SECTION 5
PROCEDURES DESCRIPTIONS

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PROCEDURES DESCRIPTION

Five procedure files (procfiles) are available for use in the IUE system. These procfiles include OPSPROC, SYSPROC, FESPROC, CAM217F, and CAM217G. The OPSPROC file is the one most commonly used, but any of the other four may be loaded into the system instead. Many of the procedures exist in more than one procfile, and some exist in all procfiles.

The following is a list of the procs contained in each file.

OPSPROC 5

ACQ	FESCMD	FESYAW	SIFOCUS
ALLOFF	FESCOLL	FLAPCHK	SIHTR
APERLOCO	FESIMAGE	FLEXP	SIZECHK
APERTURE	FESIMP	FPREP	SHADOW
CAMINIT	FESL	FSCAN	SMCHK
CAMOFF	FESLAP	HAPSHTR	SNAP
CONMAN	FESOFF	HCLEAR	SPREP
CONSOLE	FESLEWRT	LAMPCK	STOP
CSELECT	FESLGAPS	LCHK	TARGETAT
DMUCHK	FESLOCKR	MODE	TECHK
EXCOM	FESLWAIT	PLIMOFF	THDCHK
EXOBCBLD	FESPITCH	PLIMON	THS
EXOPTBLD	FESPNT	PREPCK	TLM
EXPCK	FESPRIM	MANEUVER	TOFES
EXPFIN	FESREVER	MODTIME	TRAIL
EXPOBCA	FESSAFE	MOVETARG	TSRCHK
EXPOBCM	FESSLEW	OBC	UNLOAD
EXPOSE	FESST	POSTMAN	UPLINK
EXTIME	FESTE	READMON	VHF
FCMTRAK	FESTHD	READPREP	WAVCAL
FCSTFES	FESTOAP	RTOAPER	XPREP
FESANGRT	FESTRK	SBAND	XSPREP
FESBRITE	FESTSR	SEEXPO	XYCHK
FESCALCM	FESXY	SETUP	XYFCHK
FESCAM	FESXYF	SHUTTER	OPSPROC
FESCAMT			

SYSPROC 5

ALLOFF	DELV	EXPCK	FESIMP
BITFLIP	DMU	EXPFIN	FESOFF
CEPWR	DMUCHK	FCSTFES	FESPRIM
CONMAN	DMUSW	FESCAM	FESSAFE
CONSOLE	EVCHK	FESCAMT	FESST
DB12	EVDPWR	FESCOLL	FSS
DB13	EXCOM	FESIMAGE	GYRBIAS

SYSPROC 5 (Cont)

GYRHTR	MODRA	RDRIFT	TECHK
GYRMC	MODRP	RLIMIT	THDCHK
GYROS	MODSAFE	RWEQP	THS
GYRPWR	MODTIME	RWMODE	TLM
GYTRIM	OBC	RWPWR	TMFMT
HAPSHTR	OBCFMTT	SHADOW	TOFES
IRACHK	OBCHARD	SBAND	TREF
JETENA	OBCPWR	SHUTTER	TSRCHK
JETFIRE	OBCSOFT	SIFOCUS	VALVES
LAMPCK	OPTBETA	SIHTR	UNLOAD
LCHK	PASPLA	SIZECHK	VHF
LIMITS	PASPWR	SMCHK	WAVCAL
LOADVAM	PASSPH	SMSS	WDEQP
MEMSW	PEN	SNAP	WDPS
MODBRT	PLIMOFF	SNAPAGE	XYCHK
MODCHK	PLIMON	STARLIB	XYFCHK
MODDV	PREPCK	STOP	SYSPROC
MODPNT	RATE	SUNACQ	

CAM217F

ALLOFF	EXOPTO	MODE	SNAP
APERTURE	EXPFIN	MODTIME	SPREP
CAMINIT	EXPOBCA	NPREP	SPROPT
CAMOFF	EXPOBCM	PLIMOFF	STOP
CAMON	EXPOBCU	PLIMON	THS
CONMAN	EXTIME	PREPCK	TLM
CONSOLE	FESOFF	READG1	TPREP
CSELECT	FESSAFE	READHT	TPROPT
DATA03	FLEXP	READMON	UNLOAD
DATA05	FPLANE	READPREP	UVITF
DEGAS	FPREP	SBAND	VHF
DMUCHK	FSCAN	SHUTTER	WAVCAL
ETUON	HCLEAR	SICHGE	XPREP
EXCOM	IMAGE	SIFOCUS	XSPREP
EXOBCBLD	LAMPCK	SIHTR	YSITEMP
EXOPTBLD	LNPREP	SIOFF	CAM217F
EXPCK	LVPS	SION	

CAM217G

ALLOFF	CSELECT	EXCOM	EXPOBCU
APERTURE	DATA03	EXGNDCMD	EXPGNDA
CAMINIT	DATA05	EXOPTBDG	EXPGNDM
CAMOFF	DEGAS	EXOPTG	FCSTFES
CAMON	DMUCHK	EXOPTGCT	FESCAM
CONMAN	ETUON	EXPECK	FESCAMT
CONSOLE	EXBLD	EXPFIN	FESCOLL

FESIMAGE	LCHK	SICHGE	THS
FESIMP	LNPREPG	SIFOCUS	TLM
FESOFF	LVPS	SIHTR	TOFES
FESPRIM	MODE	SIOFF	TPREPG
FESSAFE	MODTIME	SION	TPROPTG
FESST	NPREPG	SIZECHK	TSRCHK
FLEXPG	PLIMOFF	SMCHK	UNLOAD
FPLANE	PLIMON	SNAP	VHF
FPREPG	PREPCK	SPREPG	WAVCAL
FSCAN	READG1	SPROPTG	XPREPG
HCLEAR	READHT	STOP	XYCHK
IMAGE	SBAND	TECHK	XYFCHK
IMAGEG	SHUTTER	THDCHK	CAM217G
LAMPCK			

FESPROC 5

ACQ	FESIMP	FESTOAP	SEEXPO
ALLOFF	FESL	FESTOCMD	SETUP
APERLOCO	FESLAP	FESTODST	SBAND
ATTCORR	FESLEWRT	FESTOREF	SHADOW
CONMAN	FESLGAPS	FESTRK	SHUTTER
CONSOLE	FESLGRST	FESTSR	SIFOCUS
DEGAS	FESLIMIT	FESWITCH	SIHTR
DMUCHK	FESLOCKR	FESXY	SIZECHK
ETUON	FESLWAIT	FESXYF	SMCHK
EXCOM	FESMLRST	FESYAW	SNAP
EXPCK	FESOFF	FESZERO	STOP
EXPFIN	FESON	FLAPCHK	TARGETAT
EXPOSE	FESPITCH	FOCREG	TECHK
FBHOFF	FESPNT	FPLANE	THDCHK
FBHON	FESPRIM	HAPSHTR	THS
FCMTRAK	FESPRIME	LAMPCK	TOFES
FCSTFES	FESQUARE	LCHK	TLM
FESANGRT	FESREVER	MANEUVER	TRAIL
FESBRITE	FESSAFE	MODTIME	TSRCHK
FESCALCM	FESSLEW	MOVETARG	UNLOAD
FESCAM	FESSRCMD	OBC	UPLINK
FESCAMT	FESST	PLIMOFF	VHF
FESCMD	FESSTM	PLIMON	WAVCAL
FESCOLL	FESTE	PREPCK	XYCHK
FESFCM	FESTEST	POSTMAN	XYFCHK
FESFIDS	FESTHD	RTOAPER	FESPROC
FESIMAGE	FESTILT		

Table Of Camera Parameters

CAMERA ID	–	SWP – Short Wavelength Prime
		SWR – Short Wavelength Redundant
		LWP – Long Wavelength Prime
		LWR – Long Wavelength Redundant
APERTURE	–	SWSA – Short Wavelength Small Aperture
		SWLA – Short Wavelength Large Aperture
		LWSA – Long Wavelength Small Aperture
		LWLA – Long Wavelength Large Aperture
		OP – Large Aperture Open
		CL – Large Aperture Closed
SEC GAIN	–	MAXG – Maximum Gain
		MEDG – Medium Gain
		MING – Minimum Gain
READ GAIN	–	HI – High Gain
		LO – Low Gain
DISPERSION MODE	–	SWH – Short Wavelength High Dispersion
		SWL – Short Wavelength Low Dispersion
		LWH – Long Wavelength High Dispersion
		LWL – Long Wavelength Low Dispersion
LAMPS	–	TFLOOD – Tungsten Flood Lamp
		CALUV – UV Flood Lamp
		CALWL – Platinum Calibration Lamp
		BHFID – Backhole and Fiducial Lamps
		NOCAL – No Lamps

Table Of FES Parameters

FESL   - Raster Scan Line Length $0 \le FESL \le 63$

FESSM   - FES Mode

        0 = Primary
        1 = Search and Track
        2 = Field Camera

FESTHD - Threshold

        0 = 4 counts
        1 = 8 counts
        2 = 36 counts
        3 = 96 counts

FESTSR - Track Scan Rate

        0 = Fast Track
        1 = Slow Track

FESX   - X Position In Coarse Units $-63 \le FESX \le 63$

FESXF   - X Position In Fine Units $0 \le FESXF \le 31$

FESY   - Y Position In Coarse Units $-63 \le FESX \le 63$

FESYF   - Y Position In Fine Units $0 \le FESYF \le 31$

FLAP   - Overlap/Underlap Mode

        0 = Overlap
        1 = Underlap

X   - FESX Coordinate = (32*FESX) + FESXF

Y   - FESY Coordinate = (32*FESY) + FESYF

L   - Size of Raster - (32*FESL)

OPERATIONS PROCEDURES (OPSPROC)

The following pages offer brief descriptions of the most commonly used procedures and their arguments.

PROC: ACQ

PURPOSE: Target acquisition using cursor

PARTICIPANTS: Telescope Operator

PROCEDURE: The ACQ procedure allows the operator to place the EDS cursor on the desired target and acquire the target.

EXEC ACQ,CAMERA ID,T_1,T_2,<MODE>,<APER>

The arguments are the camera ID and exposure time in minutes and seconds. The fourth argument is optional and equals HI or LO dispersion mode. The last argument, also optional, is the large aperture status, OP or CL.

The procedure is as follows:

a. Configure dispersion mode and large aperture if required.
b. With the cursor on the target, the FES is commanded to that position in primary mode.
c. The target is moved to the reference point.
d. The errors are zeroed and the star is moved to the proper aperture.
e. A guide star can be picked up from the cursor position if required.
f. The OBC is commanded to FES and gyro hold if required; on-board trim mode is also possible.
g. Exposure is started.

Subroutines and procedures called: APERTURE, MODE, TOFES, FESBRITE, FESCALCM, FESLOCKR, RTOAPER, FESPNT, FESTRK, EXPOBCM

PROC: ALLOFF

PURPOSE: Emergency shutdown of scientific instrument

PARTICIPANTS: Telescope Operator

PROCEDURE: In the event of an emergency, the scientific instrument can
                be shut down by executing ALLOFF. This should only be
                used in an emergency because it cuts off power to the
                cameras in a sequence which is highly undesirable for routine
                operations.

                EXEC ALLOFF,DUMMY

SUBROUTINE: APERLOCO

PURPOSE: To return aperture or reference point location

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine is called with the number of an aperture
                and returns its X,Y position.

APERTURE NO.	APERTURE
0	Reference Point
1	SWSA
2	SWLA
3	LWSA
4	LWLA

PROC: APERTURE

PURPOSE: To open or close large aperture

PARTICIPANTS: Telescope Operator

PROCEDURE: The two large apertures (one for short wavelength cameras
                 and one for long wavelength cameras) can be opened or
                 closed by this shutter mechanism. Note: Both apertures
                 operate by a single mechanism. Hence, both will be opened
                 or both will be closed.

                 EXEC APERTURE,OP
                 EXEC APERTURE,CL

PROC: CAMINIT

PURPOSE: To define camera image numbers and command byte values

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is run after handover from VILSPA or after a
                    DAY-ZERO or COLD start. It initializes the camera image
                    numbers and verifies the correctness of the camera data base
                    by a CHECKSUM process. No camera procedures can be
                    executed unless CAMINIT has been run.

                    EXEC CAMINIT,LWR#,LWR#,SWP#,SWR#,VERSION,DAC

                    The first four numbers are the camera image numbers. The
                    next argument is the camera procfile number. The last
                    argument is the DAC version.

PROC: CAMOFF

PURPOSE: To turn off camera

PARTICIPANTS: Telescope Operator and Resident Astronomer

PROCEDURE: This procedure turns off both the low and 28V power to the
                selected camera.

                EXEC CAMOFF,SWP CAMERA ID

                Subroutines and procedures called:

                PLIMOFF

PROC: CONMAN

PURPOSE: To uplink a maneuver from the POD console

PARTICIPANTS: Operations Director and Telescope Operator

PROCEDURE: Only the POD console can uplink a constrained maneuver;
                     therefore, the maneuver capability of the spacecraft must
                     be returned to the Operations Director from the SOC.
                     The CONMAN proc can also be used for unconstrained
                     maneuver from the POD console.

                     The procedure has one argument which can be a number
                     from 1 through 10. This is the number of the console to
                     which maneuver capability is reassigned after completion
                     of commanding. Usually this capability is reassigned to
                     the SOC EDS console 10.

                     The proc first checks to see that the argument is correct
                     and then reclaims maneuver capability (RECLAIM MAN)
                     and sends :UPLINK T, PSWD. This uplinks the maneuver
                     that was generated to maneuver the spacecraft to a new
                     object. Typing GO sends :CURRATT UPDATE command,
                     which puts into the system the right ascension, declina-
                     tion, and roll of the spacecraft at the completion of the
                     maneuver. Maneuver capability is then assigned to the
                     specified console.

                     CONMAN PROC
                             IF NUM(AF)·EQ·1,START
                     TELL   CONTINUE
                     /   EXEC CONMAN,X
                     /
                     /   X=CONSOLE NUMBER OF CONSOLE TO BE ASSIGNED
                             MANEUVER CAPABILITY AFTER THE MANEUVER.
                     /   RANGE IS 1-10 SOC EDS=10 OCC EDS=9
                             RETURN   /CONMAN-AGR WRONG

PROC: CONSOLE

PURPOSE: Activate consoles, set display updates automatically

PARTICIPANT: Operations Director

PROCEDURE: To automatically bring up CRT's, set updates, and restore
                pen function afer a switch from one Sigma to the other. It
                is also used after a system reload and day zero.

                Example:

                EXEC CONSOLE,1,2,3,4,5,6   (deactivates all CRT's)

                EXEC CONSOLE,1,2,3,4,5,6,7   (activates CRT's and sets
                                                  up as follows)

                PAGE SYSTEM,1
                PAGE ACSM,2
                PAGE OBCRAW,3
                PAGE SISTAT,5
                PAGE SYSTEMP,6
                PAGE DOC,7
                SET DISPUPDT,6,120
                SET DISPUPDT,3,30
                SET DISPUPDT,2,5
                PEN RESTORE,9
                PEN ON

PROC: CSELECT

PURPOSE: To operate camera-select mechanism

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure allows for the selection of redundant cameras
                  by moving the camera-select mirror to the appropriate camera.
                  Additionally, the camera desk heaters are reconfigured.

                  EXEC CSELECT,CAMERA ID

SUBROUTINE: EXCOM

PURPOSE: To store camera information into science header

PARTICIPANTS: Telescope Operator

PROCEDURE: To store the exposure time in the science header, this
                subroutine first checks to see if any on-board lamps were
                used. If not, it stores the exposure time. If a lamp were
                used, it stores the exposure time of that lamp.

SUBROUTINE: EXOBCBLD

PURPOSE: To build exposure data block

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine builds the data block 14 required for an
                 exposure. It builds exposures for both lamp and no-lamp
                 exposures. Therefore, it is called for regular exposures,
                 preps, and calibration exposures.

SUBROUTINE: EXPCK

PURPOSE: To check if camera is ready for exposure

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine checks various parameters to ensure that
                the camera is safe for an exposure. It checks items such
                as bit rate, telemetry format, and camera select mechanism

PROC: EXPFIN

PURPOSE: To finish OBC-controlled exposure

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is executed during the last few minutes of an
                 OBC-controlled exposure. It stores certain header information
                 and turns limits on and off.

PROC: EXPOBCA

PURPOSE: Automatic OBC-controlled exposure

PARTICIPANTS: Telescope Operator

PROCEDURE: This proc begins an OBC-controlled exposure. The ground computer will remain in the proc until the exposure is complete.

EXEC EXPOBCA, CAMERA I.D., T_1, T_2, GAIN, <LAMP>

The first argument is the camera ID; the second and third arguments are the exposure time in minutes and seconds, respectively; the fourth argument is the SEC gain setting; and the fifth is an optional argument for lamp exposures.

Subroutines and procedures called:

EXPOBCM
EXPFIN

PROC: EXPOBCM

PURPOSE: Manual OBC-controlled exposure

PARTICIPANTS: Telescope Operator

PROCEDURE: This proc begins an OBC-controlled exposure. The ground
                 computer will exit the proc if the exposure is greater than
                 5 minutes. If the exposure is less than 5 minutes, the proc
                 will wait for the exposure to be completed.

                 EXEC EXPOBCM, CAMERA I.D., T_1, T_2, GAIN, <LAMP>

                 The first argument is the camera ID; the second and third
                 arguments are the exposure time in minutes and seconds,
                 respectively; the fourth argument is the SEC gain setting;
                 and the fifth is an optional argument for lamp exposures.

                 Subroutines and procedures called:

                 EXCOM
                 EXOBCBLD
                 EXPCK
                 LAMPCK

PROC:	EXPOSE
PURPOSE:	To move star to aperture and begin exposure
PARTICIPANTS:	Telescope Operator
PROCEDURE:	The EXPOSE master procedure is useful for setting up for an exposure , if the target is already in an aperture or at the reference point. If the object is not at one of these positions, use the ACQ PROC.

EXEC EXPOSE,CAMERA ID,T_1,T_2,<MODE> , <APER>

The first argument is the camera ID. The second and third arguments are the exposure time in minutes and seconds. The fourth argument is the optional dispersion mode (HI or LO). The last argument, also optional, is the status of the large aperture: OP or CL.

The chain of events for this proc is as follows:

a. Puts selected camera in the correct dispersion mode if required.

b. Opens or closes the large aperture if required.

c. Moves the target to the reference point.

d. Zeroes the errors at the reference point.

e. Moves target to correct aperture.

f. Goes to guide star (previously selected) if desired.

g. Goes to FES and Gyro hold mode.

h. Begins exposure.

Subroutines and procedures called:

MODE
APERTURE
APERLOCO
 RTOAPER
FESLOCKR
FESPNT
TOFES
FESBRITE
FESTRK
EXPOBCM

SUBROUTINE: EXTIME

PURPOSE: To calculate exposure time for lamps

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine calculates the exposure time for exposures
                with the TFLOOD and CALUV lamps.

PROC: FCMTRAK

PURPOSE: Ground controlled FES track using field camera mode

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used to determine the position of an object
                    which is either too bright or too faint to be tracked. The
                    proc uses the FES in the field camera mode to scan a small
                    area around the supposed target. The proc uses an iterative
                    process to determine the location of the object.

                    EXEC FCMTRAK,SIZE,< # SAMPLES /MINOR FRAME >

                    The first argument, size, can be equal to 1 or 2.

                        1 = Area scanned is 1 pixel smaller than 2* FESL+1
                        2 = Area scanned is 2 pixels smaller than 2* FESL+1

                    The second argument is the number of samples per minor
                    frame, 1 or 8, with a default value of 8.

                    Subroutines and procedures called:

                    LCHK
                    TOFES

SUBROUTINE: FCSTFES

PURPOSE: Calls other subroutines to check arguments for FES search
                and track and field camera modes

PARTICIPANTS: Telescope Operator

PROCEDURE: The FES search and track and field camera modes both involve
                a raster scan. This subroutine checks various scan param-
                eters and sets them up.

                If the FES is commanded to the field camera mode without the
                tracker enabled, it collects the FES data for image reconstruc-
                tion. If it is commanded to search and track or field camera
                with track enabled mode, it begins the scan and when it picks
                up a star, calls the FESBRITE procedure.
                Subroutines and procedures called:
                FLAPCHK
                TSRCHK
                THDCHK
                LCHK
                TOFES
                FESBRITE

SUBROUTINE: FESANGRT

PURPOSE: To check FES fixed-rate maneuver angles and rates.

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine checks both the angle size and rate for
                fixed-rate (DB 10) maneuvers.

                Angle - Makes sure star does not leave FES field of view.

                Rate - Checks if it exceeds absolute limits and checks if
                        it will move at such a rate that the FES will lose star
                        presence.

PROC: FESBRITE

PURPOSE: To check star brightness

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure checks the brightness of a star being
                 tracked and changes FES track modes if necessary. All
                 the track mode procs originally command the FES to the slow-
                 track, overlap mode. If the counts are greater than 500,
                 FESBRITE puts the FES in the fast-track mode. If the counts
                 are now greater than 28,000, the proc puts the FES in under-
                 lap mode. If the counts are still greater than 28,000, the
                 FES will be safed and the proc will abort.

                 EXEC FESBRITE,TIME

                 The argument is the time which the procedure will wait for
                 star presence before timing out.

PROC: FESCALCM

PURPOSE: To calculate and execute a two-axis fixed-rate maneuver

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used to maneuver a star from one point to
                 another in the FES field.

                 EXEC FESCALCM,XEND,YEND,<XSTART >,<YSTART >

                 The first two arguments are the X and Y coordinates to which
                 the star is to be moved. The last two arguments are optional
                 and are the starting position of the star. The procedure
                 comes to a WAIT and displays the pitch and yaw slew sizes.
                 A GO will uplink the maneuver; therefore the proc can be
                 used just to calculate a maneuver. If the proc is executed
                 with just two arguments, the starting position is assumed to
                 be the current position of the tracker. If the procedure is
                 executed with three arguments, the third being a dummy,
                 the proc will skip the WAIT.

                 Subroutines and procedures called:

                 FESSLEW

PROC: FESCAM

PURPOSE: To place FES in the field-camera mode with tracker disabled

PARTICIPANTS: Telescope Operator

PROCEDURE: Field-camera mode with tracker disabled is used for collecting data for FES images.

EXEC FESCAM,X,Y,L,<FESTHD>,<FESTSR>,<FLAP>

The first two arguments are the starting X and Y coordinates for the master scan. The third argument is the size of the scan. The remaining arguments - threshold, track scan rate, and overlap/underlap - are optional arguments for the track-enabled mode.

Subroutines and procedures called:

FCSTFES

PROC: FESCAMT

PURPOSE: To place FES in the field-camera mode with tracker enables

PARTICIPANTS: Telescope Operator

PROCEDURE: Field-camera mode with tracker enabled is a useful track mode
                  when tracking very faint objects.

                  EXEC FESCAMT,X,Y,L,<FESTHD>,<FESTSR>,
                  <FLAP>

                  The first two arguments are the X and Y coordinates where
                  the tracker is to be commanded. The third argument is the
                  size of the area around the X,Y position to be searched.

                  Subroutines and procedures called:

                  FCSTCFES

PROC: FESCMD

PURPOSE: To send serial FES command

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure sends a :FES command.

                  EXEC FESCMD,FESSM

                  The argument is the FES mode:

                    0 = primary
                    1 = search and track
                    2 = field camera

                  Subroutines and procedures called:

                  SMCHK

                  SIZECHK

PROC: FESCOLL

PURPOSE: To collect FES image data

PARTICIPANTS: Telescope Operator

PROCEDURE: This non-commanding procedure collects FES image data for later reconstruction. The FES must already be in the field-camera mode.

EXEC FESCOLL, # OF MF

The argument is the number of minor frames to be collected. A zero argument defaults to 1000 MF. If the argument is >0 and ≤ 8, the argument specifies the number of samples per minor frame to be collected.

PROC: FESIMAGE

PURPOSE: To reconstruct FES image

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure creates an FES image from the collected data
                 and sends it to the EDS.

                 EXEC FESIMAGE,SCALE FACTOR, EDS FILE

                 The first argument is a scaling factor. The intensity is
                 decreased by a factor of 2 raised to the power "scale factor."
                 The second argument is the EDS file (1 or 2) where the image
                 is to be sent.

PROC: FESIMP

PURPOSE: To send FES impulse command

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used to impulse the FES tracker when it
                 is in field camera track or search and track modes. This is
                 used if the tracker is locked onto a star and the operator
                 wants it to continue searching the field. This is also used
                 in primary mode to cause the FES to track at its commanded
                 position.

                 EXEC FESIMP, FES#

                 The argument is the FES number. If the argument is zero
                 it sends the command to the active FES.

PROC: FESL

PURPOSE: To reset line length

PARTICIPANTS: Telescope Operator

PROCEDURE: This proc is used to reset the FESL parameter - the scan
                 size parameter.

                 EXEC FESL,FESL

                 Subroutines and procedures called:

                 LCHK

PROC: FESLAP

PURPOSE: Step track to overlap/underlap mode

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure commands the FES to either the overlap or
               underlap mode.

               EXEC FESLAP,FLAP
               FLAP:
               Ø = overlap
               1 = underlap

               Subroutines and procedures called:
               FLAPCHK

PROC: FESLEWRT

PURPOSE: Single-axis fixed-rate slew

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure calculates and uplinks a single-axis fixed-rate maneuver.

EXEC FESLEWRT,AXIS,ANGLE,RATE

The first argument is the axis:

0 = pitch
1 = yaw
2 = roll

The second argument is the size of the slew in hundredths of an arcsecond. The third argument is the slew rate in hundredths of an arcsecond per second.

Subroutines and procedures called:

FESANGRT
FESPITCH
FESYAW
FESLWAIT

PROC: FESLGAPS

PURPOSE: To slew perpendicular to large aperture

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure performs a two-axis field-rate slew to move
                 a star across the large aperture.

                 EXEC FESLGAPS,ANGLE,RATE,<DIRECTION>

                 The first argument is the slew size in hundredths of an arc-
                 second. The second argument is the slew rate in hundredths
                 of an arcsecond/second. The third argument is the direction
                 and defaults to the long axis.

                 Subroutines and procedures called:

                 FESANGRT
                 FESSLEW

PROC: FESLOCKR

PURPOSE: Zero FES errors

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure zeroes the FES errors by performing a two-axis maneuver. This places the star exactly at the commanded position.

EXEC FESLOCKR, NUMBER OF MINOR FRAMES,< TO REF >

The first argument is the number of minor frames of data to be averaged to determine the present FES location of the star. A zero argument does not use the FESAVG processor. If the second optional argument is a 1, the FES is first commanded to the reference point in the primary mode and then locked. If it is a zero, the star is locked to the last commanded position. Default is zero.

Subroutines and procedures called:

FESBRITE

SUBROUTINE: FESLWAIT

PURPOSE: To check if a slew is in progress

PARTICIPANTS: Telescope Operator

PROCEDURE: The FESLWAIT Subroutine is called when it is necessary to wait until a fixed-rate or minimum time maneuver is complete before continuing. This subroutine will come to a WAIT until the slew in progress is complete.

PROC: FESOFF

PURPOSE: To turn off FES

PARTICIPANTS: Telescope Operator and Resident Astronomer

PROCEDURE: This procedure is used in the event that one of the fine-error
                sensors needs to be turned off.

                EXEC FESOFF, FES#

SUBROUTINE: FESPITCH

PURPOSE: Fixed-rate pitch maneuver

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine builds and uplinks a data block 10 fixed-rate pitch maneuver.

PROC: FESPNT

PURPOSE: To calculate FES coordinates of a star

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure averages FES data and calculates the FES
                    coordinates of a star being tracked.

                    EXEC FESPNT,# OF MINOR FRAMES

                    The argument is the number of minor frames to be averaged.
                    An argument of zero does not use the FESAVG processor and
                    thus can be called from a console which is not signed on.

PROC: FESPRIM

PURPOSE: To command FES to primary mode

PARTICIPANTS: This procedure commands the FES to the primary track mode
                    at the requested position.

                    EXEC FESPRIM,X,Y,<FESTR>,<FLAP>

                    The arguments are the requested FES coordinates to which
                    the tracker is to be commanded. The last two arguments are
                    the track scan rate and overlap/underlap scan pattern.
                    Default values are slow track, overlap.

                    Subroutines and procedures called:

                    FESBRITE
                    FLAPCHK
                    TOFES
                    TSRCHK

PROC: FESREVER

PURPOSE: To reserve FES image

PARTICIPANTS: Telescope Operator

PROCEDURE: Normally, an FES image is displayed with a right-handed
                 coordinate system. Astronomical charts have a left-handed
                 coordinate system. In order to more easily identify difficult
                 fields, it is useful to reverse the image.

                 EXEC FESREVER,EDSFILE,<EDSFILE>

                 The first argument is the EDS file (1 or 2) to which the
                 reversed image is to be sent. The second argument is the
                 file to which a normal image is to be sent.

PROC: FESSAFE

PURPOSE: To place FES in safe condition

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used primarily during maneuvers to ensure
                  that the FES is not damaged if it comes across a bright
                  source, such as the sun. This proc should also be used in
                  the event of an emergency loss of altitude. It places the
                  scan beam out of the field-of-view and places the FES in
                  field-camera mode.

                  EXEC FESSAFE, DUMMY

SUBROUTINE: FESSLEW

PURPOSE: Two-axis fixed-rate maneuver

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine builds and uplinks a two-axis (pitch and
               yaw) data block 10 maneuver.

PROC: FESST

PURPOSE: To command FES to search and track mode

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure commands the FES to the search and track
                mode.

        EXEC FESST,X,< Y >,< L >,< FESTHD> ,< FESTSR >,< FLAP>

The frist two arguments are the X and Y position to which
the FES is to be commanded. The third argument is the size
of the scan around the commanded position. A single argu-
ment of Ø will search the entire field. The FES will search
the field until it comes across a star bright enough to trip
the tracker, after which the tracker stays on the star.

Subroutines and procedures called:

FCSTFES

PROC: FESTE

PURPOSE: To set track to enable/disable

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used to set tracker to the enable or
                disable state.

                EXEC FESTE,FESTE

                0=disable
                1=enable

                Subroutines and procedures called:

                TECHK

PROC: FESTHD

PURPOSE: To command FES threshold

PARTICIPANTS: Telescope Operator

PROCEDURE: This proc sets the FES threshold to the required value.
                 The threshold is the number of counts from the faintest
                 star, which will trip the star tracker in search and track
                 or field camera track modes.

                 EXEC FESTHD,FESTHD

                 0 = 4 counts
                 1 = 8 counts
                 2 = 36 counts
                 3 = 96 counts

                 Subroutines and procedures called:

                 THDCHK

PROC: FESTOAP

PURPOSE: To perform a yaw-pitch-yaw maneuver

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure calculates and uplinks a yaw-pitch-yaw
                    fixed-rate maneuver. This procedure is called by procedures
                    like RTOAPER for performing canned slews from reference
                    point to aperture.

                    EXEC FESTOAP,SAC1,IMX1,<SAC0,IMX0,SAC1,IMX1

                    SAC1 = yaw slew size in arcsecond.
                    IMX1 = number of worker 0 iteration for yaw.
                    SAC0 = pitch slew size in arcseconds.
                    IMX0 = number of worker 0 iteration for pitch.

                    Subroutines and procedures called:

                    FESLWAIT

PROC: FESTRK

PURPOSE: To use FES for OBC tracking

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used to command the OBC to use FES and
                     GYRO information to hold attitude. It may also be used to
                     perform an on-board or ground gyro trim.

                     EXEC FESTRK,MODE, <BG∅ , BG1, BG2>

                     This proc can be called with either one argument or with
                     four arguments. The first argument is the mode of control:

                     -1 = OBC MONITORS FES ML=3
                      ∅ = OBC IGNORES FES ML=∅
                      1 = OBC-FES POSITION UPDATE MC∅=MC1=1
                      3 = OBC-FES GYRO TRIM & POSITION MK=2, MA=1

                     The remaining three arguments are the drifts in pitch, yaw,
                     and roll in arcsec/sec.

                     Subroutines and procedures:

                     FESLWAIT

PROC: FESTSR

PURPOSE: To reset track scan rate to fast or slow

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used to put the FES in either the fast
                    or slow tracking modes.

                    EXEC FESTSR,FESTSR

                    Ø = fast track
                    1 = slow track

                    Subroutines and procedures called:

                    TSRCHK

PROC: FESXY

PURPOSE: To reset coarse FES X and Y values

PARTICIPANTS: Telescope Operator

PROCEDURE: This is a non-commanding procedure which resets the coarse
                    FES X and Y parameters.

                    EXEC FESXY,FESX,FESY

                    Subroutines and procedures called:

                    XYCHK

PROC: FESXYF

PURPOSE: To reset FES fine X and Y values

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure resets the FES fine X and Y parameters and
                 sends an FES serial command.

                 EXEC FESXYF,FESXF,FESYF

                 Subroutines and procedures called:

                 XYFCHK

SUBROUTINE: FESYAW

PURPOSE: Fixed-rate yaw maneuver

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine builds and uplinks a data block 10 yaw
                 maneuver.

SUBROUTINE: FLAPCHK

PURPOSE: To check FES overlap/underlap parameter

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine checks the FESLAP parameter to ensure that
                 it is either 0 or 1.

                 0 = overlap
                 1 = underlap

PROC: FLEXP

PURPOSE: To command an OBC - controlled flood lamp exposure

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure prepares the camera for an exposure by
                 setting the UVC, SEC high voltages, alignments, and heater
                 to their proper values; builds the exposure data block; up-
                 links the data block; and starts the exposure.

                 EXEC FLEXP,T%,<SEC>

                 The first argument is the percentage of optimum exposure
                 request. The second argument is a data base value corre-
                 sponding to the SEC gain setting (defaults to SEC4). This
                 procedure can only be used in a master procedure.

PROC: FPREP

PURPOSE: To fast-prepare a camera

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure does a fast-prepare on a given camera. The
                   FPREP sequence was developed to be used for test exposures
                   and not for normal exposures because it does not put on a
                   smooth (processable) background. It consists of an 800%
                   tungsten flood expose followed by three fast wipes.

                   EXEC FPREP,CAMERA ID

                   Subroutines and procedures called:

                   PREPCHK
                   PLIMOFF
                   FLEXP
                   FSCAN
                   PLIMON

PROC: FSCAN

PURPOSE: Fast read-erase scans

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure performs a number of very fast read-erase
scans used in XPREP's and FPREP's.

       EXEC FSCAN,G3D,XAN,YAN,N, <G1ED>
           G3F,XAD,YAD, <G1EF>

       The argument N is the number of fast scans requested. The
other arguments are camera data base parameters.

PROC: HAPSHTR

PURPOSE: To turn HAPS heaters on or off

PARTICIPANT: Operations Director

PROCEDURE: To turn the seven HAPSHTR groups on or off. There can
                 be as many as seven arguments, each a number from 1 to 14.
                 Numbers 1 through 7 turn on heater groups 1 through 7,
                 respectively; and numbers 8 through 14 turn off groups 1
                 through 7, respectively.

Function	Commands
Heater group No. 1, 1=on (6.4 W primary chamber low thrust engines 1, 3, 4, 6, 7, and 9)	IMP 91 = On IMP 92 = Off
Heater group No. 4, 1=on (5.9 W primary heaters on +Y and -Y rem struts and mounts, low thrust engines 4 and 6 valves)	IMP 93 = On IMP 94 = Off
Heater group No. 6, 1=on (5.7 W primary heaters on high thrust engines 5 and 11)	IMP 95 = On IMP 96 = Off
Heater group No. 7, 1=on (12.2 W primary heaters on -Z hydrazine lines, hydrazine tanks C, D, F, and G	IMP 97 - On IMP 98 = Off
To arm groups 1, 4, 6, and 7	CRU CMD 43 = arm
Heater group 2, 1=on (backup heaters for group No. 1)	IMP 101 = On IMP 102 = Off
Heater group 3, 1=on (backup heaters for group No. 7, primary heaters on +Z hydrazine lines, hydrazine tanks B and H, LTE 10 and 12 valves) (15.2W)	IMP 107 = On IMP 108 = Off

Function	Commands
Heater group 5, 1=on (backup heaters for group No. 4)	IMP 109 = On IMP 110 = Off
To arm groups 2, 3, and 5	IMP 99 = Arm IMP 100 = Disarm

Group No. 1 is the only group presently being used.

The procedure first checks to see that the arguments are correct. If so, proceed to start. The variables CMDR (1) through CMDR (7) are given the number values of the commands that turn the heaters on. HYDREG (1) through HYDREG (7) are given the numbers corresponding to the bit configurations for heaters 7 to 1 on.

The heater groups are armed and the procedure then goes into a do loop. To turn heaters on, the procedure goes to HTRON, checks to see if the heater is already on, sends the proper command if it is not, checks telemetry to verify that it does come on, and then displays the message.

Heater HTR# is on.

To turn heaters off, the procedure goes to HTROFF and executes a corresponding sequence. If there are additional arguments, the procedure continues performing the HTRON or HTROFF sequence once for each argument.

PROC: HCLEAR

PURPOSE: To clear parts of the science header

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used to clear parts of the science header
                    after a read.

                    EXEC HCLEAR,REED
                    COFF

                    The REED argument will clear commands 1-3. The COFF
                    argument clears events 4 through 10.

SUBROUTINE: LAMPCK

PURPOSE: To check requested exposure times for exposures using on-board lamps.

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine checks the requested exposure times for the three on-board lamps: the tungsten flood lamp (TFLOOD), UV flood lamp (CALUV), and platinum calibration lamp (CALWL). It checks the exposure times for the various dispersion and gain modes.

SUBROUTINE: LCHK

PURPOSE: To check raster scan size parameter

PARTICIPANTS: Telescope Operator

PROCEDURE: The FESL parameter is the size of the raster scan. This
                subroutine checks the requested FESL to ensure that $0 \le FESL \le 63$.

PROC: MANEUVER

PURPOSE: To calculate maneuvers

PARTICIPANTS: Telescope Operator

PROCEDURE: This is the procedure normally used to calculate maneuvers.
        It can be called in three different ways:

  a. EXEC MANEUVER, UPLINK FLAG

   In this mode, a maneuver is calculated to the target
   whose coordinates exist in the TARGATT variable. If
   the UPLINK FLAG = 0, the maneuver is generated and
   the attitude is updated. If the flag = 1, the proc will
   generate the maneuver and configure the spacecraft.
   If the flag = 2, the maneuver is generated and the
   spacecraft is configured. If the maneuver is uncon-
   strained, it is uplinked and the attitude is updated.
   If it is constrained, the spacecraft is configured and
   the proc terminates.

  b. EXEC MANEUVER, AHRS, AMIN, ASEC, DDEG, DMIN, DSEC

   The arguments are the coordinates of the target in
   astronomical coordinates. The first three arguments
   are the right ascension in hours, minutes, and seconds.
   The last three arguments are the declination in degrees,
   minutes and seconds. In this mode, the coordinates are
   put into the TARGATT variable and the maneuver is
   generated. Normally, the proc will exit after the genera-
   tion is complete; however, the following GO's will allow
   further action:

      GO UP - update attitude
      GO PREP - prepare S/C for maneuver
      GO MANVER - prepare S/C and uplink
       if unconstrained

c. EXEC MANEUVER,YEAR,DAY,HR,MIN

This mode allows the calculation of a manuever to the
TARGATT at a given time. The first argument is the
year - 1900. The second is the day number. The third
and fourth are the GMT time. This will generate the
maneuver for that time.

Subroutines and procedures called:

UPLINK

PROC: MODE

PURPOSE: To select camera dispersion mode

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure allows the selection of a dispersion mode for
                 whatever camera is selected in either wavelength range.

                 EXEC MODE, SWH
                           SWL
                           LWH
                           LWL

                   SWH = short wavelength high dispersion
                   SWL = short wavelength low dispersion
                   LWH = long wavelength high dispersion
                   LWL = long wavelength low dispersion

PROC: MODTIME

PURPOSE: To modify an exposure time

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used when it becomes necessary to change
the time of an OBC-controlled exposure.

EXEC MODTIME, CAMERA ID, T_1, T_2

T_1 and T_2 are the new exposure times in minutes and seconds.

PROC: MOVETARG

PURPOSE: To observe moving targets by gyro trim or FES offset
                     guiding

PARTICIPANTS: Telescope Operator

PROCEDURE: Moving targets (solar system objects) provide difficulties in
                     tracking. The MOVETARG procedure is designed to aid in
                     tracking moving targets.
                     EXEC MOVETARG,DEL(RA),DEL(DEC),S/C ROLL,
                     <FES UPDATE>, T (EXPOSE)

                     The first two arguments are the rate at which the target is
                     moving in RA and DEC, respectively. These are in arc-
                     seconds/hour. The third argument is the spacecraft roll angle
                     ($0 \leq$ S/C ROLL 360°) in degrees. The third and fourth
                     arguments are the update time in minutes and the exposure
                     time in minutes.

                     The procedure can be used in two ways:

                         a. Bias the gyros. This mode requires the following initial
                             conditions:

                             ● Gyros nulled to a star
                             ● Observer supplies △RA, △DEC
                             ● Tracking target

                     The proc then calculates the pitch and yaw gyro biases and,
                     optionally, uplinks a data block 10 to bias the gyros. This
                     mode requires only three arguments.

                         b. Offset Guiding. Initial conditions are:

                             ● Gyros trimmed to target rate
                             ● Target in aperture and exposing
                             ● FES tracking guide object
                             ● Observer supplies rate of motion of target relative to
                               guide in arcsec/hr.

This procedure is executed with five arguments. The proc notes the FES position of the guide star and calculates where it will be throughout the exposure. At intervals of "FES UPDATE" the proc compares actual location of guide and calculated position and uplinks a data block 10 to correct it. This will continue until "T (EXPOSE)" is reached.

Subroutines and procedures called:

FESTRK

PROC: OBC

PURPOSE: Sends several sets of OBC commands for performing different functions. (AF(1) = Any number)

PARTICIPANTS: Operations Director

PROCEDURE: The procedure checks to see that there is one argument, then displays a list of statement labels. Entering GO LABEL, where LABEL is one of the statement labels, will cause the proc to begin execution at that statement. If GO is typed with no label, the proc aborts. The following functions can be performed:

a.   ABG   Zeros ABG's then exits proc

b.   XFER   Sends transfer command, returns to START

c.   GSFC   Sends Goddard station ID, returns to START

d.   VIL   Sends VILSPA station ID, returns to START

e.   ERRFLG   Clears error flags, exits proc

f.   DEC1   Sets OBC and ground decoders #1, exits proc

g.   DEC2   Sets OBC and ground decoders #2, exits proc

h.   RESET4K   Sends commands to reset 4K memory, exits proc

i.   RESET8K   Sends commands to reset 8K memory, exits proc

Typing GO TERM will terminate the proc.

PROC: OPSPROC

PURPOSE: To determine which procfile is loaded into the system

PARTICIPANTS: Operations Director or Telescope Operator

PROCEDURE: If called with no arguments, the proc scrolls a series of
                    comments which give the name of the current procfile in
                    the system and the changes made to it from the preceding
                    OPSPROC file. If an argument is used, the file name is
                    stored in the science header (may only be done from a con-
                    sole which is signed on).

SUBROUTINE: PLIMOFF

PURPOSE: To turn off limits for a particular camera

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine turns off the following limits for a particular camera:

a. UVC and SEC high voltages

b. Grid voltages

c. Line and X frame deflection currents

d. X and Y alignment currents

e. Heater and focus currents

There are two sets of limits, depending on which MUX is active.

SUBROUTINE: PLIMON

PURPOSE: To turn on standby limits for a particular camera

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine turns on the standby limit for a particular
                 camera and MUX combination. The limits involved are the
                 same as in PLIMOFF.

PROC: POSTMAN

PURPOSE: Post-maneuver image acquisition

PARTICIPANTS: Telescope Operator

PROCEDURE: When a maneuver is complete, the procedure can be used to take an FES image or to update the attitude.

EXEC POSTMAN,EDS FILE,<ATTFLAG>

The first argument is the EDS file to which the image is to be sent. The second argument is a flag for updating attitude:

0 = no update
1 = update

Defaults to 0.

The procedure is as follows:

  a. ATTFLAG=0
     ● Collects FES default size image (1000 minor frames).
     ● Sets Kalman filters.
     ● Reconstructs image and sends to EDS.

  b. IF EDS File ≠ 1 or 2 and ATTFLAG = 1
     ● Updates current attitude only.

  c. If EDS File = 1 or 2 and ATTFLAG = 1
     ● Updates current attitude.
     ● Collects FES default size image (1000 minor frames).
     ● Sets Kalman filters.
     ● Reconstructs image and sends it to EDS.

Subroutines and procedures called:

FESCAM

FESIMAGE

SUBROUTINE: PREPCK

PURPOSE: To check if the scientific instrument is ready for prep.

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine checks to verify that telemetry format, mechanisms, and other items are correctly configured for the scientific instrument prep.

PROC: READ

PURPOSE: To read down camera image data

PARTICIPANTS: Telescope Operator

PROCEDURE: Performs readout of camera image data, reconstructs and
                archives the image. This proc does not prep the camera.

EXEC READ,CAMERA ID,LO,< SS1>, <(ISA,ILA,SSR,LSR)
                      HI,   SS2
                            SS3
                            SS4

The first argument is the camera to be read, the second is
the camera SEC gain (usually LO). The third argument is
the scan step size which defaults to 1. The optional arguments
are for a partial read of the camera (almost never used).

Subroutines and procedures called:

SCAN

PROC: READMON

PURPOSE: To monitor reads in the passive mode

PARTICIPANTS: Operations Director and Telescope Operator

PROCEDURE: This procedure allows the participants to monitor reads or to
                   reconstruct images from history tape playbacks. Since it does
                   not command, it can be used during VILSPA shift or for
                   parallel operations using both ground computers.

EXEC READMON,CAMERA ID,PREP,T_1,T_2,GAIN,LAMP,$\dfrac{READ}{GAIN}$

The first argument is the camera ID. The second argument
is the time the PREP is done:

$\emptyset$ = no PREP   4 = LNPREP
1 = NPREP   5 = FPREP
2 = TPREP   6 = XPREP
3 = SPREP

The third and fourth arguments are the exposure times in
minutes and seconds, respectively. The fifth argument is the
SEC gain. The sixth is the lamp used:

NOCAL - no lamp
CALUV - UV flood
CALWL - platinum calibration
TFLOOD - tungsten flood

The last argument is the read gain:

LO - low gain read
HI - high gain read

Subroutine and procedures called:

PLIMOFF

PLIMON

PROC: READPREP

PURPOSE: To read image and prepare camera for exposure

PARTICIPANTS: Telescope Operator

PROCEDURE: The READPREP procedure is used to read an image and prepare the camera for the next exposure in a time-efficient manner. The procedure is as follows:

1) Read the image
2) Reconstruct the image
3) 200 percent MAX gain flood with tungsten lamp
4) Read-erase
5) While the read-erase is going, the image is ARCHIVED
6) 50 percent MED gain flood with tungsten lamp
7) Read-erase
8) While the read-erase is occurring, the image is sent to the EDS

This procedure uses the delayed-command worker for efficiency.

EXEC READPREP,CAMERA ID, READ GAIN

Subroutines and procedures called:

PREPCK

PROC: READRATE

PURPOSE: To read/erase scan

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure erases the camera target after a flood with the
                 tungsten lamp. Two of these erases occur in an SPREP.

                 EXEC READRATE,G3D,XAN,YAN,768,<GIED>,<SS2>
                             G3F,XAD,YAD,804, <GIEF>
                                         1020

                 The arguments are various camera data-base parameters.

PROC: RTOAPER

PURPOSE: To move the target to aperture from a reference point

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure moves an object from the reference point
                 (300,144) to one of the four apertures and vice versa.

                 EXEC RTOAPER,APER

                 APER: 1 = SWSA
                        2 = SWLA
                        3 = LWSA
                        4 = LWLA

                 Negative arguments move the target from the aperture to the
                 reference point.

                 Subroutines and procedures called:

                 FESTOAP

PROC: SBAND

PURPOSE: To set S-band power amplifiers either on or off

PARTICIPANT: Operations Director

PROCEDURE: SBAND has one argument, 1, 2, 3, or 4, depending on the
                    desired antenna. The procedure checks the arguments to see
                    which antenna is to be used. It then turns off the other
                    three power amps, turns on the selected power amp, and
                    checks telemetry to verify that the amp and transmitter 1 are
                    both on.

PROC: SCAN

PURPOSE: Camera scan

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure performs the various camera scans, and re-
                  constructs and archives the image.

                  EXEC SCAN,CAMERA ID,READTYPE,STEPSIZE,G3F,XAN,
                                                          G3D,XAD

                  YAN,<G1>,<HEATER>
                  YAD,

                  Read types:

                  READHI - HI GAIN 768X768 READ SCAN
                  READLO - LO GAIN 768X768 READ SCAN
                  READER7 - 804X804 READ-ERASE SCAN
                  ERASE - 1020X1020 FAST ERASE SCAN

                  Subroutines and procedures called:

                  HCLEAR

PROC: SEEXPO

PURPOSE: To start exposure clocks

PARTICIPANTS: Telescope Operator and Operations Director

PROCEDURE: This procedure is used to start the ground system clocks so that the countdown can be displayed on telemetry pages.

EXEC SEEXPO,CAMERA ID,< CAMERA ID >...

The arguments are the camera ID's. The proc will take several arguments.

PROC: SETUP

PURPOSE: To set up computer for science operations

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used to set up the ground system for science operations.

EXEC SETUP,FESINO,ALTCONS #

The first argument is the FES image number; the second is the console which becomes the ALTCONS. The procedure does the following:

   a. Initializes FESINO (1) and FESINO (2).
   b. SCIHEAD0 - initializes science header.
   c. COLCURAT 2 - collect attitude from s/c.
   d. SW FES,2 - selects FES 2.
   e. Assigns ALTCONS.
   f. Starts camera exposure clocks.
   g. Assigns EDS function keys.
   h. Stores the current procfile name into science header.

This proc also allows the following actions to be initiated:

LOAD PREPLAN
SIGNON
EXEC CAMINIT
LOAD ARCHIVE TAPE

Subroutines and procedures called:

SEEXPO

PROC: SHADOW

PURPOSE: To configure the spacecraft so that it will safely pass
                through the shadow without damage

PARTICIPANT: Operations Director

PROCEDURE: The SHADOW procedure is used during the periods of earth
                shadow. At these times, spacecraft systems have to rely on
                power supplied by the batteries, so that all non-essential
                equipment is turned off.

                This procedure has one argument, either 0 or 1. An argu-
                ment of 0 prepares the spacecraft to enter shadow.

                After checking the argument, the procedure branches either
                to SIN or SHOUT.

                SIN explains the conditions that should exist for entry into
                the shadow. Typing GO then executes sequences of com-
                mands to change the bit rate to 5 kbps, turn the VHF on,
                turn S-band off, turn chargers on, and turn all HAPS and
                SI heaters off (PAS 1 and 2).

                SHOUT executes the sequence of commands to turn on PAS 1
                and 2, S-band system 1, and HAPS heater 1.

                Example: EXEC SHADOW,#

PROC: SHUTTER

PURPOSE: To open or close sun shutter

PARTICIPANTS: Telescope Operator

PROCEDURE: The sun shutter should be closed during an emergency loss of
                    altitude. It is also necessary to close the sun shutter when
                    using the platinum calibration lamp because the lamp utilizes
                    a mirror on the back of the shutter.

                    EXEC SHUTTER,STATE

                    STATE: OP   - OPEN
                            CL   - CLOSE
                            ON   - ELECTRONICS on
                            OFF   - ELECTRONICS off
                            DDOPEN   - DIRECT drive shutter open
                            DDCLOSE - DIRECT drive shutter closed
                            RDOPEN   - REDUCED drive shutter open
                            RDCLOSE - REDUCED drive shutter closed

PROC: SIFOCUS

PURPOSE: To control telescope focus

PARTICIPANTS: Telescope Operator and Operations Director

PROCEDURE: Changes in attitude change the thermal condition of the
                telescope. This has an effect on the telescope focus. An
                out-of-focus telescope spreads out the light from a star which
                can decrease the amount of light going through the apertures
                to the spectrographs.

                EXEC SIFOCUS,REFERENCE STEP

                The SIFOCUS proc calculates a focus step number from the
                following equation:

                $$STEP = 1.28 * (TPM1 + 3.0) - 1.11 * (T92+T133+77.0)$$

                The proc then compares the calculated step with the argument,
                which is a reference step, and turns on or off certain SI
                heaters to drive the focus step to the reference focus step.
                The heaters involved are the primary mirror heaters #1 and
                #2 and the camera deck heater #1.

                Subroutines and procedures called:

                SIHTR

PROC: SIHTR

PURPOSE: To turn SI heaters on or off

PARTICIPANTS: Telescope Operator and Operations Director

PROCEDURE: This procedure is used to turn various scientific instrument
                heaters on or off.

                EXEC SIHTR, NUMBER

                The arguments are input as numbers:

                    1.   Primary #1 on
                    2.   Primary #2 on
                    3.   Secondary #1 on
                    4.   Secondary #2 on
                    5.   Camera deck #1 on
                    6.   Camera deck #2 on
                    7.   Focus position electronics on
                    8.   Primary #1 off
                    9.   Primary #2 off
                    10.   Secondary #1 off
                    11.   Secondary #2 off
                    12.   Camera deck #1 off
                    13.   Camera deck #2 off
                    14.   Focus position electronics off

SUBROUTINE: SIZECHK

PURPOSE: To check for FES wrap-around

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine ensures that the FES does not try to scan
                out of the field of view.

SUBROUTINE: SMCHK

PURPOSE: To check FES mode parameter

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine checks the FES mode parameter to ensure
                  that $0 \leq FESSM \leq 2$.

                  0 = Primary mode
                  1 = Search and track mode
                  2 = Field camera mode

PROC: SNAP

PURPOSE: To produce a hard-copy record of normal telemetry pages
                being monitored

PARTICIPANT: Data Operations Controller

PROCEDURE: SNAP takes printed copies of five telemetry pages. It has
                one argument, 0, which is a dummy argument used to begin
                execution of the procedure. It is usually run every hour
                on the hour.

                Example:

                EXEC SNAP,0

PROC: SPREP

PURPOSE: To prepare camera for exposure

PARTICIPANTS: Telescope Operator

PROCEDURE: A camera must be prepared before it can be exposed. There
                   are two reasons for camera preparation:

                   a.   To erase the remnants of the previous read.

                   b.   To put a smooth background on the camera so that
                        the image can be processed correctly.

                   The sequence for the Standard Prepare (SPREP) is:

                   a.   Expose with a 200 percent MAX GAIN flood (with
                        tungsten flood lamp).

                   b.   Erase the camera.

                   c.   Expose with a 50 percent MED GAIN flood (with
                        tungsten lamp).

                   d.   Erase the camera.

                   EXEC SPREP, CAMERA ID

                   Subroutines and procs called:

                   PREPCHK

                   PLIMOFF

                   FLEXP

                   READRATE

                   PLIMON

PROC: STOP

PURPOSE: To interrupt executing camera operation and to configure SI
                    lamps

PARTICIPANTS: Telescope Operator

PROCEDURE: The STOP procedure allows the operator to abort a current
                    camera operation mode and safely configure the camera to a
                    standby condition with a defined lamp configuration. There
                    are two ways of using the STOP procedure:

                    a. Emergency. This immediately puts the camera in a standby
                        mode without checking to see if it is safe or desirable.

                        EXEC STOP,CAMERA ID

                    b. Routine. This turns on one of the on-board lamps with
                        the camera in standby. All appropriate safety checks are
                        made.

                        EXEC STOP,CAMERA ID, LAMP

                    LAMP:

                        CALUV   -   UV flood
                        CALWL   -   platinum calibration
                        TFLOOD   -   tungsten flood
                        BHFID   -   backhole and fiducial
                        NOCAL   -   no lamps

                    Subroutines and procedures called:

                    PLIMON

                    PLIMOFF

                    Note: EXEC STOP,ID,NOCAL is used to put the camera in a
                           true standby mode. The emergency mode, for example,
                           does not put the heater to low. The NOCAL option
                           does this as well as resetting all flags.

PROC: TARGETAT

PURPOSE: To enter target attitude

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure allows the target attitude to be entered in
                 astronomical coordinates.

                 EXEC TARGETAT,AHR,AMIN,ASEC,DDEG,DMIN,<DSEC>,
                 <YEAR>

                 The first six arguments are the right ascension in hours,
                 minutes and seconds; and the declination in degrees, minutes,
                 and seconds. If the last argument is specified, the coordi-
                 nates are processed to 1950; otherwise 1950 coordinates are
                 assumed.

SUBROUTINE: TECHK

PURPOSE: To check FES track enable parameter

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine checks the FES track enable parameter.

                0 = DISABLE

                1 = ENABLE

SUBROUTINE: THDCHK

PURPOSE: To check FES threshold parameter

PARTICIPANTS: Telescope Operator

PURPOSE: This subroutine checks the FES threshold parameter to
                ensure that $0 \leq FESTHD \leq 3$.

FESTHD	MINIMUM # OF COUNTS NEEDED TO TRIP TRACKER
0	4
1	8
2	36
3	96

PROC: THS

PURPOSE: To configure THS to process telemetry data.

PARTICIPANTS: Operations Director and Data Operations Controller

PROCEDURE: The Telemetry Handling System (THS) is used to configure
                 for 20-kbps unconvolved data, which is the bit rate most
                 often used for science operations. All other bit rates are
                 keyed in as required.

SET THS,RATE,20   Configures bit sync and
                                         frame sync for 20 kbps.

SET TLMIN,THS,ON   Configures Sigma to
                                         accept THS vice DDPS
                                         data.

SET MFQUAL,GOOD,X'4300E'   Sets correct bits in
                                         ECMC to provide for
                                         data checking.

SET MFQUAL,DONTCARE,X'FFFFFF'   Tells ECMC which bits
                                         are to be acted upon
                                         when they are sampled.

SET THS   Sends an interrupt to
                                         the THS.

The THS proc is good only for 20-kbps unconvolved data
because no additional arguments exist. It should be run after
a day "0" restart or system reload, but it is dependent
upon the processing requirements for that specific time.

PROC: TLM

PURPOSE: To change telemetry formats, automatically set indirect addresses for desired devices, and a secondary option to change bit rates by adding a second argument.

PARTICIPANTS: Operations Director and Telescope Operator

PROCEDURE: The bit rate can be changed by adding a second argument. The first argument must be one of the format arguments in order for the proc to run; the current format must also be used if the bit rate is going to be changed. The allowable bit rate arguments are: 40, 20, 10, 5, 2.5, and 1.25. These are the number of kilobits per second (kbps) of telemetry sent by the OBC.

The first argument changes format.

The allowable arguments are:

XFEROM   Format 1A - transfer orbit

FES1ROM
FES2ROM   Format 2A - operations

LWPROM
LWRROM
SWPROM   Format 1B - scientific instrument video data
SWRROM

OBC1ROM
OBC2ROM   Format 2B - On-board computer memory dump

Data base mnemonics for TLM format are:

XFEROM	IA1=0	IA2=13	TMROM=0
FES1ROM	9	13	1
FES2ROM	13	13	1
LWPROM	0	4	2
LWRROM	0	10	2
SWPROM	0	6	2
SWRROM	0	12	2
OBC1ROM	0	1	3
OBC2ROM	9	0	3

Note: The above indirect addresses are for FES2 and OBC1.

The procedure first checks that all the arguments are correct, then if any cameras are scanning. Next is calls a subroutine DMUCHK which compares the data in the DMU command field to telemetry; any errors will be displayed and the procedure will abort. If the command field is correct, send = GO.

Example of format: /EXEC TLM,FES2ROM

Example of bit rate: /EXEC TLM,FES2ROM,5

A GO must be sent when changing format or bit rate after the DMU command field is displayed.

SUBROUTINE: TOFES

PURPOSE: To set up FES command parameters

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine converts the arguments X,Y, and
                 FESL into the FES command parameters FESX, FESY, FESXF,
                 FESYF.

PROC: TRAIL

PURPOSE: Perform trailed exposure

PARTICIPANTS: Telescope Operator

PROCEDURE: Often times an exposure that trails across an aperture is very useful. This procedure provides an automatic trailed exposure.

EXEC TRAIL,CAMERA ID,RATE,<APER>,<ITERATIONS>

The first argument is the camera ID. The second is the trail rate in arcseconds/second. The third argument is the large aperture condition, OP or CL, and is optional. The fourth argument, also optional, is the number of passes across the aperture requested. The trail rate must be between .03 arcsec/sec and 60 arcsec/sec.

The procedure is as follows:

   a. Lock star to reference point
   b. Move star to center of aperture
   c. Move star to a position at a certain distance from end of aperture
   d. Start exposure for 447 minutes
   e. Zero errors and slew across aperture
   f. When the pass is complete, the procedure will display the total time the star was in the aperture. The proc also gives the option of doing another pass or terminating.
   g. When finished, the exposure time is modified to 0.
   h. The star is moved back to a reference point.

Subroutines and procedures called:

APERTURE
FESLOCKR
RTOAPER
FESSLEW
FESPRIM
EXPOBCM
MODTIME

SUBROUTINE: TSRCHK

PURPOSE: To check the FES track scan rate parameter

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine checks the FES track scan rate parameter
                to ensure that it is either 0 or 1.

                0 = fast track
                1 = slow track

PROC:	UNLOAD
PURPOSE:	To unload the wheels via the on-board computer (OBC)
PARTICIPANTS:	Operations Director and ACSM System Analyst
PROCEDURE:	The IUE spacecraft maneuvering is accomplished by spinning any of three reaction wheels, pitch, yaw and roll, which are set at right angles to each other. There is a redundant wheel that will be used in the event of a failure of one of the other wheels. The idle speed of the wheels should be maintained between +250 to +1000 rpm or a -250 or -1000 rpm. If any of the wheels are out of limits after the completion of a maneuver, the unload procedure is used to correct the wheel speeds. This is accomplished by firing the appropriate low-thrust jets (1, 3, 4, 6, 7, 9, 10, 12) in 30-millisecond pulses.

The UNLOAD procedure has two arguments. The first argument specifies the wheel or wheels to be unloaded and the direction in which they are to be corrected. Any combination of wheels can be spun in either a plus or minus direction. On the single axis unloads, when only one wheel is unloaded, the first argument can be either a word or a number (the bit configuration):

Example: EXEC UNLOAD, PROLL, 1

or

EXEC UNLOAD, 520

Either of these statements means that the roll wheel will be speeded up in the positive direction with on 30-millisecond pulse. For double and triple axis unloads, the bit configuration number must be used. The bit numbers for each possible unload along with the jets fired are listed in the TELL portion of the UNLOAD proc.

The second argument is the number of pulses to be fired. The change in rpm per pulse depends on which unload is performed. No more than four pulses may be sent at once.

The procedure checks to ensure that the arguments are correct and then goes to the statement labeled "OK". At this point, the OBC mode "M" bits are set in the proper configuration turning off the Kalman filter (MB=0). This configuration is uplinked in the data block 10. The rate arrest worker is turned off and the engine valve driver is turned on (:CRU ON, 14 or :CRU ON,3). Next, a data block 17 is built setting up the jets to be fired and the number of pulses that are to be given. LOOPA :EV, FIRE=AF(1), EVE=0 configures the proper jets and sets up the fire command. The LOOPA sequence is constructed once for each pulse to be fired and then uplinked as a data block 17. Typing GO sends the commands. If the rpm change is not sufficient, typing GO LDBLK sends the commands again. If the rpm is now sufficient, GO is typed and the proc continues, turning off the EVD, turning on rate arrest worker, and resetting the Kalman filter.

```
UNLOAD          PROC
                IF NUM(AF).EQ.2,BEGIN
TELL            CONTINUE
/    EXEC UNLOAD,AF(1),AF(2)  AF(2)   5 PULSES @ 30 MSEC.
/    AF(1) MAY BE ONE OF THE FOLLOWING
/    TO UNLOAD WHEELS USE OPPOSIT SIGN OF TACH FOR AXIS TO UNLOAD.
/    TO INCREASE WHEELS USE SIGN OF TACH FOR AXIS TO INCREASE.
/    'P' FOR '+' AND 'M' FOR '-'. 'S' FOR SECONDARY.
/    SINGLE AXIS                          DOUBLE AXIS            TRIPLE AXIS
/    (10&4 )       PROLL    = 520         (10)PRPY = 512         ( 7&10)PPPYPR= 576
/    (12&6 )       MROLL    = 2080        ( 4)PRMY =    8        (3& 6)PPPRMR=   36
/    ( 7&3 )       PPITCH   =   68        (12)MRMY =2048         (4& 7)PPMYPR=   72
/    ( 9&1 )       MPITCH   =  257        ( 6)MRPY =   32        (3&12)PPMYMR=2052
/    (10&6 )       PYAW     =  544        ( 7)PRPP =   64        (1&10)MPPYPR=  513
/    (12&4 )       MYAW     = 2056        ( 1)RRMP =    1        (6& 9)MPPYMR=  288
/    ( 7&1 )       SPROLL   =   65        ( 9)MRMP =  256        (1& 4)MPMYPR=    9
/    ( 9&3 )       SMROLL   =  260        ( 3)MRPP =    4        (9&12)MPMYMR=2304
/    ( 7   )       SPPITCH  =   64        (3 &10)DPPPY  = 516        I A O
/    ( 9   )       SMPITCH  =  256        (6 & 7)SDPPPY =  96        T W L
/    (10   )       SPYAW    =  512        (3 & 4)DPPMY  =  12        C   L
/    (12   )       SMYAW    = 2048        (7 &12)SDPPMY =2112        H
/    ( 3   )       SSPITCH  =    4        (1 & 6)DMPPY  =  33
/    ( 1   )       SSMPTCH  =    1        (9 &10)SDMPPY = 768
/    ( 6   )       SSMYAW   =   32        (1 &12)DMPMY  =2049
/    ( 4   )       SSMYAW   =    8        (4 & 9)SDMPMY = 264
                  RETURN
```

PROC: UPLINK

PURPOSE: Uplink maneuver

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure configures the spacecraft for a maneuver,
                  and has the option of uplinking the maneuver.

                  EXEC UPLINK, FLAG

                  FLAG = 0 - Configure S/C only
                  FLAG = 1 - Configure S/C and UPLINK if unconstrained.
                             If constrained, the proc will terminate.

                  Subroutines and procedures called:

                  FESLWAIT

PROC: VHF

PURPOSE: To turn on or off VHF transmitter, and ranging and proper modulation source with appropriate DMV

PARTICIPANTS: Operations Director

PROCEDURE: Use of the VHF transmitter requires one argument: 0, 1, or 2. 0 turns it off, and 1 or 2 is the selection for transmitter 1 or 2. A second argument is used for ranging: 0 = off, 1 or 2 = ranging transmitter 1 or 2.

Example:

EXEC VHF,1,1 = TX1 Rng 1 - on

EXEC VHF,0,0 = TX and Rng - off

PROC: WAVCAL

PURPOSE: To take wavelength calibration exposures

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure will automatically calculate and take wave-
                   length calibration images for each of the four cameras in HI
                   or LO dispersion. The procedure closes the sun shutter
                   which is a necessary condition for using the platinum wave-
                   length calibration lamp. It does not reopen the sun shutter.

                   EXEC WAVCAL,CAMERA ID,<T CAL>,<T FLOOD>

                   The first argument is the camera ID. The operational second
                   and third arguments are the exposure times in seconds for
                   the platinum and tungsten lamps, respectively, if a non-
                   standard exposure is requested.

                   Subroutines and procedures called:

                   SHUTTER
                   EXPOBCA

PROC: XPREP

PURPOSE: Overexposure recovery prepare

PARTICIPANTS: Telescope Operator

PROCEDURE: When a camera is badly overexposed, a standard prepare
                   (SREP) may not be sufficient. A bad overexposure may
                   leave residual images which cannot be totally removed by an
                   SPREP. An XPREP consists of an 800 percent MAXG flood
                   with the tungsten flood lamp, followed by three fast scans.
                   This should eliminate any residual images. An XPREP should
                   always be followed with an SPREP so that a smooth, process-
                   able background is put on the camera.

                   EXEC XPREP,CAMERA ID

                   Subroutines and procedures called:

                   PREPCK
                   PLIMOFF
                   FLEXP
                   FSCAN
                   PLIMON

PROC: XSPREP

PURPOSE: Overexposure recovery prep

PARTICIPANTS: Telescope Operator

PROCEDURE: This procedure is used to recover from an overexposure
               (see proc description for XPREP). XSPREP does an XPREP,
               followed by an SPREP.

               EXEC XSPREP, CAMERA ID

               Subroutines and procedures called:

               XPREP
               SPREP

SUBROUTINE: XYCHK

PURPOSE: To check FES coarse X,Y parameters

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine checks the FES coarse X and Y coordinates to ensure that $-63 \leq X,\ Y \leq 63$.

SUBROUTINE: XYFCHK

PURPOSE: To check FES fine X,Y parameters

PARTICIPANTS: Telescope Operator

PROCEDURE: This subroutine checks the FES fine X,Y parameters to ensure that $0 \leq X, Y \leq 31$.