

# FLIGHT DATA FILE

*Shuttle*

## Flight Plan

33013

### STS-47

(Rotated Flight Cycle Trajectory)

Mission Operations Directorate  
Operations Division

Final  
July 1, 1992

*PCN-1  
Time*

EVENT	CDT		
Launch	09:18	Tue	Sep 1
KSC Landing	05:54	Tue	Sep 8



National Aeronautics and  
Space Administration

Lyndon B. Johnson Space Center  
Houston, Texas



STS-47 FLIGHT PLAN

FINAL (July 1, 1992)

## PCN-1 (Aug 17, 1992) Sheet 1 of 1

List of Implemented Change Requests (482s):

FLT PLN-1371  
MULTI-695A  
MULTI-698A

Incorporate the following:

1. Replace iii & iv
2. Replace Section 1 (1-1 thru 1-4)
3. Replace Section 2 (2-1 thru 2-16)
4. Replace Section 3 (3-1 thru 3-82)

IMC  
8/26/92

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Encl: 104 pages

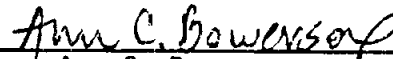
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MISSION OPERATIONS DIRECTORATE

STS-47 FLIGHT PLAN

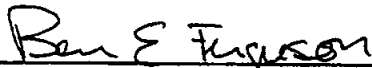
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July 1, 1992

PREPARED BY:

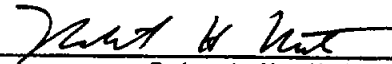


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Book Manager

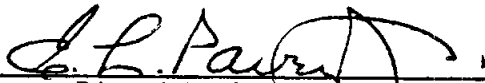
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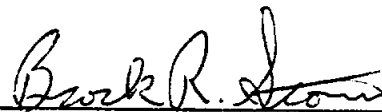
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	FLT PLN-1348	FLT PLN-1354	FLT PLN-1368
	FLT PLN-1349	FLT PLN-1355	FLT PLN-1369
	FLT PLN-1350	FLT PLN-1356	
	FLT PLN-1351	FLT PLN-1357	Exemption #: 38, 41
	FLT PLN-1352	FLT PLN-1358	

AREAS OF TECHNICAL RESPONSIBILITY

Book Manager	DH4/A. C. Bowersox	483-4478
Nominal Timelines	DH4/W. R. Chell	483-5987
Attitude and Pointing	DH4/K. J. Lawson	483-4417

STS-47 FLIGHT PLAN

**LIST OF EFFECTIVE PAGES**

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PCN-1 08/17/92

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(\*) - Omit from flight book

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DAP A.....	5-6	FLT PLN-2a/47/0/A
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A2.....	5-7	FLT PLN-4a/47/0/A
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A3.....	5-7	FLT PLN-5a/47/0/A
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DAP A7.....	5-9	FLT PLN-8b/47/0/A
A7.....	5-9	FLT PLN-9a/47/0/A
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B1.....	5-11	FLT PLN-13a/47/0/A
DAP B2.....	5-12	FLT PLN-13b/47/0/A
B2.....	5-12	FLT PLN-14a/47/0/A
DAP B3.....	5-12	FLT PLN-14b/47/0/A
B3.....	5-12	FLT PLN-15a/47/0/A
DAP B4.....	5-13	FLT PLN-15b/47/0/A
B4.....	5-13	FLT PLN-16a/47/0/A
DAP B5.....	5-13	FLT PLN-16b/47/0/A
B5.....	5-13	FLT PLN-17a/47/0/A
DAP B6.....	5-14	FLT PLN-17b/47/0/A
B6.....	5-14	FLT PLN-18a/47/0/A
DAP B7.....	5-14	FLT PLN-18b/47/0/A
B7.....	5-14	FLT PLN-19a/47/0/A
DAP B8.....	5-15	FLT PLN-19b/47/0/A
B8.....	5-15	FLT PLN-20a/47/0/A
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DAP ALT 1.....	5-16	FLT PLN-21b/47/0/A
ALT 1.....	5-16	FLT PLN-22a/47/0/A
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## INTRODUCTION

The STS-47 Flight Plan is the Flight Data File article that contains the on-orbit timeline. It does not contain the detailed timelines that are covered in the Ascent, Post Insertion, Deorbit Prep, and Entry Checklists. For continuity, the entire flight is shown in the summary level timeline.

This on-orbit timeline satisfies the objectives specified in the Flight Definition and Requirements Directive and the requirements of the STS-47 Flight Requirements Document. The Flight Plan, as part of the Flight Data File, meets the specifications of the Rotated Flight Cycle version of the STS-47 Flight Initialization Data Pack.

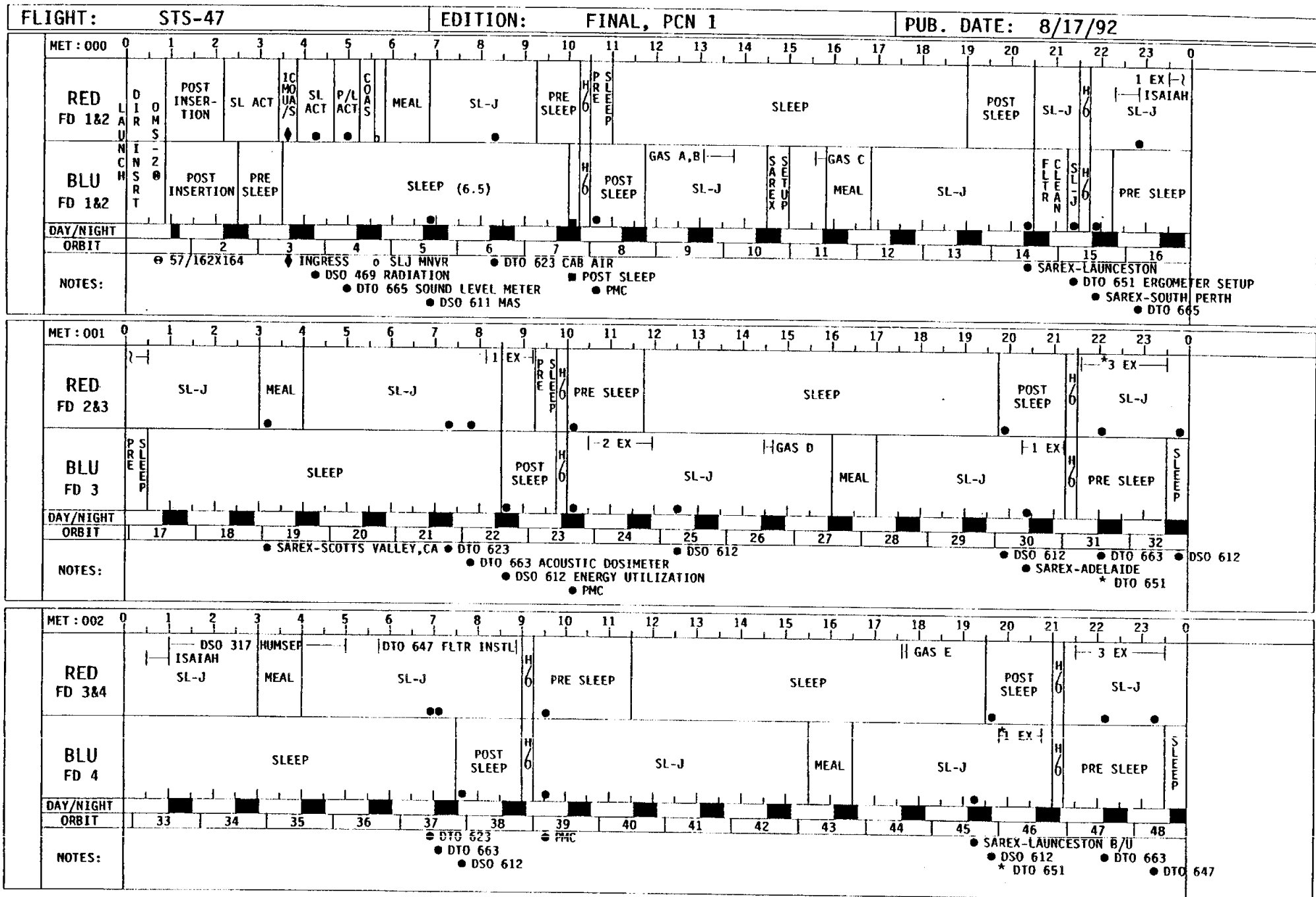
The flight profile used for this Flight Plan is for a launch date of September 1, 1992, at 9:18 CDT.

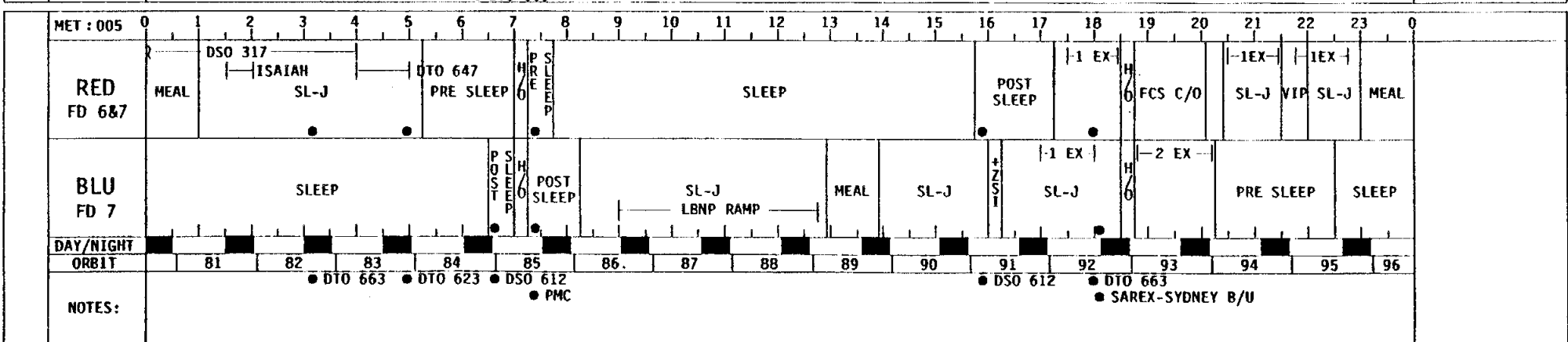
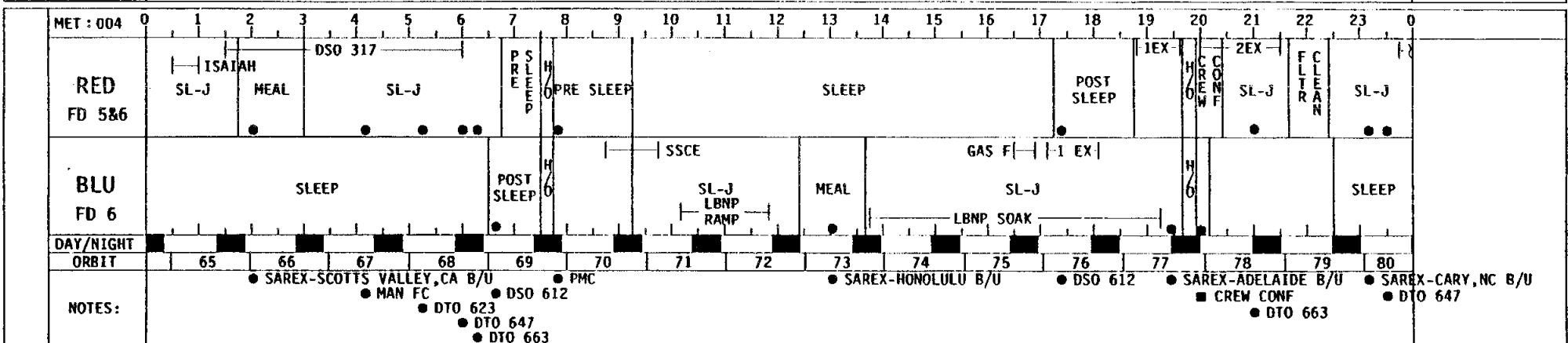
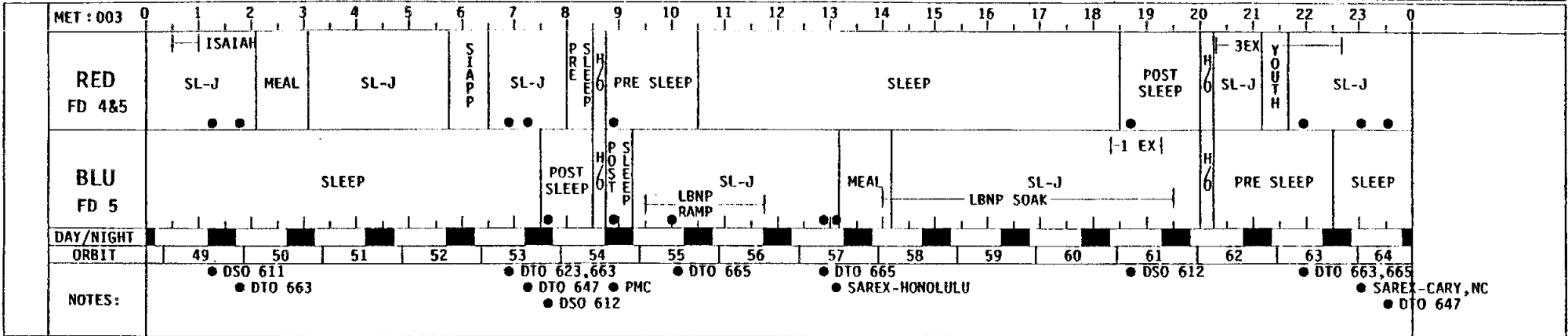
JSC-22359, Crew Scheduling Constraints (Appendix K, CPMP), Basic Rev A, January 1990, has been used to build the timelines contained in this Flight Plan. Appendix K Exemption #38 authorizes three exercise violations. The exercise period for MS1 has not been scheduled on RED FD2 due to Spacelab microgravity constraints. Two exercise periods for MS3 have been reduced to accommodate science constraints. These exercise periods on BLUE FD3 and FD4 have been reduced by seven and eight minutes, respectively. Also, no exercise periods have been scheduled on BLUE FDs 4, 5, and 6 for MS4, and BLUE FDs 5 and 6 for MS3 to satisfy LBNP requirements. Appendix K Exemption #41 authorizes a short entry day post sleep for the PLT in order for him to participate in DSO 603B.

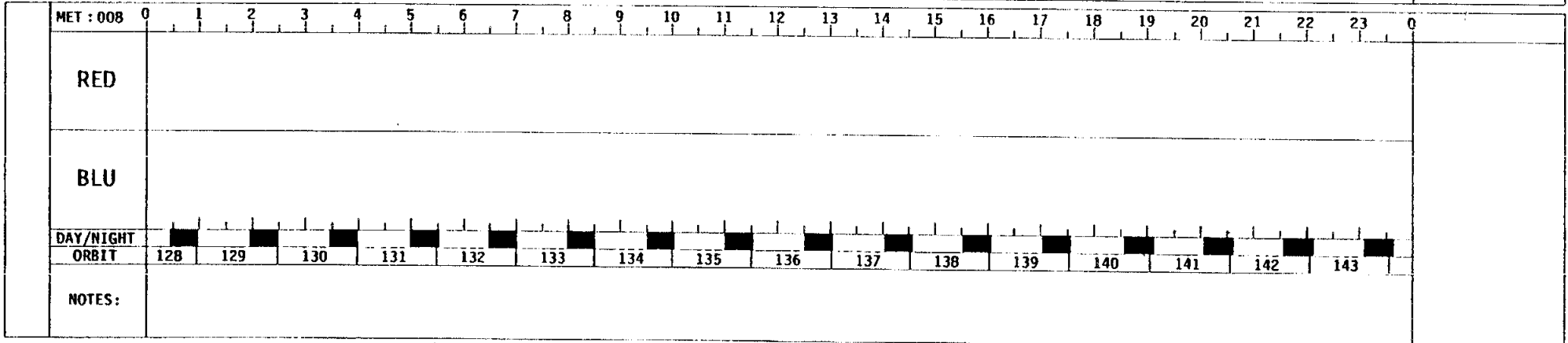
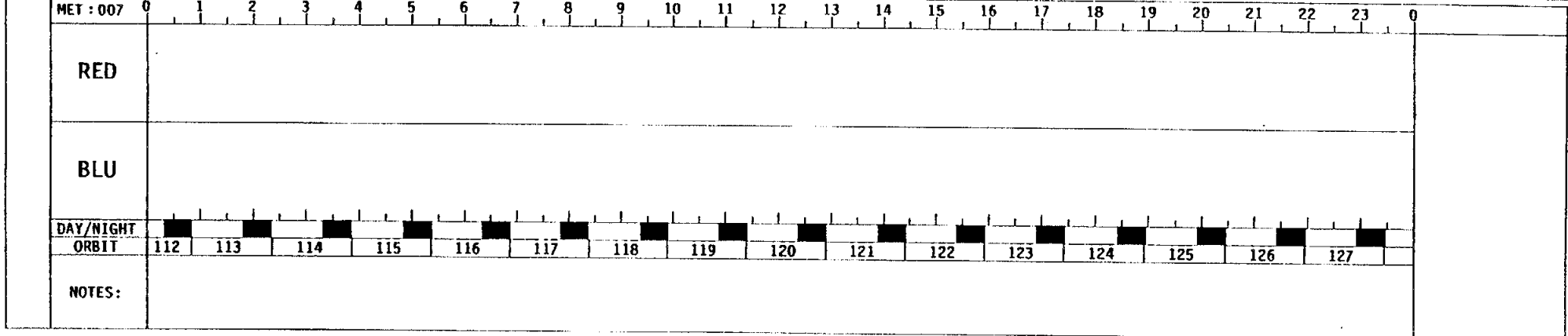
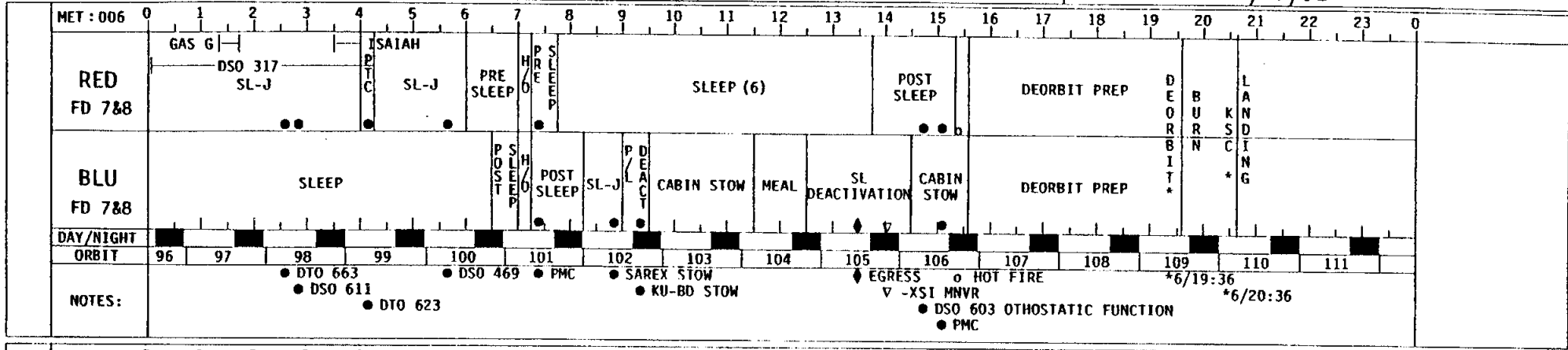
The timeline formats used in this Flight Plan are based on JSC-19933, Timeline Format Definitions and Standard Notes, Rev C, May 1990.

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STS-47 OVERVIEW









SUMMARY TIMELINE

# SUMMARY TIMELINE

GMT (D:H:M)		MET (D:H:M)		CDT (D:H:M)		FD/DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE			
245:14:18/ 246:02:18		000:00:00/ 000:12:00		245:09:18/ 245:21:18		1/245 CDT	-42.9	☉	SEPTEMBER 1, 1992	STS-47	FINAL, PCN 1	8/17/92			
CDT	:245	10	11	12	13	14	15	16	17	18	19	20	21		
FD	:001	0	1	2	3	4	5	6	7	8	9	10	11	12	
MET	:000											FD 2			
RED	CDR		PLBDD MNVDR PLBDR		PLBDD MNVDR PLBDR		PLBDD MNVDR PLBDR		PLBDD MNVDR PLBDR		PLBDD MNVDR PLBDR		PLBDD MNVDR PLBDR		
	PLT	DIRECT	POST INSERTION		P/TVO2 ACT INGRESS	SL ACTIVATION			P/TV39 SETUP PCG	PCG ACT		PRE SLEEP	H/O	SLEEP	
	MS1	LAUNCH	POST INSERTION		SL ACTIVATION	INGRESS			EFA MUC ZNT YGM E7	HZE RAD	LBNP ECHO		PRE SLEEP	H/O	SLEEP
	PS1	INSERTION	POST INSERTION		MEL ACT	TV-PARK	P/TVO4	UHS COLL	MAGGOT	M21B-10C	UHS COLL	BCR	PMS MON	PRE SLEEP	H/O
BLUE	MS2	INSERTION	POST INSERTION		PRE SLEEP								POST SLEEP		
	MS3		POST INSERTION		PRE SLEEP								POST SLEEP		
	MS4		POST INSERTION		PRE SLEEP								POST SLEEP		
DAY/NIGHT															
ORBIT		2		3		4		5		6		7		8	
TDRS															
ATTITUDE		ASCENT		-ZLV +YVV		-ZLV -YVV				BIASED -XLV +YVV					
MICRO-G															
NOTES:				*AFTE TDR/DOFF		*DSO 469 RADIATION		*M12A		*ORGANIC METAL CRYSTAL		*H/O RED TO BLUE			
		*TAPE CHANGEOUT		*APU HTR REACT		*APU HTR RECONFIG-A		*APU HTR REACT		*DSO 611 MAS		*UMS COLL		*AFTE DON	
		*AF1 STATION		*AF2 STATION		*LIQUID PHASE SINTERING									



GMT (D:H:M)		MET (D:H:M)		CDT (D:H:M)		FD/ DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE											
246:14:18/ 247:02:18		001:00:00/ 001:12:00		246:09:18/ 246:21:18		R2/246 CDT	-45.5		SEPTEMBER 2, 1992	STS-47	FINAL, PCN 1	8/17/92											
CDT :246	RED :002	MET :001	0	10	11	12	13	14	15	16	17	18	19	20	21	12							
												BLUE FD 3											
RED	CDR	EXERCISE			MEAL	SA RE X VOI RE X	MEAL		P/TV39 ACT PCG	WI AN SI TT E							PRE SLEEP	SHU DA					
	PLT	VISUAL/ MOTOR		VISUAL/ MOTOR			MEAL		PSP /EC TTG VU 3P 9		PCG SEED			EXERCISE		PRE SLEEP	H/O	PRE SLEEP	SHU DA				
	MS1	VISUAL/ MOTOR		VISUAL/ MOTOR			MEAL	FISH		FISH		M18-MCU				FEE		PRE SLEEP	H/O	PRE SLEEP	SHU DA		
	PS1	VISUAL/ MOTOR		VISUAL/ MOTOR		U MS COLL		MEAL			KIDNEY CELLS				FUNGI			PRE SLEEP	H/O	PRE SLEEP	SHU DA		
																		* UMS COLL					
BLUE	MS2	PRE SLEEP						SLEEP									POST SLEEP	H/O	EXERCISE	AS SIS T			
	MS3	PRE SLEEP						SLEEP									POST SLEEP	H/O	EXERCISE	NOI GHF M04-CHF			
	MS4	PRE SLEEP						SLEEP									POST SLEEP	H/O	FEE	AFTE SEE			
DAY/NIGHT		ORBIT																					
TDRS		E		W																			
ATTITUDE		MICRO-G																					
NOTES:		AVISUAL/ MOTOR		TAPE CHANGEOUT		SCOTT'S VALLEY, CA (N600S)		MARANGONI CONVECTION		M18-MCU		DTO 623 CAB AIR		DTO 663 ACOUSTIC DOSIMETER		DSO 612 ENERGY UTILIZATION * PMS DOFF		* AFTE DON		H/O RED TO BLUE		SUPERCONDUCTING COMPOSITES	

GMT (D:H:M)		MET (D:H:M)		CDT (D:H:M)		FD/DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE							
247:02:18 / 247:14:18		001:12:00 / 002:00:00		246:21:18 / 247:09:18		83/246 CDT	-46.7		SEPTEMBER 2, 1992	STS-47	FINAL, PCN 1	8/17/92							
CDT	:246	22	23	0	CDT:247	1	2	3	4	5	6	7	8	9	0	MET:002			
BLU	:003	12	13	14	15	16	17	18	19	20	21	22	23						
MET	:001										RED								
RED	CDR	SLEEP										POST SLEEP	H/O	POST SLEEP	SETUP	EXERCISE/ DTO 651	CONTROL 612		
	PLT	SLEEP										POST SLEEP	H/O	POST SLEEP	SETUP	EXERCISE/ DTO 651	CONTROL 612		
	MS1	SLEEP										POST SLEEP	H/O	EXERCISE	TV23-OCCF	H21A-OCCF	CONTROL 612		
	PS1	SLEEP										POST SLEEP	H/O	M02-IMF	CONTROL 612	CONTROL 612			
BLUE	MS2	KU CABLE	DSO 612	CONTROL 612	CARPETURE	P/TV43 ACT DSO 802	GG RAPS	MEAL	PS&E VTA VUC EPT	P/TV04	P/TV04	PS AEDT MUF	SAR EXE	VAR EXE	MET AB CN	PPAW ADMN	H/O	PRE SLEEP	SLEEP
	MS3	M04-CHL	MUR 120	M16-CHL	TV09	M13-CHL	M13-CHL	MEAL	M13-CHL	LBNP ECHO	IMF ACT	H/O	PRE SLEEP	SLEEP					
	MS4	FEE				MEAL	LBNP ECHO	EXERCISE	H/O	PRE SLEEP	SLEEP								
DAY/NIGHT		ORBIT		TORS		ATTITUDE		MICRO-G		NOTES:									
		25		26		27		28		29		30		31		32			
		E		W		BIASED -XLV +YV													
		SUPERCONDUCTING COMPOSITES		DSO 612 ENERGY UTILIZATION		AMORPHOUS SEMICONDUCTOR		UMS COLL		ADELAIDE, AUS (VKSAGR)		PMS DON		H/O BLUE TO RED		SINGLE CRYSTAL GROWTH		ORGANIC METAL CRYSTAL	



GMT (D:H:M)	MET (D:H:M)	CDT (D:H:M)	FD/ DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE
248:02:18/ 248:14:18	002:12:00/ 003:00:00	247:21:18/ 248:09:18	B4/247 CDT	-48.6		SEPTEMBER 3, 1992	STS-47	FINAL, PCN 1	8/17/92

CDT :247	22	23	0	CDT:248	1	2	3	4	5	6	7	8	9	0
BLU :004	12	13	14	15	16	17	18	19	20	21	22	23		
MET :002										RED	FD 4			MET:003

RED	CDR	SLEEP										DSO 612 TEST	POST SLEEP/H/O	POST SLEEP	DTO 663 OBS	EXERCISE	U M N F S I E C L A	
	PLT	SLEEP										DSO 612 TEST	POST SLEEP/H/O	POST SLEEP	EXERCISE	DE TV O A L L 6 4 L 7 0 G		
	MS1	SLEEP										POST SLEEP	H/O	EXERCISE	BCR PHOTO	BCR	U M N F S I E C L A	
	PS1	SLEEP										POST SLEEP	H/O	M17-ALF	M17'-ALF			

BLUE	MS2	CAPTURE	P/TVO4	TV40-L38	FFEU ASSIST	MEAL	PSR/E TTA VUC OPT 2	P/TV45 SETUP	P/TVO4	SAR EXE	VAR EXE	M E T A B C N	PS A E D M U R	EXERCISE/ DTO 651	PP A W D R M O N	PRE SLEEP	SLEEP
	MS3	FFEU				MEAL	LBNP ECHO			P/TVO4	VAR EXE	M E T A B C N	PS A E D M U R	EXERCISE/ DTO 651	PP A W D R M O N	PRE SLEEP	SLEEP
	MS4	M15-LDF	M15-LDF	M15-LDF	M15-LDF	M15-LDF	MEAL	LBNP ECHO			P/TVO4	VAR EXE	M E T A B C N	PS A E D M U R	EXERCISE/ DTO 651	PP A W D R M O N	PRE SLEEP

DAY/NIGHT	[Day/Night Cycle]							
ORBIT	[Orbit Cycle]							
TDRS	[TDRS Cycle]							
ATTITUDE	BIASED -XLV +YVV							
MICRO-G	M22-GHF							

NOTES: @LIQUID DROPS @GRP E GAS @LAUNCESTON AUS B/U (VK7AMC) @OPTICAL MATERIALS @DSO 612 ENERGY UTILIZATION @DTO 663 ACOUSTIC DOSIMETER @COMPOUND SEMICONDUCTORS \*AFTE TDR & AFTE DORF \*PMS DON @H/O BLUE TO RED

GMT (D:H:M)		MET (D:H:M)		CDT (D:H:M)		FD/ DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE		
248:14:18 / 249:02:18		003:00:00 / 003:12:00		248:09:18 / 248:21:18		R4 / 248 CDT	-49.3		SEPTEMBER 4, 1992	STS-47	FINAL, PCN 1	8/17/92		
CDT	:248	10	11	12	13	14	15	16	17	18	19	20	21	
RED	:004	0	1	2	3	4	5	6	7	8	9	10	11	12
MET	:003									BLUE 18 FD 5				
RED	CDR	P/TV44 ACT ISAIAH		MEAL						PRE SLEEP		PRE SLEEP		SLEEP
	PLT	P/TV44 SETUP	ISAIAH OBS	DSO 611	MEAL	VISUAL/ MOTOR				PRE SLEEP		PRE SLEEP		SLEEP
	MS1	FISH	FISH	FISH	MEAL	VISUAL/ MOTOR	VISUAL/ MOTOR	ENZYME PHOTO	FISH	PRE SLEEP		PRE SLEEP		SLEEP
	PS1	M17- ALF	M12B- LIF	PMS MON	MEAL	VISUAL/ MOTOR	VISUAL/ MOTOR	KIDNEY CELLS		PRE SLEEP		PRE SLEEP		SLEEP
BLUE	MS2									POST SLEEP		POST SLEEP		SLEEP
	MS3									POST SLEEP				LBNP RAMP
	MS4									POST SLEEP				LBNP RAMP
DAY/NIGHT		[Day/Night Cycle Diagram]												
ORBIT		[Orbit Cycle Diagram]												
TDRS		[TDRS Cycle Diagram]												
ATTITUDE		BIASED -XLV +YVV												
MICRO-G		[Micro-G Cycle Diagram]												
NOTES:	@LIQUID PHASE SINTERING @TAPE CHANGEOUT ΔVISUAL/ MOTOR @DTO 623 CAB AIR @H/O RED TO BLUE @DSO 611 MAS @DTO 663 ACOUSTIC DOSIMETER @DSO 612 ENERGY UTILIZATION @DTO 665 SLM *PMS DOFF LOCATIONS E,F,C,D,G,H @IRON DEOXIDATION BCR PHOTO													



GMT (D:H:M)	MET (D:H:M)	CDT (D:H:M)	FD/ DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE							
249:02:18/ 249:14:18	003:12:00/ 004:00:00	248:21:18/ 249:09:18	85/248 CDT	-49.9		SEPTEMBER 4, 1992	STS-47	FINAL, PCN 1	8/17/92							
CDT :246 BLU :005 MET :003	12	13	14	15	16	17	18	19	20	21	22	23	0			
									RED	FD 5			MET:004			
RED	CDR	SLEEP							DSO 612 TEST	POST SLEEP/H/O	POST SLEEP	EXERCISE	DTO 665	RU CABLE		
	PLT	SLEEP							DSO 612 TEST	POST SLEEP/H/O	POST SLEEP	P/TV27 ACT	EXERCISE	SAIRREX DETV 0A L 64L 70 G		
	MS1	SLEEP							POST SLEEP	H/O	EXERCISE	TV 27 - YTH	FISH	FISH		
	PS1	SLEEP							POST SLEEP	H/O/D/P	MOON CBT	TV 27 - YTH	TV 22 - IMF	M20-IMF		
BLUE	MS2	DTO 665	SAIRREX	DTO 665	MEAL	PS&E/TA VUC BPT 2	P/TV27 SETUP	PS&E/TA VUC BPT 2	SAIRREX	PS&E/TA VUC BPT 2	EXERCISE	PT AN DR MN	YAC TUK HD / CT OV NF	H/O	PRE SLEEP	SLEEP
	MS3	LBNAK	MEAL	LBNP SOAK							H/O	PRE SLEEP	PRE SLEEP	SLEEP		
	MS4	BCR PHOTO	BCR	MEAL	LBNP SOAK	LBNP MON	LBNP MON	LBNP MON	LBNP MON	LBNP SOAK	TV 27 - YTH	H/O	PRE SLEEP	PRE SLEEP	SLEEP	
DAY/NIGHT	ORBIT															
TORS	E W															
ATTITUDE	BIASED -XLV +YVV															
MICRO-G																
NOTES:	@DTO 665 SLM LOCATIONS N,O      @IRON DEOXIDATION      @DSO 612 ENERGY UTILIZATION      @DTO 663 ACOUSTIC DOSIMETER @HONOLULU, HA (MH6CJU)      @NI-BASE ALLOYS      @H/O BLUE TO RED      @DTO 665 SLM LOCATIONS I,J,K @DTO 665 SLM LOCATIONS L,M      @S1 SPHERE CRYSTAL      @SAMARSKITE SYSTEMS @CARY, NC (KD4ISB)															



GMT (D:H:M)		MET (D:H:M)		CDT (D:H:M)		FD/DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE				
250:02:18/ 250:14:18		004:12:00/ 005:00:00		249:21:18/ 250:09:18		B6/249 CDT	-50.6		SEPTEMBER 5, 1992	STS-47	FINAL, PCN 1	8/17/92				
CDT :249	BLU :006	12	22	23	0	1	2	3	4	5	6	7	8	9	MET:005	
MET :004																
RED	CDR	SLEEP				DSO 612 TEST	POST SLEEP		H/O	CREW CONF	EXERCISE	DC TR OS	KU CABLE	MM A L G N	DSO 317	
	PLT	SLEEP				DSO 612 TEST	POST SLEEP		H/O	CREW CONF	EXERCISE	FILTER CLEANING	TV 19 - BBU	TV 5 - IMF	VOIC EX	DE TV 0 A L 6 4 L 7 0 G
	MS1	SLEEP				POST SLEEP	EXERCISE		H/O	CREW CONF	FISH	FISH	FISH	MOB-IMF	MOB-IMF	MO3-IMF
	PS1	SLEEP				POST SLEEP	EXERCISE		H/O	CREW CONF	M16-BBU	M16-BBU	M16-BBU	M16-BBU	MEAL	
BLUE	MS2	MEAL	VOIC EX	MEAL	P/TV32 EDIT	PS&E TTA VUC 3PT	P/TV37 SETUP	GGPS RAAE SDT MUP	EXERCISE	PPAK DRND / TV	CAC OUR	VOIC EX	PRE SLEEP	SLEEP		
	MS3	LR BAN PP	MEAL	LBNP SOAK	VOIC EX	LBNP MON	LBNP MON	MOB-IMF	LBNP MON	TV 37 - COP	LBNP SOAK	MOB-IMF	PRE SLEEP	SLEEP		
	MS4	LR BAN PP	MEAL	LBNP SOAK	VOIC EX	LBNP MON	LBNP MON	MOB-IMF	LBNP MON	TV 37 - COP	LBNP SOAK	MOB-IMF	PRE SLEEP	SLEEP		
DAY/NIGHT ORBIT		72	73	74	75	76	77	78	79	80						
TDRS E W		[Timeline diagram showing TDRS events]														
ATTITUDE MICRO-G		BIASED -XLV +YVV														
NOTES:	@HONOLULU, HA B/U (WH6CJU) ♦ GHF DEACT				@DSO 612 ENERGY UTIL * PMS DON				@GLASS MELTING @ADELAIDE, AUS B/U (VK5AGR) @H/O BLUE TO RED @BUBBLE MOTION				@DTO 663 ACOUSTIC DOSIMETER @SEMICONDUCTOR SINGLE CRYSTAL FLOATING ZONE METHOD @CARY, NC B/U (KD4ISB)			

GMT (D:H:M)		MET (D:H:M)		CDT (D:H:M)		FD/DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE													
250:14:18/ 251:02:18		005:00:00/ 005:12:00		250:09:18/ 250:21:18		R6/250 CDT	-50.7		SEPTEMBER 6, 1992	STS-47	FINAL, PCN 1	8/17/92													
CDT	:250	0	10	11	12	13	14	15	16	17	18	19	20	21	12										
RED	:006									BLUE															
MET	:005									FD 7															
RED	CDR	MEAL	P/TV44 ACT ISAAH			DSO 617	P/TV38 ACT MIDDECK	PRE SLEEP	PSAE DT MUSLEEP	PPAW DR MDH/O	PRIV MED	CONF	SLEEP												
	PLT	MEAL	P/TV44 SETUP	ISAAH OBS		DOB TBA OST 6&63	P/TV38 SETUP	PRE SLEEP		DTO 647 FLTR RMVL	H/O	PRIV MED	CONF	SLEEP											
	MS1	M03-IMF	MEAL		ENZYME PHOTO		FISH	PRE SLEEP				H/O	PRIV MED	CONF	SLEEP										
	PS1	MEAL	M03-IMF					KIDNEY CELLS	PRE SLEEP			H/O	PRIV MED	CONF	SLEEP										
BLUE	MS2				SLEEP				DSO 6128	TEST SLEEP	H/O	PRIV MED	CONF	POST SLEEP	PS&ETA VUC 3PT 2	PSOL SET P	TV34 LBNP	IMU ALGN	KU CABLE	P/TV32 EDIT					
	MS3				SLEEP						H/O	PRIV MED	CONF	POST SLEEP	IMEAL CT	VCR C/O				LBNP RAMP					
	MS4				SLEEP						H/O	PRIV MED	CONF	POST SLEEP	M07-CHF						LBNP RAMP				
DAY/NIGHT		ORBIT		80		81		82		83		84		85		86		87		88					
TDRS		E		W																					
ATTITUDE		BIASED -XLV +YVV																							
MICRO-G																									
NOTES:		SEMICONDUCTOR SINGLE CRYSTAL FLOATING ZONE METHOD TAPES CHANGOUT										DTO 623 CAB AIR PMS DOFF DSO 612 ENERGY UTILIZATION										H/O RED TO BLUE UMS COLL		M07-CHF	

GMT (D:H:M)		MET (D:H:M)		CDT (D:H:M)		FD/DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE					
251:02:18/ 251:14:18		005:12:00/ 006:00:00		250:21:18/ 251:09:18		B7/250 CDT	-50.6		SEPTEMBER 6, 1992	STS-47	FINAL, PCN 1	8/17/92					
CDT	:250	22	23	0	CDT:251	1	2	3	4	5	6	7	8	9	0	MET:006	
BLU	:007	12	13	14	15	16	17	18	19	20	21	22	23				
MET	:005																
RED	CDR	SLEEP			DSO 612 TEST	POST SLEEP		DO TBS AC FT LR H/O	FCS C/O	VAC LUK PD / TV	EXERCISE		STRTGOM	MEAL			
	PLT	SLEEP			DSO 612 TEST	POST SLEEP		P/TV25 SETUP H/O	FCS C/O	PVS TRT V B 2	EXERCISE		KU CABLE STRTGOM	MEAL			
	MS1	SLEEP			POST SLEEP	BCR	POST SLEEP	EXERCISE H/O		M17-ALF				M17-ALF LHOMLOS	MEAL		
	PS1	SLEEP			POST SLEEP			M17-ALF H/O	FISH	UMS COLL	TV20-ALF	VCRIC/O	TV25-VIP	TV32-JPN	UMS COLL PMS MON	MEAL	
BLUE	MS2	CAPIGUR XFER	VCRIC/O	MEAL	TV35-FIS	PS&E /TA VUC3PT2	P/TV35	PSAE DTM P	P/TV32 EDIT	PPAW DRM N	EXERCISE	SV ARCE EXE	H/O	FCS C/O	SPAR REKET	PRE SLEEP	SLEEP
	MS3	LBNP RAMP	MEAL	FTS IV				FTS DEMO	FTS DEMO	H/O	EXERCISE	PRE SLEEP		SLEEP			
	MS4	LBNP RAMP	MEAL	M07-CHF	M07-CHF	P/TV35	FTS IV	P/TV35	FTS DEMO	M07-CHF	FTS DEMO	BCR	PHOTO	FTS DEMO H/O	EXERCISE	PRE SLEEP	
DAY/NIGHT	ORBIT																
TDRS	E W																
ATTITUDE	BIASED -XLV +YVV																
MICRO-G	M07-CHF M07-CHF																
NOTES:	@BINARY SYSTEM      @DSO 612 ENERGY UTIL      @OPTICAL MATERIALS      @APU HTR RECONFIG v APU HTR ACT      @SYDNEY, AUS B/U (VKZAS)      v PGSC XFER *PMS DON      @DTO 663 ACOUSTIC DOSIMETER *UMS COLL      @H/O BLUE TO RED																

GMT (D:H:M)	MET (D:H:M)	CDT (D:H:M)	FD/DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE				
251:14:18 / 252:02:18	006:00:00 / 006:12:00	251:09:18 / 251:21:18	R7/251 CDT	-50.3		SEPTEMBER 7, 1992	STS-47	FINAL, PCN 1	8/17/92				
CDT :251 RED :007 MET :006	0	1	2	3	4	5	6	7	8	9	10	11	12
	10	11	12	13	14	15	16	17	18	19	20	21	22
	0	1	2	3	4	5	6	7	8	9	10	11	12
<b>RED</b>	CDR	PLT	MS1	PS1	MS2	MS3	MS4						
	SETUP 3178 GRPGAS APC STOW STOW DO DS P/T V44 ACT ISAI AH3 P/T V39 P ACT T V39 T ST P C W PRE SLEEP H/O	VISUAL/MOTOR BCR DSO 611 P/T V44 SETUP ISAI AH OBS PSP /EC TTG VU 3P 9 PCG DEACT PRE SLEEP H/O	VISUAL/MOTOR VISUAL/MOTOR FISH FISH FISH FUNGI HZE RAD PRE SLEEP H/O	VISUAL/MOTOR MEL DEACT ENZYME PHOTO ED NE ZAR Y C M E KIDNEY CELLS UMS COLL PRE SLEEP H/O	SLEEP POST SLEEP H/O	SLEEP POST SLEEP H/O	SLEEP POST SLEEP H/O	EGG INCU SAREX STOW KS UTL O BMA D PAY LOAD POST SLEEP H/O	CABIN STOW CABIN STOW CABIN STOW MEAL MEAL MEAL	PG WR RP UB P			
DAY/NIGHT													
ORBIT	96	97	98	99	100	101	102	103	104				
TORS													
ATTITUDE													
MICRO-G													
NOTES:	@DSO 317 HUMSEP COLLECTION    @DT0 663 ACOUSTIC DOSIMETER    @DSO 469 RADIATION    *UMS COLL    @PREPARE FOR ENTRY @TAPE CHANGEOUT    @DSO 611 MAS    @DT0 623 CAB AIR    *PMS DOFF    VSAREX PWRDN @H/O RED TO BLUE												

GMT (D:H:M)	MET (D:H:M)	CDT (D:H:M)	FD/ DOY	BETA	MOON	HOUSTON DATE	FLIGHT	EDITION	PUB. DATE
252:02:18/ 252:14:18	006:12:00/ 007:00:00	251:21:18/ 252:09:18	8/251 CDT	-49.9		SEPTEMBER 7, 1992	STS-47	FINAL, PCN 1	8/17/92

CDT :251	22	23	0	CDT:252	1	2	3	4	5	6	7	8	9	0	MET:007
FD :008	12	13	14	15	16	17	18	19	20	21	22	23			
MET :006															

RED	CDR	SLEEP (6.0)	POST SLEEP	PROV MED	CRS HOT	FIRE	IMU MNR	IAP MLL UIB GDN OPS	BURN MVR				
	PLT	SLEEP (6.0)	POST SLEEP	DSO 603B ENT PREP	CRS HOT	FIRE		DEORBIT PREP	DEORBIT	KSC			
	MS1	SLEEP (6.0)	POST SLEEP	*			UMS COLL	DEORBIT PREP	DEORBIT PREP	DEORBIT	LANDING		
	PS1	SLEEP (6.0)	POST SLEEP	*			UMS COLL	DEORBIT PREP	DEORBIT PREP	BURN *			
BLUE	MS2	MEAL	CABIN STOW	DSO 603B ENT PREP	CRS HOT	FIRE		DEORBIT PREP					
	MS3	MEAL	SL DEACTIVATION	CABIN STOW				DEORBIT PREP					
	MS4	MEAL	SL DEACT	CABIN STOW				DEORBIT PREP					

DAY/NIGHT	[Day/Night Cycle]											
ORBIT	104	105	106	107	108	109	110	111	112			
TDRS E/W	[TDRS E/W]											
ATTITUDE MICRO-G	BIASED -XLV +YVV -XSI IMU/VERIF ENTRY											

NOTES:	◆ EGRESS * UMS COLL ○ CABIN TEMP CNTLR OFF * PMS DON	○ DSO 603 ORTHOSTATIC FUNCTION ○ ATTACH BACKPACK TO ORBITER SEAT	* DEORBIT BURN 6/19:36 * KSC LANDING 6/20:36
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DETAILED TIMELINE

DETAILED  
TIMELINE



TDR FW CONTINGENCY SITES MET DAY 000

# STS-47 (BLUE FD 01)

MS2

MS3

MS4

MCC

00:00  
A1(B1)  
AUTO/PRI

01:00

ORB 2

A1(B1)  
AUTO/VERN

02:00

ORB 3

03:00

(A1)B5  
INTRL/VERN

A1(B5)  
AUTO/VERN  
04:00

ASCENDING

ZLV

+YVV

CVTTSS  
VADSS  
GADSS  
GNHLS  
INHLS

I O S

VVTTSS  
VADSS  
GADSS  
GNHLS  
INHLS

DUAL SHIFT PRESLEEP ACTIVITY

DUAL SHIFT PRESLEEP ACTIVITY  
Perform AFTE TOR and AFTE DOFF

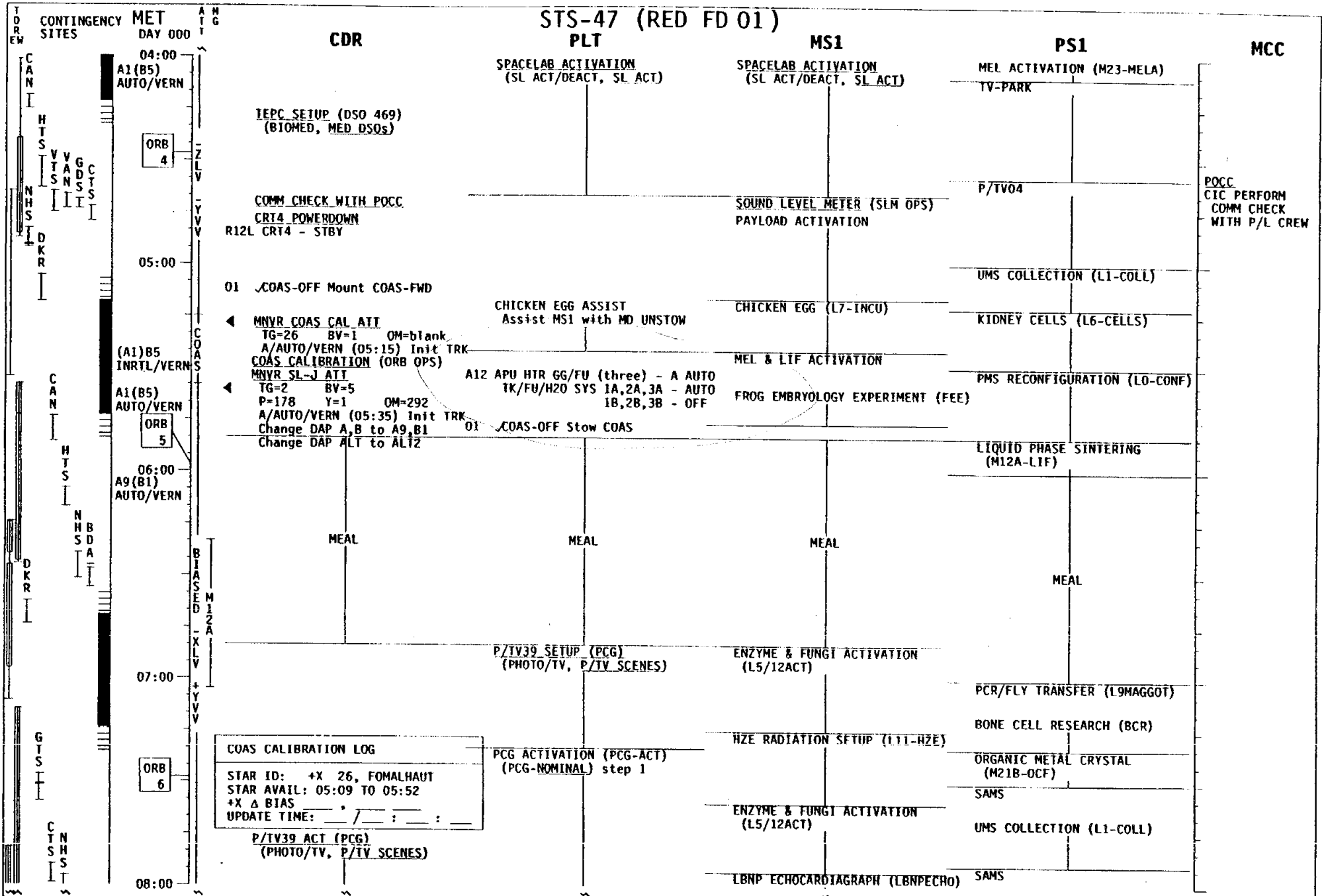
DUAL SHIFT PRESLEEP ACTIVITY  
Perform AFTE TOR and AFTE DOFF

SLEEP

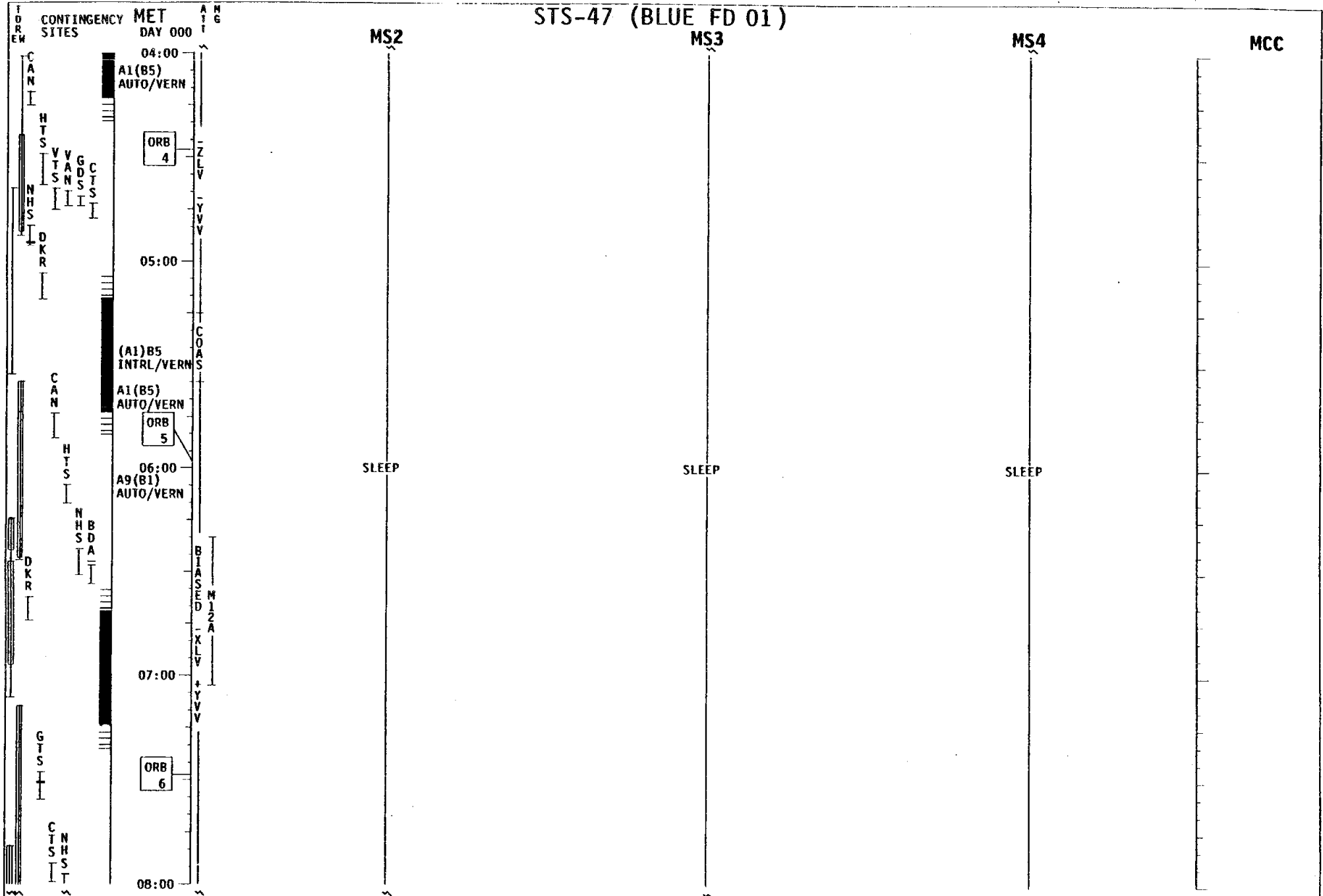
SLEEP

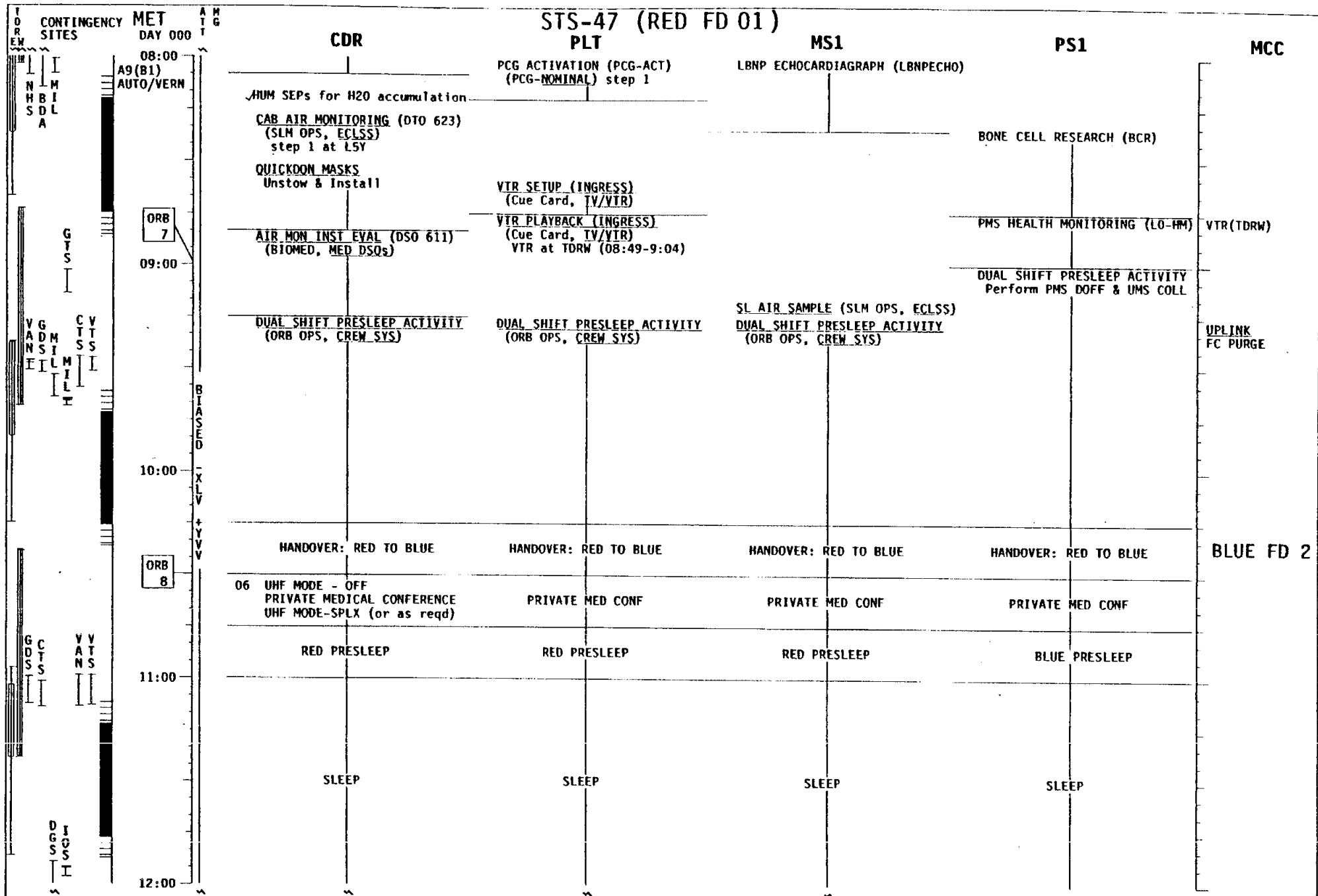
SLEEP

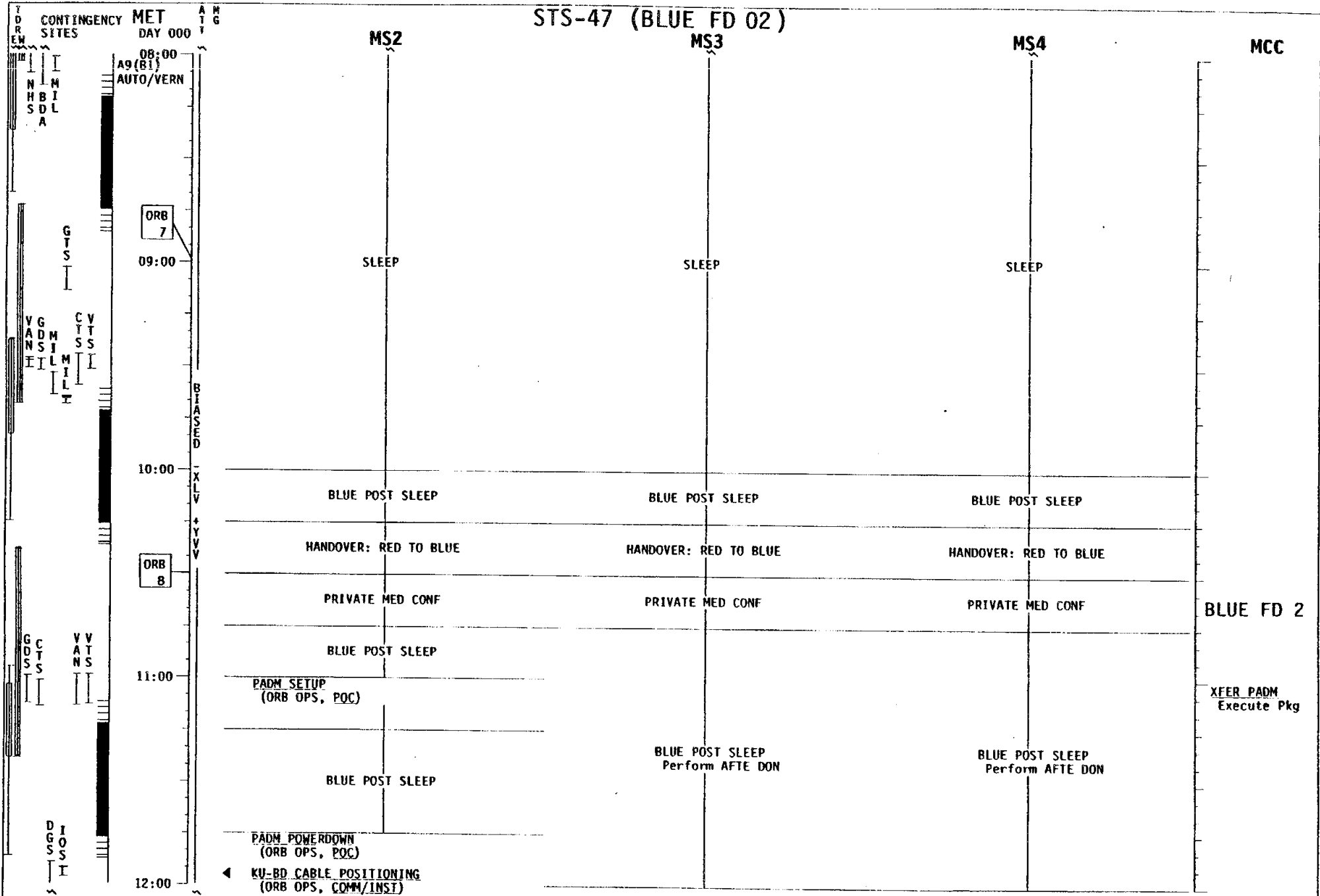
UPLINK  
EARLY TDRS H/O  
TV(TDRE)  
(GND CNTL-MOD  
-CAB)

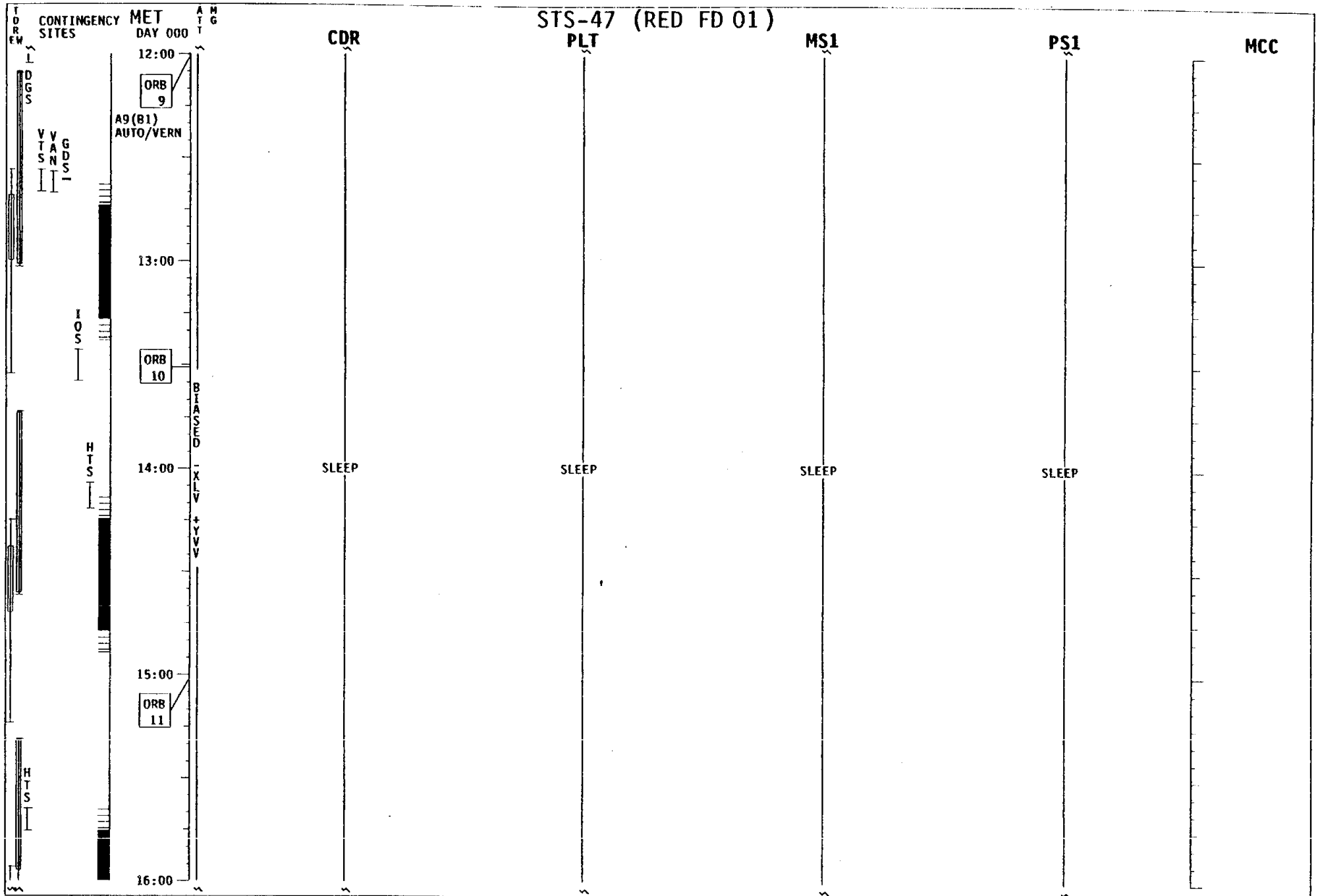


# STS-47 (BLUE FD 01)

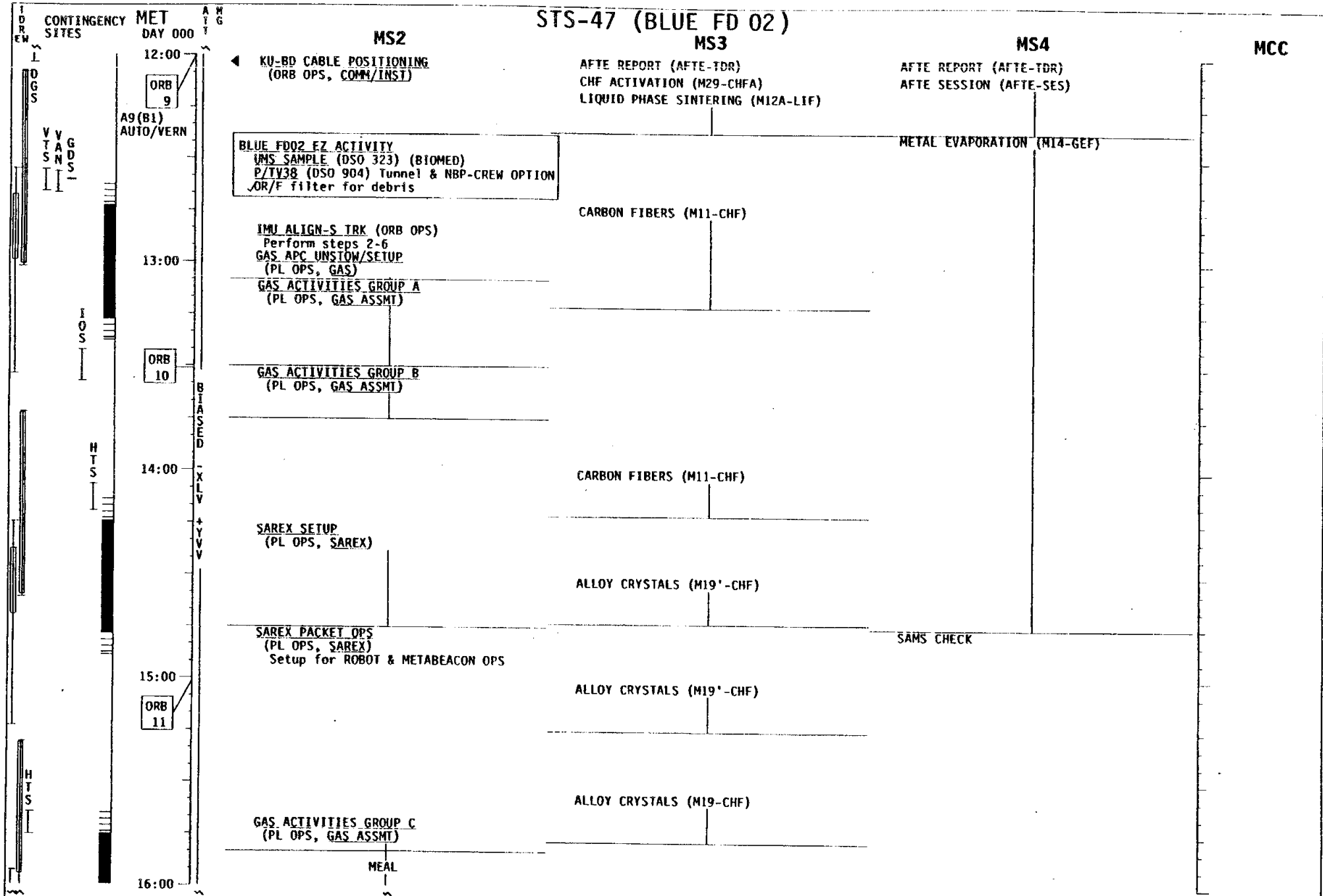


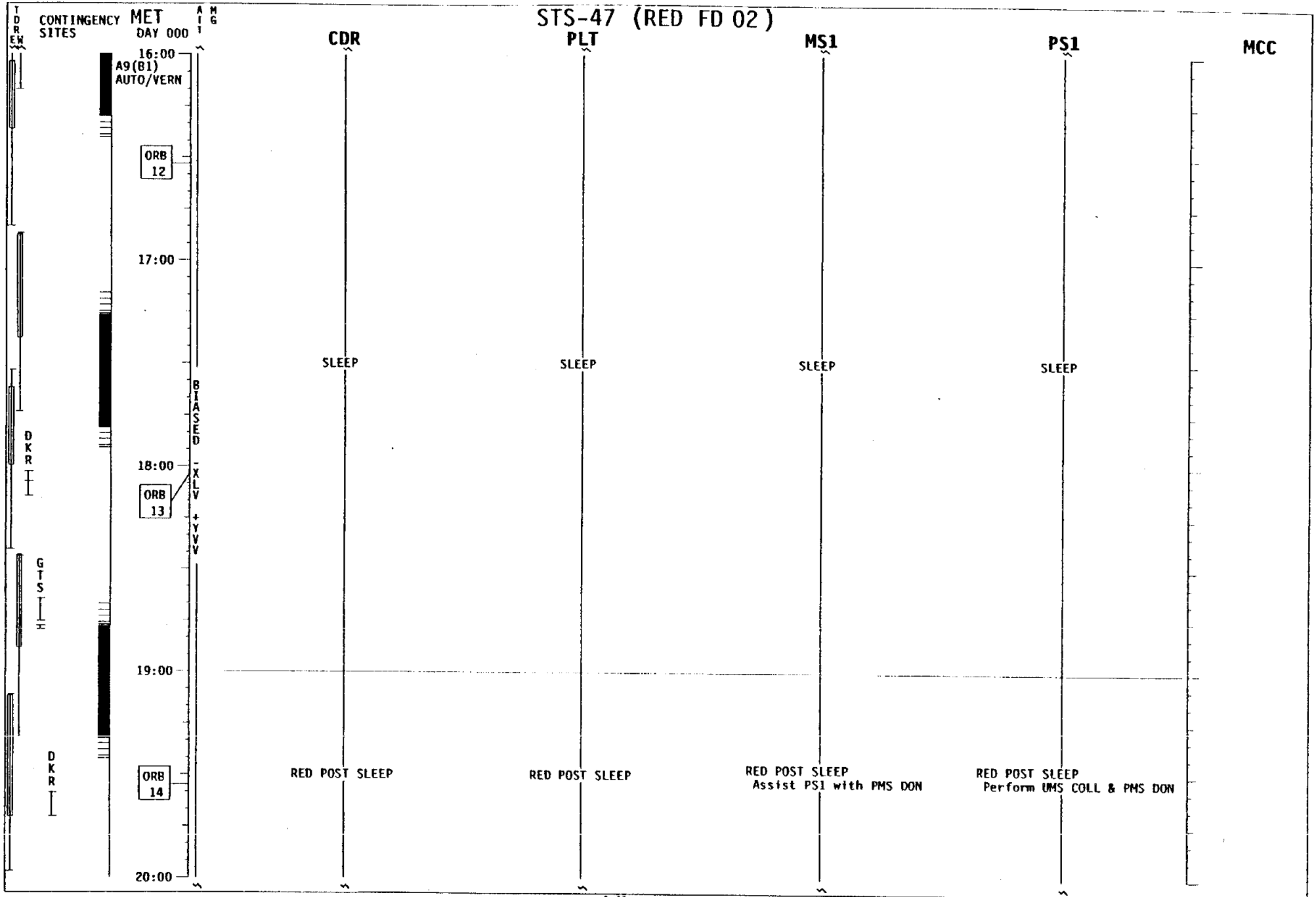


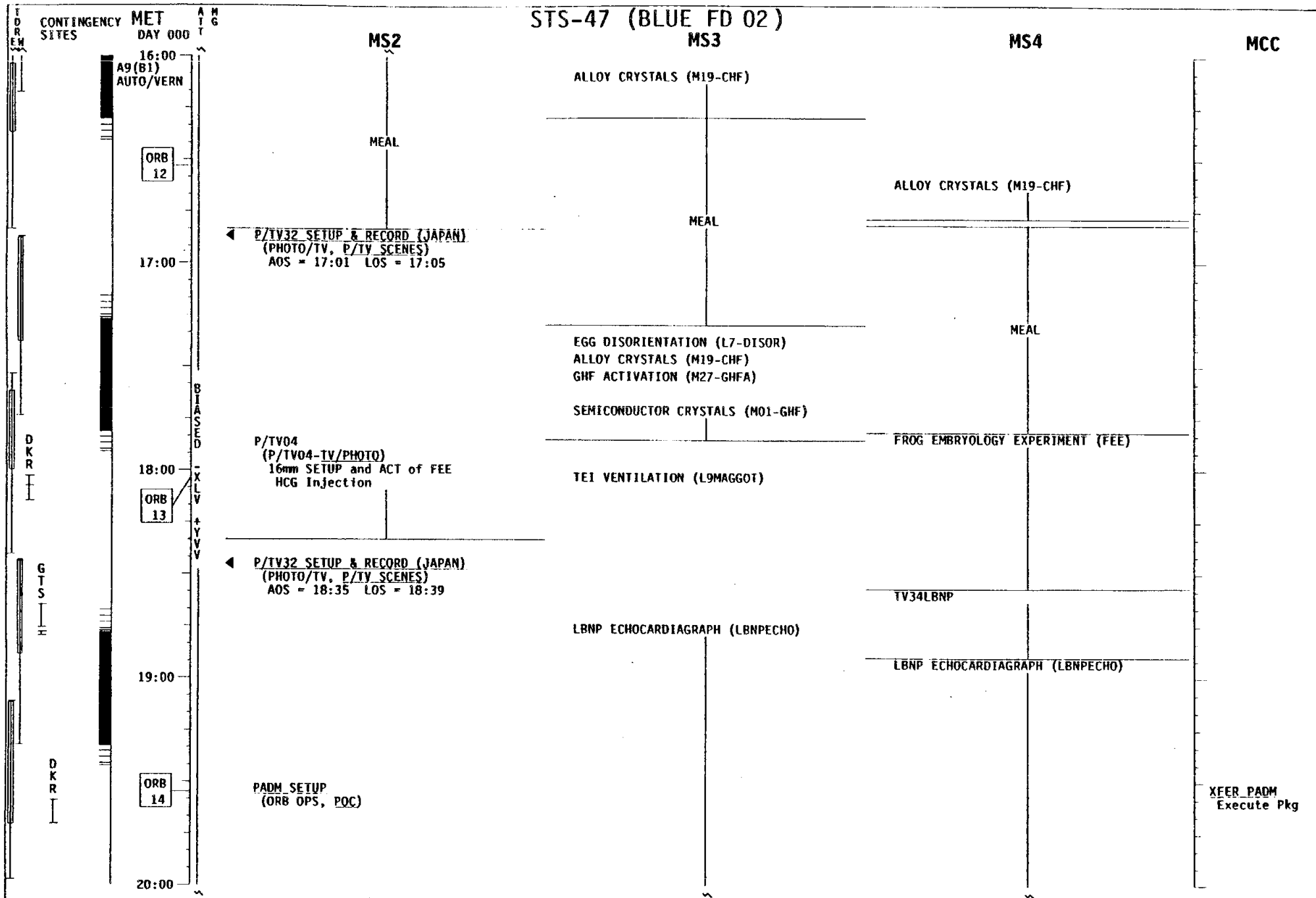


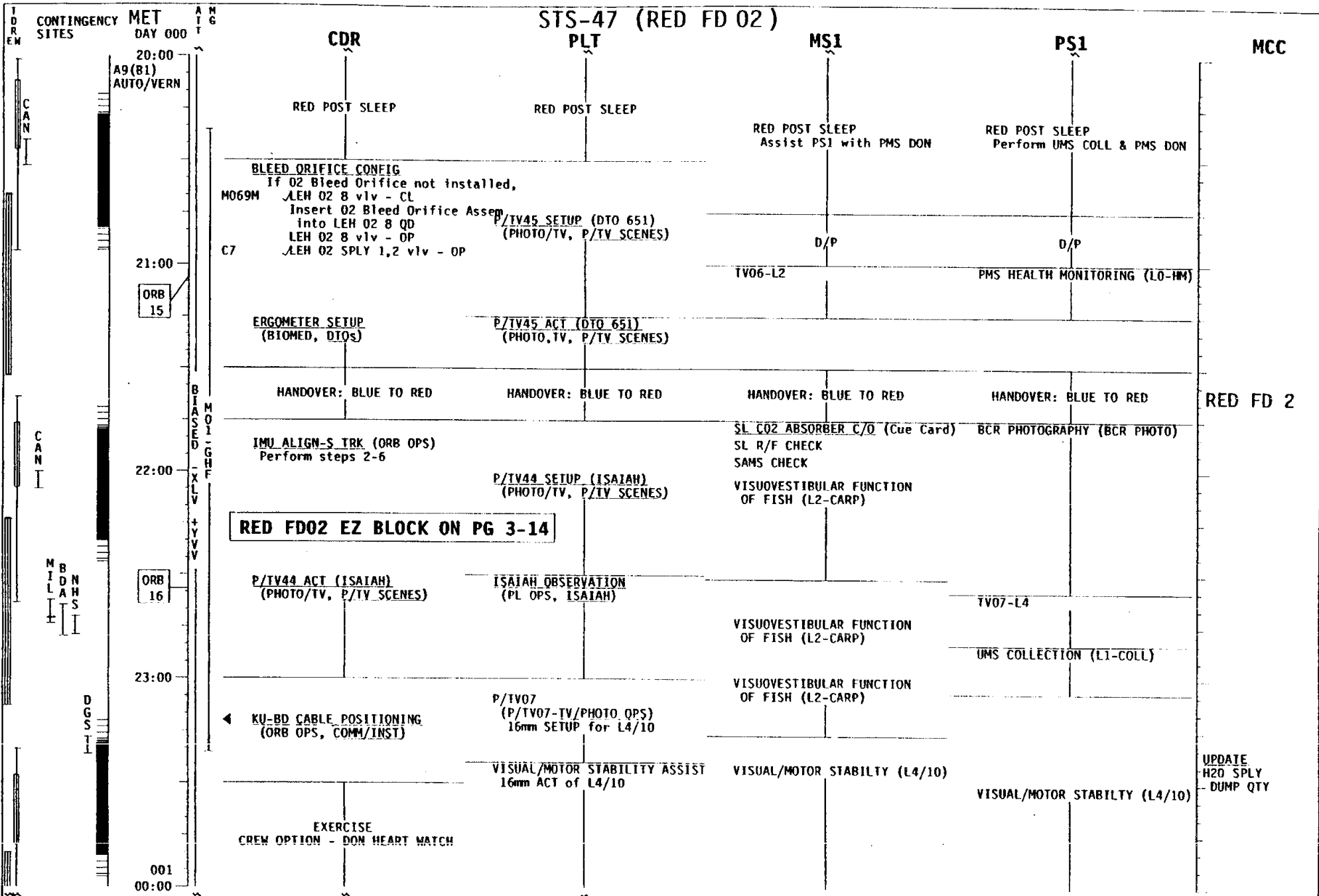


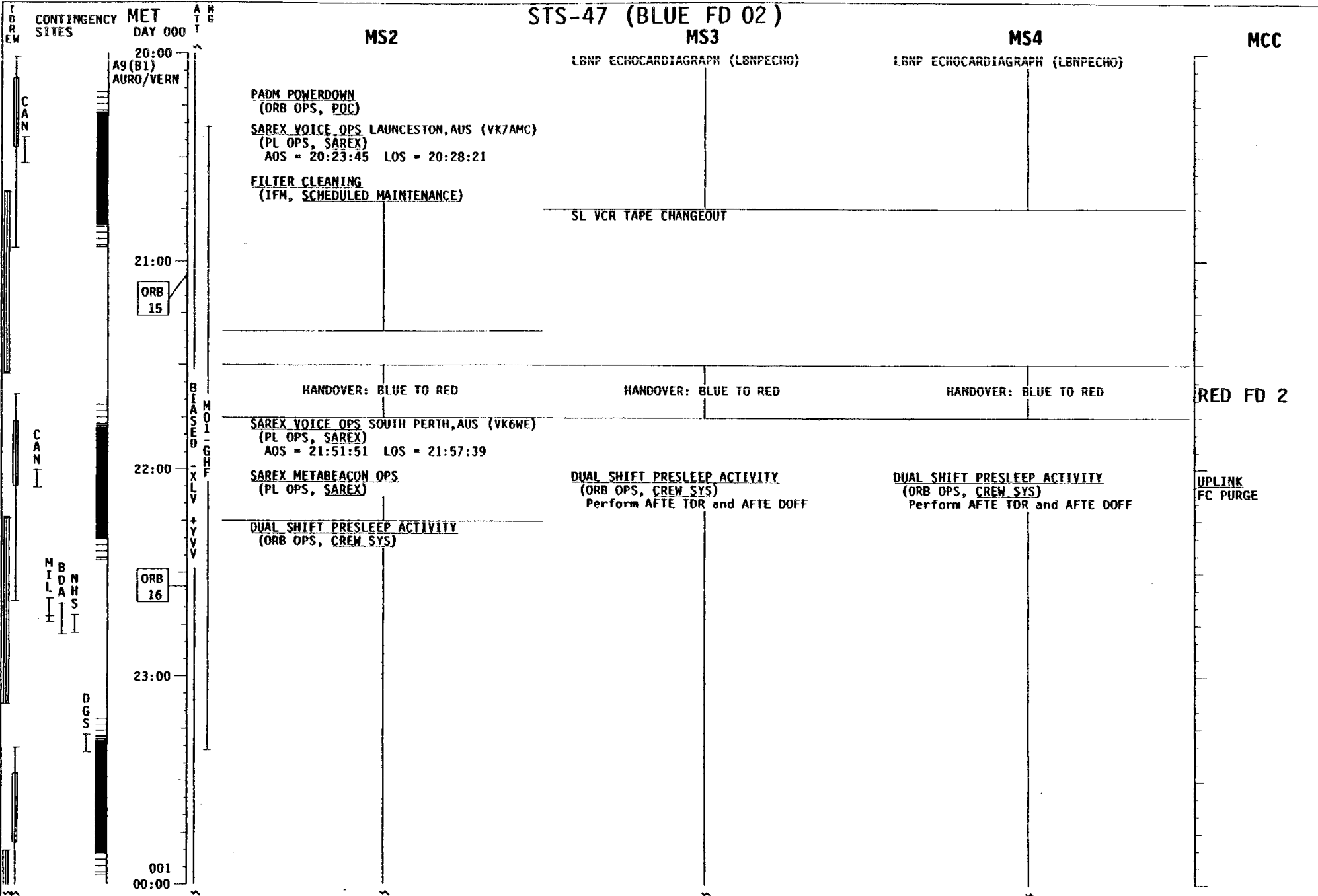


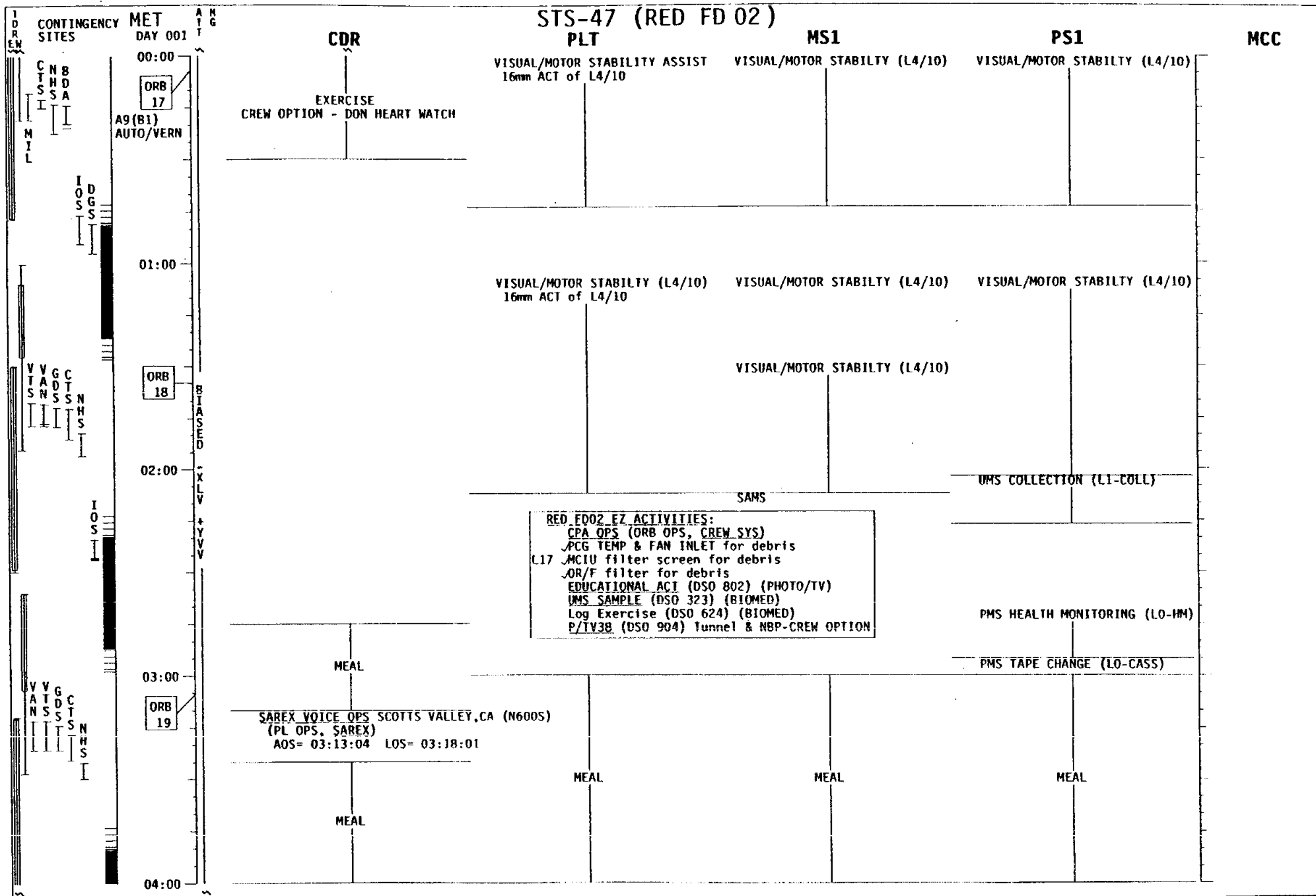


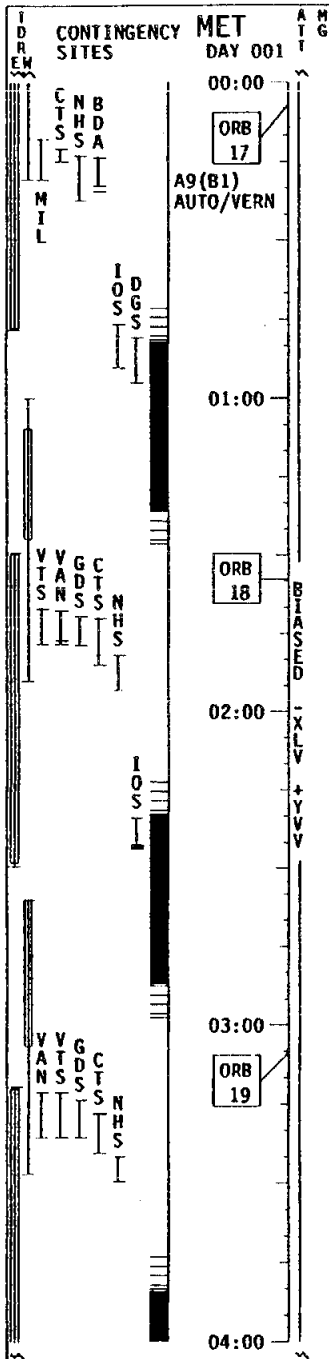












# STS-47 (BLUE FD 02)

**MS2**

DUAL SHIFT PRESLEEP ACTIVITY  
(ORB OPS, CREW SYS)

**MS3**

DUAL SHIFT PRESLEEP ACTIVITY  
(ORB OPS, CREW SYS)  
Perform AFTE TDR and AFTE DOFF

**MS4**

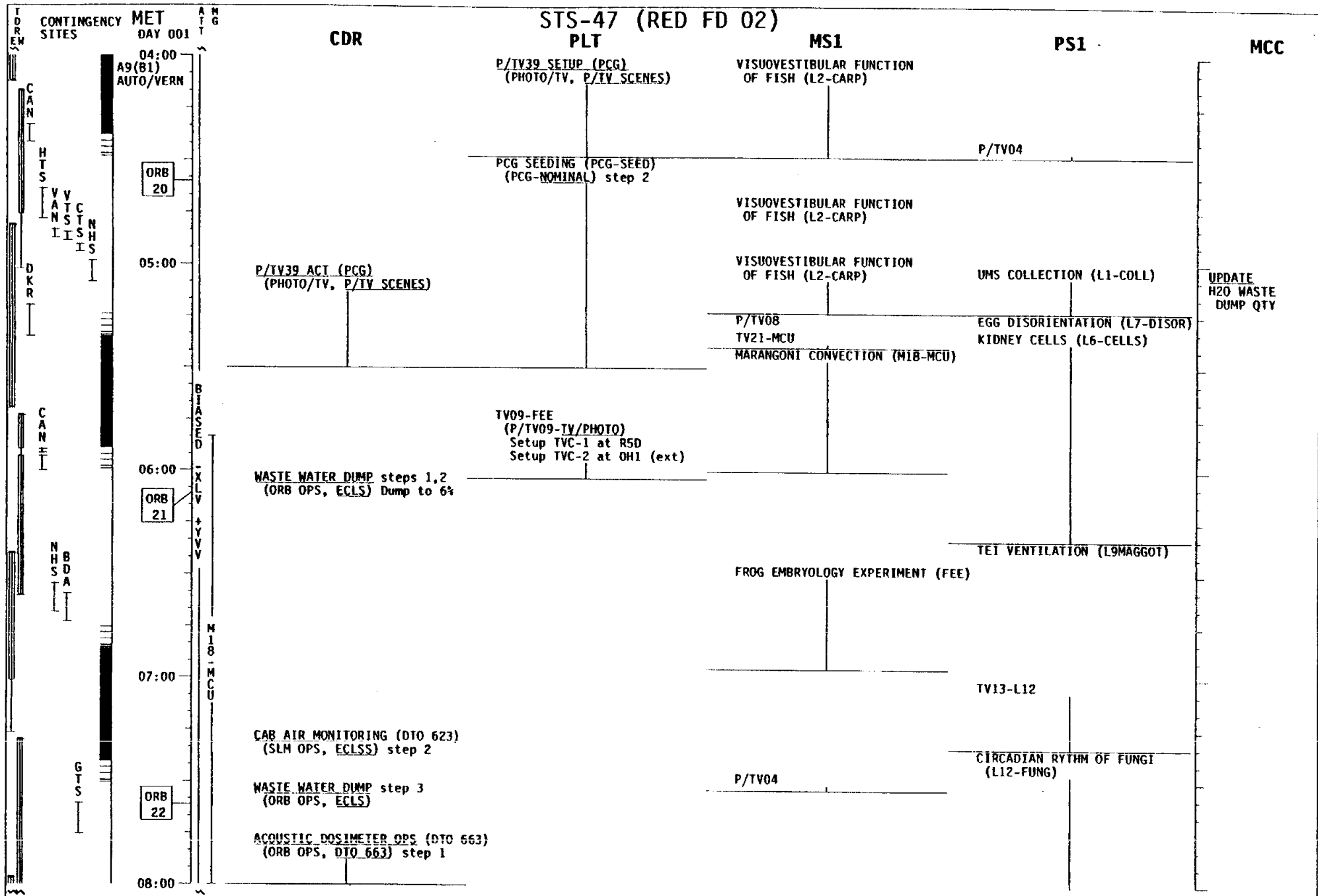
DUAL SHIFT PRESLEEP ACTIVITY  
(ORB OPS, CREW SYS)  
Perform AFTE TDR and AFTE DOFF

**MCC**

SLEEP

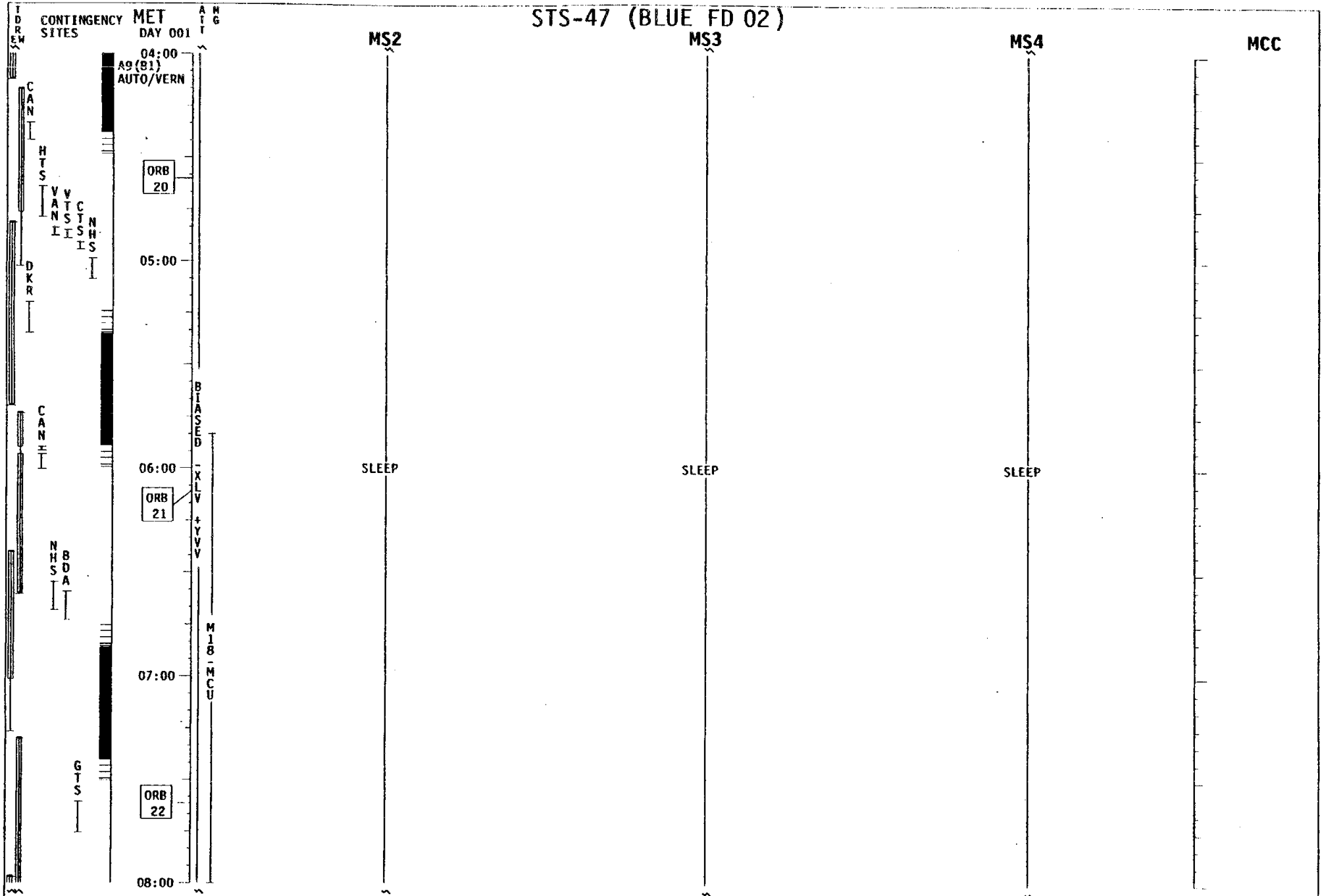
SLEEP

SLEEP

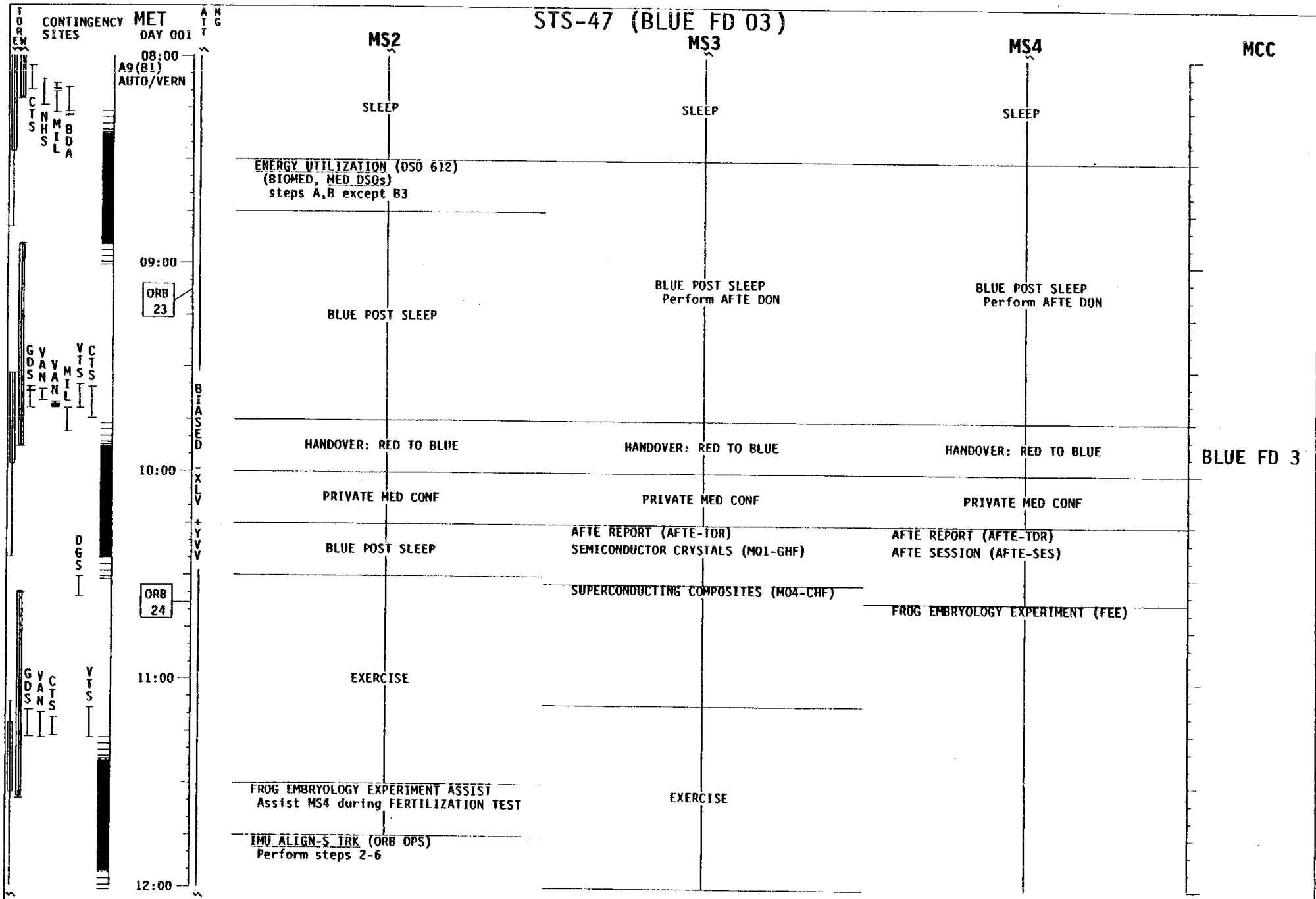


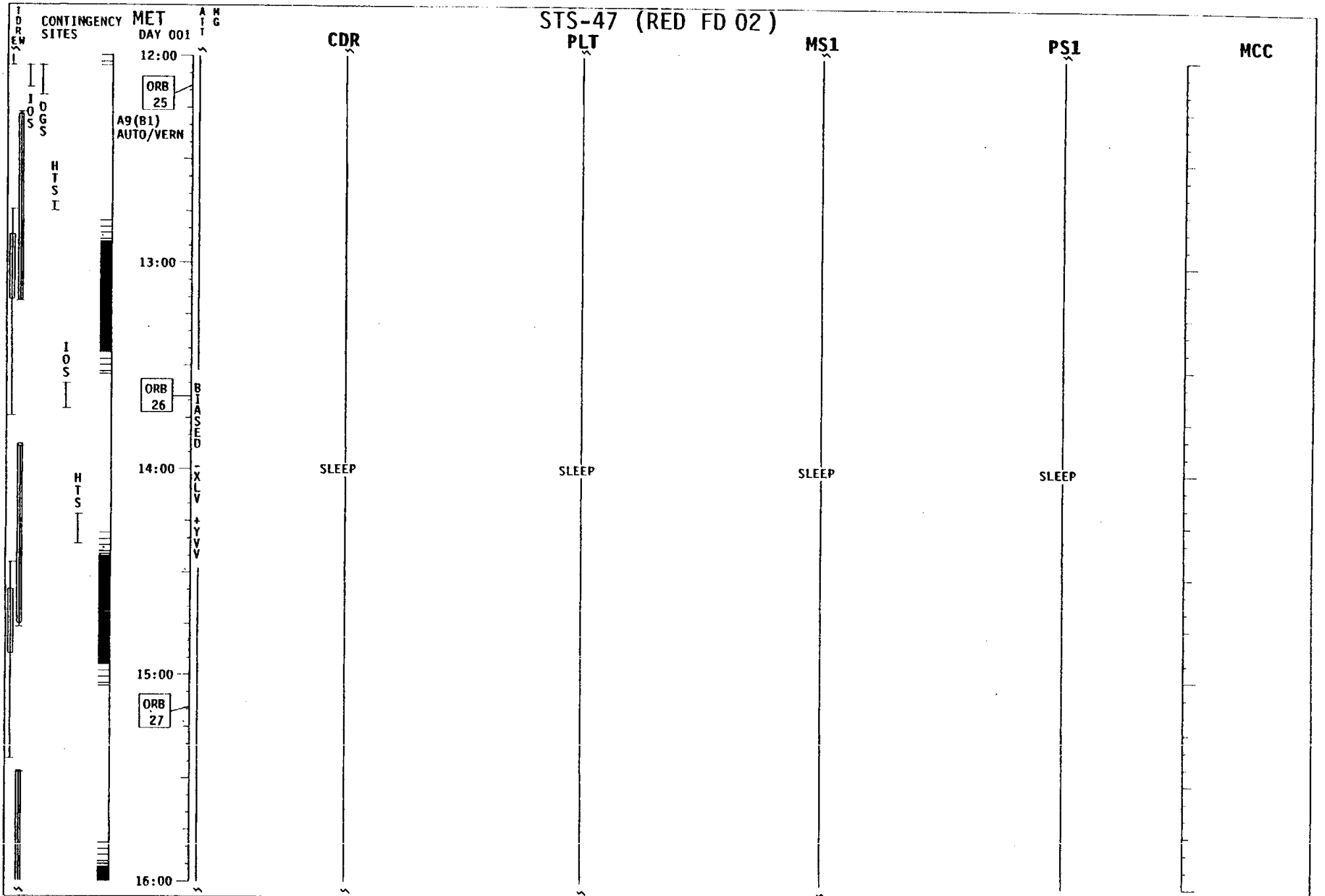


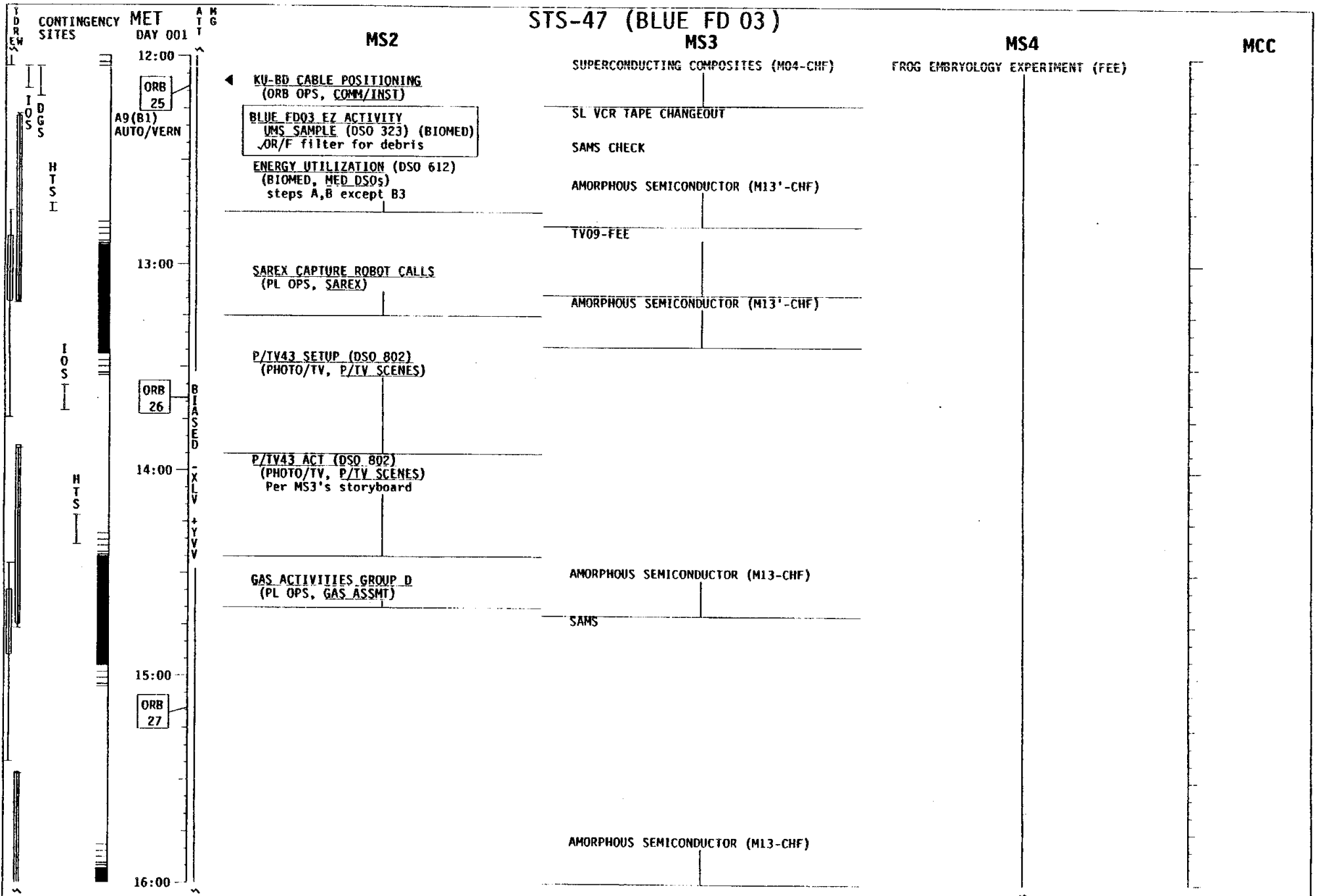
# STS-47 (BLUE FD 02)

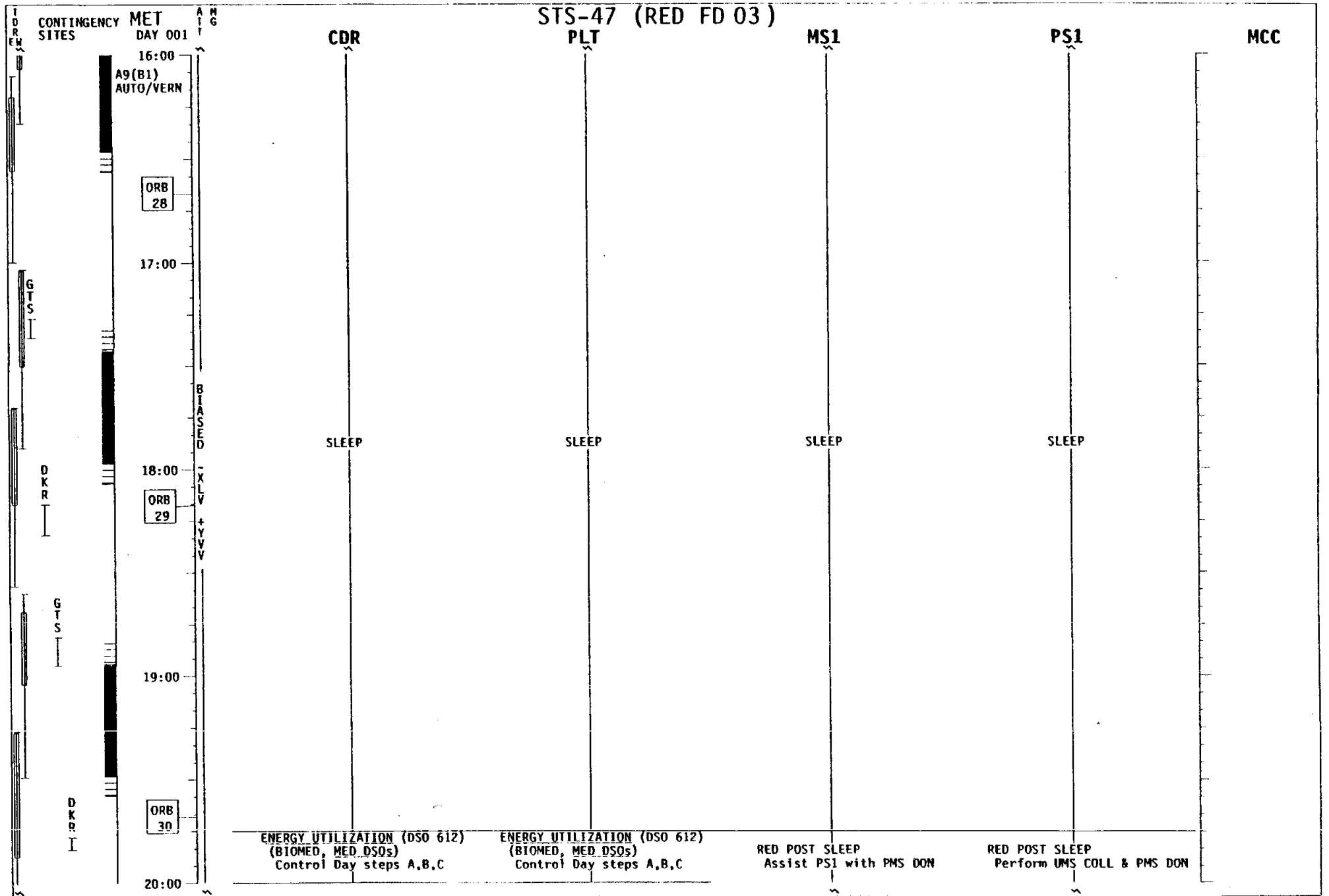


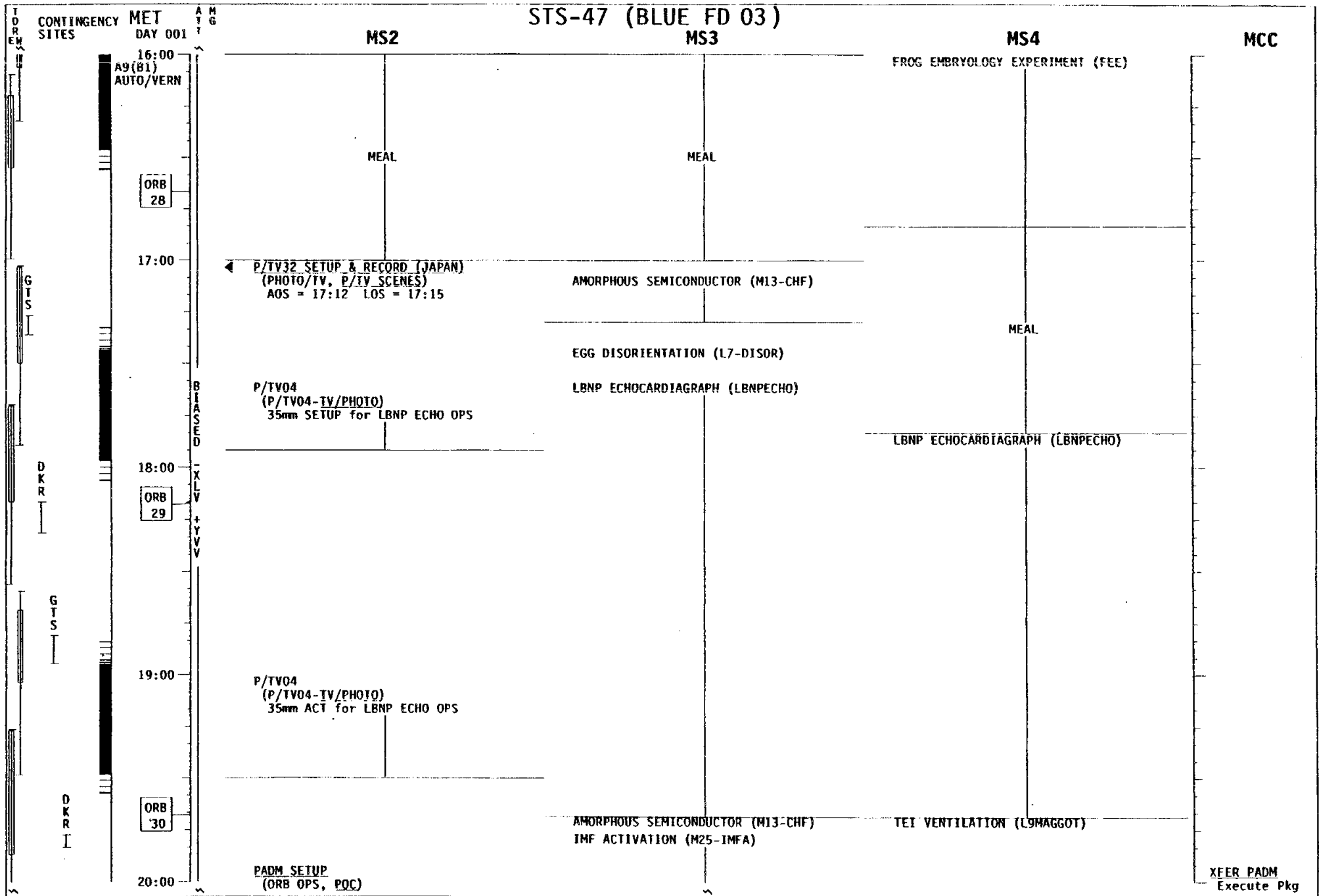


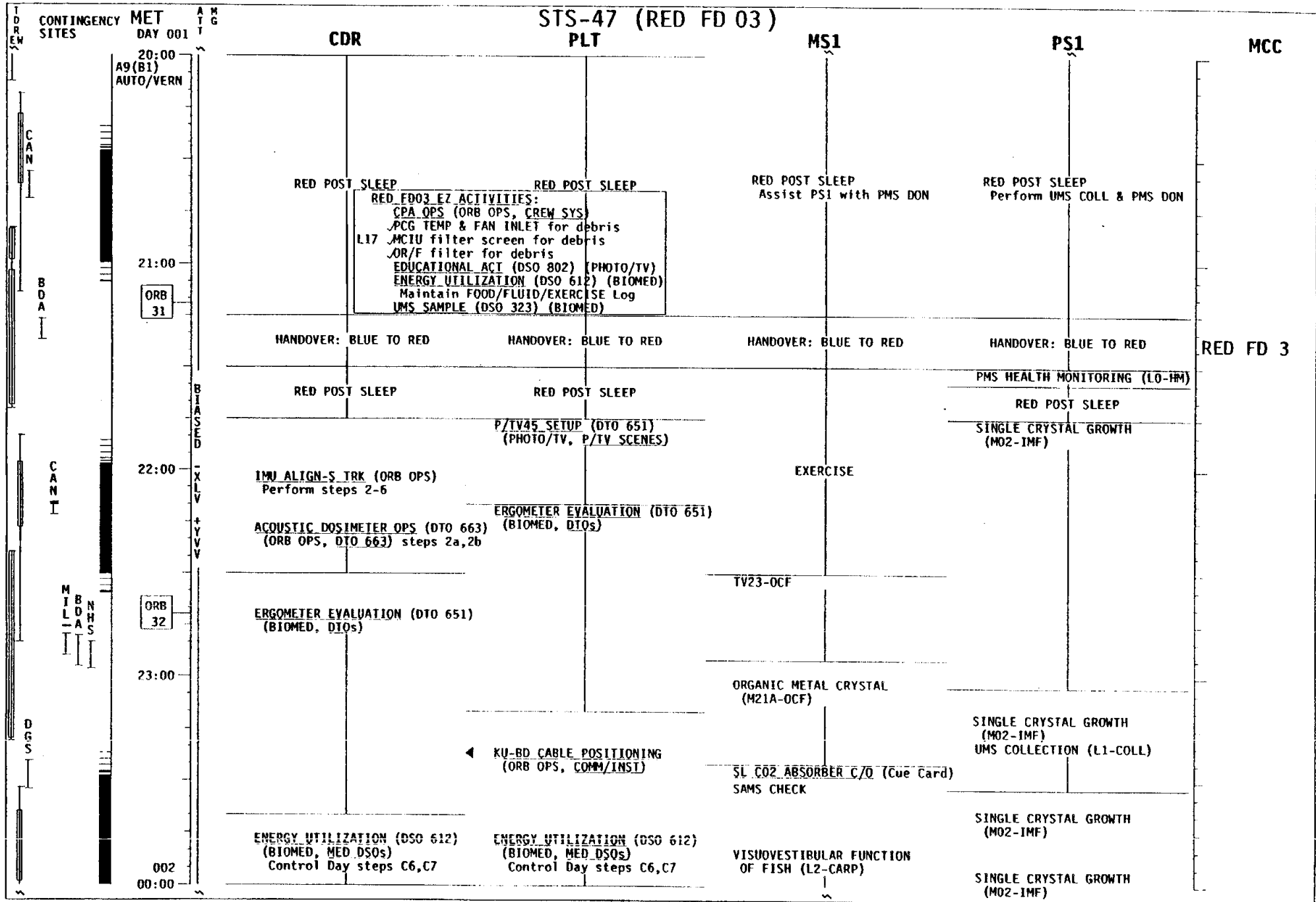




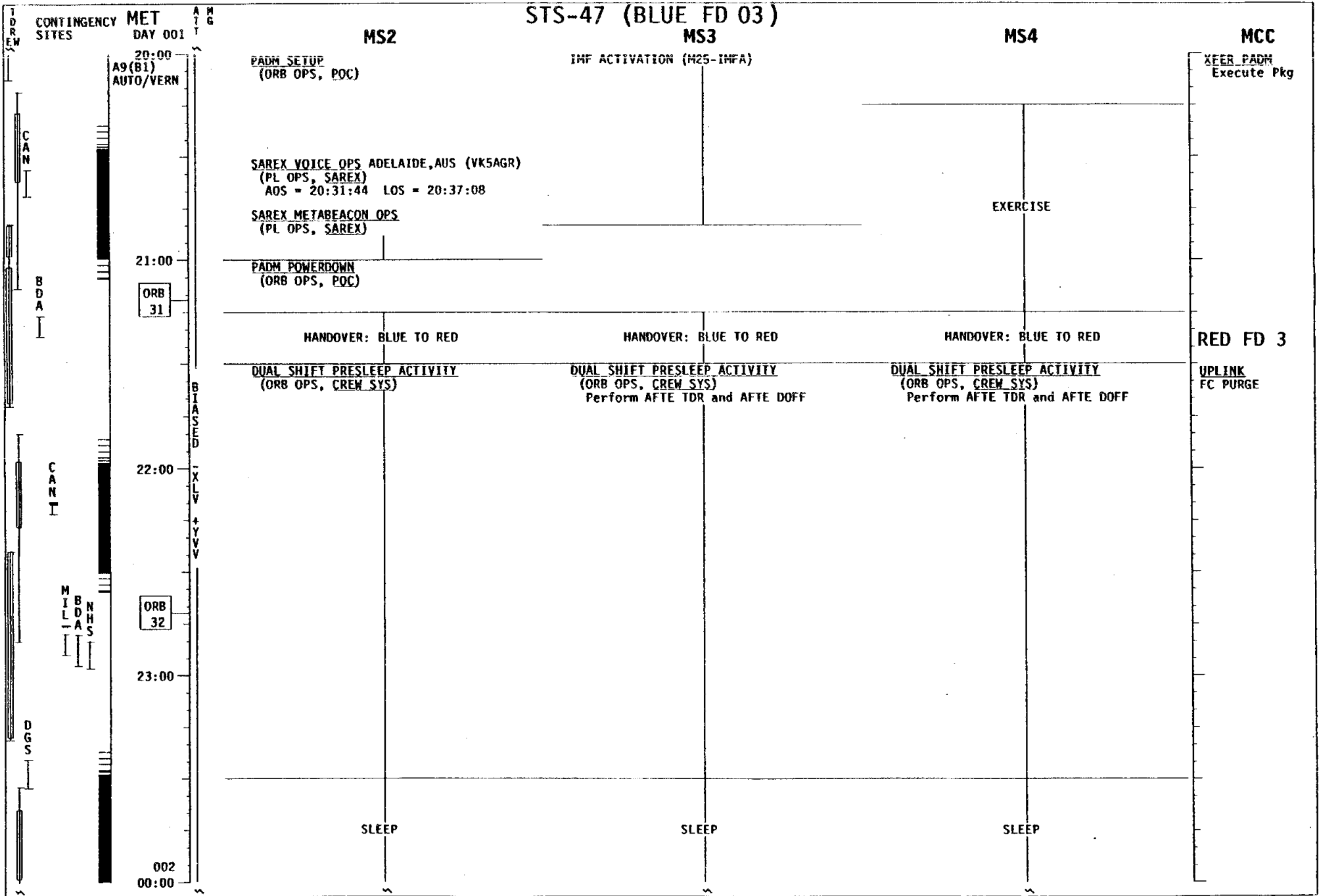


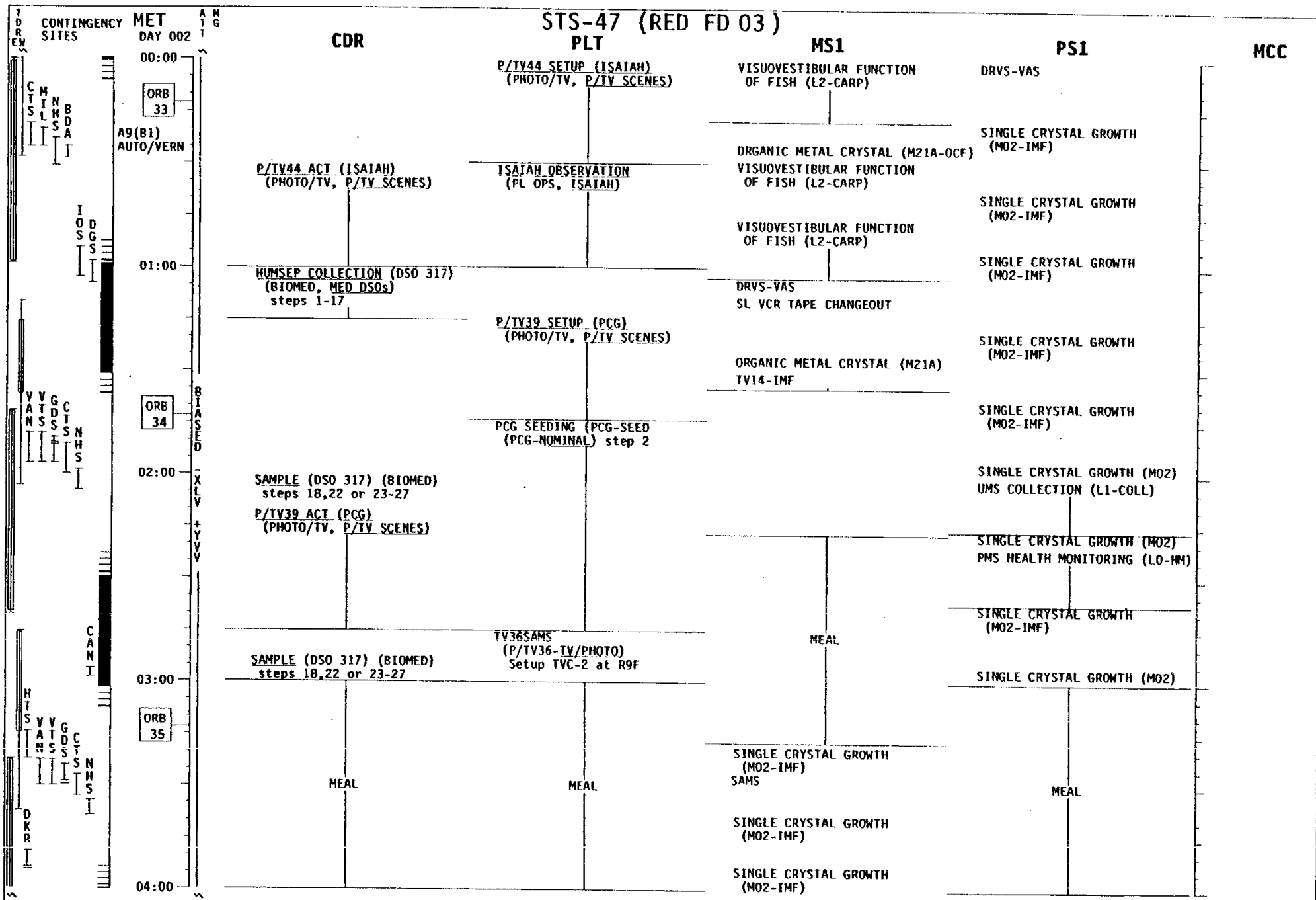




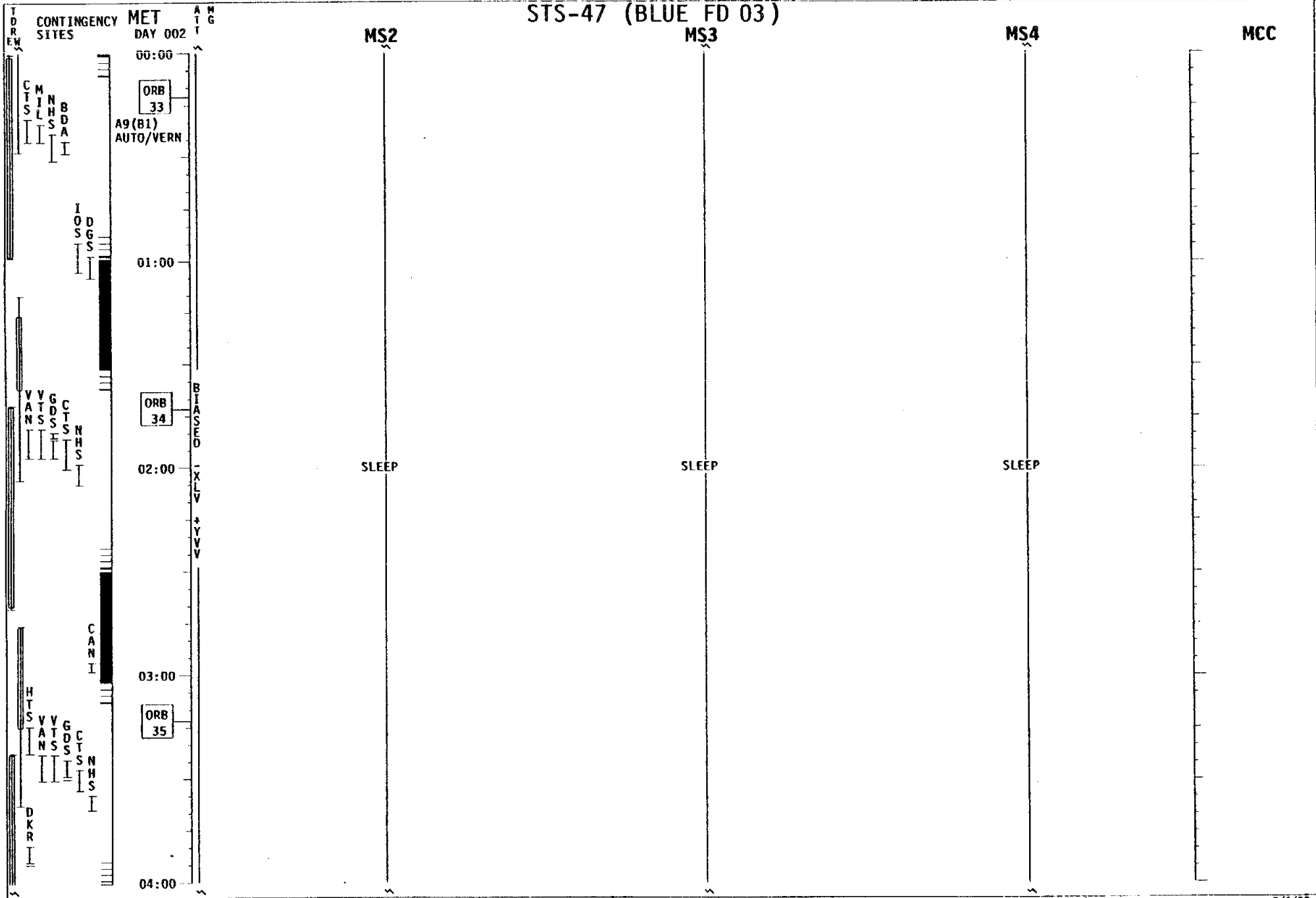


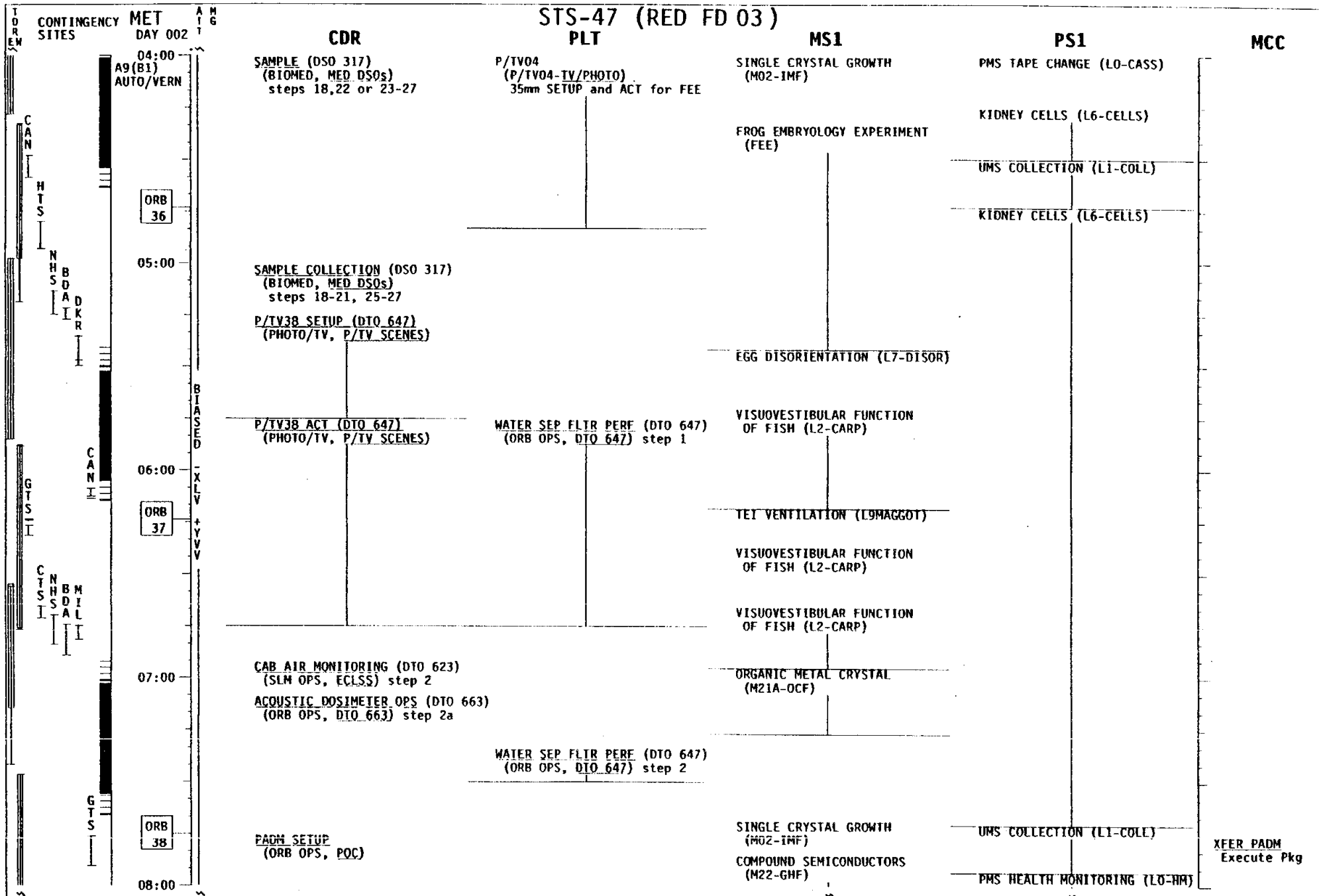


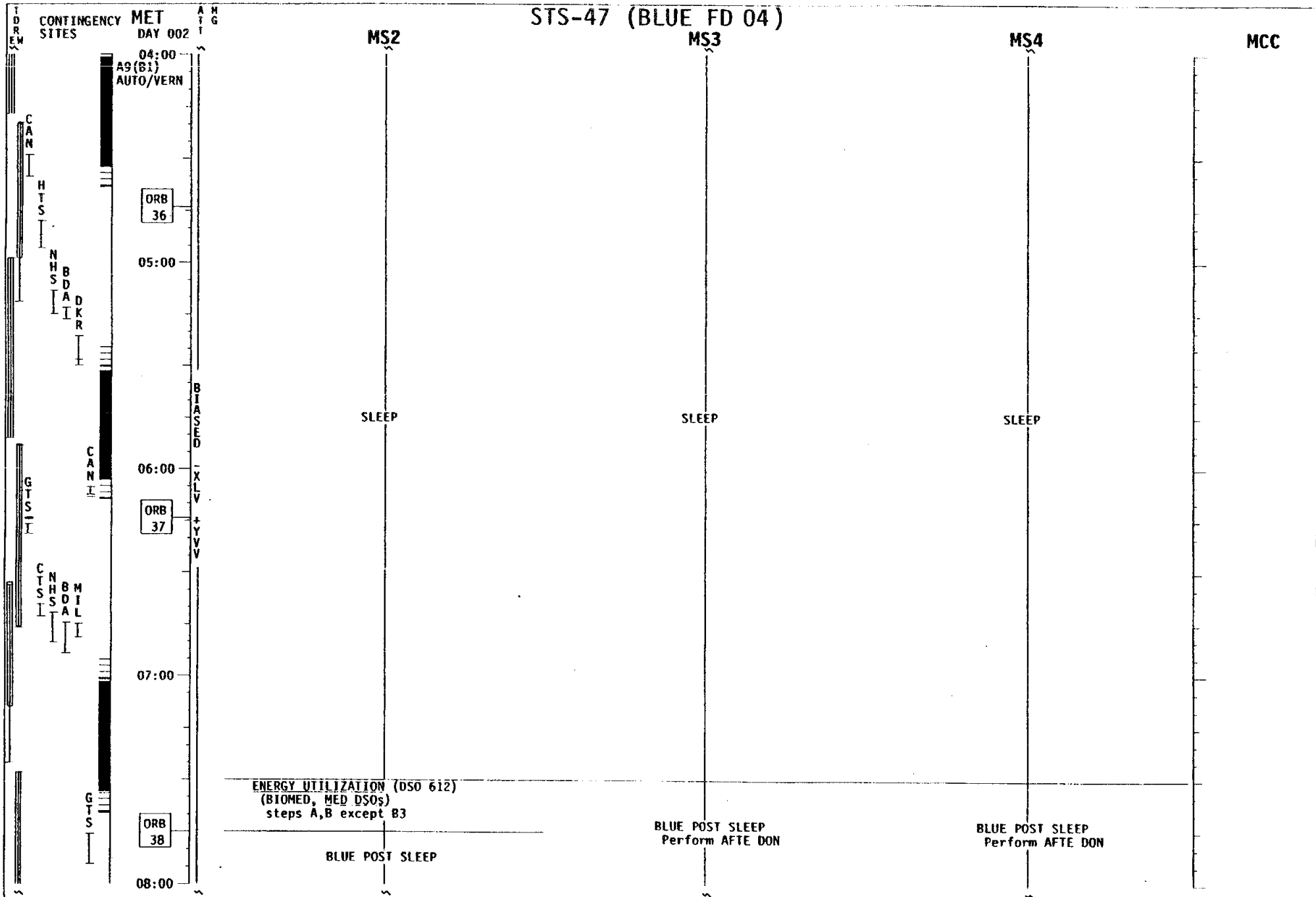


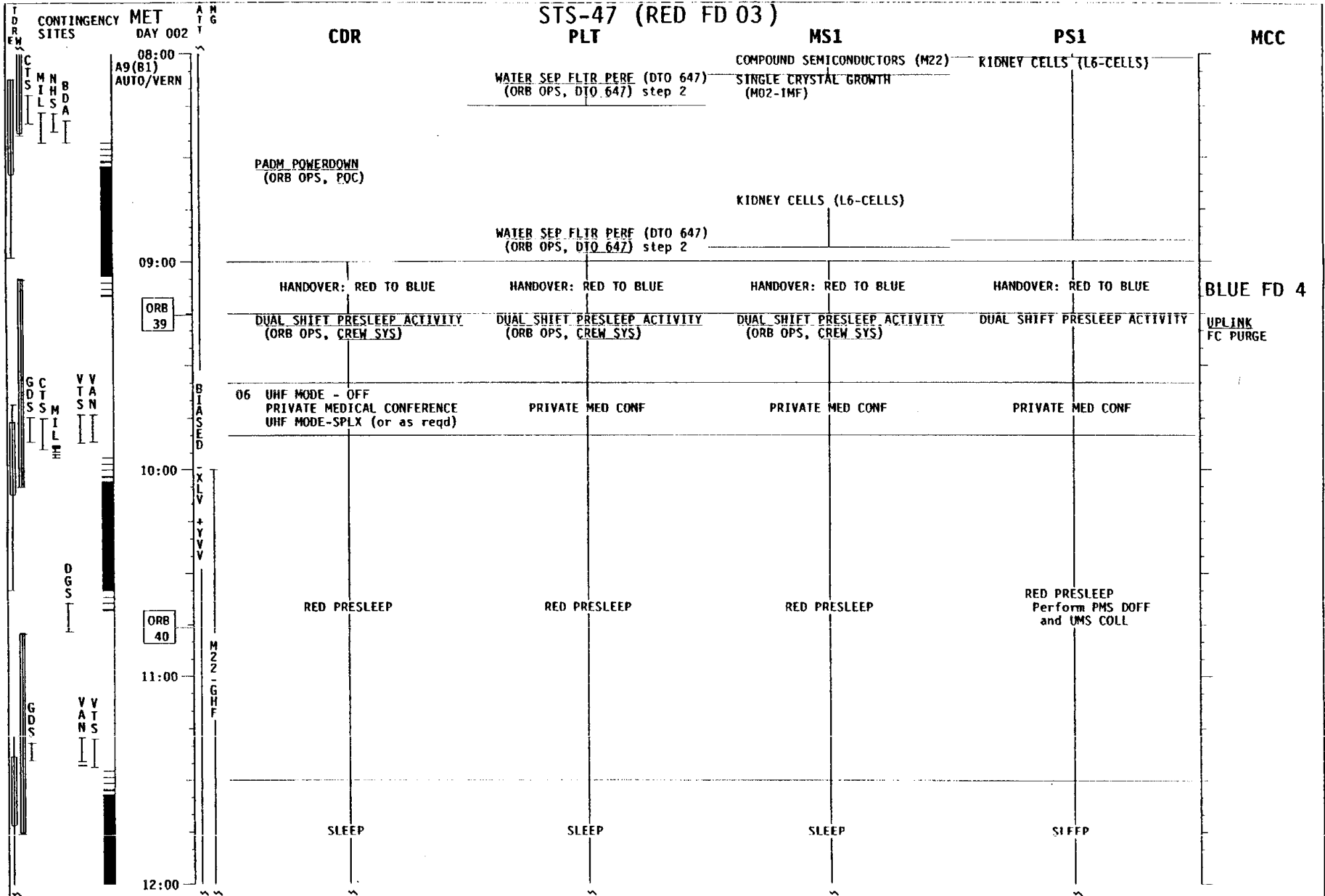


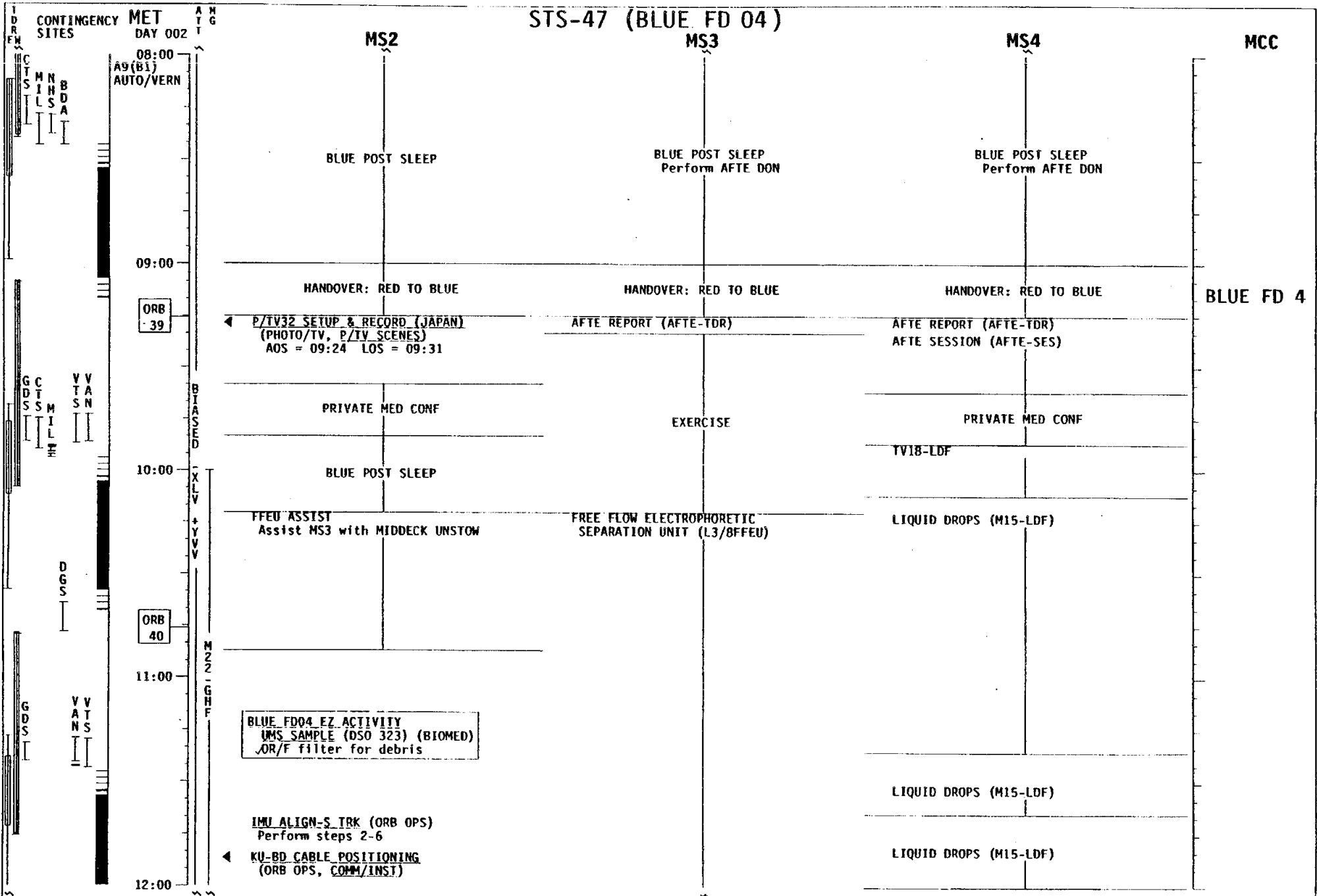
# STS-47 (BLUE FD 03)



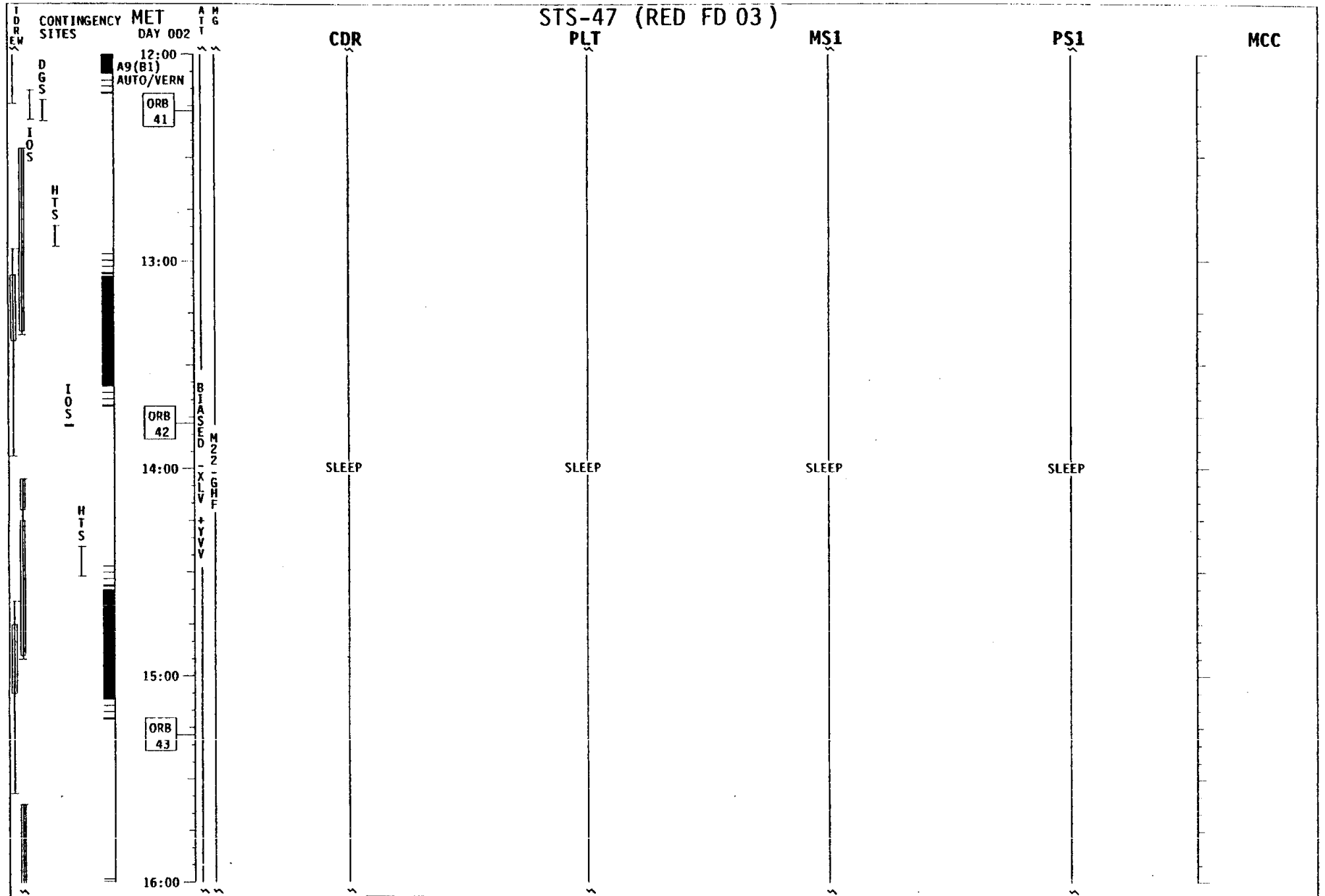




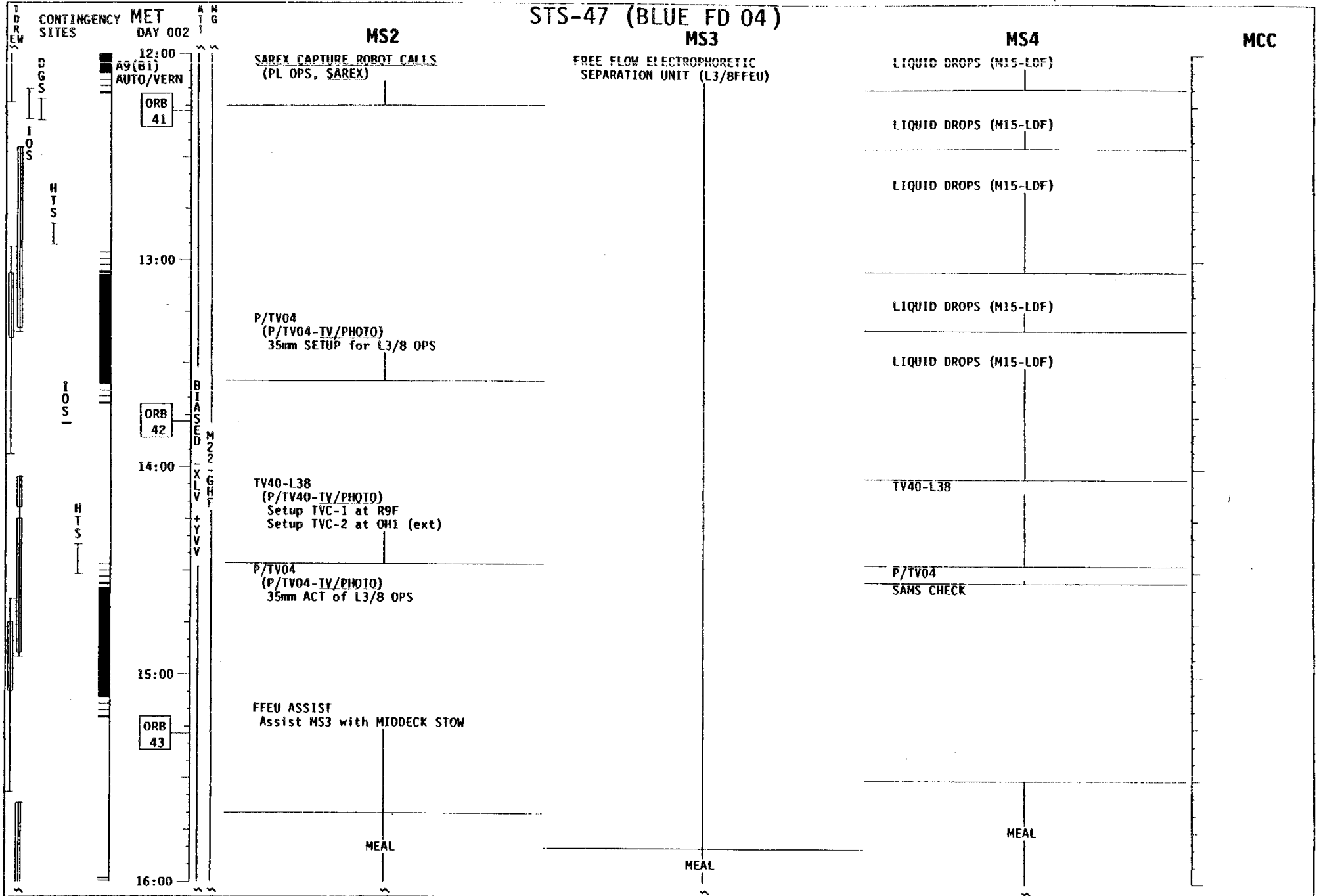




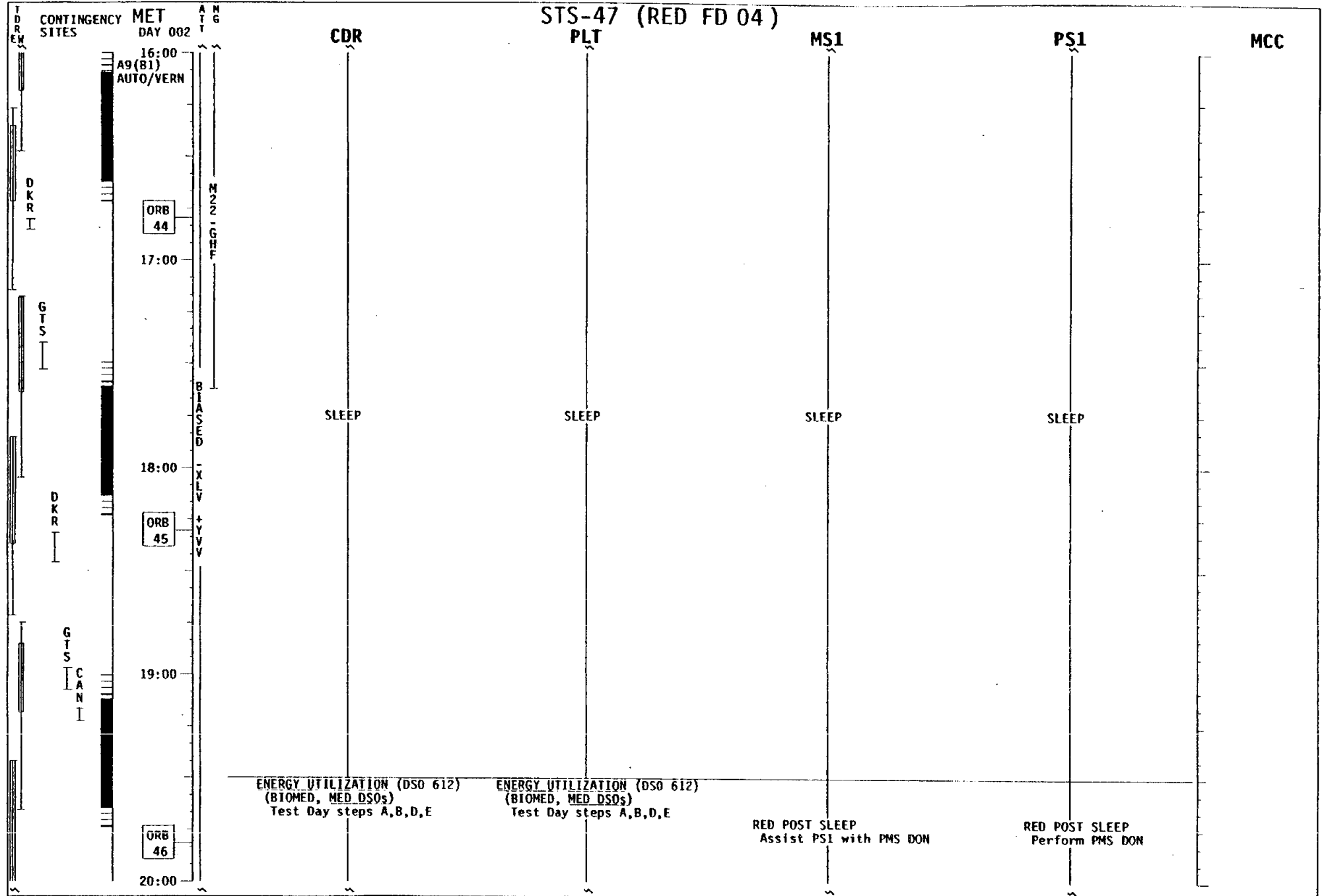
# STS-47 (RED FD 03)



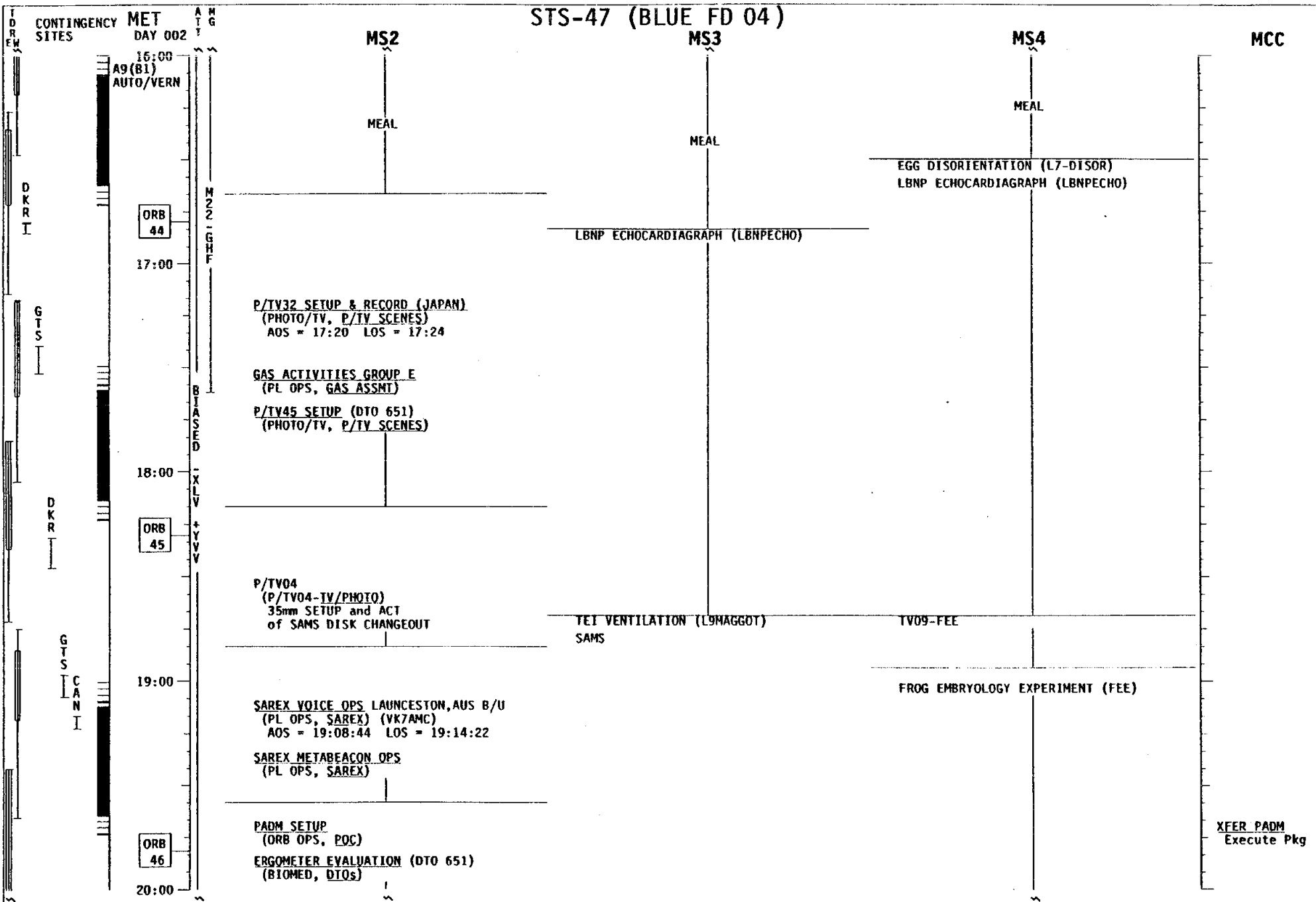


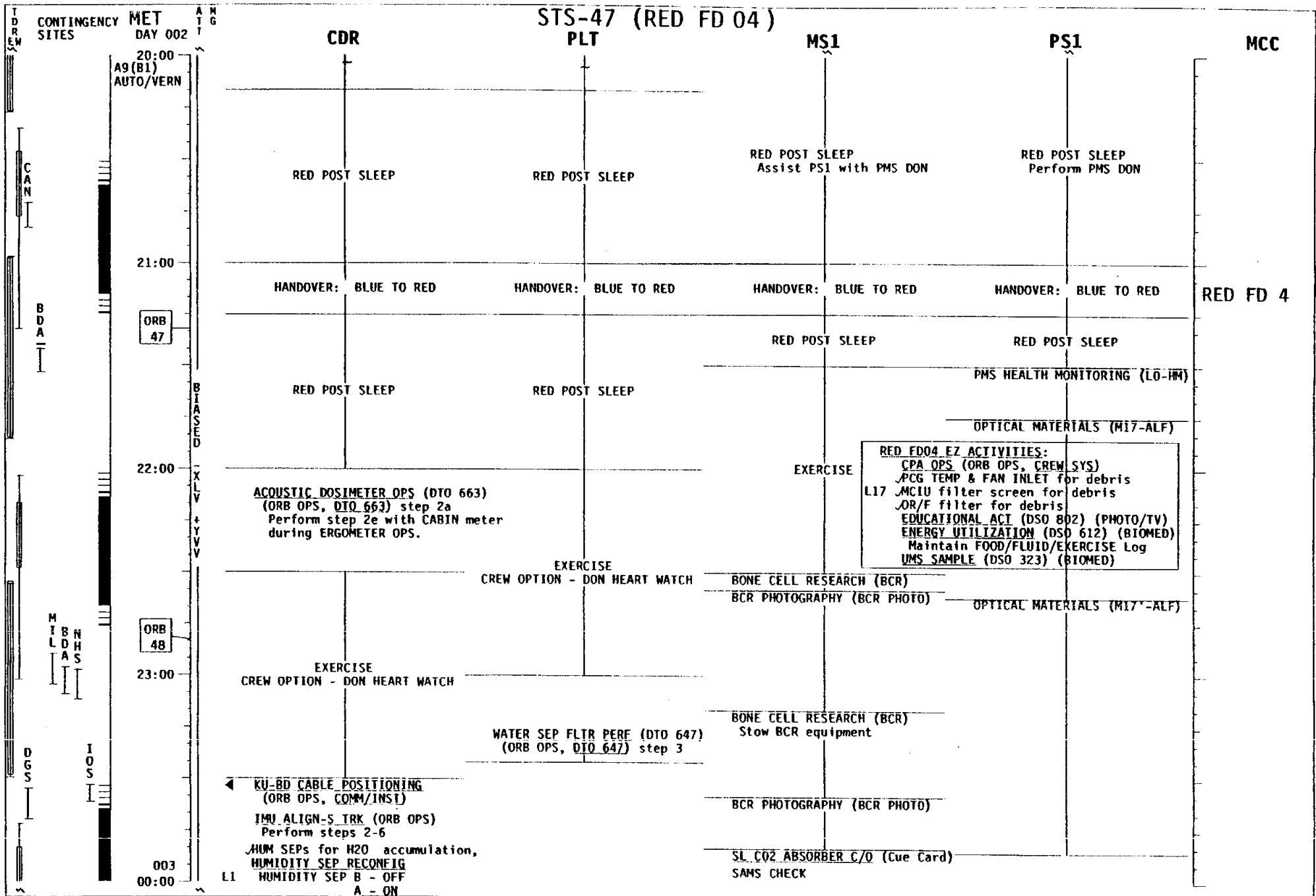


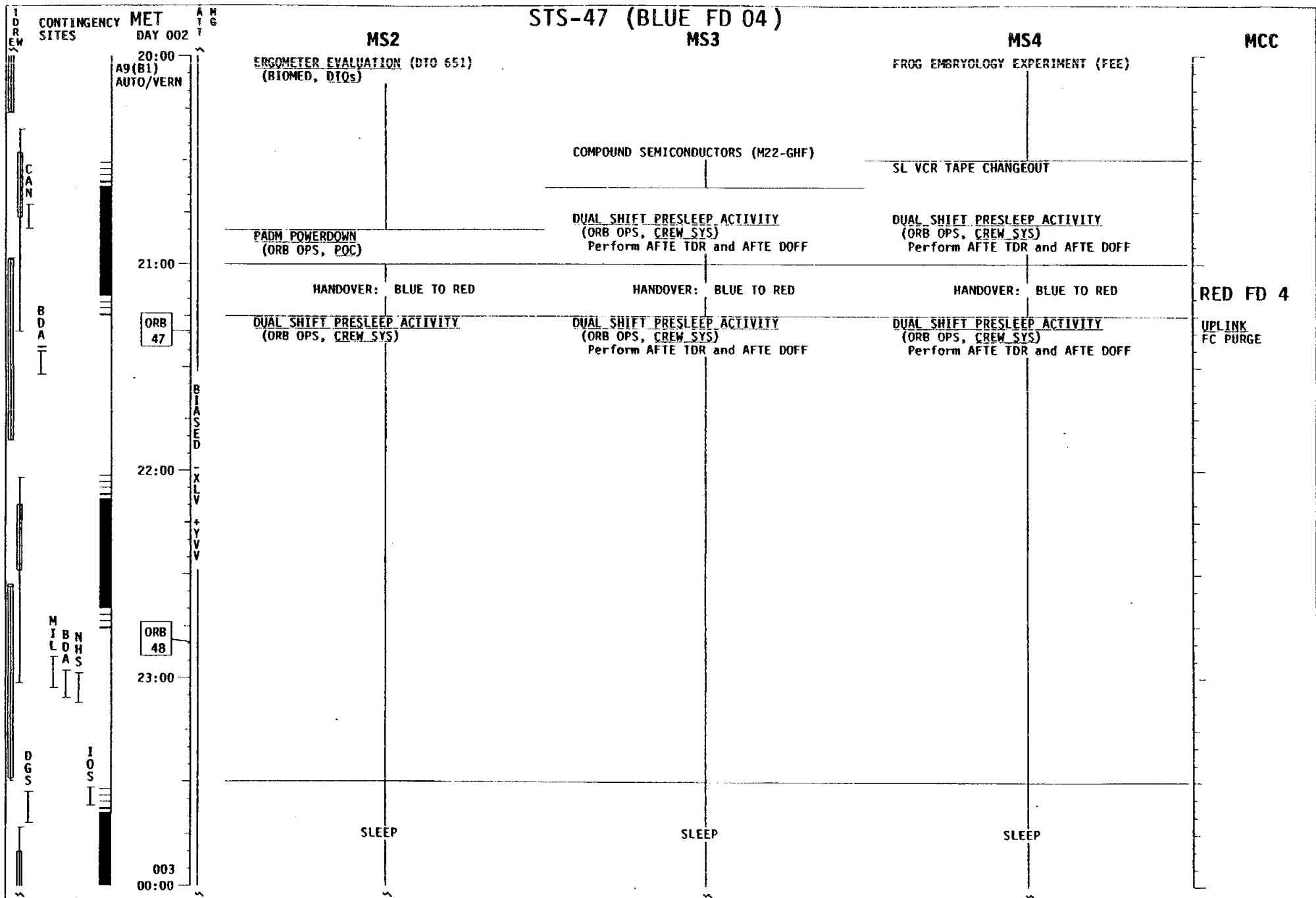
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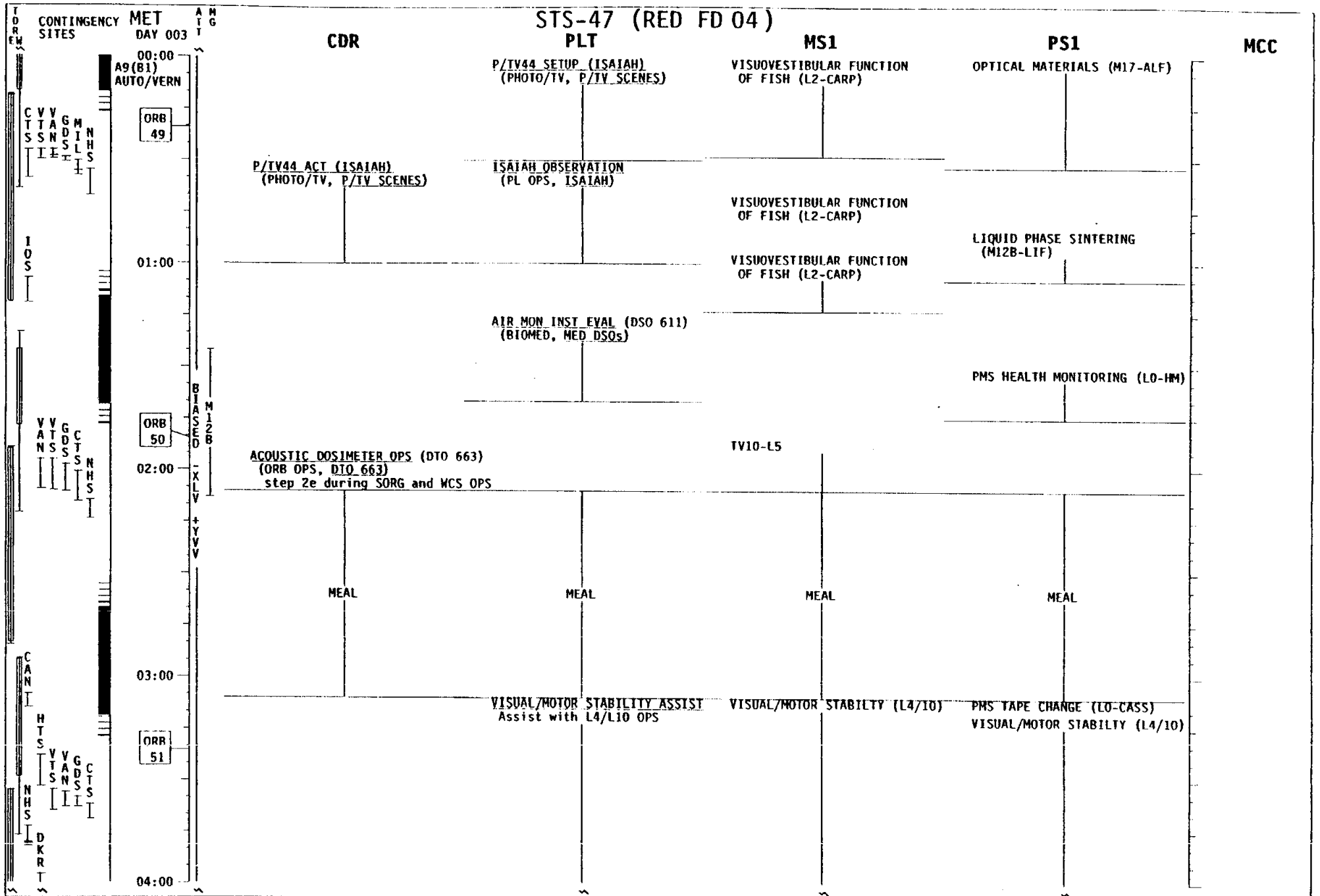


# STS-47 (BLUE FD 04)

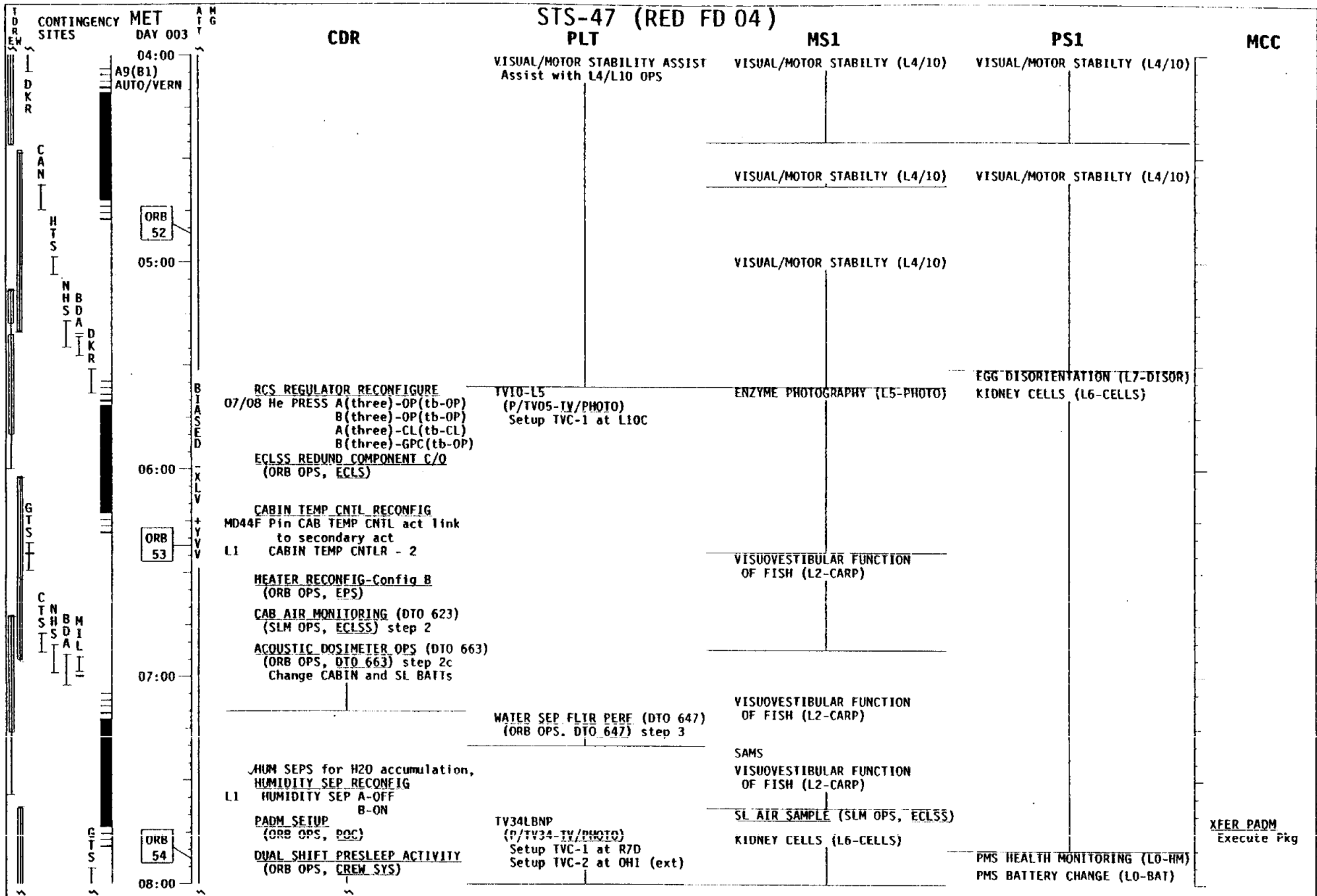






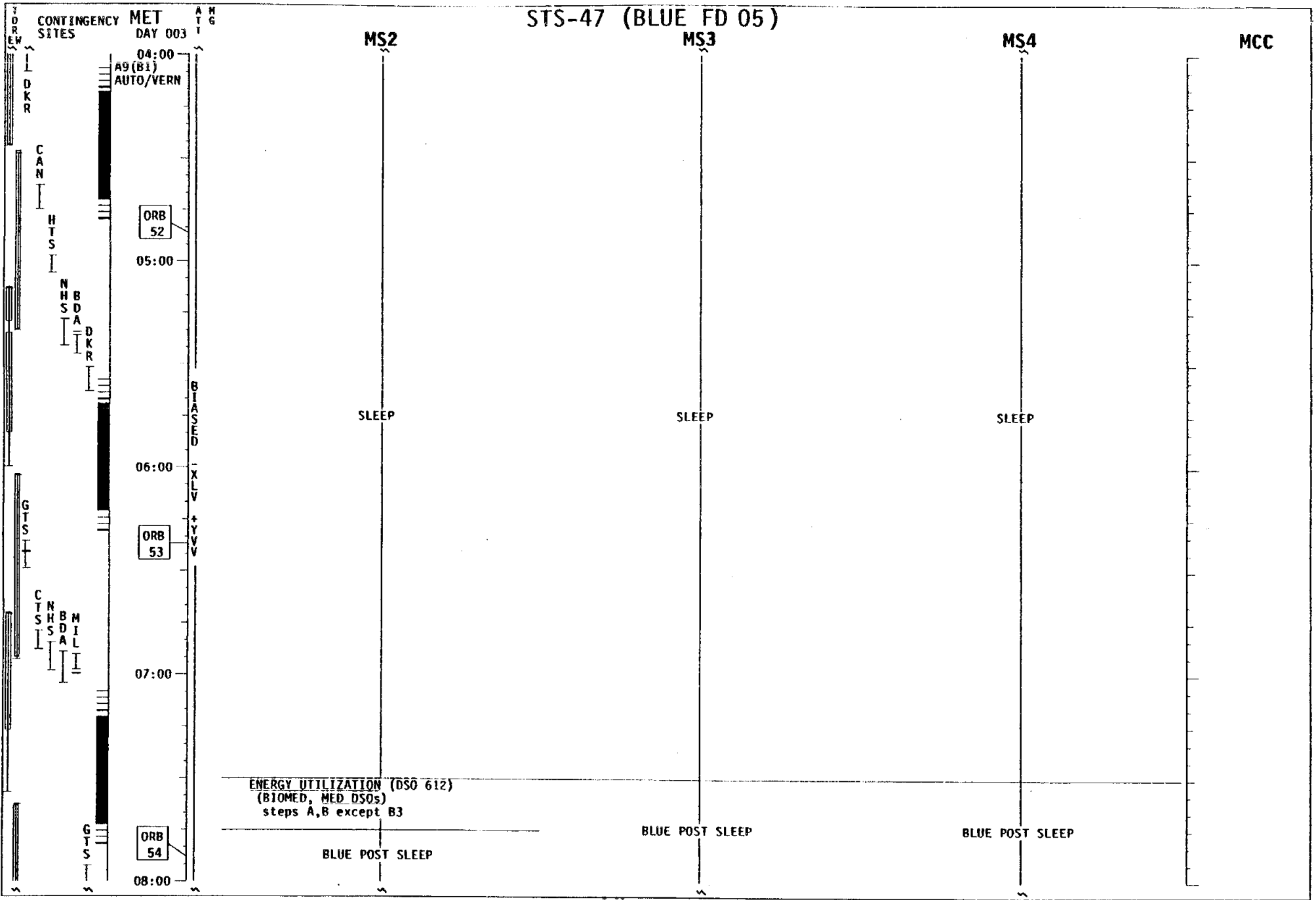




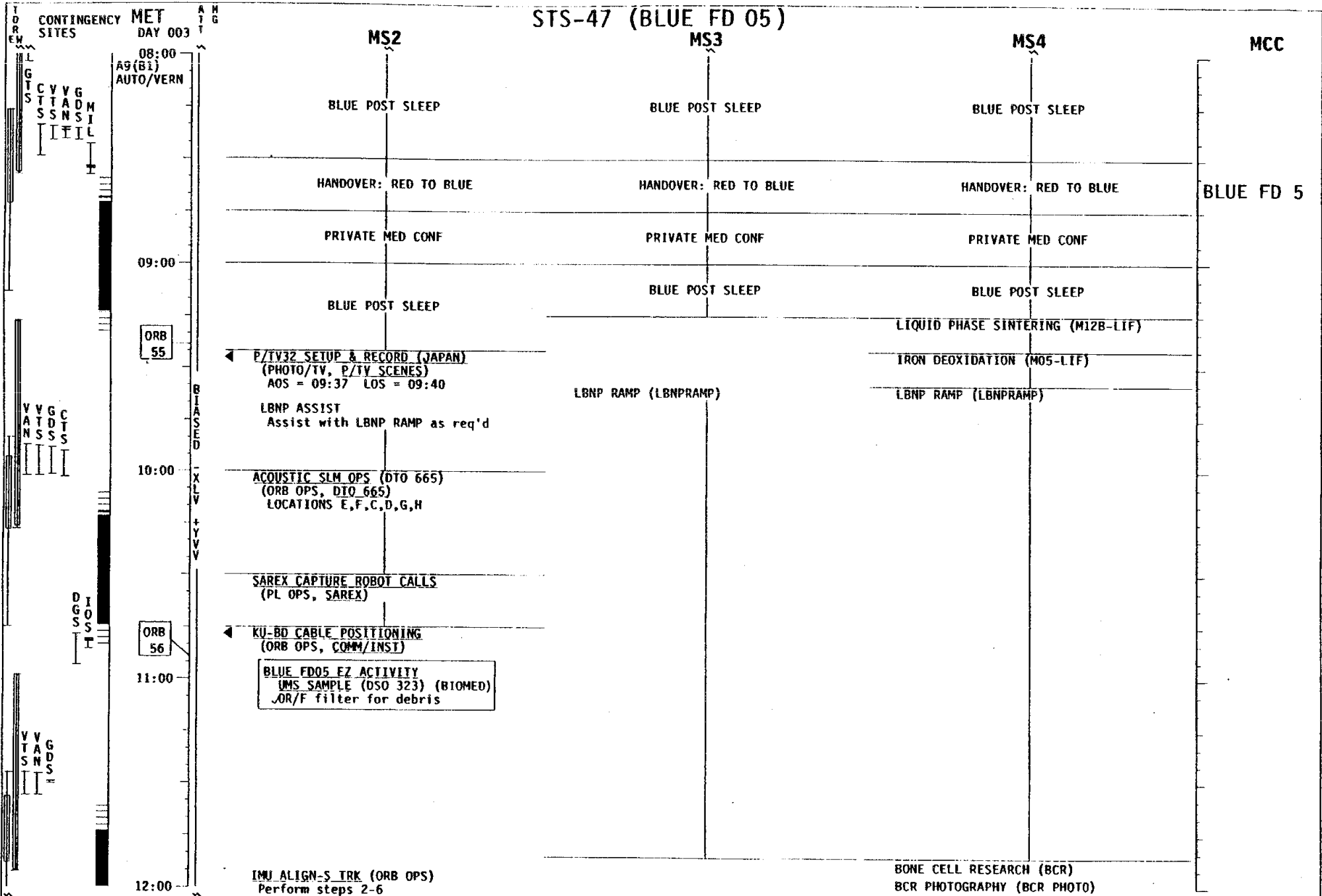




# STS-47 (BLUE FD 05)







CONTINGENCY MET  
SITES DAY 003

08:00  
A9(B1)  
AUTO/VERN

09:00

ORB 55

10:00

ORB 56

11:00

12:00

YDR EW  
HL  
GTS  
CVV G  
TTT AD  
SSNS I  
M I I I  
L I I I  
L I I I

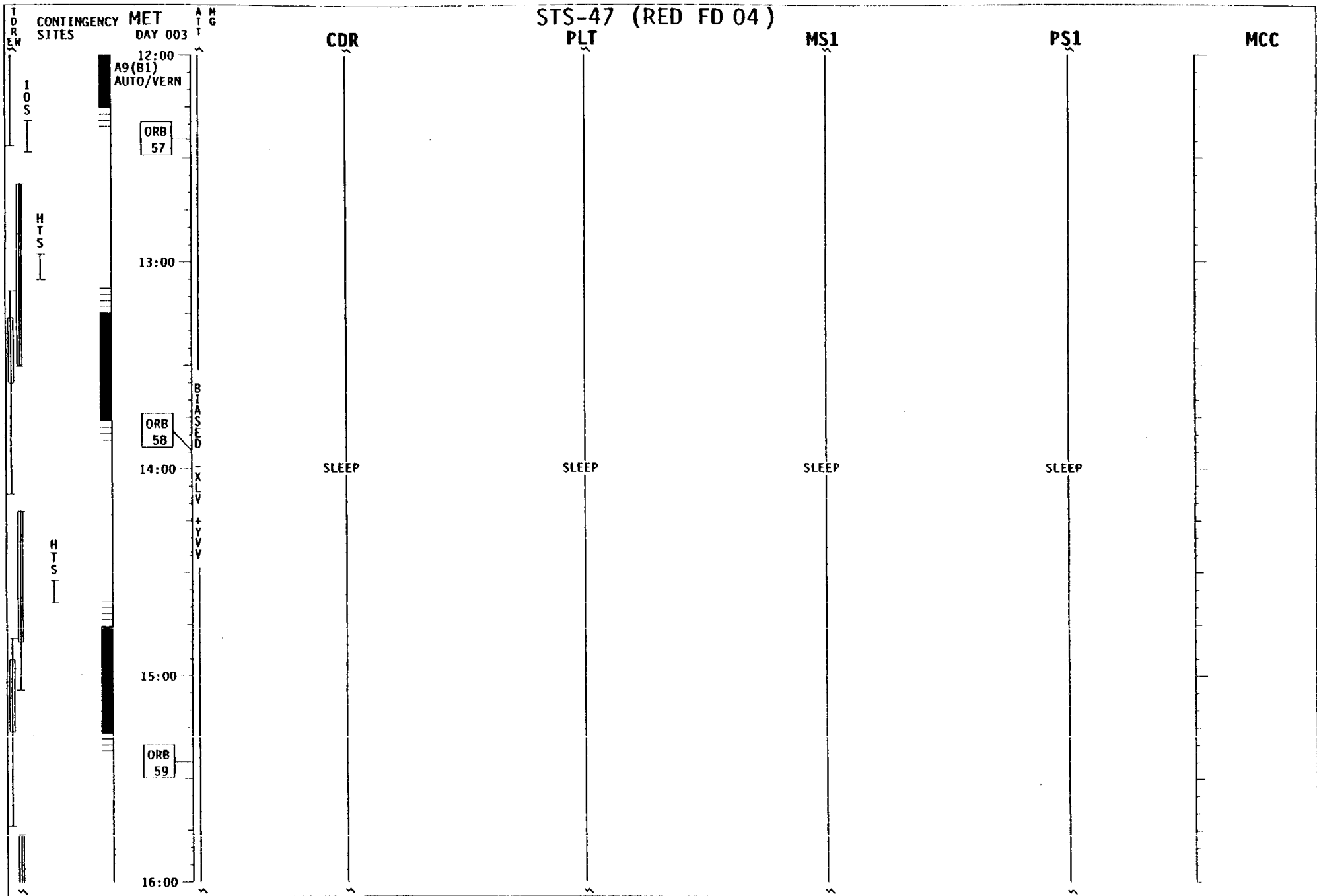
V G C  
T A D  
S N S  
S S S  
S S S

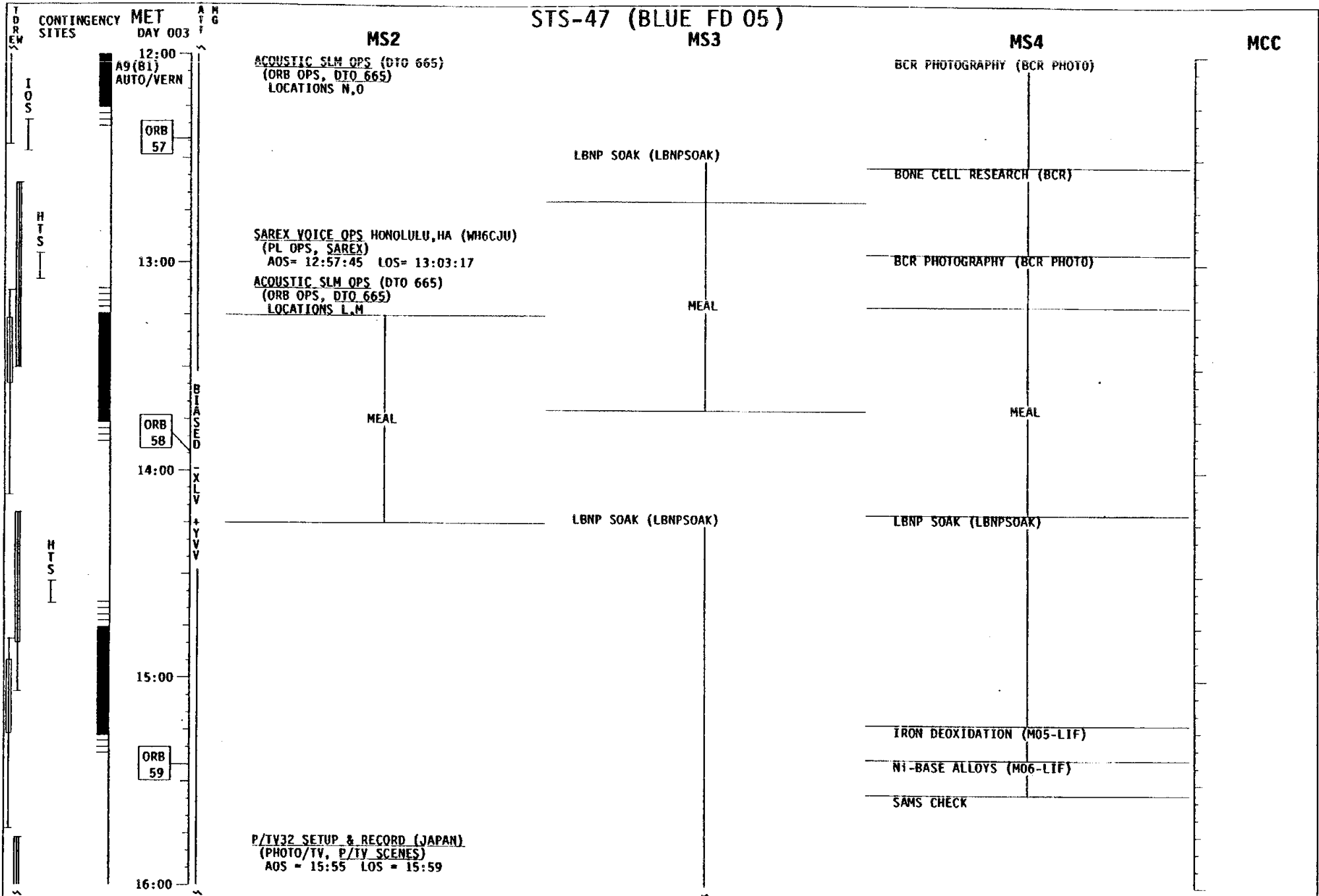
D I G  
G S S  
T I

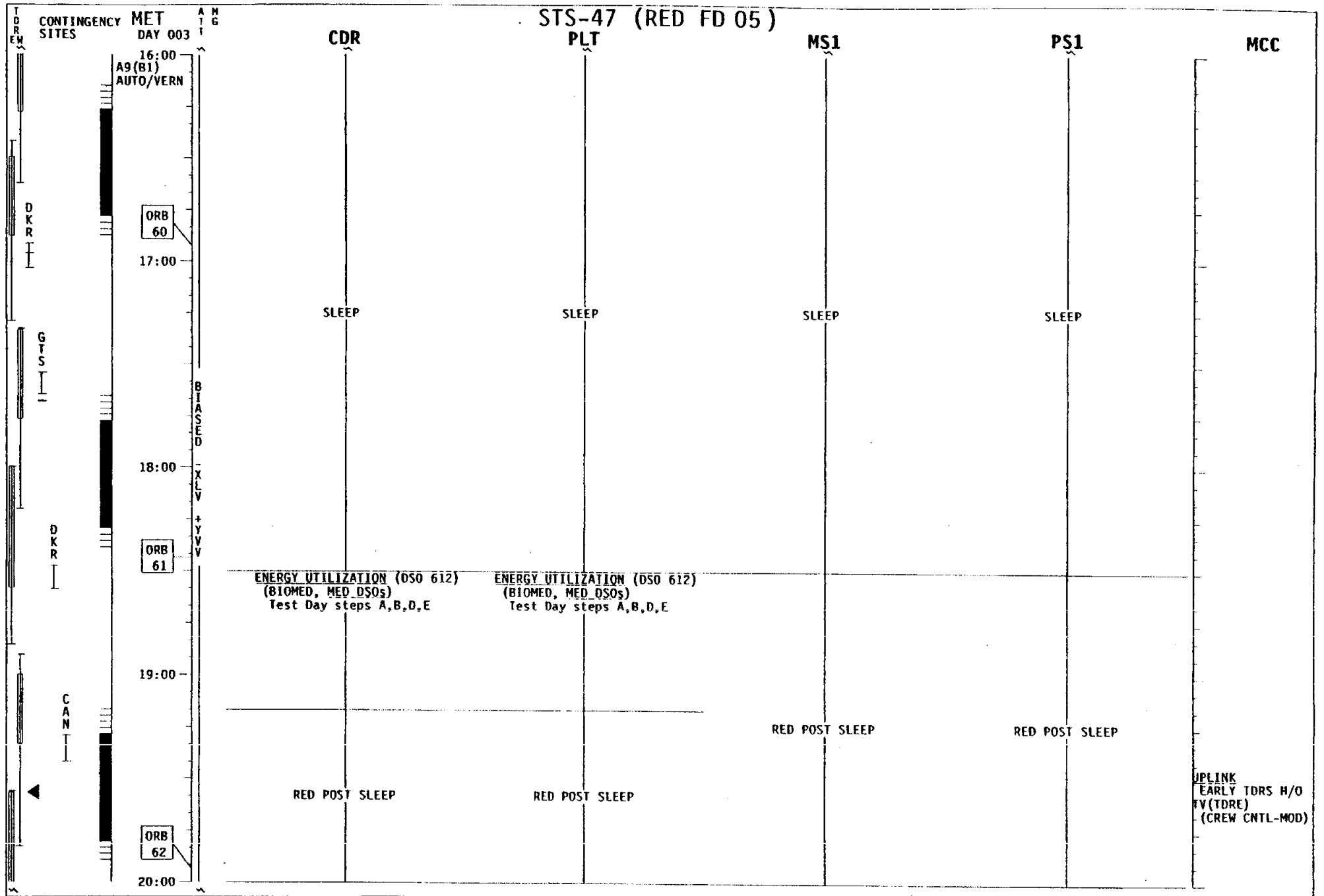
V G D  
T A S  
S N S  
S S S

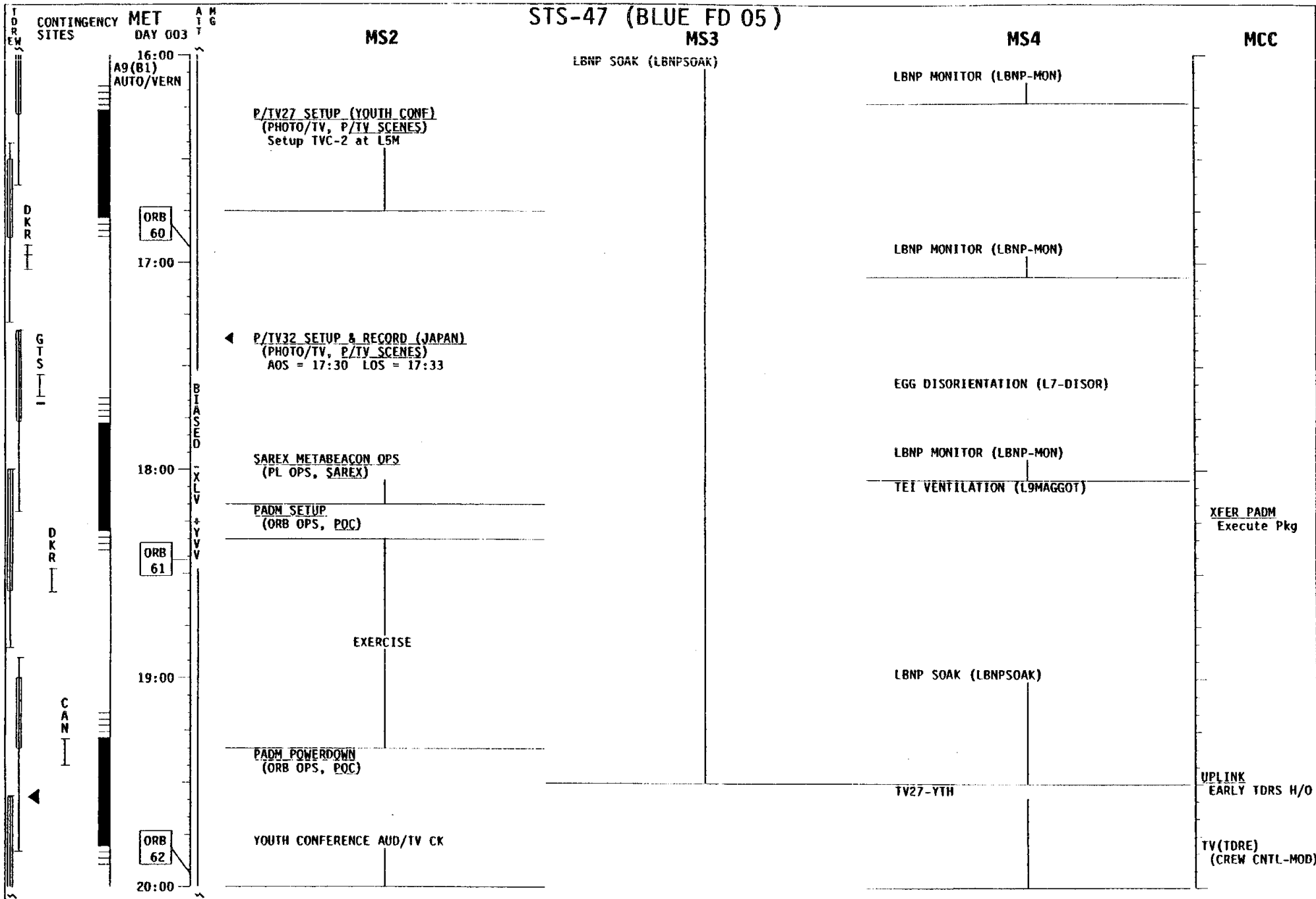
B I A  
S E  
D

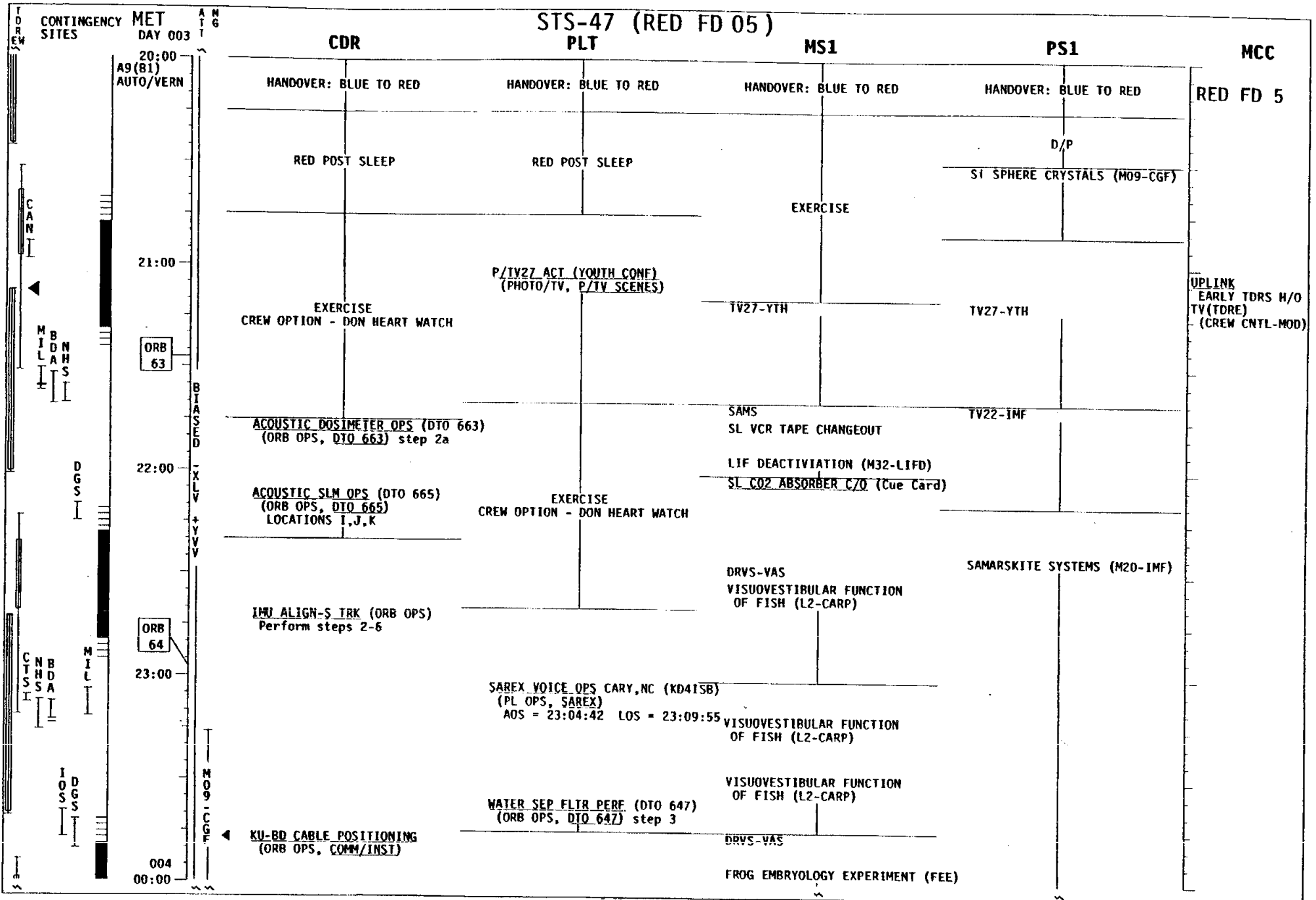
X L V  
+ Y V V



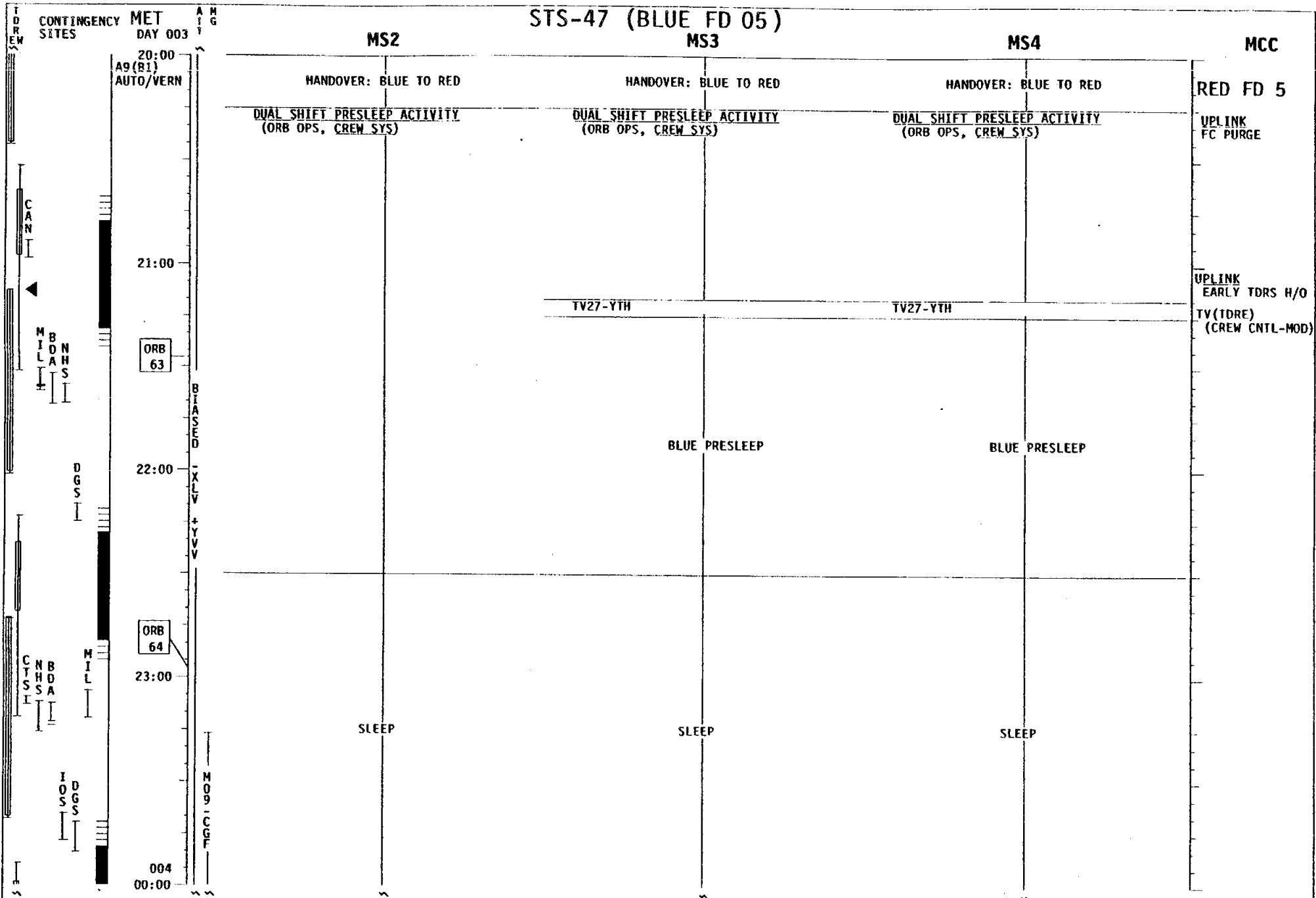


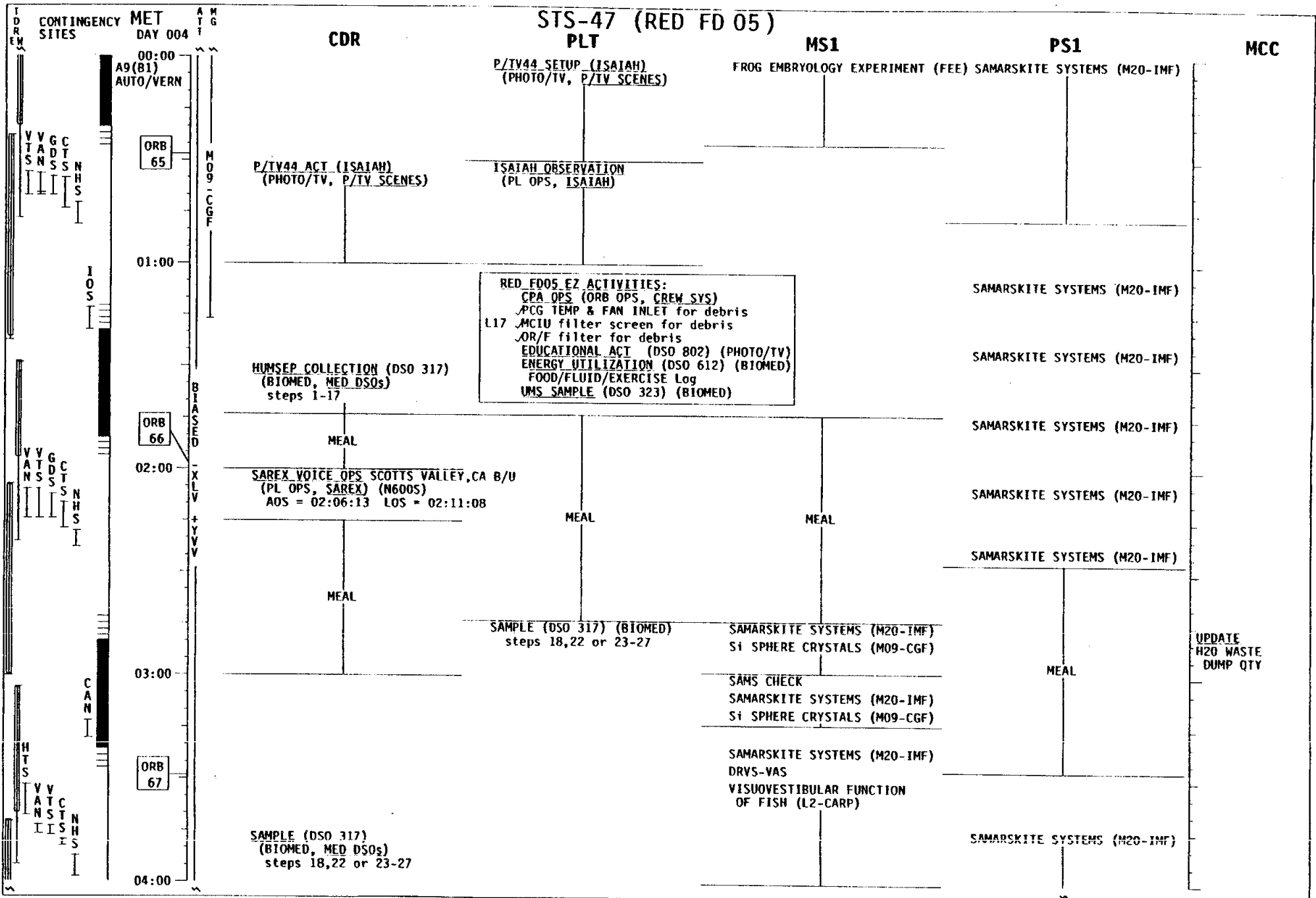




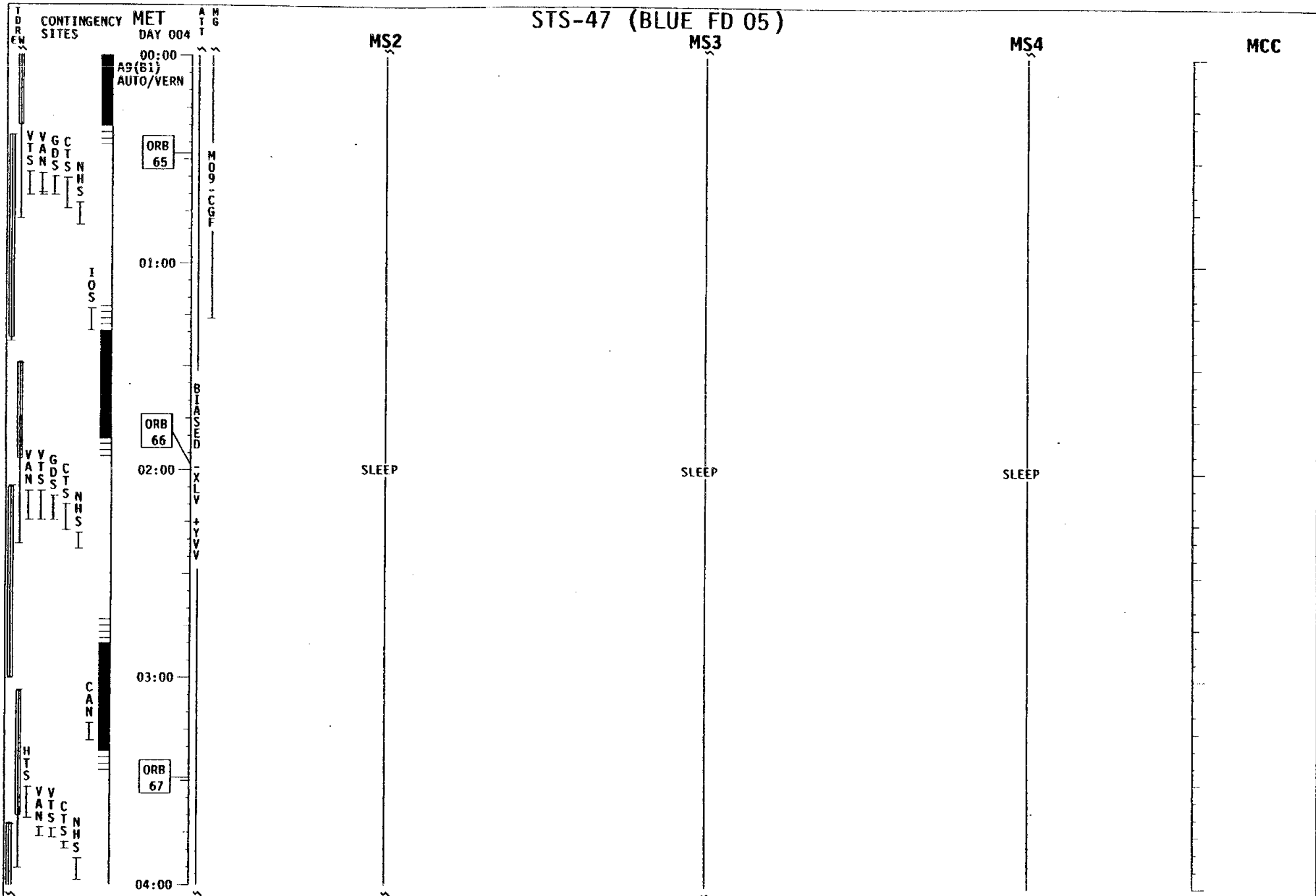


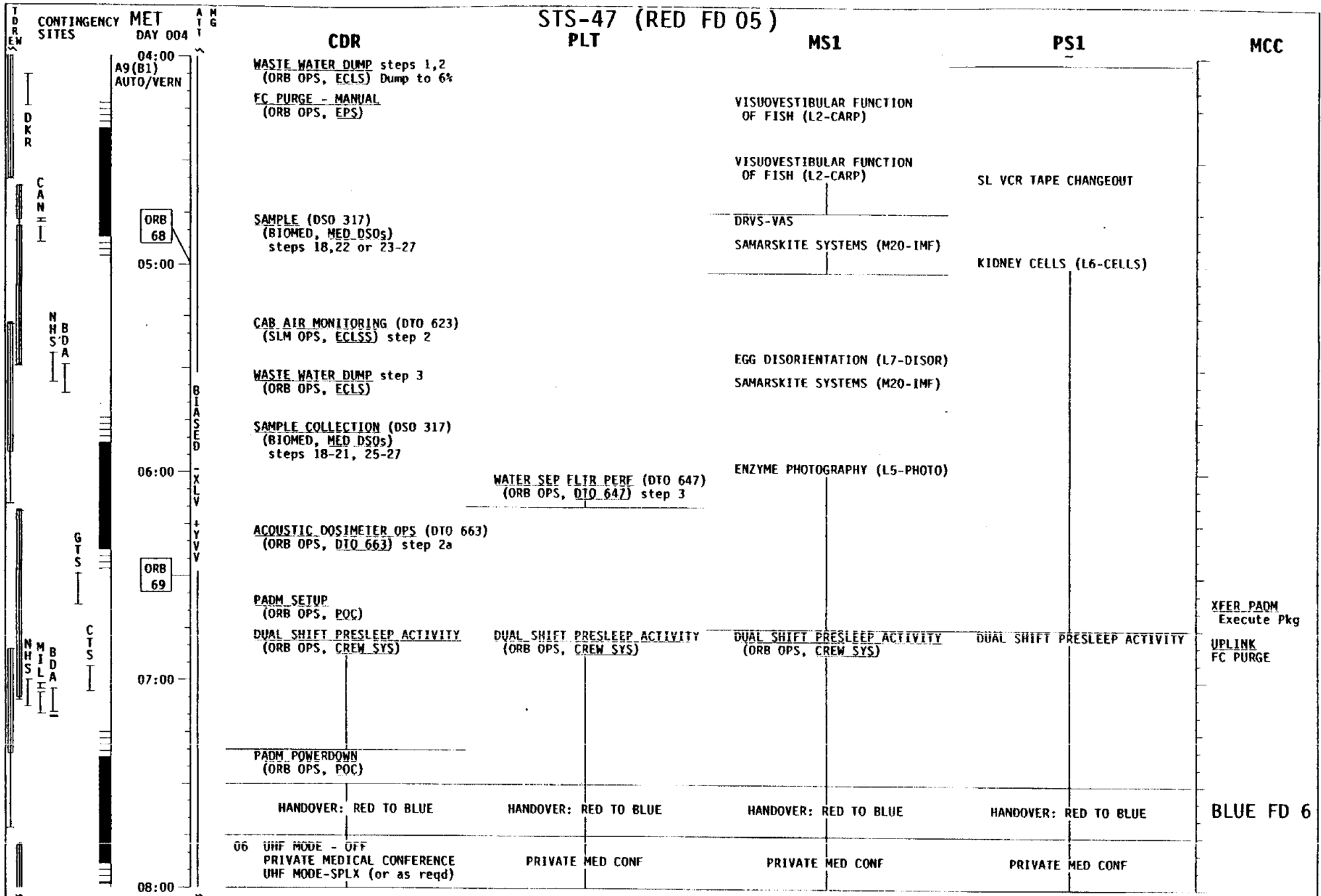




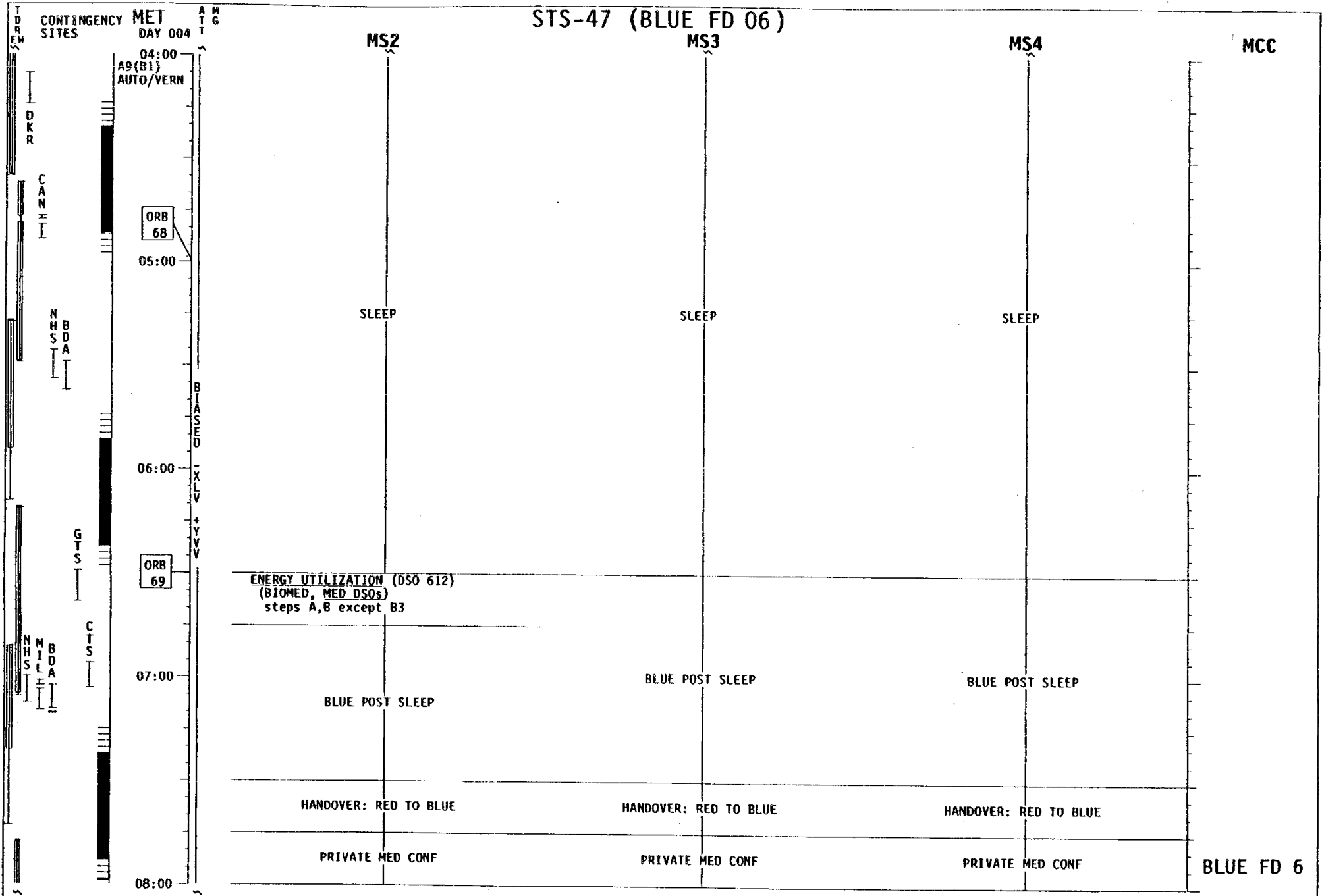


# STS-47 (BLUE FD 05)

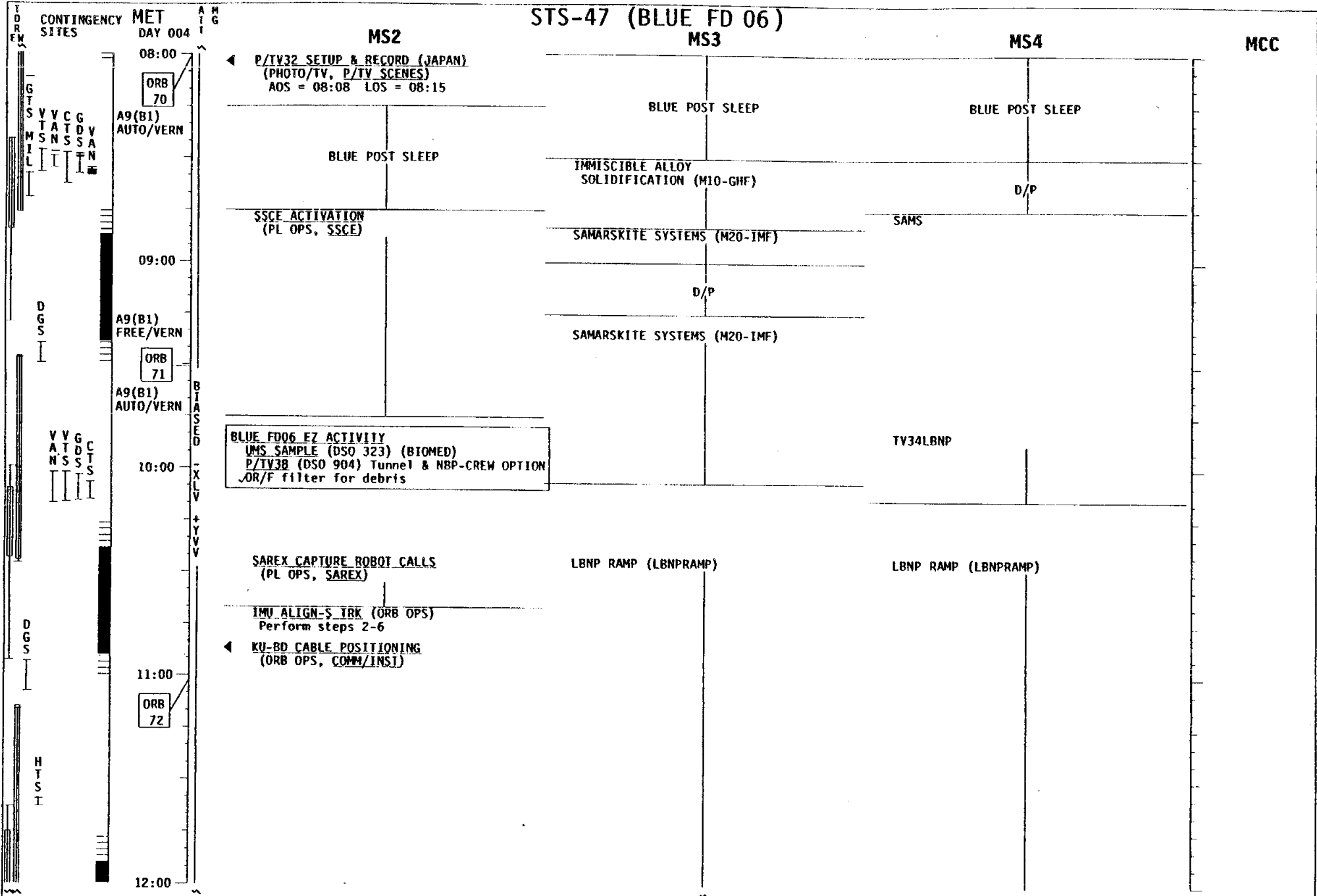


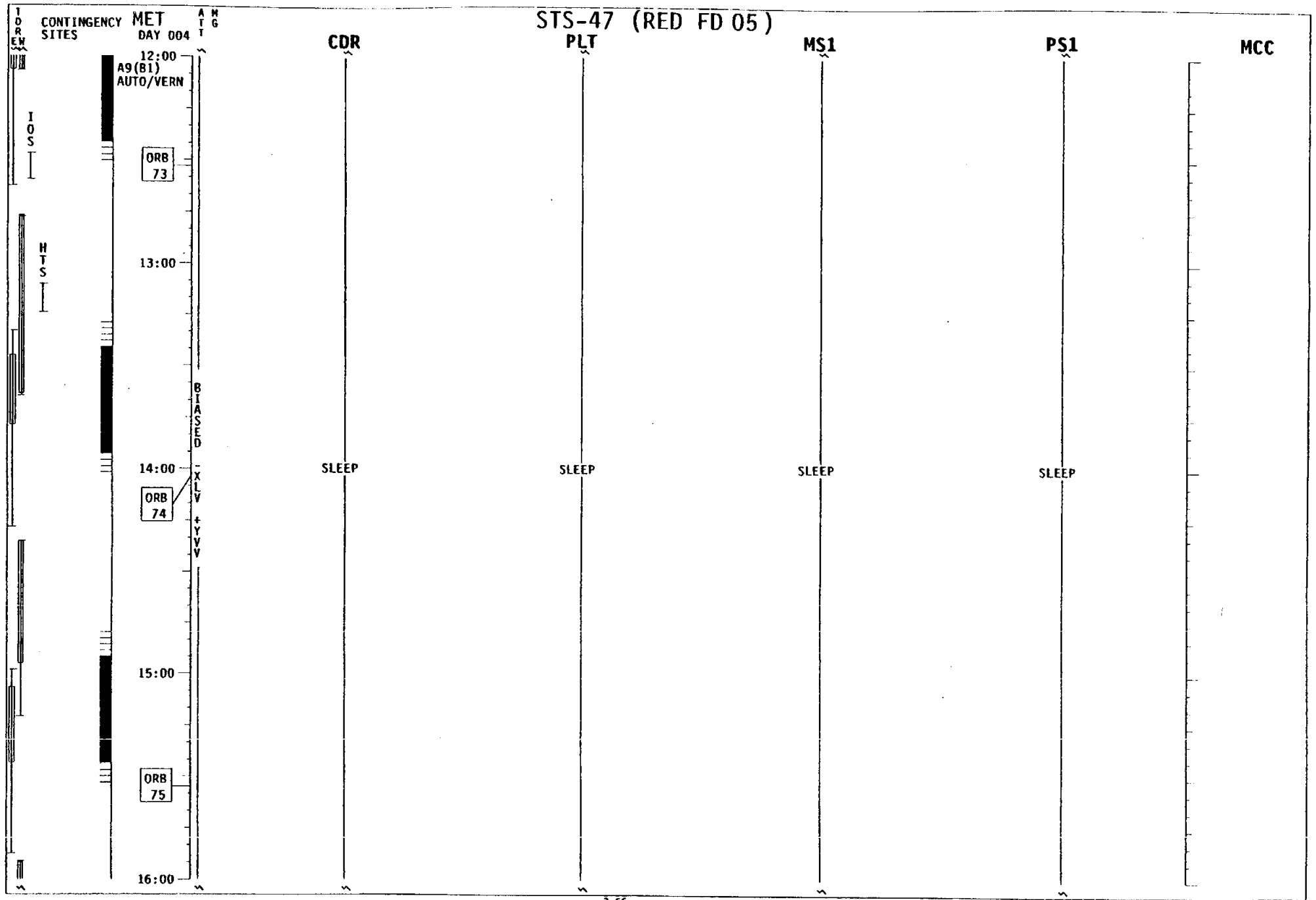


# STS-47 (BLUE FD 06)

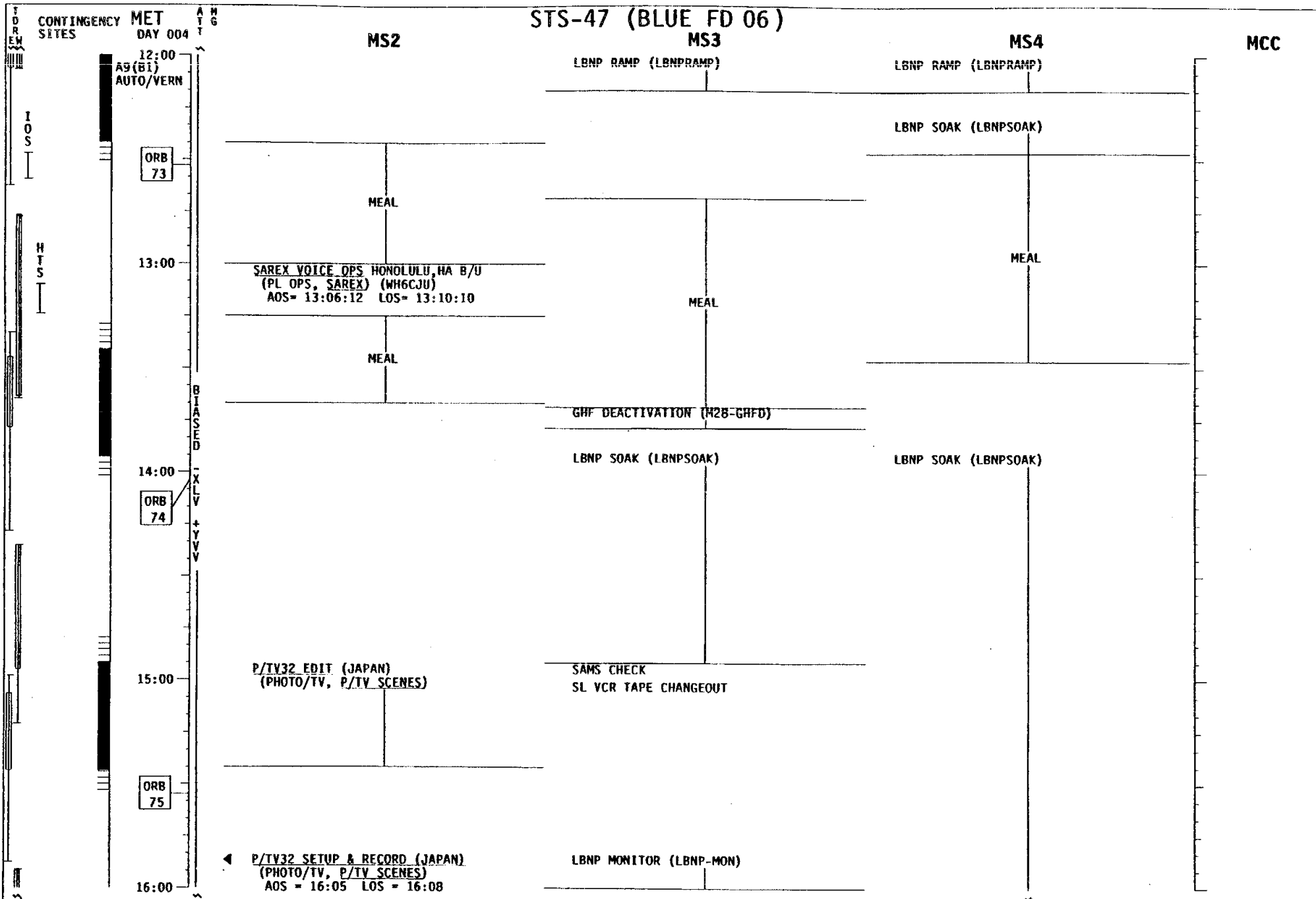


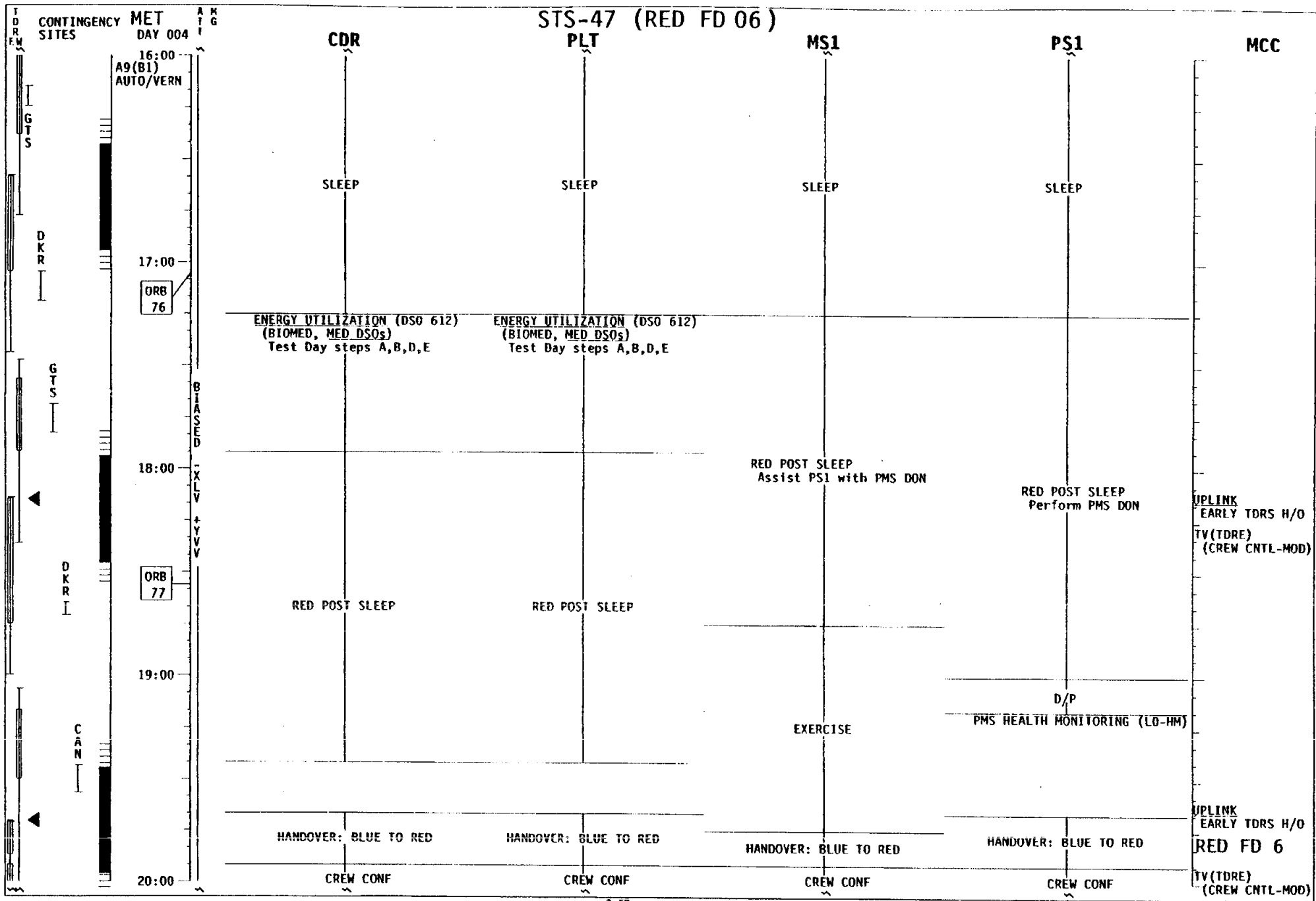


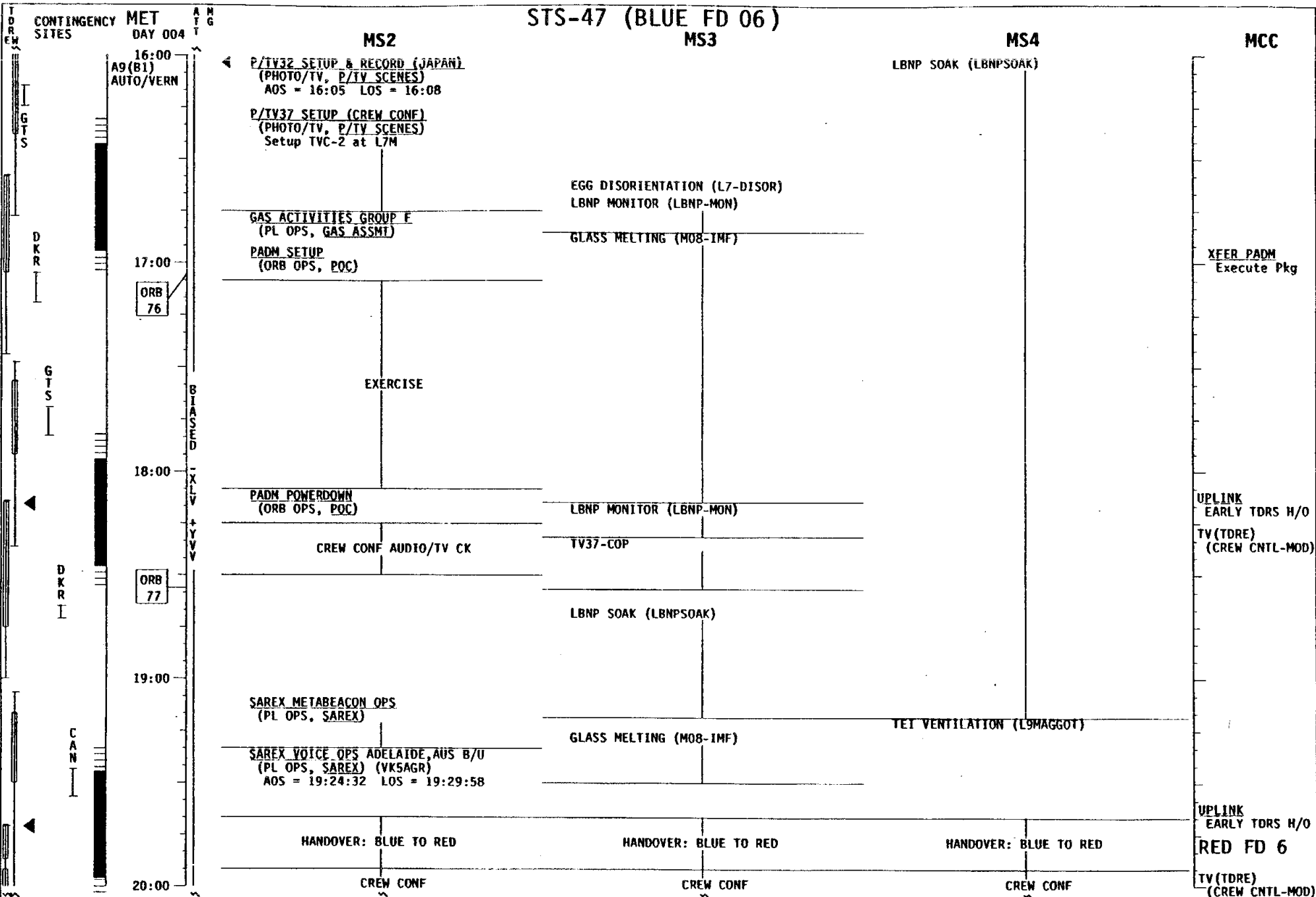


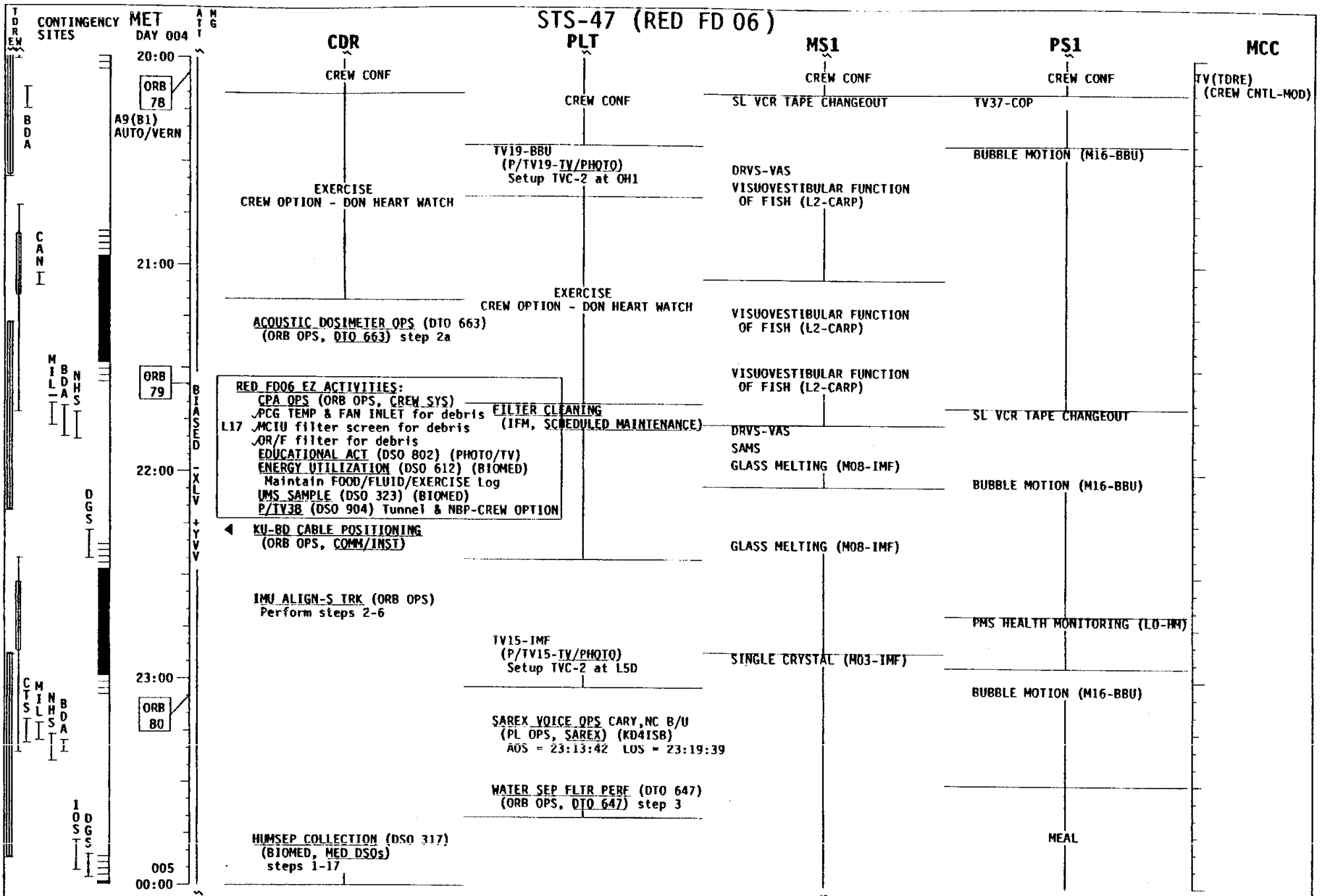


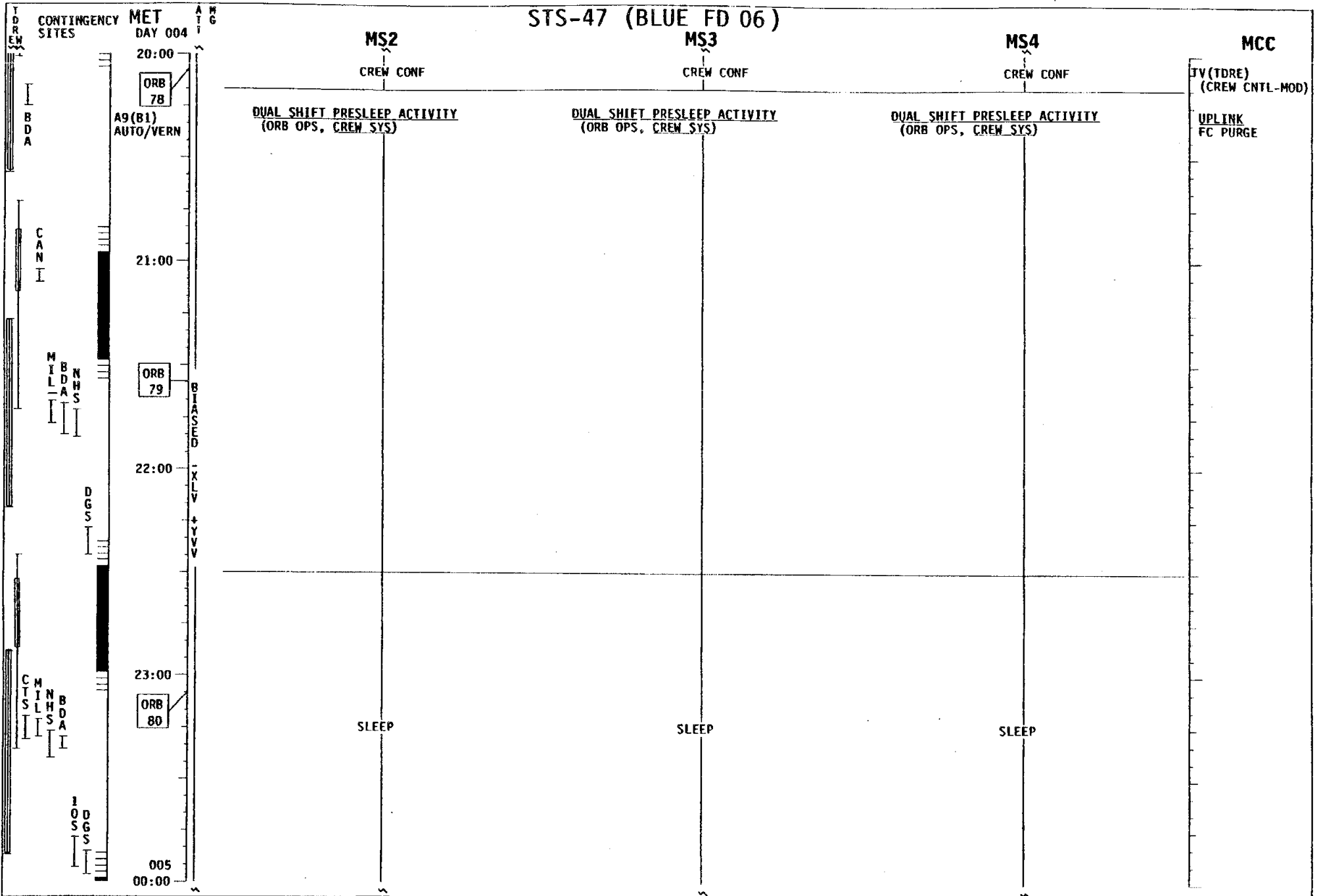


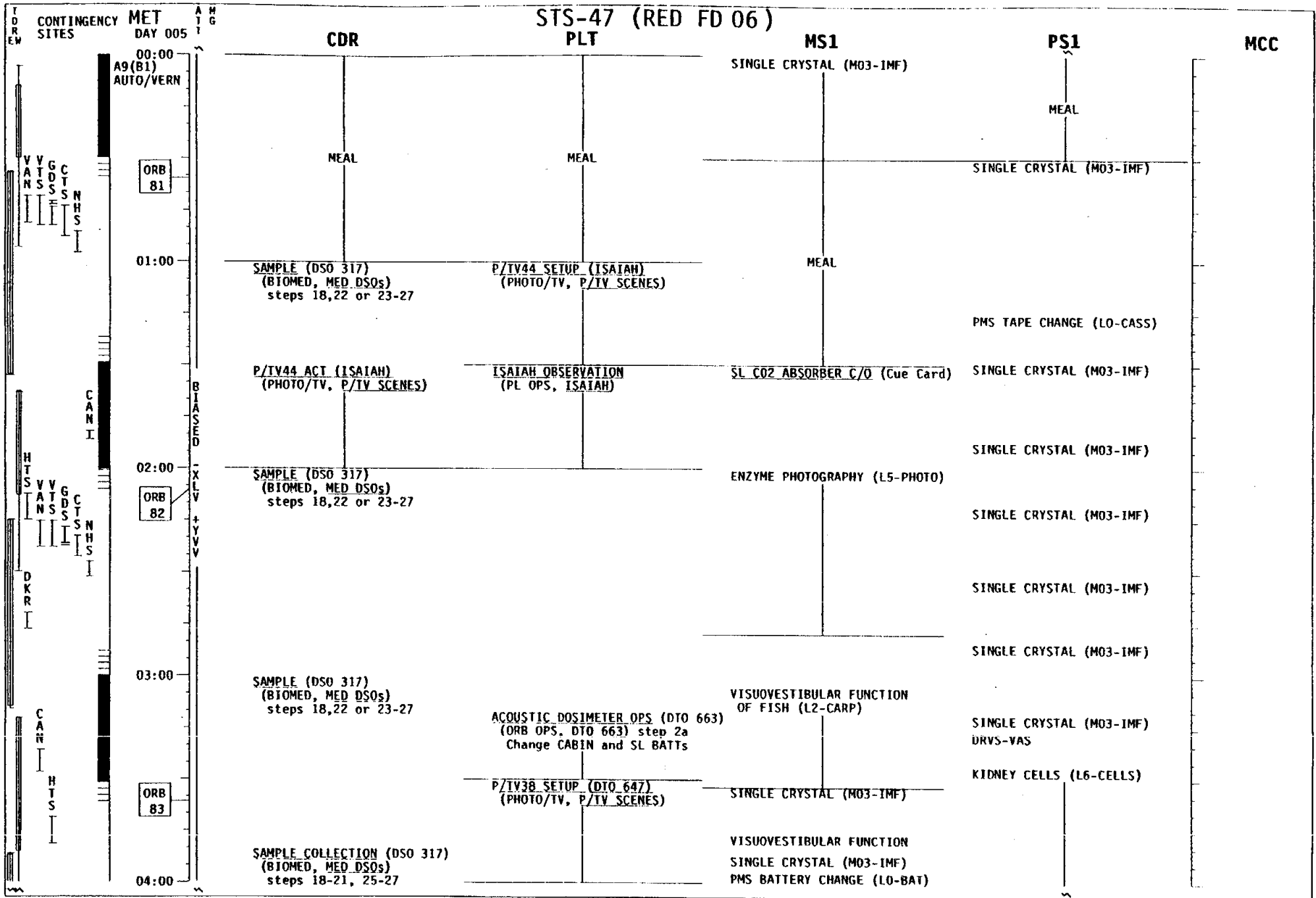


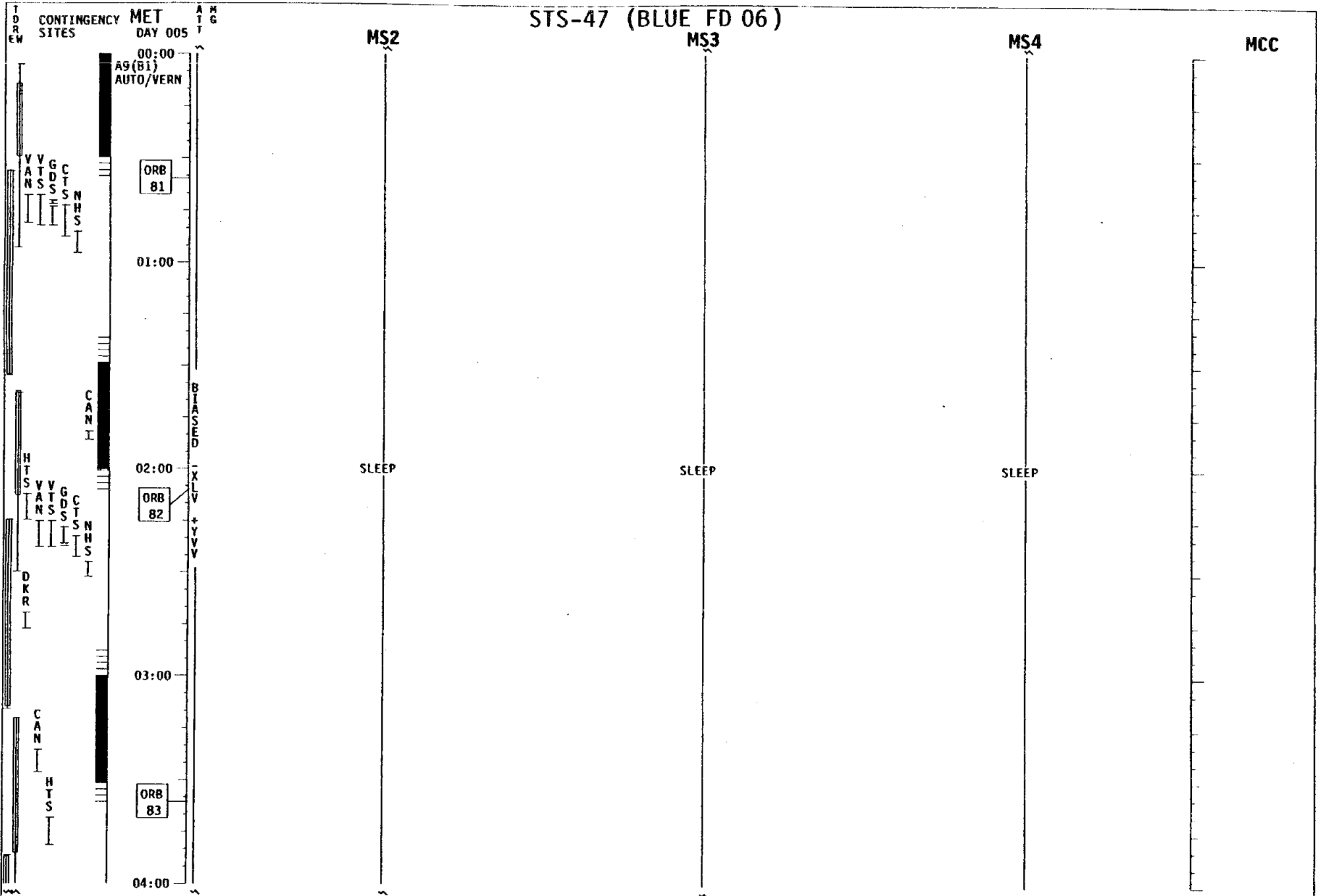


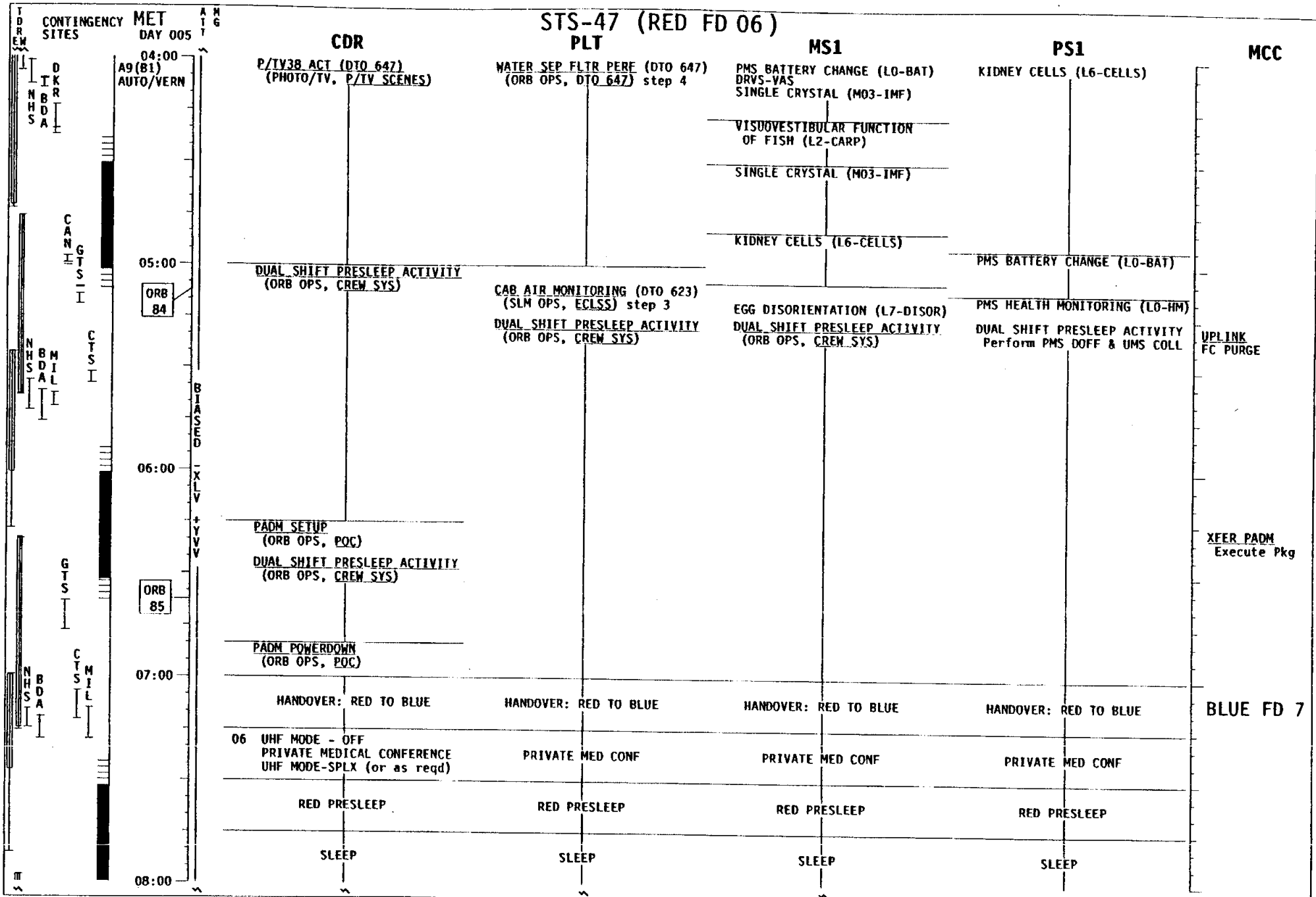






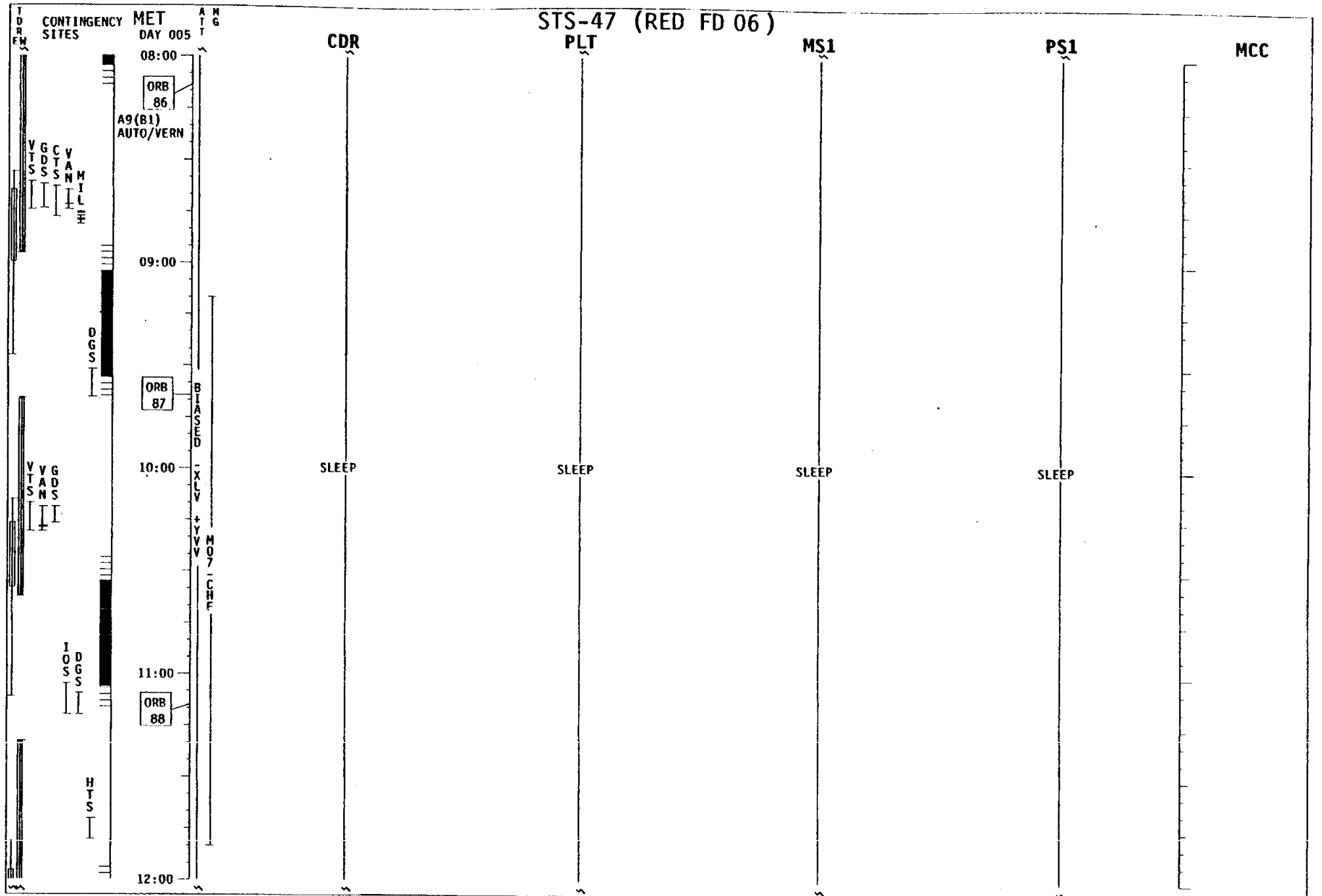




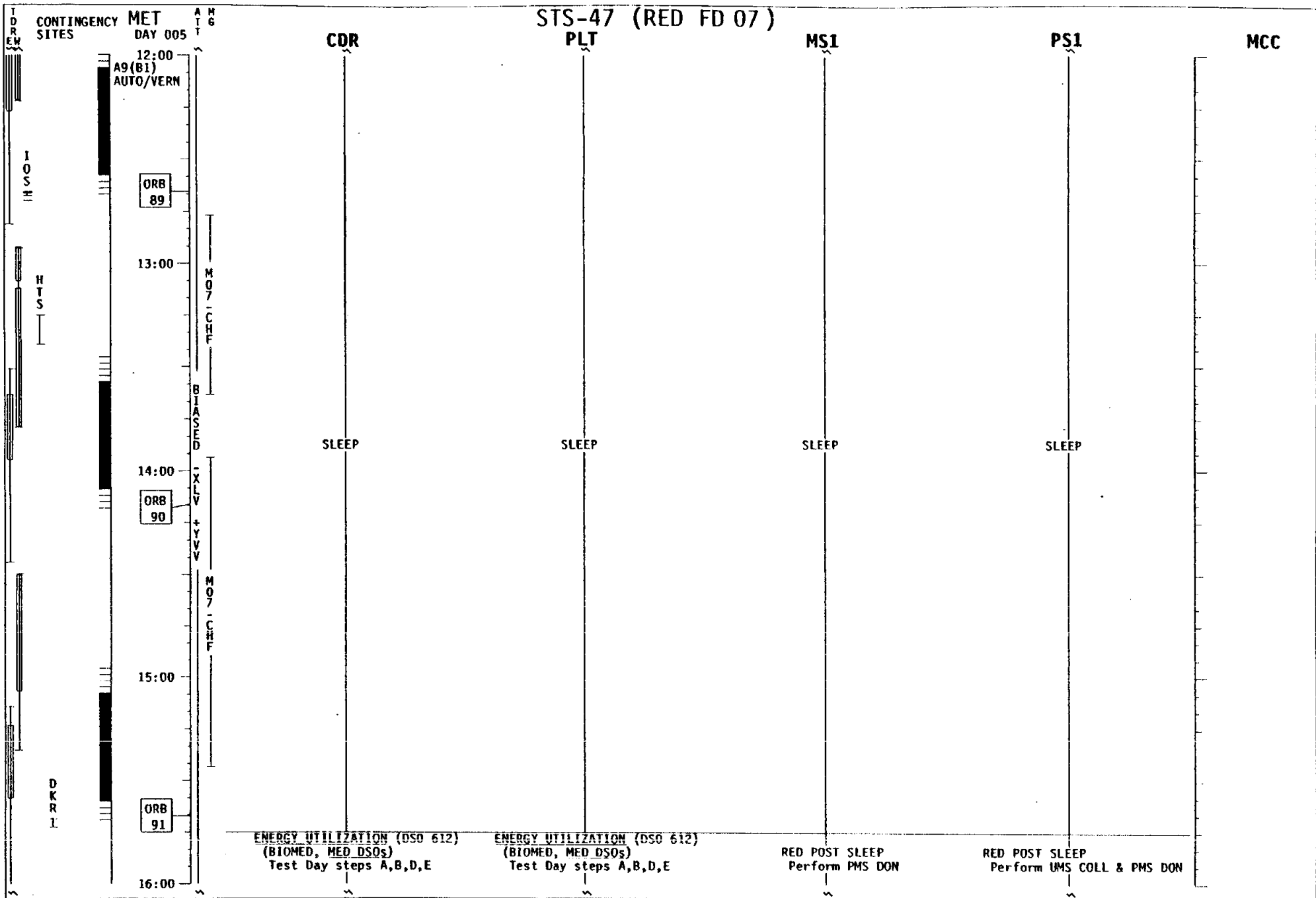


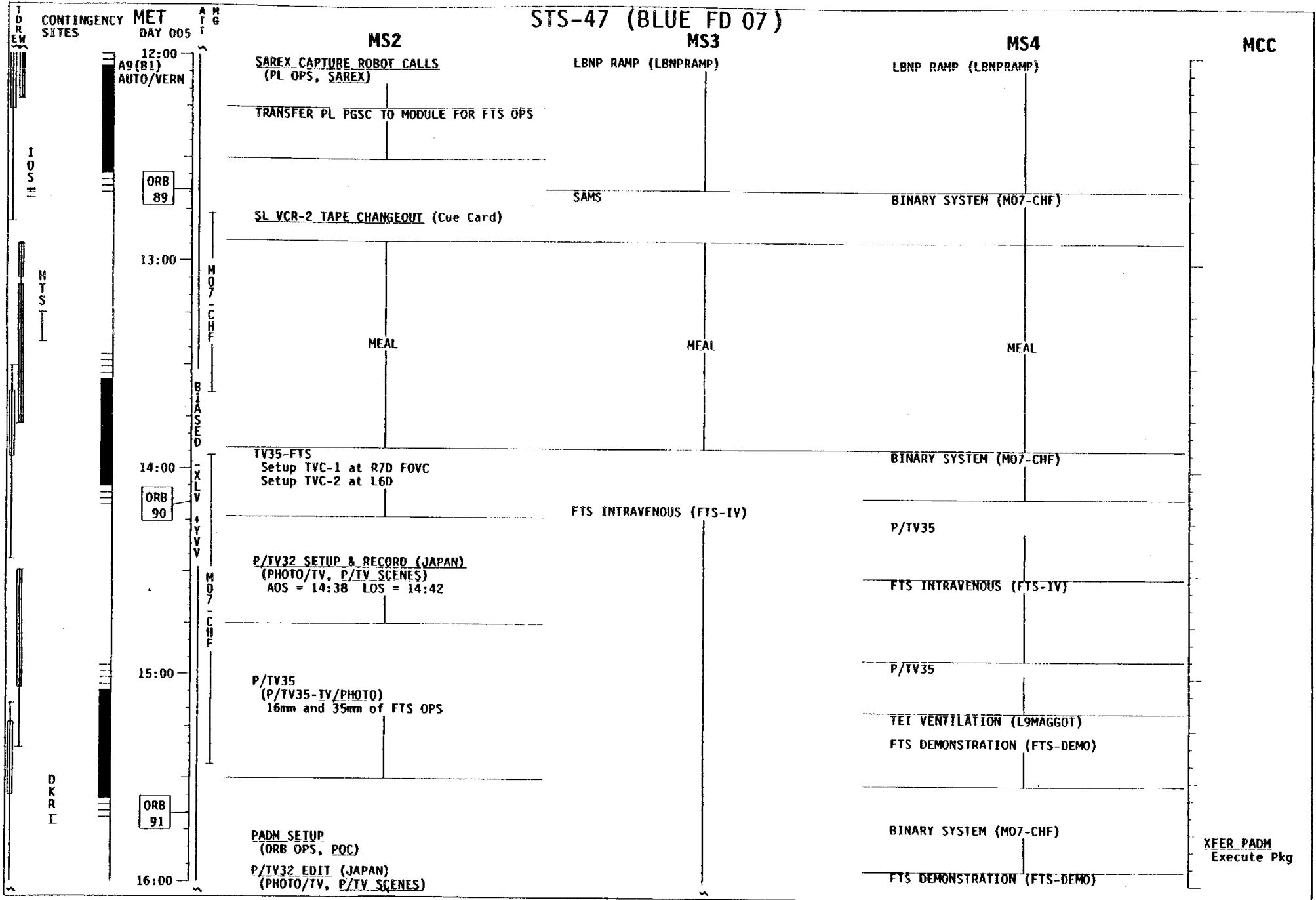


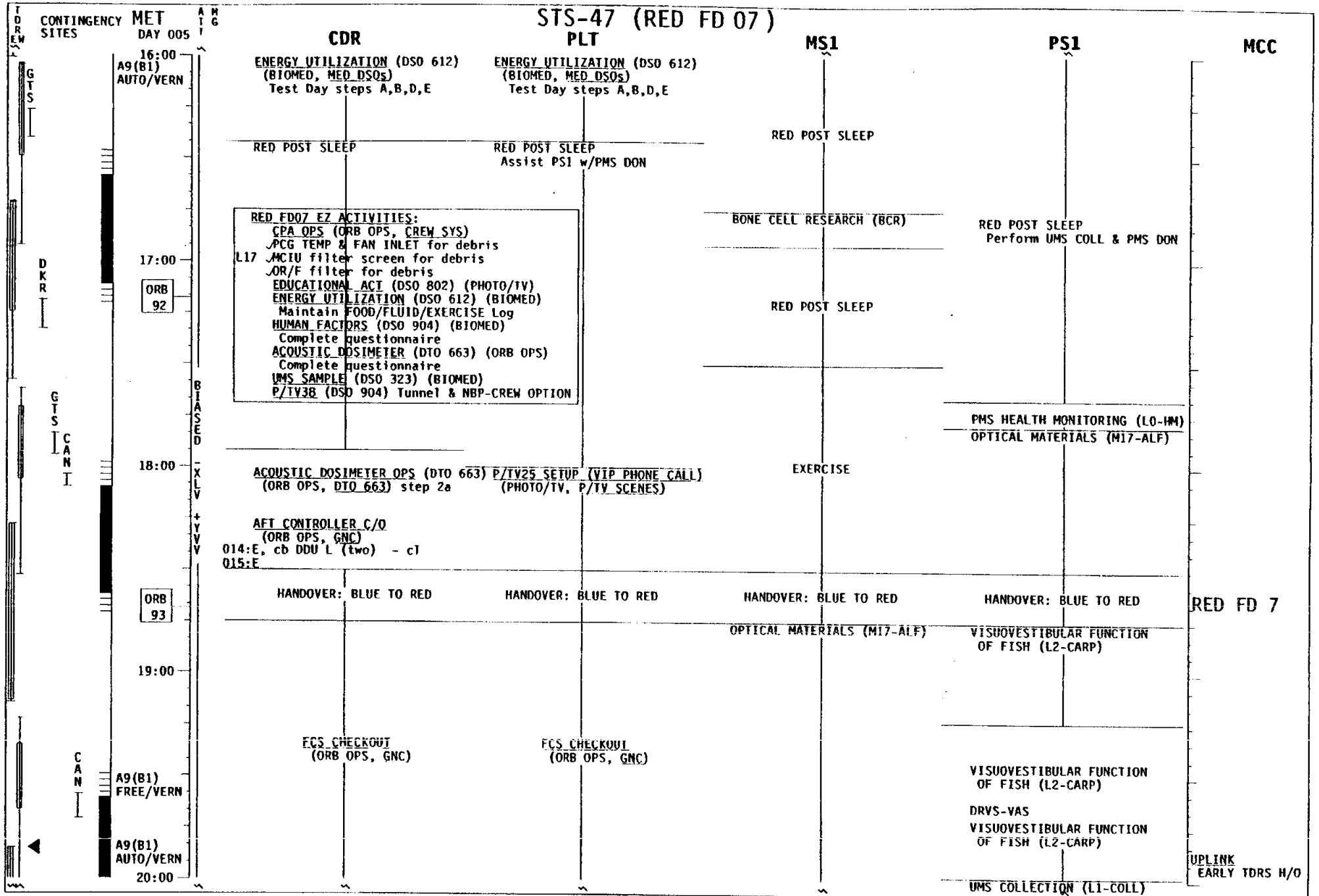


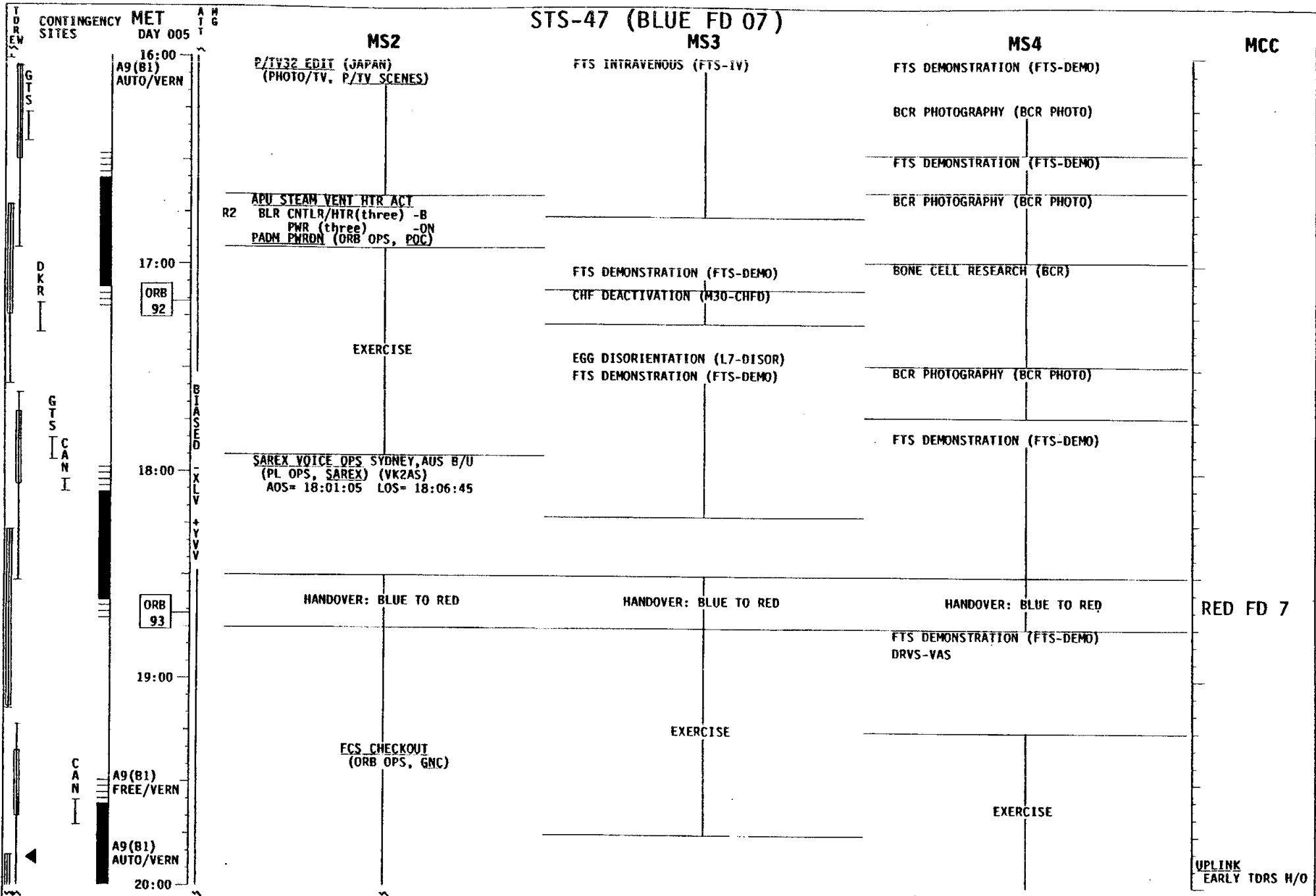


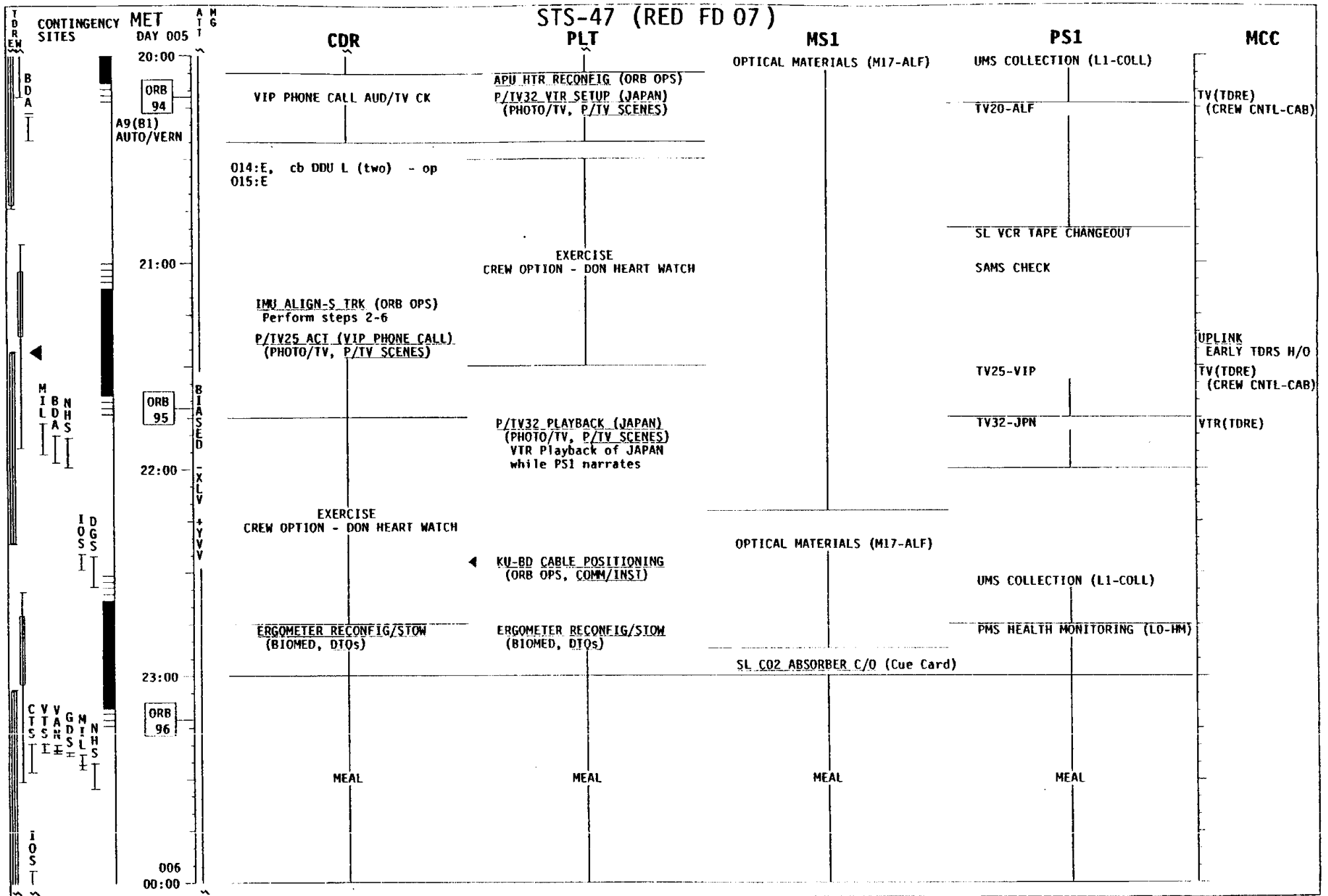




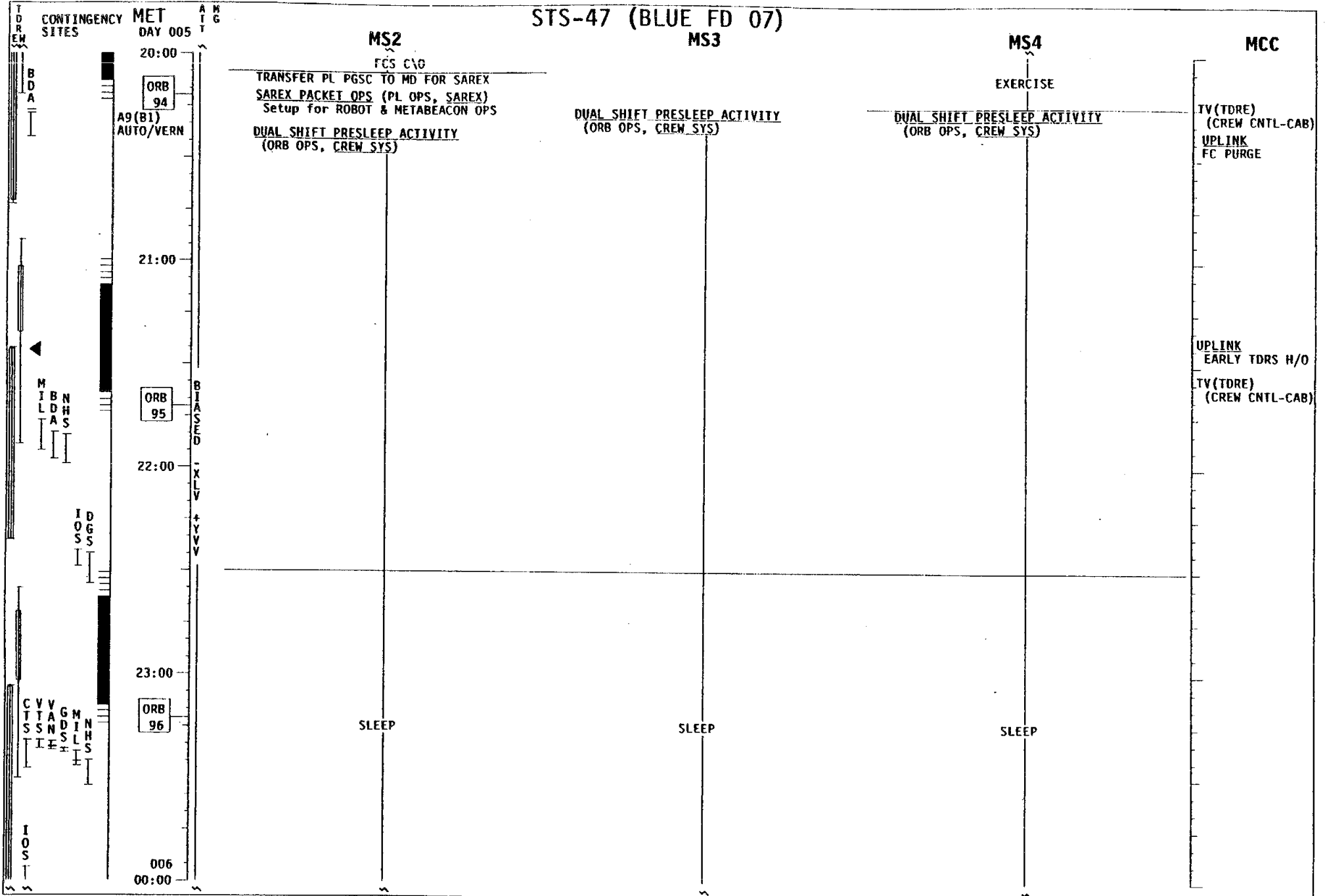


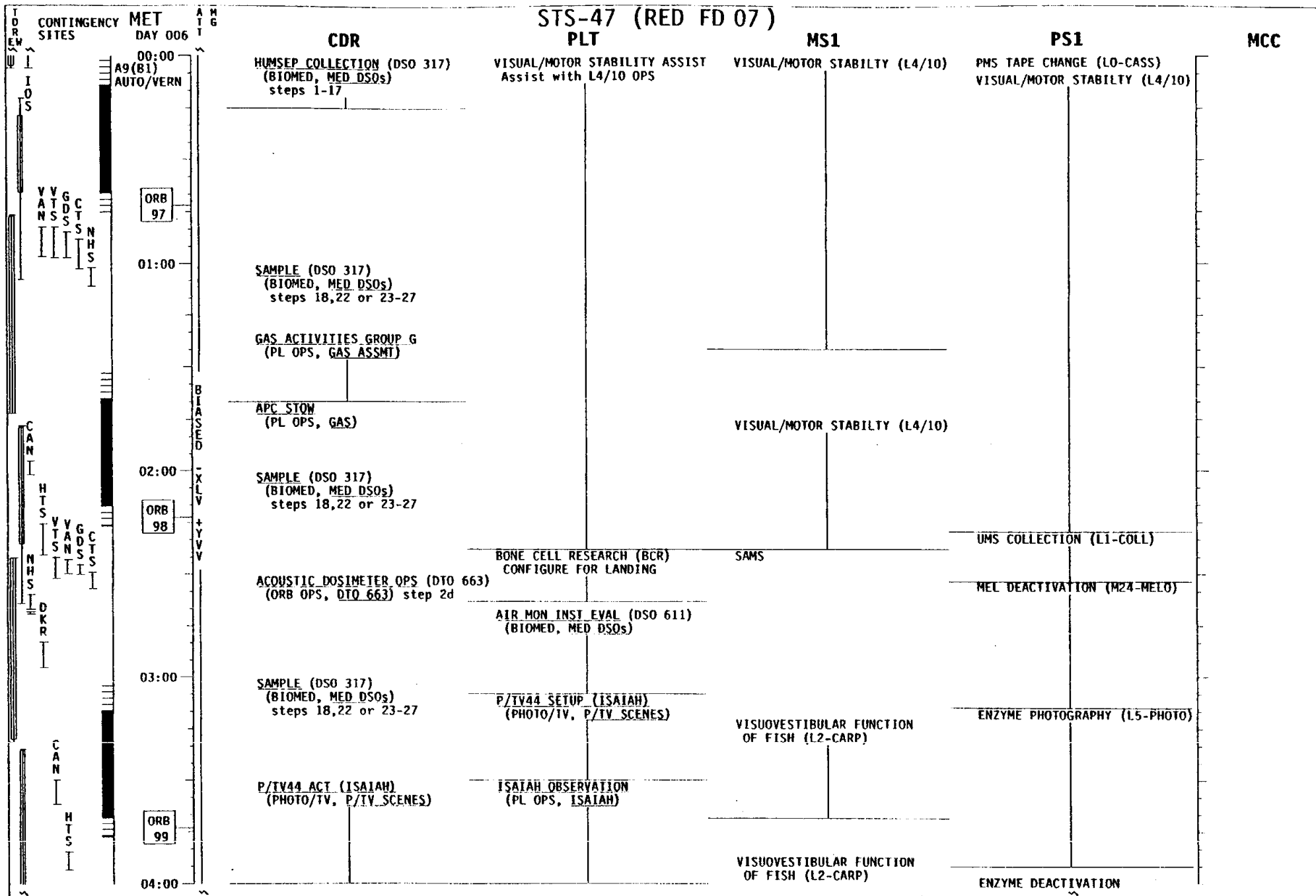




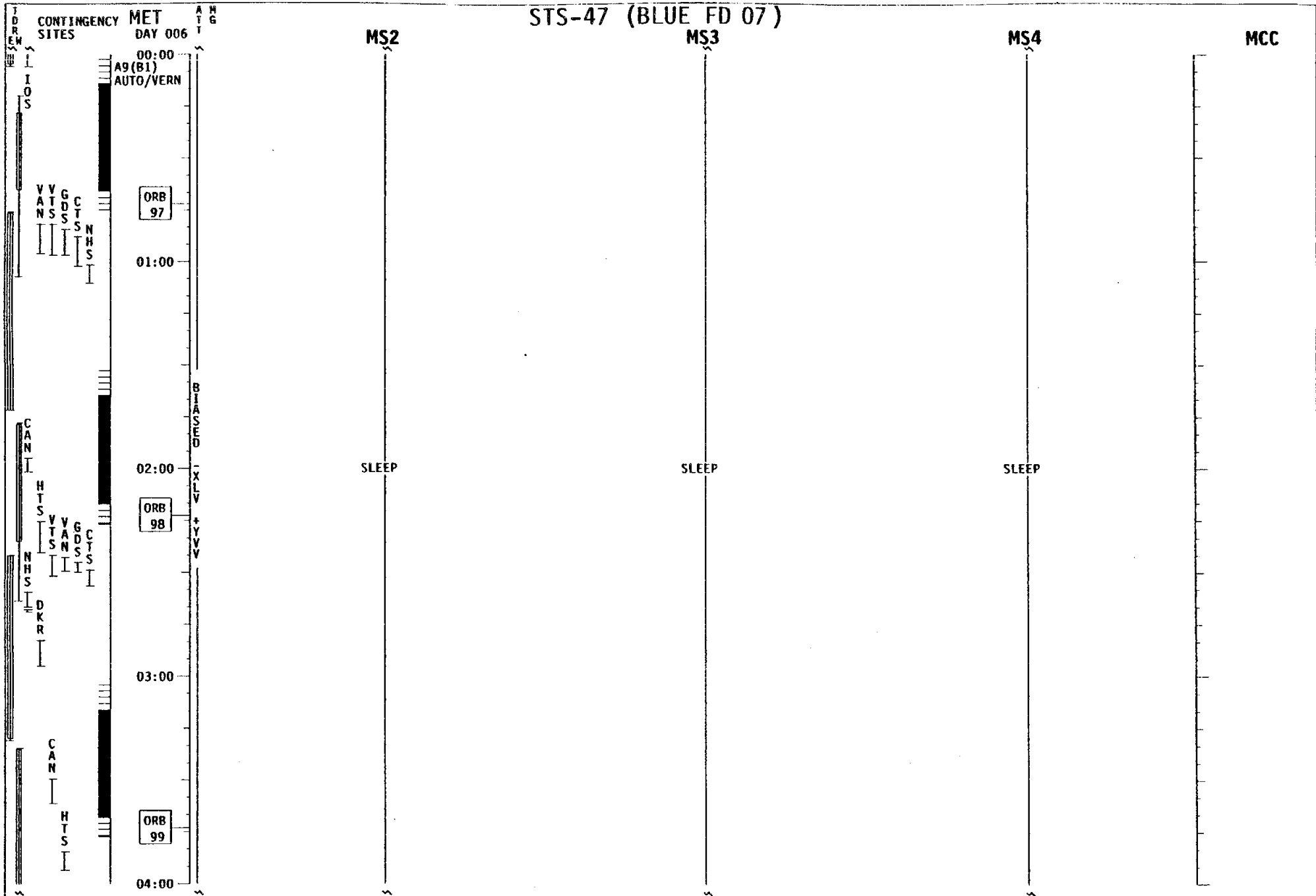








# STS-47 (BLUE FD 07)



CONTINGENCY MET  
SITES DAY 006

04:00  
A9(B1)  
AUTO/VERN

05:00  
ORB 100

06:00  
ORB 101

07:00

08:00

BD A D K R  
N H S

G T S

B D A L  
M I L

C T N H S

G T S

G D S I L  
M I L

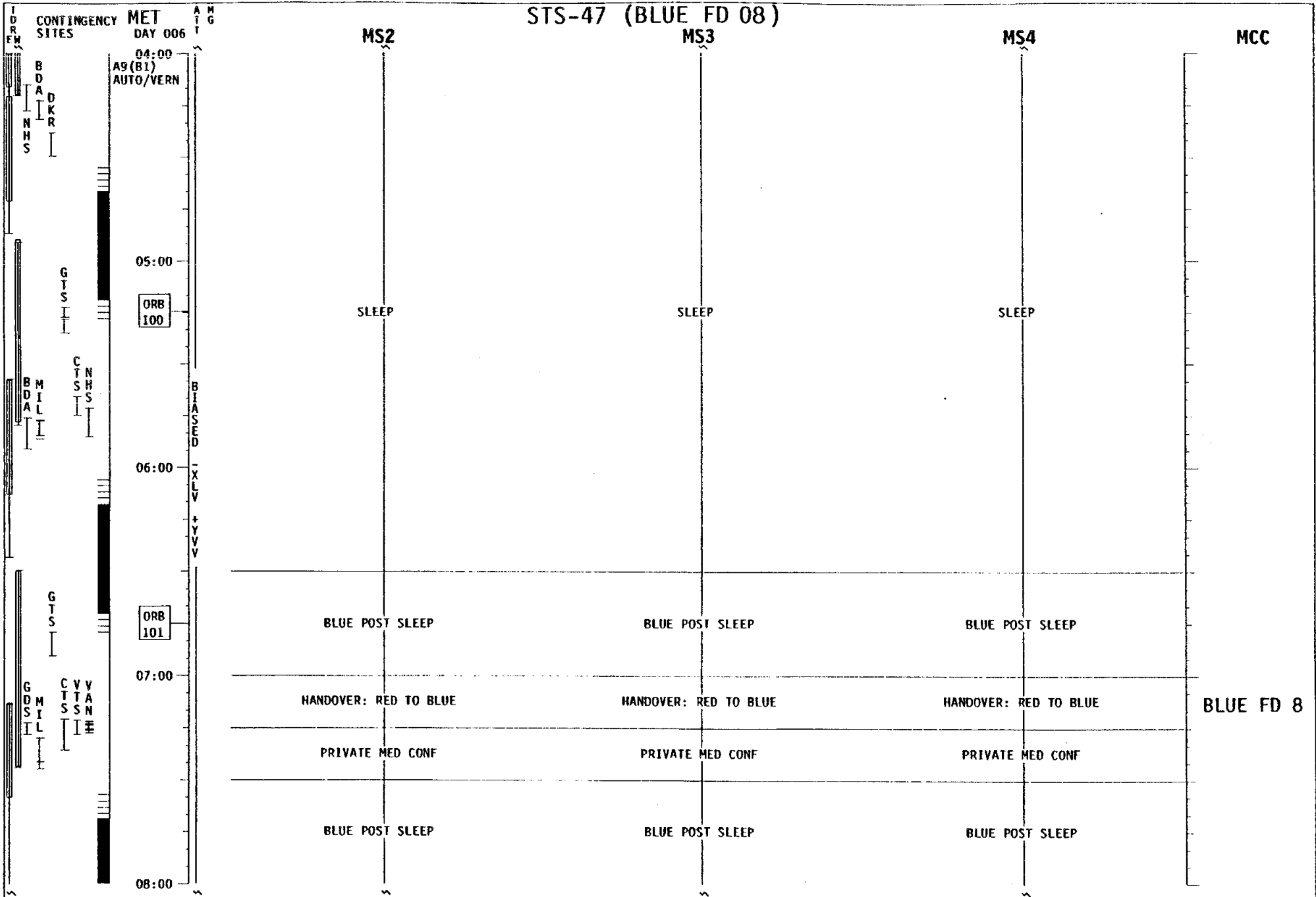
C V T T A S S N I E

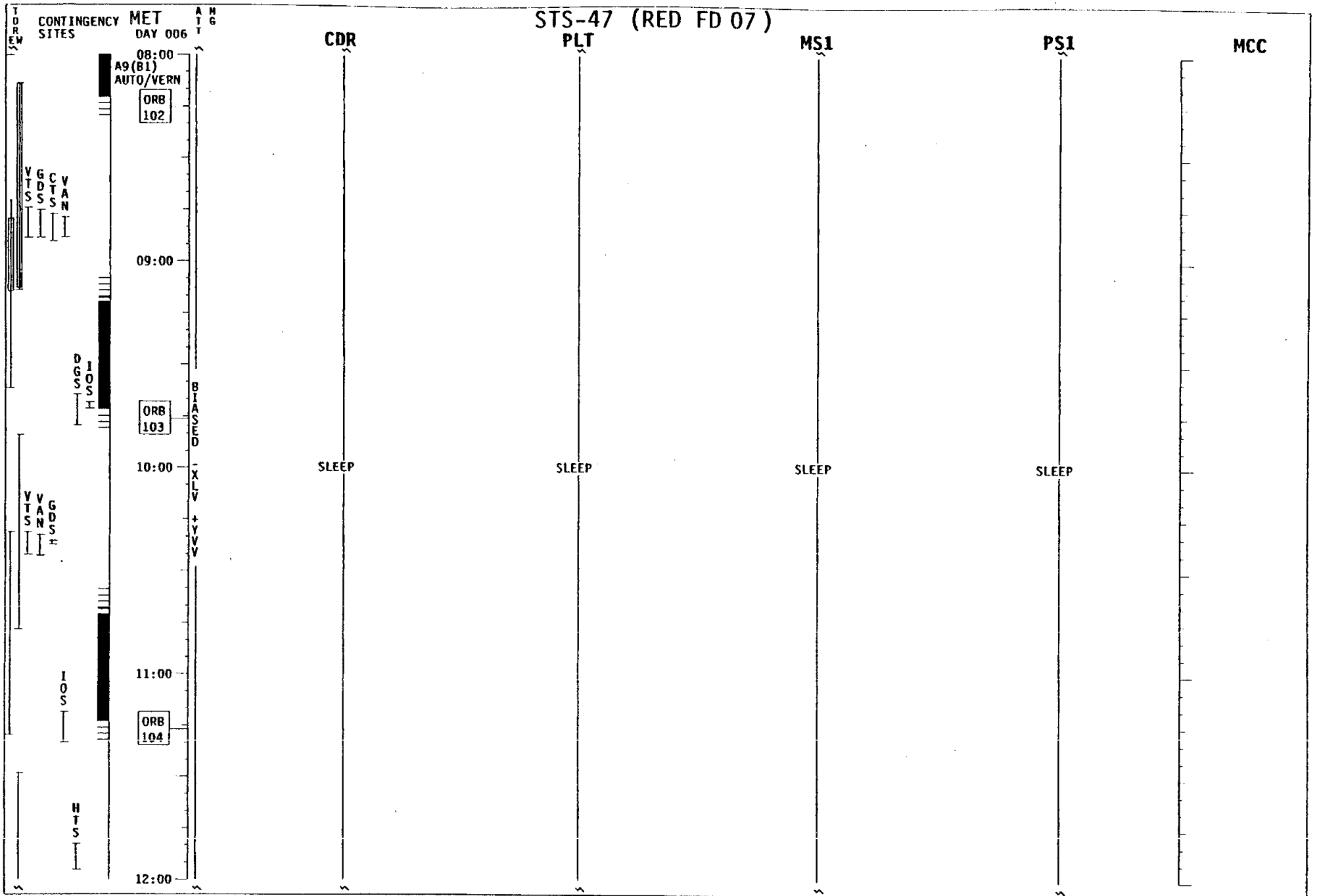
B I A S E D  
X L V  
+ Y V V

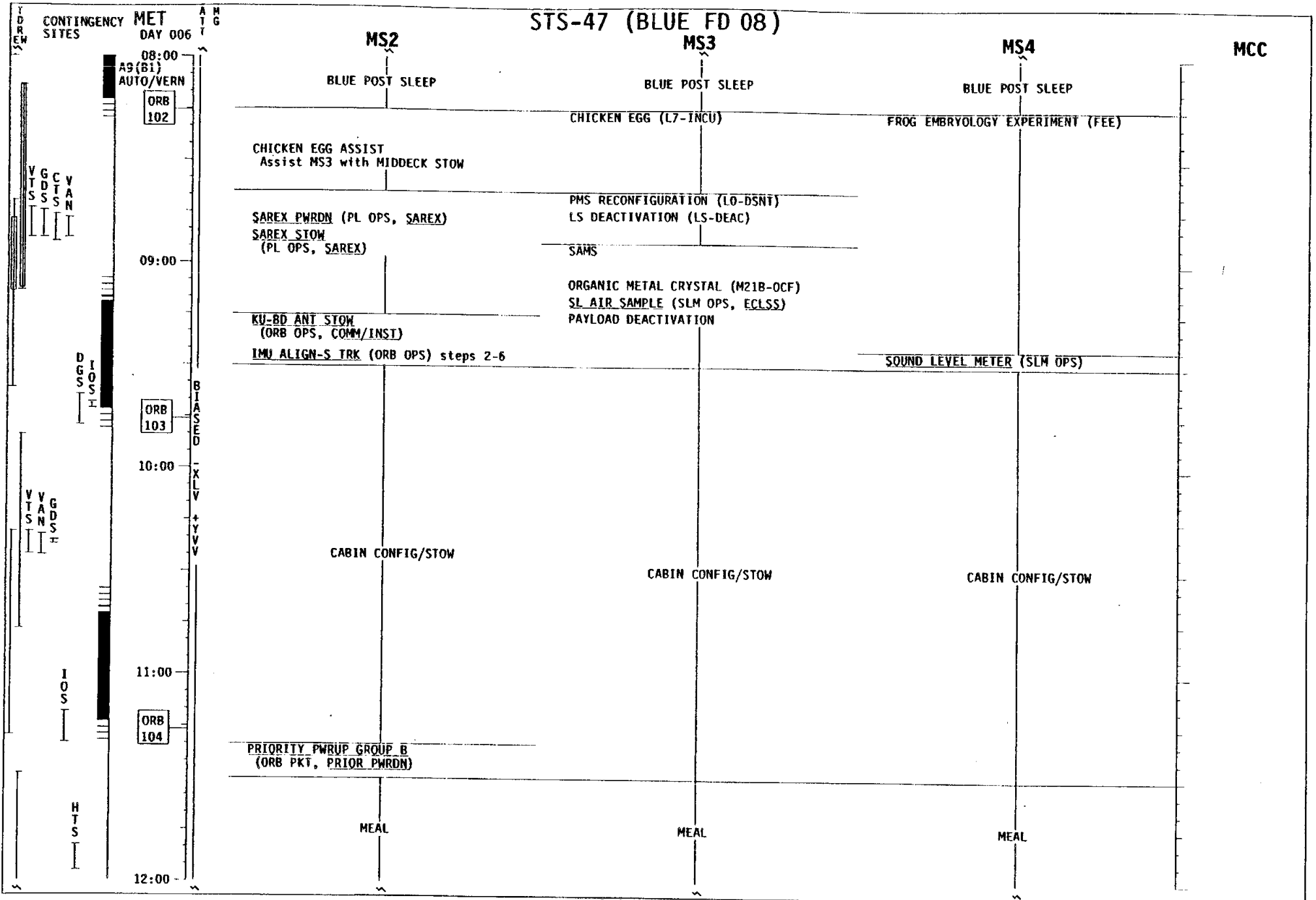
# STS-47 (RED FD 07)

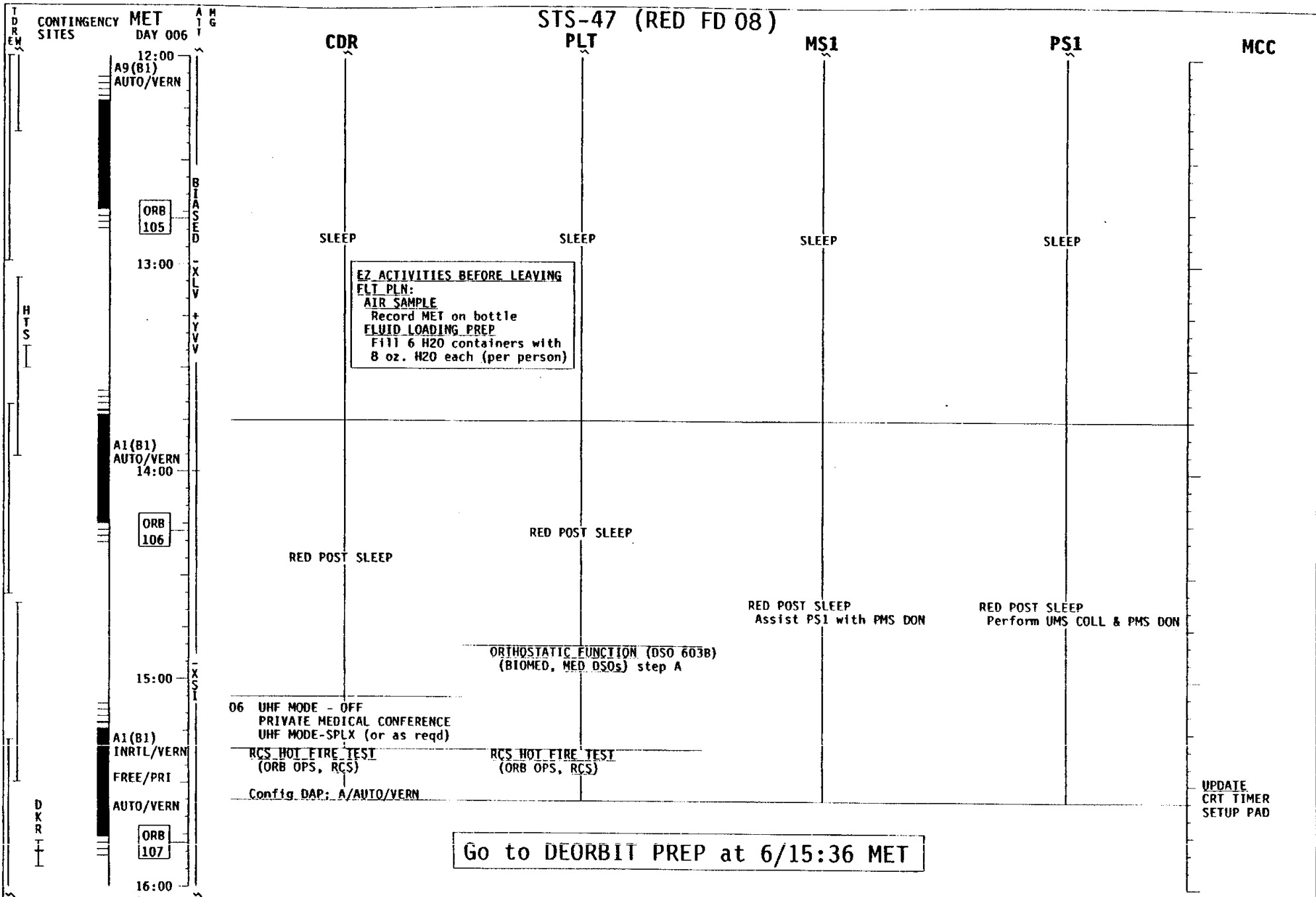
CDR	PLT	MS1	PS1	MCC
SAMPLE COLLECTION (DSO 317) (BIOMED, MED DSOs) steps 18-21, 25-27		VISUOVESTIBULAR FUNCTION OF FISH (L2-CARP)	ENZYME DEACTIVATION (L5-ENZYM) KIDNEY CELLS (L6-CELLS)	
CAB AIR MONITORING (OTO 623) (SLM OPS, ECLSS) step 3	P/TV39 SETUP (PCG) (PHOTO/TV, P/TV SCENES)	CIRCADIAN RYTHM OF FUNGI (L12-FUNG)		
JUM SEP for H2O accumulation	PCG DEACTIVATION (PCG-DEAC) (PCG-NOMINAL) step 3			
		PCR/FLY TRANSFER (L9MAGGOT)	UMS COLLECTION (L1-COLL)	
	P/TV39 ACT (PCG) (PHOTO/TV, P/TV SCENES)	HZE RADIATION SETUP (L11-HZE)	PMS HEALTH MONITORING (LO-HM) DUAL SHIFT PRESLEEP ACTIVITY Perform PMS DOFF & UMS COLL	
TEPC STOW (DSO 469) (BIOMED, MED DSOs)				
DUAL SHIFT PRESLEEP ACTIVITY (ORB OPS, CREW SYS)	DUAL SHIFT PRESLEEP ACTIVITY (ORB OPS, CREW SYS)	DUAL SHIFT PRESLEEP ACTIVITY (ORB OPS, CREW SYS)		UPLINK FC PURGE
HANDOVER: RED TO BLUE	HANDOVER: RED TO BLUE	HANDOVER: RED TO BLUE	HANDOVER: RED TO BLUE	BLUE FD 8
05 UHF MODE - OFF PRIVATE MEDICAL CONFERENCE UHF MODE-SPLX (or as reqd)	PRIVATE MED CONF	PRIVATE MED CONF	PRIVATE MED CONF	
RED PRESLEEP	RED PRESLEEP	RED PRESLEEP	RED PRESLEEP	
SLEEP	SLEEP	SLEEP	SLEEP	

# STS-47 (BLUE FD 08)

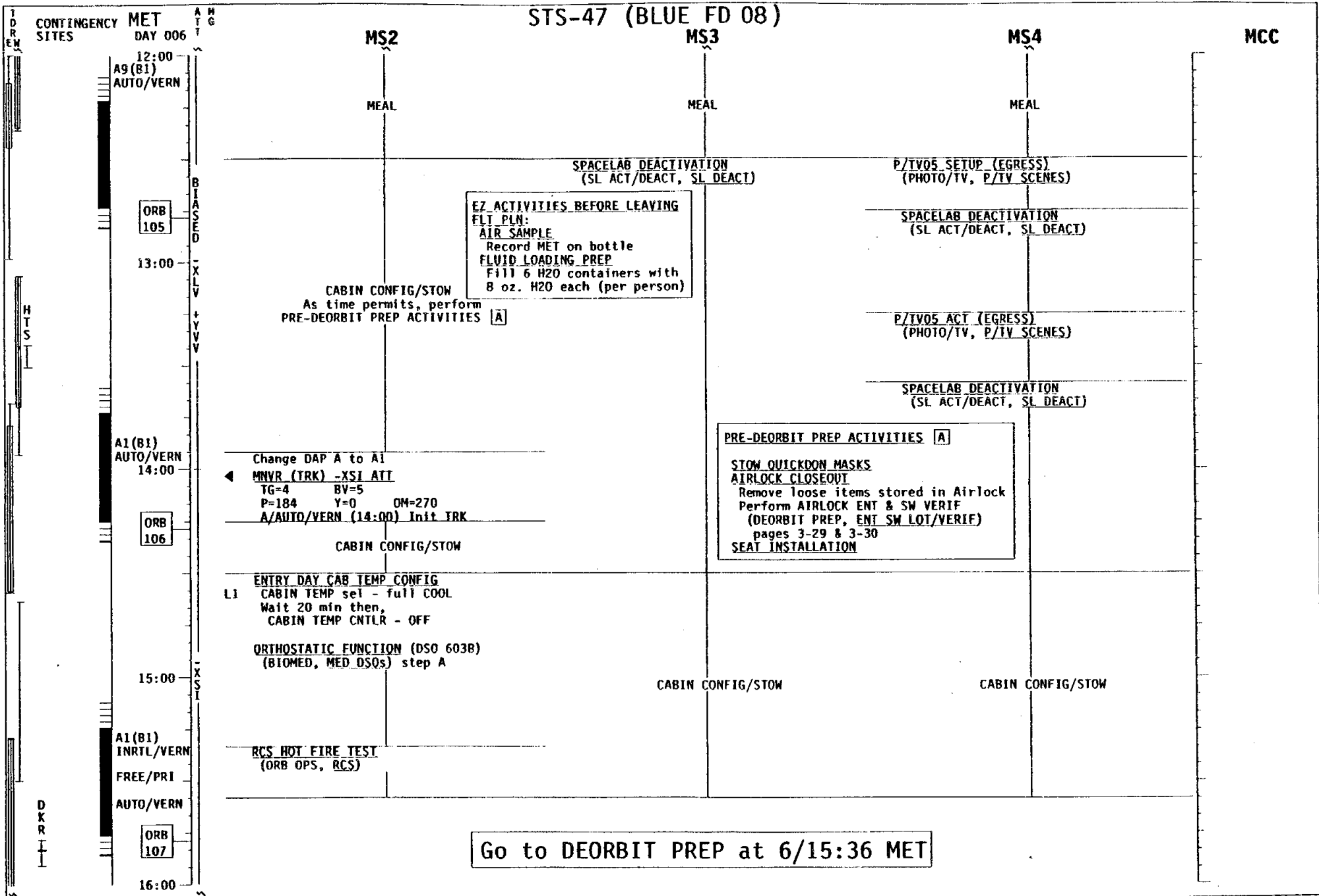












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STS-47  
ATTITUDE TIMELINE

ATTITUDE  
TIMELINE

Attitude Timeline								
GMT/MET	MNVR OPTION	DAP	E/S	REF ATT/REMARKS	EVENT			
1 000/01:12:00 MET 19:39 245/15:30:00 GMT 37:39	TGT=2 BV=3 P= 90.00 Y= 0.00 OM=270.00	A1 AUTO PRI	DSC 0.200 DB AT 5.00 DB RT 0.20	EARTH R 360 P 90	LVLH R= 0.00 P=180.00 Y= 90.00	Post Insertion Note: Not req for P.LBD opening		
2 000/03:30:00 MET 38:39 245/17:48:00 GMT 56:39	INRTL R=237.00 MNVR P=173.00 Y=284.00	A1 AUTO VERN	DSC 0.200 DB AT 1.00 DB RT 0.02	SUN R 198 P 96	Star Pair A1 -Y: 17 -Z: 26	IMU Align -Z COAS Cal Star ID: 26		
3 000/03:55:00 MET 04:07:00 245/18:13:00 GMT 25:00	TGT=2 BV=3 P= 90.00 Y= 0.00 OM= 90.00	A1 AUTO VERN	DSC 0.200 DB AT 1.00 DB RT 0.02	EARTH R 0 P 90	LVLH R= 0.00 P=180.00 Y=270.00	-ZLV Nose North		
4 000/05:10:00 MET 15:27 245/19:28:00 GMT 33:27	TGT=26 RA= 343.726 BV=1 DEC= -29.889S P= 0.00 Y= 0.00 OM=(blank)	A1 AUTO VERN	DSC 0.200 DB AT 1.00 DB RT 0.02	SUN R 290 P 158	INRTL R= 86.91 P= 30.91 Y=345.94	+X COAS Cal Star ID: 26		
5 000/05:35:00 MET 44:52 245/19:53:00 GMT 20:02:52	TGT=2 BV=5 P=178.00 Y= 1.00 OM=292.00	A1 AUTO VERN	DSC 0.200 DB AT 1.00 DB RT 0.02	EARTH R 27 P 178	LVLH R= 67.99 P= 89.82 Y= 2.23	S/L Operations		
6 006/14:00:00 MET 04:57 252/04:18:00 GMT 22:57	TGT=4 RA= 166.349 BV=5 DEC= 5.844N P=184.00 Y= 0.00 OM=270.00	A1 AUTO VERN	DSC 0.200 DB AT 1.00 DB RT 0.02	SUN R 180 P 176	INRTL R= 15.85 P= 2.05 Y=345.30	Tail Sun Rad Coldsoak		
7 006/16:38:00 MET 47:14 252/06:56:00 GMT 07:05:14	INRTL R=163.00 MNVR P= 91.00 Y=307.00	A1 AUTO PRI	DSC 0.200 DB AT 5.00 DB RT 0.20	SUN R 201 P 104	Star Pair -Y: 50 -Z: 54	D-0 IMU Align		
8 006/16:58:00 MET 17:00:40 252/07:16:00 GMT 18:40	INRTL R=183.00 MNVR P= 59.00 Y= 16.00	B1 AUTO PRI	DSC 0.500 DB AT 3.00 DB RT 0.20	SUN R 203 P 120	Star Pair -Y: 23 -Z: 37	D-0 IMU Verif		
9 006/19:21:00 MET 26:05 252/09:39:00 GMT 44:05	INRTL R= 65.00 MNVR P=245.00 Y= 20.00	TRANS AUTO	DSC 0.500 DB AT 3.50 DB RT 0.20	SUN R 112 P 57		D-0 Burn TIG: 6/19:36		

\*\*\* ALL ATTITUDES IN MEAN OF 1950 \*\*\*  
\*\*\* PYR EULER SEQUENCE \*\*\*

STS-47 DAP BOOK

## DAP A CONFIGURATIONS

	ITEM #	A1*	A2	A3	A4	A5	A6	A7	A8	A9
<u>TRANSLATION</u>										
PULSE ft/sec	1	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.05	0.10
<u>ROTATION</u>										
DSC RT NORM °/sec	2	0.200	0.400	0.200	0.500	0.200	0.200	0.200	0.200	0.100
VERN °/sec	3	0.200	0.400	0.008	0.200	0.200	0.200	0.200	0.200	0.100
PULSE NORM °/sec	4	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
VERN °/sec	5	0.010	0.010	0.010	0.010	0.050	0.010	0.010	0.010	0.010
COMP NORM °/sec	6	.00	.00	.00	.00	.00	.00	.00	.00	.00
VERN °/sec	7	.000	.000	.000	.000	.000	.000	.000	.000	.000
<u>DEADBAND</u>										
ATT NORM (deg)	8	5.00	1.00	1.00	3.00	5.00	5.00	2.00	2.00	3.00
VERN (deg)	9	1.000	1.000	0.070	1.000	1.000	1.000	1.000	1.000	0.500
RATE NORM °/sec	10	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
VERN °/sec	11	.020	.020	.010	.020	.020	.020	.020	.020	.010
<u>JET OPT</u>										
P	12	1	1	1	1	1	3	1 or 3	1	3
Y	13	1	1	3	1	1	3	1 or 3	1	3
<u>CNTL ACCEL</u>										
	14	0	0	0	0	0	0	0	0	0

\*I-LOADED OPS-2 DAP Configuration

DAP B CONFIGURATIONS

	ITEM #	B1*	B2	B3	B4	B5	B6	B7	B8
<u>TRANSLATION</u>									
PULSE ft/sec	15	0.02	0.02	0.02	0.02	0.02		0.05	0.01
<u>ROTATION</u>									
DSC RT NORM °/sec	16	0.500	0.200	0.200	0.200	0.200		0.500	0.200
VERN °/sec	17	0.200	0.200	0.200	0.008	0.016		0.200	0.200
PULSE NORM °/sec	18	0.04	0.04	0.04	0.04	0.04		0.04	0.04
VERN °/sec	19	0.002	0.002	0.002	0.002	0.002		0.002	0.002
COMP NORM °/sec	20	.00	.00	.00	.00	.00		.00	.00
VERN °/sec	21	.000	.000	.000	.000	.000		.000	.000
<u>DEADBAND</u>									
ATT NORM (deg)	22	3.00	3.00	3.00	0.30	3.00		2.00	2.00
VERN (deg)	23	1.000	1.000	1.000	0.100	0.033		1.000	1.000
RATE NORM °/sec	24	0.20	0.20	0.20	0.20	0.20		0.20	0.20
VERN °/sec	25	.020	.020	.020	.010	.020		.020	.020
<u>JET OPT</u>									
P	26	1	3	1	3	3		1 or 3	1
Y	27	1	3	1	3	3		1 or 3	1
CNTL ACCEL	28	0	0	0	0	0		0	0

\*I-LOADED OPS-2 DAP Configuration



ALT DAP CONFIGURATIONS

	ITEM #	ALT1*	ALT2
RATE DEADBAND	32	0.200	0.070
JET OPTION	33	1	3
NUMBER OF JETS	34	2	1
ON TIME	35	0.08	0.08
DELAY	36	0.00	1.00

\*I-LOADED OPS-2 DAP Configuration



<u>DAP</u>	<u>PURPOSE</u>	<u>DAP</u>	<u>PURPOSE</u>
A1	- NOMINAL IMU ALIGN LOSS OF VERN (NOSE & TAIL)	B1	- NOMINAL PRCS IMU ALIGN OMS & RCS BURNS
A2	- PTC	B2	- LOSS OF VERN (TAIL ONLY)
A3	- GG	B3	- LOSS OF VERN (NOSE & TAIL)
A4	- PRE/POST DEPLOY		GG MNVR
A5	- IMU ROTATION	B4	- SSUS DEPLOY
A6	- LOSS OF VERN (TAIL ONLY)	B5	- COAS CAL
A7	- RENDEZVOUS	B6	- (Blank)
A8	- PROX OPS	B7	- RENDEZVOUS
A9	- SL-J OPS	B8	- PROX OPS

FLT PLN-1a/47/0/A



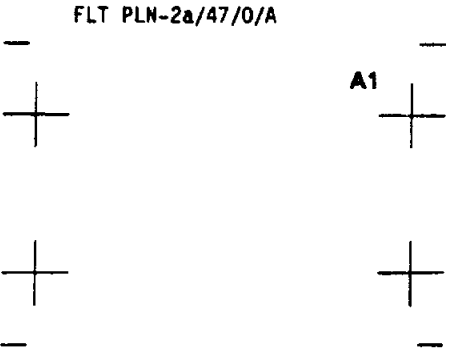
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FLT PLN-1b/47/0/A





**DAP A**



FLT PLN-2a/47/0/A

**A1**

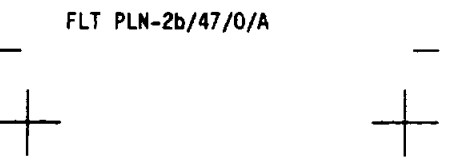
**DAP A1**

PURPOSE:  
 NOMINAL  
 IMU ALIGN  
 LOSS OF VERN  
 (NOSE & TAIL)

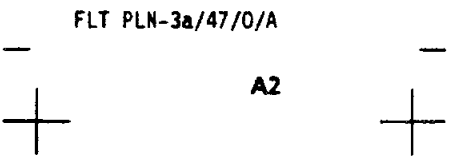


**A1**

0.1 0	1	TRANSLATION	
		PULSE	
		ROTATION	
0.2 0 0	2	DSC RT	NORM
0.2 0 0	3	VERN	
0.1 0	4	PULSE	NORM
0.0 1 0	5	VERN	
.0 0 0	6	COMP	NORM
.0 0 0	7	VERN	
		DEADBAND	
5.0 0	8	ATT	NORM
1.0 0 0	9	VERN	
0.2 0	10	RATE	NORM
.0 2 0	11	VERN	
1	12	JET OPT	P
1	13		Y
0	14	CNTL ACCEL	



FLT PLN-2b/47/0/A



FLT PLN-3a/47/0/A

**A2**



A1

DAP A2

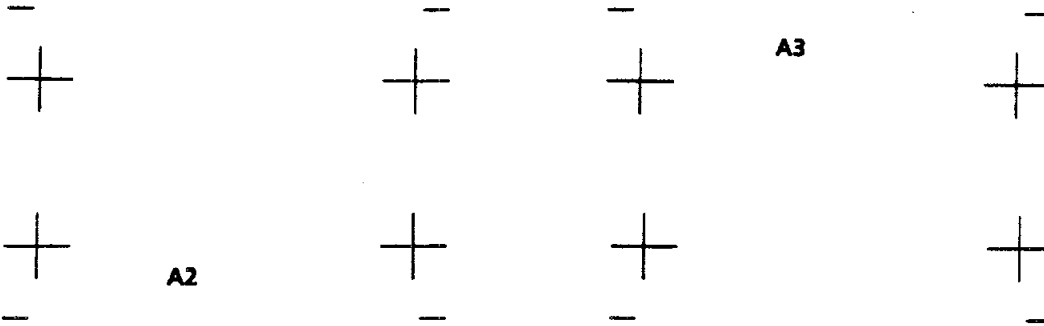
PURPOSE:  
PTC

A2

0.1 0	1	TRANSLATION	
		PULSE	
ROTATION			
0.4 0 0	2	DSC RT	NORM
0.4 0 0	3		VERN
0.1 0 0	4	PULSE	NORM
0.0 1 0	5		VERN
.0 0 0	6	COMP	NORM
.0 0 0	7		VERN
DEADBAND			
1.0 0	8	ATT	NORM
1.0 0 0	9		VERN
0.2 0	10	RATE	NORM
.0 2 0	11		VERN
1	12	JET OPT	P
1	13		Y
0	14	CNTL ACCEL	

FLT PLN-3b/47/0/A

FLT PLN-4a/47/0/A



A3

A2

DAP A3

PURPOSE:  
GG

A3

0.1 0	1	TRANSLATION	
		PULSE	
ROTATION			
0.2 0 0	2	DSC RT	NORM
0.0 0 8	3		VERN
0.1 0 0	4	PULSE	NORM
0.0 1 0	5		VERN
.0 0 0	6	COMP	NORM
.0 0 0	7		VERN
DEADBAND			
1.0 0	8	ATT	NORM
0.0 7 0	9		VERN
0.2 0	10	RATE	NORM
.0 1 0	11		VERN
1	12	JET OPT	P
3	13		Y
0	14	CNTL ACCEL	

FLT PLN-4b/47/0/A

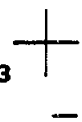
FLT PLN-5a/47/0/A



A4



A3



DAP A4

PURPOSE:  
PRE/POST DEPLOY

A4

0.1 0	1	TRANSLATION	
		PULSE	
ROTATION			
0.5 0 0	2	DSC RT	NORM
0.2 0 0	3		VERN
0.1 0	4	PULSE	NORM
0.0 1 0	5		VERN
.0 0 0	6	COMP	NORM
.0 0 0	7		VERN
DEADBAND			
3.0 0	8	ATT	NORM
1.0 0 0	9		VERN
0.2 0	10	RATE	NORM
.0 2 0	11		VERN
1	12	JET OPT	P
1	13		Y
0	14	CNTL ACCEL	

FLT PLN-5b/47/0/A

FLT PLN-6a/47/0/A



A5



A4

DAP A5

PURPOSE:  
IMU ROTATION

A5

0.1 0	1	TRANSLATION	
		PULSE	
ROTATION			
0.2 0 0	2	DSC RT	NORM
0.2 0 0	3		VERN
0.1 0	4	PULSE	NORM
0.0 5 0	5		VERN
.0 0 0	6	COMP	NORM
.0 0 0	7		VERN
DEADBAND			
5.0 0 0	8	ATT	NORM
1.0 0 0	9		VERN
0.2 0	10	RATE	NORM
.0 2 0	11		VERN
1	12	JET OPT	P
1	13		Y
0	14	CNTL ACCEL	

FLT PLN-6b/47/0/A

FLT PLN-7a/47/0/A



A6



A5



DAP A6

PURPOSE:

LOSS OF VERN  
(TAIL ONLY)

A6

0.1 0 1 TRANSLATION  
PULSE

0.2 0 0	2	ROTATION
0.2 0 0	3	DSC RT NORM
0.1 0 0	4	VERN
0.0 1 0	5	PULSE NORM
0.0 1 0	6	VERN
.0 0 0	7	COMP NORM
.0 0 0	7	VERN

5.0 0 0	8	DEADBAND
1.0 0 0	9	ATT NORM
		VERN

0.2 0	10	RATE	NORM
.0 2 0	11		VERN

3	12	JET OPT	P
3	13		Y

0 14 CNTL ACCEL

FLT PLN-7b/47/0/A

FLT PLN-8a/47/0/A



A7



A6

DAP A7

PURPOSE:

RENDEZVOUS

A7

0.1 0 1 TRANSLATION  
PULSE

0.2 0 0	2	ROTATION
0.2 0 0	3	DSC RT NORM
0.1 0 0	4	VERN
0.0 1 0	5	PULSE NORM
0.0 1 0	6	VERN
.0 0 0	7	COMP NORM
.0 0 0	7	VERN

2.0 0 0	8	DEADBAND
1.0 0 0	9	ATT NORM
		VERN

0.2 0	10	RATE	NORM
.0 2 0	11		VERN

1 or 3	12	JET OPT	P
1 or 3	13		Y

0 14 CNTL ACCEL

FLT PLN-8b/47/0/A

FLT PLN-9a/47/0/A



A8



A7



DAP A8

PURPOSE:  
PROX OPS

A8

0.0 5	1	TRANSLATION	
		PULSE	
0.2 0 0	2	ROTATION	
0.2 0 0	3	DSC RT	NORM
0.1 0 0	4		VERN
0.0 1 0	5	PULSE	NORM
.0 0 0	6		VERN
.0 0 0	7	COMP	NORM
			VERN
2.0 0	8	DEADBAND	
1.0 0 0	9	ATT	NORM
			VERN
0.2 0	10	RATE	NORM
.0 2 0	11		VERN
1	12	JET OPT	P
1	13		Y
0	14	CNTL ACCEL	

FLT PLN-9b/47/0/A

FLT PLN-10a/47/0/A



A9



A8



DAP A9

PURPOSE:  
SL-J OPERATIONS

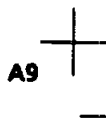
A9

0.1 0	1	TRANSLATION	
		PULSE	
0.1 0 0	2	ROTATION	
0.1 0 0	3	DSC RT	NORM
0.1 0 0	4		VERN
0.0 1 0	5	PULSE	NORM
.0 0 0	6		VERN
.0 0 0	7	COMP	NORM
			VERN
3.0 0	8	DEADBAND	
0.5 0 0	9	ATT	NORM
			VERN
0.2 0	10	RATE	NORM
.0 1 0	11		VERN
3	12	JET OPT	P
3	13		Y
0	14	CNTL ACCEL	

FLT PLN-10b/47/0/A

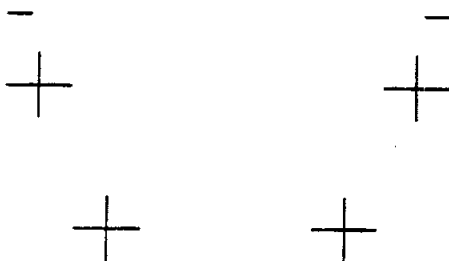
FLT PLN-11a/47/0/A



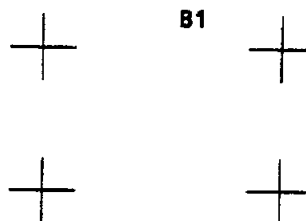


DAP B

FLT PLN-11b/47/0/A



FLT PLN-12a/47/0/A



DAP B1

PURPOSE:

NOMINAL  
PRCS IMU ALIGN  
OMS & RCS BURNS

B1

15	0.0 2
16	0.5 0 0
17	0.2 0 0
18	0.0 0 4
19	0.0 0 2
20	.0 0 0
21	.0 0 0
22	3.0 0
23	- 1.0 0 0
24	0.2 0
25	.0 2 0
26	1
27	1
28	0

FLT PLN-12b/47/0/A



FLT PLN-13a/47/0/A





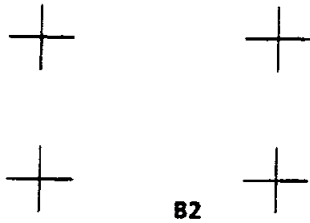


**DAP B2**

PURPOSE:

LOSS OF VERN  
(TAIL ONLY)

FLT PLN-13b/47/0/A

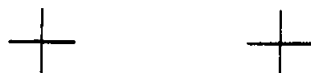


**DAP B3**

PURPOSE:

LOSS OF VERN  
(NOSE & TAIL)  
GG MNVR

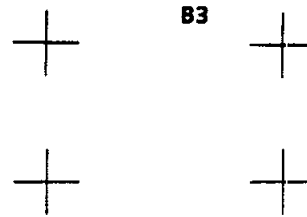
FLT PLN-14b/47/0/A



**B2**

15	0.0 2
16	0.2 0 0
17	0.2 0 0 0
18	0.0 0 4
19	0.0 0 2
20	.0 0 0
21	.0 0 0
22	3.0 0
23	- 1.0 0 0
24	0.2 0
25	.0 2 0
26	3
27	3
28	0

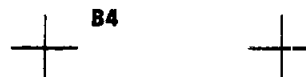
FLT PLN-14a/47/0/A



**B3**

15	0.0 2
16	0.2 0 0
17	0.2 0 0 0
18	0.0 0 4
19	0.0 0 2
20	.0 0 0
21	.0 0 0
22	3.0 0
23	- 1.0 0 0
24	0.2 0
25	.0 2 0
26	1
27	1
28	0

FLT PLN-15a/47/0/A



+ +  
B3

**DAP B4**

PURPOSE:  
SSUS DEPLOY

FLT PLN-15b/47/0/A

+ +

+ +  
B4

**DAP B5**

PURPOSE:  
COAS CAL

FLT PLN-16b/47/0/A

+ +

+ +

**B4**

15	0.0	2
16	0.2	0 0
17	0.0	0 8
18	0.0	0 4
19	0.0	0 2
20	.0	0 0
21	.0	0 0
22	0.3	0
23	0.1	0 0
24	0.2	0
25	.0	1 0
26		3
27		3
28		0

FLT PLN-16a/47/0/A

+ +  
B5

+ +

**B5**

15	0.0	2
16	0.2	0 0
17	0.0	1 6
18	0.0	0 4
19	0.0	0 2
20	.0	0 0
21	.0	0 0
22	3.0	0
23	0.0	3 3
24	0.2	0
25	.0	2 0
26		3
27		3
28		0

FLT PLN-17a/47/0/A

+ +  
B6

+

**B5**

+

**DAP B6**

PURPOSE:  
(Blank)

+

**B6**

+

15	---
16	---
17	---
18	---
19	---
20	---
21	---
22	---
23	---
24	---
25	---
26	-
27	-
28	-

FLT PLN-17b/47/0/A

FLT PLN-18a/47/0/A

+

+

+

**B7**

+

+

**B6**

+

+

+

**DAP B7**

PURPOSE:  
RENDEZVOUS

**B7**

15	0.0 5
16	0.5 0 0
17	0.2 0 0
18	0.0 0 4
19	0.0 0 2
20	.0 0 0
21	.0 0 0
22	2.0 0
23	- 1.0 0 0
24	0.2 0
25	.0 2 0
26	1 or 3
27	1 or 2
28	0

FLT PLN-18b/47/0/A

FLT PLN-19a/47/0/A

+

+

+

**B8**

+

+

B7

+

+

+

**DAP B8**

PURPOSE:  
PROX OPS

**B8**

15	0.0 1
16	0.2 0 0
17	0.2 0 0
18	0.0 4
19	0.0 0 2
20	.0 0 0
21	.0 0 0
22	2.0 0
23	- 1.0 0 0
24	0.2 0
25	.0 2 0
26	1
27	1
28	0

FLT PLN-19b/47/0/A

FLT PLN-20a/47/0/A

+

+

+

+

+

B8

+

+

DAP

PURPOSE

+

ALT1 - NOMINAL  
I-LOAD  
ALT2 - SL-J  
OPERATIONS  
LOSS OF  
VERNS

FLT PLN-21a/47/0/A

+

ALT1

+

FLT PLN-20b/47/0/A

+

+

+ DAP ALT1 +

PURPOSE:  
NOMINAL I-LOAD

FLT PLN-21b/47/0/A

+ ALT1 +

RATE DB  
32 0.2 0 0  
JET OPT  
33 1  
# JETS  
34 2  
ON TIME  
35 - 0.0 8  
DELAY  
36 - 0.0 0

FLT PLN-22a/47/0/A

+ +

+ ALT2 +

+ DAP ALT2 +

PURPOSE:  
SL-J  
OPERATIONS  
LOSS OF  
VERNS

FLT PLN-22b/47/0/A

+ ALT2 +

RATE DB  
32 0.0 7 0  
JET OPT  
33 3  
# JETS  
34 1  
ON TIME  
35 - 0.0 8  
DELAY  
36 - 1.0 0

FLT PLN-23a/47/0/A

+ ALT1 +

+ +



FLT PLN-23b/47/0/A



**ALT2**



UNIV PTG	
TGT ID	= 1 Orbiting Vehicle = 2 Earth ctr = 3 Earth tgt Input LAT ( $\pm 90$ ) LON ( $\pm 180$ , + = East) ALT (-3444.0 to 20000.0 nm) = 4 Sun ctr = 5 Celestial tgt Input RA (0-359.99) DEC ( $\pm 90$ ) = 11-110 Nav Stars
BODY VECT	= 1 +X* = 2 -X* = 3 -Z* = 4 -Y Star Tracker* = 5 Optional Input P (0-359.99) Y (270-359.99,0-90) * input OM $\rightarrow$ OM (0-359.99)
MON AXIS	= 1 +X = 2 -X
CNTL ACCEL	= 0 Orbiting Vehicle = 1 thru 5 not used
PRI JET OPT	= 1 Normal = 2 Nose only = 3 Tail only
Alt JET OPT	= 1 Normal = 2 Illegal entry = 3 Tail only

FLT PLN-24a/47/0/A



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FLT PLN-24b/47/0/A





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STS-47  
FLIGHT PLAN NOTES

FLT PLN NOTES

FLIGHT PLAN NOTES  
(CONSTRAINTS AND GUIDELINES)

A. FLIGHT DESCRIPTION

The STS-47 (OV105) launch from KSC on September 1, 1992, (ROTATED FLIGHT CYCLE) will be into a 162 by 164 nm orbit at an inclination of 57.0 degrees. The mission duration will be 7 days. Nominal landing occurs at KSC on September 8, 1992.

Landing opportunities are:

		<u>Landing Orbit No.</u>	<u>Site</u>	<u>Local Time</u>
Nominal	Primary	110	KSC	06:54 EDT
	Backup	111	KSC	08:28 EDT
1 Day Late	Primary	126	KSC	07:02 EDT
	Backup	127	KSC	08:36 EDT
2 Days Late	Primary	142	KSC	07:10 EDT
	Backup	144	EDW	07:14 PDT

MAJOR EVENTS

LAUNCH (KSC) September 1, 1992  
 MET (DD/HH:MM:SS) 0/00:00:00  
 Day of year 245  
 CDT/GMT 09:18/14:18

OMS-2  
 MET (DD/HH:MM) 0/00:39  
 DV (fps) 262  
 ORBIT hp/ha (nm) 162/164

DEORBIT BURN  
 MET (DD/HH:MM) 06/19:36  
 DV (fps) 259

LANDING (EDW)  
 MET (DD/HH:MM) 06/20:36  
 Day of year 252  
 CDT/GMT 05:54/10:54

B. CREW

1. There will be seven crewmembers onboard divided into dual-shift teams as follows:

RED TEAM - PLT, MS1, PS1

BLUE TEAM - MS2, MS3, MS4

The CDR is not assigned to a team and is free to adjust his hours real-time as necessary. Each team works approximately 12 hours followed by 12 hours off duty. This allows near continuous payload operations.

FLT PLN NOTES

2. The crewmembers assigned to the mission are:

CDR - Robert L. Gibson  
PLT - Curtis L. Brown, Jr.  
MS1 - Mark C. Lee  
MS2 - Jerome Apt  
MS3 - N. Jan Davis  
MS4 - Mae C. Jemison  
PS1 - Mamoru Mohri

3. The crewmembers responsible for performing an EVA, should one become necessary, are MS2 and MS3. The PLT is IV1.

C. ORBITER SYSTEMS

1. Communications and Instrumentation

- a. TDRS is the prime mode of communication coverage. It is assumed to be supported by TDRE (41 degrees W) and TDRW (174 degrees W). If one TDRS is lost, use of the spare TDRS (without Ku-band forward uplink capability) at 171 degrees W can be negotiated. TDRS SPARE may be moved to 107 degrees W by July 1992. In addition, there will be a semistowed TDRS satellite at 62 degrees E for contingency callup with at least a 2-hour lead time.
- b. TDRS Ku-band is the prime mode of real-time TV. There are also three GSTDN sites available as backup for TV (90-minute lead time required): GDS(GDX), MIL(MLX), and VAN.
- c. TDRE and TDRW are assumed available to support Ku-band uplink (e.g., TAGS). HDR uplink (e.g., Teleprinter) is also available through these satellites.
- d. There are six GSTDN sites available for on-orbit or for deorbit: WTR(VAN)(until the end of September 1992), GDS(GDX), MIL(MLX), BDA(BDX), DKR, and DFR. CAN and MAD can be called up for Orbiter critical and/or crew safety emergencies with 2-hour lead time required. These site passes are not displayed in this Flight Plan.
- e. RTS sites are available on a 4-hour callup basis for on-orbit contingency support: DGS, VTS, GTS, HTS, IOS, NHS, CTS, and OTS.

2. The Orbiter CCTV system provides views from one in-cabin wide-angle lens assembly camera and four PLB TV cameras. The Flight Requirements Document lists the four PLB TV lens assemblies as follows:

- a. Camera A (port forward), color lens assembly
- b. Camera B (port aft), monochrome lens assembly
- c. Camera C (starboard aft), monochrome lens assembly
- d. Camera D (starboard forward), wide-angle lens assembly

A video tape recorder (VTR) that uses 30-minute cassettes is available in the aft flight deck.

The SL TVC system consists of two cameras, TVC-1 and TVC-2. There are also two SL video cassette recorders (VCRs) that use 72-minute cassettes. NASDA is supplying another recording system, the Data Recording Video System (DRVS). The DRVS contains two cameras, JTVC-1 and JTVC-2, which are only used for the material science and life science experiments, respectively.

#### D. PAYLOADS

##### 1. Spacelab J (SL-J)

The SL-J mission is a complement of experiments from the National Aeronautics and Space Administration (NASA) and the National Space Development Agency (NASDA) of Japan. There are nineteen life science experiments and twenty-four material science experiments. This mission uses the long spacelab module with the long SL transfer tunnel.

##### a. NASA Life Science Experiments

###### (1) Autogenic Feedback Training Experiment (AFTE)

Two crewmembers will be wearing an instrumentation belt during waking hours on the first three mission days. This experiment provides continuous biofeedback to crewmembers so they may perform certain actions that may prevent the onset of space motion sickness. The objective is to provide data on an individual's symptoms prior to sickness, and to compare the effectiveness of ground learned techniques in suppressing that sickness in space. This use of biofeedback with autogenic therapy is expected to reduce the habituation period and improve operational efficiency in microgravity.

###### (2) Frog Embryology Experiment (FEE)

The objective of this experiment is to examine the effects that microgravity induces on the early development of frog embryos after fertilization.

###### (3) Fluid Therapy System (FTS)

This is an in-flight demonstration of the production of sterile water for injection from a pressurized water source, the reconstitution of sodium chloride and dextrose solutes into sterile intravenous solutions, and infusion of these solutions into a test fixture and a mannequin arm.

###### (4) Lower Body Negative Pressure (LBNP)

LBNP is subambient pressure applied to the lower torso. The principal objective is to evaluate the effectiveness of fluid loading during LBNP in reversing zero-g induced cardiovascular changes.

b. NASDA Life Science Experiments

(1) Physiological Monitoring of Japanese PS (PMS)

Aside from monitoring the health of the payload specialist (PS) during flight, this experiment will record the effects of zero-g on the cardiovascular system. The PS dons a cuff assembly around his arm with various electrodes attached to his body.

(2) Endocrine and Metabolic Changes in Japanese PS (UMS)

This experiment examines the effects of spaceflight on the secretion of ductless glands and on metabolic systems. The PS will measure urine samples regularly. Postflight urinalysis is used to examine the adaptation of these systems to weightlessness.

(3) Visuovestibular Functions of Fish (FISH)

This experiment studies the coordination of carp by examining the interaction of visual stimuli with motor control. Fish control posture and movement almost entirely by visual and vestibular cues. While tilting a dorsal light, a normal carp will erratically adjust its posture because the visual sense conflicts with the vestibular sense.

(4) Separation of Biogenic Materials by Electrophoresis Under Microgravity (FFEU)

Electrophoresis refers to the motion of charged particles through a relatively stationary liquid under the influence of an applied electric field. The objective of this experiment is to verify the separation conditions of biomaterials, such as proteins and peptides, using the free-flow electrophoretic unit (FFEU). The advantage of performing this test in space is that heat convection is negligible.

(5) Visual Stability (VISUAL STABILITY)

Electrooculography is used to measure the eye's response in microgravity to stimulus patterns produced by a Light Impulse Stimulator (LIS). These measurements of visual adaptation may play a role in estimating the susceptibility to motion sickness in space.

(6) Crystal Growth of Enzymes (ENZYME)

The objective of this experiment is to grow large single crystals of enzyme proteins in microgravity. These crystals will be structurally analyzed using X-ray crystallography and functionally analyzed by various physical methods such as spectrophotometry postflight.

(7) Rearrangement of Intermediate Filaments in Mammalian Cells in Culture (KIDNEY CELLS)

This experiment evaluates the effect of microgravity on the distribution of microfilaments in kidney cells.

(8) Plant Culture Research (PCR)

This experiment investigates the development of plant embryos at the cellular level in microgravity. Carrot cell cultures will be flown in the cell culture kit.

(9) Bone Culture Research (BCR)

This experiment compares the activity of isolated bone cells exposed to a microgravity environment with controls treated similarly on the ground.

(10) Calcium Metabolism and Bone Formation (EGG)

This experiment investigates the mechanisms that suppress bone growth in microgravity using chicken embryos.

(11) Separation of the Animal Cells and Cellular Organelle by Electrophoresis (FFEU)

The FFEU (see b(4)) will be used to separate cells and their components according to their surface charge and densities. Electrophoresis in space will improve the resolution by eliminating thermal convection and settling of large cells.

(12) Genetic Effects of HZE and Cosmic Radiations (FLY RAD)

This experiment investigates the effects of high-Z, high-Energy (HZE) particles, and low-ZE cosmic radiations on the genetic development of fruit flies.

(13) Research on Perceptual-Motor Functions (VISUAL STABILITY)

This experiment studies the effects of microgravity on the vestibular, oculomotor, and hand movement control system. This data will be used for designing man-machine systems for future spaceflight.

(14) HZE Radiation Monitoring (HZE RAD)

This experiment investigates the biological effect of cosmic radiation on microorganisms, plant seeds, and animal cells. The results will contribute to the development of radiation protection technology for life support systems and antiradiation chemical screening. Fifteen dosimeters will monitor the cosmic radiation levels.

(15) Circadium Rhythm of Conidiation in Neurospora Crassa  
(FUNGI)

This experiment investigates band formation of asexual fungus spores commonly found in Neurospora Crassa (bread mold) in order to provide evidence that external factors affect the mechanisms responsible for circadian rhythm.

c. NASA Material Science Experiments

(1) Protein Crystal Growth (PCG)

The objectives of this experiment are to grow crystals at a constant temperature over a long period of time in microgravity, to evaluate the kinetics of the growth and the defects created by fluid disturbances.

(2) Space Acceleration Measurement System (SAMS)

SAMS will operate continuously during payload activities to characterize the acceleration environment.

d. NASDA Material Science Experiments

(1) Growth of Semiconductor Single Crystals (M01-GHF)

The objective of this experiment is to grow semiconductor lead-tin-tellurium (PbSnTe) single crystals with high compositional homogeneity. A PbSnTe ingot will be melted in the Gradient Heating Furnace (GHF). Thermal convection flows are suppressed in microgravity enabling the growth of highly homogenous single crystals from the melt.

(2) Growth of Single Crystals by Traveling-Zone Method (M02-IMF)

The Image Furnace (IMF) is moved slowly along an ingot of a PbSnTe polycrystal in order to grow high-quality single crystals.

(3) Growth of Semiconductor Compound Single Crystal by Floating-Zone Method (M03-IMF)

The objective of this experiment is to grow large diameter single crystals from materials with low surface tension and high density. A microgravity environment increases the maximum stable diameter of the floating liquid zone. The IMF will be used to grow single crystals of indium-antimony (InSb).

(4) Casting of Superconducting Filamentary Composite Material (M04-CHF)

The objective of this experiment is to produce an array of aligned, discontinuous, superconducting filaments in a ductile matrix. The Continuous Heating Furnace (CHF) will produce AlPbBi alloy ingots with homogenous and fine dispersions of lead-bismuth (PbBi) particles in the aluminum (Al) matrix.



(5) Formation Mechanism of Deoxidation Products in Iron Ingot (M05-LIF)

This experiment studies the structure, composition, and distribution of deoxidation products in iron and iron-10 percent nickel (Ni) alloy ingots deoxidized with aluminum-silicon-magnesium (AlSiMn). The formation mechanism of the deoxidation products will be enhanced due to the absence of convection. Heating will occur in the Large Isothermal Furnace (LIF).

(6) Preparation of Ni Base Dispersion Strengthened Alloys (M06-LIF)

The objective of this experiment is to produce high temperature resistant Ni-base alloys which are void-free and contain fine, uniform dispersions of ceramic particles. The LIF will quickly heat, melt, and solidify experiment samples. Microgravity eliminates the effect of buoyancy in the production of these strengthened alloys.

(7) Diffusion in Liquid State and Solidification of Binary Systems (M07-CHF)

The objectives of this experiment are to measure the interdiffusivity of elements in a binary system under liquid state and to investigate the solidification structure of the binary system. Two end-to-end alloy rods will be melted in the CHF, maintained at soak temperature, and solidified.

(8) High Temperature Behavior of Glass (M08-IMF)

The primary objective of this experiment is to measure volume changes of oxide glass as the temperature rises from its glass transition temperature to its liquid temperature and above. The secondary objective is to test the effectiveness of glass melting in space in an IMF.

(9) Growth of Si Sphere Crystals and the Surface Oxidation (M09-CGF)

This experiment studies the effects of thermal convection on the solid-melt interface, the impurities, and the microstructural defects of Si (silicon) crystals grown in microgravity. The surface oxidation experiment examines the variations of the silicon-silicon dioxide (Si-SiO<sub>2</sub>) structural properties in different directions along the interface. Spherical single crystals of Si will be grown by melting the tip of a crystal rod and cooling it in the Crystal Growth Furnace (CGF). The advantage of crystal growth in space is that the growth can be done without a container attaching to the molten surface.

(10) Solidification of Immiscible Alloy (M10-GHF)

This experiment investigates the principles of solidification of monotectic and hypermonotectic alloys by observing the decomposition and coarsening processes of the immiscible liquid phase during unidirectional solidification. This experiment uses the GHF.

(11) Fabrication of Carbon Fiber/Al Hybridized Composites (M11-CHG)

The objective of this experiment is to fabricate a composite material, carbon fibers coated with Al, with very low density and high stiffness. This experiment uses the CHF.

(12) Liquid Phase Sintering (M12-LIF)

This experiment investigates the mechanism of liquid phase sintering. Cylindrical specimens of tungsten-nickel (W-Ni) alloys are heated in the LIF.

(13) Fabrication of Ternary Amorphous Semiconductor (M13-CHF)

The objective of this experiment is to fabricate a homogenous, multicomponent semiconductor without distinct crystalline structure. A mixture of silicon-arsenic-tellurium (SiAsTe) will be melted in the CHF.

(14) Gas Evaporation in Low Gravity Field (M14-GEF)

This experiment is also referred to as the Congelation Mechanism of Metal Vapors. The objective is to examine the mechanism of particle formation in a gas atmosphere and the production of submicron powders of extremely uniform size. Metal evaporation sources are heated by a filament in a spherical chamber known as the Gas Evaporation Facility (GEF).

(15) Drop Dynamics In Space and Interference With Acoustic Field (M15-LDF)

This experiment studies contactless and stable positioning of liquid drops, excitation of capillary waves on the levitated liquid drop surfaces, and deformation of liquid drops by means of triaxial acoustic resonances. The behavior of these drops will be observed in a triaxial acoustic levitation chamber called the Liquid Drop Facility (LDF).

(16) Bubble Behavior in Weightlessness (M16-BBU)

A Bubble Behavior Unit (BBU) will be used to observe bubble motion in liquid under temperature gradient and bubble behavior in liquid subject to a stationary acoustic wave.

(17) Preparation of Optical Materials Used in Nonvisible Region (M17-ALF)

This experiment uses the Acoustic Levitation Furnace (ALF) to explore the feasibility of preparing glass exhibiting superior transmittance in the nonvisible, particularly the infrared, region.

(18) Heat Transfer Under Marangoni Effect Induced Convection (M18-MCU)

This experiment investigates the role of convection on the formation of solid/liquid interface and on the solidification rate. Convection by the Marangoni effect is heating from the center.

(19) Solidification of Eutectic System Alloys (M19-CHF)

The objective of this experiment is to demonstrate a proposed theory on the formation of equiaxed crystals in cast metals. This experiment uses the CHF.

(20) Growth of Samarskite Crystals (M20-IMF)

The objective of this experiment is to demonstrate the usefulness of the slow-cooling-float-zone and the traveling-solvent-float-zone methods on samarskite systems. This experiment uses the IMF.

(21) Growth Experiment of Organic Metal Crystal (M21-OCF)

The objective of this experiment is to grow large, high-quality, single organic crystals by diffusion in the absence of convection and gravitational sedimentation. The Organic Crystal Facility is used to grow these crystals.

(22) Crystal Growth of Compound Semiconductors (M22-GHF)

The objective of this experiment is to grow an indium-gallium-arsenic (InGaAs) crystal via the directional crystallization technique in the GHF.

2. Get-Away-Special (GAS) Canisters

Attached cargo operations will be performed with the nine GAS canister experiments mounted on the GAS Bridge Assembly. The nine GAS experiments are G-102, G-255, G-300, G-330, G-482, G-520, G-521, G-534, and G-613.

- a. The G-102 canister contains seven experiments sponsored by the TRW Defense and Space Systems Group. The experiments include investigations of capillary pumping, cosmic rays, crystal growth, emulsion formation, fluid drop mechanics, floppy disks, and fiber optics.

- b. The G-255 payload is sponsored by the Kansas University Space Program and contains three microgravity experiments. The first experiment will investigate crystal growth. The second experiment examines the formation of cell membranes. The third experiment, Space Seeds, examines germination rates and seed health.
- c. The G-300 canister is sponsored by MATRA/General Electric Laboratory of Paris. Thermal conductivity measurements will be performed on distilled water and silicon oils.
- d. The G-330 payload is sponsored by the Swedish Space Corporation. A sample of Germanium/Gallium will be melted so that the boundaries of the solid/liquid interface may be studied upon re-solidification.
- e. The G-482 canister is sponsored by Telesat Canada. The purpose is to investigate the behavior of bread yeast in the absence of gravity.
- f. The G-520 payload is sponsored by the Independent Television News of London and consists of two experiments. The Chemical Garden experiment examines the directional and structural effects of microgravity on the formation of cobalt-silicate precipitate. The Liesegang Rings experiment will produce large precipitate rings in microgravity to help understand the formation mechanism.
- g. The G-521 payload is sponsored by the National Research Council of Canada, Space Division. The canister contains three gradient furnaces and twelve isothermal furnaces to process a variety of material combinations. The experiments will perform directional solidification and diffusion in microgravity.
- h. The G-534 canister is sponsored by NASA, Lewis Research Center. This payload will investigate the formation of bubbles as well as their growth, collapse, and motion. The purpose is to study the inter-relationships between heat transfer, heat rate, buoyancy, momentum, and surface tension.
- i. The G-613 payload is sponsored by the University of Washington. The primary experiment will test the ability to recover a free-fluid stream of water with a centrifugal collector. The secondary experiment will evaluate the use of a tapered artery micro heat pipe in cooling infrared detectors.

### 3. SECONDARY PAYLOADS

#### a. Israel Space Agency Investigation About Hornets (ISAI AH)

The Oriental Hornet exhibits a unique phenomena in that it builds combs in the direction of the gravitational vector. This phenomena will be tested on-orbit by examining the hornets' ability to orient their combs in microgravity. The middeck experiment contains eighteen test chambers of various shapes. The top eight include a lamp to provide day/night lighting, whereas the bottom eight will remain in constant darkness. There is a window on the top and bottom for crew viewing and photography.

b. Shuttle Amateur Radio Experiment - II (SAREX-II)

SAREX-II is middeck payload capable of two-way communication with amateur radio stations in the Line of Sight (LOS) of the Orbiter. An antenna is mounted in either window 1 or 6. Configuration C is capable of operating in a Robot mode and Voice mode. SAREX-II will operate in the Robot mode for the majority of the flight. Intermittent voice operations will be performed as time permits.

c. Solid Surface Combustion Experiment (SSCE)

The SSCE experiment will measure the flame spread rate of an ashless filter paper sample in microgravity. The goal is to improve fire safety in space travel. The filter paper sample is internally mounted in a pressurized chamber. Photography will be obtained while the sample is burning.

d. Air Force Maui Optical Site (AMOS) Calibration Test

The purpose of this test is to obtain Orbiter signature data and calibrate ground-based sensors located on the island of Maui during passive Orbiter overflights.

e. Ultraviolet Plume Instrument (UVPI)

The UVPI is an instrument on the Low-power Atmospheric Compensation Experiment (LACE) satellite in orbit at 43 degrees inclination and approximately 290 nm altitude. It is desired to take passive observations of the Orbiter by the LACE satellite to obtain imagery and/or signature data to support the calibration of the UVPI space-based sensors, and to observe Orbiter events.

E. ON-ORBIT DTOs

1. Cabin Air Monitoring (DTO 623)

This DTO will use a solid sorbent sampler in the module to continuously sample the atmosphere throughout the flight.

2. Water Separator Filter Evaluation (DTO 647)

This DTO will evaluate the performance of a filter installed at the water separator inlet. The proposed filter should remove debris from the air/water stream exiting the cabin heat exchanger.

3. Cycle Ergometer Hardware (DTO 651)

The cycle ergometer hardware will be flown as an alternative to the treadmill. DTO 651 will evaluate modifications to the ergometer such as sound mounts, modified pedals, and shoes with clip bindings. The setup and performance of this DTO will be documented on film. Three Orbiter crewmembers will perform this DTO once.

4. Foot Restraint Evaluation (DTO 655)

The purpose of this DTO is to evaluate a new design for foot restraints. The crew will comment on ease of ingress/egress; whether additional pitch is required in the design; foot loop and base plate size, fit, and comfort. The foot restraints will be used in the Spacelab module during experiment operations.

5. Acoustical Noise Dosimeter Data (DTO 663)

This DTO will measure and record decibel levels in the middeck, the sleep stations, and the Spacelab module from FD2 through FD7. Additionally, crewmembers will complete a questionnaire during the flight regarding noise levels.

6. Acoustical Noise Sound Level Data (DTO 665)

This DTO will use a Sound Level Meter to obtain baseline data of octave-band acoustical noise levels in the middeck, flight deck, sleep stations, and Spacelab module during routine Orbiter and experiment operations.

F. ON-ORBIT DSOs

1. Collection of Humidity Condensate (DSO 317)

This DSO will characterize the content of the shuttle's humidity condensate both in quantity and composition. Condensate will be collected in a modified beverage container on four separate flight days and analyzed postflight.

2. Evaluation of Samples Obtained from the Urine Monitoring System (DSO 323)

The purpose of this DSO is to determine if in-flight dilution of urine samples differs from postflight ground dilution. It will also determine if middeck pressure changes affect volume measurements differently from that experienced in ground testing.

3. In-Flight Radiation Dose - Distribution (DSO 469)

This DSO will measure the radiation at a thinly shielded region of the Orbiter. The crew will Velcro devices to the right middeck wall soon after attaining orbit and stow the hardware as late as possible. The objective is to evaluate and verify methods for assessing and managing health risks from space radiation exposure.

4. Orthostatic Function During Entry, Landing, and Egress (DSO 603B)

This DSO will measure changes in orthostatic function of crewmembers during the stresses of entry, landing, and egress from the Orbiter. Crewmembers will don and calibrate equipment prior to deorbit preparation. At LES donning, they will connect cables and power the equipment. Verbal comments will be recorded during entry, landing, and egress.

5. Air Monitoring Instrument Evaluation and Atmosphere Characterization (DSO 611)

DSO 611 is designed to evaluate and verify air monitoring equipment. The Microbial Air Sampler (MAS) will be used to collect data on the contaminants that affect crew health and safety. Samples will be collected on an early, mid, and late FD in the middeck and flight deck.
6. Energy Utilization (DSO 612)

DSO 612 will be used to develop, verify, and optimize appropriate countermeasures for maintaining entry, landing, and egress capabilities after extended duration flights. This requires prevention of muscle atrophy, weight loss, and reduced nitrogen and potassium levels. Crewmembers will collect urine, saliva, blood, and ketone samples immediately upon wakeup for five flight days. A log of all exercise, food, and fluid intake will also be maintained.
7. Pre- and Postflight Measurement of Cardiorespiratory Response (DSO 624)

DSO 624 will evaluate changes in aerobic capacity using submaximal exercise testing pre- and postflight. These evaluations will help develop optimal exercise prescriptions to prevent decrements in nominal cardiorespiratory response. On orbit, crewmembers will don their heart watches during exercise and log exercise.
8. Educational Activities (DSO 802)

The purpose of this DSO is to use the attraction of space flight to capture the interest of students and motivate them toward careers in science, engineering, and mathematics. The DSO requires motion picture photography of crew presentations in the Spacelab module, the middeck, and/or the flight deck. Lesson topics include demonstration of microgravity characteristics, material and life science experiments.
9. Documentary Television (DSO 901)

This DSO requires live television transmission or VTR dumps of crew activities and spacecraft functions which include: payload bay views, STS and payload crew activities, VTR downlink of crew activities, in-flight Crew Conference, and unscheduled TV activities.
10. Documentary Motion Picture Photography (DSO 902)

This DSO requires documentary and public affair motion picture photography of significant activities which best depicts the basic capabilities of the space shuttle and key objectives. This DSO includes motion picture photography of spacelab module activities, flight deck activities, middeck activities, and any unscheduled motion picture photography.

11. Documentary Still Photography (DSO 903)

This DSO requires still photography of crew activities in the Orbiter, Spacelab and mission related scenes of general public and historical interest. Still photography with 70mm format for exterior photography and 35mm format for interior photography is required.

12. Assessment of Human Factors (DSO 904)

This DSO will examine human factors during equipment transfer to and from the Spacelab module. Video will be obtained while the crew is translating through the SL tunnel on FD1 and FD8. Crewmembers will also complete a questionnaire during the mission.



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