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COLOSSUS Memo # 48

TO: Distribution

FROM: C. W. Braunhardt

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SUBJECT: Addenda COLOSSUS Level III Verification Plan

The attached sheets are addenda to COLOSSUS Memo #44
and should be inserted into the test plan.

COLOSSUS LEVEL 3 VERIFICATION PLAN - 4-5-68

TESTING SUMMARY

PROGRAM OR ROUTINE	NUMBER OF TESTS	PROGRAM OR ROUTINE	NUMBER OF TESTS
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P01	5	P39	4
R05	3	P79	2
P11	5	P40	13
P17	5	P41	4
P20	11	P47	3
P21	3	P51	2
P22	10	P52	2
P23	24	P53	2
P27	4	P54	2
P30	3	P61	7
R30	6	R62	2
P31	3	R63	2
R31	8	ALM	2
R32	3	DWN	12
P34	10	ICP	4
P74	3	IOP	5
R34	8	OOP	8
P35	3	SEV	5
P75	2	STP	2
R35	4	VHF	1
R36	5		
P37	8		
P38	8		
P78	2		

R05.1 S-BAND ANTENNA ROUTINE

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE AND DISPLAY THE TWO
STEERABLE S-BAND ANTENNA ANGLES WHICH WILL POINT THE
ANTENNA TOWARD THE CENTER OF THE EARTH

INITIALIZATION

IMU ON AND SET
CSM STATE VECTOR UPDATED
NOMINAL EARTH ORBIT
REFSMAT = UNIT MATRIX
ROLL, PITCH, YAW = 0 DEGREES, 0 DEGREES, 0 DEGREES

SEQUENCE

SELECT R05 FROM P00 (V64E)
AFTER V06N51 SELECT V32E
CYCLE V06N51 AND SELECT V33E
CONTINUE BY SELECTING R05 FROM P00(V64E)
EVERY 20-30 SECONDS AFTER SELECTING V34E

R05.2 S-BAND ANTENNA ROUTINE

OBJECTIVE

SAME AS R05.1

INITIALIZATION

IMU ON AND SET
CSM STATE VECTOR UPDATED
NOMINAL EARTH ORBIT
REFSMMAT = 30 DEGREES EULER ROTATION ABOUT Z-AXIS
ROLL, PITCH, YAW = 0 DEGREES, 0 DEGREES, 0 DEGREES

SEQUENCE

SAME AS R05.1

R05.3 S-BAND ANTENNA ROUTINE

OBJECTIVE

SAME AS R05.1

INITIALIZATION

IMU ON AND SET
CSM STATE VECTOR UPDATED
EQUATORIAL ORBIT IN MOON CENTERED RCS
REFSMMAT = UNIT MATRIX
ROLL, PITCH, YAW = 90 DEGREES, 90 DEGREES, 0 DEGREES

SEQUENCE

SAME AS R05.1

P11.1 NOMINAL TWO-STAGE BOOST TO ORBIT INSERTION

OBJECTIVE

DEMONSTRATE TYPICAL PERFORMANCE OF THE P11 EARTH ORBIT INSERTION MONITOR PROGRAM DURING A NOMINAL 2-STAGE BOOST INTO ORBIT
SPECIFIC AREAS INCLUDE:
TRANSFER OF CONTROL FROM P02 TO P11 AT LIFTOFF CMC CLOCK ZEROING
R AND V CALCULATION AND PERIODIC STATE VECTOR UPDATING
REFSMAT GENERATION
NOUN 62 (V,H,HDT) GENERATION
FDAI ATTITUDE ERROR DISPLAYS

INITIALIZATION

NOMINAL 2-STAGE SATURN BOOST VEHICLE, ON PAD34 AT TZERO = 2040 SECONDS
LIFTOFF SCHEDULED FOR TZERO+2 MINUTES
CHIROLL = -28 DEGREES
IMU ON (ALIGNMENT AND INITIAL CDUS ARE IRRELEVANT)
NOMINAL PAD-LOADS, PLUS THE FOLLOWING
NOMINAL 3RD ORDER POLYNOMIAL COEFFICIENTS
LAUNCHAZ = +72 DEGREES
AZIMUTH = -80 DEGREES
SATRLRT = +1 DEG/SEC
RPSTART = +10 SECONDS
POLYSTOP = -123 SECONDS

SEQUENCE

SELECT P01 VIA V37E01E FOR PRELAUNCH INITIALIZATION OF IMU AND CMC
THE TRANSFERS FROM P01 TO P02 AND, AT LIFTOFF, FROM P02 TO P11 ARE
NORMAL, SO NO ASTRONAUT ACTIVITY IS REQUIRED.
NOMINAL BOOST VIA V37E00E TO ORBIT INSERTION, SO NO ASTRONAUT ACTIVITY
IS REQUIRED
RETURN TO P00

P11.2 3-STAGE BOOST TO ORBIT INSERTION WITH ABNORMAL ROLL AND YAW
MOTION DURING THE FIRST 10 SECONDS

OBJECTIVE

DEMONSTRATE PERFORMANCE OF THE P11 EARTH ORBIT INSERTION MONITOR
PROGRAM DURING A 3-STAGE BOOST INTO ORBIT

INITIALIZATION

NOMINAL 2-STAGE SATURN BOOST VEHICLE, ON PAD34 AT TZERO = 2040 SECONDS
LIFTOFF SCHEDULED FOR TZERO+2 MINUTES
CHIROLL = -28 DEGREES
IMU ON (ALIGNMENT AND INITIAL CDUS ARE IRRELEVANT)
NOMINAL PAD-LOADS, PLUS THE FOLLOWING
NOMINAL 6TH ORDER POLYNOMIAL COEFFICIENTS
LAUNCHAZ = +105 DEGREES
AZIMUTH = -80 DEGREES
SATRLRT = -1 DEG/SEC
RPSTART = +10 SECONDS
POLYSTOP = -138 SECONDS

SEQUENCE

SELECT P01 VIA V37E01E FOR PRELAUNCH INITIALIZATION OF IMU AND CMC
THE TRANSFERS FROM P01 TO P02 AND, AT LIFTOFF, FROM P02 TO P11 ARE
NORMAL, SO ASTRONAUT ACTIVITY IS NOT REQUIRED.
THE SATURN LAUNCH VEHICLE YAWS AND ROLLS DURING THE FIRST TEN SECONDS
OF FLIGHT, THUS EXERCISING THE FDAI DISPLAYS THE REMAINING BOOST IS
NOMINAL, TO ORBIT INSERTION, SO ASTRONAUT ACTIVITY IS NOT REQUIRED.
RETURN TO P00 VIA V37E00E

P11.3 MANUALLY SELECTED P11 WITH AN ABORT TO ENTRY

OBJECTIVE

DEMONSTRATE ABORT SEQUENCING DURING P11 EARTH ORBIT INSERTION
MONITORING (SELECTING THE ENTRY PROGRAM P61)

INITIALIZATION

SAME AS P11.2, WITH THE FOLLOWING ADDITIONS:
PAD LOADED SPLASH COORDINATES
INHIBIT THE LIFTOFF DISCRETE; THRUST FAILURE (ABOVE 300K FEET ALTITUDE)

SEQUENCE

SELECT P01 VIA V37E01E FOR PRELAUNCH INITIALIZATION OF IMU AND CMC
THE TRANSFERS FROM P01 TO P02 AND, AT LIFTOFF, FROM P02 TO P11 ARE
NORMAL, SO ASTRONAUT ACTIVITY IS NOT REQUIRED
SELECT P11 VIA V75E
NOMINAL BOOST UNTIL SIVB THRUST FAILURE
SELECT P61 VIA V37E61E
TERMINATE UPON ARRIVAL IN P61 AND RETURN TO P00 VIA V37E00E

P11.4 SATURN STICK WITH RESTARTS

OBJECTIVE

DEMONSTRATE PERFORMANCE OF THE SATURN STICK, INCLUDING MANEUVER RATES ABOUT ALL AXES, WITH RESTARTS

INITIALIZATION

P11.4 IS A CONTINUATION OF P11.2, COMPRISING THE ORBITAL PHASE OF THE MISSION
RESTARTS AS REQUIRED TO DEMONSTRATE THE LEVEL OF RESTART PROTECTION PROVIDED FOR THE SATURN STICK FUNCTION

SEQUENCE

AS IN P11.2, THROUGH THE RETURN TO POD FOLLOWING EOI SET LAUNCH VEHICLE GUIDANCE PANEL SWITCH TO CMC (S/C CONTROL OF SATURN) INITIATE SATURN STICK FUNCTION VIA V46E (CONFIG BITS OF DAPDATRI = 3, PAD-LOADED)
GENERATE ROTATIONAL HAND CONTROLLER DEFLECTIONS AS FOLLOWS:

+PITCH FOR 10 SECONDS
NEUTRAL
-PITCH FOR 10 SECONDS
NEUTRAL
+YAW FOR 10 SECONDS
NEUTRAL
-YAW FOR 10 SECONDS
NEUTRAL
+ROLL FOR 10 SECONDS
NEUTRAL
-ROLL FOR 10 SECONDS

SET LAUNCH VEHICLE GUIDANCE PANEL SWITCH TO IU (DISENABLE S/C CONTROL OF SATURN)

SELECT ROUTINE R03 VIA V48E, AND LOAD DAPDATRI = 0XXXX FOR NODAP
TERMINATE SATURN STICK FUNCTION VIA V46E

SET LAUNCH VEHICLE GUIDANCE PANEL SWITCH TO CMC (S/C CONTROL OF SATURN)
GENERATE A 10 SECOND +PITCH RHC DEFLECTION AND RETURN TO NEUTRAL
RESELECT POD VIA V37E00E

P11.5 P11 RESTART PROTECTION

OBJECTIVE

DEMONSTRATE RESTART PROTECTION FOR THE P11 EARTH ORBIT INSERTION
MONITOR PROGRAM
AREAS TO BE TESTED INCLUDE A POINT PRECEEDING EVERY PHASE CHANGE OR
RESTART POINT EACH FLASHING DISPLAY
TASKS AND JOBS

INITIALIZATION

SAME AS P11.1 BUT WITH RESTARTS INCLUDED

SEQUENCE

SAME AS P11.1, WITH MODIFICATIONS FOR RESTARTS

P17.1 NOMINAL EARTH ORBIT

OBJECTIVE

VERIFY TPI SEARCH CALCULATIONS FOR NOMINAL EARTH ORBIT
AT TPI TIME = 0

INITIALIZATION

SEQUENCE

SELECT P17 WITH V37E
LOAD TPI TIME = 0
PASSIVE VEHICLE ABOVE ACTIVE VEHICLE
TPI SEARCH CALCULATIONS EXERCISED AND DISPLAYED
RESPONSE FOR EACH DISPLAY IS A PROCEED

P20.1

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE, AND MAINTAIN
PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL;
DEMONSTRATE UPDATING OF LM STATE VECTOR BY OPTICS MARKING ONLY AND
OPERATION OF VARIOUS EXTENDED VERBS LISTED IN SEQUENCE

INITIALIZATION

IMU ON AND ALIGNED
THE LM STATE VECTOR WILL BE UPDATED AND
WILL CONTAIN AN ERROR TO BE CORRECTED
NOMINAL EARTH ORBIT TRAJECTORY WITH ERRORS IN BOTH STATE VECTORS

SEQUENCE

SELECT R03 FROM P00 (V48E)
SELECT P20 FROM P00
WHEN P20 IS OPERATING AND PROPER ATTITUDE ATTAINED, SELECT R21 VIA
EXTENDED VERB 57 TO BEGIN OPTICS MARKING
MAKE 5 MARKS OVER A PERIOD OF APPROXIMATELY 15 MINUTES
TERMINATE MARKING SEQUENCE BY V32(WILL NOT ACCEPT THEN BY V33)
RESET RENDEZVOUS FLAG VIA EXTENDED VERB 56 CAUSING
TERMINATION OF P20

P20.2

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE, AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
DEMONSTRATE UPDATING OF LM STATE VECTOR BY VHF RADAR ONLY

INITIALIZATION

IMU ON AND ALIGNED
THE LM STATE VECTOR WILL BE UPDATED AND
WILL CONTAIN AN ERROR TO BE CORRECTED
NOMINAL EARTH ORBIT TRAJECTORY WITH ERRORS IN BOTH STATE VECTORS

SEQUENCE

SELECT R03 FROM P00 (V48E)
SELECT P20 FROM P00
TURN VHF RADAR ON
ALLOW VHF RANGE BY SETTING VHF RANGE FLAG VIA EXTENDED VERB 87
AFTER 5 MINUTES OF ACCEPTING VHF RANGE DATA RESET VHF RANGE FLAG
VIA EXTENDED VERB 88 TO STOP ACCEPTANCE OF RANGE DATA
RESET RENDEZVOUS FLAG VIA EXTENDED VERR 56 CAUSING
TERMINATION OF P20

P20.3

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE, AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
DEMONSTRATE UPDATING OF LM STATE VECTOR
DEMONSTRATE THE CAPABILITY OF CORRECTING A KNOWN ERROR IN THE LM STATE VECTOR BY BOTH OPTICS AND VHF MARKING
DEMONSTRATE VARIOUS EXTENDED VERBS

INITIALIZATION

IMU ON AND ALIGNED
THE LM STATE VECTOR WILL BE UPDATED AND
WILL CONTAIN AN ERROR TO BE CORRECTED
NOMINAL EARTH ORBIT TRAJECTORY
RANGE BETWEEN VEHICLES APPROX 174 KMS

SEQUENCE

SELECT R03 FROM P00 (V48E)
SELECT P20 FROM P00
SET VHF RANGE FLAG VIA V87
WHEN P20 IS OPERATING AND PROPER ATTITUDE ATTAINED, SELECT R21 VIA
EXTENDED VERB 57 TO BEGIN OPTICS MARKING
MAKE N MARKS OVER A PERIOD OF 25 MINUTES THEN TERMINATE MARKING
SEQUENCE BY V33E
TERMINATE P20 BY V56E

P20.4

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE, AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
DEMONSTRATE UPDATING OF LM STATE VECTOR
DEMONSTRATE THE CAPABILITY OF CORRECTING A KNOWN ERROR IN THE LM STATE VECTOR BY BOTH OPTICS AND VHF MARKING
DEMONSTRATE VARIOUS EXTENDED VERBS LISTED IN SEQUENCE

INITIALIZATION

IMU ON AND ALIGNED
THE LM STATE VECTOR WILL BE UPDATED AND
WILL CONTAIN AN ERROR TO BE CORRECTED
NOMINAL EARTH ORBIT TRAJECTORY
RANGE BETWEEN VEHICLES APPROX 44 KMS

SEQUENCE

SELECT R03 FROM P00 (V48E)
SELECT P20 FROM P00
WHEN P20 IS OPERATING AND PROPER ATTITUDE ATTAINED, SELECT R21 VIA
EXTENDED VERB 57 TO BEGIN OPTICS MARKING
SET VHF RANGE FLAG VIA V87
MAKE N MARKS ABOUT 1 MINUTE APART,
THEN M MARKS ABOUT 2 MINUTES APART
TERMINATE MARKING BY V33E
TERMINATE P20 BY V56E

P20.5

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
DEMONSTRATE THE CAPABILITY OF CORRECTING AN ERROR IN THE LM STATE VECTOR BY BOTH OPTICS AND VHF MARKING
DEMONSTRATE VARIOUS EXTENDED VERBS LISTED IN SEQUENCE

INITIALIZATION

IMU ON AND ALIGNED
THE LM STATE VECTOR WILL BE UPDATED AND WILL CONTAIN AN ERROR TO BE CORRECTED
NOMINAL LUNAR ORBIT TRAJECTORY

SEQUENCE

SELECT R03 FROM P00 (V48E)
SELECT P20 FROM P00
SET PREFERRED ATTITUDE FLAG VIA V76
SET VHF RANGE FLAG VIA V87
WHEN P20 IS OPERATING AND PROPER ATTITUDE ATTAINED, SELECT R21 VIA EXTENDED VERB 57 TO BEGIN OPTICS MARKING
FOLLOW SAME MARKING AND TERMINATION PROCEDURES AS IN P20.4

P20.6

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
DEMONSTRATE UPDATING OF LM STATE VECTOR
DEMONSTRATE THE CAPABILITY OF CORRECTING A KNOWN ERROR IN THE LM STATE VECTOR BY OPTICS MARKING
DEMONSTRATE VARIOUS EXTENDED VERBS LISTED IN SEQUENCE

INITIALIZATION

IMU ON AND ALIGNED
THE LM STATE VECTOR WILL BE UPDATED AND
WILL CONTAIN AN ERROR TO BE CORRECTED
NOMINAL LUNAR ORBIT TRAJECTORY

SEQUENCE

SELECT R03 FROM P00 (V48E)
SELECT P20 FROM P00
WHEN P20 IS OPERATING AND PROPER ATTITUDE ATTAINED, SELECT R21 VIA EXTENDED VERB 57 TO BEGIN OPTICS MARKING
MAKE N MARKS OVER A PERIOD OF 6 MINUTES THEN TERMINATE MARKING SEQUENCE BY V33E
TERMINATE P20 BY SELECTION OF V56
CHECK FOR COMMUNICATION ITEMS UPON TERMINATION
CHECK FOR DOWNLINK ITEMS

P20.7

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
DEMONSTRATE UPDATING OF LM STATE VECTOR
DEMONSTRATE VARIOUS EXTENDED VERBS LISTED IN SEQUENCE
DEMONSTRATE RESPONSE TO VARIOUS ALARMS AS LISTED BELOW
DEMONSTRATE THE ACCEPTANCE AND REJECTION OF EXCESSIVE UPDATES AND TEST DISPLAY CAPABILITY

INITIALIZATION

IMU ON AND ALIGNED
THE LM STATE VECTOR WILL BE UPDATED
NOMINAL EARTH ORBIT TRAJECTORY
RMAX + VMAX SET TO ZERO (PRIORITY V06N49)

SEQUENCE

SELECT R03 FROM P00 (V48E)
SELECT R21 VIA V57 (ALARM 406)
SELECT R23 VIA V54 (ALARM 406)
SELECT P20 FROM P00
SET VHF RANGE FLAG VIA V87 WITHOUT FIRST TURNING ON RADAR
WHEN P20 IS OPERATING AND PROPER ATTITUDE ATTAINED TURN ON RADAR AND SELECT R21 VIA V57 TO BEGIN OPTICS MARKING
TAKE SEVERAL MARKS OVER 5 MINUTE PERIOD
WHEN V06N49 IS DISPLAYED FOR FIRST TIME REJECT MARK BY ANSWERING WITH V32E. SECOND TIME ACCEPT BY V33E. THIRD TIME TERMINATE P20 WITH V34E.

P20.8

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
DEMONSTRATE UPDATING OF LM STATE VECTOR
DEMONSTRATE THE CAPABILITY OF CORRECTING A KNOWN ERROR IN THE LM STATE VECTOR BY BOTH OPTICS AND VHF MARKING
DEMONSTRATE VARIOUS EXTENDED VERBS LISTED IN SEQUENCE

INITIALIZATION

IMU ON AND ALIGNED
THE LM STATE VECTOR WILL CONTAIN A SMALL ERROR TO BE CORRECTED
NOMINAL EARTH ORBIT TRAJECTORY

SELECT R03 FROM P00 (V48E)
SELECT P20 FROM P00
SET VHF RANGE FLAG VIA V87
WHEN P20 IS OPERATING AND PROPER ATTITUDE ATTAINED, SELECT R21 VIA EXTENDED VERB 57 TO BEGIN MARKING
MAKE 5 MARKS OVER A PERIOD OF 5 MINUTES THEN TERMINATE MARKING SEQUENCE BY V33E
TERMINATE P20 BY SELECTION OF V56

P20.9

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN X-AXIS TRACKING ATTITUDE
DEMONSTRATE UPDATING OF LM STATE VECTOR.
DEMONSTRATE THE CAPABILITY OF CORRECTING A KNOWN ERROR IN THE LM STATE VECTOR BY COAS MARKING
DEMONSTRATE VARIOUS EXTENDED VERBS LISTED IN SEQUENCE.

INITIALIZATION

IMU ON AND ALIGNED
THE LM STATE VECTOR WILL BE UPDATED AND WILL CONTAIN AN ERROR TO BE CORRECTED
NOMINAL EARTH ORBIT TRAJECTORY.

SEQUENCE

SELECT R03 FROM P00 (V48)
SELECT P20 FROM P00
RESET PREFERRED ATTITUDE FLAG VIA V77 TO X-AXIS ATTITUDE
WHEN P20 IS OPERATING AND PROPER ATTITUDE ATTAINED, SELECT R23 VIA EXTENDED VERB 54 TO BEGIN OPTICS MARKING.
MAKE N MARKS OVER A PERIOD OF 15 MINUTES THEN TERMINATE MARKING SEQUENCE BY V33
TERMINATE P20 BY SELECTION OF V56

P20.10

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
DEMONSTRATE UPDATING OF LM STATE VECTOR
DEMONSTRATE THE CAPABILITY OF CORRECTING A KNOWN ERROR IN THE LM STATE VECTOR BY BOTH OPTICS AND VHF MARKING
DEMONSTRATE VARIOUS EXTENDED VERBS LISTED IN SEQUENCE
DEMONSTRATE THE RESTART CAPABILITY OF P20

INITIALIZATION

IMU ON AND ALIGNED
THE LM STATE VECTOR WILL BE UPDATED
THE LM STATE VECTOR WILL CONTAIN AN ERROR TO BE CORRECTED
NOMINAL EARTH ORBIT TRAJECTORY
INPUT DECK WILL CONTAIN A NUMBER OF ONE GUSEQ CARDS TO CAUSE THE RESTARTS

SEQUENCE

SELECT R03 FROM P00 (V48E)
SELECT P20 FROM P00
SET VHF RANGE FLAG VIA V87
WHEN P20 IS OPERATING AND PROPER ATTITUDE ATTAINED, SELECT R21 VIA EXTENDED VERB 57 TO BEGIN COAS MARKING
MAKE 5 MARKS OVER A PERIOD OF 5 MINUTES THEN TERMINATE MARKING SEQUENCE BY V33E
TERMINATE P20 BY SELECTION OF V56
AV37 RESTART WILL BE INCLUDED

P20.11

OBJECTIVE

DEMONSTRATE THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
DEMONSTRATE UPDATING OF BOTH STATE VECTORS AT DIFFERENT INTERVALS
DEMONSTRATE THE CAPABILITY OF CORRECTING A KNOWN ERROR IN BOTH STATE VECTORS BY BOTH OPTICS AND VHF MARKING
DEMONSTRATE VARIOUS EXTENDED VERBS LISTED IN SEQUENCE
DEMONSTRATE HOLDFLAG NOT SET TO-1 (STICK FLAG SET)

INITIALIZATION

IMU ON AND ALIGNED
THE CM STATE VECTOR WILL BE UPDATED AND WILL CONTAIN AN ERROR TO BE CORRECTED
NOMINAL EARTH ORBIT TRAJECTORY
PRESET STICK FLAG TO MANUAL MANEUVER

SEQUENCE

SELECT R03 FROM P00 (V48E)
SELECT P20 FROM P00
SET VHF RANGE FLAG VIA V87
SET STATE VECTOR FLAG TO CSM VIA V81
RESET STICK FLAG VIA V58
WHEN P20 IS OPERATING AND PROPER ATTITUDE ATTAINED, SELECT R21 VIA EXTENDED VERB 57 TO BEGIN OPTICS MARKING
MAKE 15 MARKS OVER A PERIOD OF 15 MINUTES THEN TERMINATE MARKING SEQUENCE BY V33E
RUN FOR 20 MINUTES WITH NO MARKING
RESET RENDWFLG TO INITIALIZE W-MATRIX VIA V93
SET STATE VECTOR FLAG TO LM VIA V80
RESELECT R21 VIA V57 AND MAKE 15 MARKS OVER 15 MINUTES
TERMINATE P20 BY SELECTION OF V56

P21.1 NOMINAL EARTH ORBIT
 DEFINE GROUND TRACK OF LEM

OBJECTIVE

TEST NUMERICAL COMPUTATIONS (EXERCISE PRECISION INTEGRATION
AND LATITUDE AND LONGITUDE ROUTINES)# VEHICLE IN EARTH ORBIT
TEST RECYCLE OPTION AND ASSUMED VEHICLE OPTION

INITIALIZATION

LOAD NOMINAL LEM STATE VECTOR

SEQUENCE

ALL TESTS INITIALIZED BY DSKY INPUT
ENTER ASSUMED VEHICLE OPTION = 2 FOR OTHER VEHICLE
ENTER TIME OF LAT-LONG OPTION
RECYCLE WITH UPDATED TIME

P21.2 NOMINAL MOON ORBIT
 DEFINE GROUND TRACK OF LEM

OBJECTIVE

TEST NUMERICAL COMPUTATIONS (EXERCISE PRECISION INTEGRATION
AND LATITUDE AND LONGITUDE ROUTINE)# VEHICLES IN MOON ORBIT
TEST RECYCLE OPTION AND ASSUMED VEHICLE OPTION

INITIALIZATION

LOAD NOMINAL LEM STATE VECTOR

SEQUENCE

TEST INITIALIZED BY DSKY INPUT
ENTER ASSUMED VEHICLE OPTION =2 FOR OTHER VEHICLE.
ENTER TIME OF LAT-LONG OPTION
RECYLCE WITH UPDATED TIME

P21.3 NOMINAL EARTH ORBIT
 DEFINE GROUND TRACK OF CM

OBJECTIVE

TEST NUMERICAL COMPUTATIONS (EXERCISE PRECISION INTEGRATION
AND LATITUDE & LONGITUDE ROUTINES)# VEHICLE IN EARTH ORBIT
TEST RECYCLE OPTION AND RESTART CAPABILITY

INITIALIZATION

LOAD NOMINAL CM STATE VECTOR

SEQUENCE

TEST INITIALIZED BY DSKY INPUT
ENTER TIME OF LAT-LONG OPTION
RECYCLE WITH UPDATED TIME

P23.1 NOMINAL SEQUENCE OF TRACKING, PERFORMING MARK DATA
PROCESSING, AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS EARTH
ASTRONAUT WILL SIGHT ON THE LUNAR FAR HORIZON AND A STAR
TEST DEMONSTRATES CAPABILITY OF COMPUTING, ACQUIRING, AND MAINTAINING
PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED (TO LOCAL VERTICAL)
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER OF 11 AND LOAD HORIZON
WITH 00220
PERFORM R60 MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57, RETURNING
ZERO BIAS
TAKE MARK VIA AUTO OPTICS R52 AND R53
FLASH V05 N71 AND PROCEED
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.2 NOMINAL SEQUENCE OF TRACKING, PERFORMING MARK DATA
PROCESSING, AND UPDATING THE CMC STATE VECTOR.

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS EARTH
ASTRONAUT WILL SIGHT ON THE EARTH'S NEAR HORIZON AND A STAR

TEST DEMONSTRATES CAPABILITY OF COMPUTING, ACQUIRING, AND MAINTAINING
AUTO OPTICS CONTROL
TEST DEMONSTRATES MANUAL MANEUVER OF SPACECRAFT AND UPDATING
OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC.

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER OF 28 AND LOAD HORIZON WITH
00110
PERFORM MANUAL MANEUVER AND THE OPTICS CALIBRATION ROUTINE
R57, RETURNING ZERO BIAS.
TAKE MARK VIA AUTO OPTICS R52 AND R53
FLASH V05 N71 AND PROCEED
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.3 NOMINAL SEQUENCE OF TRACKING, PERFORMING MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR.

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS EARTH
ASTRONAUT WILL SIGHT ON THE EARTH'S NEAR HORIZON AND A STAR
TEST DEMONSTRATES CAPABILITY OF COMPUTING, ACQUIRING, AND MAINTAINING
PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC.

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER OF 28 AND LOAD HORIZON
WITH 00110
PERFORM R60 MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS R52 AND R53
FLASH V05 N71 AND PROCFED
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00.

P23.4 NOMINAL SEQUENCE OF TRACKING, PERFORMING MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR.

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS EARTH
ASTRONAUT WILL SIGHT ON THE EARTH'S NEAR HORIZON AND A STAR
TEST DEMONSTRATES CAPABILITY OF MANUALLY MANEUVERING TO
PROPER TRACKING ATTITUDE AND MANUAL OPTICS CONTROL.
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU OFF
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC.

SEQUENCE

SELECT P23 FROM P00.
PERFORM MANUAL MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO BIAS.
TAKE MARK VIA R53
FLASH V05 N71; LOAD STAR NUMBER 24 AND LOAD HORIZON WITH 00110
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00.

P23.5 NOMINAL SEQUENCE OF TRACKING, PERFORMING MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR.

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS EARTH
ASTRONAUT WILL SIGHT ON THE EARTH'S NEAR HORIZON AND A STAR
TEST DEMONSTRATES CAPABILITY OF MANUALLY MANEUVERING TRACKING ATTITUDE
AND MANUAL OPTICS CONTROL.
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU OFF
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC.

SEQUENCE

SELECT P23 FROM P00
PERFORM MANUAL MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO BIAS
TAKE MARK VIA R53
FLASH V05 N71: LOAD STAR NUMBER 24 AND LOAD HORIZON WITH 00110
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.6 NOMINAL SEQUENCE OF TRACKING, PERFORMING MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR.

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS EARTH
ASTRONAUT WILL SIGHT ON THE EARTH'S NEAR HORIZON AND A STAR
TEST DEMONSTRATES CAPABILITY OF COMPUTING, ACQUIRING, AND MAINTAINING
AUTO OPTICS CONTROL
TEST DEMONSTRATES MANUAL MANEUVER OF SPACE CRAFT
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC.

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER OF 28 AND LOAD HORIZON
WITH 00110
PERFORM MANUAL MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS R52 AND R53
FLASH V05 N71 AND PROCEED
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00.

P23.7 NOMINAL SEQUENCE OF TRACKING, PERFORMING MARK DATA
PROCESSING, AND UPDATING THE CMC STATE VECTOR.

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS EARTH
ASTRONAUT WILL SIGHT ON THE EARTH'S NEAR HORIZON AND A STAR
TEST DEMONSTRATES CAPABILITY OF COMPUTING, ACQUIRING, AND MAINTAINING
PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC.

SEQUENCE

SELFC T P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER OF 28 AND LOAD HORIZON
WITH 00110
PERFORM R60 MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO RIAS
TAKE MARK VIA AUTO OPTICS R52 AND R53
FLASH V05 N71 AND PROCEED
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELFC T PROCEED AND GO TO P00.

P23.8 NOMINAL SEQUENCE OF TRACKING, PERFORMING MARK DATA
PROCESSING, AND UPDATING THE CMC STATE VECTOR.

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS EARTH
ASTRONAUT WILL SIGHT ON AN EARTH LANDMARK AND A STAR
TEST DEMONSTRATES CAPABILITY OF COMPUTING, ACQUIRING, AND
MAINTAINING AUTO OPTICS CONTROL.
TEST DEMONSTRATES MANUAL MANEUVER OF SPACECRAFT
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER OF 31 AND LOAD THE LANDMARK
ID OF ZERO
AT V06 N89 LOAD THE LANDMARK LAT IN DEG, LONG/2 IN DEG AND
ALT IN N.M.
PERFORM MANUAL MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS R52 AND R53
FLASH V05 N71 AND V06 N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.9 NOMINAL SEQUENCE OF TRACKING, PERFORMING MARK DATA
PROCESSING, AND UPDATING THE CMC STATE VECTOR.

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS EARTH
ASTRONAUT WILL SIGHT ON A LUNAR LANDMARK AND A STAR
TEST DEMONSTRATES CAPABILITY OF COMPUTING, ACQUIRING, AND
MAINTAINING PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL.
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC.

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER OF 11 AND LOAD THE LANDMARK
ID OF ZERO
AT V06 N89 LOAD THE LANDMARK LAT IN DEG., LONG/2 IN DEG. AND
ALT IN N.M.
PERFORM R60 MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS R52 AND R53.
FLASH V05 N71 AND V06 N89, PROCEED FROM EACH.
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.10 NOMINAL SEQUENCE OF TRACKING, PERFORMING MARK DATA PROCESSING, AND UPDATING THE CMC STATE VECTOR.

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS EARTH ASTRONAUT WILL SIGHT ON LANDMARKS OR HORIZONS AND STARS AT ONE TO TWO HOUR INTERVALS.

TEST DEMONSTRATES CAPABILITY OF BOTH MANUAL AND AUTOMATIC TRACKING AND OPTICS CONTROL.

TEST DEMONSTRATES CUMULATIVE ERROR OVER SEVERAL MARKS AND STATE VECTOR UPDATES.

TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

THE MARKS USED ARE THE SAME AS IN THE PREVIOUS NINE CASES

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL

AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC.

SEQUENCE

SELECT P23 FROM P00

AT V05 N70 LOAD THE STAR NUMBER DESIRED AND LOAD THE APPROPRIATE LANDMARK OR HORIZON VALUES

PERFORM MANUAL OR AUTOMATIC MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57, RETURNING ZERO BIAS

TAKE MARK VIA R53

FLASH V05 N71 AND V06 N89, LOAD DATA IF NECESSARY AND PROCEED.

COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49

SELCT PROCEED AND GO TO P00.

P23.11 NOMINAL SEQUENCE OF TRACKING. PERFORMING MARK DATA
PROCESSING, AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON AN EARTH LANDMARK AND STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN
PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE CMC STATE VECTOR

SEQUENCE

SELECT P23 FROM P00
AT V05N70 LOAD THE STAR NUMBER 22 AND LOAD THE LANDMARK ID OF ZERO.
AT V06 N89 LOAD THE LANDMARK LAT IN DEG, LONG/2 IN DEG AND ALT IN N.M.
PERFORM THE TRACKING ROUTINE R60
THEN THE OPTICS CALIBRATION ROUTINE R57,
RETURN ZERO BIAS.
TAKE MARK VIA AUTO OPTICS (R52) AND R53.
FLASH V05 N71 AND V06 N89, PROCEED FROM EACH COMPUTE DELTA R AND
DELTA V AND DISPLAY THEM VIA V06 N49,
SELECT PROCEED AND GO TO P00.

P23.12 NOMINAL SEQUENCE OF TRACKING,
 PERFORMING MARK DATA PROCESSING,
 AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON A LUNAR LANDMARK AND STAR
ASTRONAUT WILL SIGHT ON AN EARTH LANDMARK AND STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN
AUTO OPTICS CONTROL
TEST DEMONSTRATES MANUAL MANEUVER OF SPACE CRAFT
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05N70 LOAD THE STAR NUMBER 18 AND LOAD LANDMARK ID OF
ZERO
AT V06 N89 LOAD THE LANDMARK LAT IN DEG, LONG/2 IN DEG AND
ALTITUDE IN N.M.
PERFORM MANUAL MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS (R52 AND R53)
AT FLASHING V05 N71 AND V06 N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY VIA V06 N49
PROCEED AND GO TO P00

P23.13

NOMINAL SEQUENCE OF TRACKING,
MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON THE EARTH'S NEAR HORIZON AND A STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN
PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE CMC STATE VECTOR

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER 27 AND LOAD HORIZON WITH 00110
PERFORM THE TRACKING ROUTINE R60
PERFORM THE OPTICS CALIBRATION ROUTINE R57, RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS (R52 AND R53)
AT FLASHING V05 N71 AND V06 N89, PROCEED FROM FACH
COMPUTE DELTA R AND DELTA V AND DISPLAY VIA V06 N49
PROCEED AND GO TO P00

P23.14

NOMINAL SEQUENCE OF TRACKING,
MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANSEARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON THE LUNAR FAR HORIZON AND STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN
AUTO OPTICS CONTROL
TEST DEMONSTRATES MANUAL MANEUVER OF SPACE CRAFT
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE CMC STATE VECTOR

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER AND LOAD HORIZON WITH 00220
PERFORM MANUAL MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS (R52 AND R53)
AT FLASHING V05 N71 AND V06 N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY VIA V06 N49
PROCEED AND GO TO P00

P23.15 NOMINAL SEQUENCE OF TRACKING,
MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON EARTH NEAR HORIZON AND STAR
TEST DEMONSTRATES ABILITY TO COMPLETELY MANUALLY MANEUVER VEHICLE
AND OPTICS TO TAKE MARK
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU IS OFF
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
REFSMFLG IS RESET
PERFORM THE OPTICS CALIBRATION ROUTINE R57, RETURNING ZERO BIAS
TAKE MARK VIA R53
AT FLASHING V05 N71 LOAD STAR NUMBER 27 AND HORIZON 00110,
THEN PROCEED
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49,
SELECT PROCEED AND GO TO P00

P23.16 NOMINAL SEQUENCE OF TRACKING
MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON LUNAR FAR HORIZON AND STAR
TEST DEMONSTRATES THE ABILITY TO COMPLETELY MANUALLY MANEUVER
VEHICLE AND OPTICS TO TAKE MARK
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU IS OFF
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
REFSMFLG IS RESET
PERFORM THE OPTICS CALIBRATION ROUTINE R57, RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS (R52) AND R53
AT FLASHING V05 N71 LOAD STAR NUMBER 18 AND HORIZON 00220,
THEN PROCEED
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.17 NOMINAL SEQUENCE OF TRACKING,
MARK DATA PROCESSING
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON A LUNAR LANDMARK AND STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN
PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER 18 AND LOAD LANDMARK ID OF 3
PROPER VALUE FOR LAT, LONG/? AND ALT WILL BE PLACED IN THE LUNAR
LANDMARK TABLE, DEMONSTRATING THE ABILITY TO RETRIEVE DATA
PERFORM THE TRACKING ROUTINE R60, THEN THE OPTICS CALIBRATION
ROUTINE R57, RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS (R52) AND R53
AT FLASHING V05 N71 AND V06 N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.18 NOMINAL SEQUENCE OF TRACKING
MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON AN EARTH LANDMARK AND A STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN
AUTO OPTICS CONTROL
TEST DEMONSTRATES MANUAL MANEUVER OF SPACE CRAFT
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER 22 AND LOAD A LANDMARK ID OF 0
AT V06N89, LOAD LANDMARK LAT, LONG/2, AND ALT
PERFORM MANUAL MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS (R52) AND R53
AT FLASHING V05 N71 AND V06 N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.19 NOMINAL SEQUENCE OF TRACKING
MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON AN EARTH LANDMARK AND A STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN
PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER 22 AND LOAD LANDMARK ID OF 0
AT V06N89, LOAD LANDMARK LAT, LONG/2, AND ALT
PERFORM THE TRACKING ROUTINE R60, THEN THE OPTICS CALIBRATION
ROUTINE R57, RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS (R52) AND R53
AT FLASHING V05 N71 AND V06 N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.20 NOMINAL SEQUENCE OF TRACKING
MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON AN EARTH LANDMARK AND A STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN
AUTO OPTICS CONTROL
TEST DEMONSTRATES THE MANUAL MANEUVER OF SPACECRAFT
TEST DEMONSTRATES UPDATING OF CMC STATE VECTOR

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER 24 AND LOAD LANDMARK ID OF 0
AT V06N89, LOAD LAT, LONG/2, AND ALT
PERFORM MANUAL MANEUVER AND THE OPTICS CALIBRATION ROUTINE R57,
RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS R52 AND R53
AT FLASHING V05 N71 AND V06 N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.21 NOMINAL SEQUENCE OF TRACKING
MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IMOON
ASTRONAUT WILL SIGHT ON AN EARTH LANDMARK AND STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN
PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
TEST DEMONSTRATES RECYCLE OPTION FOR REJECTING MARK BECAUSE OF TOO
GREAT A DEVIATION
STATE VECTOR IS NOT UPDATED IN FIRST PASS

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER 22 AND LOAD THE LANDMARK ID OF ZERO
AT V06 N89 LOAD THE LANDMARK LAT IN DEG, LONG/2 IN DEG, AND ALT IN
N.M.
PERFORM THE TRACKING ROUTINE R60, THEN THE OPTICS CALIBRATION
ROUTINE R57, RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS R52 AND R53
AT FLASHING V05 N71 AND V06 N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06N49
ENTER AND RECYCLE

P23.22 NOMINAL SEQUENCE OF TRACKING
MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON AN EARTH LANDMARK AND STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE, ACQUIRE AND MAINTAIN
PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
TEST DEMONSTRATES ABILITY OF PROGRAM TO RESTART SEVERAL TIMES
SUCCESSFULLY AND UPDATE STATE VECTOR CORRECTLY

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05 N70 LOAD THE STAR NUMBER 22 AND LOAD THE LANDMARK ID OF ZERO
AT V06 N89 LOAD THE LANDMARK LAT IN DEG, LONG/2 IN DEG, AND ALT
IN N.M.
PERFORM THE TRACKING ROUTINE R60, THEN THE OPTICS CALIBRATION
ROUTINE R57, RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS R52 AND R53
AT FLASHING V05 N71 AND V06 N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.23 NOMINAL SEQUENCE OF TRACKING,
PERFORMING MARK DATA PROCESSING,
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON AN EARTH LANDMARK AND STAR
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE,
ACQUIRE AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS
CONTROL
TEST DEMONSTRATES KEY IN OF V94 TO REENTER POINTAXS
IF LANDMARK DRIFTS OUT OF VISION
TEST DEMONSTRATES CMC STATE VECTOR UPDATE

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05N70 LOAD THE STAR NUMBER 22 AND LOAD THE LANDMARK ID OF ZERO
AT V06 N89 LOAD THE LANDMARK LAT IN DEG, LONG/2 IN DEG, AND ALT
IN N. M.
PERFORM THE TRACKING ROUTINE R60, THEN THE OPTICS CALIBRATION
ROUTINE R57 RETURNING ZERO BIAS
TAKE MARK VIA AUTO OPTICS R52 AND P53
KEY IN V94 TO REDO POINTAXS DURING R53
AT FLASHING V05 N71 AND V06N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06 N49
SELECT PROCEED AND GO TO P00

P23.24 NOMINAL SEQUENCE OF TRACKING,
PERFORMING MARK DATA PROCESSING
AND UPDATING THE CMC STATE VECTOR

OBJECTIVE

NOMINAL TRANS-EARTH TRAJECTORY, COORDINATE CENTER IS MOON
ASTRONAUT WILL SIGHT ON LANDMARKS OR HORIZONS AND
STARS AT ONE HOUR TIME INTERVALS
TEST DEMONSTRATES THE CAPABILITY TO COMPUTE,
ACQUIRE AND MAINTAIN PROPER TRACKING ATTITUDE AND AUTO OPTICS CONTROL
TEST DEMONSTRATES CUMULATIVE ERROR OVER SEVERAL
MARKS AND STATE VECTOR UPDATES

INITIALIZATION

IMU ON AND ALIGNED TO LOCAL VERTICAL AXIS
AN ERROR WILL BE PUT IN THE STATE VECTOR IN THE CMC

SEQUENCE

SELECT P23 FROM P00
AT V05N70 LOAD THE APPROPRIATE STAR, LANDMARK, AND HORIZON
CODES FOR EACH MARK
AT V06 N89 LOAD THE LANDMARK LAT IN DEG, LONG/2 IN DEG, AND ALT
IN N. M. WHEN APPROPRIATE
PERFORM THE TRACKING ROUTINE R60, THEN THE OPTICS CALIBRATION ROUTINE
R57, RETURN ZERO BIAS
TAKE MARK VIA AUTO OPTICS R52 AND R53
AT FLASHING V05 N71 AND V06 N89, PROCEED FROM EACH
COMPUTE DELTA R AND DELTA V AND DISPLAY THEM VIA V06N49
SELECT PROCEED AND GO TO P00
DO P23 AGAIN ONE HOUR LATER

P27.2 NON-NOMINAL OPERATION OF THE UPDATE
PROGRAM (P27) WHICH IS INITIATED VIA V70, V71, V72 OR V73

OBJECTIVE

DEMONSTRATE THE NON-NOMINAL OPERATION OF THE UPDATE
PROGRAM (P27) WHICH IS INITIATED VIA V70, V71, V72 OR V73
EXAMPLES OF THE NON-NOMINAL OPERATION OF P27 ARE: V34 TO
TERMINATE THE VERB IN PROGRESS, TOO MANY COMPONENTS, ATTEMPT-
ING UPDATES WHEN NOT IN P00, P01, P02 OR P03 ETC.
DEMONSTRATE THAT THE UPDATE PROGRAM WILL NOT ACCEPT, AND WILL
IGNORE, INVALID INDEX VALUES AND OCTAL IDENTIFIERS.

INITIALIZATION

TELEMETRY TURNED ON
STATE VECTORS INITIALIZED

SEQUENCE

ATTEMPT OVERFLOW OF CLOCKS
TRY STATE VECTOR UPDATE WITH WRONG CODES
TRY UPDATES WHEN ANOTHER EXTENDED VERB IS IN PROGRESS
MAKE SURE P27 DOESN'T COME UP AND OPERATOR ERROR COMES ON
TRY TOO MANY PARAMETERS < AND TOO FEW
DURING VERIFY CYCLE TRY TO CORRECT DATA NOT PRESENT (IE.
WRONG PARAMETER INDEX)
DURING VERIFY CYCLE TRY TO CORRECT "NO OF COMPONENTS" PARAMETER
TRY TO UPDATE ERASABLES "ENDSAFE" (ONE TO TRY IS THE UPDATE
BUFFER "UP BUFF")
TRY A V71 UPDATE WHICH WILL OVERFLOW AN EBANK
TRY EVEN NUMBER OF PARAMETERS IN V72
DURING THE VERIFY CYCLE, VERIFY THAT COMPONENTS ALREADY SENT
(FOR THE CURRENT UPDATE VERB) CAN BE CORRECTED
TRY A FRESH START WHEN P27 IS IN PROGRESS
TRY KEYPRUPT WHILE UPDATE(P27) IS IN PROGRESS
SELECT V70, V71, V72, V73 FROM KEYBOARD WHILE UPDATE IS IN PROGRESS
DURING DATA LOADS TRY V34 TO TERMINATE (MAKE SURE P27 COMES DOWN)
DURING DATA LOADS TRY V32 TO RECYCLE
TRY V34 AFTER "VERIFLAY" INVERTED AND ORBITAL INTEGRATION EITHER
WAITING OR NOT WAITING
DURING DATA LOAD OR VERIFY CYCLE TRY CHANGING V21 N01 OR V21 N02
VERIFY THAT P27 CANNOT BE INTERED WHEN PXX (NOT P002 P01, P02 NOR P03)
IS IN PROGRESS
TRY V37 XXE WHEN P27 IS IN PROGRESS
TRY RESTARTS AFTER V70, V72 OR V73 (USE NOMINAL CASES FROM
P27.1) IS IN PROGRESS
TRY CC UPRUPT FAILURE FOLLOWED BY CORRECTED PROCEDURES
DURING THE VERIFICATION CYCLE INSTEAD OF LOADING DATA TR'
A.V33E

P27.4

OBJECTIVE

DEMONSTRATE THAT P27 CAN BE SUCCESSFULLY ENTERED AND PERFORM ITS
FUNCTION WHEN P02 IS IN PROGRESS

INITIALIZATION

TELEMETRY TURNED ON.
PRELAUNCH VALUES INITIALIZED.

SEQUENCE

ENTER P27 WHEN P02 IS IN PROGRESS.
EXERCISE V71 TO PERFORM A CONTIGUOUS BLOCK UPDATE
EXERCISE V72 TO PERFORM A SCATTER UPDATE.
TERMINATE SIMULATION BY V99E.

P30.1 NOMINAL P30, MOON CENTERED

OBJECTIVE

DEMONSTRATE NOMINAL OPERATION OF P30 EXTERNAL DELTA-V TARGETTING
IN THE LUNAR SPHERE OF INFLUENCE

INITIALIZATION

50 PCT FULL CSM IN THE NOMINAL LEVELIIIP40 NEAR-MOON (NEAR
CIRCULAR, RETROGRADE 150 DEG INCLINATION WRT THE EQUATOR)
ORBIT WITH THE
VEHICLE ON THE SELENOCENTRIC X-REF AXIS AT T=TZERO = 107 HRS
51 MIN, 40 SEC (388,300.00 SEC)
CMOONFLG = 1 = LMOONFLG
IMU ON, WITH THE NOMINAL LEVELIIIP40 NEAR-MOON ALIGNMENT (NEAR LOCAL
VERTICAL AT T = TZERO)
VALID REFSMMAT, WITH REFSMMAT FLAG SET
S/C ALIGNED WITH LOCAL VERTICAL AT T = TZERO
IDENTICAL CSM AND LM STATE VECTORS, VALID FOR T = TZERO
VHFCNTR FOR 3 VHF RANGING MARKS; TRKMKCNTR FOR 4 OPTICS MARKS

SEQUENCE

SELECT P00 VIA V37R00E
SELECT P30 VIA V37E30E
IN RESPONSE TO THE FLASHING V06N33 DISPLAY, LOAD (V25E) A TIME OF
IGNITION FOR TZERO PLUS 3 MINUTES:
 TIG = 107 HRS, 54 MINUTES, 40 SECONDS
IN RESPONSE TO THE FLASHING V06N81 DISPLAY, LOAD (V25E) A VELOCITY-
TO-BE-GAINED (LV) CORRESPONDING TO AN IN-PLANE (RCS) 2 JET DELTA
-V MANEUVER,
20 DEGREES ABOVE LOCAL HORIZONTAL AT IGNITION (7.5 FPS)
DELAY BRIEFLY FOLLOWING THE FLASHING V06N41 DISPLAY, THEN RESPOND
WITH A PROCFED
SELECT P41 IN RESPONSE TO THE FLASHING V37 DISPLAY
TERMINATE P41 AND RETURN TO P00 VIA V37E00E

P30.2 P30 TERMINATION AND RESELECTION

OBJECTIVE

 DEMONSTRATE AN EXIT FROM P30 AT THE V06N42 DISPLAY
 DEMONSTRATE RESELECTION OF P30 FOR THE PURPOSE OF RETARGETTING
 FOR A LATER TIG
 DEMONSTRATE NORMAL OPERATION OF P30 EXTERNAL DELTA-V TARGETTING
 DEMONSTRATE PROPER GENERATION OF THE V16N45 DISPLAY WHEN THE REFSMMAT
 FLAG IS NOT SET

INITIALIZATION

 50PCT FULL CSM/LM (AF/DF) (NEAR CIRCULAR, INCLINED 30 DEG WRT
 THE EQUATOR) IN THE NOMINAL LEVELIIIP40 NEAR-EARTH ORBIT
 WITH THE VEHICLE ON THE GEOCENTRIC X-REF AXIS AT T = TZERO =
 2HRS, 0 MIN, 2.13 SEC (7202.13 SEC)
 IMU ON, WITH THE NOMINAL LEVELIIIP40 NEAR-EARTH ALIGNMENT (NEAR LOCAL
 VERTICAL AT T=TZERO)
 VALID REFSMMAT BUT REFSMMAT FLAG NOT SET
 S/C ALIGNED WITH LOCAL VERTICAL AT T = TZERO
 IDENTICAL CSM AND LM STATE VECTORS, VALID FOR T = TZERO
 RECOVERY LOAD VHFCNTR FOR 3 VHF RANGING MARKS; TRKMICCNTR FOR 4
 OPTICS MARKS
 RECOVERY LOAD FOR A TIG AT TZERO +3 MINUTES (738213 CENTISECONDS)

SEQUENCE

 SELECT P00 VIA V37E00E
 SELECT P30 VIA V37E30E
 KEY A PROCEED IN RESPONSE TO THE FLASHING V16N33 DISPLAY
 IN RESPONSE TO THE FLASHING V06N81 DISPLAY, LOAD (V25E) A VELOCITY-TO-
 BEGAINED (LV) CORRESPONDING TO A 50 PCT CSM/LM 100 SECOND IN-PLANE SPS
 DELTA-V MANEUVER, 20 DEGREES ABOVE LOCAL HORIZONTAL AT IGNITION
 (892 FPS)
 TERMINATE (V34E) P30 AT THE FLASHING V06N42 DISPLAY, AND RESFLECT
 P30 IN RESPONSE TO THE FLASHING V37
 IN RESPONSE TO THE FLASHING V16N33 DISPLAY, LOAD (V25E) AT
 TIME OF IGNITION FOR TZERO +15 MINUTES:
 TIG = 2 HOURS, 15 MINUTES, 2.13 SECONDS (8102.13 SECONDS)
 KEY A PROCEED IN RESPONSE TO THE FLASHING V16N81 DISPLAY
 DELAY BRIEFLY FOLLOWING THE FLASHING V06N42, THEN RESPOND WITH A PROCEED
 DELAY BRIEFLY FOLLOWING THE FLASHING V16N45, THEN RESPOND WITH A PROCEED
 SELECT P40 IN RESPONSE TO THE FLASHING V37
 VERIFY THE MU-ON-BUT-REFSMMAT-FLAG-NOT-SFT ALARM VIA VC N09E
 SELECT P00 IN RESPONSE TO THE FLASHING V37

P30.3 P30 RESTARTS

OBJECTIVE

DEMONSTRATE RESTART PROTECTION FOR P30 EXTERNAL DELTA-V TARGETTING
AREAS TO BE TESTED IN CLUDE A POINT PRECEEDING EACH PHASE CHANGE
EACH FLASHING DISPLAY
TASKS AND JOBS

INITIALIZATION

SAME AS P30.1, WITH THE FOLLOWING ADDITIONS:
RESTARTS AS REQUIRED TO DEMONSTRATE THE LEVEL OF
P30 RESTART PROTECTION

SEQUENCE

SAME AS P30.1, WITH MODIFICATIONS
AS REQUIRED BY THERE STARTS

R30.1

OBJECTIVE

TEST THE BRANCHING, LOGIC AND STRUCTURE OF PARTS OF V82
PROGRAM, PARTICULAR' V82 PERF, V82 CALL, V82 GOFF, TICKTEST
DEMONSTRATE TO SEE THAT DISPLAYS ARE CALLED PROPERLY
DEMONSTRATE TO SEE THAT RESPONSES TO DISPLAYS ARE HANKLED
PROPERLY
%ON ALL DIGITAL SIMULATOR"

INITIALIZATION

SLAP1
STATE VECTOR COMPUTATIONS PATCHED OUT

SEQUENCE

V82E SEVERAL TIMES TO STEP THRU LOGICAL BRANCHES OF SECTIONS
LISTED IN OBJECTIVE
ALL DISPLAY RETURN OPTIONS EXERCISED %V32, V33, V34"

R30.2

OBJECTIVE

TEST THE BRANCHING, LOGIC, AND STRUCTURE OF PARTS OF V82
PROGRAM

IN PARTICULAR V82GON, SR 30.1

DEMONSTRATE TO SEE THAT DISPLAYS ARE CALLED PROPERLY
DEMONSTRATE TO SEE THAT RESPONSES TO DISPLAYS ARE HANDLED
PROPERLY

"ON ALL DIGITAL SIMULATOR"

INITIALIZATION

SLAP1

SEQUENCE

SIMILAR TO R30.1

R30.3 V82

OBJECTIVE

TO TEST THE BRANCHING, LOGIC, AND STRUCTURE OF PARTS OF R30 %V82"
IN PARTICULAR' V82GOFF1, SR30.1

INITIALIZATION

SLAP 1

1" LEM STATE VECTOR FOR EARTH CENTERED ORBIT, WITH HPER GREATER
THAN 300K FT.

2" CSM STATE VECTOR FOR EARTH CENTERED ORBIT, WITH HPER LESS
THAN 300K FT.

SEQUENCE

1"V82E

V33E

V33E %TO SELECT VEHICLE"

V33E %TO DISPLAY TPER IF IT EXISTS"

V34E

2"V82E

V22E2E %TO SELECT OTHER VEHICLE"

V33E

R30.4 V82

OBJECTIVE

TO TEST THE BRANCHING, LOGIC, AND STRUCTURE OF PARTS OF R30 %V82"
PROGRAM. IN PARTICULAR, V82GOFF1, SR30.1.

INITIALIZATION

SLAP1

1" LEM STATE VECTOR FOR MOON CENTERED ORBIT, WITH HPER GREATER
THAN 35K FT.

2" CSM STATE VECTOR FOR MOON CENTERED ORBIT, WITH HPER LESS THAN
35K FT

SEQUENCE

SAME AS R30.3

R30.5 V82

OBJECTIVE

TO TEST THE BRANCHING, LOGIC, AND STRUCTURE OF PARTS OF R30 %V82"
PROGRAM. IN PARTICULAR V82GOFF1, SR30 . .

INITIALIZATION

SLAP1

1"LEM STATE VECTOR FOR MOON CENTERED ORBIT, SUCH THAT RAPO WILL
BE LARGE %HAPO GREATER THAN 9999.9 NM".

2" CSM STATE VECTOR FOR EARTH CENTERED ORBIT, SUCH THAT RAPO WILL
BE LARGE %HAPO GREATER THAN 9999.9 NM".

SEQUENCE

SAME AS R30.3

R30.6 VR2

OBJECTIVE

TO TEST THAT R30 "VR2" PROGRAM CAN BE RUN SIMULTANEOUSLY WITH OTHER MISSION PROGRAMS.
IN PARTICULAR, VR2 IS PERFORMED WHILE P40 IS RUNNING' ONCE WITH AVEG OFF WHILE AN ATTITUDE MANEUVER IS BEING PERFORMED~ AND AGAIN WITH AVEG ON AND THRUSTING IS OCCURRING.

INITIALIZATION
-----SLAP1
LEM STATE VECTORSEQUENCE

1" AVEG ON

V82E
V32E RECYCLE
N32E TPER DISPLAY
V32E RECYCLE
V34E TERMINATE
RO/.6 CONT.

2" AVEG OFF

V82E
V32E
V32E
V33E

P31.1 P31 GENERAL LAMBERT TARGETTING MOON CENTERED

OBJECTIVE

DEMONSTRATE THE SEQUENCING OF P31 GENERAL LAMBERT TARGETTING
IN THE LUNAR SPHERE OF INFLUENCE

INITIALIZATION

SAME AS P30.1 (LUNAR ORBIT) WITH THE FOLLOWING EXCEPTIONS/ADDITIONS:
RECOVERY LOAD VARIABLES DELLT4, RTARG, RLS, AND TIG
REFSMMAT FLAG IS NOT SET

SEQUENCE

SELECT P00 VIA V37E00E
SELECT P31 VIA V37E30E
KEY PROCEED ON ALL DISPLAYS

P31.2 P31 GENERAL LAMBERT TARGETTING EARTH CENTERED

OBJECTIVE

DEMONSTRATE THE GENERAL SEQUENCING OF P31 INCLUDING THE ABILITY TO RESELECT P31, AND THE OPTIONS TO TERMINATE P31 AT DISPLAY

INITIALIZATION

SAME AS P30.2 (EARTH ORBIT) WITH FOLLOWING ADDITIONS:
RECOVERY LOAD VARIABLES DELLT4, RTARG, RLS

SEQUENCE

SELECT P00 VIA V37E00E
SELECT P31 VIA V37E31F
IN RESPONSE TO THE FLASHING V06N33 DISPLAY, LOAD (V25E) A TIG
FOR TZERO +3 MINUTES
PROCEED ON ALL SUBSEQUENT DISPLAYS
RESELECT P31 AT THE FLASHING V37, AND TERMINATE (V34E) AT THE
V06N33 DISPLAY
RESELECT P31 AT THE FLASHING V37, AND TERMINATE (V34E) AT THE
V06N81 DISPLAY
RESELECT P31 AT THE FLASHING V37, AND TERMINATE (V34E) AT THE
V06N42 DISPLAY
SELECT P40 AT THE FLASHING V37
RESELECT P00 AT THE FLASHING V37

P31.3 P31 RESTARTS

OBJECTIVE

TO DEMONSTRATE RESTART PROTECTION FOR P31 GENERAL LAMBERT TARGETTING

INITIALIZATION

SAME AS (P30.1) WITH RESTARTS AS
REQUIRED TO DEMONSTRATE THE LEVEL OF P31 RESTART PROTECTION

SEQUENCE

SAME AS P30.1 WITH MODIFICATIONS AS REQUIRED BY THE RESTARTS, EXCEPT
SELECT P41 INSTEAD OF P40 AT THE FLASHING V37

R31.1

OBJECTIVE

DEMONSTRATE CAPABILITY OF R31 TO PROVIDE
THE ASTRONAUT WITH A DISPLAY OF RENDEZVOUS - GEOMETRY
QUANTITIES (RANGE, RANGE RATE, THETA)

INITIALIZATION

SEQUENCE

REQUEST MAJOR MODE 34
SELECT R31
RUN FOR SEVERAL MINUTES, THEN TERMINATE

R31.2

OBJECTIVE

CHECK OPERATION AND OUTPUT OF R31
WITH CSM IN POWERED FLIGHT (V37 FLAG = SET)

INITIALIZATION

SEQUENCE

REQUEST MAJOR MODE 00
SELECT R31
RUN UNTIL MAXTIME

R31.3

OBJECTIVE

CHECK OPERATION AND OUTPUT OF R31 UNDER
COASTING AND POWERED FLIGHT CONDITIONS

INITIALIZATION
-----SEQUENCE

DAPLOAD ROUTINE R03 IS REQUESTED AND A CONFIGURATION (OF 11103, 11111)
IS INPUT, THE CSM WEIGHT IS INPUT.
R03 IS TERMINATED & MAJOR MODE 34 IN ERROR IS REQUESTED,
R31 IS REQUESTED, ALLOWED TO RUN FOR ONE MINUTE & IS TERMINATED.
WITH P34 IN OPERATION, THE TIG IS MODIFIED,
CENTRAL ANGLE IS MODIFIED AND CMC CALCULATION OF ELEVATION
ANGLE IS REQUESTED,
COMPONENTS OF DELTA V ARE MODIFIED, AND
GUIDANCE AND NAVIGATION CONTROL IS ESTABLISHED AND
MAJOR MODE 40 IS REQUESTED
WITH P40 IN OPERATION, SET SPACECRAFT CONTROL SWITCH = CMC FOR
AUTO MANEUVER,
SELECT TRIM & TEST OPTION OF ENGINE GIMBAL DRIVE TEST,
TURN ON ULLAGE JET AT TIG-20,
ENABLE ENGINE IGNITION AT TIG-3 & TURN OFF ULLAGE,
WAIT FOR TAILOFF & PROCEED,
SELECT R31 AND ALLOW IT TO OPERATE FOR 30 SECONDS & EXIT R31,
BYPASS VG TRIM, AND
CALL P00

R31.4

OBJECTIVE

CHECK OPERATION AND OUTPUT OF R31 WITH
LEM AND CSM IN CIRCULAR ORBITS, WITH THE CSM 10 METERS
OUTSIDE THE LEM

INITIALIZATION

SEQUENCE

REQUEST MAJOR MODE 34
SELECT R31 AND RUN FOR APPROXIMATELY 5 MINUTES

R31.8

OBJECTIVE

TEST OPERATION AND OUTPUT OF R31 WITH LEM
AND CSM IN CIRCULAR ORBITS
IN TEST 8 THE LEM VELOCITY IS ASSIGNED A SLIGHT X COMPONENT
SUCH THAT IT APPROACHES (AND CROSSES) THE CSM ORBIT)

INITIALIZATION

SEQUENCE

REQUEST MAJOR MODE 34
SELECT R31 AND RUN FOR APPROXIMATELY 5 MINUTES

R32.1

OBJECTIVE

DEMONSTRATE THE CAPABILITY OF R32 TO
PROVIDE TO THE CMC THE DELTA V APPLIED TO THE LEM,
AND TO PERFORM THE RELATED UPDATING OF THE LEM STATE VECTOR

INITIALIZATION

LEM STATE VECTOR, POSITION AND VELOCITY, AND TIME
DELTA V VIA DSKY
TIG

SEQUENCE

SELECT R32
AT V06N84, LOAD DELTA V COMPONENTS (X,Y,X) IN FT/SEC
AT V06N33, LOAD TIME OF IGNITION COMPONENTS (HRS,MIN,SEC)

R32.2

OBJECTIVE

CHECK RESTARTS DURING PERMANENT STATE VECTOR
UPDATE IN R32

INITIALIZATION

SAME AS R32.1

SEQUENCE

SAME AS R32.1 WITH ADDITION OF 1G0SEQ SPECIAL
REQUESTS TO CHECK SUCCESSFUL RESTART OF EACH PHASE

R32.3

OBJECTIVE

CHECK OPERATION OF R32 WHEN VEHICLES ARE IN LUNAR
SPHERE OF INFLUENCE

INITIALIZATION

SAME AS R32.1 WITH ADDITION THAT CMOONFLG
IS ESTABLISHED "SET"

SEQUENCE

SAME AS R32.1

P34.1

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING OF P34 FOR AN EARTH ORBITAL
RENDEZVOUS WHERE THE ELEVATION ANGLE IS GIVEN AND NO SOLUTION
CAN BE REACHED FOR
A CORRESPONDING TPI TIME.

INITIALIZATION

E = 206.5 DEGREES, WT = 140 DEGREES

SEQUENCE

SELECT P34 FROM P00
INPUT TPI TIME, ELEVATION
ANGLE (E), CENTRAL ANGLE (WT) THROUGH THE DSKY
TERMINATE PROGRAM UPON
DISPLAY OF V05N09 ON THE DSKY

P34.2

OBJECTIVE

SAME AS P34.1

INITIALIZATION

E = 170.0 DEGREES, WT = 140 DEGREES

SEQUENCE

SAME AS P34.1

P34.3

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING
OF P34 FOR AN EARTH ORBITAL RENDEZVOUS WHERE THE ELEVATION
ANGLE IS GIVEN
AND THE CORRESPONDING TPI TIME CALCULATED.

INITIALIZATION

E = 206.5 DEGREES, WT = 140 DEGREES

SEQUENCE

SELECT P34 FROM P00
INPUT TPI TIME, ELEVATION ANGLE (E), CENTRAL ANGLE (WT)
THROUGH THE DSKY
MAKE TWO PASSES THROUGH THE PROGRAM CALCULATIONS DISPLAYING
APPROPRIATE CALCULATED VALUES THROUGH THE DSKY
PERFORM R00 AND EXIT

P34.4

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING OF P34 FOR AN EARTH ORBITAL
RENDEZVOUS WHERE THE ELEVATION ANGLE IS CALCULATED AND
THE ASTRONAUT OVERRIDES THE CALCULATED DELTA V TPL (LV).

INITIALIZATION

WT = 140 DEGREES

SEQUENCE

SELECT P34 FROM P00
INPUT TPI TIME, CENTRAL ANGLE THROUGH THE DSKY
MAKE TWO PASSES THROUGH THE PROGRAM CALCULATIONS, RECALCULATING
THE TARGET VECTOR WITH THE NEW DELTA V TPI (LV) INPUTTED THROUGH
THE DSKY
PERFORM R00 AND EXIT

P34.5

OBJECTIVE

SAME AS P34.1

INITIALIZATION

E = 26.5 DEGREES, WT = 140 DEGREES

SEQUENCE

SAME AS P34.1

P34.6

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING OF P34 FOR A LUNAR ORBITAL
RENDEZVOUS WHERE THE ELEVATION ANGLE IS GIVEN
AND THE CORRESPONDING TPI TIME CALCULATED.

INITIALIZATION

E = 26.5 DEGREES, WT = 200 DEGREES

SEQUENCE

SAME AS P34.3

P34.7

OBJECTIVE

SAME AS P34.3

INITIALIZATION

E = 206.5 DEGREES, WT = 200 DEGREES

SEQUENCE

SAME AS P34.3

P34.8

OBJECTIVE

SAME AS P34.3

INITIALIZATION

SAME AS P34.7

SEQUENCE

SAME AS P34.3

P34.9

OBJECTIVE

SAME AS P34.6

INITIALIZATION

E = 207 DEGREES, WT = 140 DEGREES

SEQUENCE

SAME AS P34.3

P34.10

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING OF P34 FOR A LUNAR ORBITAL
RENDEZVOUS WHERE THE ELEVATION ANGLE IS CALCULATED

INITIALIZATION

WT = 195 DEGREES

SEQUENCE

SELECT P34 FROM P00
INPUT TPI TIME, CENTRAL ANGLE THROUGH THE DSKY
MAKE TWO PASSES THROUGH THE PROGRAM CALCULATIONS DISPLAYING
APPROPRIATE CALCULATED VALUES THROUGH THE DSKY
PERFORM R00 AND EXIT

P74.11

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING OF P74 FOR AN EARTH ORBITAL
RENDEZVOUS WHERE THE ELEVATION ANGLE IS GIVEN
AND THE CORRESPONDING TPI TIME CALCULATED.

INITIALIZATION

SAME AS P34.3

SEQUENCE

SAME AS P34.3 EXCEPT THAT P74
IS SELECTED FROM P00

P74.12

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING OF P74 FOR AN EARTH ORBITAL
RENDEZVOUS WHERE THE ELEVATION ANGLE IS CALCULATED AND
THE ASTRONAUT OVERRIDES THE CALCULATED DELTA V TPI (LV).

INITIALIZATION

SAME AS P34.4

SEQUENCE

SAME AS P34.4 EXCEPT THAT P74
IS SELECTED FROM P00

P74.13

OBJECTIVE

SAME AS P74.12 BUT WITH THE ADDITIONAL OBJECTIVE OF TESTING THE
RESTART CAPABILITY OF THE PROGRAM.

INITIALIZATION

SAME AS P34.4

SEQUENCE

SAME AS P74.12 BUT WITH SAME ADDITIONAL TESTING FOR RESTART
CAPABILITY

R34.1

OBJECTIVE

DEMONSTRATE CAPABILITY OF R34 TO PROVIDE
THE ASTRONAUT WITH A DISPLAY OF RENDEZVOUS - GEOMETRY
QUANTITIES (RANGE, RANGE RATE, PHI)

INITIALIZATION

SEQUENCE

REQUEST MAJOR MODE 34
SELECT R34, RUN FOR SEVERAL MINUTES, AND TERMINATE

R34.2

OBJECTIVE

CHECK OPERATION AND OUTPUT OF ROUTINE R34
WITH CSM IN POWERED FLIGHT (V37 FLAG = SET)

INITIALIZATION

SEQUENCE

REQUEST MAJOR MODE 00
SELECT R34 AND RUN TO MAXTIME

R34.3

OBJECTIVE

CHECK OPERATION AND OUTPUT OF ROUTINE R34 UNDER
COASTING AND POWERED FLIGHT CONDITIONS

INITIALIZATION
-----SEQUENCE

DAP LOAD ROUTINE R03 IS REQUESTED & A CONFIGURATION (OF 11103,
11111) IS INPUT, THE CSM WEIGHT IS INPUT
R03 IS TERMINATED & MAJOR MODE 34 IS REQUESTED.
R34 IS REQUESTED, ALLOWED TO RUN FOR ONE MINUTE & IS TERMINATED
WITH P34 IN OPERATION THE TIG IS MODIFIED,
CENTRAL ANGLE IS MODIFIED & CMC CALCULATION OF ELEVATION
ANGLE IS REQUESTED,
COMPONENTS OF DELTA V ARE MODIFIED, AND
GUIDANCE & NAVIGATION CONTROL IS ESTABLISHED & MAJOR 40 IS REQUESTED
WITH P40 IN OPERATION, SET SPACECRAFT CONTROL SWITCH MODE = CMC FOR
AUTO. MANEUVER,
SELECT TRIM & TEST OPTION OF ENGINE GIMBAL DRIVE TEST,
TURN ON ULLAGE JET AT TIG-20,
ENABLE ENGINE IGNITION AT TIG-3 & TURN OFF ULLAGE,
WAIT FOR TAILOFF & PROCEED,
SELECT R34, ALLOW IT TO OPERATE FOR 30 SECONDS & EXIT R34,
BYPASS V.G. TRIM, AND
CALL P00

R34.4

OBJECTIVE

CHECK OPERATION AND OUTPUT OF ROUTINE R34 WITH
LEM AND CSM IN CIRCULAR ORBITS WITH THE LEM 10 METERS
OUTSIDE THE CSM

INITIALIZATION

SEQUENCE

V37E74
AT M=74, V85E TO SELECT R31
AT T=-95, V34E TO TERMINATE R31

R34.5

SAME AS R34.4 EXCEPT PITCH ANGLE IS + 80 DEGREES

R34.6

SAME AS R34.4 EXCEPT PITCH ANGLE IS - 90 DEGREES

R34.7

SAME AS R34.4 EXCEPT PITCH ANGLE IS + 90 DEGREES

R34.8

OBJECTIVE

TEST OPERATION AND OUTPUT OF ROUTINE R34 WITH LEM
AND CSM IN CIRCULAR ORBITS
IN TEST 8 THE LEM VELOCITY IS ASSIGNED A SLIGHT X COMPONENT
SUCH THAT IT APPROACHES (AND CROSSES) THE CSM ORBIT

INITIALIZATION

SEQUENCE

REQUEST MAJOR MODE 34
SELECT R34 AND RUN FOR APPROXIMATELY 5 MINUTES

P35.1

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING
OF P35 FOR AN EARTH ORBITAL RENDEZVOUS.

INITIALIZATION

PRESET INTERCEPT TIME, TIME TO
PREPARE FOR BURN

SEQUENCE

SELECT P35 FROM P00
MAKE TWO PASSES THROUGH THE PROGRAM CALCULATIONS DISPLAYING
APPROPRIATE CALCULATED VALUES THROUGH THE DSKY
PERFORM R00 AND EXIT

P35.2

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING OF P35 FOR AN EARTH ORBITAL RENDEZVOUS
WHERE THE ASTRONAUT OVERRIDES THE
CALCULATED DELTA V TPI (LV).

INITIALIZATION

PRESET INTERCEPT TIME, TIME TO PREPARE
FOR BURN

SEQUENCE

SELECT P35 FROM P00
MAKE TWO PASSES THROUGH THE PROGRAM CALCULATIONS, RECALCULATING
THE TARGET VECTOR WITH THE NEW DELTA V TPI (LV) INPUTTED THROUGH
THE DSKY
PERFORM R00 AND EXIT

P35.3

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING
OF P35 FOR A LUNAR ORBITAL RENDEZVOUS.

INITIALIZATION

SAME AS P35.1

SEQUENCE

SAME AS P35.1

P75.4

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING OF P75 FOR AN EARTH ORBITAL
RENDEZVOUS.

INITIALIZATION

SAME AS P35.1

SEQUENCE

SAME AS P35.1 EXCEPT THAT
P75 IS SELECTED FROM P00

P75.5

OBJECTIVE

SAME AS P75.4 BUT WITH THE ADDITIONAL OBJECTIVE OF TESTING THE
RESTART CAPABILITY OF THE PROGRAM.

INITIALIZATION

SAME AS P75.4

SEQUENCE

SAME AS P75.4 BUT WITH SAME ADDITIONAL TESTING FOR RESTART
CAPABILITY

R35.1 LUNAR ORBIT
CM GROUND TRACK

OBJECTIVE

TEST NUMERICAL COMPUTATIONS OF A GROUND TRACK
FROM +8 DEGREES LUNAR LATITUDE, +60 DEGREES LUNAR LONGITUDE TO
-8 DEGREES LUNAR LATITUDE, -60 DEGREES LUNAR LONGITUDE

INITIALIZATION

CM STATE VECTOR, POSITION - VELOCITY - TIME

SEQUENCE

R32 IS SELECTED BY KEYBOARD INPUT
AFTER THE DISPLAY OF THE 5TH LANDMARK AND
ASSOCIATED TIME THE ROUTINE IS EXITED

R35.2 LUNAR ORBIT
CM GROUND TRACK

OBJECTIVE

SAME AS R35.1 FOR A GROUND TRACK ALONG
THE LUNAR EQUATORIAL PLANE

THE LUNAR EQUATORIAL PLANE

INITIALIZATION

SAME AS R35.1

SEQUENCE

SAME AS R35.1

R35.3 LUNAR ORBIT
CM GROUND TRACK

OBJECTIVE

SAME AS R35.1 FOR A GROUND TRACK FROM THE
-8 DEGREE LUNAR LATITUDE AND THE +60 DEGREES LONGITUDE

INITIALIZATION

SAME AS R35.1

SEQUENCE

SAME AS R35.1

R35.4 LUNAR ORBIT
CM GROUND TRACK

OBJECTIVE

SIMILAR TO R35.3; A LUNAR ORBIT WHICH YIELDS
A SIMILAR GROUND TRACK BUT IS LESS INCLINED.

INITIALIZATION

SAME AS R35.1

SEQUENCE

SAME AS R35.1

R36.1

OBJECTIVE

NOMINAL EARTH CENTERED CSM AND LM STATE VECTORS WITH LINE OF
SIGHT VECTOR ABOVE THE HORIZONTAL PLANE WITH ASTRONAUT INPUT
TIME OPTION EXERCISED

INITIALIZATION

STATE VECTORS AND TIMES FOR THE LM AND CM VEHICLES

SEQUENCE

SELECT R36
WHEN TIME (GET) IS DISPLAYED, EXERCISE TIME INPUT OPTION
FOR PRESENT TIME
AT FIRST DISPLAY OF V90 (RANGE, RRATE, RTHETA), EXERCISE RECYCLE OPTION
TERMINATE WITH V34E

R36.5

SAME AS R36.1 EXCEPT RESTARTS ARE FORCED AND THE TIME
INPUT OPTION IS USED TO INPUT A TIME OF 10 MINUTES

P37.1 TIG AT TLI + 1/2 HOUR

OBJECTIVE

VERIFY RETURN TO EARTH CALCULATIONS FROM TRANSLUNAR INJECTION PLUS
ONE HALF HOUR

INITIALIZATION

NONE

SEQUENCE

SELECT P37 FROM P00
LOAD TIG
LOAD DELTAV (1M/CS)
LOAD FPA (0 DEGREES)
PROCEED ON CONIC DISPLAYS
PROCEED ON PRECISION DISPLAYS
SELECT SPS SYSTEM

P37.2 TIG AT TLI + 60 HOURS

OBJECTIVE

VERIFY RETURN TO EARTH CALCULATIONS FROM JUST BEFORE CROSSOVER TO
LUNAR SPHERE

INITIALIZATION

NONE

SEQUENCE

SELECT P37 FROM P00
LOAD TIG
LOAD DELTAV (0)
LOAD FPA (0 DEGREE)
PROCEED ON CONIC DISPLAYS
PROCEED ON PRECISION DISPLAYS
SELECT SPS SYSTEM

P37.3 TRANSEARTH COAST

OBJECTIVE

VERIFY RETURN TO EARTH CALCULATIONS FROM JUST AFTER CROSSOVER FROM
LUNAR SPHERE
A BIASED TIG IS CALCULATED FOR THE RCS PROPULSION SYSTEM

INITIALIZATION

THE SELECTION OF TWO JETS WILL BE PRESET

SEQUENCE

SELECT P37 FROM P00
LOAD TIG
LOAD DELTAV (0)
LOAD FPA (0)
PROCEED ON CONIC DISPLAYS
PROCEED ON PRECISION DISPLAYS
SELECT RCS SYSTEM

P37.4 EARTH ORBIT CASE

OBJECTIVE

VERIFY INPUT AND PROCESSING WHEN THE ASTRONAUT SELECTS DESIRED
VALUES OF DELTAV AND FPA
THIS TEST ALSO GENERATES THE ALARM CONDITION FOR FLIGHT PATH ANGLE
OUT OF BOUNDS

INITIALIZATION

NONE

SEQUENCE

SELECT P37 FROM P00
LOAD TIG
LOAD DELTAV
LOAD FPA
PROCEED ON CONIC DISPLAYS
TERMINATE AFTER ALARM

P37.5 TRANSLUNAR COAST

OBJECTIVE

TEST THE TERMINATION OF P37 AT THE END OF THE CONIC DISPLAYS

INITIALIZATION

NONE

SEQUENCE

SELECT P37 FROM P00
LOAD TIG
LOAD DELTAV (0)
LOAD FPA (0)
TERMINATE AT END OF CONIC DISPLAYS

P37.6 STATE VECTOR ALARM

OBJECTIVE

VERIFY THE PROPER DISPLAY OF THE ALARM FOR THE STATE VECTOR IN THE
LUNAR SPHERE OF INFLUENCE

INITIALIZATION

NONE

SEQUENCE

SELECT P37 FROM P00
LOAD TIG
LOAD DELTAV (0)
LOAD FPA (0)
TERMINATE AFTER ALARM

P37.7 EXCESSIVE ITERATION ALARM

OBJECTIVE

VERIFY THE PROPER DISPLAY OF THE ALARM FOR EXCESSIVE ITERATIONS
THE ITERATION COUNTER TEST VALUE WILL BE REDUCED TO CAUSE THE ALARM
TO OCCUR AFTER ONLY A FEW ITERATION PASSES

INITIALIZATION

NONE

SEQUENCE

SAME AS P37.6

P37.8 LOW ALTITUDE CIRCULAR ORBIT

OBJECTIVE

VERIFY RETURN TO EARTH CALCULATIONS FOR A LOW
ALTITUDE CIRCULAR ORBIT
TO VERIFY A RECYCLE DURING THE PRECISION DISPLAY WITH NEW DATA TO BE
INSERTED FOR THE SECOND RUN
A BIASED TIG IS CALCULATED FOR THE RCS PROPULSION SYSTEM

INITIALIZATION

THE SELECTION OF 4 JETS WILL BE PRESET

SEQUENCE

SELECT P37 FROM P00
LOAD TIG
LOAD DELTAV (0)
LOAD FPA (0)
PROCEED ON CONIC DISPLAYS
FOLLOWING THE PRECISION DISPLAY OF DELTAV AND FPA
RECYCLE
PROCEED WITH ORIGINAL TIG
LOAD DELTAV (656 FPS)
LOAD FPA (0)
PROCEED ON CONIC DISPLAYS
PROCEED ON PRECISION DISPLAYS
SELECT RCS SYSTEM

P38.8

OBJECTIVE

SAME AS P78.10 BUT WITH THE
ADDITIONAL OBJECTIVE OF TESTING THE
RESTART CAPABILITY OF THE PROGRAM.

INITIALIZATION

SAME AS P78.10

SEQUENCE

SAME AS P78.10 BUT WITH SOME ADDITIONAL TESTING
FOR RESTART CAPABILITY

P78.9

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING
OF P78 IN SOI MODE FOR A LUNAR
ORBITAL RENDEZVOUS.

INITIALIZATION

WT = 144.5 DEGREES; SR = 20 N. MI.

SEQUENCE

SELECT P78 FROM POO
INPUT TIG, CENTRAL ANGLE, OFFSET DISTANCE
THROUGH THE DSKY
MAKE TWO PASSES THROUGH
THE PROGRAM CALCULATIONS DISPLAYING APPROPRIATE
CALCULATED VALUES THROUGH THE DSKY
PERFORM ROD AND EXIT

P78.10

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING OF
P78 IN SOR MODE FOR A LUNAR ORBITAL
RENDEZVOUS.

INITIALIZATION

WT = 144.5 DEGREES, OFFSET TIME = 22.96 SECS.

SEQUENCE

PRESET CENTRAL ANGLE, OFFSET TIME, TIME OF INTERCEPT
SELECT P78 FROM PDU
INPUT TIG AND SOR MODE INDICATOR
THROUGH THE DSKY
MAKE TWO PASSES THROUGH THE
PROGRAM CALCULATIONS DISPLAYING APPROPRIATE
CALCULATED VALUES THROUGH THE DSKY
PERFORM R00 AND EXIT

P39.4

OBJECTIVE

SAME AS P79.6 BUT WITH THE
ADDITIONAL OBJECTIVE OF TESTING THE
RESTART CAPABILITY OF THE PROGRAM.

INITIALIZATION

SAME AS P79.6

SEQUENCE

SAME AS P79.6 BUT WITH
SOME ADDITIONAL TESTING FOR RESTART
CAPABILITY

P79.5

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING
OF P79 FOR A LUNAR ORBITAL RENDEZVOUS.

INITIALIZATION

SAME AS P39.1

SEQUENCE

SAME AS P39.1 EXCEPT THAT P79
IS SELECTED FROM P00

P79.6

OBJECTIVE

VERIFY THE CORRECT FUNCTIONING OF
P79 FOR AN EARTH ORBITAL RENDEZVOUS.

INITIALIZATION

SAME AS P39.1

SEQUENCE

SAME AS P79.3

P47.1

OBJECTIVE

VEHICLE ACCELERATION DURING A MANUAL RCS-CONTROLLED THRUSTING
MANEUVER
DEMONSTRATE OPERATION OF P47 MONITORING
BY A 50 PCT FULL CSM/LM

INITIALIZATION

50 PCT FULL CSM/LM IN THE NOMINAL LEVELIIIP40 NEAR-EARTH ORBIT (NEAR-
CIRCULAR, INCLINED 30 DEGREES WRT THE EQUATOR), WITH THE VEHICLE
ON THE GEOCENTRIC X-REF AXIS AT T = TZERO = 7202.13 SEC (2 HRS,
0 MIN, 2.13 SEC)
IMU ON, WITH THE NOMINAL LEVELIIIP40 NEAR-EARTH ALIGNMENT (NEAR
LOCAL VERTICAL AT T = TZERO)
VALID REFSMMAT, WITH REFSMMAT FLAG SET
S/C ALIGNED WITH LOCAL VERTICAL AT T = TZERO
IDENTICAL CSM AND LM STATE VECTORS, VALID FOR T = TZERO
NOMINAL PAD LOADS
RECOVERY LOAD R03 DAP DATA, CALLING FOR CSM/LM, 4-JET
X-TRANS, NARROW
DEADBAND, 0.5 DEG/SEC MANEUVER RATE; QUAD AC ROLL; CSMMASS FOR
50 PCT SPS PROPELLANT, NOMINAL LEMASS FOR 100 PCT APS AND
DPS PROPELLANTS (AF/DF); ACTUATOR TRIMS ARE IMMATERIAL
SC CONT SWITCH = CMC; CMC MODE SWITCH = AUTO

SEQUENCE

SELECT P00 VIA V37E00E
SELECT R03, TO VERIFY ERASABLE LOADS AND PERFORM RCS COMPUTATIONS
INITIATE RCS DAP VIA V46E
SELECT P47 VIA V37E47E
PROCEED THROUGH P47 NORMALLY, EXERCISING +X, +Y, +Z TRANSLATION
CONTROL (10 SECOND COMBINED BURSTS)
RECYCLE THE FLASHING V16N83 DISPLAY VIA V32F
INITIATE +X TRANSLATION
REQUEST V, H, H00T DISPLAY VIA V16N62E
KEY RELEASE TO RETURN THE V16N83 DISPLAY
TERMINATE +X TRANSLATION
TERMINATE P47 WITH A PROCEED
SELECT P00 AT THE FLASHING V37

P47.2

OBJECTIVE

VEHICLE ACCELERATION DURING A MANUAL RCS-CONTROLLED THRUSTING
MANEUVER DEMONSTRATE OPERATION OF P47 MONITORING
BY A 50 PCT FULL CSM

INITIALIZATION

50 PCT FULL CSM IN THE NOMINAL LEVELIIIP40 NEAR-MOON ORBIT (NEAR-
CIRCULAR, RETROGRADE, INCLINED 150 DEGREES WRT THE EQUATOR), WITH
THE VEHICLE ON THE SELENOCENTRIC X-REF AXIS T = TZERO = 388,300 SEC
(107 HRS, 51 MIN, 40 SEC)
CMOONFLG = 1 = LMOONFLG
IMU ON, WITH THE NOMINAL LEVELIIIP40 NEAR-MOON ALIGNMENT (NEAR LOCAL
VERTICAL AT T = TZERO
VALID REFSMMAT, WITH REFSMMAT FLAG SET
S/C ALIGNED WITH LOCAL VERTICAL AT T = TZERO
IDENTICAL CSM AND LM STATE VECTORS, VALID FOR T = TZERO-20 MIN
NOMINAL PAD LOADS
RECOVERY LOAD R03 DAP DATA, CALLING FOR CSM QUADAC (2-JET) X TRANS,
NARROW DEADBAND, 4 DEG/SEC MANEUVER RATE; QUAD AC ROLL, NO FAIL-QUADS;
CSMMASS FOR 50 PCT SPS PROPELLANT, NOMINAL LEMASS FOR 100PCT APS
AND DPS PROPELLANT (AF/DF); ACTUATOR TRIMS ARE IMMATERIAL
SC CONT SWITCH IN CMC; CMC MODE SWITCH = AUTO

SEQUENCE

SELECT P00 VIA V37E00E
SELECT R03 TO VERIFY FRASABLE LOADS AND PERFORM RCS COMPUTATIONS
INITIATE RCS DAP VIA V46E
SELECT P47 VIA V37E47E
PROCEED THROUGH P47 NORMALLY, EXERCISING +X, +Y, +Z TRANSLATION
CONTROL (10 SECOND COMBINED BURSTS)
WITH OCCASIONAL SHORT BURSTS OF ROTATIONAL HAND CONTROLLER ACTIVITY
TERMINATE P47 WITH V34E
SELECT P00 AT THE FLASHING V37

P47.3

OBJECTIVE

VEHICLE ACCELERATION DURING A MANUAL RCS-CONTROLLED THRUSTING
MANEUVER DEMONSTRATE RESTART PROTECTION OF P47 WHILE MONITORING
AREAS TO BE TESTED:

A POINT PRECEEDING EVERY PHASE CHANGE

TASKS AND JOBS FLASHING DISPLAY (N83 WITH RECYCLING)

IT IS NOT NECESSARY TO TEST EXPLICITLY THE RCS DAP OR THE SERVICER
ROLLTIME, JUST THE P47 INTERFACING

INITIALIZATION

SAME AS IN P47.1 WITH THE FOLLOWING ADDITIONS:

RESTARTS AS REQUIRED TO DEMONSTRATE THE LEVEL OF RESTART
PROTECTION IN THE P47 PROGRAM

SEQUENCE

GENERALLY AS IN P47.1, WITH MODIFICATIONS AS REQUIRED
BY THE RESTARTS, WITH THE FOLLOWING EXCEPTIONS:

+X TRANSLATION ONLY, TO SAVE TIME

TERMINATE P47 AND RETURN TO P00 VIA V37E00E

(AVERAGEG IS ON)

P61.1 NOMINAL ORBITAL REENTRY

OBJECTIVE

DEMONSTRATE THE FULL ENTRY SEQUENCE FOR A NOMINAL ORBITAL REENTRY

INITIALIZATION

ALTITUDE ABOVE 4000,000 FT SO THAT P61 AND P62 WILL BE EXERCISED
CM/SM INITIALLY ALIGNED TO SEPARATION ATTITUDE
CONDITIONS CHOSEN SO THAT AT 2G ACCELERATION FINAL PHASE (P67) IS
ENTERED

SEQUENCE

DO STANDARD TURN ON
P61, ENTR VIA V37
P62
P63
P64
P65
P67 TO SPLASH

P61.2 NOMINAL LUNAR REENTRY

OBJECTIVE

DEMONSTRATE THE FULL ENTRY SEQUENCE FOR A NOMINAL LUNAR REENTRY

INITIALIZATION

ALTITUDE INITIALLY AT 400,000 FT
CM/SM ALIGNED TO SEPARATION ATTITUDE
VELOCITY AND DRAG AT 2G ARE SUCH THAT THE UPCONTROL PHASE WILL BE
EXERCISED BEFORE THE FINAL PHASE OF ENTRY

SEQUENCE

DO STANDARD TURN ON
P61, ENTER VIA V37
P62
P63
P64
P65
P67 TO SPLASH

P61.3 TEST G-LIMITER

OBJECTIVE

TEST REENTRY GUIDANCE IN THE CASE WHERE A LARGE POTENTIAL
ACCELERATION IS DETECTED AS VEHICLE ENTERS THE ATMOSPHERE,
THUS EXERCISING LOGIC TO AVOID THIS ACCELERATION

INITIALIZATION

TEST WILL BEGIN IN ATMOSPHERE BEFORE .05G
VEHICLE ALIGNED TO ENTRY ATTITUDE

SEQUENCE

P63
P64
P67 TO SPLASH

P61.4 VARIATION IN L/D OFF-NOMINAL TARGET

OBJECTIVE

DEMONSTRATE THE PERFORMANCE OF REENTRY GUIDANCE FOR AN OFF-NOMINAL
L/D AND A TARGET ON THE EDGE OF THE "FOOTPRINT"

INITIALIZATION

TEST WILL BEGIN IN ATMOSPHERE BEFORE .05G
VEHICLE ALIGNED TO ENTRY ATTITUDE

SEQUENCE

P63
P64
P65
P66
P67 TO SPLASH

P61.5 CONSTANT DRAG TEST AND NO KEPLER PHASE

OBJECTIVE

DEMONSTRATE THE CONSTANT DRAG CONTROL SECTION OF THE REENTRY
GUIDANCE WHERE THE RANGE IS SO SHORT THAT THE UPCONTROL AND
KEPLER PHASE ARE NOT INITIATED

INITIALIZATION

TEST WILL BEGIN IN ATMOSPHERE BEFORE .05G
VEHICLE ALIGNED TO ENTRY ATTITUDE

ENTRY ATTITUDE

SEQUENCE

P63
P64
P67 TO SPLASH

P61.6 SEVERE SKIP-OUT

OBJECTIVE

DEMONSTRATE THE PERFORMANCE OF ENTRY GUIDANCE IN THE CASE OF A SEVERE SKIP OUT OF THE ATMOSPHERE DURING P66.

INITIALIZATION

TEST WILL BEGIN IN ATMOSPHERE BEFORE .05G
VEHICLE ALIGNED TO ENTRY ATTITUDE

SEQUENCE

P63
P64
P65
P66
P67

P61.7 RESTARTS FOR ENTRY SEQUENCE

OBJECTIVE

TEST RESTART CAPABILITY OF REENTRY GUIDANCE

INITIALIZATION

SAME AS P61.2 WITH THE ADDITION OF RESTARTS AS REQUIRED TO
DEMONSTRATE THE LEVEL OF ENTRY RESTART PROTECTION

SEQUENCE

SAME AS P61.2 WITH MODIFICATION AS EQUIRED BY THE RESTARTS

DWN.3

SAME AS P11.1 WITH THE ADDED OBJECTIVE OF
VERIFYING THE INFORMATION CONTAINED IN THE COAST AND
ALIGNMENT DOWNLIST.

DWN.4

SAME AS P52.2 WITH THE ADDED OBJECTIVE OF
VERIFYING THE INFORMATION CONTAINED IN THE COAST AND
ALIGNMENT DOWNLIST.

DWN.5

SAME AS P34.3 WITH THE ADDED OBJECTIVE OF VERIFYING
THE INFORMATION CONTAINED IN THE RENDEZVOUS AND PRE-THRUST
DOWNLIST.

DWN.6

SAME AS P20.3 WITH THE ADDED OBJECTIVE OF VERIFYING
THE INFORMATION CONTAINED IN THE RENDEZVOUS AND THE PRE-THRUST
DOWNLIST.

DWN.7

SAME AS P20.6 WITH THE ADDED OBJECTIVE OF VERIFYING
THE INFORMATION CONTAINED IN THE RENDEZVOUS AND PRE-THRUST
DOWNLIST.

DWN.8

SAME AS P40.01 WITH THE ADDED OBJECTIVE OF
VERIFYING THE INFORMATION CONTAINED IN THE POWERED FLIGHT
DOWNLIST.

DWN.9

SAME AS P22.1 WITH THE ADDED OBJECTIVE OF VERIFYING
THE INFORMATION CONTAINED IN THE P22 DOWNLIST.

DWN. 10

SAME AS P27.1 WITH THE ADDED OBJECTIVE OF VERIFYING
THE INFORMATION CONTAINED IN THE ENTRY AND UPDATE DOWNLIST.

DWN. 11

SAME AS P23.1 WITH THE ADDED OBJECTIVE OF VERIFYING
THE INFORMATION CONTAINED IN THE RENDEZVOUS AND PRE-THRUST
DOWNLIST.

DWN. 12

SAME AS P60.2 WITH THE ADDED OBJECTIVE OF VERIFYING
THE INFORMATION CONTAINED IN THE ENTRY AND UPDATE DOWNLIST.