IUE FLIGHT OPERATIONS DIRECTIVE	21 MAY 80 DATE	N001C NUMBER

1. APPLICATION: RADIATION LIMITS FOR CAMERA OPERATIONS

IMPLEMENTATION RESPONSIBILITY: TELESCOPE OPERATOR, OPERATIONS DIRECTOR

SUPERCEDES PRIOR FODs: 002A

RESPONDS TO SCARs: N/A

2. DIRECTIVE

THE SAFE OPERATING RADIATION LIMIT FOR CAMERAS IS HEREBY ESTABLISHED AS 3.6 VOLTS AS READ OUT FROM THE RADIATION MONITORING INSTRUMENT (AS2CHØ1). WHENEVER THIS LEVEL IS EXCEEDED ALL OPERATING CAMERAS SHOULD BE COMMANDED TO 'STANDBY'.

DURING SOLAR RADIATION EVENTS, THE RADIATION LEVEL MAY INCREASE RAPIDLY. IN SUCH CASES OPERATING (EXPOSING OR READING) CAMERAS MUST BE IMMEDIATELY RETURNED TO STANDBY WHEN THE RADIATION LEVEL EXCEEDS 3.6 VOLTS:

EXEC STOP, (CAM), NOCAL /COMMAND CAMERA TO STANDBY

3. APPROVAL SIGNED: IVAN J. MASON Ivan J. Mason	21 MAY 80 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N002A NUMBER

1. APPLICATION: GROUND COMPUTER INITIALIZATION CHECKLIST

   IMPLEMENTATION RESPONSIBILITY:

   SUPERCEDES PRIOR FODs: 003

   RESPONDS TO SCARs: N/A

2. DIRECTIVE: WHEN LOADING THE SIGMA COMPUTER OR INITIALIZING WITH A "DAY ZERO" OR "COLD START" ASSURE THE FOLLOWING IS COMPLETED:

   AFTER LOADING OPSYS:

   1. VERIFY SERIAL COMMANDS AND SWITCH SETTING ARE IN THE NORMAL (OR CURRENT) SPACECRAFT CONFIGURATION, CONFIGURES GROUND COMPUTER LIKE SPACECRAFT CONFIGURATION. ASSURE GROUND SYSTEM AND OBC ARE ADDRESSING THE SAME S/C DECODER.

   2. LOAD EPHEMERIS.

   3. LOAD ORBITAL ELEMENTS.

   4. LOAD PROCFILE.

   5. SET UP PEN MATRIX.

   6. ENTER SI OPERATIONS INITIALIZATION PARAMETERS.

   AFTER "DAY ZERO" OR "COLD START" INITIALIZATION:

   USE STEPS 1, 5, 6

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 June 79 DATE	N003B NUMBER

1. APPLICATION: HOLD SLEW MODES OF OPERATION & GYRO TRIM METHODS

   IMPLEMENTATION RESPONSIBILITY:

   SUPERCEDES PRIOR FODs: 004A

   RESPONDS TO SCARs: N/A

2. DIRECTIVE: THIS DIRECTIVE PROVIDES THE INSTRUCTION FOR HOLD/SLEW MODES OF OPERATION AND GYRO TRIM.

   NOTE: MA=0 SHALL NOT BE USED WITHOUT MOM OR POD APPROVAL (SEE NOTE 4 PAGE 10)

HOLD/SLEW OPERATIONAL MODES

1. CONTROL IUE WITH FILTERED-GYROS

FILTERED GYROS IS THE PRIMARY OPERATIONS CONTROL MODE FOR IUE. IT IS INTENDED FOR USE WITH A CONTINUOUS GYRO TRIM. IN THIS CONFIGURATION, THE KALMAN FILTER IS APPLIED TO THE GYRO DATA DERIVING QUIET ATTITUDE DATA.

FOR MINIMUM-TIME SLEWS, CONTROL MUST NOT BE IN FILTERED GYROS ON THE SLEWING AXIS. THE NON-SLEWING AXES CAN REMAIN IN FILTERED GYRO MODE. FOR FIXED-RATE SLEWS, ALL AXES CAN REMAIN IN FILTERED GYRO MODE.

TO GO TO FILTERED GYROS ONLY MODE:

```
ME0=1,ME1=1,ME2=1                          /HIGH GAIN
MC0=0,MC1=0                                /DO NOT USE FES FOR CONTROL
MB0=1,MB1=1,MB2=1                          /KALMAN FILTERS
OBCDB10 ME0,ME1,ME2,MC0,MC1,MB0, MB1,MB2
                                           /BUILD DATA BLOCK 10
:OBC LDBLK,10                              /UPLINK DATA BLOCK FOR FILTERED
                                            GYROS
```

OPERATIONAL IMPLEMENTATION WILL BE PROVIDED BY THE PROC:

```
EXEC FESTRK,0                              /FILTERED GYROS
```

2. CONTROL IUE WITH FES

FES CONTROL IS AN ALTERNATE TO THE PRIMARY CONTROL MODE OF FILTERED-GYROS. FES CONTROL CAN BE UTILIZED WHEN A SUFFICIENTLY BRIGHT GUIDE STAR IS AVAILABLE. OPTIMUM PERFORMANCE WILL BE ACHIEVED USING GUIDE STARS OF 6th MAGNITUDE OR FAINTER. DO NOT SLEW IN EITHER PITCH OR YAW, IF EITHER AXIS IS IN FES CONTROL (IN EITHER MIN-TIME OR FIXED RATE MODE).

```
ML=0                                       /DISABLE FES PROCESSOR
OBCDB10 ML                                 /BUILD DATA BLOCK 10
:OBC LDBLK,10                              /UPLINK DATA BLOCK 10
```

THE ABOVE CAN BE OMITTED IF ML IS ALREADY ZERO.

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N003B NUMBER

1. APPLICATION: HOLD SLEW MODES OF OPERATION & GYRO TRIM METHODS

IMPLEMENTATION RESPONSIBILITY:

SUPERCEDES PRIOR FODs: 004A

RESPONDS TO SCARs: N/A

2. DIRECTIVE

```
ML=3,ME0=1,ME1=1,ME2=1,MK=0,MC0=1,MC1=1,MA=1     /HIGH GAIN, USE FES DATA
OBCDB10 ML,ME0,ME1,ME2,MK,MC0,MC1,MA             /BUILD DATA BLOCK 10
:OBC LDBLK,10                                    /UPLINK DATA BLOCK FOR FES
                                                  CONTROL
```

OPERATIONAL IMPLEMENTATION WILL BE PROVIDED BY THE PROC:

```
EXEC FESTRK,1                                    /CONTROL WITH FES
```

3. RAW GYRO CONTROL - RECOVERY FROM 1. OR 2.

RAW GYRO CONTROL - THIS MODE IS INTENDED FOR USE IN TWO SITUATIONS: FIRST, IN A MINIMUM-TIME SLEW, THE SLEWING AXIS MUST BE CONFIGURED TO RAW GYRO CONTROL. SECOND, THIS IS A SAFETY MODE USED AS A FALLBACK IN CASE OF DIVERGENCE PROBLEMS WITH THE KALMAN FILTERS - THIS USE IS HANDLED AUTOMATICALLY ONBOARD IUE.

```
MA=1
MB0=0,MB1=0,MB2=0                    /NO KALMAN FILTERING
OBCDB10 MB0,MB1,MB2,MA               /BUILD DATA BLOCK 10
:OBC LDBLK,10                        /UPLINK DATA BLOCK FOR RAW GYRO CONTROL
```

4. GROUND DRIFT TRIM - GROUND AND ONBOARD TRIM TECHNIQUES

A. GROUND DRIFT TRIM (MK=1)

GYRO DRIFT ABOUT THE ROLL AXIS CAN BE COMPENSATED ONLY BY A GROUND UPLINK OF THE DRIFT RATE. PITCH AND YAW DRIFT RATES CAN ALSO BE OPTIONALLY TRIMMED IN THIS MANNER.

(1) ROLL AXIS TRIM:

IN ORDER TO CALCULATE ROLL DRIFT, IT IS NECESSARY TO USE THE MANEUVER PROCESSOR. GENERATE A MANEUVER TO THE CURRENT ATTITUDE:

```
MANEUVER                             /CALL MANEUVER PROCESSOR
```

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

1. APPLICATION: HOLD SLEW MODES OF OPERATION & GYRO TRIM METHODS

IMPLEMENTATION RESPONSIBILITY:

SUPERCEDES PRIOR FODs: 004A

RESPONDS TO SCARs: N/A

2. DIRECTIVE

SLEW A(DEG,MIN,SEC),D(DEG,MIN,SEC) /COORDINATES OF CURRENT ATTITUDE
(RA) (DEC)

MANEUVER GEN /GENERATE MANEUVER

IF CONSTRAINED:

SELECT 1 /SELECT CONSTRAINED MANEUVER
(THE PITCH AND YAW LEGS FROM RESULTING MANEUVER GENERATION SHOULD BE VERY NEARLY ZERO)

CALCULATE TRUE ROLL:

$R_{TRUE}=R_{FSS}+R_{OPT}-M_{FSS}$

WHERE:

R_{FSS} = FSS ROLL ON ACSM PAGE
R_{OPT} = DESIRED ROLL ANGLE AT TOP OF MANTMLN1
M_{FSS} = PREDICTED ROLL AT BOTTOM OF MANTMLN1

TAKE AT LEAST TWO READINGS AT LEAST 30 MINUTES APART AND CALCULATE THE DRIFT:

$$X = \frac{R_{TRUE}(T1) - R_{TRUE}(T\emptyset)}{(T_1-T_\emptyset)*60*206264.81}$$ DRIFT IN RADIANS/SEC.

R_{TRUE} IN ARCSECONDS

TO TRIM THE ROLL AXIS:

THE OBC MUST BE USING FES DATA FOR CONTROL

```
BGØ=Ø,BG1=Ø,BG2=-X,MK=1          /ROLL DRIFT
OBCDB1Ø MK, BGØ,BG1,BG2          /BUILD DATA BLOCK 1Ø
:OBC LDBLK,1Ø                    /UPLINK DATA BLOCK 1Ø
```

OPERATIONAL IMPLEMENTATION WILL BE PROVIDED BY:

```
EXEC FESTRK,Ø,Ø,Ø,-Z             /GROUND ROLL DRIFT TRIM
   Z=X*206264.81                 /(Z IN ARC SECONDS PER SECOND)
```

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N003B NUMBER

1. APPLICATION: HOLD SLEW MODES OF OPERATION & GYRO TRIM METHODS

IMPLEMENTATION RESPONSIBILITY:

SUPERCEDES PRIOR FODs: 004A

RESPONDS TO SCARs: N/A

2. DIRECTIVE

(2) PITCH AND YAW AXIS GROUND TRIMS:

a. ASSIGN PENS TO ABG1 AND ABG2, EACH WITH AN ENGINEERING RANGE OF -25 TO +25.

b. DISABLE THE FES PROCESSOR.

```
ML=Ø                    /DISABLE THE FES PROCESSOR

OBCDB1Ø ML              /CONSTRUCT DATA BLOCK 1Ø

:OBC LDBLK,1Ø           /UPLINK DATA BLOCK 1Ø
```

c. WAIT 1 MINUTE. ENABLE THE FES PROCESSOR AND CONTROL THE SPACECRAFT USING A STAR AND POSITION UPDATES.

```
MA=1,MBØ=1,MB1=1,MB2=1          /USE POSITION UPDATE AND
                                 FILTERED GYROS

MCØ=1,MC1=1,MK=Ø,ML=3           /CONTROL SPACECRAFT ON FES,
                                 DON'T TRIM GYROS, AND
                                 CYCLE ML

MEØ=1,ME1=1,ME2=1               /USE HIGH GAIN

OBCDBD1Ø MA,MBØ,MB1,MB2,MCØ,MC1,MEØ,ME1,ME2,MK,ML
                                /CONSTRUCT DATA BLOCK 1Ø

:OBC LDBLK,1Ø                   /UPLINK DATA BLOCK 1Ø
```

OPERATIONAL IMPLEMENTATION WILL BE PROVIDED BY:

```
EXEC FESTRK,1                   /FES CONTROL
```

d. MONITOR THE VALUES OF ABG1 AND ABG2 OVER A TIME INTERVAL, T, OF ABOUT 30 MINUTES. ABG1(Ø) AND ABG2(Ø) ARE THE INITIAL VALUES OF ABG1 AND ABG2, AND ABG1(T) AND ABG2(T) ARE THE VALUES AFTER A PERIOD OF T MINUTES, THE PITCH AND YAW GYRO DRIFT RATES, BGØ AND BG1 ARE:

$$BG\emptyset = \frac{ABG1(T)-ABG1(\emptyset)}{T*60*206264.81} \text{ RADIANS/SEC} = m \quad \text{(PITCH DRIFT RATE)}$$

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N003B NUMBER

1. APPLICATION: HOLD SLEW MODES OF OPERATION & GYRO TRIM METHODS

IMPLEMENTATION RESPONSIBILITY:

SUPERCEDES PRIOR FODs: 004A

RESPONDS TO SCARs:

2. DIRECTIVE

$$BG1 = \frac{ABG2(T)-ABG2(\emptyset)}{T*60*206264.81} \text{ RADIANS/SEC} = n \text{ (YAW DRIFT RATE)}$$

e. UPLINK THE GROUND TRIM OF THE GYRO DRIFT RATE.

NOTE: THE FORMAT FOR ENTERING THE DRIFT RATE SHOULD BE OF THE FORM:

m = 5.4E-8

n = 6.1E-9

```
BGØ=m,BG1=n,BG2=Ø,MK=1        /GROUND TRIM THE GYROS
                               WITH THE APPROPRIATE
                               DRIFT RATES, SET ROLL
                               TRIM BG2=Ø WHEN TRIM-
                               MING PITCH AND YAW AXES.

OBCDB1Ø MK,BGØ,BG1,BG2         /CONSTRUCT DATA BLOCK 1Ø

:OBC LDBLK,1Ø                  /UPLINK DATA BLOCK 1Ø
```

OPERATIONAL IMPLEMENTATION WILL BE PROVIDED BY:

```
EXEC FESTRK,Ø,BGØ,BG1,Ø        /PITCH, YAW TRIM
```

BGØ AND BG1 ARE IN ARCSEC/SEC.

BGØ=m*206264.81 ARCSEC/SEC.
BG1=n*206264.81 ARCSEC/SEC.

B. ON BOARD TRIM

THE GYROS CAN BE TRIMMED USING THE ONBOARD LOGIC AFTER SLEWS. THE RATE BIAS IS THUS ESTIMATED AND REMOVED TO THE NOISE LEVEL OF .001 ARCSEC/SEC. OPTIMALLY, THE STAR BEING TRACKED SHOULD HAVE A MAGNITUDE BETWEEN 6 AND 12, AND THE FES SHOULD BE IN THE FAST TRACK (NOT SLOW TRACK) MODE. THE BIAS ESTIMATES ARE COMPUTED AND APPLIED EVERY 96 SECONDS AND NORMALLY 5-7 ITERATIONS ARE SUFFICIENT TO REDUCE THE DRIFT TO AN UNIMPROVABLE LEVEL. THE ONBOARD DRIFT TRIM SHALL BE DONE USING THE POSITION UPDATE (MA=1) OPTION. IN THIS CASE THE SPACECRAFT WILL BE UNDER FES CONTROL FOR ONE ITERATION OF THE HOLD/SLEW CYCLE AND WILL THEN REVERT TO GYRO CONTROL.

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N003B NUMBER

1. APPLICATION: HOLD SLEW MODES OF OPERATION & GYRO TRIM METHODS

IMPLEMENTATION RESPONSIBILITY:

SUPERCEDES PRIOR FODs: 004A

RESPONDS TO SCARs: N/A

2. DIRECTIVE

CAUTION: IT HAS BEEN OBSERVED THAT ONBOARD TRIMS MAY BE SOMEWHAT DEGRADED WHEN THE OBC IS TAKING WORKER Ø "HITS". PEAK "HIT" FREQUENCY OCCURS AT HIGHER OBC TEMPERATURES ($\geq$ 51.2°C) ANDDURING ONBOARD TRIMS.

(1) ONBOARD GYRO DRIFT TRIM WITH POSITION UPDATE

```
ML=Ø                          /DISABLE THE FES PROCESSOR
OBCDB1Ø ML                    /CONSTRUCT DATA BLOCK 1Ø
:OBC LDBLK,1Ø                 /UPLINK DATA BLOCK 1Ø
THE ABOVE CAN BE OMITTED IF ML IS ALREADY ZERO.
ML=3                          /CYCLE ML
OBCDB1Ø ML                    /CONSTRUCT DATA BLOCK 1Ø
:OBC LDBLK,1Ø                 /UPLINK DATA BLOCK 1Ø
MEØ=1,ME1=1,ME2=1             /HIGH GAIN ON ALL AXES
MCØ=Ø,MC1=Ø                   /DO NOT USE FES FOR CONTROL
MBØ=1,MB1=1,MB2=1             /FILTERED GYRO ON ALL AXES
MK=2,MA=1                     /ONBOARD TRIM WITH POSITION UPDATE
OBCDB1Ø MEØ,ME1,ME2,MCØ,MC1,MBØ,MB1,MB2,MK,MA
                              /CONSTRUCT DATA BLOCK 1Ø
:OBC LDBLK,1Ø                 /UPLINK DATA BLOCK 1Ø
OPERATIONAL IMPLEMENTATION WILL BE PROVIDED BY:
EXEC FESTRK,3                 /ONBOARD GYRO TRIM
```

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N003B NUMBER

1. APPLICATION: HOLD SLEW MODES OF OPERATION & GYRO TRIM METHODS

   IMPLEMENTATION RESPONSIBILITY:

   SUPERCEDES PRIOR FODs: 004A

   RESPONDS TO SCARs:

2. DIRECTIVE

   5. STOP GYRO TRIMS

```
MK=Ø                              /DISABLE ONBOARD TRIM
OBCDB1Ø MK                        /CONSTRUCT DATA BLOCK 1Ø
:OBC LDBLK,1Ø                     /UPLINK DATA BLOCK 1Ø
```

   6. MINIMUM-TIME SINGLE LEG SLEW

```
MANEUVER                          /CALL MANEUVER PROCESSOR
SLEW [PITCH|YAW|ROLL] (DEG,MIN,SEC)   /SLEW ANGLES, MIN. AND SEC. OPTIONAL
MANEUVER GEN                      /GENERATE MANEUVER
:UPLINK T                         /UPLINK MANEUVER
```

   IF CONSTRAINED:

```
SELECT N                          /SELECT CONSTRAINED MANEUVER,N
:UPLINK T,PSWD                    /UPLINK CONSTRAINED MANEUVER
```

   7. FIXED-RATE SLEW

   MIN. RATES — 0.03 ARCSEC/SEC, ALL AXES

   MAX. RATES — 1ØØ ARCSEC/SEC ON PITCH, YAW.
   3ØØ ARCSEC/SECON ROLL.

   SLEW ANGLE IN RADIANS:
   SACØ (IF PITCH)
   SAC1 (IF YAW)
   SAC2 (IF ROLL)
   } (+ FOR POSITIVE DIRECTION, - FOR NEGATIVE DIRECTION)

   CYCLE COUNTER
   IMXØ (PITCH)
   IMX1 (YAW)
   IMX2 (ROLL)

   EXAMPLE: PITCH AT 1Ø ARCSEC/SEC, OVER Ø.5Ø RADIANS

   SACØ=Ø.5 RADIANS

   RATE=1Ø ARCSEC/SEC x 4.8×10^{-6} RAD./ARCSEC = 4.8×10^{-5} RAD./SEC

   IMXØ= ABS $\left(\frac{\text{SACØ}}{\text{RATE}}\right)$ = ABS$(.5/4.8 \times 10^{-5})$ = 1Ø417

   (ABS-MEANS ABSOLUTE VALUE)

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N003B NUMBER

1. APPLICATION: HOLD SLEW MODES OF OPERATION & GYRO TRIM METHODS

IMPLEMENTATION RESPONSIBILITY:

SUPERCEDES PRIOR FODs: 004A

RESPONDS TO SCARs: N/A

2. DIRECTIVE

SINGLE LEG-PITCH SLEW

```
SACØ=    ,IMXØ=                          /SLEW PARAMETERS
MBØ=1,MB1=1,MB2=1,MEØ=1,ME1=1,ME2=1,MCØ=Ø,MJØ=1
                                         /HIGH GAIN, FIXED RATE SLEW
OBCDB1Ø SACØ,IMXØ,MBØ,MB1,MB2,MEØ,ME1,ME2,MCØ,MJØ
                                         /BUILD DATA BLOCK 1Ø
:OBC LDBLK,1Ø                            /UPLINK FIXED RATE PITCH SLEW
```

SINGLE LEG-YAW SLEW

```
SAC1=    ,IMX1=                          /SLEW PARAMETERS
MBØ=1,MB1=1,MB2=1,MEØ=1,ME1=1,ME2=1,MC1=Ø,MJ1=1
                                         /HIGH GAIN, FIXED RATE SLEW
OBCDB1Ø SAC1,IMX1,MBØ,MB1,MB2,MEØ,ME1,ME2,MC1,MJ1
                                         /BUILD DATA BLOCK 1Ø
:OBC LDBLK,1Ø                            /UPLINK FIXED RATE YAW SLEW
```

SINGLE LEG-ROLL SLEW

```
SAC2=    ,IMX2=                          /SLEW PARAMETERS
MBØ=1,MB1=1,MB2=1,MEØ=1,ME1=1,ME2=1,MC2=Ø,MJ2=1
                                         /HIGH GAIN, FIXED RATE SLEW
OBCDB1Ø SAC2,IMX2,MBO,MB1,MB2,MEØ,ME1,ME2,MC2,MJ2
                                         /BUILD DATA BLOCK 1Ø
:OBC LDBLK,1Ø                            /UPLINK FIXED RATE ROLL SLEW
```

COMBINED 2-AXES FIXED-RATE SLEWS

(STACK ABOVE APPROPRIATE COMMANDS)

OPERATIONAL IMPLEMENTATION WILL BE PROVIDED BY:

```
EXEC FESLEWRT,AXIS,ANGLE,RATE            /SINGLE AXIS FIXED-RATE SLEW
```

AXIS:
Ø = PITCH
1 = YAW
2 = ROLL

ANGLE IN HUNDREDTHS OF AN ARCSECOND
RATE IN HUNDRETHS OF ARCSECONDS PER SECOND

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

APPLICATION: HOLD SLEW MODES OF OPERATION & GYRO TRIM METHODS

IMPLEMENTATION RESPONSIBILITY:

SUPERCEDES PRIOR FODs: 004A

RESPONDS TO SCARs:

2. DIRECTIVE

GENERAL-MODE SWITCH COMMENTS AND NOTES

(1) ONLY AN ERROR CONDITION WILL CAUSE CONTROL TO SWITCH FROM KALMAN FILTER TO RAW GYROS (MB=1 to MB=Ø). FOR EXAMPLE: ONE CONDITION WHICH CAN CAUSE SUCH A REVERSION IS EXECUTION OF A MINIMUM-TIME SLEW WITH THE SLEWING AXIS NOT IN RAW GYRO MODE.

(2) HOLD/SLEW WILL DROP AN AXIS INTO LOW-GAIN HOLD AUTOMATICALLY, IF THE ANGULAR ERROR (AB) EXCEEDS 1.5 DEGREES ON THAT AXIS. THIS IS AN INDICATION OF DEGRADING CONTROL PERFORMANCE (SINCE THE ALGORITHM IS DESIGNED TO MAINTAIN POINTING ERRORS LESS THAN 1 ARCSECOND). THIS ANGULAR LIMIT IS APPLIED ONLY DURING HOLD-MODE OPERATIONS (NOT DURING SLEW).

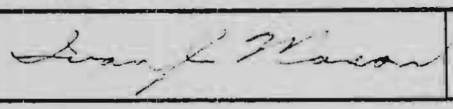
(3) DEFINITIONS OF SOME OF THE DISPLAYED VARIABLES (ON ACSM PAGE) ARE:

"ABG" : GYRO MEASURED BODY ANGLES
"AE" : FES-MEASURED BODY ANGLES
"RB" : BODY RATES

WITH IUE UNDER FES CONTROL, THE HOLD/SLEW ALGORITHM IS STRIVING TO ZERO OUT THE ANGLES "AE". SIMILARLY, WITH FILTERED-GYRO OR RAW-GYRO CONTROL, EFFORT IS DIRECTED TOWARDS ZEROING ABG.

DEFINITION OF OBC MODE BITS:

MA DO/DON'T (1/Ø) EXECUTE POSITION UPDATE ON PITCH, YAW AXES.
MB DO/DON'T (1/Ø) USE KALMAN FILTER.
MC DO/DON'T (1/Ø) USE FES IN CONTROL LOOP.
MD HOLD/SLEW (Ø/1)
ME HIGH/LOW GAINS (1/Ø)
MF DO/DON'T (1/Ø) UPDATE WHEEL VOLTAGE BIASES.
MG DO/DON'T (1/Ø) ADD BIAS VOLTAGES INTO WHEELS.
MJ DO/DON'T (1/Ø) ACCEPT SLEW COMMAND.
MK GYRO BIAS CALIBRATION
Ø NO CALIBRATION
1 GROUND CALIBRATION
2 FIRST PASS THROUGH ONBOARD REGRESSIVE DRIFT DETERMINATION
3 LATER PASS, ONBOARD
ML FES PROCESSOR
Ø or 1 FES PROCESSOR DISABLED
2 or 3 AUTOMATIC (PROCESSING IF STAR PRESENCE BIT IS SET)

3. APPROVAL SIGNED: IVAN J. MASON 	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N003B NUMBER

1. APPLICATION: HOLD SLEW MODES OF OPERATION & GYRO TRIM METHODS

   IMPLEMENTATION RESPONSIBILITY:

   SUPERCEDES PRIOR FODs: 004A

   RESPONDS TO SCARs: N/A

2. DIRECTIVE

   (4) THE FOLLOWING PROCEDURE USES ONBOARD GYRO DRIFT TRIM WITH NO POSITION UPDATES (MA=Ø), WHICH COULD BE AN UNSTABLE CONFIGURATION. IT SHALL NOT BE USED WITHOUT MOM OR POD APPROVAL. INSTABILITY MAY INCREASE WITH TIME (HOURS).

   ONBOARD GYRO DRIFT TRIM WITH NO POSITION UPDATES

```
ML=Ø                                          /DISABLE THE FES PROCESSOR
OBCDB1Ø ML                                    /CONSTRUCT DATA BLOCK 1Ø
:OBC LDBLK,1Ø                                 /UPLINK DATA BLOCK 1Ø
ML=3                                          /CYCLE ML
OBCDB1Ø ML                                    /CONSTRUCT DATA BLOCK 1Ø
:OBC LDBLK,1Ø                                 /LOAD DATA BLOCK 1Ø
MEØ=1,ME1=1,ME2=1                             /HIGH GAIN ON ALL AXES
MCØ=Ø,MC1=Ø                                   /DO NOT USE FES FOR CONTROL
MBØ=1,MB1=1,MB2=1                             /FILTERED GYRO ON ALL AXES
MK=2,MA=Ø                                     /ONBOARD TRIM WITH NO POSITION UPDATE
OBCDB1Ø MEØ,ME1,ME2,MCØ,MC1,MBØ,MB1,MB2,MK,MA
                                              /CONSTRUCT DATA BLOCK 1Ø
:OBC LDBLK,1Ø                                 /UPLINK DATA BLOCK 1Ø
```

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	17 OCT. 83 DATE	N004G NUMBER

1. APPLICATION: EVCL, EVD AND ENG CONFIGURATION AND HAPS TEMP CONTROL
   IMPLEMENTATION RESPONSIBILITY:
   SUPERCEDES PRIOR FODs: N004F
   RESPONDS TO SCARs: N/A

2. DIRECTIVE : WHEN NOT IN USE THE EVCL, EVD AND ENG SYSTEM SHALL BE RETAINED IN THE FOLLOWING CONFIGURATION:

A. ENGINE VALVE DRIVER (EVD) OFF

B. ENGINE VALVE COMMAND LOGIC (EVCL)

LPUL =	1	/PULSE MODE
PHASE =		/(DON'T CARE)
ACC =		/(DON'T CARE)
EVC =	1	/PRIMARY
HPUL =	1	/PULSE
VALVE =	125	/ONLY #2 CLOSED, MAY CHANGE DURING THE LIFE OF THE S/C
ENG =	2925	/ENA ALL LTE
EVE =	Ø	/DISABLE MODE
FIRE =	Ø	/NO FIRE COMMAND

C. HAPS HEATER GROUP NO. 2

ON - NORMAL CONFIGURATION

OFF - SEE PARA. D, WHEN THE HEATERS HAVE BEEN TURNED OFF THEY WILL REMAIN OFF UNTIL ABOUT 30 MINUTES BEFORE THE NEXT EXPECTED USE. UNLESS IT IS AN EMERGENCY LTE'S 1, 3, 4, 6, 7, 9 SHALL NOT BE USED UNLESS CAT. BED TEMP > 80°C.

ON - IF OFF, HEATER GROUP 2 SHALL NORMALLY BE TURNED ON ABOUT 30 MINUTES BEFORE HANDOVER. WHEN IT IS KNOWN THAT THE S/C WILL REMAIN NEAR THE SAME ATTITUDE AFTER HANDOVER (E.G. CONSECUTIVE SHIFT COLLABORATIVE PROGRAMS) THE HAPS HEATERS WILL REMAIN OFF, UNLESS AN UNLOAD WOULD BE REQUIRED AFTER THE HANDOVER.

3. APPROVAL IVAN J. MASON	17 OCT. 83 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	17 OCT. 83 DATE	N004G NUMBER

1. APPLICATION: EVCL, EVD AND ENG CONFIGURATION AND HAPS TEMP CONTROL
   IMPLEMENTATION RESPONSIBILITY:
   SUPERCEDES PRIOR FODs: N004F
   RESPONDS TO SCARs: N/A

2. DIRECTIVE

D. THE FOLLOWING GUIDELINES SHALL BE USED FOR OPERATIONAL CONTROL OF THE HAPS HEATERS AND OPERATIONAL CONSTRAINTS IMPOSED BY HIGH HAPS TEMPERATURES.

1. TURN OFF HAPS HEATER GROUP 2 IF EV 1, 3, 4, 6, 7 OR 9 REACH 85°C. TURN HEATER GROUP 2 BACK ON IN ACCORDANCE WITH PARAGRAPH C ABOVE.

   IF THE S/C ANALYSTS BELIEVE IT WILL BE NECESSARY TO TURN THE HAPS HEATERS OFF WHEN THE SPACECRAFT WILL REMAIN AT ONE ATTITUDE FOR A LONG PERIOD (>5 HOURS), THE HAPS HEATERS MAY BE TURNED OFF BEFORE REACHING THE 85°C EV LIMIT.

2. NORMAL SCIENCE OPERATIONS MAY CONTINUE FOR EV TEMPERATURES UP TO 85°C.

3. NORMAL SCIENCE OPERATIONS MAY CONTINUE FOR +Z LINE TEMPERATURE UP TO 90°C.

4. IF ANY HAPS TEMPERATURE ELEMENT EXCEEDS 85°C (90°C FOR THE +Z LINE) FOR MORE THAN 1 HOUR THE SCIENCE OPERATION PROGRAM SHALL BE CHANGED SO THE SPACECRAFT WILL BE MANEUVERED TO AN ATTITUDE THAT WILL COOL THE OUT-OF-LIMIT TEMPERATURE. THE MANEUVER TO THE COOLING ATTITUDE SHALL BE INITIATED WITHIN 15 MINUTES AFTER THE 1 HOUR LIMIT IS REACHED.

3. APPROVAL IVAN J. MASON	17 OCT. 83 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	5 AUG. 82 DATE	N005B NUMBER

1. APPLICATION: WHEEL SPEED CONTROL

   IMPLEMENTATION RESPONSIBILITY:

   SUPERCEDES PRIOR FODs: N005 A

   RESPONDS TO SCARs: N/A

2. DIRECTIVE

THE INERTIA WHEEL SPEED MUST BE CONTROLLED TO MINIMIZE BEARING WEAR AND PREVENT ERRATIC CONTROL (LOWER LIMIT 200 RPM) AND TO PROVIDE EFFECTIVE TORQUE CONTROL (UPPER LIMIT 1000 RPM). TO ASSURE ADEQUATE MOMENTUM CONTROL FOR SPACECRAFT EMERGENCY CONTROL ON WHEELS LIMIT THE MAXIMUM WHEEL SPEED TO APPROXIMATELY $\leq |500|$ RPM FOR THE ROLL AND YAW WHEELS AND $\leq |1000|$ RPM FOR THE PITCH WHEEL . A 50 TO 100 RPM DEVIATION FROM THIS DESIRED NOMINAL WHEEL SPEED RANGE IS PERMITTED FOR SHORT PERIODS (APPROX. 30 MINUTES) TO MINIMIZE IMPACT OF WHEEL UNLOADS ON SCIENCE OPERATIONS; HOWEVER THE SUM OF THE THREE WHEELS SHALL NOT EXCEED THE 2000 RPM LIMIT, LESS IS BETTER FOR EMERGENCY CONTROL.

WHEEL SPEED CHANGES CAN BE MADE BY FIRING POSITIVE-TORQUE JETS TO MAKE THE WHEEL RPM MORE POSITIVE AND NEGATIVE-TORQUE JETS TO MAKE THE WHEEL RPM MORE NEGATIVE. THE FOLLOWING PRECAUTIONS SHOULD BE IMPLEMENTED FOR THE UNLOADS:

(a) NEVER UNLOAD REACTION WHEELS WITH THE JETS IN THE CONTINUOUS MODE

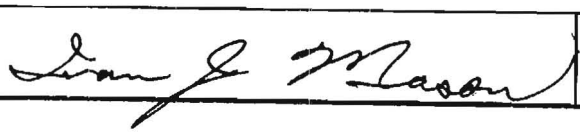
(b) THE ENGINE VALVE DRIVER IS TO BE "OFF" WHEN THE JETS ARE NOT IN USE.

(c) ALWAYS DISABLE WORKER 9 (RATE ARREST WORKER) BEFORE UNLOADING WHEELS AND REENABLE IT WHEN THE UNLOADING PROCESS IS COMPLETE. (SEE NOTE 1)

THE UNLOAD PROC INCORPORATES THE ABOVE STEPS AND CAN BE USED FOR SINGLE, DOUBLE, OR TRIPLE AXIS UNLOADS.

TO MINIMIZE IMPACT ON SCIENCE OPERATIONS, PERFORM WHEEL UNLOADS IMMEDIATELY FOLLOWING MAJOR SLEWS OR BETWEEN OBSERVATIONS; IT WILL DISABLE FES TRACKING.

NOTE 1: THERE IS NO WORKER 9 IN 4K OBC SYSTEM.

3. APPROVAL SIGNED: IVAN J. MASON 	5 AUG. 82 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N006A NUMBER

1. APPLICATION: CAMERA IMAGE RECOVERY

IMPLEMENTATION RESPONSIBILITY:

SUPERCEDES PRIOR FODs: 023

RESPONDS TO SCARs: N/A

2. DIRECTIVE: THIS DIRECTIVE PROVIDES INSTRUCTIONS FOR RECOVERY OF IMAGES FROM HISTORY TAPES.

A. COMPUTER SETUP

1. MOUNT THE DESIRED IMAGE HISTORY TAPE ON DRIVE CØ

2. ENSURE THAT NO REAL-TIME SPACECRAFT TELEMETRY IS BEING RECEIVED BY THE COMPUTER CHOSEN FOR THIS TASK.

3. MOUNT AN ARCHIVE TAPE.

4. SET POD AT ADDS TERMINAL.

5. LOAD ARCHIVE,'IUESOC',XX

6. LOAD PROCFILE TAPE,XX

7. START HISTORY TAPE RUNNING PER NORMAL PROCEDURE AND SELECT PLAYBACK AS FOLLOWS:

PLAYBACK MONTH,DAY,YEAR,START HR,START MIN,START SEC,END HR, END MIN, END SEC,TLM* RATE,SEARCH

THE TAPE WILL SEARCH THE REQUESTED START TIME, AND WHEN FOUND IT WILL POISE AT THAT TIME UNTIL PLAYBACK CONTINUE IS TYPED IN BY THE OPERATOR.

FOR EXAMPLE

PLAYBACK 3,6,78,2,1Ø,Ø,2,4Ø,Ø,2Ø,SEARCH
PLAYBACK CONTINUE

*40 KBS CAN BE SELECTED ON SIGMA 9 AND SIGMA 5

B. EXECUTE THE 'READMON' PROCEDURE FROM AN EDS

1. SIGNON 'HISTORY PLAYBACK',LSTIMG,NODATA

2. SET UP THE IMAGE NUMBERS AND FLAGS WHICH INCLUDE INO(1), INO(2), INO(3), INO(4), KFLG,MFLG AND LFLG OBTAINED FROM THE OD(S) OR THE RESIDENT ASTRONOMERS.

EXAMPLE: INO(3) =1572
KFLG=1
LFLG=1
MFLG=1
SCIHEADØ

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

1. APPLICATION: CAMERA IMAGE RECOVERY

IMPLEMENTATION RESPONSIBILITY:

SUPERCEDES PRIOR FODs: 023

RESPONDS TO SCARs: N/A

2. DIRECTIVE:

3. OBTAIN THE ARGUMENTS OF 'READMON' FROM THE OD(S) OR RESIDENT ASTRONOMERS.

THEY ARE:

ARGUMENT 1 - CAMERA ID
(LWP, LWR, SWP, SWR)

ARGUMENT 2 - TYPE OF PREPARATION

Ø = NO PREP	4 = LNPREP
1 = NPREP	5 = FPREP
2 = TPREP	6 = XPREP
3 = SPREP	

ARGUMENT 3 - EXPOSURE TIME IN MINUTES

ARGUMENT 4 - EXPOSURE TIME IN SECONDS

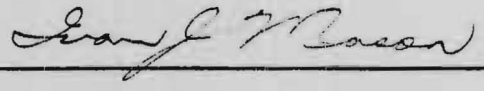
ARGUMENT 5 - EXPOSURE GAINS
(MAXG,MEDG,MING)

ARGUMENT 6 - CALIBRATION LAMPS
(NOCAL,CALUV,CALWL,TFLOOD,BHFID,COMPX)

ARGUMENT 7 - READ GAINS
(HI,LO)

ARGUMENT 8 - TYPE OF OPERATIONS (OPTIONAL)
(1 = UNUSUAL SCAN,2 = G1 CUT-OFF READ)
(3 = HEATER-LOW READ,4 = REOPTIMATION)

4. EXECUTE THE 'READMON'PROCEDURE TO THE WAIT STATEMENT "WAIT READM (JKM), 600/WAIT TLM IND SCAN-ENABLE", BEFORE STARTING THE HISTORY TAPE PLAYBACK.

3. APPROVAL SIGNED: IVAN J. MASON  | 1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N006A NUMBER

1. APPLICATION: CAMERA IMAGE RECOVERY

   IMPLEMENTATION RESPONSIBILITY:

   SUPERCEDES PRIOR FODs: 023

   RESPONDS TO SCARs: N/A

2. DIRECTIVE:

   5. EXECUTE TO "WAIT/IS TAPE READY". THEN ENTER "COM(1), 'TEXT TO BE SUPPLIED BY RESIDENT ASTRONOMER'. IF ARCHIVE TAPE IS READY TO RECEIVE IMAGE, THEN ENTER 'GO'.

   C. TYPE 'PLAYBACK STOP' TO STOP THE HISTORY TAPE.

   D. PROVIDE RESIDENT ASTRONOMER WITH A MEMO GIVING THE ARCHIVE TAPE NUMBER AND THE INDENTIFICATION (CAMERA ID AND IMAGE NO.) OF THE IMAGES ON THAT TAPE.

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N007B NUMBER

1. APPLICATION: MANEUVER CONSTRAINT PASSWORD USE

   IMPLEMENTATION RESPONSIBILITY: OD

   SUPERCEDES PRIOR FODs: 024A

   RESPONDS TO SCARs: N/A

2. DIRECTIVE: THIS DIRECTIVE PROVIDES INSTRUCTION ON MANEUVER CONSTRAINT PASSWORD (CONSTRAINT OVERRIDE) USE.

   1. ANTENNA NULL CONSTRAINT MAY BE OVERRIDDEN ROUTINELY, AT THE DISCRETION OF THE OD. USE THIS CONSTRAINT AS A WARNING OF MOMENTARY LOSS OF DATA DURING SLEWS OR THE NEED TO SWITCH TO A MORE FAVORABLE ANTENNA.

   2. EARTH AND MOON CONSTRAINTS MAY BE OVERRIDDEN AT THE REQUEST OF THE TELESCOPE OPERATOR. THE TO AND OBSERVER SHALL BE RESPONSIBLE FOR EVALUATING THE HAZARD OF DATA CONTAMINATION CAUSED BY SCATTERED LIGHT FROM THE EARTH AND MOON.

      NOTE: IF THE IUE WOULD ACTUALLY POINT NEAR THE EARTH TRACKING SITE A SIGNIFICANT ANTENNA NULL MAY BE EXPERIENCED. THE OD SHALL EVALUATE POTENTIAL ALTERNATE SLEWS, WITH THE TELESCOPE OPERATOR, TO MINIMIZE DATA DROP-OUT. IF OBSERVATIONS ARE MADE NEAR THE EARTH, OPERATIONAL DELAYS MAY BE EXPERIENCED BECAUSE IT MAY BE NECESSARY TO SLEW AWAY FROM THE EARTH TO ACHIEVE SATISFACTORY SIGNAL QUALITY FOR AN IMAGE READ. IF SIGNAL QUALITY IS INADEQUATE FOR SATISFACTORY SPACECRAFT STATUS DATA THE OD SHALL INSTRUCT THE TO TO SELECT AND SLEW TO A MORE FAVORABLE TARGET.

   3. DIGITAL SUN SENSOR (DSS) LOSS OF SUN PRESENCE CONSTRAINT MAY BE OVERRIDDEN TO OBSERVE TARGETS FROM BETA 0° TO BETA 15°. TO AVOID LOSS OF ATTITUDE REFERENCE, A TARGET IN THE RANGE OF BETA 15° TO BETA 30° SHALL BE USED BEFORE SLEWING BELOW BETA 15° AND WHEN RETURNING FROM BETA BELOW 15°.

   4. WHEEL RATE CONSTRAINTS SHALL BE CLEARED BY UNLOADING THE APPROPRIATE INERTIA WHEELS.

   5. SUN CONSTRAINTS SHALL NOT BE OVERRIDDEN.

   6. THERMAL LOUVERS AND THERMAL POWER CONSTRAINTS SHALL NOT BE OVERRIDDEN.

   7. TIME ALERTS (TEP, TMP, TEI AND TMI) AND STATIC EARTH AND MOON IMPINGEMENTS (SEI AND SMI) SHALL BE USED AS AN ALERT OF POSSIBLE DATA CONTAMINATION. THE TO AND OD WILL KEEP TRACK OF THESE WARNINGS DURING OPERATIONS AND THE TO AND OBSERVER WILL BE RESPONSIBLE FOR EVALUATING THE HAZARD OF DATA CONTAMINATION.

   8. SAFE ATTITUDE CONSTRAINTS MAY BE OVERRIDDEN AT THE DISCRETION OF THE OD.

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 MAR 78 DATE	N008 NUMBER

1. APPLICATION: RANGING AND PROCEDURE EXECUTION WHILE SLEWING S/C

   IMPLEMENTATION RESPONSIBILITY: OD/TELESCOPE OPERATOR

   SUPERCEDES PRIOR FODs: 025

   RESPONDS TO SCARs: N/A

2. DIRECTIVE:

   EFFECTIVE THIS DATE, THE OD IS AUTHORIZED (AND ENCOURAGED) TO PERMIT SIMULTANEOUS RANGING OR PROCEDURE EXECUTION WHILE THE SPACECRAFT IS EXECUTING MAJOR SLEWS, SUBJECT TO THE EXISTANCE OF THE FOLLOWING CONDITIONS (BOTH MUST BE TRUE):

   1. THERE IS NO HISTORY OF IRRECOVERABLE OBC CRASHES WITHIN THE PAST 24 HOURS.

   2. THERE IS DIRECT BENEFIT TO BE GAINED IN TERMS OF OPERATIONAL EFFICIENCY. (SLEW TIME GREATER THAN 5 MINUTES).

   WHEN PERMITTING RANGING TO OCCUR DURING A SLEW, THE OD MUST ADVISE THE RANGING STATION TO THE EFFECT THAT A MANEUVER IS IN PROGRESS, AND THAT IN THE EVENT OF ANOMALY WE MUST BE ABLE TO QUICKLY REVERT TO COMMANDING MODE. THIS IS ESPECIALLY CRITICAL WHEN THE RANGING STATION IS GREENBELT (ETC) DURING GSFC OPERATIONS PERIODS - THE ETC VHF UPLINK EQUIPMENT MUST BE RECONFIGURED FROM RANGING TO COMMANDING.

3. APPROVAL SIGNED: IVAN J. MASON	2 MAR 78 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	16 APR. 82 DATE	N009B NUMBER

1. APPLICATION: HISTORY TAPE POLICY - WRITING OF

   IMPLEMENTATION RESPONSIBILITY: OD & DOC

   SUPERCEDES PRIOR FODs: N009A

   RESPONDS TO SCARs: N/A

2. DIRECTIVE

THE FOLLOWING POLICY SHALL GOVERN THE VOLUME AND KIND OF DATA TO BE WRITTEN ON THE SYSTEM HISTORY TAPE. THE RETENTION AND RE-CYCLING OF HISTORY TAPES IS ADDRESSED IN FOD NO. N010.

1. HISTORY TAPES SHALL BE WRITTEN AT ALL TIMES IN THE GSFC IUEOCC, INCLUDING THE VILSPA ACTIVE SHIFT. VILSPA IS EXPECTED TO WRITE A HISTORY TAPE WHEN IN ACTIVE CONTROL OF THE SPACECRAFT.

2. THE FOLLOWING OPTIONS SHALL BE SELECTED WHEN WRITING HISTORY TAPES AT THE IUEOCC AS FOLLOWS:

```
DOC HISTORY,TLM,ON,1          /RECORD ALL TLM DATA

DOC HISTORY,COM,ON            /RECORD ALL COMMANDS

DOC HISTORY,EVENT,ON          /RECORD ALL EVENTS

DOC HISTORY,BETA,ON           /RECORDS BETA & ROLL
```

NOTE: THE INIT PROC PERFORMS THE ABOVE:

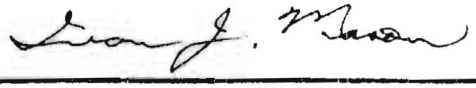
```
EXEC INIT,1
```

3. VILSPA MAY CHOOSE TO RECORD SPACECRAFT TLM ON A SAMPLE BASIS AND RECORD ALL COMMANDS AND EVENTS.

```
DOC HISTORY,TLM,ON,(N)        /RECORD TLM

DOC HISTORY,COM,ON            /RECORD ALL COMMANDS

DOC HISTORY,EVENT,ON          /RECORD ALL EVENTS
```

3. APPROVAL SIGNED: IVAN J. MASON 	16 APR. 82 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	NO10B NUMBER

1. APPLICATION: HISTORY TAPE POLICY - RETENTION OF

   IMPLEMENTATION RESPONSIBILITY: DOC

   SUPERCEDES PRIOR FODs: 027A

   RESPONDS TO SCARs: N/A

2. DIRECTIVE:

   THE FOLLOWING POLICY SHALL GOVERN THE RETENTION AND RECYCLING OF IUE OPERATIONS HISTORY TAPES.

   1. HISTORY TAPES WRITTEN PRIOR TO 10 MARCH 78 SHALL BE RETAINED IN STORAGE BUT MUST BE AVAILABLE FOR RECALL UNTIL 1 JUNE 1979.

   2. HISTORY TAPES WRITTEN FROM 10 MARCH TO 31 MAY 78 SHALL BE RETAINED IN THE IUEOCC FOR 30 DAYS FROM DATE OF CREATION. THEREAFTER, THEY MAY BE MOVED TO STORAGE BUT MUST BE AVAILABLE FOR RECALL FOR A PERIOD OF 6 ADDITIONAL MONTHS.

   3. HISTORY TAPES WRITTEN FROM JUNE 1, 1978 FORWARD SHALL BE RETAINED IN THE IUEOCC FOR 30 DAYS FROM DATE OF CREATION. THEREAFTER, THE FOLLOWING SHALL APPLY:

      a. TAPES CONTAINING DATA AT APPROXIMATELY 12 HOUR INTERVALS (e.g. 0000Z AND 1200Z) EACH DAY SHALL BE SELECTED FOR RETENTION AND MAY BE MOVED TO STORAGE BUT MUST BE AVAILABLE FOR RECALL FOR A PERIOD OF 6 ADDITIONAL MONTHS.

      b. ALL OTHER TAPES MAY BE RECYCLED, UNLESS SPECIFICALLY DESIGNATED FOR RETENTION (PARA 5, BELOW).

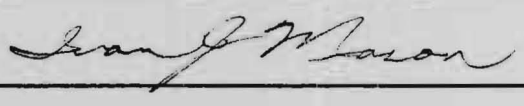
   4. VILSPA MAY RECYCLE ALL HISTORY TAPES AFTER THE 30 DAY PERIOD.

   5. CERTAIN HISTORY TAPES MAY BE DESIGNATED FOR PERMANENT STORAGE, AND HENCE ARE NOT SUBJECT TO RECYCLING UNTIL SPECIFICALLY RELEASED. THESE WILL BE SPECIFIED BY THE MOM OR POD. HISTORY TAPES WILL BE SELECTED FOR STORAGE FOR THE LIFE OF THE IUE MISSION AS FOLLOWS:

      a. ONE HISTORY TAPE EVERY 10 DAYS AFTER MARCH 1, 1978 WILL BE SELECTED FOR STORAGE FOR THE LIFE OF THE MISSION.

      b. ALL TAPES THROUGH FEBRUARY 28, 1978, THE FIRST MONTH OF OPERATION.

      c. OTHER TAPES OF SPECIAL OPERATIONS, ANOMALIES, ETC., AS SPECIFIED.

3. APPROVAL SIGNED: IVAN J. MASON 	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N011B NUMBER

1. APPLICATION: SI THERMAL CONTROL

IMPLEMENTATION RESPONSIBILITY: TO & OD

SUPERCEDES PRIOR FODs: 028A

RESPONDS TO SCARs: N/A

2. DIRECTIVE:

THIS DIRECTIVE PROVIDES INSTRUCTION FOR THERMAL CONTROL OF THE SCIENTIFIC INSTRUMENT (SI) TO ASSURE OPTIMUM FOCUS, WITHIN THE DESIGNED CAPABILITY OF THE IUE SI. THE TELESCOPE TEMPERATURE IS CONTROLLED BY THE FOLLOWING INTER-RELATED FACTORS :

S/C BETA	/SPACECRAFT/SUN ATTITUDE
CRU 2	/SEC MIRROR HEATER 1, LOW 3.4 WATTS
CRU 47	/SEC MIRROR HEATER 2, HIGH 4.4 WATTS
CRU 33	/FOCUS POSITION ELECTRONICS 1.0 WATT
CRU 23	/PRIMARY MIRROR HEATER 1, HIGH 4.5 WATTS
CRU 34	/PRIMARY MIRROR HEATER 2, LOW 3.0 WATTS
CRU 46	/CAMERA DECK HEATER 1, 11.2 WATTS
CRU 55 (SEE PAR.IIIE)	/CAMERA DECK HEATER 2, 11.2 WATTS

SI DEVICES TURNED ON OR OFF

THE SI HEATERS SHALL BE CYCLED AS NECESSARY TO MAINTAIN ALL SI DEVICES WITHIN THE FOLLOWING NORMAL OPERATING RANGE:

DEGREE C TEMP. RANGE	PARAMETER	PRIMARY CONTROL
0 TO 30	SEC MIRROR (SISM)	CRU 2,47,33
-15 TO 30	FOCUS POSITION ELECTRONICS (SMFD)	CRU 33
-5 TO 20	PRIMARY MIRROR (PM+Y) AND (PM-Y)	CRU 23,34
-60 TO -54	T133+	CRU 46,55 *
-22.5 TO -18.5	T92+	CRU 46,55 *
0 TO 15	CAMERA DECK (DKLP), (DKSP) AND (DKF1)	CRU 46,55 *

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N011B NUMBER

1. APPLICATION: SI THERMAL CONTROL

IMPLEMENTATION RESPONSIBILITY: TO & OD

SUPERCEDES PRIOR FODs: 028A

RESPONDS TO SCARs: N/A

2. DIRECTIVE:

DEGREE C TEMP. RANGE	PARAMETER	PRIMARY CONTROL
0 TO 30	CAMERA HEADS, (CHC1 THRU 4 AND CHA1 THRU 4)	CRU 46,55*
0 TO 35	SEC HV(SEC 1 THRU 4)	CRU 46,55*
0 TO 35	LINE DAC(LDC1 THRU 4)	CRU 46,55*
-10 TO 25	FES 1 & 2 (WHEN ON)	CRU 46,55*

*SEE PARA. IIIE

IN ADDITION, THE FOLLOWING SHALL BE USED TO EVALUATE THE SI THERMAL BALANCE AND USED AS A GUIDE IN CONTROLLING THE SI TEMPERATURES.

I. THERMAL STRATEGY

A. IT IS INTENDED BY DESIGN FOR THE MIRROR AND TELESCOPE TEMPERATURES TO FLUCTUATE

B. USE FOCUS EQUATION TO EVALUATE FOCUS

BEST FOCUS: $(-2 \leq \text{STEP} \leq 2)$

$$\text{STEP} = -1.11\,(T92+20+T133+57) + 1.28\,(TPM1 + 3)$$

1. PRIMARY MIRROR HEATER CONTROLS TPM1 (MAINLY)
2. CAMERA DECK HEATERS CONTROL T92 & T133 (MAINLY)

II. PROCEDURE SIFOCUS HAS BEEN DEVELOPED TO AID IN THERMAL CONTROL OF THE SI. IT ASSUMES THAT:

CRU 47 IS ON AND
CRU 2,33,55 ARE OFF

THE PROCEDURE EVALUATES THE ABOVE FOCUS EVALUATION AND OPERATES CRU 23,34, and 46, WHICH WILL NORMALLY BE ADEQUATE FOR SI THERMAL CONTROL.

THE LOGIC USES A DIFFERENCE BETWEEN THE "STEP" EQUATION AND A REFERENCE (PROC ARGUMENT).

DIFF = STEP — REF

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N011B NUMBER

1. APPLICATION: SI THERMAL CONTROL

IMPLEMENTATION RESPONSIBILITY: TO & OD

SUPERCEDES PRIOR FODs: 028A

RESPONDS TO SCARs: N/A

2. DIRECTIVE

THE FOLLOWING IS THE CONTROL STRATEGY:

A. CYCLE PM1, PM2, DK1 AS FOLLOWS:

DIFFERENCE RANGES

SI HEATERS	-2.5	-1.5	-0.5	+0.5	+1.5	
PM1	ON	ON	OFF	NO	OFF	OFF
PM2	ON	OFF	ON	HTR.	OFF	OFF
DK1	OFF	OFF	OFF	CHG.	OFF	ON

B. THE REFERENCE RECOMMENDED:

-0.5 NORMALLY

-2 3 TO 6 HOURS BEFORE SHADOW

C. THE SI HEATER STEP EQUATION SHOULD BE EVALUATED AT LEAST EVERY 1 OR 2 HOURS.

D. AT VERY LOW BETA IT MAY BE NECESSARY TO TURN ON CRU 2,33 AND/OR 55, AND THEN USE THE SIFOCUS PROCEDURE FOR SI THERMAL CONTROL.

3. APPROVAL SIGNED: IVAN J. MASON	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	1 JUNE 79 DATE	N011B NUMBER

1. APPLICATION: SI THERMAL CONTROL

IMPLEMENTATION RESPONSIBILITY: TO & OD

SUPERCEDES PRIOR FODs: 028A

RESPONDS TO SCARs: N/A

2. DIRECTIVE:

III. OTHER INSTRUCTIONS:

A. THE TO HAS PRIME RESPONSIBILITY FOR SI THERMAL BALANCE EVALUATION. THE OD WILL CHANGE HEATERS UPON REQUEST FROM THE RA OR TO, UNLESS ONE OF THE NORMAL OPERATING LIMITS WOULD BE VIOLATED.

B. THE OD SHALL MAINTAIN A LOG OF THE CURRENT SI HEATER CONFIGURATION, EVALUATE THE THERMAL BALANCE PERIODICALLY AND REVIEW WITH THE TO ANY CHANGES THAT ARE NEEDED IN THE SI HEATER CONFIGURATION. THE TO SHALL CONCUR IN ANY SI HEATER CHANGES, UNLESS SYSTEM "RED-LINE" LIMITS ARE APPROACHED. IF SYSTEM "RED-LINE" LIMITS ARE APPROACHED THE OD SHALL TAKE THE NECESSARY ACTION TO AVOID EXCEEDING DESIGN LIMITS. THE OD WILL MONITOR ALL SI HEATER CONFIGURATION CHANGES.

C. THE SIFOCUS PROC SHALL BE USED FOR ROUTINE SI THERMAL CONTROL.

THERE IS NO TELEMETRY VERIFICATION AVAILABLE ON THE SI HEATER CONFIGURATION, SO THE NORMAL (OR DESIRED) STATE OF CRU 47, 2, 33, 55 SHOULD BE COMMANDED DAILY AND ANYTIME THERE IS DOUBT CONCERNING THEIR STATUS.

:CRU ON/OFF,N /WHERE N IS 47,2,33,55 AS DESIRED

D. WARNING: CAMERA SELECT PROC SWITCHES THE DECK HEATERS. WHEN THE CAMERA SELECT OPERATION IS PERFORMED THE DECK HEATERS MUST THEN BE COMMANDED TO THEIR DESIRED CONFIGURATION.

E. CAMERA DECK HEATER NO. 1 (CRU 46) SHALL BE USED AS THE PRIMARY HEATER FOR THERMAL CONTROL OF THE CAMERA DECK EQUIPMENT, T133 AND T92. IF MORE HEAT IS REQUIRED FOR THERMAL CONTROL AT THESE STATIONS, WHILE OPERATING AT VERY LOW BETA, CAMERA DECK HEATER NO. 2 (CRU 55) MAY BE TURNED ON WITHOUT TURNING ON THE MECHANISM ELECTRONICS NO. 2. IF HEATER CYCLING IS REQUIRED, CYCLE CAMERA DECK HEATER NO. 1. WHEN ONE DECK HEATER AGAIN BECOMES SUFFICIENT FOR THERMAL CONTROL TURN CAMERA DECK HEATER NO. 2 OFF.

3. APPROVAL SIGNED: IVAN J. MASON Ivan J. Mason	1 JUNE 79 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	3 MAY 78 DATE	N012 NUMBER

1. APPLICATION: HANDOVER POLICY - MODIFICATION

IMPLEMENTATION RESPONSIBILITY: OD

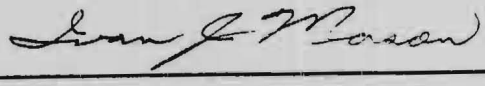
SUPERCEDES PRIOR FODs: 030

RESPONDS TO SCARs: N/A

2. DIRECTIVE:

ESTABLISHED FLIGHT OPERATIONS POLICY REQUIRES THAT HANDOVER NOT TAKE PLACE UNLESS AND UNTIL THE SPACECRAFT ATTITUDE IS POSITIVELY KNOWN AND CERTIFIED AS BEING CORRECT BY THE RELEASING STATION.

IN THE EVENT THAT THE RELEASING STATION EXPRESSES UNCERTAINTY REGARDING CURRENT ATTITUDE, THE RECEIVING STATION MAY ELECT TO EFFECT HANDOVER ANYWAY. IN SUCH A CASE, THE RECEIVING STATION ASSUMES RESPONSIBILITY FOR VERIFYING OR DETERMINING ATTITUDE. THE AUTHORITY TO INVOKE THIS OPTION RESTS WITH THE OPERATIONS DIRECTOR OF THE RECEIVING STATION. IT IS INTENDED THAT THIS ONLY BE DONE AT THE SPECIFIC REQUEST OF THE RESIDENT ASTRONOMER OR IN THE EVENT THAT THE RELEASING STATION IS UNABLE TO EFFICIENTLY VERIFY OR RECOVER ATTITUDE.

3. APPROVAL SIGNED: IVAN J. MASON 	3 MAY 78 DATE

1. **APPLICATION:** BATTERY OPERATION BETWEEN SHADOW SEASONS
IMPLEMENTATION: OD & TO
SUPERCEDES PRIOR FODS: N013F

2. DIRECTIVE:

This directive provides instructions for normal battery operation for the IUE spacecraft battery system during the non-shadow season.

Operations at high and low beta angles, where power-negative conditions occur, should be avoided. Excessive use of spacecraft batteries to supplement spacecraft power requirements at high and low beta angles will impair the battery performance during future shadow seasons. However as the solar array power output decreases with age the demand increases for use of the batteries for science operations. Limits, as specified in this directive, are imposed to conserve the batteries for shadow seasons.

A. NORMAL BATTERY SYSTEM CONFIGURATION:

Both batteries - ON

Both chargers - TRICKLE LOW

Both battery UV detectors - OFF

B. LIMITS ON USE OF THE BATTERIES FOR SCIENCE OPERATIONS:

1. Frequency of use limit:

36 power-negative operations, where 22.50 volts is reached on either battery (as indicated by 50% of the readings over a 5 minute period), will be permitted in any 12 month period.

12 operations, of these 36 operations, in a 12 month period shall be the maximum number of times that the batteries shall be permitted to reach the red-line limit of 20.6 volts.

Power-negative operations, other than science programs, shall not count against the 36/12 limit.

2. Time limit:

16 hours is the maximum period that the spacecraft may be retained in a continuous power-negative condition.

3. Current limit:

1 ampere maximum discharge rate, average current on the battery showing the highest discharge rate, as indicated under normal load conditions - wheel unloads and maneuvers are excepted.

4. Temperature limit:

25°C maximum temperature on either battery.

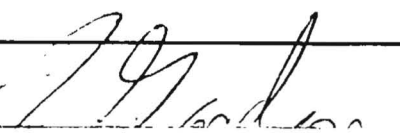
5. Depth-of-Discharge (DOD) limit:

3 ampere-hour estimated depth-of-discharge on either battery.

6. Voltage limits:

20.60 voltage level on either battery, average loads

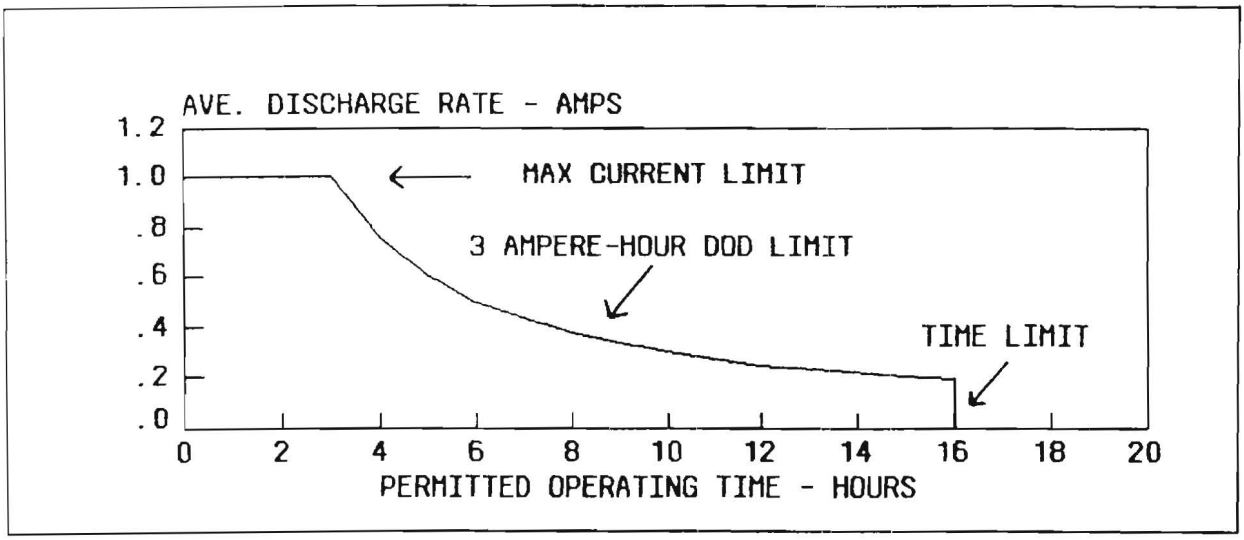
20.50 voltage level on either battery, during peak loads. This limit applies for short duration (<10 minutes), peak loads (e.g reads, ranging, and wheel unloads).

3. **APPROVAL SIGNED:**  4 Aug 87 **DATE**

2. DIRECTIVE:

Whenever a voltage, DOD, or a time limit is reached slew to a power positive attitude within 15 minutes and complete a recharge sequence. If the 25.0°C temperature limit is ever reached slew to a power-positive attitude as soon as possible (within 15 min.). Resume operations but remain power-positive until the high battery temperature can be evaluated by the Systems engineers.

The following graph illustrates the current, depth-of-discharge, and time limits imposed by this directive.



C. BATTERY OPERATION:

Knowing the state of charge of the batteries is of prime importance to the welfare of the IUE. In the past, the 3rd electrode readings have always been used as an indicator of the batteries state of charge. However due to the erratic behavior of the 3rd electrodes, they are no longer used for this purpose. Along with the knowledge that the batteries are losing capacity on a day-to-day basis, guidelines are being introduced in an attempt to offset these conditions. Described below are the measures designed to keep the batteries fully charged for whenever they are needed. Due to differences in characteristics between the two batteries certain limits of the charge process are unique to each battery.

NOTE: Battery 1 usually does not show discharge until its voltage reaches 22.44 volts. In these situations the course of action taken should then be based on the status of battery 2.

1. A 'TOP-OFF' CHARGE should be performed weekly to ensure that full-charge on the batteries is maintained. The procedure can be accomplished on any day of the week as long as there are no more than six days between top-off charges (there is no minimum time period required between top-offs). It can be done on either the U.S. or VILSPA shifts - the Operations Director (OD), assisted by the Resident Astronomer (RA) or the VILSPA Shift leader, will determine

3. APPROVAL SIGNED: [signature] DATE 4 Aug 87

2. DIRECTIVE:

when conditions are acceptable for a top-off charge. It can be performed during any normal operation, (i.e. exposures, ranging, reads, slews, etc.) as long as the conditions described below are met throughout the sequence.

Initial Conditions and Comments

- The spacecraft attitude must be such that dump current is present, with chargers on, to ensure that the maximum charge is going to each battery.
- The spacecraft should be as near thermally stable as possible so that changes in battery temperatures can be attributed to overcharging rather than spacecraft orientation.
- If at any time during this charge procedure the battery temperature rises 3°, independent of thermal effects due to spacecraft orientation, switch immediately to trickle-low charge.

BATTERY 'TOP-OFF' CHARGE

	Charge Method	Command	Conditions
Battery 1 –	main charger	EXEC CHARGER, 1	until the charge current is either < 300 ma, OR until 30 minutes have elapsed
		THEN	
	trickle-hi	:IMP 6, 7	until the battery voltage is either ≥ 25.84 v, OR until 60 minutes have elapsed
		THEN	
	trickle-low	:IMP 8	for normal operations

****

	Charge Method	Command	Conditions
Battery 2 –	main charger	EXEC CHARGER, 1	until the charge current is either < 300 ma, OR until 30 minutes have elapsed
		THEN	
	trickle-hi	:IMP 10,11	until the battery voltage is either ≥ 25.50 v, OR until 60 minutes have elapsed
		THEN	
	trickle-low	:IMP 12	for normal operations

3. APPROVAL SIGNED: [signature] DATE 4 Aug 87

2. **DIRECTIVE:**

2. Before a known power negative event can occur a 'top-off' charge sequence must be performed. It is the responsibility of the RA to notify the OD of such plans, and together make arrangements for the 'top-off' charge to take place. This sequence needs to be done in every case except when a 'top-off' or recharge cycle has been performed on the batteries within the last 24 hours. A known power negative attitude is defined as any attitude whose Beta $< 30°$ or $\geq 115°$. This range will be updated when necessitated due to seasonal changes and solar array degradation.

3. Since there is internal battery discharge during power-neutral periods, which cannot be measured, power-neutral operations will be severely limited. Therefore, for those occasions when a steady-state power-neutral situation is encountered, steps must be taken to stay power positive or to insure a measurable battery discharge rate, at least .080 mA. As low a power load as possible should be used, so as to maximize the observing time available under the given power-negative conditions.

   This equipment may be turned off, in an attempt to remain power positive:

EXEC FESOFF, 1	/FES 1 OFF

   Or take the following steps, in any combination necessary, to achieve a low rate of discharge:

:CRU ON, 31	/PAS 1 ON	(≈ 0.15 amps)
:CRU ON, 31, 45	/PAS 1 & 2 ON	(≈ 0.3 amps)
EXEC VHF, ON	/VHF ON	(≈ 0.55 amps)

   During borderline power positive observations, going power neutral will be tolerated for a total of 15 minutes of each hour in a 24 hour period, regardless of the number of targets or programs. <u>However</u> a recharge sequence (see Section D) must be performed within 24 hours of the first power neutral occurrence before the cycle can start again. A total of 30 minutes worth of power neutral activity is allowed before a recharge sequence is required.

As the batteries age there is an increasing probability that the capacity of one or more cells in the batteries will be depleted under load conditions when we use the batteries. Under these conditions that cell voltage may go to 0 volts or even slightly reverse voltage; this condition may be observed by:

a. A drop in the battery voltage and/or current over a fairly short period of time (minutes).

b. An increase in the battery current in the battery <u>NOT</u> experiencing the cell depletion will occur.

3. **APPROVAL SIGNED:** [signature] 4 Aug 87 **DATE**

2. DIRECTIVE:

If a non-normal battery discharge current is observed during power-negative operations, as indicated by a significant (unusually large) divergence in battery discharge, or a change in battery load sharing; proceed as follows:

1. Place all cameras in stand-by.
2. Turn off all SI and S/C heaters (HAPS heaters are included)
3. Maneuver to a power-positive attitude, using:

   FROM HIGH BETA: SLEW PITCH, + __°

   FROM LOW BETA: SLEW PITCH, - __°
4. Return the heaters to the normal configuration.
5. Maneuver to a near-by target to confirm S/C attitude reference.
6. Resume normal operations only at power-positive attitudes until the S/C data can be evaluated.

D. BATTERY RECOVERY FOLLOWING A POWER-NEGATIVE STATE:

Whenever a significant power-negative condition (22.5 volts reached on either battery) has occurred battery recharge will be accomplished by using all three charging capabilities - main chargers, trickle-hi and trickle-low charge. The procedure is outlined below:

Initial Conditions and Comments

- The spacecraft attitude must be such that dump current is present, with chargers on, to ensure that the maximum charge is going to each battery.
- The spacecraft should be as near thermally stable as possible so that changes in battery temperatures can be attributed to overcharging rather than spacecraft orientation.
- If at any time during this charge procedure the battery temperature rises 3°, independent of thermal effects due to spacecraft orientation, switch immediately to trickle-low charge.
- Whenever 130% of the measurable discharge energy has been replaced, return that battery to trickle-low charge.
- After maneuvering to a power positive attitude, turn off any unnecessary equipment:

:CRU OFF, 31, 45	/PAS 1 & 2 OFF
EXEC VHF, OFF	/VHF OFF

1. **APPLICATION:** BATTERY OPERATION BETWEEN SHADOW SEASONS
IMPLIMENTATION: OD & TO
SUPERCEDES PRIOR FODS: N013F

2. **DIRECTIVE:**

BATTERY RECHARGE

	Charge Method	Command	Conditions
Battery 1 —	main charger	EXEC CHARGER, 1	until the charge current is either < 300 ma, OR until 130% of the measurable discharge energy has been replaced
		THEN	
	trickle—hi	:IMP 6, 7	until the battery voltage is either ≥ 25.84 v, OR until 130% of the measurable discharge energy has been replaced
		THEN	
	trickle—low	:IMP 8	for normal operations

****

	Charge Method	Command	Conditions
Battery 2 —	main charger	EXEC CHARGER, 1	until the charge current is either < 300 ma, OR until 130% of the measurable discharge energy has been replaced
		THEN	
	trickle—hi	:IMP 10,11	until the battery voltage is either ≥ 25.50 v, OR until 130% of the measurable discharge energy has been replaced
		THEN	
	trickle—low	:IMP 12	for normal operations

3. **APPROVAL SIGNED:** [signature] DATE 4 Aug 87

1. APPLICATION: BATTERY OPERATION BETWEEN SHADOW SEASONS
IMPLEMENTATION: OD & TO
SUPERCEDES PRIOR FODS: NO13F

2. DIRECTIVE:

E. VILSPA/GSFC INTERFACE:

1. The 36/12 limits specified in B1 above shall be divided as follows:

STATION	POWER-NEG.	RED-LINE
VILSPA	12	4
GSFC	24	8

For collaborative programs, using VILSPA and GSFC shifts consecutively, the charge against this allocation shall also be at the 2:1 ratio.

The GSFC OD shall maintain the log of GSFC operations and collaborative programs which count against the above allocation.

The VILSPA shift leader shall maintain the log of VILSPA operations which count against the above allocation.

2. Notification will be provided at handover if any corrective action was taken in accordance with this directive during the last 8 hours and provide the time of the maneuver to a power-positive attitude.

3. The RA at either station may give advanced notification of the need to operate in a power-negative attitude. When so notified the other station will avoid operating in a power-negative attitude in the 8 hours preceding the planned operation, if practicable.

F. EXTENDED OPERATING TIME AT HIGH AND LOW BETAS WILL BE POSSIBLE IF THE FOLLOWING SUGGESTED GUIDELINES ARE OBSERVED.

1. Make initial camera preps before going to a beta that would result in a power-negative condition.

2. Make final camera read after slewing to a power-positive attitude.

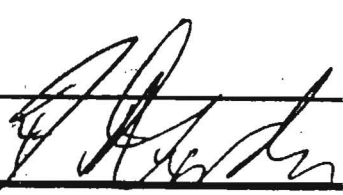
3. If a power-negative situation does exist, minimize the discharge rate by turning off non-essential equipment (Note: . HAPS heater 2 is considered essential equipment and should not be cycled off as part of routine power savings measures).

G. DEFINITIONS:

1. POWER-POSITIVE is defined as at least .060 amps charge current on each battery or the presence of dump current.

2. POWER-NEUTRAL is defined as the absence of dump current with charge current of less than .060 amps, but NO indicated discharge current on either battery.

3. POWER-NEGATIVE is defined as a condition of any average load indicated by battery discharge.

3. APPROVAL SIGNED:  DATE 4 Aug 87

1. APPLICATION: BATTERY OPERATION BETWEEN SHADOW SEASONS
IMPLEMENTATION: OD & TO
SUPERCEDES PRIOR FODS: N013F

2. DIRECTIVE:

H. FINAL INSTRUCTIONS:

1. All battery usage should be recorded on the daily shift reports.
2. The Systems Analyst is responsible for knowing the battery situation/status at all times. This includes knowing when the last 'top-off' or weekly charge sequence was done as well as keeping a record of power-neutral time during those operations. He shall also keep the OD and RA apprised of the battery situation and notify them of the appropriate action. A log of these items will be maintained at the System's position.
3. Battery data will be collected/recorded using the MacIntosh PC, or SYSTEM2 five minute snaps during all top-off and recharge sequences. Also, set up a stripchart recorder as follows during these operations:

   ANALOG PENS

   a. BATTERY 1 VOLTAGE
   b. BATTERY 2 VOLTAGE
   c. BATTERY 1 CHARGE CURRENT
   d. BATTERY 2 CHARGE CURRENT
   e. BATTERY 1 TEMPERATURE
   f. BATTERY 2 TEMPERATURE
   g. BATTERY 1 3rd ELECTRODE
   h. BATTERY 2 3rd ELECTRODE

4. Any deviation from this directive has to be approved in advance by the GSFC subsystem engineers.
5. Notify the subsystem engineers, George Morrow, at 6-6691 (Home: 730-7825), or Sid Tiller, at 6-6489 (Home: 534-8587) immediately if other anomalies occur or corrective actions do not produce expected results.

3. APPROVAL SIGNED: F. Gordon | 4 Aug 87 DATE

To: FOD Distribution

From: F. Gordon/IUE POD

Subj: Interim revision of FOD N013F, Battery Operation Between Shadow Seasons

Date: May 26, 1987

Based on recent experience with power positive/power neutral attitudes, and discussions with the GSFC battery engineers, it is obvious that the current battery FOD does not adequately cover our current battery situation. The battery people have promised us new guidelines regarding the use of the batteries by the end of the week.

The most obvious shortcoming of the current FOD guidelines is its definition of power neutral. Effective immediately:

	dump current		charge current		discharge current
power positive	> 0.0 mA	OR	≥ 60 mA		
power neutral	0.0 mA	AND	< 60 mA	AND	0.0 mA
power negative			< 60 mA	OR	> 0.0 mA

The question of can we go power neutral during reads, preps, ranging, etc. has also been brought up. At this point it is not clear what impact this has on the batteries. But until we hear from the battery people, sporadic power neutral periods should be avoided if possible. For the time being, these should be limited to no more than one power neutral event every 30 minutes.

Fred Gordon

1. APPLICATION: BATTERY OPERATION BETWEEN SHADOW SEASONS
IMPLIMENTATION: OD & TO
SUPERCEDES PRIOR FODS: N013E

6

2. DIRECTIVE:

THIS DIRECTIVE PROVIDES INSTRUCTIONS FOR NORMAL BATTERY OPERATION FOR THE IUE SPACECRAFT BATTERY SYSTEM DURING THE NON-SHADOW SEASON.

EXCESSIVE USE OF SPACECRAFT BATTERIES TO SUPPLEMENT SPACECRAFT POWER REQUIREMENTS AT HIGH AND LOW BETA ANGLES WILL IMPAIR THE BATTERY PERFORMANCE DURING FUTURE SHADOW SEASONS. OPERATIONS AT HIGH AND LOW BETA ANGLES, WHERE POWER-NEGATIVE CONDITIONS OCCUR, SHOULD BE AVOIDED.

AS THE SOLAR ARRAY POWER OUTPUT DECREASES WITH AGE THE DEMAND INCREASES FOR USE OF THE BATTERIES FOR SCIENCE OPERATIONS. LIMITS, AS SPECIFIED IN THIS DIRECTIVE, ARE IMPOSED TO CONSERVE THE BATTERIES FOR SHADOW SEASONS; HOWEVER, LIMITED OPERATIONAL USE OF THE BATTERIES IS PERMITTED TO ALLOW FOR OBSERVING TARGETS OF OPPORTUNITY AND/OR VERY HIGH SCIENTIFIC MERIT.

A. NORMAL BATTERY SYSTEM CONFIGURATION:

BOTH BATTERIES - ON

BOTH CHARGERS - TRICKLE LOW

BOTH BATTERY UV DETECTORS - OFF

THIS CONFIGURATION WILL KEEP THE BATTERIES FULLY CHARGED, TEMPERATURES LOW, AND READY FOR USE.

B. LIMITS ON USE OF THE BATTERIES FOR SCIENCE OPERATIONS:

1. FREQUENCY OF USE LIMIT:

36 POWER-NEGATIVE OPERATIONS, WHERE 22.50 VOLTS IS REACHED ON EITHER BATTERY (AS INDICATED BY 50% OF THE READINGS OVER A 5 MINUTE PERIOD), WILL BE PERMITTED IN ANY 12 MONTH PERIOD.

12 OPERATIONS, OF THESE 36 OPERATIONS, IN A 12 MONTH PERIOD SHALL BE THE MAXIMUM NUMBER OF TIMES THAT THE BATTERIES SHALL BE PERMITTED TO REACH THE RED-LINE LIMIT OF 20.6 VOLTS.

POWER-NEGATIVE OPERATIONS, OTHER THAN SCIENCE PROGRAMS, SHALL NOT COUNT AGAINST THE 36/12 LIMIT.

2. TIME LIMIT:

16 HOURS IS THE MAXIMUM PERIOD THAT THE SPACECRAFT MAY BE RETAINED IN A CONTINUOUS POWER-NEGATIVE CONDITION. SEE NOTE 1.

3. CURRENT LIMIT:

1 AMPERE MAXIMUM DISCHARGE RATE, AVERAGE CURRENT ON THE BATTERY SHOWING THE HIGHEST DISCHARGE RATE, AS INDICATED UNDER NORMAL LOAD CONDITIONS - WHEEL UNLOADS AND MANEUVERS ARE EXCEPTED. SEE NOTE 1.

4. BATTERY TEMPERATURE LIMIT:

25°C MAXIMUM TEMPERATURE ON EITHER BATTERY, IF THE 25.0°C TEMPERATURE LIMIT IS EVER REACHED SLEW TO A POWER-POSITIVE ATTITUDE AS SOON AS POSSIBLE (WITHIN 30 MIN.). RESUME OPERATIONS BUT REMAIN POWER-POSITIVE UNTIL THE HIGH BATTERY TEMPERATURE CAN BE EVALUATED BY THE SYSTEMS ENGINEERS.

3. APPROVAL SIGNED: Frederick Gordon | 25 March '87 DATE

2. DIRECTIVE:

5. RED-LINE LIMITS:

3 AMPERE-HOUR ESTIMATED DEPTH-OF-DISCHARGE ON EITHER BATTERY. SEE NOTE 1.

20.60 VOLTAGE LEVEL ON EITHER BATTERY, AVERAGE LOADS.

20.50 VOLTAGE LEVEL ON EITHER BATTERY, DURING PEAK LOADS. THIS LIMIT APPLIES FOR SHORT DURATION (< 10 MINUTES), PEAK LOADS (E.G. READS, RANGING, AND WHEEL UNLOADS).

C. BATTERY OPERATION:

KNOWING THE STATE OF CHARGE OF THE BATTERIES IS OF PRIME IMPORTANCE TO THE WELFARE OF THE IUE. IN THE PAST THE 3RD ELECTRODE READINGS HAVE ALWAYS BEEN USED AS AN INDICATOR OF THE BATTERIES STATE OF CHARGE. HOWEVER DUE TO THE ERRATIC BEHAVIOR OF THE 3RD ELECTRODES, THEY CAN NO LONGER BE USED FOR THIS PURPOSE. SINCE THERE IS INTERNAL BATTERY DISCHARGE DURING POWER-NEUTRAL PERIODS, WHICH CANNOT BE MEASURED, POWER-NEUTRAL OPERATIONS WILL NO LONGER BE PERMITTED. THEREFORE, FOR THOSE OCCASIONS WHEN A POWER-NEUTRAL SITUATION MAY BE ENCOUNTERED, STEPS MUST BE TAKEN TO STAY POWER POSITIVE OR TO INSURE A MEASURABLE BATTERY DISCHARGE RATE OF ≈ 100 - 300 mA.

TAKE THE FOLLOWING STEPS, AS NECESSARY, TO ACHIEVE A LOW RATE OF DISCHARGE:

:CRU ON,31,45	/PAS 1 & 2 ON
EXEC VHF,ON	/VHF ON

ALSO AS THE BATTERIES AGE THERE IS AN INCREASING PROBABILITY THAT THE CAPACITY OF 1 OR MORE CELLS IN THE BATTERIES WILL BE DEPLETED UNDER LOAD CONDITIONS WHEN WE USE THE BATTERIES. UNDER THESE CONDITIONS THAT CELL VOLTAGE MAY GO TO 0 VOLTS OR EVEN SLIGHTLY REVERSE VOLTAGE; THIS CONDITION MAY BE OBSERVED BY:

a. A DROP IN THE BATTERY VOLTAGE AND/OR CURRENT OVER A FAIRLY SHORT PERIOD OF TIME (MINUTES).

b. AN INCREASE IN THE BATTERY CURRENT IN THE BATTERY NOT EXPERIENCING THE CELL DEPLETION WILL OCCUR.

IF A NON-NORMAL BATTERY DISCHARGE CURRENT IS OBSERVED DURING POWER-NEGATIVE OPERATIONS, AS INDICATED BY A SIGNIFICANT (UNUSUALLY LARGE) DIVERGENCE IN BATTERY DISCHARGE, OR A CHANGE IN BATTERY LOAD SHARING; PROCEED AS FOLLOWS:

1. PLACE ALL CAMERAS IN STAND-BY.
2. TURN OFF ALL SI AND S/C HEATERS.
3. MANEUVER TO A POWER-POSITIVE ATTITUDE, USING:

   HIGH BETA: SLEW PITCH, + __°
   LOW BETA: SLEW PITCH, - __°

4. RETURN THE HEATERS TO THE NORMAL CONFIGURATION.

3. APPROVAL SIGNED: Frederick Gordon II | 25 March 87 DATE

2. DIRECTIVE:

5. MANEUVER TO A NEAR-BY TARGET TO CONFIRM S/C ATTITUDE REFERENCE.

6. RESUME NORMAL OPERATIONS ONLY AT POWER-POSITIVE ATTITUDES UNTIL THE S/C DATA CAN BE EVALUATED.

D. BATTERY RECOVERY FOLLOWING A POWER-NEGATIVE STATE:

WHENEVER A SIGNIFICANT POWER-NEGATIVE CONDITION HAS OCCURRED BATTERY RECHARGE WILL BE ACCOMPLISHED BY USING THE MAIN CHARGERS. AFTER RETURNING TO A POWER POSITIVE ATTITUDE, TURN OFF ANY UNNECESSARY EQUIPMENT;

```
:CRU OFF,31,45          /PAS 1 & 2 OFF
EXEC VHF,OFF            /VHF OFF
```

AND THEN TURN ON THE BATTERY CHARGERS:

```
EXEC CHARGER,ON         /CHARGER 1 & 2 ON
```

TARGETS SHOULD BE SELECTED SO THAT THE MINIMUM CHARGE CURRENT IS GREATER THAN 200mA TO EACH BATTERY, OR THAT THERE IS DUMP CURRENT PRESENT. THE CHARGERS SHALL REMAIN ON UNTIL 115 - 120% OF DISCHARGE ENERGY HAS BEEN RETURNED TO EACH BATTERY. THE CHARGERS SHALL THEN BE TURNED OFF:

```
:IMP 6                  /CHARGER 1 OFF
:IMP 10                 /CHARGER 2 OFF
```

E. VILSPA/GSFC INTERFACE:

1. THE 36/12 LIMITS SPECIFIED IN B1 ABOVE SHALL BE DIVIDED AS FOLLOWS:

STATION	POWER-NEG.	RED-LINE
VILSPA	12	4
GSFC	24	8

FOR COLLABORATIVE PROGRAMS, USING VILSPA AND GSFC SHIFTS CONSECUTIVELY, THE CHARGE AGAINST THIS ALLOCATION SHALL ALSO BE AT THE 2:1 RATIO.

THE GSFC OD SHALL MAINTAIN THE LOG OF GSFC OPERATIONS AND COLLABORATIVE PROGRAMS WHICH COUNT AGAINST THE ABOVE ALLOCATION.

THE VILSPA SHIFT LEADER SHALL MAINTAIN THE LOG OF VILSPA OPERATIONS WHICH COUNT AGAINST THE ABOVE ALLOCATION.

2. NOTIFICATION WILL BE PROVIDED AT HANDOVER IF ANY CORRECTIVE ACTION WAS TAKEN IN ACCORDANCE WITH THIS DIRECTIVE DURING THE LAST 8 HOURS AND PROVIDE THE TIME OF THE MANEUVER TO A POWER-POSITIVE ATTITUDE.

3. THE RA AT EITHER STATION MAY GIVE ADVANCED NOTIFICATION OF THE NEED TO OPERATE IN A POWER-NEGATIVE ATTITUDE. WHEN SO NOTIFIED THE OTHER STATION WILL AVOID OPERATING IN A POWER-NEGATIVE ATTITUDE IN THE 8 HOURS PRECEDING THE PLANNED OPERATION, IF PRACTICABLE.

3. APPROVAL SIGNED: Frederick Gordon | 25 March '87 DATE

2. DIRECTIVE:

F. EXTENDED OPERATING TIME AT HIGH AND LOW BETAS WILL BE POSSIBLE IF THE FOLLOWING SUGGESTED GUIDELINES ARE OBSERVED.

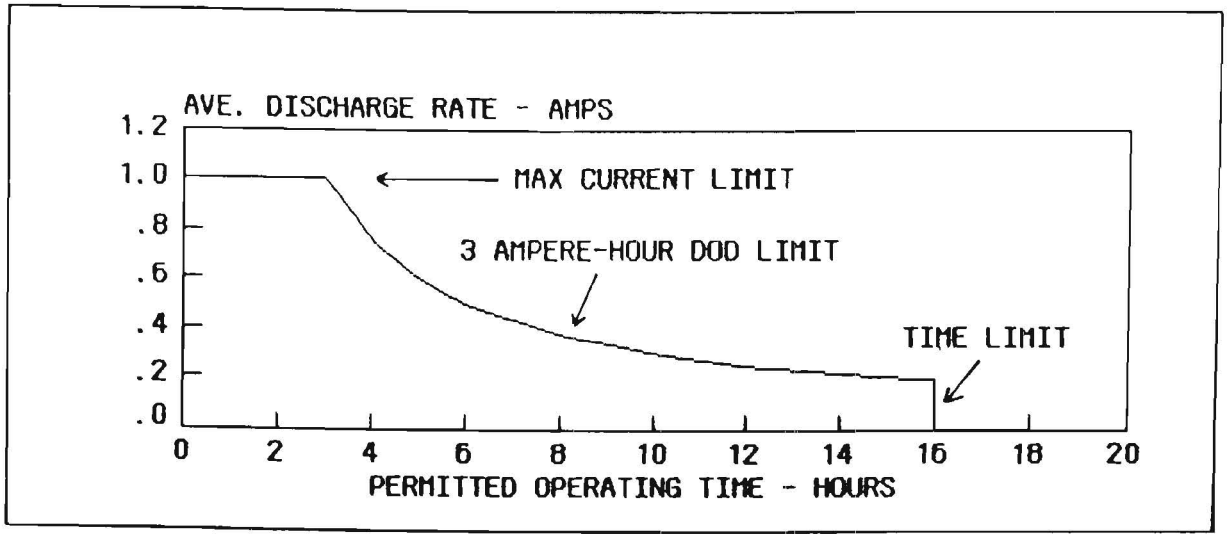
1. MAKE INITIAL CAMERA PREPS BEFORE GOING TO A BETA THAT WOULD RESULT IN A POWER-NEGATIVE CONDITION.
2. MAKE FINAL CAMERA READ AFTER SLEWING TO A POWER-POSITIVE ATTITUDE.
3. IF A POWER-NEGATIVE SITUATION DOES EXIST, MINIMIZE THE DISCHARGE RATE BY TURNING OFF NON-ESSENTIAL EQUIPMENT.

G. DEFINITIONS:

1. POWER-POSITIVE IS DEFINED AS AT LEAST .080 AMPS CHARGE CURRENT ON EACH BATTERY OR THE PRESENCE OF DUMP CURRENT.
2. POWER-NEUTRAL IS DEFINED AS THE ABSENCE OF DUMP CURRENT AND NO INDICATED AVERAGE LOAD CHARGE OR DISCHARGE CURRENT ON EITHER BATTERY.
3. POWER-NEGATIVE IS DEFINED AS A CONDITION OF ANY AVERAGE LOAD INDICATED BY BATTERY DISCHARGE.

H. NOTES:

THE FOLLOWING GRAPH ILLUSTRATES THE CURRENT, DEPTH-OF-DISCHARGE, AND TIME LIMITS IMPOSED BY THIS DIRECTIVE.



2. ANY DEVIATION FROM THIS DIRECTIVE SHALL BE APPROVED IN ADVANCE BY THE GSFC SUBSYSTEM ENGINEERS.
3. NOTIFY THE SUBSYSTEM ENGINEERS, SID TILLER, AT 6-6489 (HOME: 534-8587), OR HARRY WANNAMACHER, AT 6-5964 (HOME: 262-2765) IMMEDIATELY IF OTHER ANOMALIES OCCUR OR CORRECTIVE ACTIONS DO NOT PRODUCE EXPECTED RESULTS.

3. APPROVAL SIGNED: Frederick Gabbard | 25 March 87 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	28 JULY 78 DATE	N015 NUMBER

1. APPLICATION: POLICY ON TERMINATION OF IUEOCC SUPPORT DURING THE VILSPA SHIFT

IMPLEMENTATION RESPONSIBILITY: OD & SHIFT SUPERVISOR

SUPERCEDES PRIOR FODs: 033

RESPONDS TO SCARs: N/A

2. DIRECTIVE:

THIS DIRECTIVE PROVIDES INSTRUCTION FOR PROVIDING IUEOCC SUPPORT OF SPACECRAFT OPERATIONS DURING THE VILSPA OPERATING SHIFT IN THE EVENT OF EQUIPMENT FAILURE; OR WHEN THERE IS OTHER URGENT NEED FOR THE SIGMA FOR OFF-LINE USE.

NORMALLY THE SIGMA 5 WILL BE DEDICATED TO SPACECRAFT MONITORING DURING THE VILSPA SHIFT. WHEN THE SIGMA 5 IS SCHEDULED FOR OTHER THAN SPACECRAFT MONITORING THE SIGMA 9 WILL NORMALLY BE SCHEDULED FOR SPACECRAFT MONITORING.

A. EQUIPMENT FAILURE:

WHEN THERE IS AN EQUIPMENT FAILURE, THE FOLLOWING GENERAL GUIDELINES SHALL BE FOLLOWED:

1. THE OD WILL CONTACT VILSPA AND CONFIRM THAT ALL SYSTEMS AT VILSPA ARE FUNCTIONING NORMALLY. IF ALL SYSTEMS AT VILSPA ARE FUNCTIONING NORMALLY AND ALL SPACECRAFT SYSTEMS ARE NORMAL, GSFC WILL NOT INTERRUPT THE SIGMA 9 SCHEDULED WORK TO PROVIDE ON-LINE BACK-UP TO THE SIGMA 5.

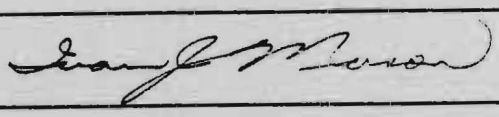
2. THE OD WILL INFORM VILSPA THAT GSFC WILL NOT BE MONITORING SPACECRAFT OPERATIONS AND PROVIDE VILSPA WITH THE ANTICIPATED LENGTH OF THE DOWN-TIME.

3. VILSPA WILL INFORM THE GSFC OD IF ANY OF THE VILSPA SYSTEMS BECOME MARGINAL OR IF ANY SPACECRAFT ANOMALIES ARE NOTED. GSFC OPERATIONS PERSONNEL WILL BE PREPARED TO BRING UP EITHER THE SIGMA 5 OR SIGMA 9 SYSTEM QUICKLY IF THIS ALERT IS PROVIDED BY VILSPA.

4. DURING PERIODS WHEN SPACECRAFT DATA IS NOT BEING PROCESSED AND MONITORED BY THE MOR PERSONNEL, THE D.O.C. WILL MONITOR DATA QUALITY AND MAINTAIN BEST POSSIBLE SIGNAL QUALITY SHOULD GSFC HAVE TO REGAIN CONTROL.

B. OFF-LINE USE OF OPERATIONS SYSTEM:

CONCURRENCE OF THE MOM OR POD WILL NORMALLY BE OBTAINED BEFORE THE SIGMA COMPUTER SYSTEM THAT IS SUPPORTING SPACECRAFT OPERATION IS TO BE TAKEN FOR "URGENTLY" NEEDED OFF-LINE PROCESSING; IF THE EXPECTED TIME WILL BE MORE THAN 15 TO 30 MINUTES IN ANY ONE VILSPA SHIFT. TIMES LESS THAN 30 MINUTES WILL BE AGREED UPON BETWEEN THE OD AND SHIFT SUPERVISORS. IF PRIOR CONCURRENCE OF THE MOM OR POD IS NOT FEASIBLE, THE OD WILL INCLUDE A NOTE OF EXPLANATION WITH THE SHIFT OPERATIONS REPORT TO THE POD.

3. APPROVAL SIGNED: IVAN J. MASON 	28 JULY 78 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	28 JULY 78 DATE	N015 NUMBER

1. APPLICATION: POLICY ON TERMINATION OF IUEOCC SUPPORT DURING THE VILSPA SHIFT

   IMPLEMENTATION RESPONSIBILITY: OD & SHIFT SUPERVISOR

   SUPERCEDES PRIOR FODs: 033

   RESPONDS TO SCARs: N/A

2. DIRECTIVE:

   THE GUIDELINES FOR ASSURANCE OF NORMAL OPERATION AND RAPID RECOVERY OUTLINED IN PARAGRAPH A-1 THROUGH 4 SHALL BE FOLLOWED WHEN GSFC TERMINATES SPACECRAFT SUPPORT.

   C. NOTE:

   THE OD WILL REPORT ALL TIMES GSFC IS NOT MONITORING SPACECRAFT OPERATIONS ON THE SHIFT OPERATIONS REPORT TO THE POD.

3. APPROVAL SIGNED: IVAN J. MASON	28 JULY 78 DATE

To: FOD Distribution
From: F. Gordon/IUE POD
Subj: Beta Restrictions Update
Date: March 15, 1988

Normal spacecraft operations will continue to be restricted to Beta angles greater than 30°. However special operations between Betas 25° and 30° will be permitted if a written request is approved in advance by the IUE POD.

Fred Gordon

IUE FLIGHT OPERATIONS DIRECTIVE	DATE: FEBRUARY 11, 1988	NUMBER: NO16F

1. **APPLICATION:** OBC OPERATING TEMPERATURE LIMITS
IMPLEMENTATION:
SUPERCEDES PRIOR FODS: NO16E AS OF MARCH 1, 1988

2. **DIRECTIVE:** SCIENCE OPERATIONS SHALL BE IMPACTED (LIMITED) IN ACCORDANCE WITH THE FOLLOWING GUIDELINES TO LIMIT THE OBC TEMPERATURE.

A. THERE IS NO LIMIT ON SCIENCE OPERATIONS FOR OBC (PR1) TEMPERATURES LESS THAN 55.8°C.

B. WHEN THE OBC TEMPERATURE STABILIZES AT 55.8°C AND WHEN THE BETA ANGLE IS WITHIN THE LIMITS GIVEN IN PARAGRAPH G FOR THE MONTH IN QUESTION, A NEW CAMERA EXPOSURE SHALL NOT BE STARTED BEFORE SLEWING TO A COOLER ATTITUDE. THE S/C WILL REMAIN OUTSIDE OF THE CONSTRAINED REGION UNTIL THERE IS EVIDENCE OF OBC COOLING (<55.8°C). THE FOLLOWING OPERATIONS MAY BE CONTINUED AT THIS TEMPERATURE TO MORE EFFICIENTLY USE SPACECRAFT TIME: (SEE PARAGRAPH F1).

1. A CAMERA EXPOSURE IN PROGRESS MAY BE CONTINUED FOR UP TO 1 HOUR AFTER THE TEMPERATURE BECOMES STABLE AT 55.8°C.

2. A CAMERA READ OR THE READ PORTION OF A READPREP MAY BE PERFORMED BEFORE INITIATING THE MANEUVER TO A COOLER BETA.

3. HANDOVER MAY BE PERFORMED WITHOUT MANEUVERING TO A COOLER BETA, PROVIDING THAT THE ONE HOUR CONSTRAINT IS NOT VIOLATED. IF A MANEUVER MUST BE PERFORMED NEAR HANDOVER, THE ACQUIRING STATION WILL BE CONTACTED BY THE CONTROLLING STATION FOR INFORMATION ABOUT THE ACQUIRING STATION'S FIRST TARGET. IF PRACTICABLE, THE SPACECRAFT WILL THEN BE MANEUVERED IN A MANNER THAT WILL MOST EFFICIENTLY USE SPACECRAFT TIME.

THE CUMULATIVE TIME FOR PERFORMANCE OF THE ABOVE UNTIL THE MANEUVER INITIATION SHALL BE ≤1 HOUR FROM TEMPERATURE STABILITY AT 55.8°C.

C. OPERATIONS MAY CONTINUE WITHOUT MANEUVERING TO A COOLER ATTITUDE IF BETA IS OUTSIDE THE APPROPRIATE CRITICAL REGION OUTLINED IN PARAGRAPH G. AVAILABLE ENGINEERING DATA SHOW THAT A TEMPERATURE OF 55.8°C MAY BE MAINTAINED WHEN NEAR THE UPPER OR LOWER LIMITS OF BETAS DEFINED IN PARAGRAPH G; OBC COOLING MAY NOT OCCUR, BUT HEATING IS NOT EXPECTED TO CONTINUE.

D. IF AN OBC TEMPERATURE >55.8°C IS SEEN, THE OPERATIONS IN PROGRESS WILL BE MODIFIED AS SOON AS POSSIBLE, AND THE SPACECRAFT WILL BE MANEUVERED TO A TARGET RESULTING IN BETA <40° OR BETA >110° UNTIL THE OBC TEMPERATURE STABILIZES AT ≤54.6°C. IF A READ IS IN PROGRESS, WAIT UNTIL THE READ IS COMPLETE BEFORE INITIATING THE MANEUVER.

3. **APPROVAL SIGNED:** FRED GORDON F. Gordon **DATE:** 2 Feb 88

2. **DIRECTIVE:**

E. WHEN THE OBC TEMPERATURE IS ≥52.3°C, THE SYSTEMS ENGINEER SHALL MONITOR THE OBC TEMPERATURE AND INFORM THE T.O. WHEN THE TEMPERATURE STABILIZES AND WHEN IT STARTS TO ALTERNATE BETWEEN TELEMETRY VALUES.

F. DEFINITIONS:

1. STABILITY AT 55.8°C IS DEFINED AS BEING REACHED WHEN THE TIME INTERVAL BETWEEN 54.6° C READINGS IS GREATER THAN 10 MINUTES, AS SEEN ON THE STRIP CHART RECORDER. IF AT LEAST THREE 54.6°C READINGS OCCUR WITHIN A 15 MINUTE PERIOD, SCIENCE OPERATIONS WILL BE NOTIFIED THAT THE OBC IS NO LONGER STABLE AT 55.8°C. THE ABOVE CRITERIA WILL THEN BE USED AGAIN TO DETERMINE WHEN STABILITY AT 55.8°C OCCURS.

2. STABILITY AT ANY TEMPERATURE SHALL GENERALLY BE DEFINED AS BEING REACHED WHEN TRANSITIONING IS AT >10 MINUTE INTERVALS.

G. THE FOLLOWING TABLE PROVIDES THE MONTHLY LOWER AND UPPER LIMITS FOR BETA ANGLES WITHIN WHICH NORMAL OPERATIONS ARE RESTRICTED (SEE PARAGRAPH B) BY A STABLE OBC TEMPERATURE OF 55.8°C. THERE ARE NO BETA ANGLE CONSTRAINTS ON SCIENCE OPERATIONS DURING THE MONTHS OF MAY, JUNE, JULY, AND AUGUST FOR OBC TEMPERATURES OF 55.8°C (SEE PARAGRAPH D). THE APPLICABLE BETA ANGLE LIMITS FOR EACH OBSERVING SHIFT WILL BE THOSE CORRESPONDING TO THE UT STARTING TIME OF THE SHIFT.

MONTH	LOWER LIMIT	UPPER LIMIT
JANUARY	55.0°	105.0°
FEBRUARY	55.0°	100.0°
MARCH	60.0°	100.0°
APRIL	65.0°	95.0°
MAY	-	-
JUNE	-	-
JULY	-	-
AUGUST	-	-
SEPTEMBER	70.0°	90.0°
OCTOBER	65.0°	95.0°
NOVEMBER	60.0°	100.0°
DECEMBER	55.0°	105.0°

3. **APPROVAL SIGNED:** FRED GORDON F. Gordon **DATE:** 26 Feb 88

IUE FLIGHT OPERATIONS DIRECTIVE	DATE:APRIL 29,1985	NUMBER: N016E

1. APPLICATION: OBC OPERATING TEMPERATURE LIMITS
IMPLIMENTATION:
SUPERCEDES PRIOR FODS: N016D

2. DIRECTIVE: SCIENCE OPERATIONS SHALL BE IMPACTED (LIMITED) IN ACCORDANCE WITH THE FOLLOWING GUIDELINES TO LIMIT THE OBC TEMPERATURE.

1. THERE IS NO LIMIT ON SCIENCE OPERATION FOR OBC (PR1) TEMPERATURES LESS THAN 55.8°C.
2. WHEN THE OBC TEMPERATURE STABILIZES AT 55.8°C AND WHEN THE BETA ANGLE IS WITHIN THE LIMITS GIVEN IN PARAGRAPH 7 FOR THE MONTH IN QUESTION, A NEW CAMERA EXPOSURE SHALL NOT BE STARTED BEFORE SLEWING TO A COOLER ATTITUDE. THE FOLLOWING OPERATIONS MAY BE CONTINUED AT THIS TEMPERATURE TO MORE EFFICIENTLY USE THE SPACECRAFT TIME: (SEE PARAGRAPH 6a)

   a. A CAMERA EXPOSURE IN PROGRESS MAY BE CONTINUED FOR UP TO 1 HOUR AFTER THE TEMPERATURE BECOMES STABLE AT 55.8°C.

   b. A CAMERA READ OR THE READ PORTION OF A READPREP MAY BE PERFORMED BEFORE INITIATING THE MANEUVER TO A COOLER BETA.

   c. HANDOVER MAY BE PERFORMED WITHOUT MANEUVERING TO A COOLER BETA, PROVIDING THAT THE ONE HOUR CONSTRAINT IS NOT VIOLATED. IF A MANEUVER MUST BE PERFORMED NEAR HANDOVER, THE ACQUIRING STATION WILL BE CONTACTED BY THE CONTROLLING STATION FOR INFORMATION ABOUT THE ACQUIRING STATION'S FIRST TARGET. IF PRACTICABLE, THE SPACECRAFT THEN WILL BE MANEUVERED IN A MANNER THAT WILL MOST EFFICIENTLY USE THE SPACECRAFT TIME.

   THE CUMULATIVE TIME FOR PERFORMANCE OF THE ABOVE UNTIL THE MANEUVER INITIATION SHALL BE $\leq$1 HOUR FROM TEMPERATURE STABILITY AT 55.8°C.

3. OPERATIONS MAY CONTINUE WITHOUT MANEUVERING TO A COOLER ATTITUDE IF BETA IS OUTSIDE THE APPROPRIATE CRITICAL REGION OUTLINED IN PARAGRAPH 7. AVAILABLE ENGINEERING DATA SHOW THAT A TEMPERATURE OF 55.8°C MAY BE MAINTAINED WHEN NEAR THE UPPER OR LOWER LIMITS OF BETA DEFINED IN PARAGRAPH 7; OBC COOLING MAY NOT OCCUR BUT HEATING IS NOT EXPECTED TO CONTINUE.
4. IF AN OBC TEMPERATURE >55.8°C IS SEEN, THE OPERATIONS IN PROGRESS WILL BE MODIFIED, AS SOON AS POSSIBLE, AND THE SPACECRAT WILL BE MANEUVERED TO A TARGET RESULTING IN BETA <40° OR BETA >110° UNTIL THE OBC TEMPERATURE STABILIZES AT $\leq$54.6°C. IF A READ IS IN PROGRESS WAIT UNTIL THE READ IS COMPLETE BEFORE INITIATING THE MANEUVER.

3. APPROVAL SIGNED: FRED GORDON	APRIL 29, 1985 DATE

1. APPLICATION: OBC OPERATING TEMPERATURE LIMITS
IMPLIMENTATION:
SUPERCEDES PRIOR FODS: N016D

2. DIRECTIVE:

5. WHEN THE OBC TEMPERATURE IS ⩾52.3°C, THE SYSTEMS ENGINEER SHALL MONITOR THE OBC TEMPERATURE AND INFORM THE T.O. WHEN THE TEMPERATURE STABILIZES AND WHEN IT STARTS TO ALTERNATE BETWEEN TELEMETRY VALUES.

6. DEFINITIONS:

a. STABILITY AT 55.8°C IS DEFINED AS BEING REACHED WHEN THE TIME INTERVAL BETWEEN 54.6°C READINGS IS GREATER THAN 10 MINUTES, AS SEEN ON THE STRIP CHART RECORDER. IF AT LEAST THREE 54.6°C READINGS OCCUR WITHIN A 15 MINUTE PERIOD SCIENCE OPERATIONS WILL BE NOTIFIED THAT THE OBC IS NO LONGER STABLE AT 55.8°C. THE ABOVE CRITERIA WILL THEN BE USED AGAIN TO DETERMINE WHEN STABILITY AT 55.8°C OCCURS.

b. STABILITY AT ANY TEMPERATURE SHALL GENERALLY BE DEFINED AS BEING REACHED WHEN TRANSITIONING IS AT >10 MINUTE INTERVALS.

7. THE FOLLOWING TABLE PROVIDES THE MONTHLY LOWER AND UPPER LIMITS FOR BETA ANGLES WITHIN WHICH NORMAL OPERATIONS ARE RESTRICTED (SEE PARAGRAPH 2) BY A STABLE OBC TEMPERATURE OF 55.8°C. THERE ARE NO BETA ANGLE CONSTRAINTS ON SCIENCE OPERATIONS DURING THE MONTHS OF MAY, JUNE, JULY, AND AUGUST FOR OBC TEMPERATURES OF 55.8°C (SEE PARAGRAPH 4). THE APPLICABLE BETA ANGLE LIMITS FOR EACH SHIFT WILL BE THOSE CORRESPONDING TO THE UT STARTING TIME OF THE SHIFT.

MONTH	LOWER LIMIT	UPPER LIMIT
JANUARY	55.0°	100.0°
FEBRUARY	55.0	95.0
MARCH	60.0	95.0
APRIL	65.0	90.0
MAY	-	-
JUNE	-	-
JULY	-	-
AUGUST	-	-
SEPTEMBER	70.0	85.0
OCTOBER	65.0	90.0
NOVEMBER	65.0	90.0
DECEMBER	60.0	95.0

3. APPROVAL SIGNED: FRED GORDON

APRIL 29, 1985
DATE

IUE FLIGHT OPERATIONS DIRECTIVE	20 JULY 84 DATE	N017B NUMBER

1. APPLICATION: OPERATIONAL VOICE COMMUNICATIONS BETWEEN VILSPA AND GSFC

   IMPLEMENTATION RESPONSIBILITY: OD

   SUPERCEDES PRIOR FODs: N017A

   RESPONDS TO SCARs:

2. DIRECTIVE: THIS FOD PROVIDES INSTRUCTION FOR OPERATIONS WHEN SCAMA VOICE COMMUNICATIONS BETWEEN GSFC AND VILSPA ARE INTERRUPTED DURING THE VILSPA SHIFT.

   NORMALLY, A SCAMA VOICE CIRCUIT FOR OPERATIONS IS TO BE ESTABLISHED BETWEEN THE TWO OPERATING LOCATIONS ABOUT 30 MINUTES BEFORE THE SCHEDULED HAND-OVER TO VILSPA AND RETAINED UNTIL ALL OPERATIONAL REQUIREMENTS ARE COMPLETED AT THE END OF THE VILSPA SHIFT. WHEN THERE IS AN INTERRUPTION IN THIS SCHEDULED SERVICE, THE FOLLOWING GUIDELINES APPLY:

   1. WHEN ACTIVATION IS DELAYED OR IF THE CIRCUIT FAILS, THE IUEOCC DOC SHIFT SUPERVISOR WILL CONTACT THE NASCOM SHIFT COMMUNICATIONS MANAGER (SCM) TO TRY TO HAVE THE IUEOCC/VILSPA OPERATIONAL SERVICE RESTORED. THIS RESTORED SERVICE MAY TAKE THE FORM OF AN ALTERNATE CIRCUIT OR SHARING A CIRCUIT WITH OTHER OPERATIONAL MISSIONS. WHEN THE NORMALLY SCHEDULED CIRCUIT BECOMES AVAILABLE, THE SCM WILL RE-ESTABLISH THE SCHEDULED CIRCUIT BY CONTACTING IUE OPERATIONS.

      IF THE SCAMA LINK IS OUT BETWEEN MADRID AND VILSPA, THE SCM WILL HAVE THE MADRID SWITCH ESTABLISH A VOICE LINK WITH VILSPA USING A COMMERCIAL CIRCUIT, IF THE SCAMA/COMMERCIAL CIRCUIT INTERFACE AT MADRID CAN BE MADE AVAILABLE FOR IUE OPERATIONS.

      THE IUEOCC SHIFT SUPERVISOR WILL WORK WITH THE SCM TO ESTABLISH AND MAINTAIN SATISFACTORY VOICE COMMUNICATIONS WITH VILSPA, IF POSSIBLE.

   2. WHEN SCAMA SUPPORT IS NOT AVAILABLE FOR HANDOVER, THE IUEOCC WILL INITIATE A COMMERCIAL CALL TO VILSPA 15 MINUTES BEFORE THE SCHEDULED HANDOVER TIME. THIS COMMERCIAL CIRCUIT WILL BE RETAINED UNTIL ALL HANDOVER INFORMATION IS EXCHANGED AND ASSURANCE OF SAFE OPERATION BY THE RECEIVING STATION IS GIVEN. THIS COMMERCIAL CALL WILL BE ESTABLISHED AS FOLLOWS:

      USE THE SPECIAL TELEPHONE (344-7057), ON THE O.D.'S CONSOLE:

      a. DIRECT DIAL:

         9-011-341-401-9661 OR 9-011-341-401-9916
         9-011-341-402-5341
         9-011-341-402-4641

      b. IF OPERATOR ASSISTANCE IS REQUIRED, DIAL "9-0" FOR THE COMMERCIAL OPERATOR.

         REQUEST THE EUROPEAN OVERSEAS OPERATOR.

3. APPROVAL FRED GORDON	20 JULY 84 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	20 JULY 84 DATE	NO17B NUMBER

1. APPLICATION: OPERATIONAL VOICE COMMUNICATIONS BETWEEN VILSPA AND GSFC
   IMPLEMENTATION RESPONSIBILITY: OD
   SUPERCEDES PRIOR FODs: NO17A
   RESPONDS TO SCARs:

2. DIRECTIVE

INFORM THE OVERSEAS OPERATOR YOU WANT TO PLACE A CALL TO:

MADRID, SPAIN, 401-9661 OR 401-9916
402-5341
402-4641

WHEN ALL OPERATIONS ARE "NORMAL" THE COMMERCIAL CALL WILL BE TERMINATED.

WHEN THIS DIRECT COMMERCIAL SERVICE IS USED THE IUEOCC SHIFT SUPERVISOR WILL INFORM THE SCM THAT CONTACT HAS BEEN MADE WITH VILSPA USING COMMERCIAL SERVICE. IF THE IUEOCC HAS DIFFICULTY IN ESTABLISHING A COMMERCIAL CALL TO VILSPA, THE IUEOCC SHIFT SUPERVISOR WILL CONTACT THE SCM FOR ASSISTANCE.

3. WHEN SCAMA SERVICE IS OUT, THE IUEOCC OR VILSPA OPERATIONS PERSONNEL WILL PLACE A COMMERCIAL CALL IMMEDIATELY IF A S/C ANOMALY IS SUSPECTED OR A GROUND SYSTEM FAILURE OCCURS AT VILSPA.

   a. IUEOCC WILL PLACE A CALL PER PARAGRAPH 2 ABOVE.

   b. VILSPA WILL PLACE A CALL TO THE IUEOCC GSFC, GREENBELT, MD., U.S.A., AS FOLLOWS:

      DIRECT DIAL: 07-1-301-344-8625

      344-8683
      344-7057 ALTERNATE PHONES
      344-8905

4. WHEN NORMAL SCAMA SERVICE IS OUT ON A DAY WHEN "RANGING" IS SCHEDULED, THE RANGING SUPPORT WILL BE CANCELLED AND RESCHEDULED FOR THE FOLLOWING DAY.

NOTE: ALL USE OF THE SPECIAL TELEPHONE (344-7057) FOR LONG DISTANCE CALLS, WILL BE LOGGED AND PROVIDED TO THE IUE POD, GIVING:

DATE:

TIME: _____ TO _____

DESTINATION OF THE CALL:

REASON:

3. APPROVAL	FRED GORDON	20 JULY 84 DATE

IUE FLIGHT OPERATIONS DIRECTIVE	17 OCT. 83 DATE	NO18E NUMBER

1. APPLICATION: CAMERA MANAGEMENT POLICY

IMPLEMENTATION RESPONSIBILITY:

SUPERCEDES PRIOR FODs: NO18D

RESPONDS TO SCARs:

2. DIRECTIVE: THIS FOD PROVIDES CAMERA MANAGEMENT POLICY FOR THE OPERATION OF IUE CAMERAS.

1. THE SWP CAMERA SHALL NOT BE TURNED OFF EXCEPT IN THE EVENT OF A S/C EMERGENCY THAT WOULD REQUIRE POWERING DOWN THE COMPLETE SI AND OTHER SUBSYSTEMS TO REDUCE THE POWER LOAD.

2. THE LWP AND SWP ARE THE PRIMARY CAMERAS FOR NORMAL OPERATIONS.

3. THE LWR MAY BE USED AS AN OPERATIONAL CAMERA. THE FOLLOWING GUIDELINES SHALL CONTROL THE ALTERNATE OPERATIONAL USE OF THE LWR AND LWP CAMERAS.

a. GUEST OBSERVERS MAY USE THE LWR CAMERA BY MAKING A REQUEST TO THE OBSERVATORY RESIDENT ASTRONOMER.

b. NORMALLY ONLY ONE LONG WAVELENGTH CAMERA WILL BE ON AT A TIME TO MAINTAIN THERMAL STABILITY IN THE LONGWAVE SPECTROGRAPH. WHEN SWITCHING BETWEEN THE TWO LONG WAVELENGTH (LW) CAMERAS THE FOLLOWING SEQUENCE WILL BE USED:

- BOTH OF THE CAMERAS WHICH ARE CURRENTLY ON MUST BE IN STANDBY MODE.
- TURN ON THE LW CAMERA BEING ACTIVATED BY MEANS OF THE CAMON PROC. IF THIS CAMERA HAS NOT BEEN USED FOR 7 DAYS OR MORE, THE CATHODE HEATER SHOULD BE COMMANDED TO HIGH FOR A 15 MINUTE DE-GAS PERIOD PRIOR TO THE FIRST READ-SCAN OF THE SAFETY READ. THIS COMMANDING IS ALSO DONE IN THE CAMON PROC.
- VERIFY THAT THE VOLTAGES AND CURRENTS ARE APPROPRIATE FOR THE STANDBY MODE (WITH THE HEATER HIGH IF NECESSARY).
- WITH PROPER TURN ON VERIFIED, OPERATE THE CAMERA SELECT MECHANISM.
- AT THE CONCLUSION OF THE DEGAS PERIOD, THE CAMERA BEING ACTIVATED SHOULD BE READ IN THE LO GAIN MODE AND SPREPED. IF A SAFETY READ WAS NOT REQUIRED (LESS THAN 7 DAYS SINCE THE LAST USE), THE CAMERA MAY BE SPREPED. BECAUSE OF AN ANOMALY IN THE SCAN CONTROL LOGIC, THE LWP CAMERA'S SCAN MAY TERMINATE PREMATURELY. IF IT DOES, PLACE THE CAMERA IN STANDBY MODE BY USING THE STOP PROC AND THEN RE-EXECUTE THE SCAN.
- WHEN THE CAMERA BEING ACTIVATED HAS BEEN SHOWN TO BE OPERATIONAL BY A READ AND/OR SPREP, THE ALTERNATE LW CAMERA WILL BE TURNED OFF. THE OTHER CAMERAS SHOULD BE IN STANDBY MODE DURING CAMERA TURN OFF.
- SEE PARAGRAPH 6 FOR ALTERNATE CAMERA SWITCHING GUIDELINES.

c. THE LWR MAY BE SWITCHED ON ONCE AND OFF ONCE PER GUEST OBSERVER PER

3. APPROVAL	17 OCT. 83 DATE

OBSERVING DAY. UNLESS IT IS KNOWN THAT THE NEXT GUEST OBSERVER WISHES TO USE THE LWR THE TIME TO SWITCH BACK TO THE LWP SHALL BE TAKEN FROM THE GUEST OBSERVER USING THE LWR.

d. HANDOVER SHALL NORMALLY BE PERFORMED WITH THE LWP ON AND THE LWR OFF UNLESS MUTUALLY AGREED UPON BY THE RESIDENT ASTRONOMERS AT THE TWO OBSERVATORIES.

WHEN THE LWR IS BEING USED, THE RESIDENT ASTRONOMER AT THE OBSERVATORY CONTROLLING THE SPACECRAFT SHALL INQUIRE IF THE NEXT OBSERVER DESIRES TO USE THE LWR BEFORE SWITCHING BACK TO THE LWP. THIS TECHNIQUE WILL MINIMIZE UNNECESSARY SWITCHING BETWEEN CAMERAS.

4. THE LWP CAMERA HAS EXPERIENCED SCAN ANOMALIES. THE OPERATING PROCEDURES ATTEMPT TO DETECT AND RESET INCORRECT SCAN PARAMETERS. IN THE EVENT THAT A FAILURE NOT PREVIOUSLY KNOWN OCCURS AT ANY STAGE IN THE CAMERA SWITCHING PROCESS, THE FOLLOWING STEPS ARE TO BE TAKEN:

- THE CAMERA SELECT MECHANISM WILL BE RESTORED TO THE INITIAL POSITION.
- THE CAMERA WHICH EXPERIENCED THE FAILURE WILL BE RESTORED TO STANDBY AND TURNED OFF.
- AN IUE SCAR, INCLUDING COMMANDED MODES, TELEMETRY APPEARANCE, AND GMT TIMES, SHALL BE PREPARED AND SUBMITTED. HISTORY TAPES AND ANY OTHER DATA THAT MAY BE USEFUL IN ANALYSIS OF THE ANOMALY WILL BE RETAINED.

5. SAFETY READS WILL BE CONTINUED ON THE LWR AND SWR, WHEN REQUIRED. THE SWR WILL ONLY BE TURNED ON FOR THE REQUIRED SAFETY READS.

6. ALTERNATE LWP/LWR CAMERA TURN ON/OFF POLICY.

AS AN INTERIM POLICY, BOTH CAMERAS MAY REMAIN ON AS FOLLOWS:

- o EXPOSURE TIME(S) $<$ 15 MIN.
- o TOTAL TIME BOTH CAMERAS ARE ON $\leq$ 60 MIN.

HAVING BOTH LW CAMERAS ON MAY AFFECT THE THERMAL STABILITY OF THE LONGWAVE SPECTROGRAPH AND CONSEQUENTLY AFFECT THE SCIENCE DATA, THIS POTENTIAL IMPACT ON THE SCIENCE DATA SHALL BE REVIEWED WITH THE GO.