JSC - 09142

11

ASTP

FINAL

PCN-1

NOTE: This is a PAGE CHANGE NOTICE to be incorporated into the previous edition. DISCARD ONLY the changed out pages.

G&C CHECKLIST

PREPARED BY
PROCEDURES BRANCH
CREW TRAINING & PROCEDURES DIVISION

National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER
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ASTP

CSM G&C CHECKLIST

JUNE 23, 1975

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CHANGE CONTROL RECORD

APOLLO/SOYUZ TEST PROJECT G&C CHECKLIST

CONTROL NO.	FDF EDITION INCORPORATED		DISAPPROVED OR OTHER DISPOSITION
	TITLE	DATE	
001	PCN-1	1/15/75	
002	FINAL	4/16/75	
003	FINAL	4/16/75	
004	FINAL	4/16/75	
005	FINAL	4/16/75	
006	FINAL	4/16/75	
007	FINAL	4/16/75	
008	FINAL	4/16/75	
009	FINAL	4/16/75	
010	FINAL	4/16/75	
011	FINAL	4/16/75	
012	FINAL	4/16/75	
013	FINAL	4/16/75	
014	PCN-1	6/23/75	
015	PCN-1	6/23/75	
016	PCN-1	6/23/75	
017	PCN-1	6/23/75	

ASTP CSM G&C CHECKLIST

LIST OF EFFECTIVE PAGES

BASIC 9/16/74
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FINAL 4/16/75
PCN-1 6/23/75

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*i	6/23/75
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iv	4/16/75
v	4/16/75
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1-9	4/16/75
1-10	4/16/75
1-11	4/16/75
1-12	4/16/75
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1-14	4/16/75
1-15	4/16/75
1-16	4/16/75
*1-17	6/23/75
1-18	4/16/75
1-19	4/16/75
*1-20	6/23/75
1-21	4/16/75
1-22	4/16/75
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1-24	4/16/75
1-25	4/16/75
1-26	4/16/75
1-27	4/16/75
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2-5	4/16/75
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2-8	4/16/75
2-9	4/16/75
2-10	4/16/75
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*2-17	6/23/75
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* current change

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6-2	4/16/75
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6-5	4/16/75
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CMC REFERENCE DATA

STAR LIST

Numerical		Alphabetical	
00	Planet	Acamar	6
1	Alpheratz	Achernar	4
2	Diphda	Acrux	25
3	Navi	Aldebaran	11
4	Achernar	Alkaid	27
5	Polaris	Alphard	21
6	Acamar	Alphecca	32
7	Menkar	Alpheratz	1
10	Mirfak	Altair	40
11	Aldebaran	Antares	33
12	Rigel	Arcturus	31
13	Capella	Atria	34
14	Canopus	Canopus	14
15	Sirius	Capella	13
16	Procyon	Dabih	41
17	Regor	Deneb	43
20	Dnoces	Denebola	23
21	Alphard	Diphda	2
22	Regulus	Dnoces	20
23	Denebola	Earth	47
24	Gienah	Enif	44
25	Acrux	Fomalhaut	45
26	Spica	Gienah	24
27	Alkaid	Menkar	7
30	Menkent	Menkent	30
31	Arcturus	Mirfak	10
32	Alphecca	Navi	3
33	Antares	Nunki	37
34	Atria	Peacock	42
35	Rasalhague	Planet	00
36	Vega	Polaris	5
37	Nunki	Procyon	16
40	Altair	Rasalhague	35
41	Dabih	Regor	17
42	Peacock	Regulus	22
43	Deneb	Rigel	12
44	Enif	Sirius	15
45	Fomalhaut	Spica	26
46	Sun	Sun	46
47	Earth	Vega	36

VERB LIST (Decimal)

01	Display Oct Compnt 1 (R1)
02	Display Oct Compnt 2 (R1)
03	Display Oct Compnt 3 (R1)
04	Display Oct Compnt 1,2 (R1,R2)
05	Display Oct Compnt 1,2,3 (R1,R2,R3)
06	Display Decimal (R1 or R1,R2 or R1,R2,R3)
07	Display DP Decimal (R1,R2)
11	Monitor Oct Compnt 1 (R1)
12	Monitor Oct Compnt 2 (R1)
13	Monitor Oct Compnt 3 (R1)
14	Monitor Oct Compnt 1,2 (R1,R2)
15	Monitor Oct Compnt 1,2,3 (R1,R2,R3)
16	Monitor Decimal (R1 or R1,R2 or R1,R2,R3)
17	Monitor DP Decimal (R1,R2)
21	Load Compnt 1 (R1)
22	Load Compnt 2 (R2)
23	Load Compnt 3 (R3)
24	Load Compnt 1,2 (R1,R2)
25	Load Compnt 1,2,3 (R1,R2,R3)
27	Display Fixed Memory
30	Request Executive (Initiate EMP's)
31	Request Waitlist (Initiate EMP's)
32	Recycle Prog
33	Proceed Without DSKY Inputs
34	Terminate Function
35	DSKY Condition Light Test.....2-8
36	Request Fresh Start.....1-14
37	Change Prog (Major Mode)
*40	Zero ICDU's
41	Coarse Align CDU's (N20 & N91).....(N20) 2-19 (N91) 2-4
42	Fine Align IMU
43	Load FDAI Att Error Needles (N22)
44	Load Docked DAP (R04).....2-13
*45	Activate Docked DAP.....2-13
*46	Activate Undocked DAP.....2-14
*47	Set Soyuz S.V. into CSM S.V.
48	Load Undocked DAP (R03).....2-14
49	Start Crew Defined Mnvr (R62).....6-15
50	Please Perform
51	Please Mark
53	Please Mark Alternate LOS (COAS)
54	Start Rend Backup Sighting Mark (R23).....4-5

*Callable with other extended verb in use
and does not lock out other extended verbs

NOUN LIST (Decimal)

01	Specify Machine Address (Fract) (R1,R2,R3)		.XXXXX
02	Specify Machine Address (Whole) (R1,R2,R3)		XXXXX.
03	Specify Machine Address (Degree) (R1,R2,R3)		.01deg
04	Att Error	R,P,Y	.01deg
05	Angular Sep. Error		.01deg
	Angular Sep.		.01deg
06	Option Code (R1,R2)		OCTAL
07	Bit Operator: Address, Bit ID, Action		OCTAL
08	Alarm Data		OCTAL
09	Alarm Codes		OCTAL
10	Channel to be Specified (R1)		OCTAL
11	TIG (NCC)	hrs,min,	.01sec
12	Option Code (R1,R2)		OCTAL
13	TIG (NSR)	hrs,min,	.01sec
14	Star Tracker OG,IG		arc min
15	Increment Machine Address (R1)		OCTAL
16	Time of Event	hrs,min,	.01sec
17	Astronaut Total Att	R,P,Y	.01deg
18	Auto Maneuver Angles	R,P,Y	.01deg
19	Star Tracker OG (R1,R2)		OCTAL
20	Present ICDU Angles	R,P,Y	.01deg
21	PIPA Pulses X,Y,Z (R1,R2,R3)		pulses
22	New ICDU Angles	R,P,Y	.01deg
23	Docking Angles (P50)		.01deg
24	Delta CMC Clock Time	hrs,min,	.01sec
25	Checklist (please perform)		OCTAL
26	Prio/Delay, ADRES, BBCON (R1,R2,R3)		OCTAL
27	CMC Self-Check On/Off Sw		OCTAL
28	TIG (NC2)	hrs,min,	.01sec
29	X-SM Launch Azimuth		.01deg
30	Target Code (gyrocomp verify)		OCTAL
31	Time of Rend W-Matrix Initialization	hrs,min,	.01sec
32	Time from Perigee	hrs,min,	.01sec
33	Time of Ignition (TIG)	hrs,min,	.01sec
34	Time of Event	hrs,min,	.01sec
35	Time from Event	hrs,min,	.01sec
36	Time of CMC Clock	hrs,min,	.01sec
37	TIG (TPI)	hrs,min,	.01sec

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38	State Vector Time	—		hrs,min,.01sec
39	TIG (last mnvr)			hrs,min,.01sec
40	TF GETI/TFC			min-sec
	VG			.1fps
	ΔV (accumulated)			.1fps
41	Target Azimuth			.01deg
	Elevation			.001deg
	Code (N30)			0000X
42	Apogee Alt (HA) (PAD)			.1nm
	Perigee Alt (HP) (PAD)			.1nm
	ΔV (required)			.1fps
43	Lat (+ North)	Rho	See EMP	.01deg
	Long (+ East)	Gamma	ASTP-75	.01deg
	Alt (Pad)			.1nm
44	Apogee Alt (HA) (PAD)			.1nm
	Perigee Alt (HP) (N50) (PAD)			.1nm
	TFF			min-sec
45	Marks (VHF-Optics)			XXBXX
	TF GETI (next burn)			min-sec
	MGA			.01deg
46	Undocked DAP Config (R1,R2)			OCTAL
47	CSM Weight or CSM/DM Weight			LBS
	Other Vehicle Weight			LBS
48	Pitch Trim			.01deg
	Yaw Trim			.01deg
49	ΔR			.01nm
	ΔV			.1fps
	Source Code (1=Optics,2=VHF)			0000X.
50	ΔR (miss distance)			.1nm
	Perigee Alt (HP) (PAD)			.1nm
	TFF			min-sec
52	CENTANG (CSM)			.01deg
53	Range			.01nm
	Range Rate			.1fps
	Phi (SXT/local horiz)			.01deg
54	Range			.01nm
	Range Rate			.1fps
	Theta (S/C +X/local horiz)			.01deg
55	Precision offsets			CODE
	E (Elev Angle)			.01deg
56	Vehicle Rate		R,P,Y	.0001deg/sec
57	No. of Half Revs			XXXXX.
	ΔH (NCC)			.1nm
	ΔH (NSR)			.1nm
58	ΔV (TPI)			.1fps
	ΔV (TPF)			.1fps
	ΔT (TPI-NOMTPI)			min-sec

59	ΔV LOS X,Y,Z (R1,R2,R3)	.1fps
60	G Max	.01g
	V Pred	fps
	Gamma EI	.01deg
61	Impact Lat (+ North)	.01deg
	Impact Long (+ East)	.01deg
	Heads Up/Down (+ Heads up)	+/-00001
62	VI (Inertial Vel Mag)	fps
	HDOT (Alt Rate)	fps
	H (Alt) (PAD)	.1nm
63	RTGO from 0.05 G to Splash	.1nm
	VIO (Predicted Inertial Vel)	fps
	TFE (Time from .05G)	min-sec
64	Drag Acceleration	.01g
	VI (Inertial Velocity)	fps
	RTOGO to Target	.1nm
65	Sampled CMC Time	hrs,min,.01sec
	(fetched in interrupt)	
66	Beta (Cmd Bank Angle)	.01deg
	CRSRNG Error	.1nm
	DNRNG Error	.1nm
67	RTOGO to Target	.1nm
	Lat, Present Position (+ North)	.01deg
	Long, Present Position (+ East)	.01deg
68	Beta (Cmd Bank Angle)	.01deg
	VI (Inertial Velocity)	fps
	HDOT (Alt Rate)	fps
69	Beta (Cmd Bank Angle)	.01deg
	DL	.01g
	VL	fps
70	Sensor/Star Code (before mark)	OCTAL
71	Sensor/Star Code (after mark)	OCTAL
72	Time of Opt. (R27)	hrs,min,.01sec
73	Alt (P21) (PAD)	10nm
	Vel (P21)	fps
	Gamma (P21)	.01deg
74	Beta (Cmd Bank Angle)	.01deg
	VI (Inertial Velocity)	fps
	Drag Acceleration	.01g
75	ΔH (NSR)	.1nm
	ΔT (TPI-NSR)	min-sec
	ΔT (TPI-NOMTPI)	min-sec
76	Range	.01nm
	Range Rate	.1fps
	TFO (Time from Optimization)	min-sec

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77	Range		.01nm
	Range Rate		.1fps
	Theta/Phi (see N53 & N54)		.01deg
78	Axis Yaw		.01deg
	Axis Pitch		.01deg
	Omicron		.01deg
79	P20 Opt 2 Rate		.0001deg/sec
	P20 Deadband		.01deg
80	TF GETI/TFC		min-sec
	VG		fps
	ΔV (accumulated)		fps
81	ΔVX,Y,Z (local vert)	(R1,R2,R3)	.1fps
82	ΔVX,Y,Z NSR (local vert)	(R1,R2,R3)	.1fps
83	ΔVX,Y,Z (control axes)	(R1,R2,R3)	.1fps
84	ΔV (next mnvr)		.1fps
	ΔH (next mnvr)		.1nm
	ΔV (3rd mnvr)		.1fps
85	VGX,Y,Z (control axes)	(R1,R2,R3)	.1fps
86	ΔVX,Y,Z (local vert)	(R1,R2,R3)	fps
87	Docked DAP Config		OCTAL
	Chan 5 Inhibit		OCTAL
	Chan 6 Inhibit		OCTAL
88	Planet X,Y,Z	(R1,R2,R3)	.XXXXX
89	Docked DAP Rate		.0001deg/sec
	Docked DAP DB		.01deg
90	Rend Out-of-Plane Y (CSM)		.01nm
	Y DOT (CSM)		.1fps
	Y DOT (Soyuz)		.1fps
91	Optics Angles Shaft (R1)		.01deg
	Trun (R2)		.001deg
92	New Optics Angles Shaft (R1)		.01deg
	Trun (R2)		.001deg
93	Δ Gyro Angles X,Y,Z	(R1,R2,R3)	.001deg
94	COAS LOS Shaft (R1)		.01deg
	Trun (R2)		.001deg
95	TIG (NC1)		hrs,min,.01sec
96	Y (CSM)		.01nm
	Y Dot (CSM)		.1fps
	Y Dot (Soyuz)		.1fps
97	System Test Inputs	(R1,R2,R3)	XXXXX.
98	System Test Results		XXXXX.
			.XXXXX
			XXXXX.
99	Pos Err		ft
	Vel Err		.1fps
	Option (0=No Reinit,1=Rend)		0000X.

V50 N25 CHECKLIST CODES

R1 Code	Action	Function
00013	Key in	Gyro Torque Option (P52,P54)
00014	Key in	Fine Align Option
00015	Perform	Celestial Body Acq
00016	Key in	Terminate Mark Sequence
00017	Perform	MINKEY Rendezvous
00020	Perform	MINKEY PC Pulse Torquing
00041	Switch	CM/SM SEP to up
00062	Key in	CMC to STBY
00204	Key in	Engine Gimbal Test Option

V04 N06 (N12) OPTION CODES

R1 Code	Purpose	Input for R2
00001	Specify IMU Orientation	1=PREF 2=NOM 3=REFS
00002	Specify Vehicle	1=CSM 2=Soyuz
00004	Specify FULTKFLG Setting	0=VHF and Optics 1=VHF or Optics
00012	Specify P50 Option	1=Acq SS 2=Acq SS/ST 3=Ind. Source
00013	Specify P55 Option	1=IMU Aligned 2=IMU Not Aligned
00024	Specify P20 Mode	0=Rend (VECPOINT) 1=Celest body (VECPOINT) 2=Rotate 4=Rend (3-Axis) 5=Celestial body (3-Axis)

ALARM CODES

V05 N09 ALARM CODES

00107 Star tracker angles out of limits (P55).
00110 MARK REJECT has been entered but ignored.
Continue
00113 No inbits (Chan 16).
Continue; if alarm recurs use MDC DSKY.
00114 More marks made than desired.
Continue
00115 V41 N91 keyed with OPTICS MODE not in CMC.
OPTICS MODE - CMC and OPTICS ZERO - OFF
00116 Optics switch altered before 15 sec zero time elapsed.
OPTICS ZERO - ZERO (15 sec)
00117 V41 N91 keyed but CMC has reserved OCDU.
Consult STDN (Alarm should not occur)
00120 Optics torque has been requested but optics have not been zeroed since last FRESH START or RESTART.
OPTICS ZERO - OFF, then ZERO (15 sec)
00121 In 0.05 sec following mark, an ICDU changed by more than 0.033 degree.
Repeat MARK
(m)00205 PIPA saturated.
Use SCS control (G&N 12)
00206 The IMU zero routine has been entered with both the GMBL LOCK lt and NO ATT lt on.
Coarse align to 0,0,0; reselect V40E
(m)00207 ISS turn-on request not present for 90 sec (G&N 7a/3).
(m)00210 The IMU is not operating (G&N 12).
(m)00211 Coarse align error > 2 deg.
If P52 or P54 in progress, wait for F 50 25 00015 (CMC will pulse torque IMU at 0.5 deg/sec), then continue; if V41 N20, repeat. (G&N 12)
(m)00212 PIPA fail, but PIPA is not being used.
PIPA Check (G&N 6/7)
(m)00213 IMU not operating with turn-on request.
(G&N 7a/11)
00214 Program using IMU when turned off.
Exit program

ALARM CODES/
CMC RECOVERY

(m)00217 IMU coarse align or pulse torque difficulty has occurred.
If code 00211 also, perform 00211 cure only; then reinitiate current program.
If alarm recurs, terminate use of ISS (G&N 12)

00220 IMU orientation unknown.
Align IMU, or if aligned set REFSMFLG.

00401 Desired middle gimbal angle is excessive.
Call N22 - maneuver if MGA <85 deg, or realign IMU

00402 Second MINKEY pulse torque must be done.

00404 Target out of view (90 deg test).

00405 Acceptable star pair is not available.

00406 Rend navigation not operating.
Select P20 (Opt 0 or 4) or continue

00421 W-matrix overflow.
Notify STDN but continue (W-matrix automatically reinitialized at next mark)

00500 Not enough jets for Pitch/Yaw (Docked).

00501 Not enough jets for Roll (Docked).

00600 Failure in Phase Match Iteration (P31,P32).

00601 Failure in Height Mnvr Iteration (P31,P32).

00602 Failure in Outer Loop Iteration (P31,P32).

00603 Failure in ORDTPI iteration (P31,P32,P33).

00611 No TIG for given Elev Angle.

(m)00777 ISS warning caused by PIPA fail.
Perform 'CMC RECOVERY' (G/1-14) (G&N 6)

01102 CMC Self-Test error.

(m)01105 Downlink too fast.
RSET; if alarm recurs, Downlink Failure. (G&N 12)

(m)01106 Uplink too fast.
RSET; if alarm recurs, Uplink Failure. (G&N 12)

(m)01107 Phase-Table failure.
Assume Eras-Memory is destroyed (G&N SSR-3)
If Comm: 1. Contact STDN
2. V74E (erasable dump downlink) (42 sec - HBR)
3. Do P27 (as necessary)
4. V37E 51E, PRO, V37E 00E
5. V46E (V45E docked)
6. OPTICS ZERO - OFF, ZERO
7. 'REASONABLENESS CHECK' (G/1-14)
If alarm recurs, CMC Failure

01301 Arcsin or arccos input is greater than one.
Notify STDN, continue

(m)01407 VG increasing (G&N 12).

01426 IMU unsatisfactory (entry).
Realign or use SCS

01427 IMU reversed (entry).
Note FDAI operation is inverted

01520 V37 request not permitted at this time.
Wait till COMP ACTY lt not on continuously - reselect V37 or if P62-P67, select P00 and then desired program

01600 Overflow in drift test (gnd test alarm only)

01601 Bad IMU torque abort (gnd test alarm only)

01703 Insufficient time for integration.
TIG slipped

(m)03777 ISS warning caused by ICDU fail (G&N 6)

(m)04777 ISS warning caused by ICDU & PIPA fails (G&N 6)

(m)07777 ISS warning caused by IMU fail (G&N 6)

(m)10777 ISS warning caused by IMU & PIPA fails (G&N 6)

(m)13777 ISS warning caused by IMU & ICDU fails (G&N 6)

(m)14777 ISS warning caused by IMU, ICDU, & PIPA fails (G&N 6)

**20430 Orbital integration has been terminated to avoid possible infinite loop.
Notify STDN
Probable S.V. uplink required

**20607 No solution to conic subroutine.
Reselect program

**21204 Negative or zero time Waitlist call.
If Ave-G or extended verb on, continue; otherwise reselect program

**21206 Second job attempts to go to sleep via keyboard and display program.
See 21204

**21210 Second attempt is made to stall IMU.
Reselect program
Do not attempt use of IMU while CMC is using it

**21302 SQRT called with negative argument.
See 21204

**21501 Keyboard & Display alarm during internal use
See 21204

**21502 Illegal flashing display.
See 21204

**21521 P01 selected and P11 has already been performed.
Select correct program

*31104 Delay routine busy.
Reselect extended verb or continue with program

*31201 Executive overflow - no VAC Area.
Reselect extended verb and/or continue program

*31202 Executive overflow - no Core Sets.
See 31201

*31203 Waitlist overflow - too many tasks.
See 31201

*31211 Illegal interrupt of extended verb.
Reselect extended verb after optics marking is completed.

*32000 Docked DAP cycles overlap.

(m) - Malfunction Procedure indicated

**(2xxxx) - Generates restart (no lt), F V37 (P00D00)

*(3xxxx) - Restart (no lt) and program continues (i.e., attempted recovery) (BAILOUT)

NOTE - All ** alarms act as * type if they occur when Ave-G is on or display type extended verb is active

CMC RECOVERY

If P06 Inadvertently Selected (with F 50 25 00062):

1. a. Press PRO to STBY, then PRO to F 37
   or b. V37E 00E
2. V37E 51E, PRO, V37E 00E (Sets DRIFTFLG)
3. V25N7E, 77E, 10000E, 1E (Sets REFSMFLG)

If All 8's Appear Spontaneously on DSKY:

1. V99 N99
2. V25N01E
3. 00000E
4. +99999E
5. +99999E
6. +99999 CLR,CLR,CLR
7. 00000E
8. 00000E
9. 00000E

If OPR ERR, begin again

If LOS Before P27 CMC Auto Update Completed:

1. a. DSKY V33 N02: Key ENTR
   or b. DSKY V21 N01 (N02): Key V34E
2. UPLINK ACTY lt - out, P00 or P20 displayed
3. UPTLM (MDC) - BLOCK

If Leave MINKEY & Reenter:

1. If VHF marks desired, must redo V87
2. It is NOT necessary to redo V57
3. If backup optics marks desired, must redo V54
4. If VHF data processing desired, must redo V76
5. If MINKEY sequence is exited following TPM1 and reentered by selecting P36, CMC will not be aware that TPM1 has been performed. Following TPM2 burn, CMC will reselect P36.

If STBY lt Remains On During 'CMC POWER UP':

1. V37E 00E, then repeat power up (alternate DSKY)
2. If STBY lt still on:
   cb CMPTR MNA & MNB (2) - open, then close
3. V74E (erasable dump downlink) (42 sec - HBR)

If CSM S.V. Lost During Rendezvous No-Comm Period:

1. V47E (Soyuz S.V. to CSM slots)
2. P77 (Braking): N33 = 51:25:44.10
   N81 = (-15.8, -1.3, -23.5 fps)
3. P77's (nom TIG & negative nom ΔV - Rend Book) for each maneuver not yet executed -- load in reverse order to rend (TPI, NSR, NCC, NC2, NC1)

If Unable to Call P00, Perform Steps in Order as Req'd:

1. V96E
2. V36E, wait 15 sec, V96E
   or GOJAM (RSET + MARK REJ simultaneously), wait 15 sec, V37E 00E
3. Perform 'FRESH START RECOVERY'

If PIPA Fails During Ave-G:

1. Burn SCS
2. V36E prior to PRO on N85 (Prevent S.V. update)
3. P77 (load burn ΔV's)
4. Perform 'FRESH START RECOVERY'

If V36E or GOJAM Performed, or Alarm 01107 Occurs:

Perform 'FRESH START RECOVERY'

FRESH START RECOVERY (SSR-3)

Contact STDN
V74E (erasable dump downlink) (42 sec - HBR)
Do P27 (as necessary)
V37E 51E, PRO, V37E 00E (Sets DRIFTFLG)
V46E (V45E Docked)
OPT ZERO - OFF, then ZERO
Perform 'REASONABLENESS CHECK'

REASONABLENESS CHECK (TIME, S.V., and REFSMMAT)

V16N65E
V82E (both options), V83E
V37E 52E, AUTO OPTICS Check (2 stars)
(NO GO - do P51)

(For further S.V. check, do P21 or P29; STDN contact req'd)

CMC MONITOR/UPDATE

P27 CMC UPDATE

V37E 00E (Not nec. if P20 Opt 1,2,5 in foreground or V96E)

Auto Update:

1 UP TLM (2) - ACCEPT
UPLINK ACTY lt - on
Poss LOS before completion
*'CMC RECOVERY' (G/1-13) *

2 Update complete:
UPLINK ACTY lt - out
UP TLM (MDC) - BLOCK

Voice (PAD) Update:

1 V71E Loading Consec Addresses
or V72E Loading Single Addresses

2 F 21 01 R3 Verify buffer address 304
R1 Load index data from PAD, E
R3 Verify next buffer address 305

3 F 21 01 R1 Load next data from PAD, E
Repeat Step 3 for all data

4 F 21 02 R3 330
(Verify Data) V1N1E
R3 304E
R1 Verify index data
N15E (R3 305)
R1 Verify data
Consecutive ENTR's display remaining data. Note octal ident (01-24) of incorrect data
KEY REL, to 5

5 F 21 02 R3 330
(Change) Load octal indent, XXE to 3
(Accept Update) Key V33E

6 P00 or P20 Displayed (key P00 if V96E)
Perform 'REASONABLENESS CHECK' (G/1-14)

P77 ΔV UPDATE

1		V37E 77E	
	F 06 33	TIG	(hrs,min,.01sec)
		Load TIG	
		PRO	
2	F 06 81	ΔV X,Y,Z (LV)	(.1fps)
		Load ΔV	
		PRO	
3	F 37		

V55 CMC TIME UPDATE (Decimal)

1		V55E	
	F 21 24	Load Δ CMC Time	(hrs,min,.01sec)
2		V16N65E	
		Check Updated Time	
		V37E 00E	

A. *CHANGE DATA IN ERASABLE (SINGLE ADDRESS) MEMORY

V21N1E
F 21 01 Load ADDRESS (R3), E
Load DATA in R1, E

B. DISPLAY/VERIFY DATA IN (SINGLE ADDRESS) ERASABLE MEMORY

V1N1E
01 01 Load ADDRESS (R3), E
Read DATA in R1

C. *CHANGE DATA IN ERASABLE (CONSEC ADDRESS) MEMORY

V21N1E, (ADDRESS) E
F 21 01 Load ADDRESS (R3), E
Load DATA in R1, E
N15E (for next word)
ENTR (for each succeeding word)

D. DISPLAY/VERIFY DATA IN (CONSEC ADDRESS) ERASABLE MEMORY

V1N1E,
01 01 Load ADDRESS (R3), E
Read DATA in R1
N15E (For next word)
ENTR (For each succeeding word)

*NOTE: If data is loaded over a flashing display, V21 N01 will be overwritten following XXXXXE. Re-key V21N1E before each load.

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FLAG WORD DISPLAY

```
1          V1N1E, (FLGWD Address) E
2    01 01 R1 FLGWD, R3 ADDRESS
3          KEY REL
```

FLAG WORD SET/RESET

```
1          V25N7E
   F 21 07 (Load FLGWD Address) E
2  F 22 07 (Load Bit Code)* E
3  F 23 07
        (Set Bit)   1E
        (Reset Bit) E
```

*To determine code:

Find bit in chart. Number above bit (4,2 or 1) is code.
(Used in correct octal position)

For more than one bit, add codes.

Examples:	Bit	Code
	3	4
	6	40
	7	100
	15&13	50000

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FLAGWORD BIT ASSIGNMENTS

FLGWRD	ADRS	4 BIT 15	2 BIT 14	1 BIT 13	4 BIT 12	2 BIT 11	1 BIT 10	4 BIT 9	2 BIT 8	1 BIT 7	4 BIT 6	2 BIT 5	1 BIT 4	4 BIT 3	2 BIT 2	1 BIT 1
0	74		JSWITCH	P55.1FLG	P50.1FLG	ATMFLAG	P30FLAG	NEEDLFLG	IMUSE	RNDVZFLG	SGTMK (R53FLAG)	NC12FLG	CYC61FLG	FREEFLAG	NCINTFLG	P29FLAG
1	75	2JETSFLG (NJETSFLG)	STIKFLAG	ERADCOMP (ERADFLAG)	NODOP01	RCSBURN (ENGZFLAG)	LMTRG (TARG1FLG)	NCLPFLG	CSMUPDAT (VEMUPFLG)	UPDATFLG	IDLEFAIL	TRACKFLG	MARKFLG	ITER1SW (SLOPESW)	GUESSSW	AVEGFLAG
2	76	DRIFTFLG	R21MARK	ITERFLG	P21FLAG	STEERSW	SKIPVHF	IMPULSW	XDELVFLG	FIRSTFLG HAVEELEV (ETPIFLAG)	FINALFLG	REVFLAG	PFRATFLG	S8FLAG	CALCMANZ	NODOV37 (NODOFLAG)
3	77	V50N18FL	GLOKFAIL	REFSMFLG	500**FLG	501**FLG	VFLAG	POOFLAG	PRECIFLG	CULTFLAG	45/46FLG	STATEFLG	CONICINT (INTYPFLG)	CSMINTSW (VINTFLAG)		WMATINT (DIROFLAG)
4	100	MARKIDLE (MRKIDFLG)	PRIOIDLE (PRIODFLG)	NORMIDLE (NRMIDFLG)	PDSPFLAG	MARKWAIT (MWAITFFG)	NORMWAIT (NWAITFLG)	MRKWTKEY (MRKNVFLG)	NRMWTKEY (NRMNVFLG)	PRONTKEY (PRONVFLG)	PINBRFLG	RUPTMARK (MRUPTFLG)	RUPTNORM (NRUPTFLG)	MKOVNORM (MKOVFLAG)	VNFLAG	XDSPFLAG
5	101	DSKYFLAG				FSTINCRP (INCORFLG)	NEWTFLAG			ENGONFLG	3AXISFLG	BKUPLO (GRRBKFLG)		NOSOLNSW (SOLNSW)		RENDWFLG
6	102	DAPBIT1	DAPBIT2	STRULLSW ENTRYDSP	CMDAPARM	GAMDIFSW	GONEPAST	RELVELSW	EGSW	NOSWITCH	HIND	INRLSW	LATSW	OSGSW	CNDSTBY	GYRDIF
7	103	TERMIFLG	ITSWITCH	IGNFLAG	ASTMFLAG	TIMRFLAG	NORMSW	RVSW	GONEBYTG (GONEBY)		V37FLAG		UPLOCKFL	VERIFLAG	LRATTCH (ATTCHFLG)	TFFSW
8	104			NEWIFLG				UTFLAG		INFINFLG	ORDERSW	APSESW	COGAFLAG	V96UNFLG	R67FLAG	360SW
9	105	SWTOVER			MAXDBFLG			VHFRFLAG	VHFSOURC	R22CAFLG	N22ERNDS (N22ORN17)	QUITFLAG	R31FLAG	RIDTFLAG	RIDAVFLG	AVERIOSW
10	106	PCMANFLG	INTINUSE (INTFLAG)	INTGRAB (REINTFLG)	REJCTFLG	HDSUPFLG		EXTRANGE	P35FLAG	AUTOSEQ	TCOMPFLG	MANEUFLG	PTV93FLG	TPIMNFLG	FULTKFLG	PCFLAG
11	107				R27FLAG	CYCLFLAG	NOUNFLG	N77FLAG	AZIMFLAG	FIXFLAG	SNAPFLAG	P48FLAG	P25FLAG	TDFLAG	R27UP2	R27UP1

CHANNEL SET/RESET

NOTE: Only Channel No's <30 may be used

1 Display output channel

2 V25N7E
F 21 07 (Load Channel Number) E

3 F 22 07 (Load Bit Code)* E

4 F 23 07
(Set Bit) 1E
(Reset Bit) E

*To determine code:

Find bit in chart. Number above bit (4,2 or 1) is code.
(Used in correct octal position)

For more than one bit, add codes.

Examples:	Bit	Code
	3	4
	6	40
	7	100
	15&13	50000

DISPLAY OF INPUT/OUTPUT CHANNELS

V11N10E
F 01 10 (Load Channel Address) E
R1 OCT CONTENTS OF SPECIFIED CHNL

MODE SWITCH OVERRIDE

NOTE: Place switch(s) to desired mode before proceeding

(Via Channel 31/33 Control)

V21N1E, 373E, A00D0 ENTR

A=0: Use switches
(SC CONT and CMC MODE)
A=1: CMC FREE
A=2: CMC HOLD
A=3: CMC AUTO
A=5,6 or 7: SCS

D=0: Use switches (OPTICS)
D=1: OPT CMC
D=2: OPT ZERO
D=3: OPT MAN

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CMC INPUT/OUTPUT CHANNELS

CHANNEL		NAME	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1
			BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1
CP	1	L			SHFT PULSE			CENTRAL PROCESSOR REGISTER L, BITS 16-1									
	2	Q			SHFT PULSE			CENTRAL PROCESSOR REGISTER Q, BITS 16-1									
	3	HISCALAR			SHFT PULSE			HIGH-ORDER SCALAR CHANNEL, BITS 14-1									
	4	LOSCALAR			SHFT PULSE			LOW-ORDER SCALAR CHANNEL, BITS 14-1									
OUT	5	PYJETS								B4: -YW/+X Z6: -YW	B3: +YW/-X 15: +YW	D4: -YW/-X 16: -YW	D3: +YW/+X 25: +YW	A4: -P/+X 14: -P	A3: +P/-X 23: +P	C4: -P/-X 24: -P	C3: +P/+X 13: +P
	6	ROLLJETS								C2: -R/+Y	C1: +R/-Y	A2: -R/-Y	A1: +R/+Y	D2: -R/+Z 22: -R	D1: +R/-Z 21: +R	B2: -R/-Z 12: -R	B1: +R/+Z 11: +R
CP	7	SUPERBNK									F-EXT 7	F-EXT 6	F-EXT 5				
OUT	10	OUT0	RELAY ADRS 4	RELAY ADRS 3	RELAY ADRS 2	RELAY ADRS 1	RELAY BIT 11	RELAY BIT 10	RELAY BIT 9	RELAY BIT 8	RELAY BIT 7	RELAY BIT 6	RELAY BIT 5	RELAY BIT 4	RELAY BIT 3	RELAY BIT 2	RELAY BIT 1
	11	DSALMOUT			SPS ENGINE ON/OFF			RESET DSKY STATUS LTS	TEST CONN BIT(AVE-G)		DPR ERR LAMP	VN FLASH	KEY REL LAMP	TEMP LAMP	UPLINK ACTY LAMP	COMP ACTY LAMP	ISS WARN
	12	CHAN12	ISS TURNON DELAY DONE	SIVB CUTOFF	SIVB INJ SEQ START		DISABLE OPTICS DAC	ZERO OPTICS	SIVB TAKE-OVER ENABL	TVC ENABLE		IMU ERROR CTR ENABLE	ZERO ICDU'S	IMU COARSE ALN ENABLE		OPTICS ERR CTR ENABLE	ZERO OPT CDU'S
	13	CHAN13	ENABLE T6RUPT	RESET TRAP 32 (B10-1)	RESET TRAP 31B(B12-7)	RESET TRAP 31A (B6-1)	STANDBY ENABLE	TEST DSKY LIGHTS			DNLNK WORD ORDER CODE	BLOCK UPLINK	ENABLE CROSSLINK	VHF DATA READ ACTY			VHF RANGE SELECT
	14	CHAN14	DRIVE CDUX	DRIVE CDUY	DRIVE CDUZ	DRIVE TVC YAW/CDUT	DRIVE TVC PITCH/CDUS	GYRO ACTY	NEG GYRO TORQ CMD	00=NO GYRO 01=X GYRO	10=Y GYRO 11=Z GYRO	GYRO ENABLE					
IN	15	MNKEYIN											MDC KEY CODE BIT 5	MDC KEY CODE BIT 4	MDC KEY CODE BIT 3	MDC KEY CODE BIT 2	MDC KEY CODE BIT 1
	16	NAVKEYIN									MARK REJ	MARK	NAV KEY CODE BIT 5	NAV KEY CODE BIT 4	NAV KEY CODE BIT 3	NAV KEY CODE BIT 2	NAV KEY CODE BIT 1
	30*	CHAN30	IMU TEMP IN LIMITS	ISS TURNON REQUEST	IMU FAIL	ICDU FAIL	IMU CAGE	SC CONTROL OF SIVB	IMU OPERATE OK		OPTICS CDU FAIL		LIFT-OFF (SIVB SIG)				
	31*	CHAN31	G&N S/C CONTROL	FREE MODE	HOLD MODE	THC -Z	THC +Z	THC -Y	THC +Y	THC -X	THC +X	RHC -ROLL	RHC +ROLL	RHC -YAW	RHC +YAW	RHC -PITCH	RHC +PITCH
	32*	CHAN32		PROCEED								MIC -ROLL	MIC +ROLL	MIC -YAW	MIC +YAW	MIC -PITCH	MIC +PITCH
	33*	CHAN33	OSCILLATOR ALARM	COMPUTER WARNING	PIPA FAIL	DOWNLINK TOO FAST	+UPLINK TOO FAST						CMC OPTICS MODE	ZERO OPT MODE		VHF RANGE DATA OK	
OUT	34	DNTM1						FIRST DOWNLINK WORD OF TWO WORDS									
	35	DNTM2						SECOND DOWNLINK WORD OF TWO WORDS									
	77	RESTART MONITOR							SCALAR DBL FREQ	SCALAR FAIL	COUNTER FAIL	VOLTAGE FAIL	NIGHT WATCHMAN	RUPTLOC	TC TRAP	PARITY FAIL(ERAS)	PARITY FAIL(BOTH)
			BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1

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ERASABLE MEMORY PROGRAMS

ASTP EMP LIST

The following list represents only those EMP's which may have application to ASTP.

EMP NO.	TITLE OF EMP
SL-3	GDC REFSMMAT Determination, IMU Fail (G/1-24)
SL-4	Backup Optics Variance in R22 with Degraded IMU or Optics
SL-5	Marking with Failed Mark Button (G/1-25)
SL-6	DSKY Display of VHF Range During P37
SL-9	Inhibit IMU Coarse Alignment due to Runaway CDUZ During Coasting Flight (G/1-26)
*SL-15	VHF Manual Range Input (G/1-27)
SL-21	Enter P51/P53 if IMU Operate Bit has Failed Off (G/3-13, Step 3)
SL-22	SPS Gimbal Drive Test (G/2-9)
*SL-23	Monitor Jet-On Failure (G/1-28)
*SL-26	ICDU Transient Monitor (Non-Rend) (G/1-29)
*SL-27	Single ICDU Transient Monitor (TPI to TPF) (G/1-31)
*SL-28	Combined ICDU Transient and Jet-On Monitor (G/1-32)
*SL-50	GDC REFSMMAT Realign, IMU Failed (G/1-33)
*ASTP-75	S-BAND Antenna Angle Computation (G/1-35)
*ASTP-76	Translational Impulse Mode (G/1-36)
*ASTP-77	MA 083 Raster Scan Maneuver (G/1-37)

*Requires a P27 uplink of program coding.

EMP GENERAL RESTRICTIONS

1. EMP's are not protected against hardware restart (SL-23 excepted). If a RESTART occurs, repeat procedure.
2. A Fresh Start (V36E) will generally cause EMP operation to be terminated.
3. EMP's will not overwrite erasable PADS or fixed-memory programs, but indiscriminate selection of programs and/or extended verbs can cause EMP's to be overwritten. Refer to specific EMP.

EMP GENERAL RESTRICTIONS (CONT)

4. The following matrix reflects for ASTP those EMP's which are not compatible due to areas of common coding (N26 excluded):

If EMP Loaded	Specified EMP is Overwritten SL -23	SL -26	SL -27	SL -28	ASTP -75	ASTP -76	ASTP -77
SL-23	---			X		X	X
SL-26		---	X	X	X	X	
SL-27		X	---	X	X	X	
SL-28	X	X	X	---	X	X	X
ASTP-75		X	X	X	---	X	
ASTP-76	X	X	X	X	X	---	X
ASTP-77	X			X			---

EMP SL-50 is compatible with the above EMP's.

EMP SL-3: GDC REFSMMAT Determination, IMU Failed

Purpose:
A means of using the GDC in place of the IMU to determine S/C orientation. EMP SL-3 bypasses the first part of P51 to permit use of the program with the GDC.

Restrictions:
1. Do not start the EMP with extended verbs running or from anything but P00.
2. The IMU power switch must be off before starting the EMP.
3. Constant attitude must be maintained from loading GDC angles until MARK.
4. Perform rendezvous optics marking after GDC REFSMMAT Determination only if N20 is loaded to FDAI values.
5. GDC REFSMMAT Realign (G/3-15) must be repeated frequently if an accurate alignment is to be maintained, due to high GDC drift rates.

Procedures:
Perform 'GDC REFSMMAT DETERMINATION' (G/3-13)

EMP SL-5: Mark Push Button Failed

Purpose:
A means of using the LEB DSKY to inform the CMC of an optics mark whenever the MK PB or MK Input Channel has failed.

Restrictions:
1. The EMP cannot be used if either the MK PB or the MK REJ PB has failed hard-on.
2. The EMP cannot be used if the MK channel bit has failed off and the MK REJ channel bit has failed on.
3. Execution of the EMP is not reliable if the MK or MK REJ channel has failed intermittently on.
4. If the MK channel bit or both the MK and MK REJ channel bits have failed on, the MDC DSKY (essentially a two-man operation) must be used to execute the EMP with any key on the LEB DSKY depressed to effect the mark.
5. The EMP cannot be used to perform MK REJ's.

Procedures:

1 V25N26E, 1E, 2151E, 16067E
V31 (Do not ENTR)

2 When SXT ready to mark: key ENTR
(Must use LEB DSKY)

NOTES: Use MK REJ to reject.

As long as 31 remains in verb window, ENTR may be used to MARK. Otherwise, V31 must be re-keyed.

In P20, the EMP does not interfere with normal DSKY operations (e.g., V76E and V16N76E are permitted).

3 TERMINATE: V21N26E, E

EMP SL-9: Inhibit IMU Coarse Align Due to Runaway CDUZ

Purpose:
A means of inhibiting IMU coarse alignment due to T4RUPT monitoring of a runaway CDUZ during coasting-flight.

Restrictions:
1. The crew must assume total responsibility (i.e., monitor GDC Ball) to avoid an actual gimbal-lock condition and subsequent IMU dump. The CMC logic to provide an automatic coarse align is bypassed by the EMP.
2. Since the GIMBAL LOCK status lamp remains on continuously (consequence of the runaway CDUZ), a primary visual cue of an actual impending gimbal-lock condition is lost to the crew.
3. Consult STDN for SPS burns (TVC DAP will not operate normally with EMP running).
4. Consult STDN for entry (Ave-G will not be enabled in P62 with EMP running).
5. During translations, DAP performance will be degraded (overcontrol but stable).
6. Do not select V46 (activate CSM DAP) while EMP is running. Docked DAP V44 & V45 may be executed with the EMP running.
7. The EMP will be disabled via V37E XXE while Ave-G is on (P4X or P6X).
8. V82 data (N44) will not generally be valid for the specified event time (N16).

Procedures:
V48E, 3XXXXE (Saturn DAP), V34E
V25N7E, 75E, 1E, 1E (sets AVEGFLAG)

NOTE: Refer to CSM MALFUNCTION PROCEDURES (G&N 7/11) for additional details regarding malfunction.

EMP SL-15: VHF Manual Range Input

Purpose:
A means of manually loading VHF range data into the CMC (for rend navigation) in the event data cannot be acquired automatically by the CMC.

Restrictions:
1. Consult STDN regarding usage of this EMP (STDN S.V. updates could be alternate solution to VHF/CMC interface problem).
2. The EMP will be overwritten by P27, P40, P41, P52/P54 Opt 1 or 2, or P52 NPC (XSMD overlay).
3. EMP cannot be executed while R22 (optics or VHF S.V. updating) or R27 is operating.
4. A new range value cannot be loaded until the previous manual range mark has been processed.
5. Manual range entries limited to values <163.83 nm. Consult STDN if actual VHF range is > 163.83 nm.
6. Requires an uplink of program coding (2 loads).

Procedures:

Rendezvous in Progress

1 V88E (Inhibit R22 VHF processing)
V77E (Terminate R27)
V25N26E, 26001E, 306E, 70067E
V16N45E if required

2 F 16 45 Observe R1 mark counter to increment (R22 mark processing complete)

3 V21N2E, 3663E, +RAN.GE ENTR (future value)
V30 (Do not ENTR)
When VHF range approaches value loaded: ENTR

WARNING

*Cannot perform 'MARK REJ' to *
*recover from a bad mark (can *
reject via V32E if get a N49)

To process additional VHF marks, repeat steps 2 and 3 for each mark.

4 TERMINATE: V21N26E, E

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EMP SL-23: Monitor Jet-On Failure

Purpose:
A means of continuously monitoring (once/sec) DAP att errors in order to detect RCS jet-on failures. The ISS C/W indicator and MASTER ALARM are activated in the event a failure is detected.

Restrictions:
1. The EMP requires the CSM DAP or Docked DAP to be active & the S/C to remain in CMC/AUTO or HOLD.
2. EMP cannot be used during VHF marking periods.
3. The EMP will be disabled via V37E XXE.
4. Do not execute EMP with Ave-G on (P4X or P6X) since use same restart group (Consult STDN).
5. Auto maneuvers or CDU failures may cause a false indication of a jet-on failure.
6. Requires an uplink of program coding (2 loads).

Procedures:

ISS - on
DAP or Docked DAP - on (G/2-13, 2-14)
SC CONT - CMC
CMC MODE - AUTO or HOLD

1 Perform 'P27 CMC UPDATE' (G/1-15)
STDN will uplink EMP SL-23

2 V37E XXE (Select prior to starting EMP)

3 V25N26E, 1E, 605E, 6E
V31E
V21N26E, E

4 To Verify Operation of EMP:
V16N45E (Note 'VHF marks' counting up)
KEY REL

5 To Reset MASTER ALARM:
V25N7E, 11E, 1E, E

6 TERMINATE: V37E XXE

EMP SL-26: ICDU Transient Monitor (Non-Rend)

Purpose:
A means of continuously monitoring (during non-rend periods) ICDU angular changes in order to detect a CDU transient. The CDU counter is restored to its previous value and the OPR ERR and ISS C/W indicator lamps, and the MASTER ALARM are activated in the event a CDU transient is detected.

Restrictions:
1. EMP usage is restricted to non-rend mission phase (Rend navigation and P31-P36 overwrite EMP).
2. CMC Self-Check is not permitted.
3. Large maneuver rates could induce gimbal angle rates sufficient to cause a false indication of an ICDU transient. This effectively freezes the CDU, resulting in loss of attitude control about that axis.
4. Requires an uplink of program coding (6 loads).

Procedures:

ISS - on

1 Perform 'P27 CMC UPDATE' (G/1-15)
STDN will uplink EMP SL-26

2 V25N26E, 1E, 1517E, 5E
V31E
V21N26E, E

3 To Verify Operation of EMP:
V16N45E (Note 'VHF marks' counting up)

4 To Reset OPR ERR and MASTER ALARM:
RSET
V25N7E, 11E, 46001E, E
MASTER ALARM - reset

NOTES: CDU runaway if OPR ERR cannot be cleared by RSET.

Following a CDU transient, perform V40E as soon as possible to resynchronize CDU counters.

To determine which CDU affected by transient:
V1N10E, 11E, observe R1 = ABXXX

If B = 2 or 3, CDUX transient
If B = 4 or 5, CDUY transient
If B = 6 or 7, CDUX & CDUY transients
If A = 4 or 5, CDUZ transient

5 TERMINATE: V74E
V37E XXE (no wait required)

EMP SL-27: Single ICDU Transient Monitor (TPI to TPF)

Purpose:
A means of continuously monitoring (terminal phase rend) ICDU changes for a specified CDU in order to detect a CDU transient. The CDU counter is restored to its previous value and the OPR ERR and ISS C/W indicator lamps, and the MASTER ALARM are activated in the event a CDU transient is detected.

Restrictions:
1. EMP usage is intended only during terminal phase rend (P31-P34 will overwrite EMP).
2. CMC Self-Check is not permitted.
3. Large maneuver rates could induce gimbal angle rates sufficient to cause a false indication of an ICDU transient. This effectively freezes the CDU, resulting in loss of attitude control about that axis.
4. Consult STDN regarding changes to TLM bit rate.
5. Consult STDN regarding selection of different CDU to be monitored.
6. Requires an uplink of program coding (6 loads).

Procedures:

ISS - on

1 Perform 'P27 CMC UPDATE' (G/1-15)
STDN will uplink EMP SL-26

2 V25N26E, 1E, 1440E, 4E
V31E
V21N26E, E

3 To Reset OPR ERR and MASTER ALARM:
RSET
V25N7E, 11E, 1E, E
MASTER ALARM - reset

NOTES: CDU runaway if OPR ERR cannot be cleared by RSET.

Following a CDU transient, perform V40E as soon as possible to resynchronize CDU counters.

4 TERMINATE: V74E

EMP SL-28: Combined ICDU Transient & Jet-On Monitor

Purpose:
A means of continuously monitoring:
1. DAP attitude errors (once/sec) in order to detect RCS jet-on failures. The ISS C/W indicator and MASTER ALARM are activated in the event a failure is detected.
2. ICDU angular changes in order to detect a CDU transient. The CDU counter is restored to its previous value and the OPR ERR and ISS C/W indicator lamps, and the MASTER ALARM are activated in the event a CDU transient is detected.

Restrictions:
1. Perform EMP only in P00 or P20 Opt 2 or 5.
2. CMC Self-Check is not permitted.
3. The EMP requires the CSM DAP or Docked DAP to be active & the S/C to remain in CMC/AUTO or HOLD.
4. Auto maneuvers or CDU failures may cause a false indication of a jet-on failure.
5. Large maneuver rates could induce gimbal angle rates sufficient to cause a false indication of an ICDU transient. This effectively freezes the CDU, resulting in loss of attitude control about that axis.
6. Requires an uplink of program coding for both EMP SL-26 (6 loads) and SL-28 (3 loads).

Procedures:

ISS - on
DAP or Docked DAP - on (G/2-13, 2-14)
SC CONT - CMC
CMC MODE - AUTO or HOLD

1 Perform 'P27 CMC UPDATE' (G/1-15)
STDN will uplink EMP SL-26 & SL-28

2 V25N26E, 1E, 1522E, 5E
V31E
V21N26E, E

3 To Reset OPR ERR and MASTER ALARM:
RSET
V25N7E, 11E, 46001E, E
MASTER ALARM - reset

NOTES: CDU runaway if OPR ERR cannot be cleared by RSET.

Following a CDU transient, perform V40E as soon as possible to resynchronize CDU counters.

To determine which CDU affected by transient:
V1N10E, 11E, observe R1 = ABXXX

If B = 2 or 3, CDUX transient
If B = 4 or 5, CDUY transient
If B = 6 or 7, CDUX & CDUY transients
If A = 4 or 5, CDUZ transient

4 TERMINATE: V74E
V37E XXE (no wait required)

EMP SL-50: GDC REFSMMAT Realign, IMU Failed

Purpose:
A means of obtaining from P52 MARK data the resultant ICDU angles required for a GDC realign to REFSMMAT.

Restrictions:
1. V44, V45, V46, and V48 will overwrite EMP.
2. The IMU power switch must be off before starting EMP.
3. No active extended verbs between F 06 93 and keying V30E.
4. The contents of N20 at each mark, and at the execution of the EMP must agree with the GDC angles. Therefore, it is necessary to load N20 with the FDAI attitude prior to each mark.
5. Constant atttitude must be maintained from EMP execute until GDC align.
6. GDC REFSMMAT Realigns (G/3-15) must be repeated frequently if an accurate alignment is to be maintained, due to high GDC drift rates.
7. Requires an uplink of program coding (2 loads). If Comm failure, load EMP manually (G/1-34).

Procedures:
Perform 'GDC REFSMMAT REALIGN' (G/3-15)

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EMP SL-50 UPLINK LOADS (GDC REFSMMAT REALIGN)

NOTE: In the event of No-Comm condition, the EMP may be loaded manually via P27 (G/1-15)

PURP				V	7	1				V	7	1
GET			:	:					:	:		
304	01	INDEX			2	4	INDEX				2	4
305	02	0	3	2	4	2	0	3	2	6	4	
306	03	0	6	0	0	6	4	7	3	0	3	
307	04	7	7	7	7	5	7	7	7	7	6	
310	05	0	2	7	0	3	3	4	1	2	4	
311	06	0	2	6	6	1	5	5	2	3	7	
312	07	7	7	7	7	5	3	5	0	4	0	
313	10	0	2	7	1	1	0	4	6	4	7	
314	11	0	2	6	6	7	2	4	0	0	0	
315	12	7	7	7	7	5	2	0	4	5	6	
316	13	0	2	7	1	7	0	5	5	3	7	
317	14	0	2	6	7	5	0	1	6	7	7	
320	15	7	7	6	3	4	0	5	5	3	7	
321	16	2	4	0	1	7	0	0	0	0	4	
322	17	4	7	4	7	1	0	0	0	0	6	
323	20	7	7	6	3	4	3	1	3	0	0	
324	21	2	4	0	1	7	5	2	0	3	3	
325	22	3	4	7	4	7	3	1	3	0	1	
326	23	7	7	6	3	4	5	4	0	3	4	
327	24	2	4	0	1	7	0	5	5	3	7	

EMP ASTP-75: S-BAND Antenna Angle Computation

Purpose:
A means of determining the current S-BAND antenna pointing angles between the CSM and the ATS-F.

Restrictions:
1. EMP usage is restricted to non-rend mission phase (Rend navigation and P31-P36 overwrite EMP).
2. EMP cannot be executed while a display-type extended verb is running.
3. EMP cannot be executed in parallel with most EMP's requiring an uplink (see 'EMP GENERAL RESTRICTIONS', G/1-23).
4. Requires ATS-F S.V. to be uplinked into Soyuz S.V. slots.
5. Requires an uplink of program coding (5 loads).

Procedures:

ISS - on & aligned

1 Perform 'P27 CMC UPDATE' (G/1-15)
STDN will uplink EMP ASTP-75 and ATS-F state vector

2 V25N26E, 10001E, 1412E, 66105E
V30E

3 F 16 43 RHO,GAMMA (.01deg,.01deg)
HGA TRACK - MAN
HGA BEAM - WIDE
Set required P&Y angles
Tune for signal strength > 1/3 scale
HGA TRACK - REACQ
HGA BEAM - NARROW
PRO (Exit)

NOTES: N43 display will be updated once/sec.

RHO - S-BAND Ant PITCH
GAMMA - S-BAND Ant YAW

If V32E is keyed, a meaningless display of N44 will occur; to recover, key N43 (or V34E to exit EMP).

EMP ASTP-76: Translational Impulse Mode

Purpose:
A means of providing fixed length, 2-jet impulse translations via the THC.

Restrictions:
1. Use only in P20 Option 5 and P00.
2. EMP must be terminated before activating CSM-alone DAP (V46E).
3. Enter one THC command at a time; return to detent between commands.
4. All jets are (hardware) enabled.
5. Downlink high bit rate has been selected.
   Note: Low bit rate could synchronize with DAP and inhibit operation of EMP ASTP-76.
6. The vehicles are not actually docked.
7. Do not call P21, P29, any P3X, or CMC SELF-CHECK.
8. EMP ASTP-75 is not valid anytime after uplink of ASTP-76 program coding (15 loads).

Procedures:

ISS - on & aligned

1		V44E
	F 05 87	V25E,E,E,E
		PRO
	F 06 89	
		PRO
2		V45E
3		V31E (Key only once)
		V5N26E, verify 00001, 01536, 12007
4		TERMINATE: V31E

NOTES: Activation of EMP ASTP-76 via V31E alters N26 so that the next V31E terminates the EMP.

If Restart occurs prior to activation:
V25N26E, 1E, 1555E, 12007E
V31E

If Restart occurs after activation:
V25N26E, 1E, 1523E, 12007E
V31E

EMP ASTP-77: MA 083 Raster Scan Maneuver

Purpose:
To mnvr the spacecraft in a predefined manner to perform a Raster Scan which determines the misalignment of the EUV Telescope.

Restrictions:
1. Must always be started at the initial attitude.
2. N79 must always be loaded with 0.1 deg/sec rate for MA 083. For other scan sizes, N79 is variable.
3. Raster Scan size can be changed by uplink.
4. Requires an uplink of program coding (7 loads).

Procedures:

ISS - on & aligned
DAP or Docked DAP - on (G/2-13, 2-14)
SC CONT - CMC/AUTO

1 V37E 00E

2 Mnvr to initial attitude
V49E (G/6-15)
RHC - LOCKED

3 V25N79E, +01000E, +00020E

4 V25N26E, 1E, 1622E, 74007E
V31E

5 TERMINATE: Self terminating normally
or Any RHC command will stop EMP

V37E XXE

NOTES: The normal scan consists of 9 segments:
1. a 6 deg positive roll segment,
2. a 1 deg pitch/yaw segment,
3. a 6 deg negative roll segment,
4. etc.

POWER UP/POWER DOWN

CMC POWER UP

1 PRO, hold (~5 sec) until STBY lt - out
(repeat, if necessary)
*CMC Warning, RESTART, PROG Alarm *
RSET & continue. If STBY lt remains
* on, see 'CMC RECOVERY' (G/1-13) *

2 F 37 V96E
Perform 'P27 CMC UPDATE' (G/1-15)

P06 CMC POWER DOWN

V37E 06E
F 50 25 00062 CMC PWR DN

PRO, hold (~5 sec) until STBY lt - on
(repeat, if necessary)

IMU POWER UP

1 If FDAI desired:
FDAI/GPI PWR - 1
LOGIC PWR 2/3 - on (up)
FDAI SELECT - 1
FDAI SOURCE - CMC

2 CMC MODE - FREE
G/N IMU PWR - on (up)
NO ATT lt - on (90 sec)
NO ATT lt - out
Wait 15 sec (to allow PIPA inhibit reset)

3 V37E XXE
*If CMC Not Available: *
* G/N IMU PWR - on (up), wait 90 sec*
* IMU CAGE - on (up) 5 sec, release *

IMU POWER DOWN

1 CMC MODE - FREE
G/N IMU PWR - OFF
ISS WARNING - RSET and continue

2 Wait 5 min prior to 'IMU POWER UP'

BACK

COLOR_____

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2-2

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POWER UP
POWER DOWN

SCS POWER UP

1 SC CONT - CMC

2 cb SCS LOGIC BUS (4) - close
FDAI/GPI PWR - OFF
BMAG PWR 1 - ON (25 sec spinup) (70W)
BMAG PWR 2 - as required (71W)
FDAI/GPI PWR - 1 or BOTH (17W or 31W)
LOGIC PWR 2/3 - on (up)
SCS ELECT PWR - ECA or GDC/ECA (30W or 89W)
SIG COND/DR BIAS PWR 1 - AC1, 2 - AC2
AUTO RCS SELECT (16) - enable

3 If Docked to Soyuz:
MAN ATT (R) - MIN IMP

4 If required:
THC PWR - on (up)
RHC PWR NORM 2 - AC/DC
RHC, THC - ARMED

NOTE: If BMAG's - OFF prior to SCS power up, C/W BMAG TEMP lts - out following 40 min warmup period.

If BMAG PWR 1 - WARM UP, BMAG PWR 2 - OFF, BMAG #1 can be brought up rapidly as RATE 1 or as ATT 1/RATE 2 with BMAG #2 providing a servicable rate reference within ~2 min.

SCS POWER DOWN

(Partial-G&N Control, or Total Power Down)

1

EMS FUNCTION - OFF
EMS MODE - STBY
FDAI SCALE - 5/1
FDAI SELECT - 1
FDAI SOURCE - CMC
ATT SET - GDC
MAN ATT (3) - RATE CMD
LIM CYCLE - OFF
ATT DB/RATE - MAX/LOW
THC PWR - OFF
RHC PWR NORMAL (2) - OFF
RHC PWR DIRECT (2) - OFF
SC CONT - CMC
BMAG MODE (3) - RATE 1
SCS TVC (2) - RATE CMD
ATVC GAIN - HI
EMS Roll - OFF
.05G SW - OFF
TVC GMBL DRIVE (2) - 1

2

TVC SERVO PWR (2) - OFF (Verify)
BMAG PWR 2 - OFF (~71W savings)
BMAG PWR 1 - WARM UP (~20W savings) or
- OFF (~70W savings)

3

	SCS PWR DN	G&N CONTROL AUTHORITY
FDAI/GPI PWR	- OFF	1
LOGIC PWR 2/3	- OFF	on (up)
SCS ELEC PWR	- OFF	ECA
SIG COND/DR BIAS PWR (2)	- OFF	1-AC1, 2-AC2
AUTO RCS SELECT (16)	- OFF	enabled
cb SCS LOGIC BUS (4)	- open	closed
RHC & THC - as required		

NOTES: If BMAG PWR 1 - OFF, BMAG #1 will require ~40 min warmup to provide stable att ref.

If BMAG PWR 1 - WARM UP, BMAG PWR 2 - OFF, BMAG #1 can be brought up rapidly as RATE 1 or as ATT 1/RATE 2 with BMAG #2 providing a servicable rate reference within ~2 min.

OPTICS POWER UP

Verify optics manual drive disengaged
OPT ZERO - OFF
OPT MODE - MAN
G/N PWR OPTICS - on (up)
OHC - Drive Trun <10 deg
OPT ZERO - ZERO (15 sec)

OPTICS POWER DOWN

OHC - Drive Trun <10 deg
OPT ZERO - ZERO
G/N PWR OPTICS - OFF

SCT MANUAL DRIVE PROCEDURE

1 Verify G&N PWR OPTICS - OFF

2 Insert tool E and rotate ~1 rev CCW
to engage drive (socket backs out)

3 Drive optics either direction
(~1 rev/degree)

4 To disengage, push and rotate
~1 rev CW (button will remain flush)

V41 N91 COARSE ALIGN OCDU's

G/N PWR OPTICS - on
OPT MODE - CMC
OPT ZERO - OFF

NOTE: V41 N91 may be used as Boresight Star Check.

1 V37E 00E

2 V41N91E

3 F 21 92 SHAFT, TRUN NEW OCDU (.01deg,.001deg)
Load desired shaft and trun

4 41 Optics Drives to Specified Angles

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SCS LOGIC BUS PWR LOSS

SCS LOGIC BUS POWER LOSS

	SC CONT - CMC	SC CONT - SCS
LOGIC BUS 1	TVC GMBL DR - 1 or 2 BMAG #1 Rate ACCEL CMD/MIN IMP DIR ULLAGE logic THRUST on pb LIMIT CYCLE - OFF ATT DB - MIN RATE - HI Auto switchover to #2 Gmbl Motors	TVC GMBL DR - 1 or 2 BMAG (3) - RT 2 or ATT 1/RT 2 MAN ATT (3) - RT CMD LIMIT CYCLE - on (up) ATT DB - MAX RATE - LOW *Use THC & DIRECT ON for ΔV *Use Direct CM RCS (single ring) only and RCS CMD - OFF for Entry
LOGIC BUS 2	FDAI SCALE - 5/1 FDAI SOURCE - GDC or ATT SET ATT SET - GDC SCS TVC (2) - ACCEL CMD SPS GMBL tw (2) - zero *SCS TVC (RHC, tw) enabled also THC/cw FDAI SCALE - 5/5 CDU Att Err (FDAI 1) BMAG Att Err(FDAI 2) SCS ACCEL CMD (CMC) CMC/FDAI 2 IMU/ATT SET BMAG #2 Rate(control)	FDAI SCALE - 5/1 FDAI SOURCE - GDC or ATT SET ATT SET - GDC BMAG (R) - RT 1 (Man Mnvr) *Roll Coupling on YAW Rate Needle (Entry Mode) *Select TVC Gmbl #2 by TVC GMBL DR (2) - 2

BACK

COLOR 1

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2-6

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SCS LOGIC BUS PWR LOSS (CONT)

SCS LOGIC BUS POWER LOSS

	SC CONT - CMC	SC CONT - SCS
LOGIC BUS 3	FDAI SELECT - 1/2 FDAI SOURCE - CMC *Select TVC Gmbl #2 by TVC GMBL DR (2) - AUTO GMBL MOT P1,Y1 - OFF FDAI SEL - 1 and 2 ATT SET SCS AUTO TVC SCS Att Hold (P,Y) BMAG (P,Y) Att Err BMAG #2 (P,Y) Rate	FDAI SELECT - 1/2 FDAI SOURCE - CMC BMAG (P,Y) - RT 1 (MTVC, SCS RT CMD) or RT 2 (MTVC ACCEL CMD) THC - CW SC CONT - CMC SCS TVC (2) - RT CMD TVC GMBL DR (2) - 1 *Select TVC Gmbl #2 by TVC GMBL DR (2) - AUTO
LOGIC BUS 4	FDAI SCALE - 5/5 or 5/1 FDAI SELECT - 1 or 2 ATT SET - IMU GDC Align RSI Align RCS Entry Cross-Cpl FDAI SCALE - 50/15 FDAI SELECT -1/2	FDAI SCALE - 5/5 or 5/1 FDAI SELECT - 1 or 2 ATT SET - IMU

SYSTEMS CHECKS

CMC SELF-CHECK

```
1            V25N1E, 1365E, E,E,E

2            V15N1E, 1365E
     15 01   R1 NUMBER OF ERRORS
             R2 NUMBER OF TESTS STARTED
             R3 NUMBER OF E-MEM TESTS SUCCESSFUL

3            V21N27E, 10E SELF-CHECKS ERASABLE & FIXED,
                      4E SELF-CHECKS ERASABLE, or
                      5E SELF-CHECKS FIXED

4    15 01   Test Successful When R2 ≥ 00003 (~78 sec)
                *If PROG lt on                    *
                *  V5N9E  01102 SELF-CHECK ERR*
                *                               *
                *N8E - Copy for STDN             *

       (Term)  V21N27E, E
```

V91 COMPUTE BANKSUM

```
1            V37E 00E

2            V91E
   F 05 01   R1 - SUM OF ALL CELLS IN BANK (BANKSUM)
             R2 - BANK NUMBER
             R3 - FACTOR REQ'D TO FORCE R1=R2

             Verify R1 = R2 or R1+R2 = 77777
               (if not, copy R2 for STDN)

       (Next Bank)  PRO (Last Bank Number = 43)
       (Term)       V34E
```

V35 DSKY CONDITION LIGHT TEST

1 V37E 00E

2 V35E

3 Monitor the Following Events:

a. All DSKY condition lts (both DSKY's) - on
(flashing KEY REL and OPR ERR)

b. ISS Warning (2) - on
CMC Warning (2) - on
PGNS Caution (LEB) - on
MASTER ALARM (3) - on
(00212 Alarm)

c. All DSKY numerical windows display '8';
Sign positions in R1,R2,R3 show '+';
V,N windows flash

Wait 5 sec

d. All DSKY condition lts - out
(except NO ATT if IMU in Coarse Align)

e. ISS Warning (2) - out
CMC Warning (2) - out
PGNS Caution (LEB) - out

f. V,N Flash - stop
DSKY - P00

g. MASTER ALARM - RESET
DSKY - Key RSET (clears 00212 alarm)
(Don't call Ave-G for 10 sec)

SPS GIMBAL DRIVE TEST (EMP SL-22)

DAP - loaded (N48)

1 TVC Prep

cb SCS LOGIC BUS (4) - close (verify)
TVC SERVO PWR 1 - AC1/MNA
SC CONT - CMC
SCS TVC (2) - RATE CMD
MN BUS TIE (2) - on (up)
GMBL MOT P1,Y1 - START/ON
LV/SPS IND - GPI (verify)
TVC GMBL DRIVE (2) - 1

2 V25N1E, 3051E, 1E, E, E
V25N26E, 1E, 2323E, 40066E
V31E
V21N26E, E
Monitor GPI Response:
P&Y (0, +2, -2, 0), Trim

If GPI Response Abnormal:

Go to CSM MALF PROC (G&N SSR-4)

NOTE: CMC DOES NOT PASS
GIMBAL DRIVE TEST

3 TERMINATE:

GMBL MOT (2) - OFF
TVC SERVO PWR 1 - OFF
MN BUS TIE (2) - OFF
V37E XXE

SCS DRIFT CHECK

IMU - on and aligned
SCS - operating
Damp Vehicle Rates

1 Perform 'GDC ALIGN TO IMU' (G/3-11)

2 BMAG MODE (3) - RATE 2
Record:

GET ____:____:____
Wait 60 min

3 GDC/IMU Comparison:

V16N20E (Present IMU Angles)
FDAI SEL - 1
FDAI SOURCE - ATT SET
ATT SET - GDC
ATT SET dials - null FDAI 1 error needles
Key VERB when nulled (freeze display)
Record & Compute BMAG #2 Drift:

GET ____:____:____

DSKY (deg) R_____ P_____ Y_____

ATT SET (deg) R_____ P_____ Y_____

#2 Drift (deg/hr) R_____ P_____ Y_____

KEY REL
FDAI SELECT - 1/2

4 If BMAG #2 drift >10 deg/hr (any axis),
repeat steps 1 thru 3, except
BMAG MODE (3) - RATE 1
Record & Compute BMAG #1 Drift:

#1 Drift (deg/hr) R_____ P_____ Y_____

If BMAG #1 drift >10 deg/hr
* (any axis), GDC FAILED *

EMS ΔV TEST & NULL BIAS CHECK

EMS MODE - STBY
EMS FUNC - ΔV SET/VHF RNG
Set ΔV Ind to 1586.8 fps
EMS MODE - NORMAL
EMS FUNC - ΔV TEST
  SPS THRUST lt - on/out (10 sec)
  ΔV Ind stops at -0.1 to -41.5
EMS MODE - STBY
EMS FUNC - ΔV SET/VHF RNG
Set ΔV Ind to -100.0 fps
CMC MODE - FREE (until measurement complete)
  or BMAG MODE (3) - RATE 2
EMS FUNC - ΔV (wait 5 sec)
Start DET
00:00 EMS MODE - NORM
01:40 EMS MODE - STBY
  If ΔV ≤1 fps, do not bias

  If ΔV >1 fps but <10 fps, bias if desired

  If ΔV >10 fps, EMS is NO-GO

* CAUTION *
Bias check invalidated
* by EMS FUNC - OFF *

EMS ENTRY CHECK

1	EMS FUNC - OFF cb EMS (2) - close EMS MODE - STBY	Lamp illumination other than those listed indicates malf. ΔV/EMS SET sw slews G-V scroll & sets RNG Ind. LV up & down lts not applicable to ASTP.
2	EMS FUNC - EMS TEST 1 Wait 5 sec EMS MODE - NORMAL wait 10 sec Check Ind lts - out RANGE Ind - 0.0 Slew hairline to notch in Self-Test Pattern	Checks lower trip-point of .05G comparator. Allow 10 sec to verify no malfunctions. No lt on before or after 10 sec. EMS scroll can be slewed only one inch in reverse.
3	EMS FUNC - EMS TEST 2 .05G lt - on (rest out) Wait 10 sec	Checks upper trip-point of .05G comparator. No other lt on before or after 10 sec.
4	EMS FUNC - EMS TEST 3 .05G lt - on RSI lower lt - on (10 sec later) Set RANGE counter to 58 ±0.0 nm	Checks corridor verification circuitry associated with LV down lt. Ctr displays - sign for neg nos. or no sign for pos nos. in most significant digit.
5	EMS FUNC - EMS TEST 4 .05G lt - on (rest out) Trace within pattern to lower rt corner at 9G RANGE Ind counts down to 0.0 ±0.2 nm	Checks range-to-go integrator circuits, rng-to-go indicator, G-V servo circuits, and G-V plotter.
6	EMS FUNC - EMS TEST 5 .05G lt - on RSI upper lt - on (10 sec later) RANGE Ind - 0.0 Scribe traces vert line 9G to 0.28 ±0.1G	Checks corridor verification circuitry associated with LV up lt & enables scroll slewing to start of entry pattern. After scroll set to <37K fps, reselecting 'EMS TEST 5' not permitted; range integrator and scroll synchronization would be lost.
7	EMS - OFF/STBY	

INITIALIZATIONS/CALIBRATIONS

DOCKED DAP LOAD & ACTIVATE (V44 & V45)

1 V44E
F 05 87 R1 ABCDE Nominal: 01111
R2 00CDE* 00146 (B3,D4,A3,C4)
R3 00CDE* 00000

R1	ROLL PREF	QUAD A/C FOR $\ddot{X}$	QUAD B/D FOR $\ddot{X}$	PITCH	YAW
	0 = B/D 1 = A/C	0 = Avoid 1 = Allow	0 = Avoid 1 = Allow	0 = Couple 1 = Force (Z)	0 = Couple 1 = Force (Y)
R2	CHANNEL 5 JET INHIBIT (X-Trans, P&Y Couples) (Code shown will inhibit indicated jet)		1 = B3 (+Y $-\ddot{X}$) 2 = B4 (-Y $+\ddot{X}$)	1 = A4 (-P $+\ddot{X}$) 2 = D3 (+Y $+\ddot{X}$) 4 = D4 (-Y $-\ddot{X}$)	1 = C3 (+P $+\ddot{X}$) 2 = C4 (-P $-\ddot{X}$) 4 = A3 (+P $-\ddot{X}$)
R3	CHANNEL 6 JET INHIBIT (Roll Couples, P&Y Force) (Code shown will inhibit indicated jet)		1 = C1 (+R +Y) 2 = C2 (-R -Y)	1 = D2 (-R +P) 2 = A1 (+R -Y) 4 = A2 (-R +Y)	1 = B1 (+R +P) 2 = B2 (-R -P) 4 = D1 (+R -P)

PRO

2 F 06 89 RATE, DB (.0001deg/sec,.01deg)
Nom: +05000,+00500
Load desired values
PRO

3 If Att DB changed or activation req'd:
CMC MODE - FREE
V45E
CMC MODE - as desired

* CAUTION *
*When under Docked DAP control in FREE *
* mode, the THC should not be deflected*
* in the ±Y or ±Z directions *

* TO REENABLE ALL JETS: V59E

BACK

COLOR_____

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2-14

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UNDOCKED DAP LOAD & ACTIVATE (V48 & V46)

1 V48E
F 04 46 R1 ABCDE
R2 ABCDE

	VEHICLE CONFIG	QUAD A/C FOR $\ddot{X}$	QUAD B/D FOR $\ddot{X}$	ATT DEADBAND	AUTO MNVR RATE
R1	0 = No DAP 1 = CSM or CSM/DM 3 = CSM & SIVB 6 = CSM/DM (No G&N TVC)	0 = Avoid 1 = Allow	0 = Avoid 1 = Allow	0 = ±0.5 deg 1 = ±5.0 deg	0 = 0.05deg/sec 1 = 0.2 deg/sec 2 = 0.5 deg/sec 3 = 2.0 deg/sec
	ROLL QUAD SELECT	QUAD A	QUAD B	QUAD C	QUAD D
R2	0 = Use B/D Roll 1 = Use A/C Roll	0 = Fail 1 = Use	0 = Fail 1 = Use	0 = Fail 1 = Use	0 = Fail 1 = Use

PRO

2 F 06 47 CSM WT,OTHER VEHICLE WT (lbs,lbs)
Load correct values
PRO

3 F 06 48 TRIM ENGINE GMBL (.01deg)
Load correct values
PRO

4 If activation req'd:
CMC MODE - FREE
V46E
CMC MODE - as desired

INITIALIZATIONS
CALIBRATIONS

DOCKED DAP JET/QUAD FAIL RESELECT

1. Disable failed jet(s) via AUTO RCS SELECT.
2. Inhibit failed jet(s) via N87 reconfig table below.
3. Initial N87 config assumed to be:
   (Consult STDN for reconfig if DAP configured P,Y Couples).
   01111
   00146
   00000

Jets Failed	N87 Δ'S R2**	N87 Δ'S R3	-X If OK***
A1		00020	
B1		00001	
C1		00100	
D1		00004	
A2		00040	
B2		00002	
C2		00200	
D2		00010	
A1 & B1*		00020	
A1 & C1		00120	
A1 & D1*		00020	
A1 & A2		00060	
A1 & B2		00022	
A1 & C2	00106	00220	D4***
A1 & D2		00030	
B1 & C1*		00100	
B1 & D1		00005	
B1 & A2		00041	
B1 & B2		00003	
B1 & C2		00201	
B1 & D2	00142	00011	A3***

Jet/Quad Failed	N87 Δ'S R2**	N87 Δ'S R3	-X If OK***
C1 & D1*		00100	
C1 & A2	00046	00140	B3***
C1 & B2		00102	
C1 & C2		00300	
C1 & D2		00110	
D1 & A2		00044	
D1 & B2	00144	00006	C4***
D1 & C2		00204	
D1 & D2		00014	
A2 & B2*		00040	
A2 & C2		00240	
A2 & D2*		00040	
B2 & C2*		00200	
B2 & D2		00012	
C2 & D2*		00200	
QUAD A		00060	
QUAD B		00003	
QUAD C		00300	
QUAD D		00014	

*Att control may be severely degraded about ROLL axis.

**Pitch or Yaw Couple required to maintain att control (Att control may be degraded if corresponding -X thruster is not enabled via AUTO RCS SELECT).
A1 & C2 ~ -YAW C1 & A2 ~ +YAW
B1 & D2 ~ +PITCH D1 & B2 ~ -PITCH

***Consult STDN prior to enabling any -X thrusters (A3,B3,C4,D4) while docked to Soyuz.

SIMBAY EXPERIMENTS JET/QUAD FAIL RESELECT

Note: This table applicable only during experiments MA 048, MA 083, and MA 088

1. Disable failed jet(s) via AUTO RCS SELECT
2. Reconfigure DAP per table below
3. Initial conditions assumed to be:

   AUTO RCS SELECT D1,B2,A3,C4,B3,D4 - MNA
   AUTO RCS SELECT A2,B1,A4,B4 - OFF (verify)
   Undocked DAP activated (6110X, 01111)
   SC CONT - CMC/AUTO

Jet/Quad Failed *	AUTO RCS ON	Undocked DAP N46 R2 Δ	Reconfigure for Docked DAP Mode N87:R1	R2	R3
A3	C3				
B2	D2				
B3	D3				
C4	D2,D3 A1		00010	00013	00241
D1	A1,C2	11111			
D4	A1,C1 C2,C3		10001	00260	00045
QUAD A	C3				
QUAD B	D2,D3				
QUAD C	D2,D3 A1		00010	00013	00241
QUAD D	A1,C1 C2,C3		10001	00260	00045

* Consult STDN for multiple jet failures

MA 007 EXPERIMENT JET/QUAD FAIL RESELECT

Note: This table applicable only during experiment MA 007.

1. Disable failed jet(s) via AUTO RCS SELECT
2. Reconfigure DAP per table below
3. Initial conditions assumed to be:

AUTO RCS SELECT D1,B2,C3,A4,D3,B4 - MNA
AUTO RCS SELECT A2,B1,A3,C4,B3,D4 - OFF (verify)
undocked DAP activated (6110X, 01111)
SC CONT - CMC/AUTO

Jet/Quad Failed *	AUTO RCS ON	Undocked DAP N46 R2 Δ	Reconfigure for Docked DAP Mode N87:R1	R2	R3
A4	C1,D2		00010	00016	00241
B2	D2				
B4	A1,C1 C2,D2		10001	00340	00041
C3	A1,D2		00010	00007	00241
D1	A1,C2	11111			
D3	A1,C1 C2		10001	00160	00045
QUAD A	C1,D2		00010	00016	00241
QUAD B	A1,C1 C2,D2		10001	00340	00041
QUAD C	A1,D2		00010	00007	00241
QUAD D	A1,C1 C2		10001	00160	00045

* Consult STDN for multiple jet failures

ORDEAL INITIALIZATION (G&N)

(In-Plane Alignment Req'd)
FDAI 1 or 2 - ORB RATE
EARTH/LUNAR - EARTH

1 V82E
F 04 12 R1 00002 SPECIFY VEHICLE
R2 00001
PRO

2 F 06 16 GET EVENT (hrs,min,.01sec)
PRO

3 F 16 44 HA,HP (.1nm,.1nm)
Calculate Average
ALT SET - Set Average
PRO

4 V83E
F 16 54 RNG,RDOT,THETA (.01nm,.1fps,.01deg)
MODE - HOLD/FAST
SLEW - To THETA
MODE - OPR/SLOW
PRO

ORDEAL INITIALIZATION (HORIZON METHOD)

(In-Plane GDC Alignment Req'd)
FDAI 1 or 2 - ORB RATE
EARTH/LUNAR - EARTH

1 STDN Supply Altitude
ALT SET - Set

2 SC +X At the Horizon (0 deg yaw,heads up)

3 MODE - HOLD/FAST
SLEW FDAI:

ALT	ANGLE
100 nm	346 deg
120 nm	345 deg
200 nm	341 deg

MODE - OPR/SLOW

MEASUREMENT & LOADING OF PIPA BIAS

DET - RESET
S/C Rates <0.1 deg/sec
CMC MODE - FREE

1		V25N21E, E,E,E/Start Event Timer
2	06 21	V6N21 (do not ENTR) X,Y,Z PIPA COUNTS
3		At T + 1:04 - ENTR Record: (X)R1_____ (Y)R2_____ (Z)R3_____ (±000AB)
4	F 21 01	V21N1E (use same sign as above) 1452E, (Calculated X Bias) E,E (±AB000) 1454E, (Calculated Y Bias) E,E 1456E, (Calculated Z Bias) E

NOTES: If data is loaded over a flashing display, V21 N01 will be overwritten following XXXXXE. Re-key V21N1E before each load.
N21 represents uncompensated PIPA pulses & is not changed by loading of PIPA Bias.

V41 N20 COARSE ALIGN ICDU's

ISS - on

1	F 21 22	V41N20E Load desired ICDU angles
3	41	NO ATT lt - on *Poss PROG Alarm - V5N9E * *211 Crs Aln Err; repeat V41 N20*
4		V40E NO ATT lt - out Wait 10 sec
5		V37E XXE

If Coarse Align performed in CMC - FREE, cycle CMC MODE sw to HOLD to reinitialize FDAI needle drive routine.

COAS LOS DETERMINATION

ISS - on
SCS - operating
SC CONT - SCS
MAN ATT (3) - MIN IMP
OPT MODE - MAN
OPT ZERO - OFF
COAS PWR - on (up)
G/N PWR OPTICS - on
OHC - Drive Trun <10 deg
OPT ZERO - ZERO (15 sec)
OPT MODE - CMC

1 V37E 52E

2 F 04 06 R1 00001
R2 00003
PRO

3 F 50 25 00015
ENTR

4 F 01 70 000DE STAR CODE
Load Boresight Star Code
OPT ZERO - OFF
PRO

5 06 92 SHAFT,TRUN (.01deg,.001deg)
Center Target
MARK with VERB key
Record:

SHAFT _____ TRUN _____

(Repeat) KEY REL
(Exit) V37E XXE
OPT MODE - MAN
OHC - Drive Trun <10 deg
OPT ZERO - ZERO
COAS PWR - as req

ALIGNMENT PROGRAMS

P51 IMU ORIENTATION DETERMINATION

ISS - on SCS - on G/N PWR OPT - on	CSM Optics: OPT MODE - MAN OPT ZERO - OFF OHC - Drive Trun <10 deg OPT ZERO - ZERO (15 sec)

1 V37E 51E
F 50 25 00015 MNVR TO ACQ STARS
(Coarse Align IMU to 0,0,0) ENTR, to 2
(Bypass) PRO, to 3

2 41 22 DESIRED GIMBAL ANGLES (0,0,0)
NO ATT lt - on, then out, to 1

3 F 51 PLEASE MARK
OPT ZERO - OFF
MARK

4 F 50 25 00016 TERMINATE MARKS
PRO

5 F 01 71 00CDE STAR CODE
Load desired code (Verify C=0)
PRO: DE=00, to 6
1st MARK, to 3
2nd MARK, to 7

6 F 06 88 CELESTIAL BODY VECTOR
Load desired vector
PRO: 1st MARK, to 3
2nd MARK, to 7

7 F 06 05 ANGULAR SEP ERR,ANGULAR SEP (.01deg,.01deg)
(Reject) V32E, to 1
(Accept) PRO

8 F 37 XXE (If P52, bypass ZERO OPTICS)
OHC - Drive Trun <10 deg
OPT ZERO - ZERO

If coarse align performed in CMC - FREE, cycle CMC MODE sw to HOLD to reinitialize FDAI needle drive routine.

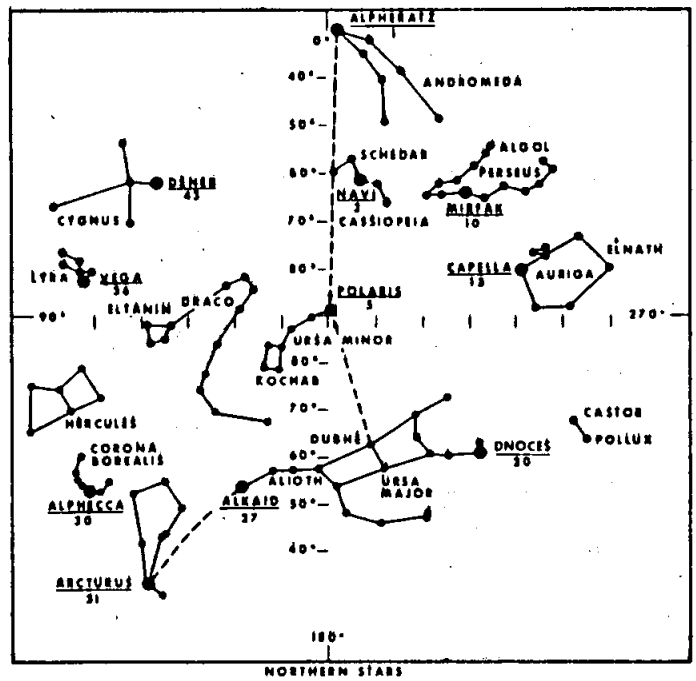
BACK

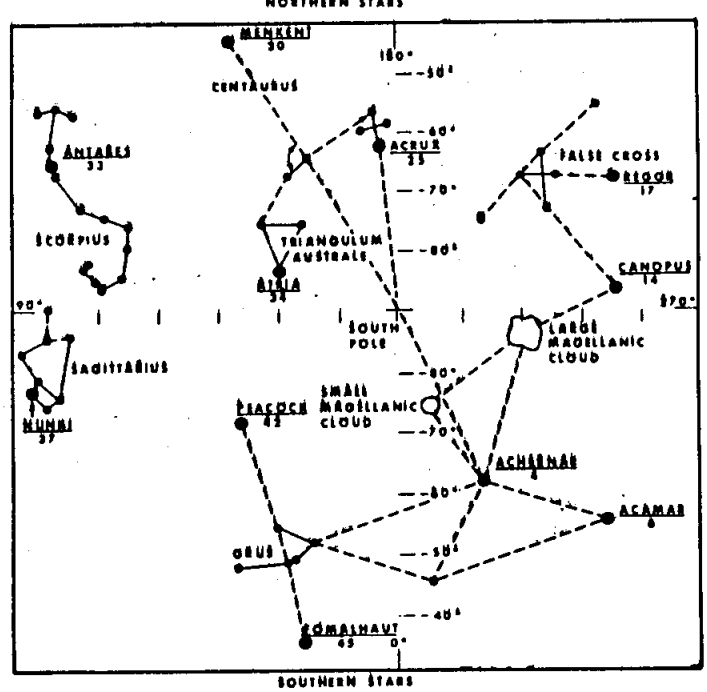
COLOR_____

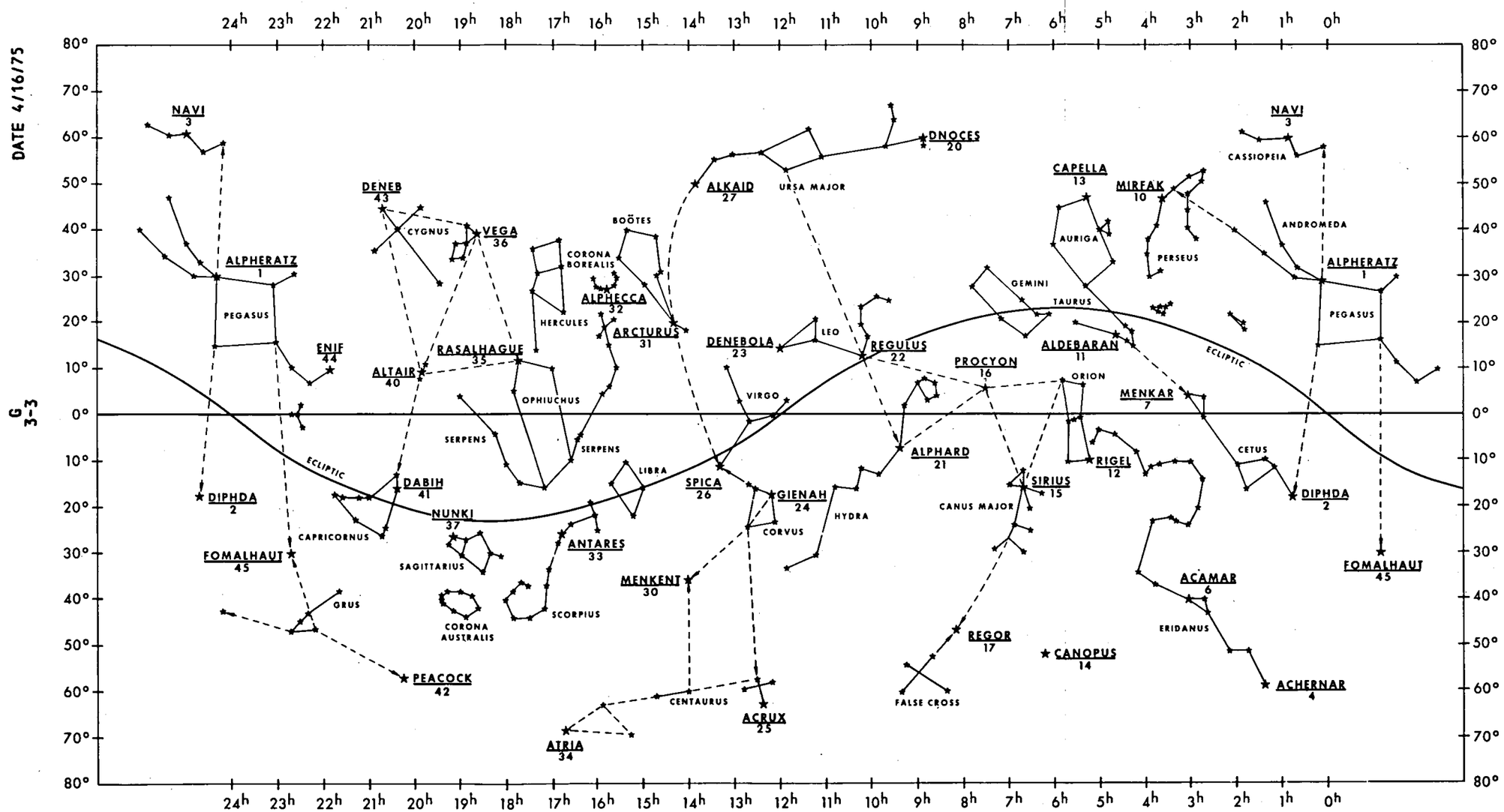
INFLT ALIGNMENT
PROGS (P50'S)

G
3-2

DATE 4/16/75






DATE 4/16/75
G 3-3
24h 23h 22h 21h 20h 19h 18h 17h 16h 15h 14h 13h 12h 11h 10h 9h 8h 7h 6h 5h 4h 3h 2h 1h 0h
80° 70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50° 60° 70° 80°
NAVI 3
ALPHERATZ 1
PEGASUS
ENIF 44
DIPHDA 2
FOMALHAUT 45
ECLIPTIC
CAPRICORNUS
SAGITTARIUS
GRUS
PEACOCK 42
CORONA AUSTRALIS
SCORPIUS
ANTARES 33
ATRIA 34
CENTAURUS
ACRUX 25
MENKENT 30
NUNKI 37
DABIH 41
ALTAIR 40
SERPENS
OPHIUCHUS
SERPENS
RASALHAGUE 35
HERCULES
CORONA BOREALIS
ALPHECCA 32
BOÖTES
ARCTURUS 31
CYGNUS
VEGA 36
DENEB 43
LIBRA
SPICA 26
VIRGO
DENEBOLA 23
LEO
REGULUS 22
CORVUS
GIENAH 24
ALKAID 27
URSA MAJOR
DNOCES 20
HYDRA
ALPHARD 21
CANUS MAJOR
SIRIUS 15
PROCYON 16
FALSE CROSS
REGOR 17
CANOPUS 14
ORION
MENKAR 7
RIGEL 12
GEMINI
TAURUS
ALDEBARAN 11
AURIGA
CAPELLA 13
MIRFAK 10
PERSEUS
CASSIOPEIA
NAVI 3
ANDROMEDA
ALPHERATZ 1
PEGASUS
CETUS
DIPHDA 2
FOMALHAUT 45
ACAMAR 6
ERIDANUS
ACHERNAR 4

G
3-4

DATE 4/16/75

G
3-5

DATE 4/16/75

STAR LIST

Numerical		Alphabetical	
00	Planet	Acamar	6
1	Alpheratz	Achernar	4
2	Diphda	Acrux	25
3	Navi	Aldebaran	11
4	Achernar	Alkaid	27
5	Polaris	Alphard	21
6	Acamar	Alphecca	32
7	Menkar	Alpheratz	1
10	Mirfak	Altair	40
11	Aldebaran	Antares	33
12	Rigel	Arcturus	31
13	Capella	Atria	34
14	Canopus	Canopus	14
15	Sirius	Capella	13
16	Procyon	Dabih	41
17	Regor	Deneb	43
20	Dnoces	Denebola	23
21	Alphard	Diphda	2
22	Regulus	Dnoces	20
23	Denebola	Earth	47
24	Gienah	Enif	44
25	Acrux	Fomalhaut	45
26	Spica	Gienah	24
27	Alkaid	Menkar	7
30	Menkent	Menkent	30
31	Arcturus	Mirfak	10
32	Alphecca	Navi	3
33	Antares	Nunki	37
34	Atria	Peacock	42
35	Rasalhague	Planet	00
36	Vega	Polaris	5
37	Nunki	Procyon	16
40	Altair	Rasalhague	35
41	Dabih	Regor	17
42	Peacock	Regulus	22
43	Deneb	Rigel	12
44	Enif	Sirius	15
45	Fomalhaut	Spica	26
46	Sun	Sun	46
47	Earth	Vega	36

P52 IMU REALIGN

ISS - on SCS - on G/N PWR OPT - on	CSM OPTICS: OPT MODE - MAN OPT ZERO - OFF OHC - Drive Trun <10 deg OPT ZERO - ZERO (15 sec) OPT MODE - CMC

1 V37E 52E
F 04 06 R1 00001 IMU ALIGN OPTION
R2 0000X X=1 PREF PRO, to 3
X=2 NOM PRO, to 2
X=3 REFS PRO, to 6

2 F 06 34 GET ALIGN (hrs,min,.01sec)
Load desired time (0,0,0 for present time)
PRO

3 F 06 22 NEW ICDU ANGLES OG,IG,MG (.01deg)
(If MG >±70 deg, Mnvr) V32E, to 3
PRO

4 F 50 25 00013 GYRO TORQUE
CMC MODE - FREE
(Coarse) PRO
NO ATT lt - on, then out, to 6
(Torque) ENTR

5 16 20 ICDU ANGLES (.01deg)
When torque complete, to 16

6 F 50 25 00015 STAR SELECT (maneuver if necessary)
(PICAPAR) PRO
*F 05 09 00405 NO PAIR *
*(Crew Specify) PRO, to 7 *
(PICAPAR) Mnvr, V32E, to 6
(Man Acq) ENTR

7 F 01 70 00CDE STAR CODE
Load desired code (Verify C=0)
OPT ZERO - OFF
OPT MODE - CMC
PRO: DE=00, to 8
Otherwise, to 9
F 05 09 00404 (TA >90 deg)
*Mnvr - PRO, to 9 *

```
 8  F 06 88   CELESTIAL BODY VECTOR
               Load desired vector
               PRO
                         *F 05 09 00404 (TA >90 deg)*
                         *Mnvr - PRO, to 9          *

 9    06 92   SHAFT,TRUN                    (.01deg,.001deg)
               OPT MODE - MAN

10  F 51      PLEASE MARK
               MARK

11  F 50 25   00016 TERMINATE MARKS
               PRO

12  F 01 71   00CDE STAR CODE
               Load code (if different from N70)
                 (Verify C=0)
               PRO: DE=00, to 13
                    1st MARK, to 7
                    2nd MARK, to 14

13  F 06 88   CELESTIAL BODY VECTOR
               Verify vector
               PRO: 1st MARK, to 7
                    2nd MARK, to 14

14  F 06 05   ANGULAR SEP ERR,ANGULAR SEP(.01deg,.01deg)
          (Reject)  V32E, to 16
          (Accept)  PRO

15  F 06 93   TORQUING ANGLES  OG,IG,MG        (.001deg)
          (Torque)  CMC MODE - FREE
                    PRO
          (Bypass)  V32E

16  F 50 25   00014 ALIGNMENT CHECK
          (Recheck)  PRO, to 6
          (Bypass)   ENTR

17  F 37      XXE
               OHC - Drive Trun <10 deg
               OPT ZERO - ZERO

               CMC MODE - AUTO
```

P53 BACKUP IMU ORIENT DETERMINATION

(Optics failed)
ISS - on
SCS - operating
COAS LOS DETERMINATION - complete

1 V37E 53E
F 50 25 00015 MNVR TO ACQ STARS
(Coarse Align IMU to 0,0,0) ENTR, to 2
(Bypass) PRO, to 3

2 41 22 DESIRED GIMBAL ANGLES (0,0,0)
NO ATT lt - on, then out, to 1

3 F 06 94 COAS SHAFT,TRUN ANGLES (.01deg,.001deg)
Load proper angles: Nominal: Shaft +00000
PRO Trun +57470

4 F 53 PLEASE MARK
ENTR (target centered)

5 F 50 25 00016 TERMINATE MARKS
(Reject) ENTR, to 4
(Accept) PRO

6 F 01 71 00CDE STAR CODE
Load desired code (Verify C=0)
PRO: DE=00, to 7
1st MARK, to 3
2nd MARK, to 8

7 F 06 88 CELESTIAL BODY VECTOR
Load desired vector
PRO: 1st MARK, to 3
2nd MARK, to 8

8 F 06 05 ANGULAR SEP ERR,ANGULAR SEP (.01deg,.01deg)
(Reject) V32E, to 1
(Accept) PRO

9 F 37 XXE

If Coarse Align performed in CMC - FREE,
cycle CMC MODE sw to HOLD to reinitialize
FDAI needle drive routine.

P54 BACKUP IMU REALIGN

(Optics failed)
ISS - on
SCS - operating
COAS LOS DETERMINATION - complete

1 V37E 54E
F 04 06 R1 00001 IMU ALIGN OPTION
R2 0000X X=1 PREF PRO, to 3
X=2 NOM PRO, to 2
X=3 REFS PRO, to 6

2 F 06 34 GET ALIGN (hrs,min,.01sec)
Load desired time (0,0,0 for present time)
PRO

3 F 06 22 NEW ICDU ANGLES OG,IG,MG (.01deg)
(If MG >±70 deg, Mnvr) V32E, to 3
PRO

4 F 50 25 00013 GYRO TORQUE
CMC MODE - FREE
(Coarse) PRO
NO ATT lt - on, then out, to 6
(Torque) ENTR

5 16 20 ICDU ANGLES (.01deg)
When torque complete, to 16

6 F 50 25 00015 STAR SELECT (Mnvr if necessary)
(PICAPAR) PRO
*F 05 09 00405 NO PAIR *
*(Crew Specify) PRO, to 7 *
(PICAPAR) Mnvr, V32E, to 6
(Man Acq) ENTR

7 F 01 70 00CDE STAR CODE
Load desired code (Verify C=0)
PRO: DE = 00, to 8
Otherwise, to 9

8 F 06 88 CELESTIAL BODY VECTOR
Load desired vector
PRO

9 F 06 94 COAS SHAFT,TRUN ANGLES (.01deg,.001deg)
Load proper angles; Nominal: Shaft +00000
PRO Trun +57470

10 F 53 PLEASE MARK
ENTR (target centered)

11 F 50 25 00016 TERMINATE MARKS
(Reject) ENTR, to 10
(Accept) PRO

12 F 01 71 00CDE STAR CODE
Load code (if different from N70)
(Verify C=0)
PRO: DE=00, to 13
1st MARK, to 7
2nd MARK, to 14

13 F 06 88 CELESTIAL BODY VECTOR
Verify vector
PRO: 1st MARK, to 7
2nd MARK, to 14

14 F 06 05 ANGULAR SEP ERR,ANGULAR SEP(.01deg,.01deg)
(Reject) V32E, to 16
(Accept) PRO

15 F 06 93 TORQUING ANGLES OG,IG,MG (.001deg)
(Torque) CMC MODE - FREE
PRO
(Bypass) V32E

16 F 50 25 00014 ALIGNMENT CHECK
(Recheck) PRO, to 6
(Bypass) ENTR

17 F 37 XXE

If Coarse Align performed in CMC - FREE,
cycle CMC MODE sw to HOLD to reinitialize
FDAI needle drive routine.

BACKUP ALIGNMENTS

RAPID IMU REALIGN

NOTE: This procedure assumes a good GDC alignment

1 V41N20E
Load R,P,Y from GDC Ball

2 V40, Verify R,P,Y on GDC Ball - ENTR
(Releases platform and recovers PGNS control modes)

3 V25N7E, 77E, 10000E, 1E (Sets REFSMFLG)

4 V37E 51E, PRO (Sets DRIFTFLG)

5 Perform P52, Option 3

NOTE: If loss of alignment is due to temporary loss of DC BUS, update CMC Clock with V55 to complete recovery.

GDC ALIGNMENT TO IMU GIMBAL ANGLES

IMU - on
SCS - operating

1 Damp vehicle rates

2 ATT SET dials - set to IMU angles on FDAI 1
FDAI SELECT - 1
FDAI SOURCE - ATT SET
ATT SET - IMU
ATT SET dials - null FDAI 1 needles
ATT SET - GDC
GDC ALIGN PB - push (null needles)
FDAI SEL - 1/2

BACKUP ALIGNMENTS

BACKUP GDC AND IMU ALIGNMENT

(IMU or CMC failed)
SCS - operating
RECORD: Nav Stars (PRI,SEC),
R,P,Y ALIGN from STDN

1 FDAI SEL - 1
FDAI SOURCE - ATT SET
ATT SET - GDC

2 Set SCT SHFT = 0 deg, TRUN = 352.5 deg
OPTICS PWR - OFF

3 ATT SET dials - R,P,Y ALIGN

4 Mnvr to position stars in SCT:

R Line	North-POLARIS	(5)
SEC Star	South-ATRIA	(34)
0 deg Mark	North-NAVI	(3)
PRI Star	South-ACRUX	(25)

5 GDC ALIGN PB - push (hull needles)

Omit the following steps
if IMU is failed:

6 ATT SET dials - 0,0,0
ATT SET - IMU
Mnvr to 0,0,0 on FDAI 1 (IMU)

7 IMU CAGE - on (up) & HOLD
ATT SET - GDC
Mnvr to 0,0,0 on FDAI 1 (GDC) and null
error needles

8 IMU CAGE - Release

GDC REFSMMAT DETERMINATION (P51 & EMP SL-3)

(IMU Failed)
GDC - on
SCS - on
IMU - off
OPT MODE - MAN
OPT ZERO - OFF
G/N PWR OPTICS - on
OHC - Drive Trun <10 deg
OPT ZERO - ZERO (15 sec)

1 Acquire Nav Star in optics
FDAI Scale - 5/1
Hold Att (ATT DB - MIN/LOW)
V25N20E
Load GDC angles

2 V96E

3 Initiate P51 logic as follows:
V21N1E, 1204E, 63E (65 if P53 desired)
V25N26E, 13001E, 3266E, 30005E
V30E
V21N26E, E

NOTE: Major Mode lts on DSKY do not change from 00 to 51.

4 F 50 25 00015 ACQ STARS
PRO

5 F 51 PLEASE MARK
If necessary, Mnvr and:
V25N20E
Load present GDC angles
OPT ZERO - OFF
Null FDAI needles with Min Imp
Center star in optics, then: MARK

6 F 50 25 00016 TERM MARKS
PRO

7 F 01 71 00CDE STAR CODE
Load desired code (Verify C=0)
PRO: DE=00, to 8
1st MARK, to 5
2nd MARK, to 9

8 F 06 88 CELESTIAL BODY VECTOR
Load vector
PRO: 1st MARK, to 5
2nd MARK, to 9

9 F 06 05 ANGULAR SEP ERR,ANGULAR SEP(.01deg,.01deg)
(Reject) V32E, to 4
(Accept) PRO

10 F 37 XXE
OHC - Drive Trun <10 deg
OPT ZERO - ZERO

The CMC has now calculated a REFSMMAT for the GDC and has set REFSMFLG & DRIFTFLG.

GDC REFSMMAT REALIGN (P52 & EMP SL-50)

(IMU failed)
GDC - on & REFSMMAT known (G/3-13)
SCS - operating
IMU - off
Option 3:
OPT MODE - MAN
OPT ZERO - OFF
G/N PWR OPTICS - on
OHC - Drive Trun <10 deg
OPT ZERO - ZERO (15 sec)

Initialize EMP SL-50

(req one time only)

V48E, V21E, E (no DAP)
PRO,PRO,PRO, V46E
V25N7E
77E, 10000E, 1E (Sets REFSMFLG)
V37E 00E
Perform 'P27 CMC UPDATE' (G/1-15)
STDN will uplink EMP SL-50
Do NOT activate DAP

*If No Comm: *
* manually load EMP*
* (G/1-34) *

1 Acquire Nav Target in
optics (Option 3 only)
Hold Att (ATT DB - MIN/LOW)
V25N20E
Load GDC angles

2 V37E 52E
F 04 06 R1 00001 'ALIGN' OPTION
R2 0000X X=1 PREF PRO, to 4
X=2 NOM PRO, to 3
X=3 REFS PRO, to 6

3 F 06 34 GET ALIGN (hrs,min,.01sec)
Load desired time (0,0,0 for present time)
PRO

4 F 06 22 NEW ICDU ANGLES OG,IG,MG (.01deg)
(If MG >±70 deg, Mnvr and reload N20) V32E, to 4

Align GDC to new angles
PRO

5 F 50 25 00013 GYRO TORQUE
PRO
NO ATT lt - on, then out

6 F 50 25 00015 ACQ STARS
(Option 3) PRO
(Not Opt 3) V37E XXE (procedure complete)

7 F 01 70 OOCDE STAR CODE
Load desired code (Verify C=0)
OPT ZERO - OFF
OPT MODE - CMC
PRO: DE=00, to 8
Otherwise, to 9
*F 05 09 00404 (TA >90 deg) *
Mnvr, reload N20, PRO, to 9

8 F 06 88 CELESTIAL BODY VECTOR
Load desired vector
PRO
*F 05 09 00404 (TA >90 deg) *
Mnvr, reload N20, PRO, to 9

9 06 92 SHAFT,TRUN (.01deg,.001deg)
OPT MODE - MAN

10 F 51 PLEASE MARK
(If required) V25N20E
Load present GDC angles

Null FDAI needles with Min Imp
Center star in optics, then: MARK

11 F 50 25 00016 TERMINATE MARKS
PRO

12 F 01 71 . OOCDE STAR CODE
Load code (if different from N70)
(Verify C=0)
PRO: DE=00, to 13
1st MARK, to 7
2nd MARK, to 14

13 F 06 88 CELESTIAL BODY VECTOR
Verify vector
PRO: 1st MARK, to 7
2nd MARK, to 14

14 F 06 05 ANGULAR SEP ERR,ANGULAR SEP(.01deg,.01deg)
(Reject) V32E, to 18
(Accept) PRO

15 F 06 93 TORQUING ANGLES OG,IG,MG (.001deg)
Verify Att Hold (ATT DB - MIN/LOW)

V25N26E, 10001E,1642E,50006E
V30E
*F 01 70 (restart to 12) *
Redo 2nd Mark and subseq

16 F 06 22 NEW GDC ANGLES R,P,Y (.01deg)
(Reject) V32E
(Accept) Align GDC
PRO
(CMC sets N20 = N22)

17 F 06 93 TORQUING ANGLES OG,IG,MG (.001deg)
(Recheck) V32E
(Exit) OHC - Drive Trun <10 deg
OPT ZERO - ZERO
G/N PWR OPTICS - OFF
V37E XXE (procedure complete)

NOTE: Subsequent performance of
V44, V45, V46, or V48 will
overwrite EMP SL-50.

18 F 50 25 00014 ALIGNMENT CHECK
PRO, to 6

ORBIT NAV AND TRACKING

V82 START ORBIT PARAMETER DISPLAY

NOTE: If high CMC activity (e.g., P4X w/ Lambert), poss PROG Alarm and restart (no light) - code 31201 or 31202 stored

1 V82E (If Ave-G on, to 3)
F 04 12 R1 00002 Specify Vehicle
R2 0000X X=1 CSM
X=2 Soyuz (or ATS-F)
PRO

2 F 06 16 GET EVENT (hrs,min,.01sec)
Load desired time (0,0,0 for present time)
PRO

3 F 16 44 HA,HP,TFF (.1nm,.1nm,min-sec)
(P00/P11 ΔR) N50E, to 4
(TF Perigee) N32E, to 5
(Recycle) V32E, to 2 (not req if Ave-G on)
(Exit) PRO

4 F 16 50 ΔR (Miss Dist),HP,TFF (.1nm,.1nm,min-sec)
KEY REL, to 3

5 F 16 32 TIME FROM PERIGEE (hrs,min,.01sec)
(Useful only if TFF = -59B59)
KEY REL, to 3

P20 OPT 185 CELESTIAL BODY-UNIVERSAL TRACK

ISS - on and aligned
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

1
F 04 06 V37E 20E
R1 00024 TRACKING OPTION
R2 0000X X=1 VECPOINT
X=5 3-AXIS
PRO

2 F 06 78* AXIS YAW,AXIS PITCH,OMICRON (.01deg)
Load values (Omicron ignored for Opt 1)
(See table below for nominal values)
PRO

3 F 06 79* R2 DEADBAND (.01deg)
Load desired DB
PRO

4 F 01 70 R1 000DE STARCODE
Load Code
PRO (DE not = 00, to 6)

5 F 06 88 CELESTIAL BODY VECTOR
Load vector
PRO

6 If req'd mnvr <10 deg, DAP mnvr
without display, to 8
F 50 18 REQUEST MNVR TO FDAI R,P,Y ANGLES (.01deg)
(Auto) PRO
(Man) RHC - Mnvr to N18 Angles
ENTR, to 8
(Reject) ENTR, to 8

ORBIT NAV
AND TRACKING

NOMINAL VALUES: N78				N70
ATTITUDE	YAW	PITCH	OMICRON	STARCODE
Nom SI	90 deg	125 deg	180 deg	46 (Sun)
LV (Hds Up)	0 deg	270 deg	0 deg	47 (Earth)
LV (Hds Dn)	0 deg	90 deg	180 deg	47 (Earth)

7 06 18 AUTO MNVR TO ATT (.01deg)
When mnvr complete, to 6

8 CMC continues tracking center of celestial body

*NOTE: CMC will react to changes in N78 and N79 (May take 4 sec).
*Poss UPLINK ACTY lt *
* (Mnvr >10 deg req'd) *
*Key V58E to permit the *
* required auto mnvr *

9 TERMINATE P20: V56E

P20 OPT 2 ROTATE-UNIVERSAL TRACKING

ISS - on and aligned
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

1 If required, perform 'V49 CREW DEFINED MNVR' (G/6-15) to initial tracking attitude.

2 V37E 20E
F 04 06 R1 00024 TRACKING OPTION
R2 00002 ROTATE
PRO

3 F 06 78 AXIS YAW,AXIS PITCH,OMICRON (.01deg)
Load values (Omicron ignored)
PRO

4 F 06 79 RATE,DEADBAND (.0001deg/sec,.01deg)
Load desired values
PRO

5 F 06 34 START TIME (hrs,min,.01sec)
Load desired GET (0,0,0 for present time)
PRO

6 Maneuver starts at specified START TIME

NOTE: Selection of the following programs will not stop rotation:
P21, P27, P29, P30, P52, or P54

P21 GROUND TRACK DETERMINATION

```
1                V37E 21E
   F 04 06       R1 00002 SPECIFY VEHICLE
                 R2 0000X   X=1 CSM
                            X=2 Soyuz
                 PRO

2  F 06 34       GET LAT,LONG                (hrs,min,.01sec)
                 Load desired GET (0,0,0 for present time)
                 PRO

3  F 06 43       LAT,LONG,ALT          (.01deg,.01deg,.1nm)
     (Recycle)   V32E, to 2 (Increments GET 10 min)
     (Exit)      PRO

     NOTE: Via N73E: ALT,VEL,GAMMA (10nm,fps,.01deg)

4  F 37          XXE
```

P29 TIME OF LONGITUDE

```
1                V37E 29E

2  F 04 06       R1 00002 SPECIFY VEHICLE
                 R2 0000X   X=1 CSM
                            X=2 Soyuz
                 PRO

3  F 06 34       GET BASE TIME             (hrs,min,.01sec)
                 Load search time (0,0,0 for present time)
                 PRO

4  F 06 43       R2 DESIRED LONG                 (.01deg)
                 Load Longitude
                 PRO

5  F 06 34       GET LONG                  (hrs,min,.01sec)
     (Change Long) V32E, to 4
     (See Lat)     PRO

6  F 06 43       LAT,LONG,ALT        (.01deg,.01deg,.1nm)
     (Recycle)   V32E, to 2
     (Term)      PRO

7  F 37          XXE
```

REND NAV AND TRACKING

V54 START RENDEZVOUS BACKUP SIGHTING MARK

P20 - running in Opt 0 or 4
Optics immobile but usable

NOTES: If high CMC activity (e.g., P3X w/ P20 and R27), poss PROG Alarm & restart (no light) - code 31201 or 31202 stored.

Exercise caution when using DSKY while this routine is operating. A V16NXXE (KEY REL to term) is permissible. However, to avoid taking unwanted marks, other verbs/nouns (e.g., V64,V76,V48,V32,V87,V77, etc.) should be used either before initiation or after termination of this routine.

1 V54E
*Poss PROG Alarm *
*V5N9E - 00406 *
Not rend tracking

2 F 06 94 COAS SHAFT,TRUN (.01deg,.001deg)
Load angles:
SXT - If N91 = TPAC, use N91
If N91 not = TPAC, use TPAC
COAS - 'COAS LOS DETERMINATION' (G/2-20)
or Nominal: +00000, +57470
PRO

F 53 45 PERFORM BACKUP MARK
MARKS,TFI,MGA or CODE (mks,min-sec,.01deg)

RHC - Align target on COAS LOS
ENTR (V86E to reject - within 7 sec)
*Poss F 06 49 ΔR,ΔV,Source Code *
* (.01nm,.1fps,0000X)*
*(Reject) V32E *
*(Accept) PRO *

When Marking Complete:
PRO (return to program in progress)

V57 FULL-TRACK FLAG DISPLAY

```
        V57E
F 04 12 R1 00004 SPECIFY FULTKFLG SETTING
        R2 0000X   X=0 VHF AND OPTICS WORKING
                   X=1 VHF OR OPTICS WORKING
            (If display erased upon ENTR,
             verify by repeating V57)
        PRO
```

V64 OPTICS ANGLE TRANSFORM

NOTE: If P20 is active, the values displayed in N78 will be used for tracking. Each time MINKEY is initiated, N78 R1 & R2 will be overwritten with 0 deg,-35 deg.

```
1       V64E
F 06 94 LOS SHAFT,TRUN                  (.01deg,.001deg)
        Load angles:
          SXT - If N91 = TPAC, use N91
                If N91 not = TPAC, use TPAC
          COAS - 'COAS LOS DETERMINATION' (G/2-20)
                 or Nominal:  +00000
                              +57470
        PRO

2 F 06 78 AXIS YAW,AXIS PITCH,OMICRON           (.01deg)
            (Omicron is not calculated)
        PRO
```

V67 W-MATRIX RSS ERROR DISPLAY

```
1       V67E
F 06 99 POS ERR,VEL ERR,OPT CODE          (ft,.1fps)
        R3 0000X   X=0 NO REINITIALIZATION
                   X=1 USE NEW DATA
        Load desired data
          Nominal for Rend:  02000
                             00020
                             00001
        PRO

2       V93E (Reinitialize W-matrix)
```

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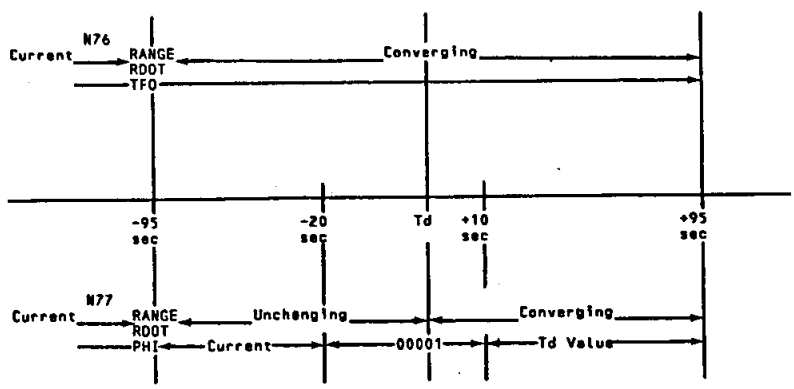
V76/V77 ENABLE/DISABLE VHF DATA PROCESSING

1 V76E
F 06 72 TIME OF OPTIMIZ (R27) (hrs,min,.01sec)
Load desired time
PRO

2 TERMINATE: V77E

Filter Operation



Definitions:

N72: OPTIMIZATION TIME = Td (hrs,min,.01sec)
N76: RANGE (.01nm)
RDOT (.1fps)
TFO (min-sec)
N77: RANGE (.01nm)
RDOT (.1fps)
PHI (.01deg) (SXT/local horiz)

TFO = (Present T - Td) = (Present T - N72)

V83 START RENDEZVOUS PARAMETER DISPLAY #1

NOTE: If high CMC activity (e.g., P3X w/ P20), poss PROG Alarm and restart (no light) - code 31201 or 31202 stored.

V83E
F 16 54 RANGE,RDOT,THETA (.01nm,.1fps,.01deg)
PRO

V85 START RENDEZVOUS PARAMETER DISPLAY #2

NOTE: If high CMC activity (e.g., P3X w/ P20), poss PROG Alarm and restart (no light) - code 31201 or 31202 stored.

V85E
F 16 53 RANGE,RDOT,PHI (.01nm,.1fps,.01deg)
PRO

V87/V88 ENABLE/DISABLE VHF MARKS

VHF AM B - DUPLEX
VHF RNG - on (up)
P20 Opt 0 or 4 - running

1 V87E (Enable VHF marks)

NOTE: VHF marks are not restricted to ranges less than 327.68 nm.

2 TERMINATE: V88E or V37E XXE

V89 START RENDEZVOUS FINAL ATTITUDE

ISS - on
SCS - operating
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

1 V37E 00E
V62E

2 V89E
F 06 78 AXIS YAW,AXIS PITCH (.01deg)
Load axis to be pointed at Soyuz
PRO

3 F 06 18 FINAL FDAI R,P,Y ANGLES (.01deg)
(New Display) V32E, to 3
(Accept) PRO

4 F 50 18 REQUEST MNVR TO FDAI R,P,Y ANGLES (.01deg)
(Auto) PRO
(Man) RHC - Mnvr to N18 Angles, to 6

5 06 18 AUTO MNVR TO ATT (.01deg)

6 F 50 18 REQUEST TRIM MNVR (.01deg)
(Bypass) ENTR
(Trim) Align S/C about pointing axis
PRO, to 5

V90 REQUEST RENDEZVOUS OUT-OF-PLANE DISPLAY

1 V90E

2 F 06 16 GET EVENT (hrs,min,.01sec)
Load desired time (0,0,0 for present time)
PRO

3 F 06 96 Y(CSM),YDOT(CSM), (.01nm,.1fps,.1fps)
YDOT(SOYUZ)
(Recycle) V32E, to 2
(Exit) PRO

P20 OPT 0&4 RENDEZVOUS-UNIVERSAL TRACKING

ISS - on and aligned
SCS - on (desirable)
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2
G/N PWR OPTICS - on
OPT MODE - MAN
OPT ZERO - OFF
OHC - Drive Trun <10 deg
OPT ZERO - ZERO (15 sec)
OPT MODE - CMC

1 V37E 20E
F 04 06 R1 00024 TRACKING OPTION
R2 0000X X=0 VECPOINT
X=4 3-AXIS
PRO

2 F 06 78* AXIS YAW,AXIS PITCH,OMICRON (.01deg)
Load values (Omicron ignored for Opt 0)
PRO

3 F 06 79* R2 DEADBAND (.01deg)
Load desired DB
PRO

4 If req'd mnvr <10 deg, DAP mnvr
without display, to 6
F 50 18 REQUEST MNVR TO FDAI R,P,Y ANGLES (.01deg)
(Auto) PRO
(Man) RHC - Mnvr to N18 Angles
ENTR, to 6
(Reject) ENTR, to 6

5 06 18 AUTO MNVR TO ATT (.01deg)
When Mnvr complete, to 4

6 OPT ZERO - OFF

CMC continues Soyuz Attitude and Optics Tracking

*NOTE: CMC will react to changes in N78 and N79 (May take 18 sec).

```
*Poss UPLINK ACTY lt     *
*  (Mnvr >10 deg req'd)  *
*Key V58E to permit the  *
*  required auto mnvr    *
```

To start VHF Marks - V87E (V88E to stop)
MARK at will (Reject within 7 sec)

```
*Poss F 06 49 ΔR,ΔV,Source Code  *
*              (.01nm,.1fps,0000X)*
*(Reject)  V32E                  *
*(Accept)  PRO                   *
```

For Backup Marks, see V54 (G/4-5)
For failed Mark PB, see EMP SL-5 (G/1-25)

7 TERMINATE P20:
V56E
OHC - Drive Trun <10 deg
OPT ZERO - ZERO
G/N PWR OPT - OFF

P20 OPT 4 WITH GDC REFSMMAT

IMU - off
GDC - on and REFSMMAT known (G/3-13)
SCS - operating
OPT MODE - MAN
OPT ZERO - OFF
G/N PWR OPTICS - on
OHC - Drive Trun <10 deg
OPT ZERO - ZERO (15 sec)
OPT MODE - CMC

1 V25N20E
Load present GDC angles

2 Perform P20, Opt 4 (G/4-10)
(Return after PRO on N79)

3 Display Desired Att:
V16N18E FDAI R,P,Y ANGLES (.01deg)

4 Mnvr to 0 or 180 Roll, N18 Pitch, 0 Yaw
V25N20E
Load present GDC angles

5 OPT ZERO - OFF
MARK at will (Reject within 7 sec)
(repeat step 4 as required)

```
*Poss F 06 49 ΔR,ΔV,Source Code  *
*             (.01nm,.1fps,0000X)*
*(Reject)  V32E                  *
*(Accept)  PRO                   *
```

For Backup Marks, see V54 (G/4-5)
For failed Mark PB, see EMP SL-5 (G/1-25)

6 TERMINATE P20:
V56E
OHC - Drive Trun <10 deg
OPT ZERO - ZERO
G/N PWR OPTICS - OFF

P25 CONTINGENCY VHF RANGE RATE PROGRAM

VHF RNG - on (up)
VHF AM B - DUPLEX

1		V37E 25E	
2	F 06 72	TIME of OPTIMIZ Load time (0,0,0 for no optimization) PRO (N72=0, to 4)	(hrs,min,.01sec)
3	F 16 76	RANGE,RDOT,TFO (Recycle) V32E, to 2 (N77 Disp) PRO	(.01nm,.1fps,min-sec)
4	F 16 77	RANGE,RDOT,-00001 (Recycle) V32E, to 2 (Term) PRO	(.01nm,.1fps)

NOTES: During Braking Phase, re-enable VHF data processing after each thrusting by V76E, PRO.

. Allow 20 sec for convergence.

V77 will not disable VHF data processing during P25.

See V76/V77 for Filter Operations (G/4-7).

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TARGETING PROGRAMS

P30 EXTERNAL ΔV

1			V37E 30E	
	F	06 33	TIG	(hrs,min,.01sec)
			Load desired TIG	
			PRO	
2	F	06 81	ΔV X,Y,Z(LV)	(.1fps)
			Load desired ΔV's	(Do not load all 0's)
			PRO	
3	F	06 42	HA,HP,ΔV(REQ)	(.1nm,.1nm,.1fps)
			Set ΔV COUNTER	
			PRO	
4	F	16 45	MARKS,TFI,MGA	(marks,min-sec,.01deg)
			(MGA = -00002 if REFSMFLG not set)	
			Set EVENT TIMER	
			PRO	
5	F	37	XX	

P31 NC1 TARGETING

MINKEY: ISS = on & aligned
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

1 V37E 31E (If REFSMFLG not set, to 4)
F 50 25 00017 MINKEY OPTION
(Accept) PRO
(Reject) ENTR

2 If req'd Mnvr <10 deg, DAP mnvr
without display, to 4
F 50 18 REQUEST MNVR FDAI TO R,P,Y ANGLES (.01deg)
(Accept) PRO
(Reject) ENTR, to 4

3 06 18 AUTO MNVR TO ATT (.01deg)
(If Non-MINKEY, when mnvr complete, to 2)

4 F 06 95 TIG(NC1) (hrs,min,.01sec)
Load desired data
PRO

5 F 06 57 HALF-REVS(NC1/NC2), (+000NN,.1nm,.1nm)
ΔH(NCC),ΔH(NSR)
Load desired data
PRO

6 F 06 37 TIG(TPI) (hrs,min,.01sec)
Load desired data
PRO

7 F 16 45 MARKS,TFI,-00001 (marks,min-sec)
(Recycle) V32E
(Final Pass) PRO (Term marking)

F 05 09 Iteration Failure:
*
* 00600 Phase Match *
* 00601 Height Maneuver *
* 00603 ORDTPI *
* (Redo) V32E, to 4, adjust inputs*
* (Cont) PRO, to 9, load N81 *
* 00602 Outer Loop *
* (Redo) V32E, to 4, adjust inputs*
* (Cont) PRO, to 8, CMC uses *
* result of last iteration*

8 F 06 84 ΔV(NC2),ΔH(NC2),ΔV(NCC) (.1fps,.1nm,.1fps)
PRO

9 F 06 81 ΔV X,Y,Z(LV) NC1 (.1fps)
PRO (If Recycle, to 7)

10 F 16 45 MARKS,TFI,MGA (marks,min-sec,.01deg)
(MGA = -00002 if REFSMFLG not set)
Set EVENT TIMER
PRO
If MINKEY: ΔV <10 fps, to P41 (G/6-12)
ΔV ≥10 fps, to P40 (G/6-2)

11 F 37 XXE

P32 NC2 TARGETING

MINKEY: ISS - on & aligned
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

1 V37E 32E (If REFSMFLG not set, to 4)
F 50 25 00017 MINKEY OPTION
(Accept) PRO
(Reject) ENTR

2 If req'd Mnvr <10 deg, DAP mnvr
without display, to 4
F 50 18 REQUEST MNVR FDAI TO R,P,Y ANGLES (.01deg)
(Accept) PRO
(Reject) ENTR, to 4

3 06 18 AUTO MNVR TO ATT (.01deg)
(If Non-MINKEY, when mnvr complete, to 2)

4 F 06 28 TIG(NC2) (hrs,min,.01sec)
Load data if needed
PRO

5 F 06 57 Blank,ΔH(NCC),ΔH(NSR) (.1nm,.1nm)
Load desired data
PRO

6 F 06 37 TIG(TPI) (hrs,min,.01sec)
Load desired data
PRO

```
 7  F 16 45   MARKS,TFI,-00001              (marks,min-sec)
       (Recycle)    V32E
       (Final Pass) PRO (Term marking)
                   *F 05 09 Iteration Failure:          *
                   *                                    *
                   *  00600 Phase Match                 *
                   *  00601 Height Maneuver             *
                   *  00603 GRDTPI                      *
                   *    (Redo) V32E, to 4, adjust inputs*
                   *    (Cont)  PRO, to 9, load N81     *
                   *  00602 Outer Loop                  *
                   *    (Redo) V32E, to 4, adjust inputs*
                   *    (Cont)  PRO, to 8, CMC uses     *
                   *            result of last iteration*

 8  F 06 84   ΔV(NCC),ΔH(NCC),ΔV(NSR) (.1fps,.1nm,.1fps)
       PRO

 9  F 06 81   ΔV X,Y,Z(LV) NC2                    (.1fps)
       PRO  (If Recycle, to 7)

10  F 16 45   MARKS,TFI,MGA        (marks,min-sec,.01deg)
         (MGA = -00002 if REFSMFLG not set)
       Set EVENT TIMER
       PRO
            If MINKEY: ΔV <10 fps, to P41 (G/6-12)
                       ΔV ≥10 fps, to P40 (G/6-2)

11  F 37      XXE
```

P33 NCC TARGETING

MINKEY: ISS - on & aligned
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

```
1            V37E 33E  (If REFSMFLG not set, to 4)
   F 50 25   00017 MINKEY OPTION
       (Accept)  PRO
       (Reject)  ENTR

2            If req'd Mnvr <10 deg, DAP mnvr
               without display, to 4
   F 50 18   REQUEST MNVR FDAI TO R,P,Y ANGLES (.01deg)
       (Accept)  PRO
       (Reject)  ENTR, to 4
```

```
3    06 18   AUTO MNVR TO ATT                          (.01deg)
             (If Non-MINKEY, when mnvr complete, to 2)

4  F 06 11   TIG(NCC)                                  (hrs,min,.01sec)
             Load desired data
             PRO

5  F 06 13   TIG(NSR)                                  (hrs,min,.01sec)
             Load desired data
             PRO

6  F 06 37   TIG(TPI)                                  (hrs,min,.01sec)
             Load desired data
             PRO

7  F 16 45   MARKS,TFI,-00001                          (marks,min-sec)
          (Recycle)    V32E
          (Final Pass) PRO (Term Marking)
                       *F 05 09 00603                              *
                       *  QRDTPI Iteration Failure                 *
                       *(Redo) V32E, to 4, adjust inputs           *
                       *(Cont)  PRO, to 9, load N81                *

8  F 06 82   ΔV X,Y,Z(LV) NSR                          (.1fps)
             PRO

9  F 06 81   ΔV X,Y,Z(LV) NCC                          (.1fps)
             PRO  (If Recycle, to 7)

10 F 16 45   MARKS,TFI,MGA          (marks,min-sec,.01deg)
               (MGA = -00002 if REFSMFLG not set)
             Set EVENT TIMER
             PRO
                  If MINKEY: ΔV <10 fps, to P41 (G/6-12)
                             ΔV ≥10 fps, to P40 (G/6-2)

11 F 37      XXE
```

P34 NSR TARGETING

(P33 Complete)
MINKEY: ISS - on & aligned
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

1 V37E 34E (If REFSMFLG not set, to 4)
F 50 25 00017 MINKEY OPTION
(Accept) PRO
(Reject) ENTR

2 If req'd Mnvr <10 deg, DAP mnvr without display, to 4
F 50 18 REQUEST MNVR FDAI TO R,P,Y ANGLES (.01deg)
(Accept) PRO
(Reject) ENTR, to 4

3 06 18 AUTO MNVR TO ATT (.01deg)
(If Non-MINKEY, when mnvr complete, to 2)

4 F 06 13 TIG(NSR) (hrs,min,.01sec)
PRO

5 F 16 45 MARKS,TFI,-00001 (marks,min-sec)
(Recycle) V32E
(Final Pass) PRO (Term Marking)
F 05 09 00611 No TIG For Elev Ang
*(Redo) V32E, to 4, adjust inputs *
*(Cont) PRO, to 6, CMC will use *
* initial value of TIG(TPI)*

6 F 06 75 ΔH(NSR),ΔT(TPI-NSR), (.1nm,min-sec)
ΔT(TPI-NOMTPI)
PRO

7 F 06 81 ΔV X,Y,Z(LV) NSR (.1fps)
PRO (If Recycle, to 5)

8 F 16 45 MARKS,TFI,MGA (marks,min-sec,.01deg)
(MGA = -00002 if REFSMFLG not set)
Set EVENT TIMER
PRO
If MINKEY: ΔV <10 fps, to P41 (G/6-12)
ΔV ≥10 fps, to P40 (G/6-2)

9 F 37 XXE

P35 TPI TARGETING

MINKEY: ISS - on & aligned
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

1 V37E 35E (If REFSMFLG not set, to 4)
F 50 25 00017 MINKEY OPTION
(Accept) PRO
(Reject) ENTR

2 If req'd Mnvr <10 deg, DAP mnvr without display, to 4
F 50 18 REQUEST MNVR FDAI TO R,P,Y ANGLES (.01deg)
(Accept) PRO
(Reject) ENTR, to 4

3 06 18 AUTO MNVR TO ATT (.01deg)
(If Non-MINKEY, when mnvr complete, to 2)

4 F 06 37 TIG(TPI) (hrs,min,.01sec)
Load desired TIG
PRO

5 F 06 55 PRECISION OFFSETS,ELEV ANGLE (0000X,.01deg)
Load desired values
(R2 = +00000 to calc Elev at TIG Time)
PRO

6 F 16 45 MARKS,TFI,-00001 (marks,min-sec)
(Recycle) V32E (TIG Option, to 8)
(Final Pass) PRO (Term Marking) (TIG Opt, to 8)
*F 05 09 00611 No Sol'n *
PRO, to 4, adjust inputs

7 F 06 37 TIG(TPI) (hrs,min,.01sec)
PRO (If MINKEY Final Pass and new value loaded into N37, to 8. Otherwise, to 9)

8 F 06 55 PRECISION OFFSETS,ELEV ANGLE (0000X,.01deg)
PRO

9 F 06 58 ΔV(TPI),ΔV(TPF), (.1fps,.1fps,min-sec)
Δt(TPI-NOMTPI)
PRO

10 F 06 81 ΔV X,Y,Z(LV) TPI (.1fps)
PRO (If Recycle, to 6)

NOTE: ΔV X,Y,Z(LOS) via N59E; KEY REL, to 10

11 F 16 45 MARKS,TFI,MGA (marks,min-sec,.01deg)
(MGA = -00002 if REFSMFLG not set)
Set EVENT TIMER
PRO
If MINKEY: ΔV <10 fps, to P41 (G/6-12)
ΔV ≥10 fps, to P40 (G/6-2)

12 F 37 XXE

P36 TPM TARGETING

(P35 Complete)
MINKEY: ISS - on & aligned
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

1 V37E 36E (If REFSMFLG not set, to 4)
F 50 25 00017 MINKEY OPTION
(Accept) PRO
(Reject) ENTR

2 If req'd Mnvr <10 deg, DAP mnvr
without display, to 4
F 50 18 REQUEST MNVR FDAI TO R,P,Y ANGLES (.01deg)
(Accept) PRO
(Reject) ENTR, to 4

3 06 18 AUTO MNVR TO ATT (.01deg)
(If Non-MINKEY, when mnvr complete, to 2)

4 F 16 45 MARKS,TFI,-00001 (marks,min-sec)
PRO at TPI+9/TPI+21 min (Term Marking)

5 F 06 59 ΔV X,Y,Z(LOS) TPM (.1fps)
PRO

6 F 16 45 MARKS,TFI,MGA (marks,min-sec,.01deg)
PRO (MGA = -00002 if REFSMFLG not set)
If MINKEY: ΔV <10 fps, to P41 (G/6-12)
ΔV ≥10 fps, to P40 (G/6-2)

7 F 37 XXE

DATE 4/16/75

P37 REND FINAL PROGRAM

MINKEY: ISS - on & aligned
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

1			V37E 37E (If REFSMFLG not set, to 4)
	F	50 25	00017 MINKEY OPTION
			(Accept) PRO
			(Reject) ENTR
2			If req'd Mnvr <10 deg, DAP mnvr without display, to 4
	F	50 18	REQUEST MNVR FDAI TO R,P,Y ANGLES (.01deg) (X-Axis Track)
			(Accept) PRO
			(Reject) ENTR, to 4
3		06 18	AUTO MNVR TO ATT (.01deg) (If Non-MINKEY, when mnvr complete, to 2)
4	F	16 54	RANGE,RDOT,THETA (.01nm,.1fps,.01deg) (Extended Verbs locked out)
			PRO (If MINKEY, to P48 Step 2)
5	F	37	XXE

P38 NPC TARGETING

MINKEY: ISS - on & aligned
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

NOTE: Avoid marking between steps 4 and 5 (V88E and take no optics marks).

1 V37E 38E (If REFSMFLG not set, to 4)
F 50 25 00017 MINKEY OPTION
(Accept) PRO
(Reject) ENTR

2 If req'd Mnvr <10 deg, DAP mnvr without display, to 4
F 50 18 REQUEST MNVR FDAI TO R,P,Y ANGLES (.01deg)
(Accept) PRO
(Reject) ENTR, to 4

3 06 18 AUTO MNVR TO ATT (.01deg)
(If Non-MINKEY, when mnvr complete, to 2)

4 F 06 39 TIG(LAST MNVR) (hrs,min,.01sec)
Change data if needed
PRO

5 F 06 33 TIG(NPC) (hrs,min,.01sec)
Load desired TIG
PRO

6 F 16 45 MARKS,TFI,-00001 (marks,min-sec)
(Recycle) V32E
(Final Pass) PRO (Term Marking)

7 F 06 81 ΔV X,Y,Z(LV) NPC (.1fps)
Change data if desired
PRO (If Recycle, to 5)

8 F 16 45 MARKS,TFI,MGA (marks,min-sec,.01deg)
(MGA = -00002 if REFSMFLG not set)
Set EVENT TIMER
PRO (If ΔV Mag. = 0, or if Non-MINKEY, to 17)

9		52 in PROG Lights	
	F 06 22	NEW ICDU ANGLES OG,IG,MG	(.01deg)
		(If MG >±70 deg, Mnvr) V32E, to 9	
		PRO	
10	F 50 25	00020 MINKEY PULSE TORQUE	
		(Bypass) ENTR (Go to P41) (G/6-12)	
		(Torque) CMC MODE - FREE	
		PRO	
11	16 20	ICDU ANGLES	(.01deg)
		If RESTART during torquing, perform	
		* 'NPC RESTART RECOVERY' (G/5-12) *	
		When Torque Complete:	
		CMC MODE - AUTO	
		ΔV <10 fps, to P41 (G/6-12)	
		ΔV ≥10 fps, to P40 (G/6-2)	
12		20 in PROG Lights	
		SC CONT CMC/AUTO	
		If req'd Mnvr <10 deg, DAP mnvr without display, to 14	
	F 50 18	REQUEST MNVR TO R,P,Y ANGLES	(.01deg)
	(Accept)	PRO	
	(Reject)	ENTR, to 14	
13	06 18	AUTO MNVR TO ATT	(.01deg)
14		52 in PROG Lights	
	F 06 22	NEW ICDU ANGLES OG,IG,MG	(.01deg)
		(If MG >±70 deg, Mnvr) V32E, to 14	
		PRO	
15	F 50 25	00020 MINKEY PULSE TORQUE	
		CMC MODE - FREE	
		PRO	
		ICDU ANGLES	(.01deg)
16	16 20	*If RESTART during torquing, perform*	
		* 'NPC RESTART RECOVERY' (G/5-12) *	
		When Torque complete:	
		CMC MODE - AUTO	
		Align GDC to IMU	
17	F 37	XXE	

NPC RESTART RECOVERY

NOTE: This recovery procedure will permit gyro torquing to be continued from the point of interruption.

1 DB/RATE - MIN/LOW
BMAG MODE (3) - ATT 1/RATE 2
SC CONT - SCS

2 V37E 00E
V25N26E, 13001E, 2327E, 30005E
V30E

NOTE: V16N20E to monitor pulse torquing until complete (up to 82 sec).

3 F 50 25 00015 PULSE TORQUE COMPLETE
V21N26E, E
SC CONT - CMC
CMC MODE - AUTO
BMAG MODE (3) - RATE 2
OPT ZERO - OFF, then ZERO
Perform P52, Opt 3 (REFS)
(If Post-NPC, to 5)

4 Perform following steps only for Pre-NPC:
a. If time, go to SPS BURN CUE CARD and perform burn (G&N or SCS as desired).

b. If burn SCS, perform P77 after burn.

c. After burn as time permits, configure for Rend REFSMMAT uplink (G/1-15), then perform P52, Opt 1 (PREF).

5 Align GDC to IMU
Return to Post-NPC Nominal Procedures

THRUST CONTROL

P40 SPS THRUSTING (REND & ENTRY)

Targeting complete
ISS & SCS operating
DAP loaded
Test C/W lamps

	SPS Thrusting Prep	SCS DELTAS
	AUTO RCS SEL (12) - MNA/MNB (4 Roll Jets - OFF) If Rend: Do 'EMS ΔV TEST & NULL BIAS CHECK' (G/2-11) FDAI SCALE - 5/1 MAN ATT (3) - RATE CMD ATT DB/RATE - MIN/LOW	
Δ	BMAG MODE (3) - RATE 2	BMAG MODE (3) - ATT 1/RATE 2
Δ	SC CONT - CMC/AUTO	SC CONT - SCS
Δ	FDAI (2) - INRTL	If Rend and No Chart Sol'n: FDAI 1 - ORB RT
	If Rend: Set GDC tW If Entry: Align GDC to IMU cb STAB CONT (all) - close except DIR ULL (2) - open cb SPS (8) - close (cb GAUGING (4) - open) SCS TVC (2) - RATE CMD TVC GMBL DRIVE P&Y - AUTO ATVC GAIN - HI RHC #2 - ARMED EMS - ΔV SET/STBY Set Tailoff ΔV=____ (≥7fps) EMS FUNC - ΔV Set EVENT TIMER (V16 N45) If P30 performed: Mnvr to PAD Burn Att: V37E 00E V49E (G/6-15) Perform V41 N91 Boresight Star Check (G/2-4) *If NO-GO: * * SCS TVC (2) - AUTO* * SC CONT - SCS *	

THRUST CONTROL PROGS (P40's)

BACK

COLOR_____

DATE 4/16/75

THRUST CONTROL PROGS (P40'S)

2			Δ V37E 40E (TFI via N40 or N45)	RHC to Burn Att
3	F	50 18	REQ MNVR TO BURN ATT(.01deg) (Auto) PRO (Man) RHC - Mnvr to Att, to 5	
4		06 18	AUTO MNVR TO ATT (.01deg)	
5	F	50 18	REQ TRIM MNVR (.01deg) Change S/C Roll if req'd If Rend: Align GDC to IMU	
	54:00		MN BUS TIE (2) - on (up) *If No ATS: * * TAPE RCDR - * * HBR/RCD/FWD/CMD RESET* TVC SERVO PWR 1 - AC1/MNA TVC SERVO PWR 2 - AC2/MNB RHC PWR NORM (2) - AC RHC PWR DIR (2) - OFF BMAG MODE (3) - ATT 1/RT 2 SC CONT - SCS	
	55:00		Primary TVC Check GMBL MOT P1,Y1 - START (on) (DP Confirm) Verify Trim Cont & Set Trim Verify MTVC	
			Δ	SCS TVC (2) - AUTO
			THC - CW Verify NO MTVC Secondary TVC Check GMBL MOT P2,Y2 - START (on) (DP Confirm) Verify Trim Cont & Set Trim	
			Δ SC CONT - CMC Verify MTVC THC - Neutral Verify NO MTVC	Omit this step
			Δ Verify GPI returns to 0,0 RHC PWR NORM (2) - AC/DC RHC PWR DIR (2) - MNA/MNB	GPI to Trim

(Trim)	Δ BMAG MODE (3) - RATE 2	Check Burn Att
	Δ PRO, to 4	Omit this step
(Bypass)	Δ BMAG MODE (3) - ATT 1/RT 2	Omit this step
	Δ ENTR	Omit this step
57:00	Δ If Entry and Boresight Star Check was NO-GO:	Set GDC tw to PAD values Track Horiz at 16 deg Window Mark (hds dn) Hold Att
58:00		Align GDC (PAD)
		NOTE: If Entry, Horizon at 5 deg Window Mark at TIG
6 F 50 25	00204 GMBL TEST OPTION	
(Reject)	ENTR	
Δ (Accept)	SC CONT - CMC (verify)	Omit this step
	PRO	
	Monitor GPI Response P&Y(0,+2,-2,0), Trim	
	*If Test Fails: *	
	* SC CONT - SCS *	
	* SCS TVC (2) - AUTO*	
7 06 40	TFI,VG,ΔVM (m-s,.1fps,.1fps)	
	*PROG Alarm - V5N9E *	
	* 01703 TIG Slipped*	
	*KEY REL *	
	Δ RATE - HIGH	RATE - LOW
	RHC #2 - ARMED (verify)	
	THC - ARMED	
	Check ΔVc	
	Check EVENT TIMER	
	SPS He VLV (2) - AUTO	
	Check He, N2A, and N2B	
59:00	EMS MODE - NORMAL	
	THC PWR - on (up)	
59:25	DSKY Blanks	

```
59:30
   06 40  TFI,VG,ΔVM (m-s,.1fps,.1fps)
           (Ave-G on)
           ΔV THRUST A (B) - NORM
           Check PIPA Bias <2 fps
             for 5 sec period
              *If PIPA Check Fails:*
              * SC CONT - SCS      *
              * SCS TVC (2) - AUTO *

59:40     Δ If Rend: Ullage                  Ullage at 59:46
            Monitor ΔVM (R3) Count Up

59:46     Δ If Entry: Ullage                 Ullage
            Monitor ΔVM (R3) Count Up
59:55
 F 99 40   REQUEST ENG ON ENABLE
      (Auto Ign)   PRO (TFI >0 sec)
      (Bypass Ign) ΔV THRUST A&B - OFF
                   ENTR, to 10
      (Exit)       V34E, to 13

8 00:00    Δ IGN                            THRUST pb - push
   06 40  TFC,VG,ΔVM (m-s,.1fps,.1fps)

        *Long Burn Recovery:          *
        *                             *
        *  F 97 40  SPS Thrust Fail   *
        * G&N REIGNITION:              *
        *   F 97 40  ENTR             *
        *   F 99 40                   *
        *       ΔV THRUST (2) - NORM  *
        *       Check Gmbl Trim       *
        *       Ullage                *
        *       PRO, to 8             *
        * SCS REIGNITION:              *
        *   (See Short Burn Recovery)*
        * RCS COMPLETION:              *
        *   F 97 40  ENTR             *
        *   F 99 40                   *
        *       ΔV THRUST A&B - OFF   *
        *       ENTR, to 10           *
        * EXIT P40: V34E, to 13       *
```

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	*Short Burn Recovery: *	
	* *	
	* Thrust Off with Att Drift*	
	* (No F 97 40) *	
	*SCS REIGNITION: *	
	* SC CONT - SCS *	
	* Check Att & Gmbl Trim *	
	* BMAG MODE (3)-ATT 1/RT 2*	
	* SCS TVC (2) - AUTO *	
	* ΔV THRUST (2) - NORM *	
	* Ullage *	
	* THRUST pb - push, to 8 *	
00:03	ΔV THRUST B (A) - NORM	
	Δ	RATE - HIGH
	Monitor Thrusting:	ENTRY BURN COMPLETION RULES
	Pc 95-105 psia	
	EMS Counting Down	1 If VG >22 fps restart SPS, SCS control
	SPS INJ VLVS (4) - open	
	SPS He VLV tb - gray	2 If no restart & VG >22 fps, use RCS COMPLETION CHART
	SPS FUEL/OXID PRESS: 170-195 psia	
00:XX	ECO	3 If VG <22 fps to overburn, trim VGX, VGZ to ±.2 fps
	At BT+1 sec:	
	ΔV THRUST A&B - OFF	
9 F 16 40	TFC(static),VG,ΔVM	
	Verify Thrust Off:	
	SPS INJ VLVS (4) - close	
	SPS He VLV tb (2) - bp	
	PRO	
10 F 16 85	VG X,Y,Z (.1fps)	
	AUTO RCS SEL(16) - MNA/MNB	
	Null Residuals	
	Record (ΔVc, FDAI, N85)	
	If Rend: PRO, to 12	
	If Entry: V82E, to 11	
11 F 16 44	HA,HP,TFF (.1nm,.1nm,m-s)	
	Verify HP ≤38 nm	
	*If HP > 38 nm: *	
	* continue burn *	
	* until HP is OK*	
	PRO,PRO	

12		AUTO RCS ROLL (4) - OFF GMBL MTRS (4) - OFF (DP Confirm) TVC SERVO PWR 1&2 - OFF		
	Δ	BMAG MODE (3) - RATE 2	BMAG MODE(3) - ATT 1/RT 2	
		THC - LOCKED THC PWR - OFF RHC PWR DIR (2) - OFF		
		If Rend: MN BUS TIE (2) - OFF EMS FUNC - ΔV SET/VHF RNG EMS MODE - BU/VHF RNG VHF RNG - RESET RHC - LOCKED PCM BIT RATE - LOW		
		If Entry: EMS FUNC - OFF EMS MODE - STBY		
		If Rend MINKEY: to P3X, Step 2; except P38, to Step 12		
13	F 37	XXE		

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SPS BURN GIMBAL CHECK MALFUNCTIONS

NOTE: Monitor rate needles for eng bell movement during Trim & MTVC checks. Complete all gmbl tests before analyzing to determine failure.

PROBLEM	FAILURE	ACTION
NO TRIM:		
Sys 1 or 2, P or Y	Gmbl Trim tw Pot	TVC GMBL DR - Good Sys
	Gmbl Trim tw Shaft	Burn G&N or SCS MTVC
Both sys, P&Y	cb TVC AC1 Open	Close cb; if unable, TVC SERVO PWR 1 - AC2/MNB
NO MTVC:		
RHC #2, P or Y	RHC #2 Prop Cont Open	Chg to RHC #1; RHC #2 Off
Both RHC's, P or Y	RHC Amp Open	Burn G&N or SCS AUTO
Both RHC's, P&Y	cb ECA/TVC AC2 Open	Close cb; if unable, TVC SERVO PWR 2 - AC1/MNA
NO TRIM OR MTVC:		
Sys 1 or 2, P or Y	Affected Gmbl Motor Not On	TVC GMBL DR - Good Sys, Corres cb SPS PITCH or SPS YAW - open
	Gmbl Cmd Amp	TVC GMBL DR - Good Sys, Corres cb SPS PITCH or SPS YAW - open
	GPI Ind 1 or 2	Cycle SPS IND Sw to SIVB,GPI to Test Gage, TVC GMBL DR - Good sys
	Gmbl Posn Transducer	Monitor Rt Ndls During MTVC, TVC GMBL DR - Good Sys
Sys 1, P&Y	SC CONT Sw Open	Burn G&N or THC/cw for SCS
Sys 2, P&Y	THC/cw Sw Open	Burn G&N or SC CONT - SCS
GPI HARDOVER:		
One Sys, P or Y	Gmbl Posn Transducer Hardover	TVC GMBL DR - Good Sys
Both Sys, P or Y	RHC #2 Prop Cont Short	Chg to RHC #1, RHC PWR NORM 2 - OFF
	RHC Amp Hardover	SCS TVC - AUTO for Trim OK, Burn G&N or SCS AUTO
GPI OSCILLATION:		
One Sys	Gmbl Rate Transducer Open	TVC GMBL DR - Good Sys
One or Both Sys	Gmbl Actuator Binding	TVC GMBL DR - Good Sys

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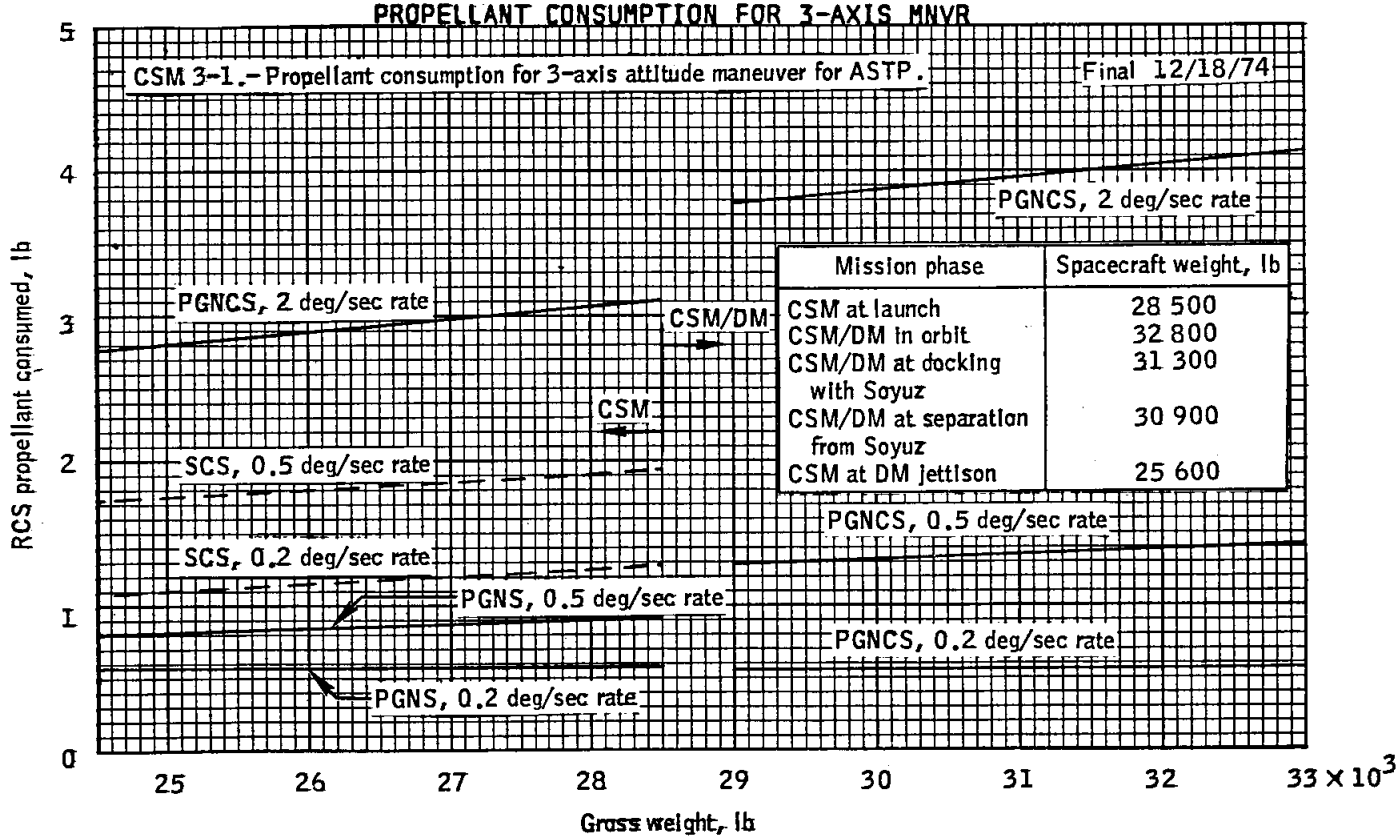
PROPELLANT CONSUMPTION FOR 3-AXIS MNVR

CSM 3-1.- Propellant consumption for 3-axis attitude maneuver for ASTP.

Final 12/18/74



Mission phase	Spacecraft weight, lb
CSM at launch	28 500
CSM/DM in orbit	32 800
CSM/DM at docking with Soyuz	31 300
CSM/DM at separation from Soyuz	30 900
CSM at DM jettison	25 600

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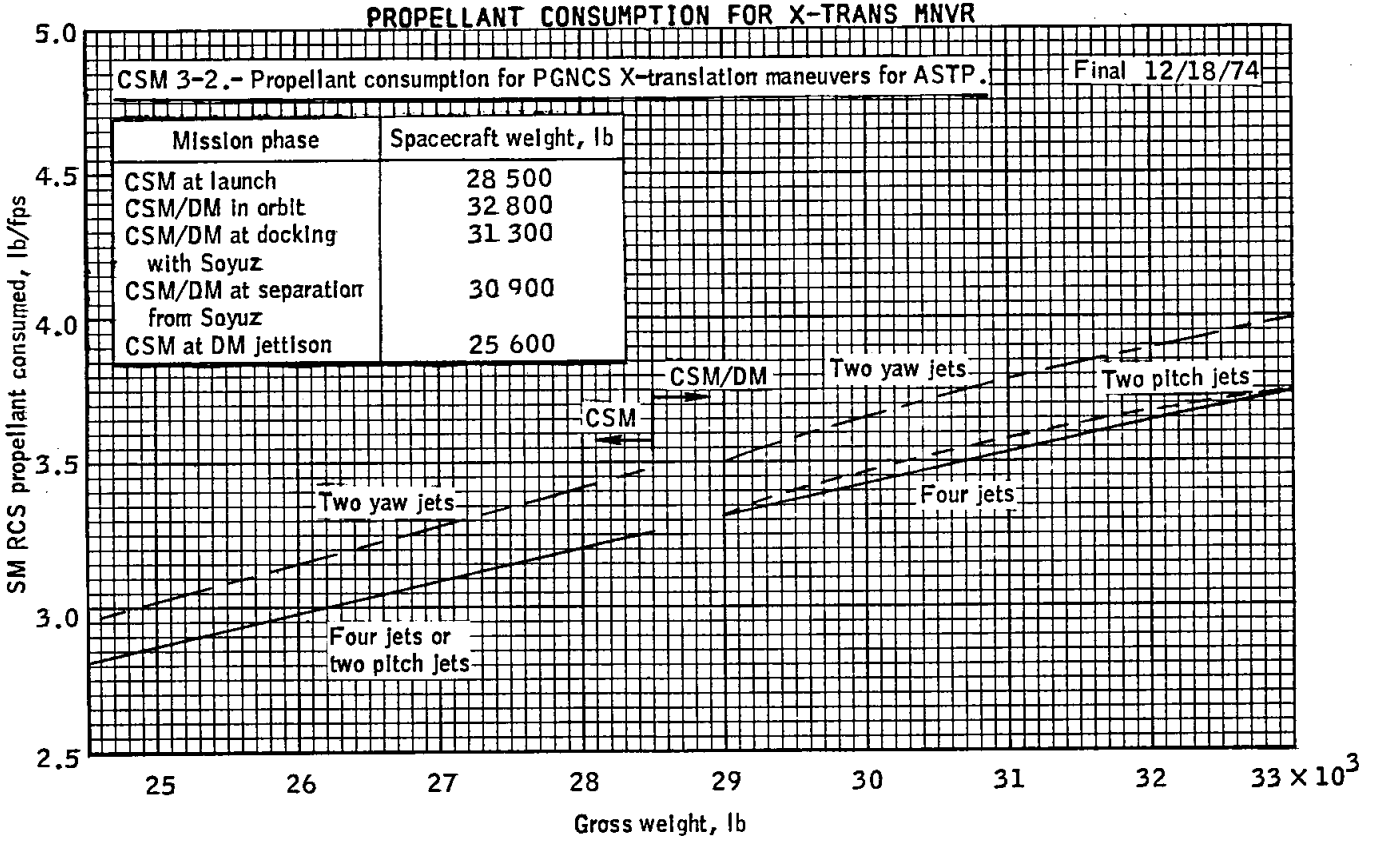
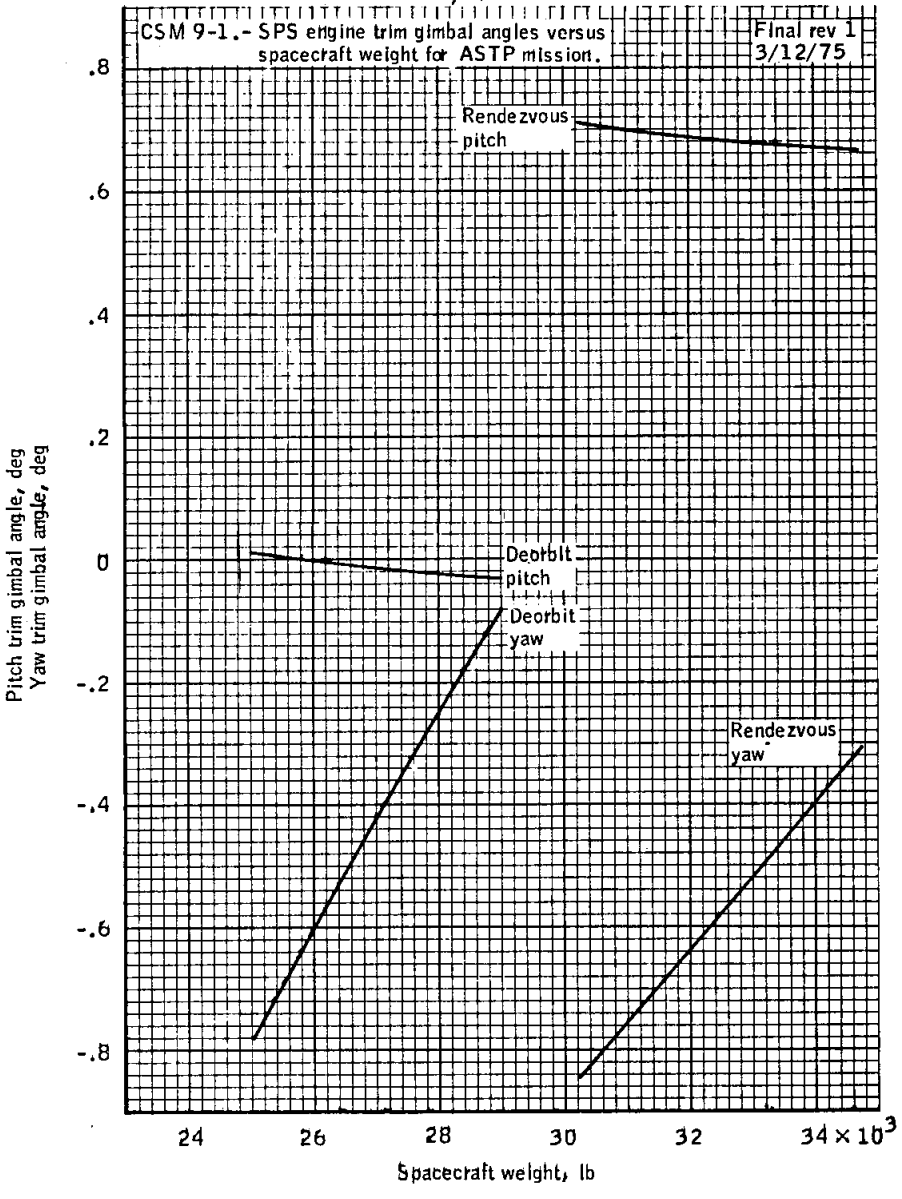

PROPELLANT CONSUMPTION FOR X-TRANS MNVR
CSM 3-2.- Propellant consumption for PGNCS X-translation maneuvers for ASTP.
Final 12/18/74
Mission phase | Spacecraft weight, lb
CSM at launch | 28 500
CSM/DM in orbit | 32 800
CSM/DM at docking with Soyuz | 31 300
CSM/DM at separation from Soyuz | 30 900
CSM at DM jettison | 25 600
SM RCS propellant consumed, lb/fps
5.0
4.5
4.0
3.5
3.0
2.5
25
26
27
28
29
30
31
32
33 X 10^3
Gross weight, lb
CSM/DM
CSM
Two yaw jets
Two pitch jets
Four jets
Two yaw jets
Four jets or two pitch jets

G
6-10

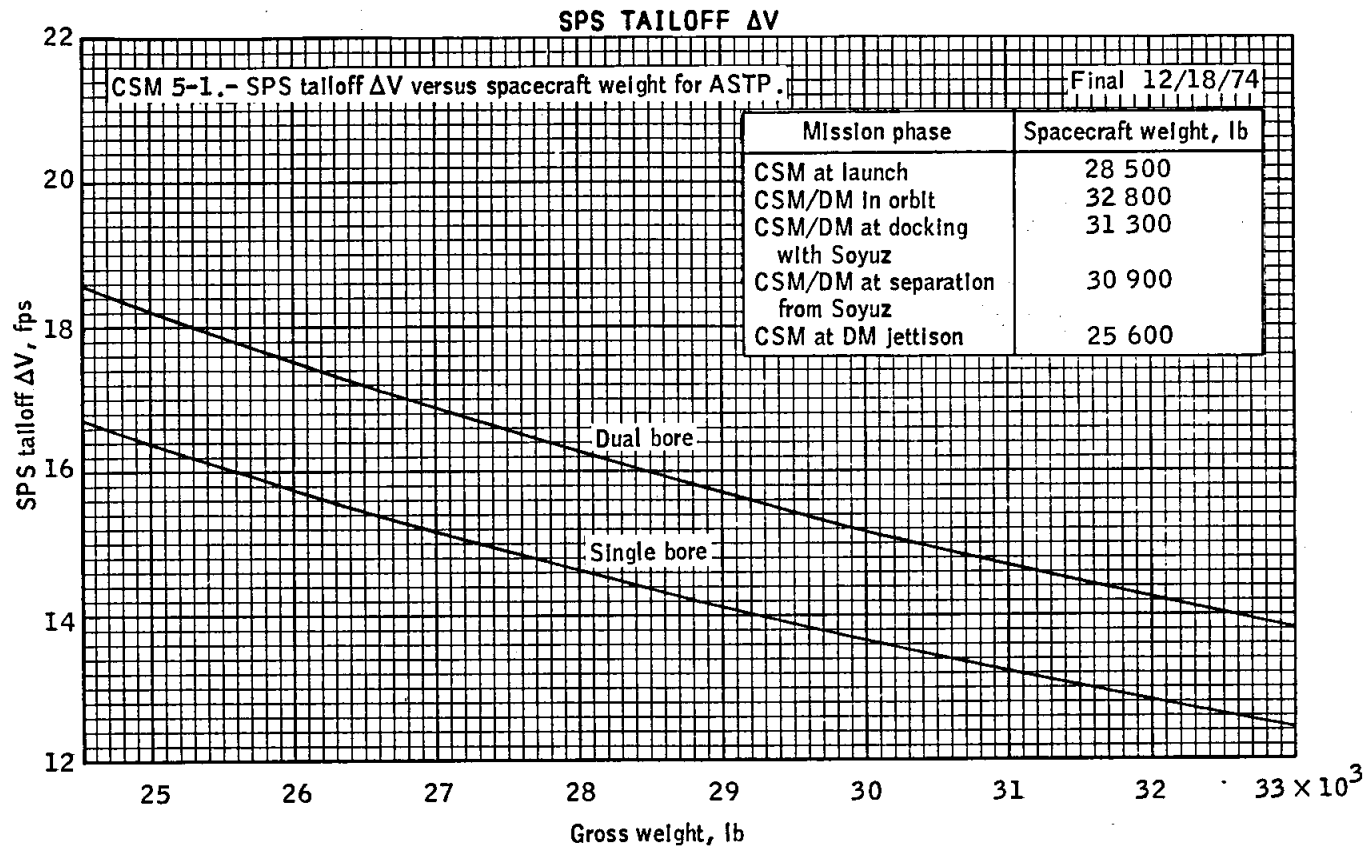
DATE 4/16/75

SPS ENGINE TRIM GIMBAL ANGLES

Davis/MPSO/MPAD
Data source: ODB AMD-S/MPAD CONSUMABLES
Data confirmed: R. Davis 3/12/75



DATE 4/16/75


SPS TAILOFF ΔV
CSM 5-1.- SPS tailoff ΔV versus spacecraft weight for ASTP.
Final 12/18/74
Mission phase | Spacecraft weight, lb
CSM at launch | 28 500
CSM/DM in orbit | 32 800
CSM/DM at docking with Soyuz | 31 300
CSM/DM at separation from Soyuz | 30 900
CSM at DM jettison | 25 600
Dual bore
Single bore
SPS tailoff ΔV, fps
22
20
18
16
14
12
25
26
27
28
29
30
31
32
33 X 10^3
Gross weight, lb

P41 RCS THRUSTING

Targeting complete
ISS & SCS operating
DAP loaded (check ROLL jets)
Test C/W lamps

1 RCS Thrusting Prep

AUTO RCS SEL (16) - MNA/MNB
Perform 'EMS ΔV TEST & NULL BIAS CHECK' (G/2-11)
FDAI SCALE - 5/1
MAN ATT (3) - RATE CMD
ATT DB/RATE - MIN/LOW
BMAG MODE (3) - RATE 2
EMS - ΔV SET/STBY
Set ΔVC
EMS FUNC - ΔV
CMC MODE - FREE
RHC PWR NORM (2) - AC/DC
RHC PWR DIR (2) - MNA/MNB
Set EVENT TIMER (V16 N45)
SC CONT - CMC/AUTO
If Req'd:
Mnvr to PAD Burn Att:
V37E 00E
V49E (G/6-15)
Perform V41 N91 Boresight Star Check (G/2-4)
*If NO-GO: * SC CONT - SCS*

2 V37E 41E (TFI via N40 or N45)

3 F 50 18 REQUEST MNVR TO BURN ATT (.01deg)
(Auto) PRO
(Man) RHC - Mnvr to Att, to 5

4 06 18 AUTO MNVR TO ATT (.01deg)

5 F 50 18 REQUEST TRIM MNVR (.01deg)
Change S/C Roll if req'd
(Trim) PRO, to 4
(Bypass) BMAG MODE (3) - ATT 1/RT 2
Align GDC to IMU
ENTR

	55:00		
6	06 85	VG X,Y,Z	(.1fps)
		*PROG Alarm - V5N9E *	
		* 01703 TIG Slipped*	
		*KEY REL *	
	58:00	RHC & THC - ARMED	
		TAPE RCDR - HBR/RCD/FWD/CMD RESET	
	59:00	EMS MODE - NORMAL	
		THC PWR - on (up)	
	59:25	DSKY Blanks	
	59:30		
	16 85	VG X,Y,Z	(.1fps)
		(Ave-G on)	
	00:00		
7	F 16 85	VG X,Y,Z	(.1fps)
		Null Components	
		If Req'd: Record (ΔVc and N85)	
		PRO	
		EMS FUNC - as desired	
		EMS MODE - as desired	
		RHC & THC - LOCKED	
		THC PWR - OFF	
		RHC PWR DIR - OFF	
		BMAG MODE (3) - RATE 2	
		PCM BIT RATE - LOW	
		If MINKEY: to P3X, Step 2; except P38	
		If P38 and pulse torque	
		bypassed: to P41, Step 8	
		performed: to P38, Step 9	
8	F 37	XXE	

P47 THRUST MONITOR PROGRAM

ISS - on & aligned

1 V37E 47E
(Ave-G on)

2 F 16 83 ΔV X,Y,Z (.1fps)
(Recycle) V32E (zero's N83)
(Term) PRO

3 F 37 XXE

P48 RENDEZVOUS THRUST MONITOR PROGRAM

ISS - on & aligned
VHF RNG - on (up)
VHF AM B - DUPLEX

1 V37E 48E
(Ave-G on)

2 F 16 77 RNG,RDOT,THETA (.01nm,.1fps,.01deg)
(Display N83) PRO, to 4
(Display N76) V25N72E
Load optimization time
V32E

3 F 16 76 RNG,RDOT,TFO (.01nm,.1fps,min-sec)
PRO, to 2

4 F 16 83 ΔV X,Y,Z (.1fps)
(Reinit) V32E: If N72 loaded
non-zero, to 3
Otherwise, to 2
(Term) PRO

5 F 37 XXE

DATE 4/16/75

V49 CREW DEFINED MANEUVER

ISS - on
SCS - operating
SC CONT - CMC/AUTO
BMAG MODE (3) - RATE 2

1			V37E 00E V62E	
2			V49E	
	F	06 22	NEW ICDU ANGLES R,P,Y Load desired angles PRO	(.01deg)
3	F	50 18	REQUEST MNVR TO FDAI R,P,Y ANGLES (Auto) PRO (Man) RHC - Mnvr to N18 Angles, to 5	(.01deg)
4		06 18	AUTO MNVR TO ATT	(.01deg)
5	F	50 18	REQUEST TRIM MNVR TO FDAI R,P,Y (Trim) PRO, to 4 (Bypass) ENTR	(.01deg)

COLOR_____

DATE 4/16/75

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ASTP

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