U.S. Government

MEMORANDUM

Lyndon B. Johnson Space Center

NASA

REFER TO: DA8-83-24 (FT)	DATE: May 23, 1983	INITIATOR: DA8/WWFink:skl:5/30/83:3051	ENCL

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FROM: DA8/Chief, STS-8 Orbit Flight Techniques

SIGNATURE: Brock R. Stone
Brock R. Stone

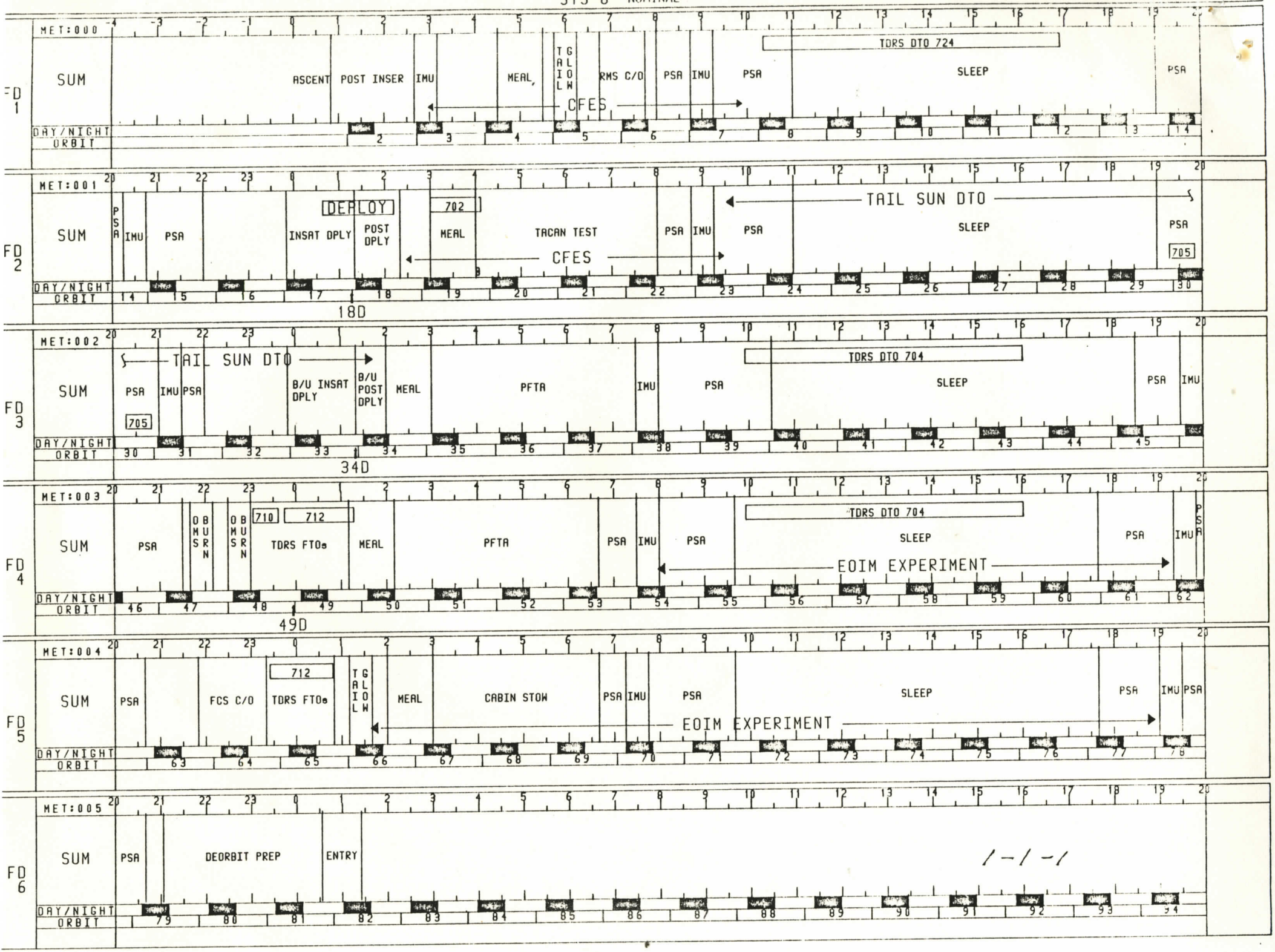
SUBJ: STS-8 Orbit Flight Techniques Panel Meeting #1 Agenda

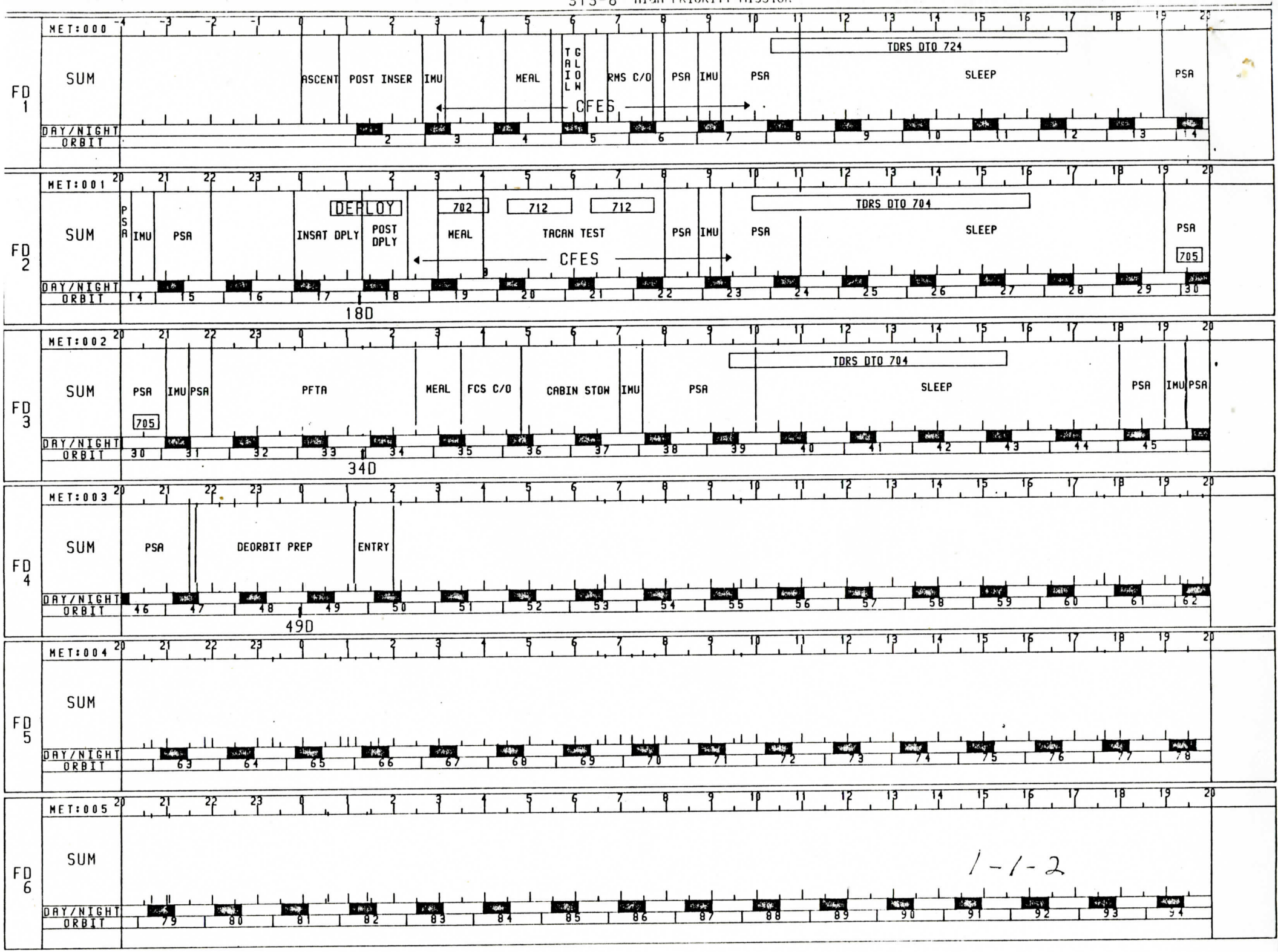
The first meeting of the STS-8 Flight Techniques Panel will be held on Wednesday, June 1, 1983, at 12:00 CDT at the Johnson Space Center, building 4, room 382. Presenters will please provide a copy of presentation material not later than Friday, May 27 to W. W. Fink, DA8, ext. 3051, building 29, room 108H.

Agenda

1. STS-8 CAP Review	DH4/C. Conley	x3486
2. STS-8 Consumables Analysis		
o Propulsive	FM2/A. Loyd	x3278
o Non-propulsive	FM2/G. Clark	x3278
3. Orbiter Thermal DTO's	RIC/J. Clawson	333-2030
o RMS Thermal Constraints	DF4/D. Moore	x2991
o TV Cameras Thermal Constraints	DF2/J. Conner	x5841
4. DTO 503 Overview	MP/K. Suit	x2281
5. RMS Loads Analysis Status	MDAC/E. Taylor	486-4420
6. Payload Berthing/Deberthing TV Requirements	EN4/J. Brown	x3071
7. PRLA Requirements for Entry and PTI's	ES2/D. Hamilton	x4387

STS-8 NOMINAL 6/1/83 DRAFT C. L. CUTLER

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1-1-2

JSC/DSAD MISSION PLANNING AND ANALYSIS DIVISION	STS-8 HYDROGEN BUDGET MISSION DURATION - 122.16 HRS (a)	NO: DATE: 6/1/83 NAME: G Clark ORG: FM2

TRAJ: CYCLE 3
CAP: OVERVIEW (UNPUBLISHED)
ANALYSIS DATE: 5-27-83

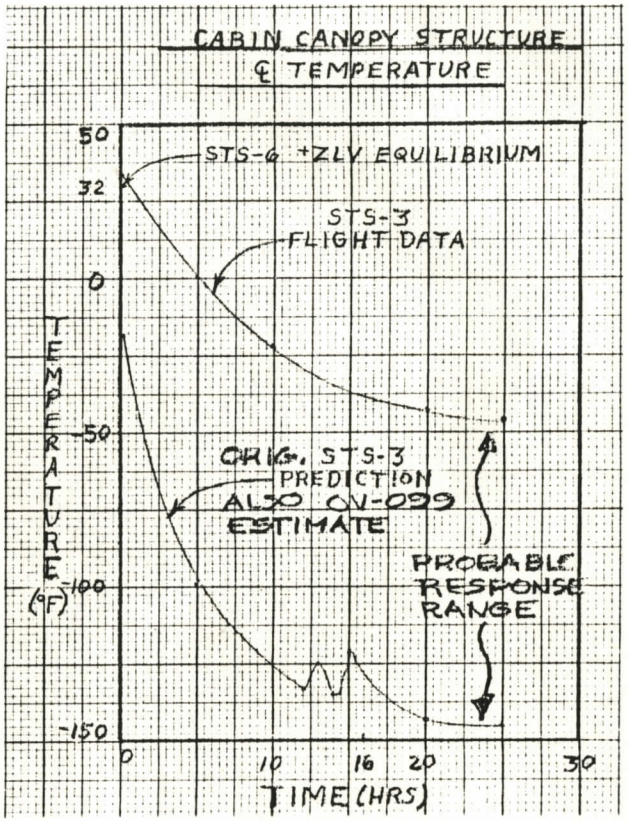
	CRYOGENIC H_2, lbm	
	REQUIREMENT	QUANTITY
EXPECTED LOADING (3 TANK SETS)		281.60
PRELAUNCH USAGE (PLANNED SERVICE COMPLETION @ L/O 56 HOURS)	10.9	
EXPECTED LAUNCH LOAD		270.7
RESIDUALS (b)	18.9	
MEASUREMENT UNCERTAINTY (RSS)	4.2	
AVAILABLE FOR MISSION USE		247.6
MISSION REQUIREMENT (PRELIMINARY)	145.6	
EXPECTED MISSION MARGIN		102.0
EVENT UNCERTAINTIES		
LOADING	5.6	
24 HOUR LAUNCH HOLD	6.9	
DISPERSION/FLIGHT PLANNING UNCERTAINTY (c)	1.5	
AVAILABLE FOR ADDITIONAL ALLOCATION		88.0
CONTINGENCY -2ND MISSION EXTENSION DAYS (d)	47.2	
FLIGHT PLANNING MARGIN		40.8

(a) INCLUDES 41 MINUTES POST-LANDING TIME.
(b) TANKS 1 & 2 = 8.8%, TANK 3 = 2.9%
(c) 1% OF MISSION REQUIREMENT.
(d) MISSION EXTENSION DAYS ARE 47.4 HOURS IN DURATION. ASSUMES PTC ATTITUDE AND POWERED DOWN VEHICLE (TOTAL FUEL CELL POWER = 11.5 KW - INCLUDES SURVIVAL TO PAYLOADS)

DTO 0114 COLD CANOPY TEST
STS-8 PROPOSAL

BACKGROUND / OBJECTIVE:

OV-099 & SUBS HAVE DIFFERENT CREW CABIN / CANOPY THERMAL INSULATION SYSTEM THAN OV-102. THEORETICALLY, 099's CANOPY SHOULD RESPOND FASTER TO COLD ENVIRONMENTS THAN OV 102, POSSIBLY RESULTING IN MORE RESTRICTIVE CONSTRAINTS FOR CERTAIN ATTITUDES. PURPOSE OF THIS DTO IS TO GATHER DATA IN A COLD CANOPY ATTITUDE (TAIL TO SUN, TOP TO SPACE, ORB RATE, SAME AS STS-3/OV-102).



REQUIREMENTS:

24 HOURS TAIL SUN, TOP SPACE, ORB RATE PRECEEDED BY ≈ 8 HOURS ZLV OR PTC, BETA ANGLE ≥ 30° DESIRED. ONLY NORMAL OI MEASUREMENTS REQUIRED.

STS-8 POTENTIAL:

$\beta \approx 35°$ TO 40°
DURATION MAY BE LIMITED TO ≈ 16 HOURS

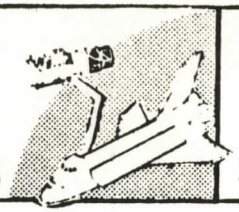
CONCLUSION:

- PERFORM TEST ON STS-8 IF POSSIBLE
- 16 HOURS PROBABLY ADEQUATE TO DETERMINE RESPONSE
- 24 HRS HIGHLY DESIRABLE

Space Transportation System
Development & Production Division

Rockwell International

J. F. CLAWSON
RI/HOUSTON EXT 267



SUBJECT TV CAMERA THERMAL CONSTRAINTS

NAME

DATE

PAGE

- STS-3 PROBLEM REVIEW

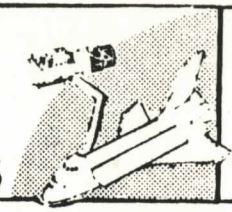
  THERMAL CAUSED THE LOSS OF 2 CAMERAS

- A CAMERA CIRCUIT REDESIGN HAS SOLVED THE STS-3 THERMAL PROBLEM

- NO THERMAL CONSTRAINTS ON THE TV IF THE CAMERA HEATERS AND PAN/TILT HEATERS ARE ON

  CAMERA DAMAGE CAN OCCUR AT -50°F

JSC FLIGHT OPERATIONS



SUBJECT STS-8 RMS THERMAL CONSTRAINTS

NAME D. E. MOORE

DATE 5-27-83

BIT CHANGE	INDICATED TEMPERATURE (F°)		
		+23°	THERMOSTAT FOR EE MOTOR MODULE AND EEEU TURNS ON.
	21°		
18° →			
	15°		
		+14°	THERMOSTAT FOR SHOULDER, ELBOW, AND WRIST TURNS ON.
11° →			
	8°		
4° →			HEATERS SUSPECTED AS FAILED.
	0°		
-5° →			
	-10°		
-18° →			HEATERS ARE FAILED.
	-25°		
		-32°	QUAL TEMP FOR ABE'S
-38° →		-41°	QUAL AND SURVIVAL TEMP FOR LED'S
	-52°		
		-58°	SURVIVAL TEMP FOR ABE'S

1-3-3

RECOMMENDATIONS

- FOR FAILED HEATERS (-25°F) WITH ARM CRADLED
  - UNCRADLE ARM AND PLACE IN OVERHEAD POSITION
  - TURN ON ARM ELECTRONICS WITH ARM-SELECT
- FOR -52°F TEMP
  - BREAK ATTITUDE

1-3-4

RMS TESTING DURING STS-8

DTO 503, "PDRS PAYLOAD HANDLING PERFORMANCE"

- PURPOSE
  - EVALUATE HARDWARE/SOFTWARE AND MAN/MACHINE INTERFACE CHARACTERISTICS
  - CONFIRM LOADED RMS PERFORMANCE ENVELOPE
  - VERIFY GROUND BASED SIMULATORS
  - VERIFY ADEQUACY OF PAYLOAD BAY AND RMS CCTV CAMERAS TO PROVIDE ADEQUATE VISUAL CUES FOR PAYLOAD HANDLING
  - DETERMINE DEGREE OF INTERACTION BETWEEN THE RMS AND FCS
- TESTS TO BE CONDUCTED
  - A. DEPLOYMENT AND BERTHING
    - EVALUATE OPTIMUM AND ALTERNATE CREW TECHNIQUES
  - B. AUTO TRAJECTORY EVALUATION
    - LOADED AND UNLOADED OPERATIONS
  - C. LARGE SPACE STRUCTURE VIBRATION DAMPING
    - OBTAIN DATA FOR STUDY OF VIBRATION DAMPING
  - D. RMS CONTROL SYSTEM EVALUATION
    - ARM RESPONSE TO MANEUVER COMMANDS IN VARIOUS ARM CONFIGURATIONS AND OPERATING MODES
  - E. RMS/FCS INTERACTION
    - EVALUATE TECHNIQUES FOR STABILIZING ORBITER AND ATTACHED PAYLOAD RATES SIMULTANEOUSLY
- DATA REQUIREMENTS
  - STRAIN GAGE
  - ARM PARAMETERS
  - CREW LOGS/VOICE RECORDINGS
  - CCTV AND DAC CAMERA VIEWS
  - ELEVON ANGLE POSITIONS
  - PRCS/VRCS FIRING HISTORIES

DTO 503

BERTH AND DEPLOY SECTION

RUN	GRAPPLE FIXTURE	MODE	DIGITALS	DIRECT VIEW	BLKHD CCTV'S
1	5	MANUAL AUGMENTED	✓	✓	✓
2	5	DIRECT		✓	✓
3	5	DIRECT	✓	✓	✓
4	2	DIRECT		✓	✓
5	2	DIRECT	✓	✓	✓

RMS Control System Evaluation - Manual

Conduct RMS control system runs as follows using grapple fixtures #2 and #5:

RUN	MANEUVER	MODE	RUN TERM.	ARM CONFIG.	PRIORITY GF#5	PRIORITY GF#2
1	SH P (+)	Single Coarse	Brakes	A	1	2
2	6 joint trans (+Z)	Orb Loaded Coarse	Brakes	A	1	2
3	WR R (+)	Single Coarse	Brakes	A	1	2
4	WR Y (+)	Single Coarse	Brakes	A	1	2
5.	SH P (+)	Direct	Brakes	A	1	2
6.	6 joint trans (+Y) towards starboard	Orb Loaded Coarse	Pos Hold	A	1	2
7.	6 joint trans (-X) towards tail	Orb Loaded Coarse	Safing	A	2	2
8.	+ Pitch RCS 2 Jet, Tail only	Idle/ Brakes	Brakes	B	1	2
9.	+ Roll RCS 2 Jet, Tail only	Idle/ Brakes	Brakes	B	1	2
10.	6 joint Rotation (+ Yaw)	Orb Loaded Coarse	Brakes	A	1	2
11.	SH P +	Single Coarse	Safing	C	3	3
12.	SH P +	Direct	Brakes	C	1	2
13.	6 joint trans (-Z)	Orb Loaded	Brakes	D	2	2
14.	6 joint trans (-Z)	Orb Loaded	Safing	D	2	2

RUN	MANEUVER	MODE	RUN TERM.	ARM CONFIG.	PRIORITY GF#5	PRIORITY GF#2
15.	-Pitch RCS	Brakes ON	Brakes	B	1	2
16.	+Pitch RCS	Safing ON	Safing	B	3	3
17.	- Pitch RCS	Safing ON	Safing	B	3	3
18.	+Pitch RCS	Pos Hold	--	B	3	3
19.	-Pitch RCS	Pos Hold	--	B	3	3
20.	-Roll RCS	Brakes ON	Brakes	B	1	2
21.	+Roll RCS	Safing ON	Safing	B	3	3
22.	-Roll RCS	Safing ON	Safing	B	2	2
23.	+Roll RCS	Pos Hold	--	B	2	2
24.	-Roll RCS	Pos Hold	--	B	3	3
25.	-Pitch RCS	Brakes	--	E	1	1
26.	-Roll RCS	Brakes	--	E	1	1

NOTE: Conduct all RMS Control System evaluations in free drift. Conduct all PRCS interaction tests in ~~the~~ tail only jet configuration.

h-h-1

Arm Configurations

Configuration A - Standard CVR

RMS joint angles: -35.24, 102.45, -93.79, -65.51, 5.52, 3.12

End Effector position (reference only):

x	y	z	Pitch	Yaw	Roll
-899.81	-45.02	-713.65	305.27	330.01	325.21

Configuration B - Standard PRIS

RMS joint angles: -90, +90, -10, 0, 0, 0

End Effectors position (reference only):

x	y	z	Pitch	Yaw	Roll
-679.5	-255.0	-1029.1	90°	9.5°	70.52°

Configuration C - Control System Evaluations

RMS joint angles: 0, -25, -11, 0, 0, 180°

End Effector position: (reference only):

x	y	z	Pitch	Yaw	Roll
-1248.0	-173.9	-631.0	14.2°	5.0°	179.4°

Configuration D - Control System Evaluations

RMS joint angles: -38, -32, -38, 0, 0, 0

End Effector position (reference only):

x	y	z	Pitch	Yaw	Roll
-1123	180	-671	10°	323°	2°

Configuration E - Longeron Stiffness Evaluation

RMS joint angles: 0, +90, -10, 0, 0, 0

x	y	z	Pitch	Yaw	Roll
-740.7	-307.7	-1009.2	79.4°	19.2°	344.0°

All run times are to be as follows:

	Grapple Fixture #2	Grapple Fixture #5
Command or time:	15 sec	15 sec
Total Run time:	60 sec	75 sec
RCS Interaction Pulse times:	240 msec	

S-4-1

RMS/FCS INTERACTION

PROCEDURE	DESCRIPTION	GRAPPLE FIXTURE	PRIORITY
5A	EVALUATION OF MOVING ARM/VRCS ATTITUDE HOLD (±Z, ±Y, RMS TRANSLATION MANEUVER FOR TWO SETS OF FCS DB AND RL). ARM CONFIGURATION A	2	1
5B	EVALUATE FCS SENSITIVITY TO MASS PROPERTY I-LOADS (JET ACCELERATIONS). THREE CASES: NOMINAL, ±20% OF NOMINAL. ESTABLISH ORBITER RATES IN THREE AXES; ALLOW TO DAMP FOR EACH CASE. ARM CONFIGURATION A	2	2
5C	EVALUATE LDEF DEPLOYMENT SCENARIO: VRCS ATTITUDE MNVR, RMS MNVR, DAMPING FOR TIP OFF. LAST STEP REPEATED FOR TWO SETS OF FCS DB AND RL (VIA REESTABLISHING ORBITER RATES). ARM CONFIGURATION A → LDEF DEPLOY	5	1

NASA Lyndon B. Johnson Space Center — Research and Engineering Directorate

PFTA PRLA REQUIREMENTS	STRUCTURES & THERMAL DIVISION	
	ES4/ R. ROCHA	1 JUNE 1983

STS-8 PDRS/PFTA

STRUCTURAL REQUIREMENTS

for the

PAYLOAD RETENTION LATCH ASSEMBLY

1-7-1

NASA Lyndon B. Johnson Space Center — Research and Engineering Directorate

PFTA PRLA REQUIREMENTS

STRUCTURES & THERMAL DIVISION

ES4/ R. ROCHA — 1 JUNE 1983

FAILURE = ORBITER LATCH (ONE OR MORE) FAILED OPEN AFTER PFTA REBERTHING

FAILURE CONDITION	ACCEPTABILITY	STRUCTURAL ASSESSMENT
KEEL ALONE	ACCEPTABLE	ACCEPTABLE RISK: DAMAGE TO OPEN KEEL AND/OR LONGERON BRIDGE BEARINGS
1 PRIMARY	ACCEPTABLE BUT CONDITIONAL	LANDING TOUCHDOWN SINK SPEED LIMITED TO TBD FPS MINIMIZE BEARING CONTACT DAMAGE AT FWD TRUNNION HIGH RISE GUIDES CAN TAKE X LOADS
2 PRIMARIES	NOT ACCEPTABLE	OMS BURN NZ < 0 ROTATION ABOUT Y AXIS INTOLERABLE
2 STABILIZERS	NOT ACCEPTABLE	SAME AS ABOVE
1 STABILIZER	NOT ACCEPTABLE	CONCERN: FWD BEARING STIFFNESS OF LATCHED SIDE MAY BE INSUFFICIENT TO PREVENT LARGE ROTATIONS OF END BEAM AND/OR TRUNNION PULLOUT