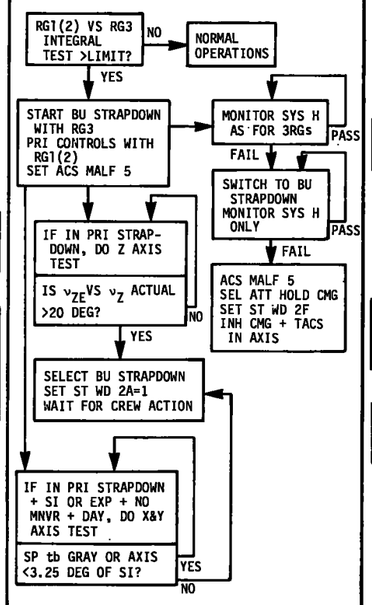
REDUNDANCY MGT:

RATE GYRO

THREE GYRO ROUTINE

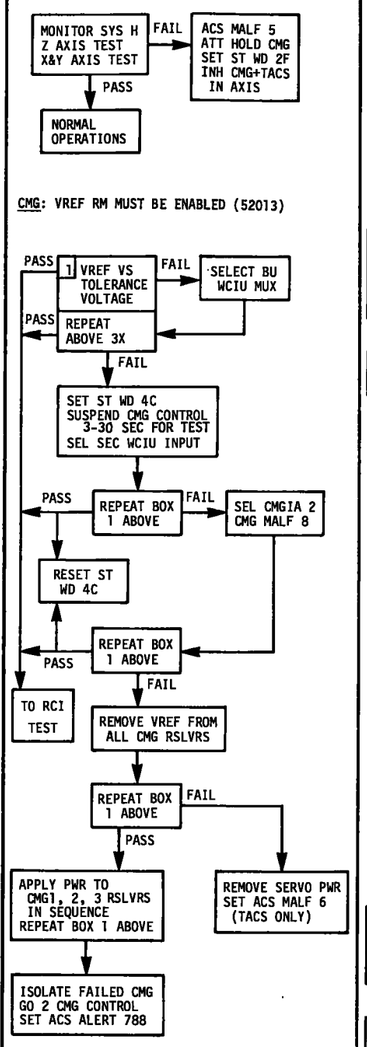


TWO GYRO ROUTINE



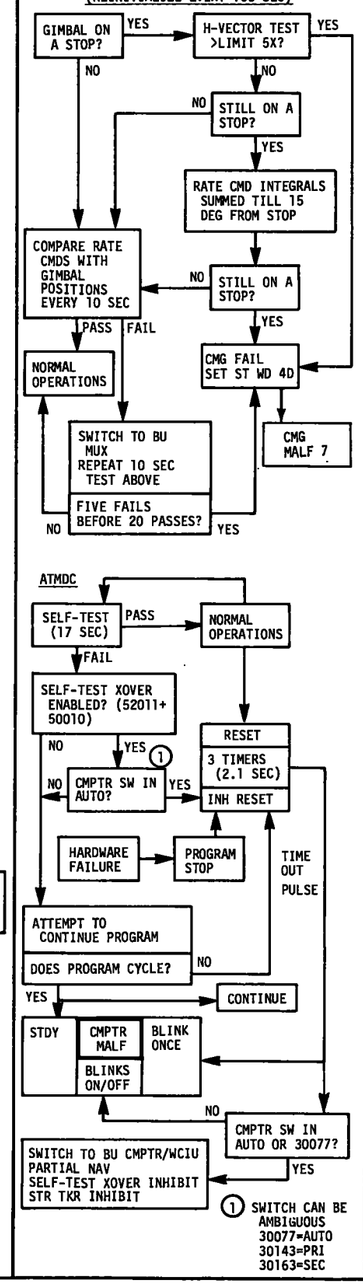
REDUNDANCY MGT:

SINGLE GYRO ROUTINE

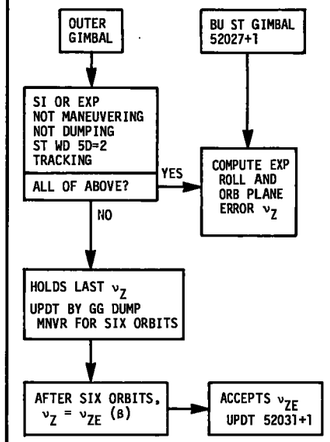


REDUNDANCY MGT:

RCI: RCI RM MUST BE ENABLED (52013) (REINITIALIZE EVERY 100 SEC)



STAR TRACKER:



ALERTS:

ACS-1=RG, 2=ACQ SS, 3=RG SC SW, 4-ST, 5=MNVR T, 6=CMPTR RESTART
CMG-7=CMG FAIL, 8=VREF, 9=AUTO RESET

C&Ws:

CLUSTER ATT-1=THRUSTER STUCK, 2=HI RATE
COMPUTER MALF-3=SELF-TEST (ALSO HDWR FAIL)
ACS MALF-4=CMG SAT, 5=2ND RG, 6=TACS ONLY 7=2ND ACQ SS

TIMING:

1. TWO KINDS:
   a. ATMDC TIMER IS RESET ONLY AT XOVER
   b. MISSION TIMER IS USED FOR DISPLAY. TM AND EXP FILM. A OR B SELECTABLE (30055,30035). EITHER CAN BE UPDATED (52033)
2. CLOCK CK: DAY/SP tb SHOULD AGREE ± 2 SEC

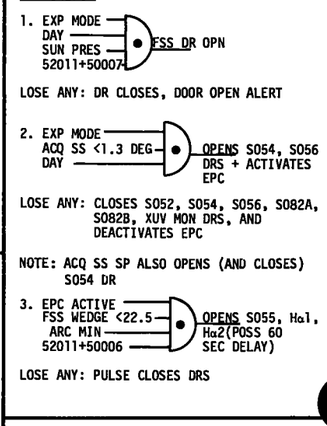
EXP SUPPORT:

EPC: ENABLED IF:

1. EXP PTG MODE
2. ORB PHASE = DAY
3. X&Y ERRORS RSS <1.3 DEG
4. NO SI ACQ MNVR

NOTE: FSS DR OPN NOT REQUIRED, BUT OPEN BEFORE SEL EXP TO AVOID PROBLEMS

DOOR LOGIC:



ATT/RATE DEADBANDS:

	TACS				CMG	
AXIS	ATT DBD	RATE DBD	MNVR RATE DBD	RESET RATE DBD	RATE DBD	ONE H EQUIV
X	3	0.3	0.03	0.02	0.08	0.2
Y	2	0.2	0.015	0.01	0.03	0.03
Z	2	0.2	0.03	0.02	0.037	0.03

C&D BUSSES (FUNCTIONAL)

FUNCTION	PWR BUS
DISPLAYS	
DAS/ORB PHASE	PI
POWER SYS	PI
EVENT TIME	PI
ACS CNTRS	PI
DEPLOY	
SOL ARY 1/3	CR
SOL ARY 2/4	CD
SCN SPECT MIR	CR
FILM RESET	
FILM RST sel	I
FILM RESET	I
CANISTER THERMAL	
PUMP	CD
CONTROLLER	CD
HTR PWR	CD
Monitor sel	CI
Monitor ind	I
Mon pwr fl lt	I
LIGHTING	
INTEGRAL	PI
INTEGRAL cont	I
NUMERIC	PI
NUMERIC cont	I
ALERT/STAT	PI
ALERT/STAT cont	I
LAMP TEST sel	I
EVENT TIME	
MIN-SEC ind	I
XUV SPECT	C
XUV SLIT	C
SLEW MIN	I
SLEW SEC	I
START/STOP	I
TONE	A
CONSOLE PWR DIST	
ALL SWITCHES & CKT BREAKERS	P
ORBIT PHASE	
TM REMV/DAS ind	I
TM REMV/DAS tb	I
DAS	
PWR	P
0-9,CLR, ENTR keys	C
GROUND/DAS	
CMPTR	CR
TLM	CR
PWR SYS	CR
GRD CMD	CR
CSTR THRM	CR
ACS	CR
EXP/TV	CR
EVA	
ROLL	CR
AUTO DOOR	CDR

FUNCTION	PWR BUS
ALERT	
20 ALERT lts	I
TELEMETRY	
TLM PWR tb	CD
TRNS 1 IN	CD
TRNS 1 IN tb	I
TRNS 2 IN	CD
TRNS 2 IN tb	I
TRNS 1 OUT	CD
TRNS 1 OUT tb	I
TRNS 2 OUT	CD
TRNS 2 OUT tb	I
TR 1 RECORD	CD
TR 1 tb	I
TR 2 RECORD	CD
TR 2 tb	I
TR 1 OFF	CD
TR 2 OFF	CD
ATTITUDE CONTROL SYSTEM	
EPC RL RSLVR	C
EPC 800 HZ	C
FSS	CD
EPC RG U/D	CD
EPC RG L/R	CD
MODE	
EXP PTG	CDR
EXP PTG tb	I
SLR INERT	CDR
SLR INERT tb	I
ATT HOLD	CDR
ATT HOLD tb	I
SR/SS	CD
SR/SS tb	I
STAR TRACK	
POWER	CD
ACQ	C
ACQ tb	I
SHUTTER	C
SHUTTER tb	I
FSS DOOR	CD
FSS DOOR tb	I
MOMENTUM DUMP	
AUTO GG	CD
AUTO GG tb	I
CAGE	CD
CAGE tb	I
FSS BIAS	
XUV SLIT	C
H-ALPHA 1	C
IN	C
MARK	C
SUN ACQ SEN tb	I
SUN ACQ SP tb	I
CMPTR tb	I
CMPTR	CD
EPEA	CD
TACS 1-6	CDR
TACS 1-6 lts	I
CMG SYS 1-3	CD
CMG SYS 1-3 tb	I
RG MON X,Y,Z	CI
RG MON X,Y,Z tb	I

FUNCTION	PWR BUS
MONITOR	
ACS sel	CIP
ACS ind	I
ACS fail lt	I
ANGLE sel	CIP
ANGLE ind	I
ANGLE fl lt	I
COUNTER	
1,2,3 sel	CIP
1,2,3 ind	I
1,2,3 tb	I
MANUAL PGT CONTROL	
MPC	CD
ROLL ENABLE	CR
ROLL HI RATE	CR
ROLL LO RATE	CR
ROLL GAIN	CR
MAN PTG ENABLE	CR
MAN PTG tb	I
POWER SYSTEM	
BAT TEMP tb	I
BAT VOLTS tb	I
REG VOLTS tb	I
BAT CHG tb	I
REG/BUS/BAT	
pwr fail lt	I
ind	I
REG/BAT	
pwr fail lt	I
ind	I
CBRM STATUS	
CHGR 1-18 lts	I
BAT 1-18 lts	I
REG 1-18 lts	I
WATT-HR ind	I
WATT-HR RESET	I
Pwr Mon sel	CIP
CBRM SEL sel	CI
TV	
Ma RC	C
Ma RETICLE	C
Ma1 PWR	CR
Ma1 ZOOM	CR
Ma2 PWR	CR
Ma2 ZOOM	CR
MON 1	PIR
MON 2	PIR
SYNC GEN	CPD
MON 1 sel	CI
MON 2 sel	CI

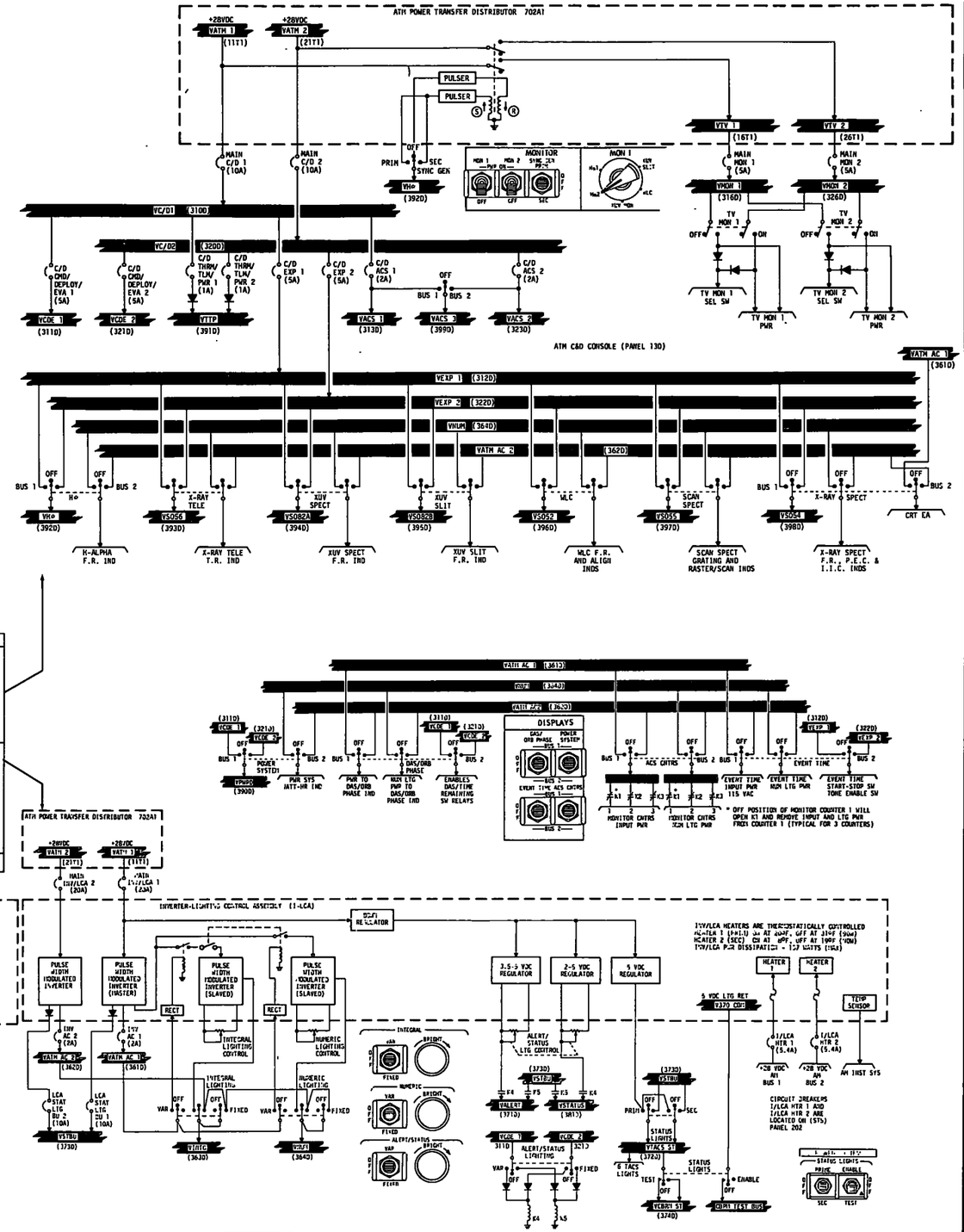
FUNCTION	PWR BUS
TV	
XUV MON	
GATN sel	C
PWR	CR
DOORS	CD
DOORS tb	I
VID INTEG	C
GRID	C
XUV SLIT	
VL DISPLAY	C
XUV SLIT tb	I
LINE PTG	C
WLC PWR	CR
WLC GRID	C
MON 1 ind	I
MON 2 ind	I
H-ALPHA	
Ha1 CMR PWR	CR
Ha1 DOOR	CR
Ha1 DOOR tb	I
Ha2 DOOR	CR
Ha2 DOOR tb	I
Ha1 FR/MIN	C
Ha1 HEATER	CD
Ha1 HGT INTLK	C
Ha1 FR REMN ind	I
Ha1 AUTO	C
Ha1 RDY/OPR lts	I
Ha2 HEATER	C
X-RAY TELE	
X-REA PWR	CD
HV PWR BE	C
HV PWR AL	C
DOOR	CR
DOOR tb	I
BE APRT POS	
AUTO	C
INCR	C
APRT POS tb	I
AL APRT POS	
AUTO	C
INCR	C
APRT POS tb	I
CAMR PWR	CD
CAMR AIRLOCK	C
CAMR/TELE sel	C
FILTER tb	I
EXPOSURE	C
FLARE	C
FR REMAIN ind	I
START/STOP	C
RDY/OPR lts	I
THERMAL	CD
X-RAY/RF ACTIVITY	
DATA DRIVE	
BE	CI
RECORD	CI
FORWARD	CI
HISTORY PLOT ind	I
CLOCK	I

FUNCTION	PWR BUS
XUV SPECT	
MAIN PWR	CD
PWR/DOORS	CD
PWR/DOORS tb	I
MODE	CD
WAVE LTH	C
WAVE LTH tb	I
EXPOSURE	C
EXPOSURE tb	I
FLARE	C
FLARE tb	I
FR REMAIN ind	I
START/STOP	C
RDY/OPR lts	I
THERMAL	CD
XUV SLIT	
MAIN PWR	CD
PWR/DOORS	CD
PWR/DOORS tb	I
MODE	C
WAVE LTH	I
WAVE LTH tb	I
AUTO SEQ	C
FLARE	C
FLARE tb	I
FR REMAIN ind	I
START/STOP	C
RDY/OPR lts	I
THERMAL	CD
WLC	
MAIN PWR	CD
DOOR	CD
DOOR tb	I
AUTO DOOR	C
MODE sel	CD
LOW FILM INH	C
FR REMAIN ind	I
START/STOP	CI
RDY/OPR lts	I
THERMAL	CD
MIRROR POS	C
SCALE	CI
ALIGN	CID
MODE	CD
SEQ COMPL tb	I
WLC ALIGN	
ind	I
pwr fail lt	I
SCAN SPECT	
HV 1-7	CD
DOOR	CD
DOOR tb	I
MAIN HV	C
MAIN PWR	CD
INTEN DATA ind	I
INTEN DATA	PI
DET ELEC	C
DET SEL	C
HV/DOOR INTLK	C
EXP/HGT INTLK	C
GRATING POS ind	I

FUNCTION	PWR BUS
SCAN SPECT	
RASTER/SCAN RESET	CI
RASTER/SCAN ind	I
MODE sel	CD
MIR POS	C
MIR LIMIT tb	I
GRATING REF	C
D-ORDER tb	I
START/STOP	CD
RDY/OPR lts	I
GRATING MTR DRV	C
THERMAL	CD
X-RAY SPECT	
MAIN PWR	CD
DOOR	CD
DOOR tb	I
IMAGE DISSECT	CR
X-RAY IMAGE	CR
PHOTO MULT	CR
FILTER sel	CD
FILTER CONF tb	I
MODE	CD
FR REMAIN ind	I
START/STOP	CD
RDY/OPR lts	I
PHOTOMULT TEST	C
THERMAL PWR	CD
GRATING	C
GRATING tb	I
PICTR RATE sel	C
EXPOS RANGE sel	C
FLARE THRESHOLD	
COARSE	C
FINE	C
PH EXP CNTR ind	C
IMAGE THRS sel	C
IMAGE INTENSITY	
COUNT ind	I
BRIGHT cont	I
X-RAY IMAGE ind	I
FOCUS cont	I
MASTER FLARE MODE	
TM/LT ENBL	CIA
X-RAY/RF lts	I
INIT	CR
TONE VOL ADJ	
EVNT THR cont	A
FLR ALERT cont	A
Tone Generator	A
CANISTER CONTROL (PANEL 160)	
POWER	
PRIM cb/sw	P
SEC cb/sw	P
ROLL	CP
SOB2 DOORS	CR
SOB2A DOOR lt	I
SOB2B DOOR lt	I
CSTR ROTAT cont	C

FUNCTION	PWR BUS
DAS BACKUP (PANEL 121)	
DIGIT 1-5 sel	C
DATA TRANS	CR
ENTER	CR
CLEAR	CR
SOLAR RADIO NOISE BURST MONITOR (PANELS 128, 129)	
CAL NOISE	
SOURCE sel	CI
SRNBM ind	I
SWITCHING	
MODE sel	C
SYS GAIN cont	C
REF BAL cont	C
ORBIT PERIOD	
pb/ind	CI
ON TIME pb/ind	CI
THRESHOLD cont	C
ENABLE ind	I
START	C
POWER	P

ATM BUS DESIGNATIONS		
ABBR NAME	BUS NUM	BUS TITLE
VACS 1	313D	ACS 1
VACS 2	323D	ACS 2
VACS 3	399D	ACS 3
VALERT	371D	ALRT LTG
VATM AC1	361D	ATM AC 1
VATM AC2	362D	ATM AC 2
VCBRM	374D	CBRM
STAT		STAT LTG
VC/D 1	310D	C&D 1
VC/D 2	320D	C&D 2
VCDE 1	311D	CMD/DPLY/EVA 1
VCDE 2	321D	CMD/DPLY/EVA 2
VEXP 1	312D	EXP 1
VEXP 2	322D	EXP 2
VHα	392D	H-ALPHA
VINTG	363D	INTGR LTG
VMON 1	316D	MON BUS 1
VMON 2	326D	MON BUS 2
VNUM	364D	NUM LTG
VPWRD	390D	PWR DSPLY
VS052	396D	WLC
VS054	398D	XRAY SPEC
VS055	397D	SCAN SPEC
VS056	393D	XRAY TELE
VS082A	394D	XUV SPECT
VS082B	395D	XUV SLIT
VSTATUS	381D	STAT LTG
VSTBU	373D	ST LTG BU
VTACS ST	372D	TACS LTG
VTTP	391D	THV/TM/PR



C&D BUS (NUMERICAL)

VACS/VACS 2
ATT CONTROL SYSTEM
MODE EXP PTG
MODE SLR INERTIAL
MODE ATT HOLD
MANUAL PTG CONTROL
ROLL ENABLE
ROLL HIGH RATE
ROLL LOW RATE
ROLL GAIN
ENABLE
CONS PWR DIST-ACS MONITOR
COUNTERS 1,2,3 sel

VACS 3
ATT CONTROL SYSTEM
EPC 800 HZ RSLVR
EPC 800 HZ
FSS
RATE GYRO UP/DN
RATE GYRO L/R
SR/SS
STAR TRACK PWR
STAR TRACK ACQ
STAR TRACK SHUTTER
FSS DOOR
MOM DUMP AUTO GG
MOM DUMP CAGE
FSS BIAS XUV SLIT
FSS BIAS Ha1
FSS BIAS IN
FSS BIAS MARK
CMPTR
EPEA
CMG SYS 1,2,3
RG MONITOR X,Y,Z
MONITOR
ACS ind
ACS sel
ANGLE ind
ANGLE sel
COUNTERS 1,2,3 sel
LTG-LAMP TEST sel

VALERT
20 ALERT lts
LTG-LAMP TEST sel

VATM AC1/AC2
DISPLAYS
DAS/ORB PHASE
ACS CNTRS
EVENT TIME
SOS5-INTEN DATA
SOS5-INTEN DATA ind
CONSOLE PWR DIST
X-RAY SPECT
ORB PHASE
TIME REMAINING ind
MONITOR
COUNTERS 1,2,3
EVENT TIME
MIN-SEC ind
LIGHTING
INTEGRAL
NUMERIC

VCBRM STAT
S4 CBRM STATUS lts
STATUS LIGHTS
PRIM
ENABLE

VC/D 1
VCDE BUS 1 (311D)
VTTP BUS (391D)
VACS BUS 1 (313D)
VEXP BUS 1 (312D)

VC/D 2
VCDE BUS 2 (321D)
VTTP BUS (391D)
VACS BUS 2 (323D)
VEXP BUS 2 (322D)

VCDE 1/VCDE 2
GROUND/DAS
CMPTR
TLM
PWR SYS
GRD CMD
CSTR THRM
ACS
EXP/TV
DAS-PWR
ATM POWER
DEPLOY
SOLAR ARRAY 1/3
SOLAR ARRAY 2/4
SCAN SPEC MIRROR
EVA-ROLL
EVA-AUTO DOOR
LTG-ALERT/STATUS
DISPLAYS
DAS/ORB PHASE
PWR SYS

VEXP 1/VEXP 2
H-ALPHA
Ha1 CAMR PWR
Ha1 DOOR
Ha2 DOOR
S056-X-REA PWR
S056-DOOR
S056-IMAGE DISSECT
S054-PHOTO MULT
TV-Ha1 PWR
TV-Ha1 ZOOM
TV-Ha2 PWR
TV-Ha2 ZOOM
TV-XUV MON PWR
TV-WLC PWR
MSTR FLR MODE-INIT
CONSOLE PWR DIST
X-RAY SPECT
ORB PHASE
TIME REMAINING ind
MONITOR
COUNTERS 1,2,3
EVENT TIME
MIN-SEC ind
LIGHTING
INTEGRAL
NUMERIC

VHα
H-ALPHA
Ha1 HEATER
Ha1 NIGHT INTLK
Ha1 FR REMAINING
Ha2 HEATER
FILM RESET sel
FILM RESET
TV-Hα RC
TV-Hα RETICLE
TV-MONITR-SYNC GEN

VINTG
PANEL NOMENCLATURE 61 panel talkbacks
CSTR THRM-MON ind
POWER SYSTEM
REG/BUS/BAT ind
REG/BAT ind
MONITOR-ACS ind
MONITOR-ANGLE ind
WLC-ALIGN ind
X-RAY/RF ACTIVITY
HISTORY PLOTTER
DAS-10 keys
LIGHTING-INTEGRAL

VMON 1/VMON 2
TV-MON 1 ind
TV-MON 2 ind
TV-MON 1 sel
TV-MON 2 sel

VNUM
CONSOLE PWR DIST
Hα
X-RAY TELE
XUV SPECT
XUV SLIT
WLC
SCAN SPECT
X-RAY SPECT
SOS5-INTEN DATA
DISPLAYS
DAS/ORB PHASE
PWR SYS
ACS CNTRS
EVENT TIME
LIGHTING-NUMERIC

VPWRD
DISPLAYS-PWR SYS
POWER SYSTEM
REG/BUS/BAT ind
REG/BAT ind
BAT TEMP tb
BAT VOLTS tb
REG VOLTS tb
BAT CHG tb
PWR MONITOR sel
CBRM SELECT sel
WATT-HR ind
WATT-HR RESET
SELECT 1-12

VS052
WLC
MAIN PWR
DOOR
AUTO DOOR
MODE sel
FR REMAINING ind
THERMAL
MIRROR POS
SCALE
ALIGN
CONSOLE PWR DIST
WLC
FILM RESET sel
FILM RESET-RESET
TV-WLC GRID

VS054
X-RAY SPECT
MAIN PWR
DOOR
GRATING
FILTER sel
MODE
FR REMAINING ind
START/STOP
PHOTO MULT TEST
THERMAL
MASTER FLARE MODE
TM/LT
CONSOLE PWR DIST
X-RAY SPECT
FILM RESET sel
FILM RESET-RESET

VS055
SCAN SPECT
MAIN PWR
MAIN HV
DOOR
HV/DOOR INTLK
EXP HGHT INTLK
THERMAL
GRATING POS ind
RASTER/SCAN ind
RASTER/SCAN RESET
CONSOLE PWR DIST
SCAN SPECT

VS056
X-RAY TELE
HV PWR BE
HV PWR AL
CAMR PWR
FLARE
FR REMAINING ind
CAMERA/TELE sel
THERMAL
CONSOLE PWR DIST
X-RAY TELE
FILM RESET sel
FILM RESET-RESET
X-RAY/RF ACTIVITY
HISTORY PLOT
BE
RECORD
FORWARD

VS082A
XUV SPECT
MAIN PWR
PWR/DOORS
MODE
FR REMAINING ind
THERMAL
CONSOLE PWR DIST
XUV SLIT
FILM RESET sel
FILM RESET-RESET
EVENT TIME
XUV SPECT

VS082B
XUV SLIT
MAIN PWR
PWR/DOORS
MODE
FR REMAINING ind
THERMAL
CONSOLE PWR DIST
XUV SLIT
FILM RESET sel
FILM RESET-RESET
EVENT TIME
XUV SLIT

VSTATUS
6 ind pwr fl lts
7 RDY/OPR lts
MASTER FLARE MODE
X-RAY/RF lts

VSTBU
Backup bus for VALERT,VTACS ST, VCBRM STAT and VSTATUS
LIGHTING
ALERT/STATUS
POWER SYSTEM
STATUS LTG-PRIM
STATUS LTG-ENABLE

VTACS ST
POWER SYSTEM
STATUS LTG-PRIM
STATUS LTS-ENABLE
ATT CONTROL SYSTEM
6 TACS lts

VTTP
CAUTISER THERMAL
PUMP
CONTROLLER
Monitor sel
HTR PWR
Monitor ind

VTTP
TELEMETRY
TLM PWR
TRNS 1 INPUT
TRNS 2 INPUT
TRNS 1 OUTPUT
TRNS 2 OUTPUT
TR 1 RECRD
TR 2 RECRD
TR 1 OFF
TR 2 OFF
POWER SYSTEM
CMGR
REG
CBRM SELECT sel
CBRM SELECT-SELECT

S052 (I-PWR)
REQD CMDS FOR S052
I-PWR ACTIVE:
MAIN PWR-ON

WLC
MODE
LOW FILM INHIBIT
START/STOP
ALIGN
MODE

S054 (I-PWR)
REQD CMDS FOR S054
I-PWR ACTIVE:
MAIN PWR ON

X-RAY SPECT
PICTURE RATE sel
EXPOS RANGE sel
FLR THR COARSE sel
FLR THR FINE sel
X-RAY IMAGE
X-RAY IMAGE ind
PM EXPOS COUNT ind
IMG INT COUNT ind
IMG THRESHOLD sel

S055 (I-PWR)
REQD CMDS FOR S055
I-PWR (CMD) ACTIVE:
MAIN PWR-PRIM or SEC

SCAN SPECT
MODE sel
MIR POS
GRATING REF
START/STOP
GRATING MTR DRIVE
DET ELEC TEST
DET SEL
HV ENA/RESET 1-7

S055 (I-PWR)
REQD CMDS FOR S055
I-PWR (HV ENA) ACT:
MAIN HV-ENABLE

SCAN SPECT
MAIN HV
HV ENA/RESET 1-7

S056 (I-PWR)
REQD CMDS FOR S056
I-PWR (X-REA) ACT:
X-REA PWR-ON

X-RAY TELE
BE APRT POS AUTO
BE APRT POS INCR
AL APRT POS AUTO
AL APRT POS INCR

S056 (I-PWR)
REQD CMDS FOR S056
I-PWR (X-RAY) ACT:
CAMR PWR-ON

X-RAY TELE
CAMERA AIRLOCK
CAMERA/TELE sel
START/STOP

S082A (I-PWR)
REQD CMDS FOR S082A
I-PWR ACTIVE:
MAIN PWR-ON
PWR/DOORS-ON

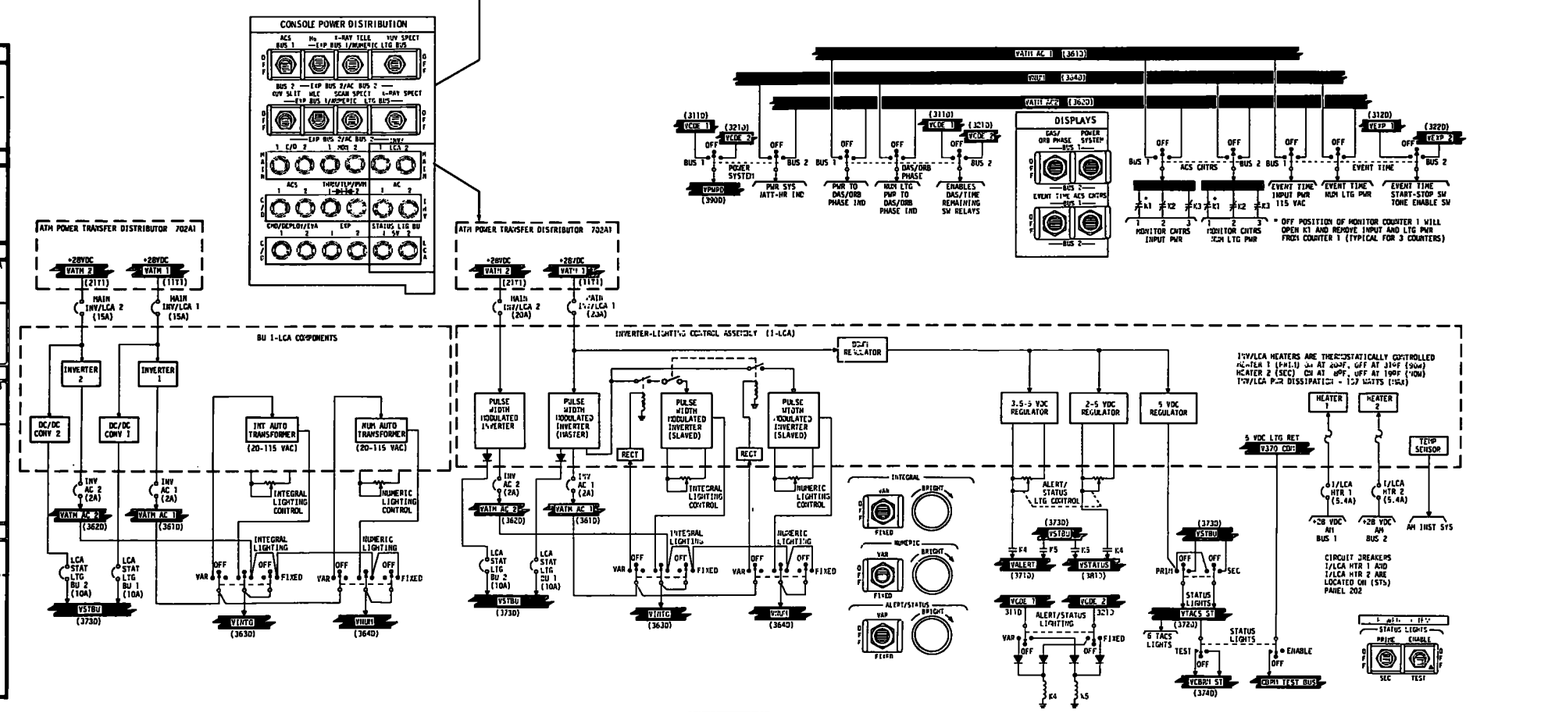
XUV SPECT
MODE
WAVE LTH
EXPOSURE
FLARE
START/STOP

S082B (I-PWR)
REQD CMDS FOR S082B
I-PWR ACTIVE:
MAIN PWR-ON
PWR/DOORS-ON

XUV SLIT
MODE
WAVE LTH
AUTO SEQ
FLARE
START/STOP
TV
XUV SLIT WL DISP
XUV SLIT LMB PTG
XUV MON GAIN sel

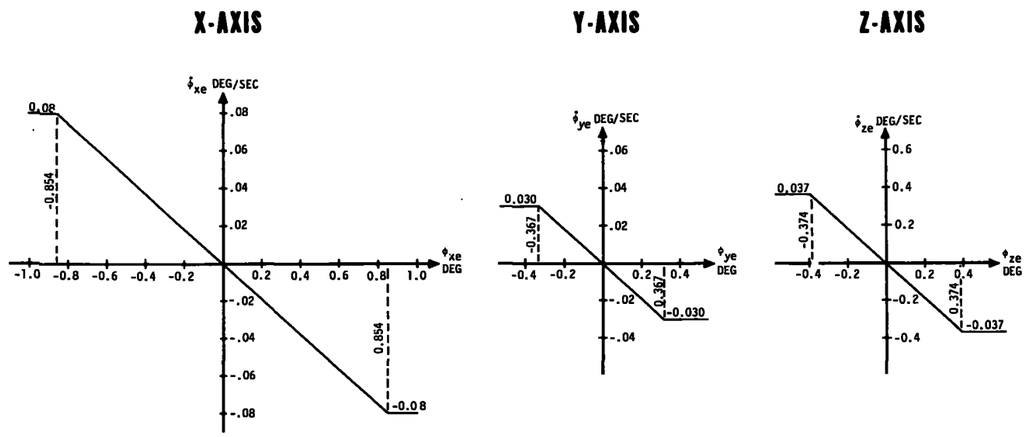
Hα(I-PWR)
REQD CMDS FOR Ha1
I-PWR ACTIVE:
CAMR PWR-ON

H-ALPHA
Ha1 FR/MIN
Ha1 AUTO

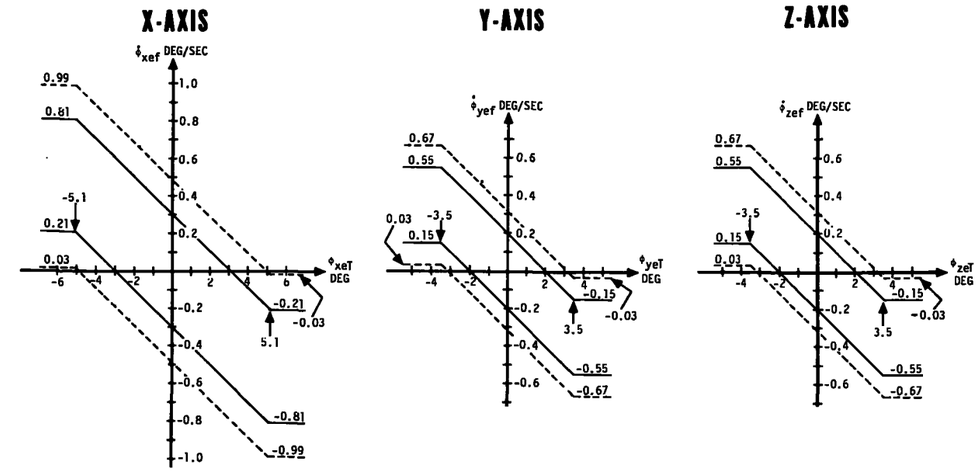


BUS/CONT

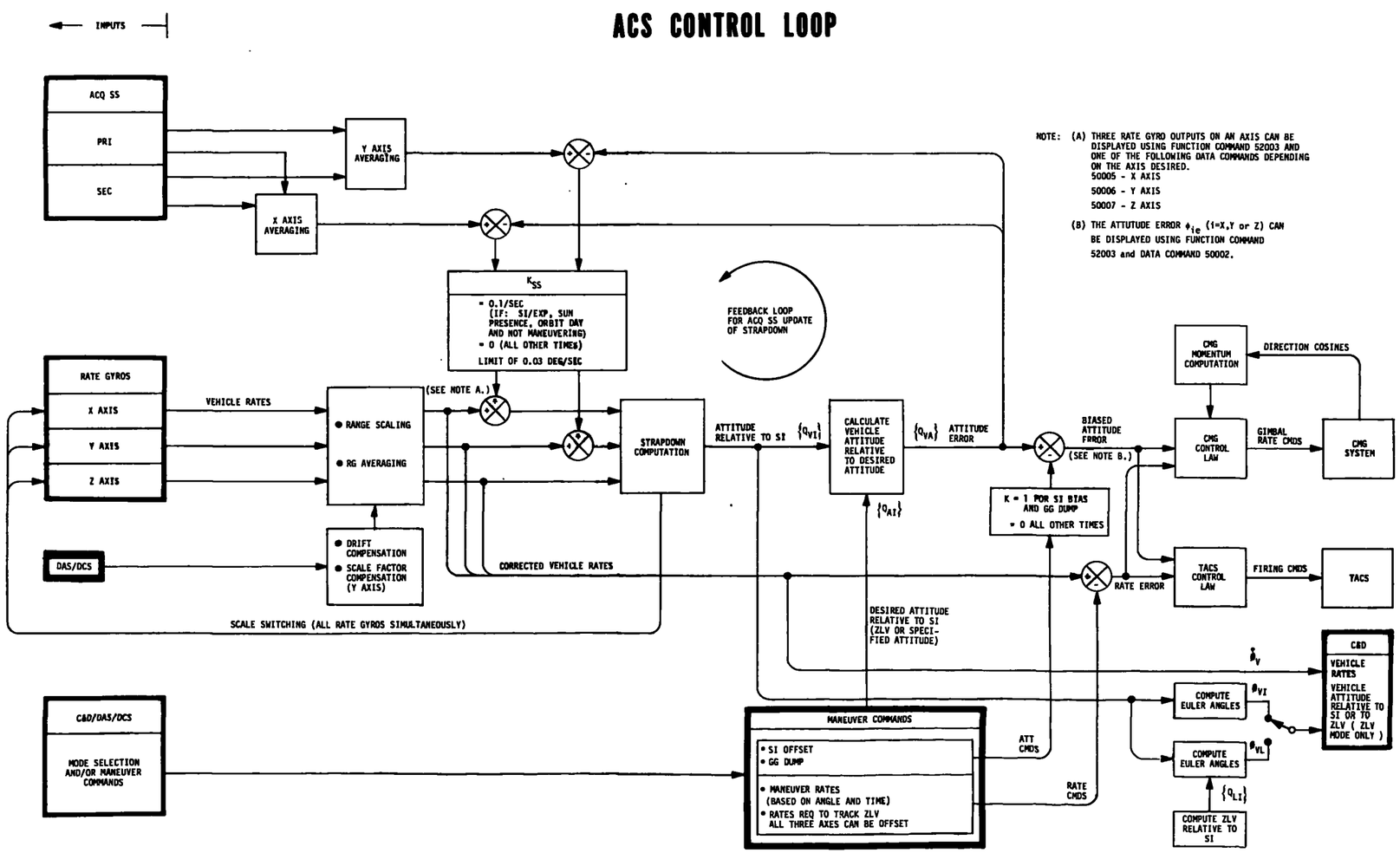
CMG CONTROL LAW (NOT MANEUVERING)



TACS CONTROL LAW



ACS CONTROL LOOP



NOTE: (A) THREE RATE GYRO OUTPUTS ON AN AXIS CAN BE DISPLAYED USING FUNCTION COMMAND 52003 AND ONE OF THE FOLLOWING DATA COMMANDS DEPENDING ON THE AXIS DESIRED.
50005 - X AXIS
50006 - Y AXIS
50007 - Z AXIS

(B) THE ATTUTUDE ERROR ϕ_{ie} (i=X,Y or Z) CAN BE DISPLAYED USING FUNCTION COMMAND 52003 and DATA COMMAND 50002.

Teleprinter Fail
Summary Sheet Guidelines

1. Voice updates for the ATM Schedule Pad will nominally consist of the following:

   GMT or Time Remaining Time
   JOP and Step number
   Building Block
   Target

   On an occassional basis changes to experiment mode settings on the summary sheets will be voiced up.

   Voice updates for Solar Activity Pad:

   Major active regions, prominences, and filaments
   Θ/R coordinates and flare probabilities

   The remainder of the Solar Activity Pad will be updated only for significant changes.

2. Setup times have been developed according to the following guidelines and have subsequently been verified by crew simulations.

   a. Grating selection - average 3 min. (Selection time begins prior to start of pointing).

   b. Fine pointing (and roll) at a target from an arbitary pointing and roll requires 2 min. Network cells and bright spots require an additional 3 or 4 min for search time.

   c. Maximizing or minimizing DET 1 or 3 requires 1 minute.

   d. Nearly all JOP's assume that each step may be accomplished independently of any other. In those cases where steps are performed back to back with little change in pointing, roll and grating position the setup time can be reduced accordingly (never below 1 min).

   The results of future crew simulations or mission experience will be used to modify the setup times if necessary.

3. Generally if a BB must be deleted or truncated it should be the last one scheduled for that pass. The P.I.'s will attempt to schedule the highest priority Building Blocks at the beginning of the pass.

4. If the scheduled operations are interrupted for any reason, the crew and P.I. will not attempt to reschedule that day those BB's which were not completed. BB1 is an exception. The crew will complete BB1 in the next orbit, if possible.

5. All coordinates voiced up will be assumed to be suggested coordinates unless indicated otherwise.

6. JOP 1
   The BB sequences in 1A and 1B should be performed by the same crewman to insure that the same network cell boundary is relocated.

   JOP 1 coordinates voice updated for JOPS 1A,1B and 1D will give the crewman the region within which to find a network cell or bright spot.

7. JOPs 2 and 4
   Repetitions of BB's or pointings on a target will be accomplished at different positions unless specified otherwise by the summary sheets.

8. JOP 5
   The same crewman should perform as many of the BBs composing a latitude scan as possible.

9. JOP 8
   JOP 8A will be initiated on any eruptive prominence, disappearing filament, or surge (Hα or XUV) outside .7R that the crewman considers to be significant based on previous crew training.

   JOP 8B will be initiated by the crewman whenever a white light structure which is moving out through the corona is observed. Significant changes in the shape of a white light structure occurring over the period of 1 or 2 orbits will result in crew initiation of JOP 8B. Other changes noted will be reported to the ground prior to JOP 8B initiation.

10. JOP 12
    The Scientist Pilot should be scheduled for this JOP when possible.

11. JOP 13
    The Scientist Pilot must be scheduled for this JOP.

12. JOPS 15 and 17
    The BB sequences in 15A and 17A/B should be performed by the same crewman to insure that the bright spot is relocated and the coronal hole pointings sample the areas desired. If voice uplinked coordinates are not indicated as exact, the crewman will assume the coordinates are suggested and improve the pointing using the XUV MON photographs and Image Persistence Scope (IPS).

13. JOP 16
    JOP 16 will be initiated by the crewman based on previous crew training.

14. Permanent changes to the JOP Summary Sheets will be voiced up using the exact wording to be incorporated and indicating all the FDF material affected.