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```

```
#  ************************************************************************
#  *                                                                      *
#  *          THIS AGC PROGRAM SHALL ALSO BE REFERRED TO AS               *
#  *                                                                      *
#  *                                                                      *
#  *                        COLOSSUS 2A                                   *
#  *                                                                      *
#  *                                                                      *
#  *       THIS PROGRAM IS INTENDED FOR USE IN THE CM AS SPECIFIED        *
#  *       IN REPORT R-577. THIS PROGRAM WAS PREPARED UNDER DSR           *
#  *       PROJECT 55-23870, SPONSORED BY THE MANNED SPACECRAFT           *
#  *       CENTER OF THE NATIONAL AERONAUTICS AND SPACE                   *
#  *       ADMINISTRATION THROUGH CONTRACT NAS 9-4065 WITH THE            *
#  *       INSTRUMENTATION LABORATORY, MASSACHUSETTS INSTITUTE OF         *
#  *       TECHNOLOGY, CAMBRIDGE, MASS.                                   *
#  *                                                                      *
#  ************************************************************************


#          SUBMITTED      MARGARET H. HAMILTON              DATE    28 MAR 69
#              M.H.HAMILTON, COLOSSUS PROGRAMMING LEADER
#              APOLLO GUIDANCE AND NAVIGATION

#          APPROVED       DANIEL J. LICKLY                  DATE    28 MAR 69
#              D.J.LICKLY, DIRECTOR, MISSION PROGRAM DEVELOPMENT
#              APOLLO GUIDANCE AND NAVIGATION PROGRAM

#          APPROVED   FRED H. MARTIN                        DATE    28 MAR 69
#              FRED H. MARTIN, COLOSSUS PROJECT MANGER
#              APOLLO GUIDANCE AND NAVIGATION PROGRAM

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#              N.E. SEARS, DIRECTOR, MISSION DEVELOPMENT
#              APOLLO GUIDANCE AND NAVIGATION PROGRAM

#          APPROVED   RICHARD H. BATTIN                     DATE    28 MAR 69
#              R.H. BATTIN, DIRECTOR, MISSION DEVELOPMENT
#              APOLLO GUIDANCE AND NAVIGATION PROGRAM

#          APPROVED   DAVID G. HOAG                         DATE    28 MAR 69
#              D.G. HOAG, DIRECTOR
#              APOLLO GUIDANCE AND NAVIGATION PROGRAM

#          APPROVED   RALPH R. RAGAN                        DATE    28 MAR 69
#              R.R. RAGAN, DEPUTY DIRECTOR
#              INSTRUMENTATION LABORATORY
```

```
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```

```
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#                 RTB OP CODES
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```

```
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#        OCCUPIED LOCATIONS TABLE
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```

```
# VERB LIST FOR CSM

# REGULAR VERBS

# 00 NOT IN USE
# 01 DISPLAY OCTAL COMP 1 IN R1
# 02 DISPLAY OCTAL COMP 2 IN R1
# 03 DISPLAY OCTAL COMP 3 IN R1
# 04 DISPLAY OCTAL COMP 1,2 IN R1,R2
# 05 DISPLAY OCTAL COMP 1,2,3 IN R1,R2,R3
# 06 DISPLAY DECIMAL IN R1 OR R1,R2 OR R1,R2,R3
# 07 DISPLAY DP DECIMAL IN R1,R2  TEST ONLY
# 08
# 09
# 10
# 11 MONITOR OCTAL COMP 1 IN R1
# 12 MONITOR OCTAL COMP 2 IN R1
# 13 MONITOR OCTAL COMP 3 IN R1
# 14 MONITOR OCTAL COMP 1,2, IN R1,R2
# 15 MONITOR OCTAL COMP 1,2,3 IN R1,R2,R3
# 16 MONITOR DECIMAL IN R1 OR R1,R2 OR R1,R2,R3
# 17 MONITOR DP DECIMAL IN R1,R2  TEST ONLY
# 18
# 19
# 20
# 21 LOAD COMPONENT 1 INTO R1
# 22 LOAD COMPONENT 2 INTO R2
# 23 LOAD COMPONENT 3 INTO R3
# 24 LOAD COMPONENT 1,2 INTO R1,R2
# 25 LOAD COMPONENT 1,2,3 INTO R1,R2,R3
# 26
# 27 DISPLAY FIXED MEMORY
# 28
# 29
# 30 REQUEST EXECUTIVE
# 31 REQUEST WAITLIST
# 32 RECYCLE PROGRAM
# 33 PROCEED WITHOUT DSKY INPUTS
# 34 TERMINATE FUNCTION
# 35 TEST LIGHTS
# 36 REQUEST FRESH START
# 37 CHANGE PROGRAM  MAJOR MODE
# 38
# 39
```

EXTENDED VERBS

40 ZERO CDU-S
41 COARSE ALIGN CDU-S
42 FINE ALIGN IMU-S
43 LOAD IMU ATT ERROR METERS
44 SET SURFACE FLAG
45 RESET SURFACE FLAG
46 ESTABLISH G+C CONTROL
47 MOVE LM STATE VECTOR INTO CM STATE VECTOR.
48 REQUEST DAP DATA LOAD ROUTINE R03
49 REQUEST CREW DEFINED MANEUVER ROUTINE R62
50 PLEASE PERFORM
51 PLEASE MARK
52 MARK ON OFFSET LANDING SITE
53 PLEASE PERFORM ALTERNATE LOS MARK
54 REQUEST RENDEZVOUS BACKUP SIGHTING MARK ROUTINE R23
55 INCREMENT AGC TIME DECIMAL
56 TERMINATE TRACKING P20 + P25
57 REQUEST RENDEZVOUS SIGHTING MARK ROUTINE R21
58 RESET STICK FLAG
59 PLEASE CALIBRATE
60 SET ASTRONAUT TOTAL ATTITUDE N17 TO PRESENT ATTITUDE
61 DISPLAY DAP ATTITUDE ERROR
62 DISPLAY TOTAL ATTITUDE ERROR WRT N22 THETAD
63 DISPLAY TOTAL ASTRONAUT ATTITUDE ERROR WRT N17 CPHIX
64 REQUEST S-BAND ANTENNA ROUTINE
65 OPTICAL VERIFICATION OF PRELAUNCH ALIGNMENT
66 VEHICLES ARE ATTACHED. MOVE THIS VEHICLE STATE TO OTHER VEHICLE.
67
68 CSM STROKE TEST ON
69 CAUSE RESTART
70 UPDATE LIFTOFF TIME
71 UNIVERSAL UPDATE-BLOCK ADR
72 UNIVERSAL UPDATE-SINGLE ADR
73 UPDATE AGC TIME OCTAL
74 INITIALIZE ERASABLE DUMP VIA DOWNLINK
75 BACKUP LIFTOFF
76 SET PREFERRED ATTITUDE FLAG
77 RESET PREFERRED ATTITUDE FLAG
78 UPDATE PRELAUNCH AZIMUTH
79 REQUEST LUNAR LANDMARK SELECTION ROUTINE R35
80 UPDATE LEM STATE VECTOR
81 UPDATE CSM STATE VECTOR
82 REQUEST ORBIT PARAM DISPLAY R30
83 REQUEST REND PARAM DISPLAY R31
84 START TARGET DELTA V R32
85 REQUEST RENDEZVOUS PARAMETER DISPLAY NO. 2 R34
86 REJECT RENDEZVOUS BACKUP SIGHTING MARK
87 SET VHF RANGE FLAG

88 RESET VHF RANGE FLAG
89 REQUEST RENDEZVOUS FINAL ATTITUDE ROUTINE R63
90 REQUEST RENDEZVOUS OUT OF PLANE DISPLAY ROUTINE R36
91 DISPLAY BANK SUM
92 OPERATE IMU PERFORMANCE TEST P07
93 ENABLE W MATRIX INITIALIZATION
94 PERFORM CYSLUNAR ATTITUDE MANEUVER P23
95 NO UPDATE OF EITHER STATE VECTOR P20 OR P22
96 TERMINATE INTEGRATION AND GO TO P00
97 PERFORM ENGINE FAIL PROCEDURE
98 ENABLE TRANSLUNAR INJECT
99 PLEASE ENABLE ENGINE

```
# IN THE FOLLOWING NOUN LIST THE  NO LOAD  RESTRICTION MEANS THE NOUN
# CONTAINS AT LEAST ONE COMPONENT WHICH CANNOT BE LOADED, I.E. OF
# SCALE TYPE L  MIN/SEC  OR PP  2 INTEGERS .
# IN THIS CASE VERBS 24 AND 25 ARE NOT ALLOWED, BUT VERBS 21, 22 OR 23
# MAY BE USED TO LOAD ANY OF THE NOUN S COMPONENTS WHICH ARE NOT OF THE
# ABOVE SCALE TYPES.
# THE  DEC ONLY  RESTRICTION MEANS ONLY DECIMAL OPERATION IS ALLOWED ON
# EVERY COMPONENT IN THE NOUN.  NOTE THAT  NO LOAD  IMPLIES  DEC ONLY .

# NORMAL NOUNS                                COMPONENTS   SCALE AND DECIMAL POINT          RESTRICTIONS

# 00    NOT IN USE
# 01    SPECIFY MACHINE ADDRESS  FRACTIONAL     3COMP    .XXXXX FOR EACH
# 02    SPECIFY MACHINE ADDRESS  WHOLE          3COMP    XXXXX. FOR EACH
# 03    SPECIFY MACHINE ADDRESS  DEGREES        3COMP    XXX.XX DEG FOR EACH
# 04    SPARE
# 05    ANGULAR ERROR/DIFFERENCE                1COMP    XXX.XX DEG
# 06    OPTION CODE                             2COMP    OCTAL ONLY FOR EACH
# LOADING NOUN 07 WILL SET OR RESET SELECTED BITS IN ANY ERASABLE REGISTER
# 07    ECADR OF WORD TO BE MODIFIED            3COMP    OCTAL ONLY FOR EACH
#       ONES FOR BITS TO BE MODIFIED
#       1 TO SET OR 0 TO RESET SELECTED BITS
# 08    ALARM DATA                              3COMP    OCTAL ONLY FOR EACH
# 09    ALARM CODES                             3COMP    OCTAL ONLY FOR EACH
# 10    CHANNEL TO BE SPECIFIED                 1COMP    OCTAL ONLY
# 11    TIG OF CSI                              3COMP    00XXX. HRS              DEC ONLY
#                                                        000XX. MIN              MUST LOAD 3 COMPS
#                                                        0XX.XX SEC
# 12    OPTION CODE                             2COMP    OCTAL ONLY FOR EACH
#         USED BY EXTENDED VERBS ONLY
# 13    TIG OF CDH                              3COMP    00XXX. HRS              DEC ONLY
#                                                        000XX. MIN              MUST LOAD 3 COMPS
#                                                        0XX.XX SEC
# 14    SPARE
# 15    INCREMENT MACHINE ADDRESS               1COMP    OCTAL ONLY
# 16    TIME OF EVENT                           3COMP    00XXX. HRS              DEC ONLY
#         USED BY EXTENDED VERBS ONLY                    000XX. MIN              MUST LOAD 3 COMPS
#                                                        0XX.XX SEC
# 17    ASTRONAUT TOTAL ATTITUDE                3COMP    XXX.XX DEG FOR EACH
# 18    AUTO MANEUVER BALL ANGLES               3COMP    XXX.XX DEG FOR EACH
# 19    BYPASS ATTITUDE TRIM MANEUVER           3COMP    XXX.XX DEG FOR EACH
# 20    ICDU ANGLES                             3COMP    XXX.XX DEG FOR EACH
# 21    PIPAS                                   3COMP    XXXXX. PULSES FOR EACH
# 22    NEW ICDU ANGLES                         3COMP    XXX.XX DEG FOR EACH
# 23    SPARE
# 24    DELTA TIME FOR AGC CLOCK                3COMP    00XXX. HRS.             DEC ONLY
#                                                        000XX. MIN              MUST LOAD 3 COMPS
#                                                        0XX.XX SEC
# 25    CHECKLIST                               3COMP    XXXXX. FOR EACH
#         USED WITH PLEASE PERFORM ONLY
```

# 26	PRIORITY/DELAY, ADRES, BBCON	3COMP	OCTAL ONLY FOR EACH	
# 27	SELF TEST ON/OFF SWITCH	1COMP	XXXXX.	
# 28	SPARE			
# 29	XSM LAUNCH AZIMUTH	1COMP	XXX.XX DEG	DEC ONLY

# 30	TARGET CODES	3COMP	XXXXX. FOR EACH	
# 31	TIME OF LANDING SITE	3COMP	00XXX. HRS	DEC ONLY
#			000XX. MIN	MUST LOAD 3 COMPS
#			0XX.XX SEC	
# 32	TIME FROM PERIGEE	3COMP	00XXX. HRS	DEC ONLY
#			000XX. MIN	MUST LOAD 3 COMPS
#			0XX.XX SEC	
# 33	TIME OF IGNITION	3COMP	00XXX. HRS	DEC ONLY
#			000XX. MIN	MUST LOAD 3 COMPS
#			0XX.XX SEC	
# 34	TIME OF EVENT	3COMP	00XXX. HRS	DEC ONLY
#			000XX. MIN	MUST LOAD 3 COMPS
#			0XX.XX SEC	
# 35	TIME FROM EVENT	3COMP	00XXX. HRS	DEC ONLY
#			000XX. MIN	MUST LOAD 3 COMPS
#			0XX.XX SEC	
# 36	TIME OF AGC CLOCK	3COMP	00XXX. HRS	DEC ONLY
#			000XX. MIN	MUST LOAD 3 COMPS
#			0XX.XX SEC	
# 37	TIG OF TPI	3COMP	00XXX. HRS	DEC ONLY
#			000XX. MIN	MUST LOAD 3 COMPS
#			0XX.XX SEC	
# 38	TIME OF STATE VECTOR	3COMP	00XXX. HRS	DEC ONLY
#			000XX. MIN	MUST LOAD 3 COMPS
#			0XX.XX SEC	
# 39	DELTA TIME FOR TRANSFER	3COMP	00XXX. HRS	DEC ONLY
#			000XX. MIN	MUST LOAD 3 COMPS
#			0XX.XX SEC	

#	MIXED NOUNS	COMPONENTS	SCALE AND DECIMAL POINT RESTRICTIONS	
#				
# 40	TIME FROM IGNITION/CUTOFF	3COMP	XXBXX MIN/SEC	NO LOAD, DEC ONLY
#	VG,		XXXX.X FT/SEC	
#	DELTA V ACCUMULATED		XXXX.X FT/SEC	
# 41	TARGET AZIMUTH,	2COMP	XXX.XX DEG	
#	ELEVATION		XX.XXX DEG	
# 42	APOGEE,	3COMP	XXXX.X NAUT MI	DEC ONLY
#	PERIGEE,		XXXX.X NAUT MI	
#	DELTA V REQUIRED		XXXX.X FT/SEC	
# 43	LATITUDE,	3COMP	XXX.XX DEG	DEC ONLY
#	LONGITUDE,		XXX.XX DEG	
#	ALTITUDE		XXXX.X NAUT MI	
# 44	APOGEE,	3COMP	XXXX.X NAUT MI	NO LOAD, DEC ONLY
#	PERIGEE,		XXXX.X NAUT MI	
#	TFF		XXBXX MIN/SEC	
# 45	MARKS VHF - OPTICS	3COMP	+XXBXX	NO LOAD, DEC ONLY
#	TFI OF NEXT BURN		XXBXX MIN/SEC	
#	MGA		XXX.XX DEG	
# 46	AUTOPILOT CONFIGURATION	2COMP	OCTAL ONLY FOR EACH	
# 47	THIS VEHICLE WEIGHT	2COMP	XXXXX. LBS	DEC ONLY
#	OTHER VEHICLE WEIGHT		XXXXX. LBS	
# 48	PITCH TRIM	2COMP	XXX.XX DEG	DEC ONLY
#	YAW TRIM,		XXX.XX DEG	
# 49	DELTA R	3COMP	XXXX.X NAUT MI	DEC ONLY
#	DELTA V		XXXX.X FT/SEC	
#	VHF OR OPTICS CODE		XXXXX.	
# 50	SPLASH ERROR,	3COMP	XXXX.X NAUT MI	NO LOAD, DEC ONLY
#	PERIGEE,		XXXX.X NAUT MI	
#	TFF		XXBXX MIN/SEC	
# 51	S-BAND ANTENNA ANGLES PITCH	2COMP	XXX.XX DEG	DEC ONLY
#	YAW		XXX.XX DEG	
# 52	CENTRAL ANGLE OF ACTIVE VEHICLE	1COMP	XXX.XX DEG	
# 53	RANGE,	3COMP	XXX.XX NAUT MI	DEC ONLY
#	RANGE RATE,		XXXX.X FT/SEC	
#	PHI		XXX.XX DEG	
# 54	RANGE,	3COMP	XXX.XX NAUT MI	DEC ONLY
#	RANGE RATE,		XXXX.X FT/SEC	
#	THETA		XXX.XX DEG	
# 55	PERIGEE CODE	3COMP	XXXXX.	DEC ONLY
#	ELEVATION ANGLE		XXX.XX DEG	
#	CENTRAL ANGLE OF PASSIVE VEHICLE		XXX.XX DEG	
# 56	REENTRY ANGLE,	2COMP	XXX.XX DEG	DEC ONLY
#	DELTA V		XXXXX. FT/SEC	
# 57	DELTA R	1COMP	XXXX.X NAUT MI	DEC ONLY
# 58	PERIGEE ALT POST TPI	3COMP	XXXX.X NAUT MI	DEC ONLY
#	DELTA V TPI		XXXX.X FT/SEC	
#	DELTA V TPF		XXXX.X FT/SEC	
# 59	DELTA VELOCITY LOS	3COMP	XXXX.X FT/SEC FOR EA.	DEC ONLY
# 60	GMAX,	3COMP	XXX.XX G	DEC ONLY

#	VPRED,		XXXXX. FT/SEC	
#	GAMMA EI		XXX.XX DEG	
# 61	IMPACT LATITUDE,	3COMP	XXX.XX DEG	DEC ONLY
#	IMPACT LONGITUDE,		XXX.XX DEG	
#	HEADS UP/DOWN		+/- 00001	
# 62	INERTIAL VEL MAG VI ,	3COMP	XXXXX. FT/SEC	DEC ONLY
#	ALT RATE CHANGE HDOT ,		XXXXX. FT/SEC	
#	ALT ABOVE PAD RADIUS H		XXXX.X NAUT MI	
# 63	RANGE 297,431 TO SPLASH RTGO ,	3COMP	XXXX.X NAUT MI	NO LOAD, DEC ONLY
#	PREDICTED INERT VEL VIO ,		XXXXX. FT/SEC	
#	TIME FROM 297,431 TFE ,		XXBXX MIN/SEC	
# 64	DRAG ACCELERATION,	3COMP	XXX.XX G	DEC ONLY
#	INERTIAL VELOCITY VI ,		XXXXX. FT/SEC	
#	RANGE TO SPLASH		XXXX.X NAUT MI	
# 65	SAMPLED AGC TIME	3COMP	00XXX. HRS	DEC ONLY
#	FETCHED IN INTERRUPT		000XX. MIN	MUST LOAD 3 COMPS
#			0XX.XX SEC	
# 66	COMMAND BANK ANGLE BETA ,	3COMP	XXX.XX DEG	DEC ONLY
#	CROSS RANGE ERROR,		XXXX.X NAUT MI	
#	DOWN RANGE ERROR		XXXX.X NAUT MI	
# 67	RANGE TO TARGET,	3COMP	XXXX.X NAUT MI	DEC ONLY
#	PRESENT LATITUDE,		XXX.XX DEG	
#	PRESENT LONGITUDE		XXX.XX DEG	
# 68	COMMAND BANK ANGLE BETA ,	3COMP	XXX.XX DEG	DEC ONLY
#	INERTIAL VELOCITY VI ,		XXXXX. FT/SEC	
#	ALT RATE CHANGE RDOT		XXXXX. FT/SEC	
# 69	BETA	3COMP	XXX.XX DEG	DEC ONLY
#	DL		XXX.XX G	
#	VL		XXXXX. FT/SEC	
# 70	STAR CODE,	3COMP	OCTAL ONLY	
#	LANDMARK DATA,		OCTAL ONLY	
#	HORIZON DATA		OCTAL ONLY	
# 71	STAR CODE	3COMP	OCTAL ONLY	
#	LANDMARK DATA		OCTAL ONLY	
#	HORIZON DATA		OCTAL ONLY	
# 72	DELT ANG	3COMP	XXX.XX DEG	DEC ONLY
# 73	ALTITUDE	3COMP	XXXXXB. NAUT MI	
#	VELOCITY		XXXXX. FT/SEC	
#	FLIGHT PATH ANGLE		XXX.XX DEG	
# 74	COMMAND BANK ANGLE BETA	3COMP	XXX.XX DEG	
#	INERTIAL VELOCITY VI		XXXXX. FT/SEC	
#	DRAG ACCELERATION		XXX.XX G	
# 75	DELTA ALTITUDE CDH	3COMP	XXXX.X NAUT MI	NO LOAD, DEC ONLY
#	DELTA TIME CDH-CSI OR TPI-CDH		XXBXX MIN/SEC	
#	DELTA TIME TPI-CDH OR TPI-NOMTPI		XXBXX MIN/SEC	
# 76	SPARE			
# 77	SPARE			
# 78	SPARE			
# 79	SPARE			
# 80	TIME FROM IGNITION/CUTOFF	3COMP	XXBXX MIN/SEC	NO LOAD, DEC ONLY

#	VG			XXXXX. FT/SEC	
#	DELTA V ACCUMULATED			XXXXX. FT/SEC	
# 81	DELTA V LV		3COMP	XXXX.X FT/SEC FOR EACH	DEC ONLY
# 82	DELTA V LV		3COMP	XXXX.X FT/SEC FOR EACH	DEC ONLY
# 83	DELTA V BODY		3COMP	XXXX.X FT/SEC FOR EACH	DEC ONLY
# 84	DELTA V OTHER VEHICLE		3COMP	XXXX.X FT/SEC FOR EACH	DEC ONLY
# 85	VG BODY		3COMP	XXXX.X FT/SEC FOR EACH	DEC ONLY
# 86	DELTA V LV		3COMP	XXXXX. FT/SEC FOR EACH	DEC ONLY
# 87	MARK DATA	SHAFT,	2COMP	XXX.XX DEG	
#		TRUNION		XX.XXX DEG	
# 88	HALF UNIT SUN OR PLANET VECTOR		3COMP	.XXXXX FOR EACH	DEC ONLY
# 89	LANDMARK	LATITUDE,	3COMP	XX.XXX DEG	DEC ONLY
#		LONGITUDE/2,		XX.XXX DEG	
#		ALTITUDE		XXX.XX NAUT MI	
# 90	Y		3COMP	XXX.XX NM	DEC ONLY
#	Y DOT			XXXX.X FPS	
#	PSI			XXX.XX DEG	
# 91	OCDU ANGLES	SHAFT,	2COMP	XXX.XX DEG	
#		TRUNION		XX.XXX DEG	
# 92	NEW OPTICS ANGLES	SHAFT,	2COMP	XXX.XX DEG	
#		TRUNION		XX.XXX DEG	
# 93	DELTA GYRO ANGLES		3COMP	XX.XXX DEG FOR EACH	
# 94	NEW OPTICS ANGLES	SHAFT	2COMP	XXX.XX DEG	
#		TRUNNION		XX.XXX DEG	
# 95	PREFERRED ATTITUDE ICDU ANGLES		3COMP	XXX.XX FOR FOR EACH	
# 96	+X-AXIS ATTITUDE ICDU ANGLES		3COMP	XXX.XX DEG FOR EACH	
# 97	SYSTEM TEST INPUTS		3COMP	XXXXX. FOR EACH	
# 98	SYSTEM TEST RESULTS AND INPUTS		3COMP	XXXXX.	
#				.XXXXX	
#				XXXXX.	
# 99	RMS IN POSITION		3COMP	XXXXX.FT	DEC ONLY
#	RMS IN VELOCITY			XXXX.X FT/SEC	
#	RMS OPTION			XXXXX.	

```
# REGISTERS AND SCALING  FOR NORMAL NOUNS
#
# NOUN          REGISTER        SCALE TYPE
#
# 00    NOT IN USE
# 01    SPECIFY ADDRESS         B
# 02    SPECIFY ADDRESS         C
# 03    SPECIFY ADDRESS         D
# 04    SPARE
# 05            DSPTEM1         H
# 06            OPTION1         A
# 07            XREG            A
# 08            ALMCADR         A
# 09            FAILREG         A
# 10    SPECIFY CHANNEL         A
# 11            TCSI            K
# 12            OPTIONX         A
# 13            TCDH            K
# 14    SPARE
# 15    INCREMENT ADDRESS       A
# 16            DSPTEMX         C
# 17            CPHIX           D
# 18            THETAD          D
# 19            THETAD          D
# 20            CDUX            D
# 21            PIPAX           C
# 22            THETAD          D
# 23    SPARE
# 24            DSPTEM2 +1      K
# 25            DSPTEM1         C
# 26            DSPTEM1         A
# 27            SMODE           C
# 28    SPARE
# 29            DSPTEM1         D
# 30            DSPTEM1         C
# 31            DSPTEM1         K
# 32            -TPER           K
# 33            TIG             K
# 34            DSPTEM1         K
# 35            TTOGO           K
# 36            TIME2           K
# 37            TTPI            K
# 38            TET             K
# 39            T3TOT4          K
```

REGISTERS AND SCALING FOR MIXED NOUNS

NOUN	COMP	REGISTER	SCALE TYPE
40	1	TTOGO	L
	2	VGDISP	S
	3	DVTOTAL	S
41	1	DSPTEM1	D
	2	DSPTEM1 +1	E
42	1	HAPO	Q
	2	HPER	Q
	3	VGDISP	S
43	1	LAT	H
	2	LONG	H
	3	ALT	Q
44	1	HAPOX	Q
	2	HPERX	Q
	3	TFF	L
45	1	VHFCNT	PP
	2	TTOGO	L
	3	+MGA	H
46	1	DAPDATR1	A
	2	DAPDATR2	A
47	1	CSMMASS	KK
	2	LEMMASS	KK
48	1	PACTOFF	FF
	2	YACTOFF	FF
49	1	N49DISP	Q
	2	N49DISP +2	S
	3	N49DISP +4	C
50	1	RSP-RREC	LL
	2	HPERX	Q
	3	TFF	L
51	1	RHOSB	H
	2	GAMMASB	H
52	1	ACTCENT	H
53	1	RANGE	JJ
	2	RRATE	S
	3	RTHETA	H
54	1	RANGE	JJ
	2	RRATE	S
	3	RTHETA	H
55	1	NN1	C
	2	ELEV	H
	3	CENTANG	H
56	1	RTEGAM2D	H
	2	RTEDVD	P
57	1	DELTAR	Q
58	1	POSTTPI	Q
	2	DELVTPI	S

```
#         3       DELVTPF         S
# 59      1       DVLOS           S
#         2       DVLOS +2        S
#         3       DVLOS +4        S
# 60      1       GMAX            T
#         2       VPRED           P
#         3       GAMMAEI         H
# 61      1       LAT SPL         H
#         2       LNG SPL         H
#         3       HEADSUP         C
# 62      1       VMAGI           P
#         2       HDOT            P
#         3       ALTI            Q
# 63      1       RTGO            LL
#         2       VIO             P
#         3       TTE             L
# 64      1       D               MM
#         2       VMAGI           P
#         3       RTGON64         LL
# 65      1       SAMPTIME        K
#         2       SAMPTIME        K
#         3       SAMPTIME        K
# 66      1       ROLLC           H
#         2       XRNGERR         VV
#         3       DNRNGERR        LL
# 67      1       RTGON67         LL
#         2       LAT             H
#         3       LONG            H
# 68      1       ROLLC           H
#         2       VMAGI           P
#         3       RDOT            UU
# 69      1       ROLLC           H
#         2       Q7              MM
#         3       VL              UU
# 70      1       STARCODE        A
#         2       LANDMARK        A
#         3       HORIZON         A
# 71      1       STARCODE        A
#         2       LANDMARK        A
#         3       HORIZON         A
# 72      1       THETZERO        H
# 73      1       P21ALT          Q  MEMORY/100 TO DISPLAY TENS N.M.
#         2       P21VEL          P
#         3       P21GAM          H
# 74      1       ROLLC           H
#         2       VMAGI           P
#         3       D               MM
# 75      1       DIFFALT         Q
#         2       T1TOT2          L
#         3       T2TOT3          L
```

# 76	SPARE		
# 77	SPARE		
# 78	SPARE		
# 79	SPARE		
# 80	1	TTOGO	L
#	2	VGDISP	P
#	3	DVTOTAL	P
# 81	1	DELVLVC	S
#	2	DELVLVC +2	S
#	3	DELVLVC +4	S
# 82	1	DELVLVC	S
#	2	DELVLVC +2	S
#	3	DELVLVC +4	S
# 83	1	DELVIMU	S
#	2	DELVIMU +2	S
#	3	DELVIMU +4	S
# 84	1	DELVOV	S
#	2	DELVOV +2	S
#	3	DELVOV +4	S
# 85	1	VGBODY	S
#	2	VGBODY +2	S
#	3	VGBODY +4	S
# 86	1	DELVLVC	P
#	2	DELVLVC +2	P
#	3	DELVLVC +4	P
# 87	1	MRKBUF1 +3	D
#	2	MRKBUF1 +5	J
# 88	1	STARSAV3	ZZ
#	2	STARSAV3 +2	ZZ
#	3	STARSAV3 +4	ZZ
# 89	1	LANDLAT	G
#	2	LANDLONG	G
#	3	LANDALT	JJ
# 90	1	RANGE	JJ
#	2	RRATE	S
#	3	RTHETA	H
# 91	1	CDUS	D
#	2	CDUT	J
# 92	1	SAC	D
#	2	PAC	J
# 93	1	OGC	G
#	2	OGC +2	G
#	3	OGC +4	G
# 94	1	MRKBUF1 +3	D
#	2	MRKBUF1 +5	J
# 95	1	PRAXIS	D
#	2	PRAXIS +1	D
#	3	PRAXIS +2	D
# 96	1	CPHIX	D
#	2	CPHIX +1	D

```
#        3        CPHIX +2         D
# 97     1        DSPTEM1          C
#        2        DSPTEM1 +1       C
#        3        DSPTEM1 +2       C
# 98     1        DSPTEM2          C
#        2        DSPTEM2 +1       B
#        3        DSPTEM2 +2       C
# 99     1        WWPOS            XX
#        2        WWVEL            YY
#        3        WWOPT            C
```

NOUN SCALES AND FORMATS

-SCALE TYPE- UNITS	DECIMAL FORMAT	PRECISION --	AGC FORMAT
----------	----------	--	----------
-A-			
OCTAL	XXXXX	SP	OCTAL
-B-			-14
FRACTIONAL	.XXXXX MAX .99996	SP	BIT 1 2 UNITS
-C-			
WHOLE	XXXXX. MAX 16383.	SP	BIT 1 1 UNIT
-D-			15
CDU DEGREES	XXX.XX DEGREES MAX 359.99	SP	BIT 1 360/2 DEGREES USES 15 BITS FOR MAGNI- TUDE AND 2-S COMP.
-E-			14
ELEVATION DEGREES	XX.XXX DEGREES MAX 89.999	SP	BIT 1 90/2 DEGREES
-F-			14
DEGREES 180	XXX.XX DEGREES MAX 179.99	SP	BIT 1 180/2 DEGREES
-G-			
DP DEGREES 90	XX.XXX DEGREES	DP	BIT 1 OF LOW REGISTER 28 360/2 DEGREES
-H-			
DP DEGREES 360	XXX.XX DEGREES MAX 359.99	DP	BIT 1 OF LOW REGISTER 28 360/2 DEGREES
-J-			15
Y OPTICS DEGREES	XX.XXX DEGREES BIAS OF 19.775 DEGREES ADDED FOR DISPLAY, SUBTRACTED FOR LOAD. NOTE NEGATIVE NUM- BERS CANNOT BE LOADED.	SP	BIT 1 90/2 DEGREES USES 15 BITS FOR MAGNI- TUDE AND 2-S COMP.
-K-			

```
# ASSEMBLY AND OPERATION INFORMATION                                  PAGE    20

#
# TIME  HR, MIN, SEC     00XXX. HR                DP      BIT 1 OF LOW REGISTER
#                        000XX. MIN                         -2
#                        0XX.XX SEC                       10   SEC
#                         DECIMAL ONLY.
#                        MAX MIN COMP 59
#                        MAX SEC COMP 59.99
#                        MAX CAPACITY 745 HRS
#                                     39 MINS
#                                     14.55 SECS.
#                        WHEN LOADING, ALL 3
#                        COMPONENTS MUST BE
#                        SUPPLIED.
#
# -L-
# TIME  MIN/SEC          XXBXX MIN/SEC            DP      BIT 1 OF LOW REGISTER
#                         B IS A BLANK                       -2
#                        POSITION, DECIMAL                10   SEC
#                        ONLY, DISPLAY OR
#                        MONITOR ONLY. CANNOT
#                        BE LOADED.
#                        MAX MIN COMP 59
#                        MAX SEC COMP 59
#                        VALUES GREATER THAN
#                        59 MIN 59 SEC
#                        ARE DISPLAYED AS
#                        59 MIN 59 SEC.
#
# -M-                                                              -2
# TIME  SEC              XXX.XX SEC               SP      BIT 1   10   SEC
#                         MAX 163.83
#
# -N-
# TIME SEC  DP           XXX.XX SEC               DP      BIT 1 OF LOW REGISTER
#                                                           -2
#                                                 10   SEC
#
# -P-
# VELOCITY 2             XXXXX. FEET/SEC          DP      BIT 1 OF HIGH REGISTER
#                         MAX 41994.                        -7
#                                                 2   METERS/CENTI-SEC
#
# -Q-
# POSITION 4             XXXX.X NAUTICAL MILES    DP      BIT 1 OF LOW REGISTER
#                                                 2 METERS
#
# -S-
# VELOCITY 3             XXXX.X FT/SEC            DP      BIT 1 OF HIGH REGISTER
#                                                          -7
#                                                 2   METERS/CENTI-SEC
```

```
#                                                                                    -2
# -T-
# G                      XXX.XX G                 SP       BIT 1   10    G
#                         MAX 163.83
#
# -FF-
# TRIM DEGREES           XXX.XX DEG.              SP       LOW ORDER BIT   85.41 SEC
#                         MAX 388.69                       OF ARC
#
# -GG-
# INERTIA                XXXXXBB. SLUG FT SQ      SP       FRACTIONAL PART OF
#                         MAX 07733BB.                      20      2
#                                                          2   KG M
#
# -II-                                                                         20
# THRUST MOMENT          XXXXXBB. FT LBS          SP       FRACTIONAL PART OF 2
#                         MAX 07733BB.                     NEWTON METER
#
# -JJ-
# POSITION5              XXX.XX NAUT MI           DP       BIT 1 OF LOW REGISTER
#                                                          2 METERS
#
# -KK-                                                                         16
# WEIGHT2                XXXXX. LBS               SP       FRACTIONAL PART OF 2   KG
#
# -LL-
# POSITION6              XXXX.X NAUT MI           DP       BIT 1 OF LOW REG
#                                                                              -28
#                                                           6,373,338  2 PI  X2
#                                                          -----------------------
#                                                                    1852
#                                                          NAUT. MI.
#
# -MM-
# DRAG ACCELERATION      XXX.XX G                 DP       BIT 1 OF LOW REGISTER
#                        MAX  024.99                           -28
#                                                          25X2    G
#
# -PP-
# 2 INTEGERS             +XXBYY                   DP       BIT 1 OF HIGH REGISTER
#                         B IS A BLANK                      1 UNIT OF XX
#                        POSITION.  DECIMAL                BIT 1 OF LOW REGISTER
#                        ONLY, DISPLAY OR                   1 UNIT OF YY
#                        MONITOR ONLY. CANNOT               EACH REGISTER MUST
#                        BE LOADED.                        CONTAIN A POSITIVE INTEGER
#                         MAX 99B99                         LESS THAN 100
#
# -UU-
# VELOCITY/2VS           XXXXX. FEET/SEC          DP       FRACTIONAL PART OF
#                         MAX 51532.                       2VS FEET/SEC
#                                                           VS    25766.1973
```

```
#
# -VV-
# POSITION8              XXXX.X NAUT MI          DP      BIT 1 OF LOW REGISTER
#                                                                  -28
#                                                        4 X 6,373,338 X 2
#                                                        ----------------
#                                                              1852
#                                                        NAUT MI.
#
# -XX-
# POSITION 9             XXXXX. FEET             DP      BIT 1 OF LOW REGISTER
#                                                         -9
#                                                        2   METERS
#
# -YY-
# VELOCITY 4             XXXX.X FEET/SEC         DP      FRACTIONAL PART OF
#                         MAX 328.0                      METERS/CENTI-SEC
#
# -ZZ-
# DP FRACTIONAL          .XXXXX                  DP      BIT 1 OF HIGH REGISTER
#                                                         -14
#                                                        2    UNITS

# THAT-S ALL ON THE NOUNS.
```

ALARM CODES FOR 504

REPORT DEFICIENCIES TO JOHN SUTHERLAND @ MIT 617-864-6900 X1458

# *9 CODE	*	*18 TYPE	*60 SET BY	*25 COLUMN ALARM ROUTINE
# 00110		NO MARK SINCE LAST MARK REJECT	SXTMARK	ALARM
# 00112		MARK NOT BEING ACCEPTED	SXTMARK	ALARM
# 00113		NO INBITS	SXTMARK	ALARM
# 00114		MARK MADE BUT NOT DESIRED	SXTMARK	ALARM
# 00115		OPTICS TORQUE REQUESTWITH SWITCH NOT AT CGC	EXT VERB OPTICS CDU	ALARM
# 00116		OPTICS SWITCH ALTERED BEFORE 15 SEC ZERO TIME ELAPSED.	T4RUPT	ALARM
# 00117		OPTICS TORQUE REQUEST WITH OPTICS NOT AVAILABLE OPTIND -0	EXT VERB OPTICS CDU	ALARM
# 00120		OPTICS TORQUE REQUEST WITH OPTICS NOT ZEROED	T4RUPT	ALARM
# 00121		CDUS NO GOOD AT TIME OF MARK	SXTMARK	ALARM
# 00122		MARKING NOT CALLED FOR	SXTMARK	ALARM
# 00124		P17 TPI SEARCH - NO SAFE PERICTR HERE.	TPI SEARCH	ALARM
# 00205		BAD PIPA READING	SERVICER	ALARM
# 00206		ZERO ENCODE NOT ALLOWED WITH COARSE ALIGN + GIMBAL LOCK	IMU MODE SWITCHING	ALARM
# 00207		ISS TURNON REQUEST NOT PRESENT FOR 90 SEC	T4RUPT	ALARM
# 00210		IMU NOT OPERATING	IMU MODE SWITCH, IMU-2, R02, P51	ALARM,VARALARM
# 00211		COARSE ALIGN ERROR - DRIVE 2 DEGREES	IMU MODE SWITCH	ALARM
# 00212		PIPA FAIL BUT PIPA IS NOT BEING USED	IMU MODE SWITCH,T4RPT	ALARM
# 00213		IMU NOT OPERATING WITH TURN-ON REQUEST	T4RUPT	ALARM
# 00214		PROGRAM USING IMU WHEN TURNED OFF	T4RUPT	ALARM
# 00215		PREFERRED ORIENTATION NOT SPECIFIED	P52,P54	ALARM
# 00217		BAD RETURN FROM STALL ROUTINES.	CURTAINS	ALARM2
# 00220		IMU NOT ALIGNED - NO REFSMMAT	R02,P51	VARALARM
# 00401		DESIRED GIMBAL ANGLES YIELD GIMBAL LOCK	IMF ALIGN, IMU-2	ALARM
# 00404		TARGET OUT OF VIEW - TRUN ANGLE 90 DEG	R52	PRIOLARM
# 00405		TWO STARS NOT AVAILABLE	P52,P54	ALARM
# 00406		REND NAVIGATION NOT OPERATING	R21,R23	ALARM
# 00407		AUTO OPTICS REQUEST TRUN ANGLE 50 DEG.	R52	ALARM
# 00421		W-MATRIX OVERFLOW	INTEGRV	VARALARM
# 00430	*	INTEG. ABORT DUE TO SUBSURFACE S. V.	ALL CALLS TO INTEG	POODOO
# 00600		IMAGINARY ROOTS ON FIRST ITERATION	P32, P72	VARALARM
# 00601		PERIGEE ALTITUDE LT PMIN1	P32,P72,	VARALARM
# 00602		PERIGEE ALTITUDE LT PMIN2	P32,P72,	VARALARM
# 00603		CSI TO CDH TIME LT PMIN22	P32,P72,P33,P73	VARALARM
# 00604		CDH TO TPI TIME LT PMIN23	P32,P72	VARALARM
# 00605		NUMBER OF ITERATIONS EXCEEDS LOOP MAXIMUM	P32,P72,P37	VARALARM
# 00606		DV EXCEEDS MAXIMUM	P32,P72	VARALARM
# 00607	*	NO SOLN FROM TIME-THETA OR TIME-RADIUS	TIMETHET,TIMERAD	POODOO

# 00610	*	LAMBDA LESS THAN UNITY	P37	POODOO
# 00611		NO TIG FOR GIVEN ELEV ANGLE	P34,P74	VARALARM
# 00612		STATE VECTOR IN WRONG SPHERE OF INFLUENCE	P37	VARALARM
# 00613		REENTRY ANGLE OUT OF LIMITS	P37	VARALARM
# 00777		PIPA FAIL CAUSED ISS WARNING.	T4RUPT	VARALARM
# 01102		CMC SELF TEST ERROR		ALARM2
# 01103	*	UNUSED CCS BRANCH EXECUTED	ABORT	POODOO
# 01104	*	DELAY ROUTINE BUSY	EXEC	BAILOUT
# 01105		DOWNLINK TOO FAST	T4RUPT	ALARM
# 01106		UPLINK TOO FAST	T4RUPT	ALARM
# 01107		PHASE TABLE FAILURE. ASSUME	RESATRT	ALARM
#		ERASABLE MEMORY IS DESTROYED		
# 01201	*	EXECUTIVE OVERFLOW-NO VAC AREAS	EXEC	BAILOUT
# 01202	*	EXECUTIVE OVERFLOW-NO CORE SETS	EXEC	BAILOUT
# 01203	*	WAITLIST OVERFLOW-TOO MANY TASKS	WAITLIST	BAILOUT
# 01204	*	NEGATIVE OR ZERO WAITLIST CALL	WAITLIST	POODOO
# 01206	*	SECOND JOB ATTEMPTS TO GO TO SLEEP	PINBALL	POODOO
#		VIA KEYBOARD AND DISPLAY PROGRAM		
# 01207	*	NO VAC AREA FOR MARKS	SXTMARK	BAILOUT
# 01210	*	TWO PROGRAMS USING DEVICE AT SAME TIME	IMU MODE SWITCH	POODOO
# 01211	*	ILLEGAL INTERRUPT OF EXTENDED VERB	SXTMARK	BAILOUT
# 01301		ARCSIN-ARCCOS ARGUMENT TOO LARGE	INTERPRETER	ALARM
# 01302	*	SQRT CALLED WITH NEGATIVE ARGUMENT.ABORT	INTERPRETER	POODOO
# 01407		VG INCREASING	S40.8	ALARM
# 01426		IMU UNSATISFACTORY	P61, P62	ALARM
# 01427		IMU REVERSED	P61, P62	ALARM
# 01501	*	KEYBOARD AND DISPLAY ALARM DURING	PINBALL	POODOO
#		INTERNAL USE NVSUB . ABORT.		
# 01502	*	ILLEGAL FLASHING DISPLAY	GOPLAY	POODOO
# 01520		V37 REQUEST NOT PERMITTED AT THIS TIME	V37	ALARM
# 01521	*	P01 ILLEGALLY SELECTED	P01, P07	POODOO
# 01600		OVERFLOW IN DRIFT TEST	OPT PRE ALIGN CALIB	ALARM
# 01601		BAD IMU TORQUE	OPT PRE ALIGN CALIB	ALARM
# 01602		BAD OPTICS DURING VERIFICATION	OPTALGN CALIB CSM	ALARM
# 01703		INSUF. TIME FOR INTEG., TIG WAS SLIPPED	R41	ALARM
# 03777		ICDU FAIL CAUSED THE ISS WARNING	T4RUPT	VARALARM
# 04777		ICDU , PIPA FAILS CAUSED THE ISS WARNING	T4RUPT	VARALARM
# 07777		IMU FAIL CAUSED THE ISS WARNING	T4RUPT	VARALARM
# 10777		IMU , PIPA FAILS CAUSED THE ISS WARNING	T4RUPT	VARALARM
# 13777		IMU , ICDU FAILS CAUSED THE ISS WARNING	T4RUPT	VARALARM
# 14777		IMU,ICDU,PIPA FAILS CAUSED THE ISSWNING	T4RUPT	VARALARM
#	*	INDICATES ABORT TYPE.ALL OTHERS ARE NON-ABORTIVE		

```
#                CHECKLIST CODES FOR 504

#                PLEASE REPORT ANY DEFICIENCIES IN THIS LIST TO JOHN SUTHERLAND

# *9             *17              *26  COLUMN
#
# R1 CODE           ACTION TO BE EFFECTED
#
# 00014          KEY IN           FINE ALIGNMENT OPTION
# 00015          PERFORM          CELESTIAL BODY ACQUISITION
# 00016          KEY IN           TERMINATE MARK SEQUENCE
# 00041          SWITCH           CM/SM SEPARATION TO UP
# 00062          SWITCH           AGC POWER DOWN
# 00202          PERFORM          GNCS AUTOMATIC MANEUVER
# 00203          SWITCH           TO CMC-AUTO
# 00204          PERFORM          SPS GIMBAL TRIM
# 00403          SWITCH           OPTICS TO MANUAL OR ZERO
#                                   SWITCH DENOTES CHANGE POSITION OF A CONSOLE SWITCH
#                                   PERFORM DENOTES START OR END OF A TASK
#                                   KEY IN DENOTES KEY IN OF DATA THRU THE DSKY
```

#

OPTION CODES FOR 504

PLEASE REPORT ANY DEFICIENCIES IN THIS LIST TO JOHN SUTHERLAND

THE SPECIFIED OPTION CODES WILL BE FLASHED IN COMPONENT R1 IN
CONJUNCTION WITH VERB04NOUN06 TO REQUEST THE ASTRONAUT TO LOAD INTO
COMPONENT R2 THE OPTION HE DESIRES.

*9 *17 *52 *11 *25 COLUMN

OPTION

# CODE	PURPOSE	INPUT FOR COMPONENT 2	PROGRAM S	APPLICABILITY
# 00001	SPECIFY IMU ORIENTATION	1 PREF 2 NOM 3 REFSMMAT	P50 S	ALL
# 00002	SPECIFY VEHICLE	1 THIS 2 OTHER	P21,R30	ALL
# 00003	SPECIFY TRACKING ATTITUDE	1 PREFERRED 2 OTHER	R63	ALL
# 00004	SPECIFY RADAR	1 RR 2 LR	R04	SUNDANCE + LUMINARY
# 00005	SPECIFY SOR PHASE	1 FIRST 2 SECOND	P38	COLOSSUS + LUMINARY
# 00006	SPECIFY RR COARSE ALIGN OPTION	1 LOCKON 2 CONTINUOUS DESIG.	V41N72	SUNDANCE + LUMINARY
# 00007	SPECIFY PROPULSION SYSTEM	1 SPS 2 RCS	P37	COLOSSUS
# 00010	SPECIFY ALIGNMENT MODE	0 ANY TIME 1 REFSMMAT +G 2 TWO BODIES 3 ONE BODY + G	P57	LUMINARY
# 00011	SPECIFY SEPARATION MONITOR PHASE	1 DELTAV 2 STATE VECTOR UPDATE	P46	LUMINARY
# 00012	SPECIFY CSM ORBIT OPTION	1 NO ORBIT CHANGE 2 CHANGE ORBIT TO PASS OVER LM	P22	LUMINARY

```
# TAGS FOR RELATIVE SETLOC AND BLANK BANK CARDS

FIXED           MEMORY  120000 - 167777
                COUNT   BANKSUM

# MODULE 1 CONTAINS BANKS 0 THROUGH 5

                BLOCK   02
FFTAG1          EQUALS
FFTAG2          EQUALS
FFTAG3          EQUALS
FFTAG4          EQUALS
FFTAG7          EQUALS
FFTAG8          EQUALS
FFTAG9          EQUALS
FFTAG10         EQUALS
FFTAG12         EQUALS
P30SUBS         EQUALS
STOPRAT         EQUALS
P23S            EQUALS
                BNKSUM  02

                BLOCK   03
FFTAG5          EQUALS
FFTAG6          EQUALS
DAPS9           EQUALS
FFTAG13         EQUALS
                BNKSUM  03

                BANK    00
DLAYJOB         EQUALS
                BNKSUM  00

                BANK    01
RESTART         EQUALS
                BNKSUM  01

                BANK    4
VERB37          EQUALS
CONICS1         EQUALS
PINBALL4        EQUALS
CSI/CDH1        EQUALS
INTPRET2        EQUALS
IMUCAL1         EQUALS
```

```
STBLEORB        EQUALS
E/PROG          EQUALS
MIDDGIM         EQUALS
                BNKSUM  04

                BANK    5
FRANDRES        EQUALS
DOWNTELM        EQUALS
DAPMASS         EQUALS
CDHTAG          EQUALS
                BNKSUM  05

# MODULE 2 CONTAINS BANKS 6 THROUGH 13

                BANK    6
IMUCOMP         EQUALS
T4RUP           EQUALS
IMUCAL2         EQUALS
CSIPROG         EQUALS
                BNKSUM  06

                BANK    7
SXTMARKE        EQUALS
R02             EQUALS
MODESW          EQUALS
XANG            EQUALS
KEYRUPT         EQUALS
CSIPROG6        EQUALS
                BNKSUM  07

                BANK    10
DISPLAYS        EQUALS
PHASETAB        EQUALS
COMGEOM2        EQUALS
SXTMARK1        EQUALS
P60S4           EQUALS
OPTDRV          EQUALS
CSIPROG8        EQUALS
                BNKSUM  10

                BANK    11
ORBITAL         EQUALS
ORBITAL1        EQUALS                  # CONSTANTS
```

```
INTVEL          EQUALS
S52/2           EQUALS
CSIPROG5        EQUALS
INTINIT1        EQUALS
                BNKSUM  11

                BANK    12
CONICS          EQUALS
CSIPROG2        EQUALS
CSI/CDH2        EQUALS
MODCHG2         EQUALS
                BNKSUM  12

                BANK    13
P76LOC          EQUALS
LATLONG         EQUALS
INTINIT         EQUALS
SR52/1          EQUALS
ORBITAL2        EQUALS
CDHTAGS         EQUALS
E/PROG1         EQUALS
MODCHG3         EQUALS
                BNKSUM  13

# SPACER

# MODULE 3 CONTAINS BANKS 14 THROUGH 21

                BANK    14
STARTAB         EQUALS
RT53            EQUALS
P50S1           EQUALS
MEASINC2        EQUALS
CSI/CDH3        EQUALS
                BNKSUM  14

                BANK    15
P50S            EQUALS
ETRYDAP         EQUALS
S52/3           EQUALS
                BNKSUM  15

                BANK    16
P40S1           EQUALS
```

```
DAPROLL         EQUALS
P50S2           EQUALS
P23S1           EQUALS
RTE2            EQUALS
                BNKSUM   16

                BANK     17
DAPS4           EQUALS
DAPS5           EQUALS
DAPS7           EQUALS
P50S3           EQUALS
                BNKSUM   17

                BANK     20
DAPS6           EQUALS
DAPS1           EQUALS
DAPS2           EQUALS
MANUSTUF        EQUALS
R36CM           EQUALS
VAC5LOC         EQUALS
                BNKSUM   20

                BANK     21
DAPS3           EQUALS
MYSUBS          EQUALS
KALCMON3        EQUALS
                BNKSUM   21

# MODULE 4 CONTAINS BANKS 22 THROUGH 27

                BANK     22
RTBCODES        EQUALS
RTBCODE1        EQUALS
DAPS8           EQUALS
APOPERI         EQUALS
P40S5           EQUALS
KALCMON2        EQUALS
KALCMON1        EQUALS
CSIPROG3        EQUALS
                BNKSUM   22
```

```
                BANK    23
P20S2           EQUALS
INFLIGHT        EQUALS
COMGEOM1        EQUALS
POWFLITE        EQUALS
POWFLIT1        EQUALS
RENDGUID        EQUALS
POWFLIT2        EQUALS
R30LOC          EQUALS
P11FOUR         EQUALS
CSIPROG4        EQUALS
                BNKSUM  23

                BANK    24
LOADDAP         EQUALS
P40S            EQUALS
CSIPROG7        EQUALS
                BNKSUM  24

                BANK    25
REENTRY         EQUALS
CDHTAG1         EQUALS
                BNKSUM  25

                BANK    26
INTPRET1        EQUALS
REENTRY1        EQUALS
P60S            EQUALS
P60S1           EQUALS
P60S2           EQUALS
P60S3           EQUALS
PLANTIN         EQUALS          # LUNAR ROT
EPHEM           EQUALS
P05P06          EQUALS
26P50S          EQUALS
                BNKSUM  26

                BANK    27
TOF-FF          EQUALS
TOF-FF1         EQUALS
MANUVER         EQUALS
MANUVER1        EQUALS
```

```
VECPT           EQUALS
UPDATE1         EQUALS
UPDATE2         EQUALS
R22S1           EQUALS
P60S5           EQUALS
P40S2           EQUALS
                BNKSUM  27

# MODULE 5 CONTAINS BANKS 30 THROUGH 35

                BANK    30
IMUSUPER        EQUALS
LOWSUPER        EQUALS
FCSTART         EQUALS                  # STANDARD LOCATION FOR THIS.  FOR EXTV8
LOPC            EQUALS
P20S1           EQUALS
P20S6           EQUALS
P40S3           EQUALS
R35A            EQUALS
                BNKSUM  30

                BANK    31
R35             EQUALS
RT23            EQUALS
P30S1A          EQUALS
R34             EQUALS
CDHTAG2         EQUALS
CSIPROG9        EQUALS
R31             EQUALS
P22S            EQUALS
RTE3            EQUALS
                BNKSUM  31

                BANK    32
MSGSCAN1        EQUALS
RTE             EQUALS
DELRSPL1        EQUALS
IMUCAL3         EQUALS
                BNKSUM  32

                BANK    33
TESTLEAD        EQUALS
```

```
IMUCAL          EQUALS
                BNKSUM  33

                BANK    34
P11ONE          EQUALS
P20S3           EQUALS
P20S4           EQUALS
RTECON          EQUALS
                BNKSUM  34

                BANK    35
RTECON1         EQUALS
CSI/CDH         EQUALS
P30S1           EQUALS
P30S            EQUALS
P17S1           EQUALS
MEASINC3        EQUALS
INTINIT2        EQUALS
                BNKSUM  35

# MODULE 6 CONTAINS BANKS 36 THROUGH 43

                BANK    36
MEASINC         EQUALS
MEASINC1        EQUALS
P17S            EQUALS
RTE1            EQUALS
S3435LOC        EQUALS
                BNKSUM  36

                BANK    37
P20S            EQUALS
BODYATT         EQUALS
RENDEZ          EQUALS
SERVICES        EQUALS
P11TWO          EQUALS
CDHTAG3         EQUALS
                BNKSUM  37

                BANK    40
PINSUPER        EQUALS
```

```
SELFSUPR        EQUALS
PINBALL1        EQUALS
R36CM1          EQUALS
                BNKSUM  40

                BANK    41
PINBALL2        EQUALS
R36LM           EQUALS
                BNKSUM  41

                BANK    42
SBAND           EQUALS
PINBALL3        EQUALS
EXTVBS          EQUALS
R36LM1          EQUALS
                BNKSUM  42

                BANK    43
SELFCHEC        EQUALS
EXTVERBS        EQUALS
                BNKSUM  43

HI6ZEROS        EQUALS  ZEROVECS                # ZERO VECTOR ALWAYS IN HIGH MEMORY
LO6ZEROS        EQUALS  ZEROVEC                 # ZERO VECTOR ALWAYS IN LOW MEMORY
HIDPHALF        EQUALS  UNITX
LODPHALF        EQUALS  XUNIT
HIDP1/4         EQUALS  DP1/4TH
LODP1/4         EQUALS  D1/4                    # 2DEC .25
HIUNITX         EQUALS  UNITX
HIUNITY         EQUALS  UNITY
HIUNITZ         EQUALS  UNITZ
LOUNITX         EQUALS  XUNIT                   # 2DEC .5
LOUNITY         EQUALS  YUNIT                   # 2DEC 0
LOUNITZ         EQUALS  ZUNIT                   # 2DEC 0
3/4LOWDP        EQUALS  3/4                     # 2DEC 3.0 B-2
                SBANK   LOWSUPER

# ROPE SPECIFIC ASSIGNS OBVIATING NEED TO CHECK COMPUTER FLAG IN DETVRUZVING INTEGRATION AREA ENTRIES

OTHPREC         EQUALS  LEMPREC
ATOPOTH         EQUALS  ATOPLEM
ATOPTHIS        EQUALS  ATOPCSM
MOONTHIS        EQUALS  CMOONFLG
```

```
MOONOTH         EQUALS  LMOONFLG
MOVATHIS        EQUALS  MOVEACSM
STATEST         EQUALS  V83CALL                 # * TEMPORARY
THISPREC        EQUALS  CSMPREC
THISAXIS                UNITX
ERASID          EQUALS  LOW10                   # DOWNLINK ERASABLE DUMP ID
DELAYNUM        EQUALS  THREE

##################################################################################################################

#   THE FOLLOWING ECADRS ARE DEFINED TO FACILITATE EBANK SWITCHING.  THEY ALSO MAKE IT EASIER FOR
# ERASABLE CONTROL TO REARRANGE ERASABLE MEMORY WITHOUT DISRUPTING THE PROGRAMS WHICH SET EBANKS.
# PRIOR TO ROPE RELEASE FIXED MEMORY CAN BE SAVED BY SETTING EACH EBXXXX  EBANKX  X 4,5,6,7 .EBANKX OF COURSE
# WILL BE THE BANK WHERE THE ERASABLES REFERENCED IN EBXXXX WILL BE STORED.

                BANK    7
                EBANK   MARKDOWN
EBMARKDO        ECADR   MARKDOWN
                EBANK   MRKBUF1
EBMRKBUF        ECADR   MRKBUF1

                BANK    24
                EBANK   DVCNTR
EBDVCNTR        ECADR   DVCNTR
                EBANK   P40TMP
EBP40TMP        ECADR   P40TMP

                BANK    34
                EBANK   DVCNTR
EBDVCNT         ECADR   DVCNTR
                EBANK   QPLACES
EBQPLACE        ECADR   QPLACES

                BANK    37
                EBANK   RN1
EBRN1           ECADR   RN1

##################################################################################################################
```

*** END OF MAIN PROGRAM ***