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FLIGHT PROGRAM LANGUAGE REQUIREMENTS

VOLUME III

APPENDICES

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Pages - 262

PREFACE

This report summarizes the efforts and results of a study to establish requirements for a flight programming language for future onboard computer applications. This study was performed by M&S Computing under contract NAS8-26990 from the Marshall Space Flight Center of NASA. The technical monitor was Mr. Richard Jenke, S&E-CSE-LI.

Several government-sponsored study and development efforts have been directed toward design and implementation of high level programming languages suitable for future aerospace applications. As a result, several different languages were available as potential candidates for future NASA flight programming efforts. The study centered around an evaluation of the four most pertinent existing aerospace languages. Evaluation criteria were established and selected kernels from the current Saturn V and Skylab Flight Programs were used as benchmark problems for sample coding. An independent review of the language specifications incorporated anticipated future programming requirements into the evaluation. A set of detailed language requirements was synthesized from these activities.

This report is the final report of the study and is provided in three volumes. This third volume contains the report appendices, which describe the benchmark problems coded and provide listings of the benchmark coding.

Distribution of this report is provided in the interest of information exchange and should not be construed as endorsement by NASA of the material presented. Responsibility for the contents resides with the organization that prepared it.

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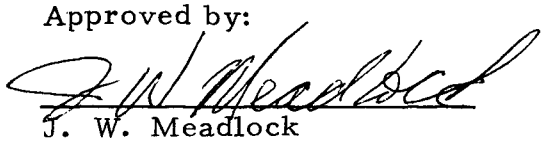

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APPENDIX A

FLIGHT PROGRAM KERNEL DESCRIPTIONS

This appendix contains flowcharts and narrative descriptions of the flight program kernels which were coded. The descriptions also discuss certain assumptions made during coding of the kernels and the unique language requirements imposed by each kernel. The actual coding of the kernels is found in Appendix B.

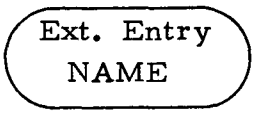
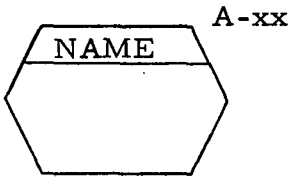
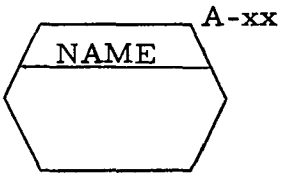
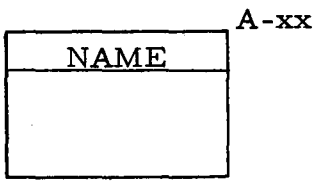
Each kernel description is a separate paragraph of this appendix, and a kernel flowchart is included as a figure at the end of the paragraph. Kernel names and associated paragraph and flowchart figure numbers are listed below:

Paragraph	Kernel Name	Flowchart Figure
A. 1	Initialization	A-1 (a-b)
A. 2	Interrupt Processor	A-2 (a-d)
A. 3	Non-Interrupt Sequencer	A-3
A. 4	Periodic Processor	A-4
A. 5	Events Processor	A-5
A. 6	Iterative Guidance Mode	A-6 (a-d)
A. 7	Digital Command System	A-7 (a-c)
A. 8	Accelerometer Processing	A-8 (a-d)
A. 9	Minor Loop	A-9 (a-d)
A. 10	Switch Selector Processor	A-10 (a-n)
A. 11	ATM Task Keying	A-11

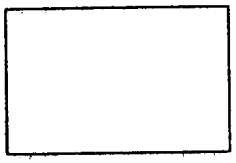
Separate pages of multiple-page flowcharts are designated by lower case letters appended to the figure numbers. These are indicated above.

As a documentation aid, paragraph A. 12 contains glossaries of the names used in the program listings of Appendix B. The glossaries include brief explanations of each name.

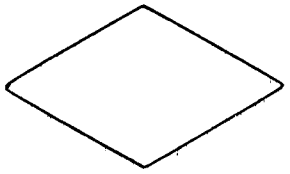
Special flowchart symbology has been used to identify and cross-reference program kernels and the various types of partitioning within kernels. The following depicts and explains this symbology. The "Entry Point" column shows the symbol used for entry into each type of program block, and the corresponding "Calling Symbol" indicates how that type of program block is called from some other flowchart. The label "A-xx" references the flowchart where the "called" program block is described. If there is no label, the program block was not coded and no flowchart is provided.

Entry Point	Calling Symbol	Type of Program Block
		External entry point to a program kernel. Called from some other kernel.
		Internal entry point to a subprogram within a kernel. Called only from within the kernel.
		Indicates a program block which is coded in-line on the coding sheets but is shown on a separate flowchart solely for clarity of documentation. It is not a separate subprogram.
	(None)	Entry to logic which is executed on occurence of the interrupt NAME.

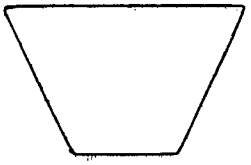
Flowchart symbols internal to a program block have conventional interpretations as follows:



Process

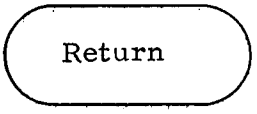


Decision



Input/Output

On-Page Connector



Return to calling program at point of call

The term "Note x" on a flowchart identifies a note at the end of the kernel descriptions.

A. 1 Initialization

A. 1. 1 Description of Operation

A certain amount of initialization must be performed for any type of computing system. For a flight program, initialization involves setting up both program data storage areas and hardware registers. For example, data variables for an integration scheme must be assigned initial values and program switches must be setup to properly control program execution. Certain hardware registers such as accelerometers and the real time clock must be read to obtain initial values while others such as program controlled timers must be loaded with an initial value.

While it is true that program data storage areas could be initialized at program generation time, it is usually desirable to perform the initialization in real time under program control to eliminate the need for reloading the program each time it is to be restarted. In addition, a certain amount of reinitialization must be performed dynamically as the transition is made from one mission phase to another.

Two entry points exist for the Initialization kernel. The first is used when the program is entered from Prepare-to-Launch and performs overall system initialization. The second is used at the end of each mission phase to perform the initialization for the next phase.

A. 1. 2 Unique Language Characteristics Required

The manner in which initialization is performed depends greatly upon the organization of the data base. Data which is defined as "local" and is contained within an application module would require an initialization pass to be made through the module unless special techniques were provided by the language to enable such data to be externally referenced by a centralized initialization program. A separate initialization pass through each module forces an undesirable decentralization of the function, so the best choice within the capabilities of the selected languages is to put all data which must be initialized into a common data pool (Compool), so it can be accessed by the Initialization module. However, since almost all of the Saturn flight program data gets initialized, this design would leave very little data local to the modules and would reduce the opportunities to describe local and global data in the languages. Therefore, some of this data

remains local to the module and the details of the application module data initialization were not coded. This decision was influenced by the fact that the detailed coding is primarily restricted to a set of assignment statements, and data item assignment capabilities in the languages are well exercised in other kernels.

A.1.3 Flowchart Notes

Note 1

For HAL and CLASP the phase control logic beginning at GP002 had to be made a separate program module since it was common to both EGP0 and MPA00. This was necessitated by language restrictions which limit a program module to a single entry point.

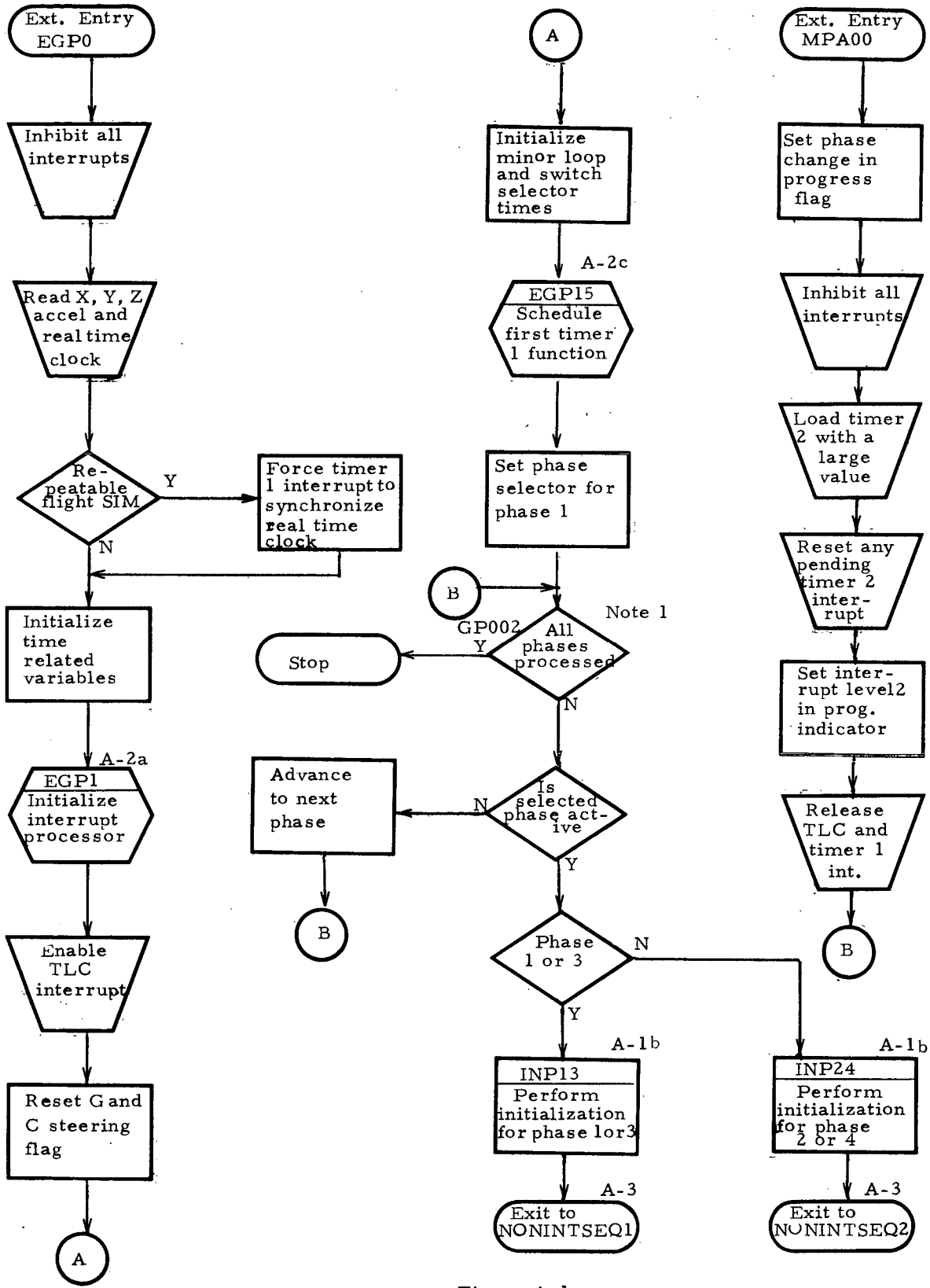

Ext. Entry EGP0
Inhibit all interrupts
Read X, Y, Z accel and real time clock
Re-peatable flight SIM
Y
N
Force timer 1 interrupt to synchronize real time clock
Initialize time related variables
A-2a
EGP1
Initialize interrupt processor
Enable TLC interrupt
Reset G and C steering flag
A
A
Initialize minor loop and switch selector times
A-2c
EGP15
Schedule first timer 1 function
Set phase selector for phase 1
B
GP002
All phases processed
Note 1
Y
Stop
N
Advance to next phase
N
Is selected phase active
Y
B
Phase 1 or 3
N
Y
A-1b
INP13
Perform initialization for phase 1 or 3
A-3
Exit to NONINTSEQ1
Ext. Entry MPA00
Set phase change in progress flag
Inhibit all interrupts
Load timer 2 with a large value
Reset any pending timer 2 inter-rupt
Set inter-rupt level 2 in prog. indicator
Release TLC and timer 1 int.
B
A-1b
INP24
Perform initialization for phase 2 or 4
A-3
Exit to NONINTSEQ2

Figure A-1a

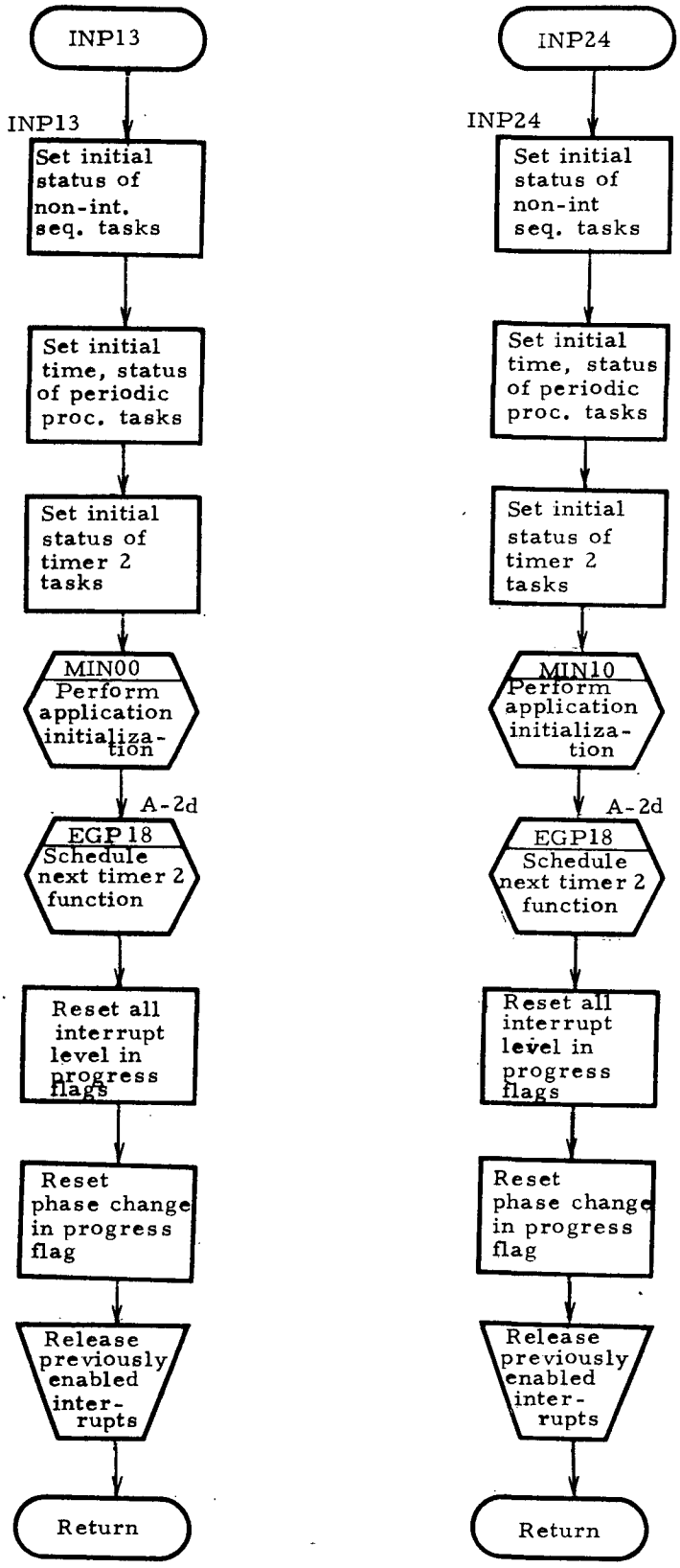

INP13
INP13
Set initial status of non-int. seq. tasks
Set initial time, status of periodic proc. tasks
Set initial status of timer 2 tasks
MIN00
Perform application initialization
A-2d
EGP18
Schedule next timer 2 function
Reset all interrupt level in progress flags
Reset phase change in progress flag
Release previously enabled interrupts
Return
INP24
INP24
Set initial status of non-int seq. tasks
Set initial time, status of periodic proc. tasks
Set initial status of timer 2 tasks
MIN10
Perform application initialization
A-2d
EGP18
Schedule next timer 2 function
Reset all interrupt level in progress flags
Reset phase change in progress flag
Release previously enabled interrupts
Return

Figure A-1b

A.2 Interrupt Processor

A.2.1 Description of Operation

In most present-day computing systems and, in all likelihood, those of the future, hardware interrupts are used to signal both the occurrence of external events and/or the expiration of a program-specified time period. Direct handling of interrupts is performed by a task called the Interrupt Processor which is usually a part of an operating system. The Interrupt Processor determines the cause of the interrupt and makes provision for initiating the task associated with the interrupt. In a system where tasks are invoked according to priority, the task to be executed in response to the interrupt may or may not be executed before control is returned to the interrupted task, depending on relative priority of the two tasks. In non-priority systems, the interrupt task is executed before control is returned to the interrupted task.

The Saturn Flight Program has provision for five effective levels of priority. Listed in order of priority they are:

Level 4 - Computer memory failure (TLC)
Level 3 - Timer 1
Level 2 - External interrupts
Level 1 - Timer 2
Level 0 - Background (non-interrupt level)

The two timers are program loadable and are used internally for scheduling of time dependent tasks.

Included in the Interrupt Processor kernel are the Timer Scheduler subroutines to illustrate capabilities for scheduling program controllable interrupts. Timer 1 Scheduler is dedicated to the Minor Loop and Switch Selector Tasks and schedules whichever is due next by loading the time-to-go into Timer 1. The Timer 2 Scheduler is assigned all remaining tasks which must be activated via a time-dependent interrupt. All Timer 2 tasks can be enabled or disabled under program control, and, when enabled, must have an activation time specified. The Timer 2 Scheduler selects the enabled tasks next due for execution and loads Timer 2 with the required time-to-go. Since Timer 2 can hold only a maximum of four seconds, the Timer 2 Scheduler schedules itself if no other task is due within the next four seconds.

Also included in the kernel is the system time update subroutine which maintains mission elapsed time by accumulating readings from a hardware real time clock.

A.2.2 Unique Language Characteristics Required

The Interrupt Processor requires facilities for responding to hardware interrupts and for controlling (inhibiting/enabling) them. Part of this control includes knowing which interrupts have been inhibited by other modules and, therefore, should not be enabled by this module. Since this capability was not readily available, comments were appended to the logic to indicate that only "previously enabled interrupts" are being enabled.

Interrupt control capabilities are often considered privileged functions which should be relegated to the operating system. In the Saturn Flight Program, however, application programs occasionally require direct interface with external hardware. For protection from other activities, they need control of interrupts, making it desirable to be able to perform such control in a high-level language. Interrupt control requirements are also demonstrated by several other kernels. Accelerometer Processing (Paragraph A.8.1) is a good example.

The Interrupt Processor also requires the ability to select the proper task (subprogram) for execution in response to a given interrupt since the task assignment varies in real time for the timer interrupts. Timing efficiency is highly important for selection and transfer of control.

A.2.3 Assumptions Made During Coding

It was assumed that certain functions were performed automatically by compiler-generated code or by the system under which the object programs execute. In particular, the saving and restoring of program status for the interrupted task as well as resetting the hardware interrupt indication were assumed to be automatic.

Symbolic names were assumed for each of the hardware interrupts of the Saturn Launch Vehicle Digital Computer. These names were then used in any kernel where direct reference was made to interrupts. Paragraph A.12 contains a glossary of these names.

A.2.4 Flowchart Notes

Note 1

The program entry point EGP1 is utilized to activate the interrupt handling routines for SPL and CLASP. The statements within it are not executed during the activation process but are merely armed (readied) for execution in response to the associated interrupts. For HAL the entry is used to schedule the interrupt handling tasks.

Note 2

The Timer 1 interrupt handler for CLASP and HAL does not determine which of the Switch Selector modules is to receive control. Since these languages restrict a program module to a single entry point, control is passed to a common entry point of the switch Selector Processor which then internally decides which function is to be performed.

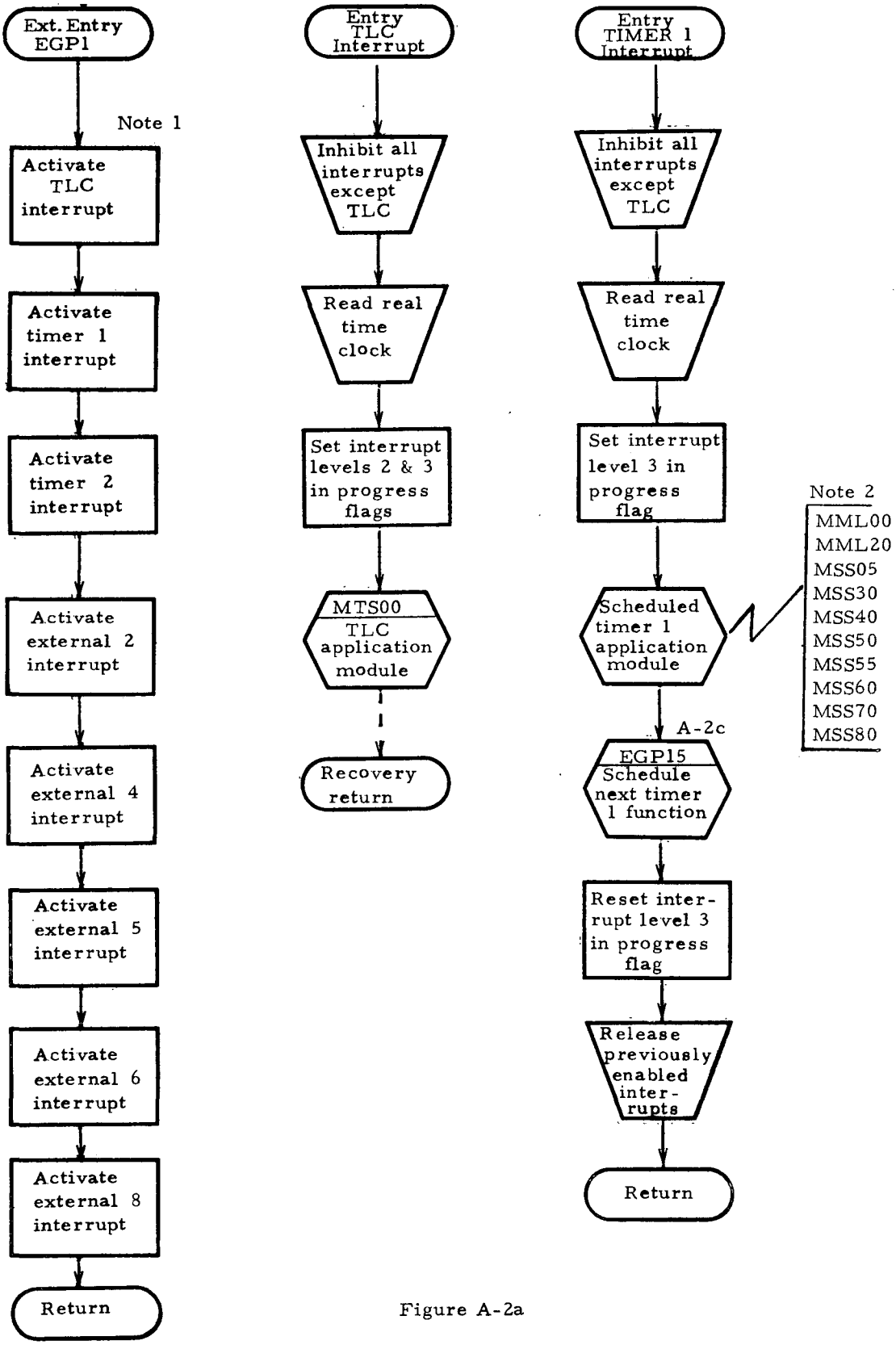

Ext. Entry EGP1
Note 1
Activate TLC interrupt
Activate timer 1 interrupt
Activate timer 2 interrupt
Activate external 2 interrupt
Activate external 4 interrupt
Activate external 5 interrupt
Activate external 6 interrupt
Activate external 8 interrupt
Return
Entry TLC Interrupt
Inhibit all interrupts except TLC
Read real time clock
Set interrupt levels 2 & 3 in progress flags
MTS00
TLC application module
Recovery return
Entry TIMER 1 Interrupt
Inhibit all interrupts except TLC
Read real time clock
Set interrupt level 3 in progress flag
Scheduled timer 1 application module
Note 2
MML00
MML20
MSS05
MSS30
MSS40
MSS50
MSS55
MSS60
MSS70
MSS80
A-2c
EGP15
Schedule next timer 1 function
Reset interrupt level 3 in progress flag
Release previously enabled interrupts
Return

Figure A-2a

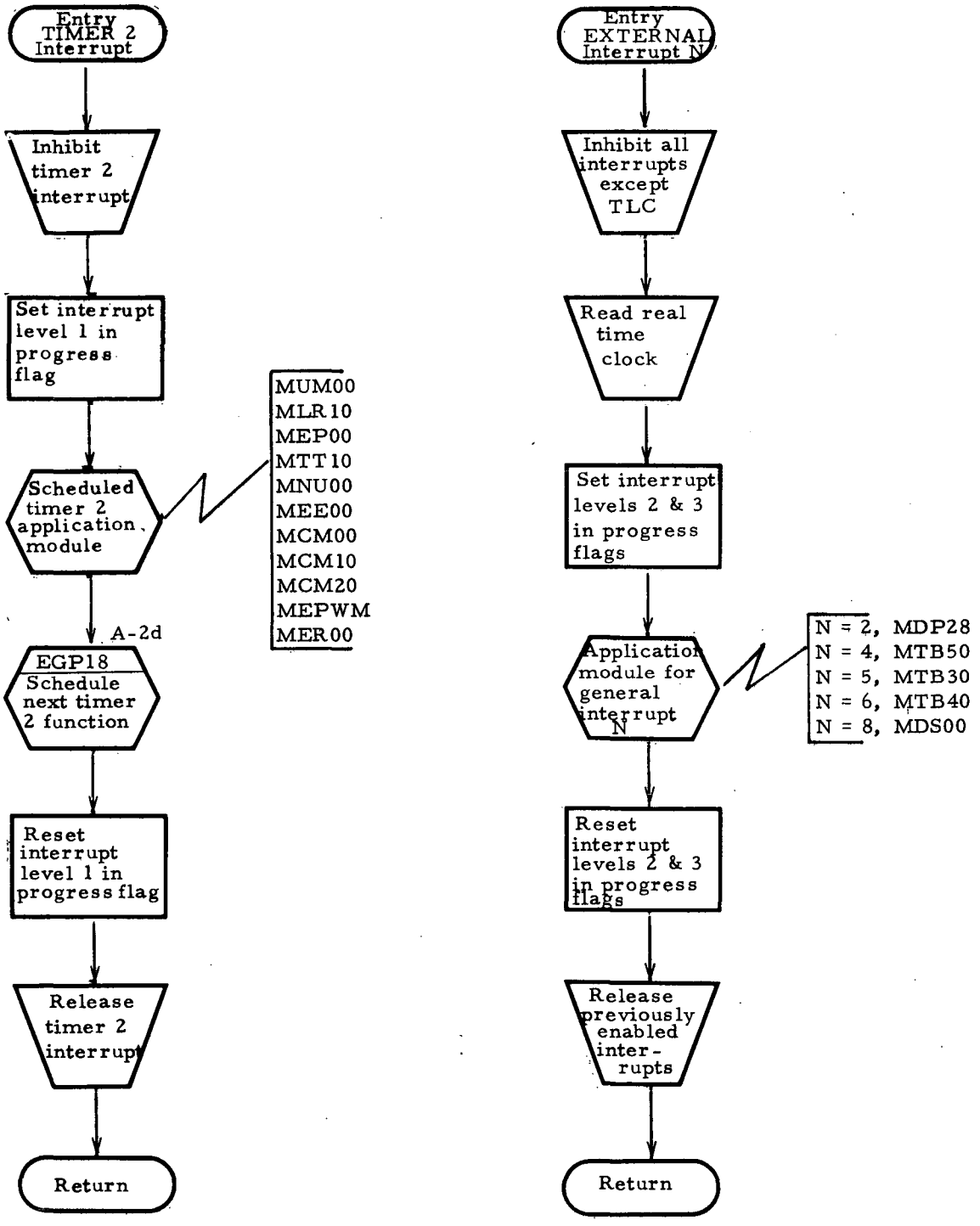

Entry TIMER 2 Interrupt
Inhibit timer 2 interrupt
Set interrupt level 1 in progress flag
Scheduled timer 2 application module
MUM00
MLR10
MEP00
MTT10
MNU00
MEE00
MCM00
MCM10
MCM20
MEPWM
MER00
A-2d
EGP18
Schedule next timer 2 function
Reset interrupt level 1 in progress flag
Release timer 2 interrupt
Return
Entry EXTERNAL Interrupt N
Inhibit all interrupts except TLC
Read real time clock
Set interrupt levels 2 & 3 in progress flags
Application module for general interrupt N
N = 2, MDP28
N = 4, MTB50
N = 5, MTB30
N = 6, MTB40
N = 8, MDS00
Reset interrupt levels 2 & 3 in progress flags
Release previously enabled inter-rupts
Return

Figure A-2b

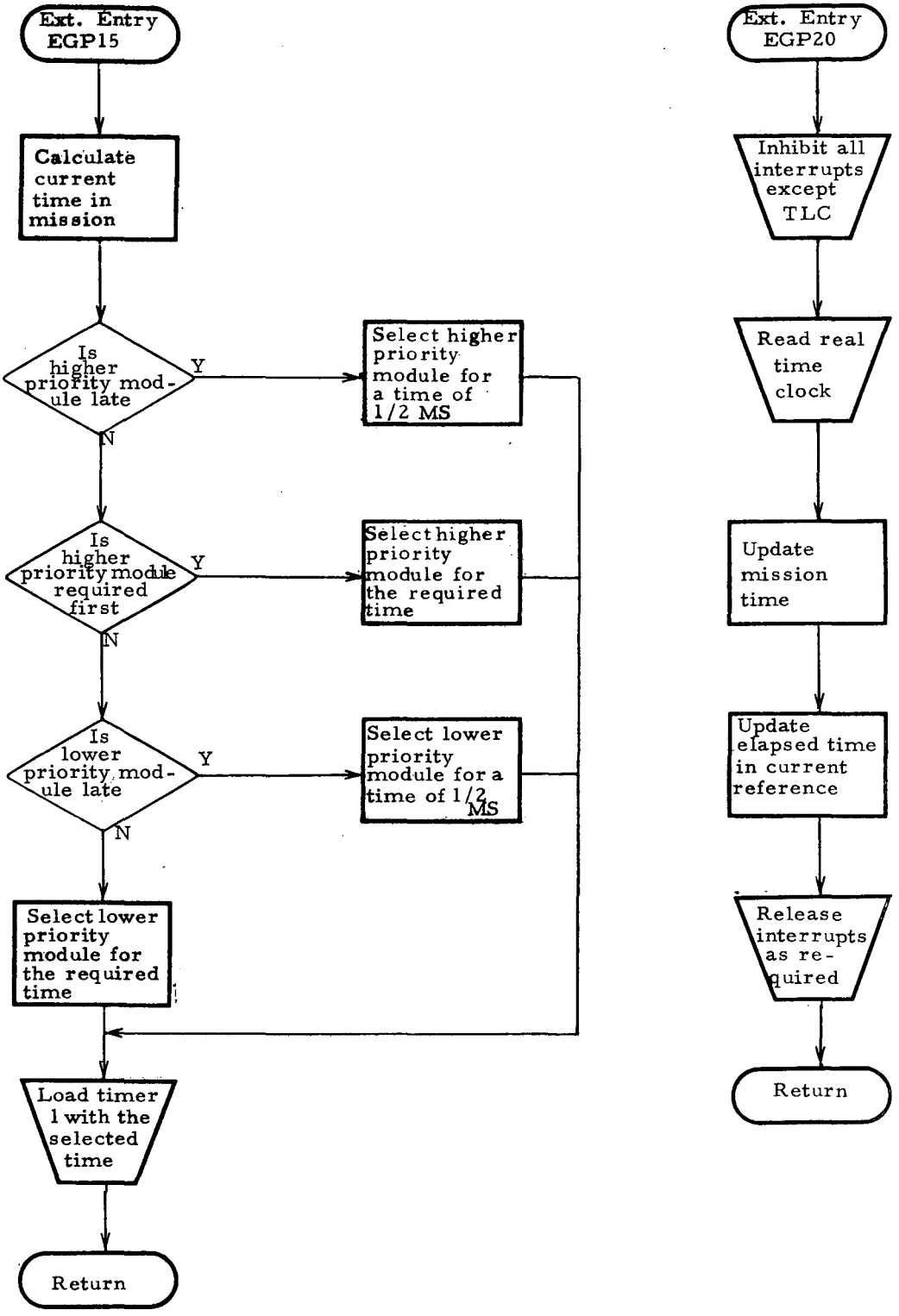

Ext. Entry EGP15
Calculate current time in mission
Is higher priority module late
Y
N
Select higher priority module for a time of 1/2 MS
Is higher priority module required first
Y
N
Select higher priority module for the required time
Is lower priority module late
Y
N
Select lower priority module for a time of 1/2 MS
Select lower priority module for the required time
Load timer 1 with the selected time
Return
Ext. Entry EGP20
Inhibit all interrupts except TLC
Read real time clock
Update mission time
Update elapsed time in current reference
Release interrupts as required
Return

Figure A-2c

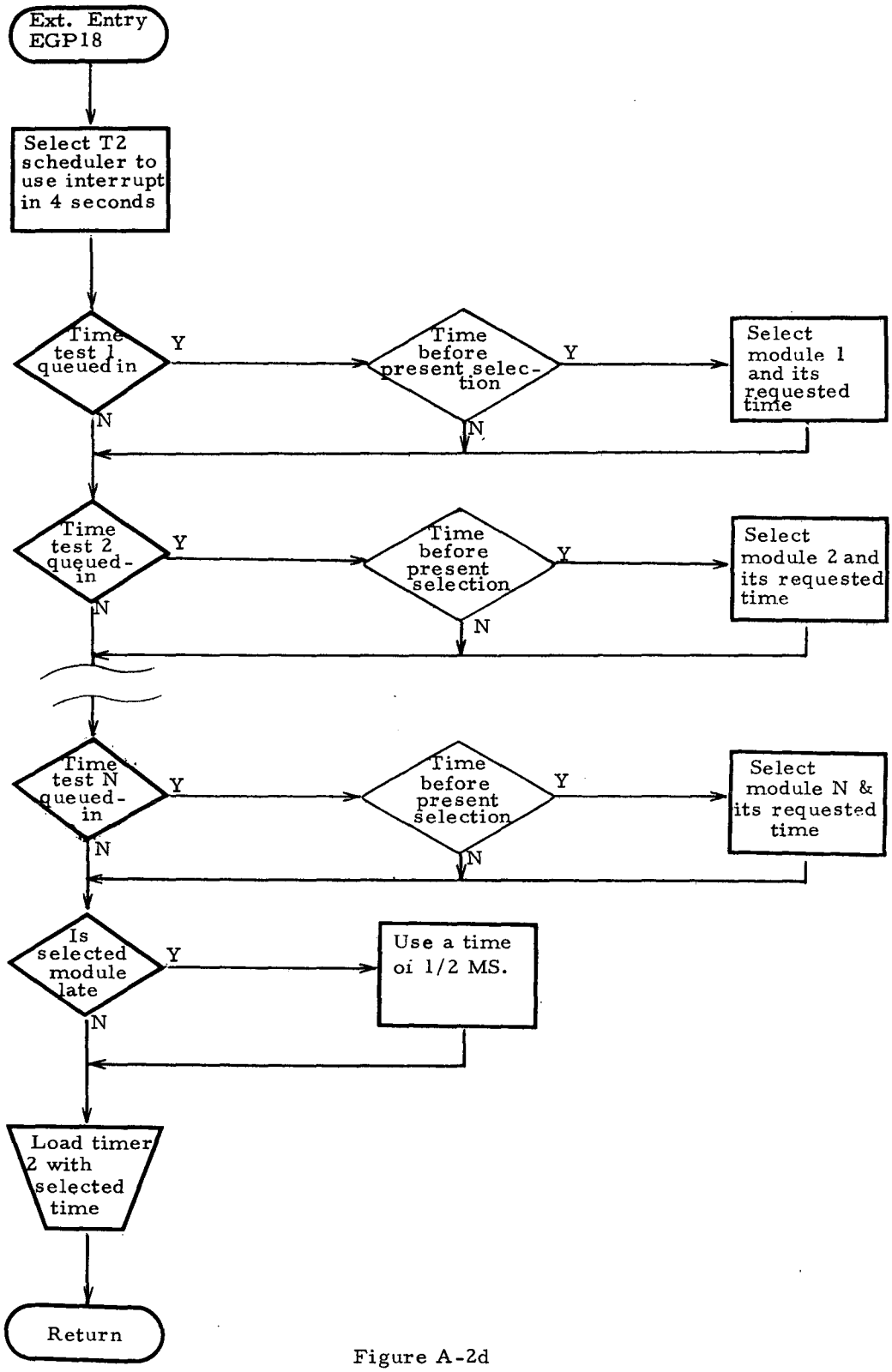

Ext. Entry EGP18
Select T2 scheduler to use interrupt in 4 seconds
Time test 1 queued in
Y
N
Time before present selection
Y
N
Select module 1 and its requested time
Time test 2 queued-in
Y
N
Time before present selection
Y
N
Select module 2 and its requested time
Time test N queued-in
Y
N
Time before present selection
Y
N
Select module N & its requested time
Is selected module late
Y
N
Use a time of 1/2 MS.
Load timer 2 with selected time
Return

Figure A-2d

A.3 Non-Interrupt Sequencer

A.3.1 Description of Operation

The bulk of the Saturn Flight Program computations are performed on a non-interrupt basis. That is, the basic mode of execution consists of cycling a series of computational tasks on the lowest system priority level (lower than all of the interrupt levels). This is performed by the Non-Interrupt Sequencer which is a part of the operating system. Actually there are two Non-Interrupt Sequencers, one for the powered phases of a mission and one for the coast phases. Two sequencers are used because the computations performed differ considerably between the two phase types and require different groups of application tasks.

Tasks to be executed by the Non-Interrupt Sequencer have associated status indicators which can be used to enable or disable each individual task. During system initialization for a given mission phase, the status indicators for the tasks to be cycled during that phase are set to a predefined state. After initialization is completed, control is transferred to the appropriate sequencer.

The Non-Interrupt Sequencer for a given phase examines the status indicators assigned to it in the order in which the associated tasks are to be executed. If an indicator is enabled, the task is invoked. Otherwise the next indicator in the sequence is tested. When control is returned from an enabled application task, the sequencer calls the Periodic Processor (paragraph A.4) before stepping to the next indicator. After all indicators have been tested, the Non-Interrupt Sequencer returns to the first indicator in the group and repeats the cycle continuously until the end of the phase.

The status indicators are set as required by application tasks in response to the occurrence of external events (interrupts or discretes), on the basis of elapsed time, or as a result of internally programmed decisions. In this manner, the basic sequence of computations for a given mission phase can be modified as required.

A.3.2 Unique Language Characteristics Required

The Non-Interrupt Sequencer existed in the Saturn Flight Program as executable tables consisting of modifiable instructions which were used to invoke enabled application tasks and to bypass disabled tasks. Rather than using status indicators to enable/disable, the

instructions in the sequencer control tables were simply modified as required.

Since programming in a higher level language makes it impractical, if not impossible, to "execute" a table or to modify instructions, the sample coding of the Non-Interrupt Sequencer was implemented through testing of status indicators as described in the preceding paragraph (A. 3. 1).

A. 3. 3 Flowchart Notes

Note 1

The Non-Interrupt Sequencer flowchart is general in the sense that it applies to any mission phase. Actually the kernel, as coded, contains two separate programs for the boost and coast mission phases.

NON-INTERRUPT SEQUENCER

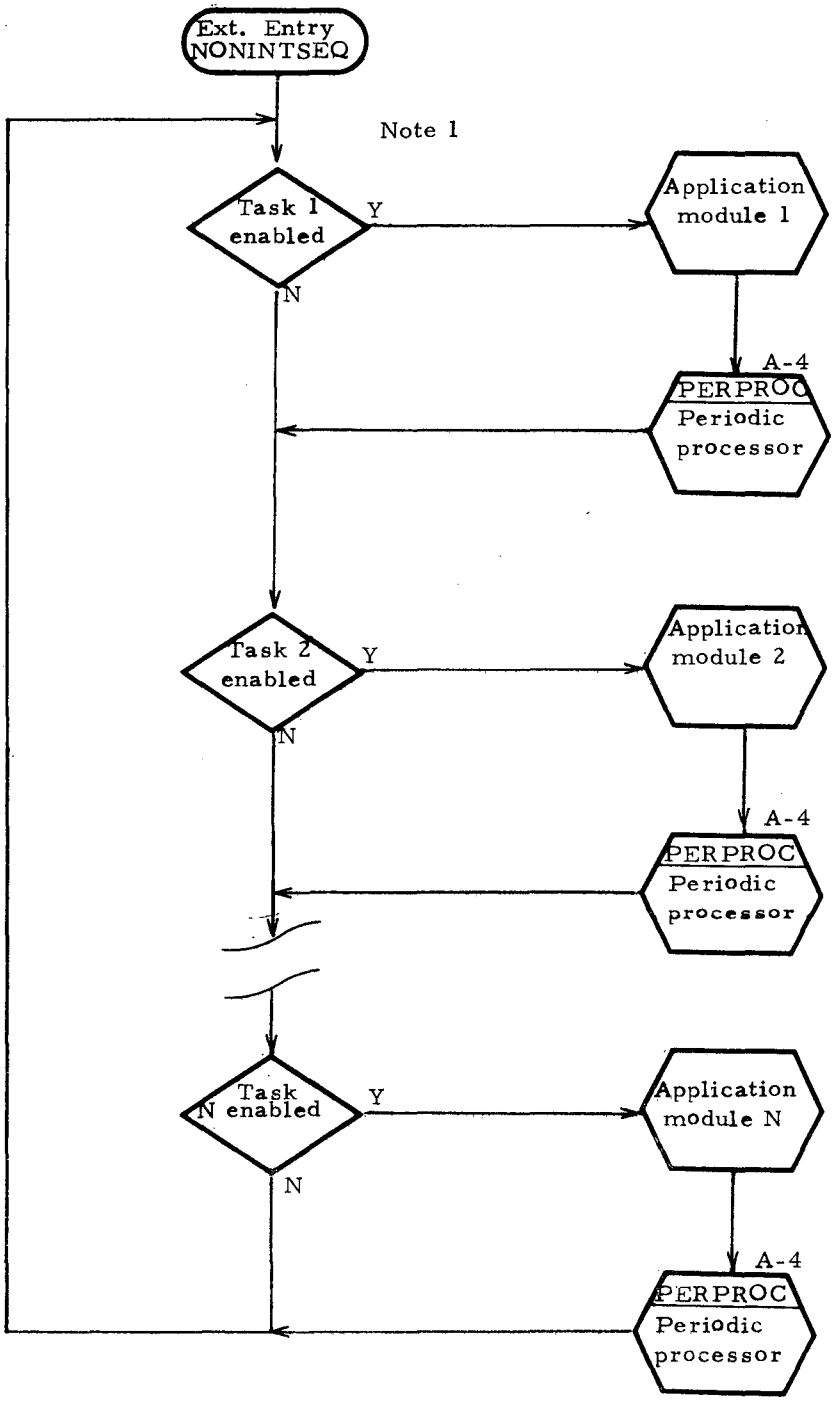


Figure A-3

A.4 Periodic Processor

A.4.1 Description of Operation

Certain tasks in the Saturn Flight Program must be executed repetitively at a fixed frequency but require neither stringent timing accuracy nor synchronization with other tasks. An example is a task which compresses data as a function of time. The scheduling of such tasks is performed by the Periodic Processor as a function of the operating system.

The Periodic Processor is invoked by the Non-Interrupt Sequencer following the execution of each enabled application task. Consequently, the timing accuracy with which it is capable of scheduling tasks is no better than the execution time required by the longest Non-Interrupt Sequencer subtask. Since this time resolution is relatively low, tasks with execution frequencies exceeding five times per second or with stringent timing accuracy requirements should be scheduled by the Interrupt Processor, through the Timer 1 and Timer 2 schedulers.

The Periodic Processor utilizes control tables containing timing information for each periodic application task and status indicators similar to those of the Non-Interrupt Sequencer (paragraph A.3). The Periodic Processor first examines the status indicator for an entry and then, if the task is enabled, it compares the task execution interval with the time elapsed since its last execution. If the task is enabled and is due to execute, it is invoked by the Periodic Processor. When the task completes execution and returns control, or when the task for a given entry is not invoked, the Periodic Processor continues on to the next table entry. Upon reaching the end of the table, control is returned to the Non-Interrupt Sequencer.

A.4.2 Unique Language Characteristics Required

The Periodic Processor requires the capability to access data from control tables.

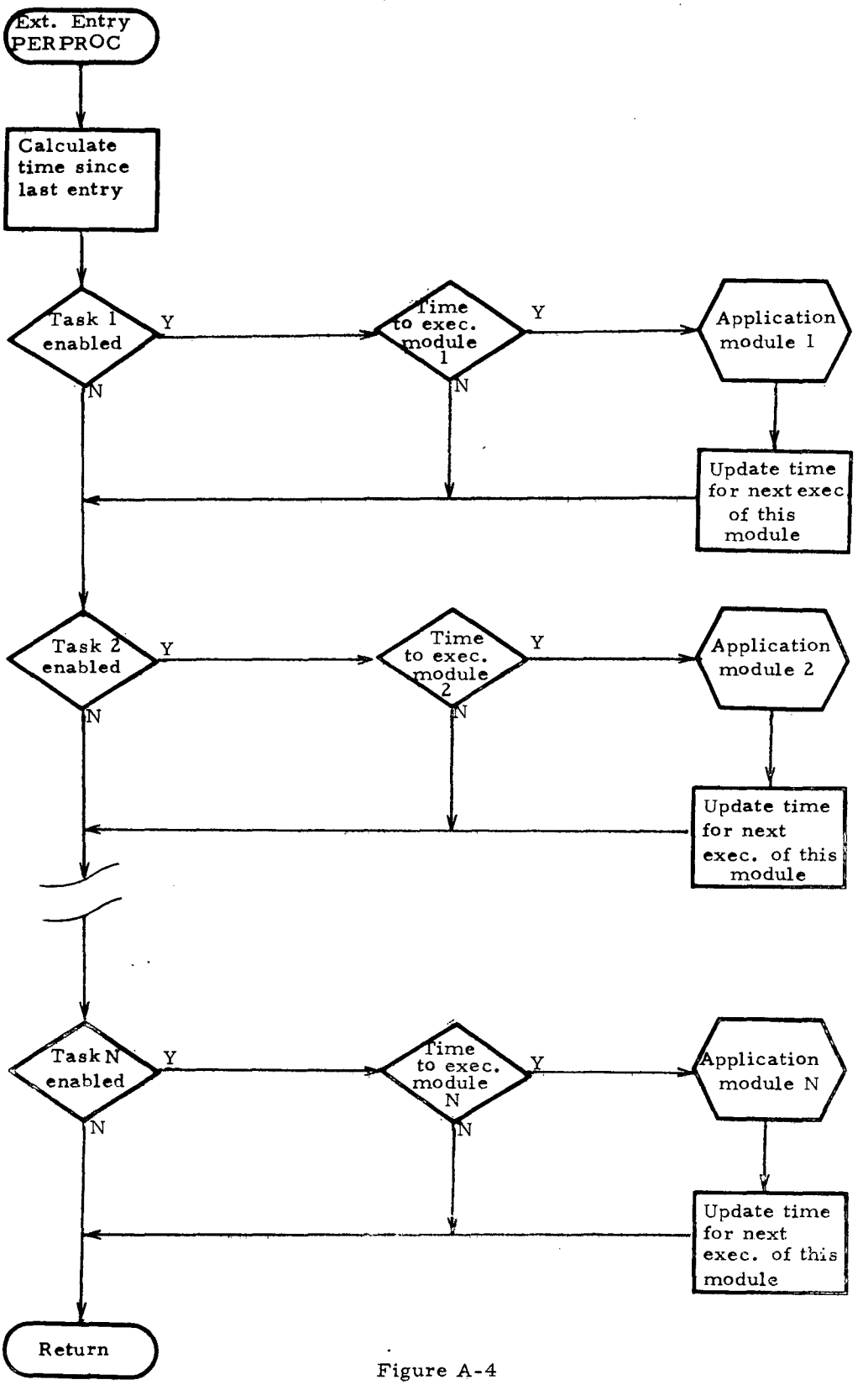

Ext. Entry PERPROC
Calculate time since last entry
Task 1 enabled
Y
N
Time to exec. module 1
Y
N
Application module 1
Update time for next exec of this module
Task 2 enabled
Y
N
Time to exec. module 2
Y
N
Application module 2
Update time for next exec. of this module
Task N enabled
Y
N
Time to exec. module N
Y
N
Application module N
Update time for next exec. of this module
Return

Figure A-4

A.5 Events Processor

A.5.1 Description of Operation

Non-repetitive tasks to be executed at a given time are scheduled for execution by the Events Processor in coordination with the Interrupt Processor. The Events Processor utilizes a predefined table of task identifiers with associated execution times. An example of such a task is one which sets accelerometer reasonableness test constants at a given time during the mission.

The Events Processor selects one entry at a time from the table and schedules the entries in the sequence in which they exist in the table. The execution time for a given table entry is used by the Events Processor to reschedule itself via the low priority timer of the Interrupt Processor. Then when it is reactivated at the specified time, it executes the associated task and selects the next entry from the table. When it reaches the end of a table, it disables itself and remains dormant until it is re-enabled at a later time.

Two special entry points are required in addition to the normal entry from the Interrupt Processor. The first is used at the start of each mission time base (time reference frame) to initialize pointers to the beginning of the corresponding Event Table. The second entry is utilized to enable and reschedule the Events Processor as required following periods when it has been disabled.

A.5.2 Unique Language Characteristics Required

The Events Processor is responsible for invoking a relatively large group of tasks (one at a time) using the identifiers obtained from the Events Processor Table. Language capabilities permitting a call to one of several tasks depending on the value of the identifier would significantly improve efficiency. Lacking such capabilities the programmer is forced to code a call for each task and then use the identifier as an index for a "computed GOTO" in order to pass control to the tasks.

As implied in the preceding discussions, the Events Processor also requires means for accessing data tables.

A.5.3 Flowchart Notes

Note 1

Since CLASP and HAL do not permit multiple entry points for a module, the MEP05 module must call the MEP10 module for these languages rather than transfer control to it as shown in the flowchart.

EVENTS PROCESSOR

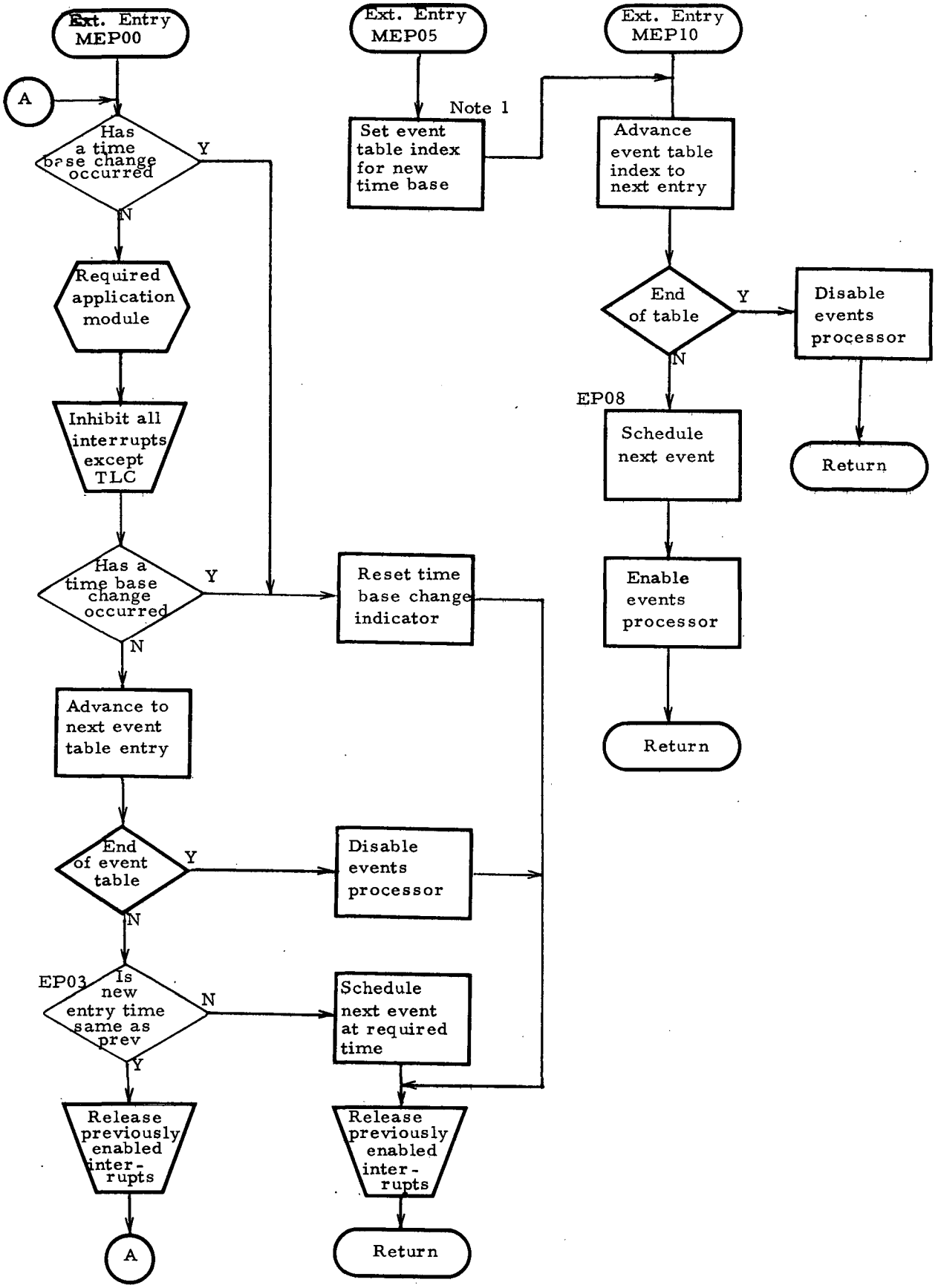


Figure A-5

A.6 Iterative Guidance Mode

A.6.1 Description of Operation

Iterative Guidance Mode (IGM) is a path-adaptive guidance program which steers along a nearly optimum trajectory toward a predefined target. It is path-adaptive in the sense that it is designed to adjust to perturbations to nominal vehicle performance. For example, if one of the upper stage engines fails to develop full thrust, IGM will adapt the steering computations to still achieve terminal position and velocity with sufficient accuracy. The steering program is based on the calculus of variations and is derived from a simplified set of differential equations of motion. It is designed for powered flight in a vacuum with multiple distinct thrust levels and short coasting periods.

IGM is executed once each iteration of the flight program background loop (Non-Interrupt Sequencer, paragraph A.3) during the periods when it is active. It performs two basic functions:

- o Guidance computations
- o Phasing

Guidance computations generate vehicle steering commands (desired attitude angles) using navigation data, vehicle performance data, time, and desired terminal conditions. Calculations are performed in the target plane and injection coordinate systems and then rotated into the plumbline coordinate system for attitude control.

Phasing evaluates vehicle performance data and estimates the times to go until the expected thrust level changes occur. For the Saturn V vehicle and missions, there are two distinct thrust level changes for the translunar injection boost period.

Due to the large size of IGM, it is neither informative nor practical to code all of it in each of the languages. Therefore, only the portion containing the guidance computations is coded. The operations performed by the phasing segment are similar to those contained in other kernels so coding them would be redundant.

A.6.2 Unique Language Characteristics Required

The IGM kernel contains the majority of the numerical computations performed by the selected kernels. In addition to the common

mathematical expressions including built-in functions (LOG, SQRT, SIN, ATAN, etc.), it also demonstrates vector and matrix operations. It requires capabilities for coding vector expressions and for performing such functions as dot product and vector rotation.

A.6.3 Flowchart Notes

Note 1

The dashed connector from the entry point to the first block indicates the omission of the phasing portion of IGM which was not coded.

ITERATIVE GUIDANCE MODE

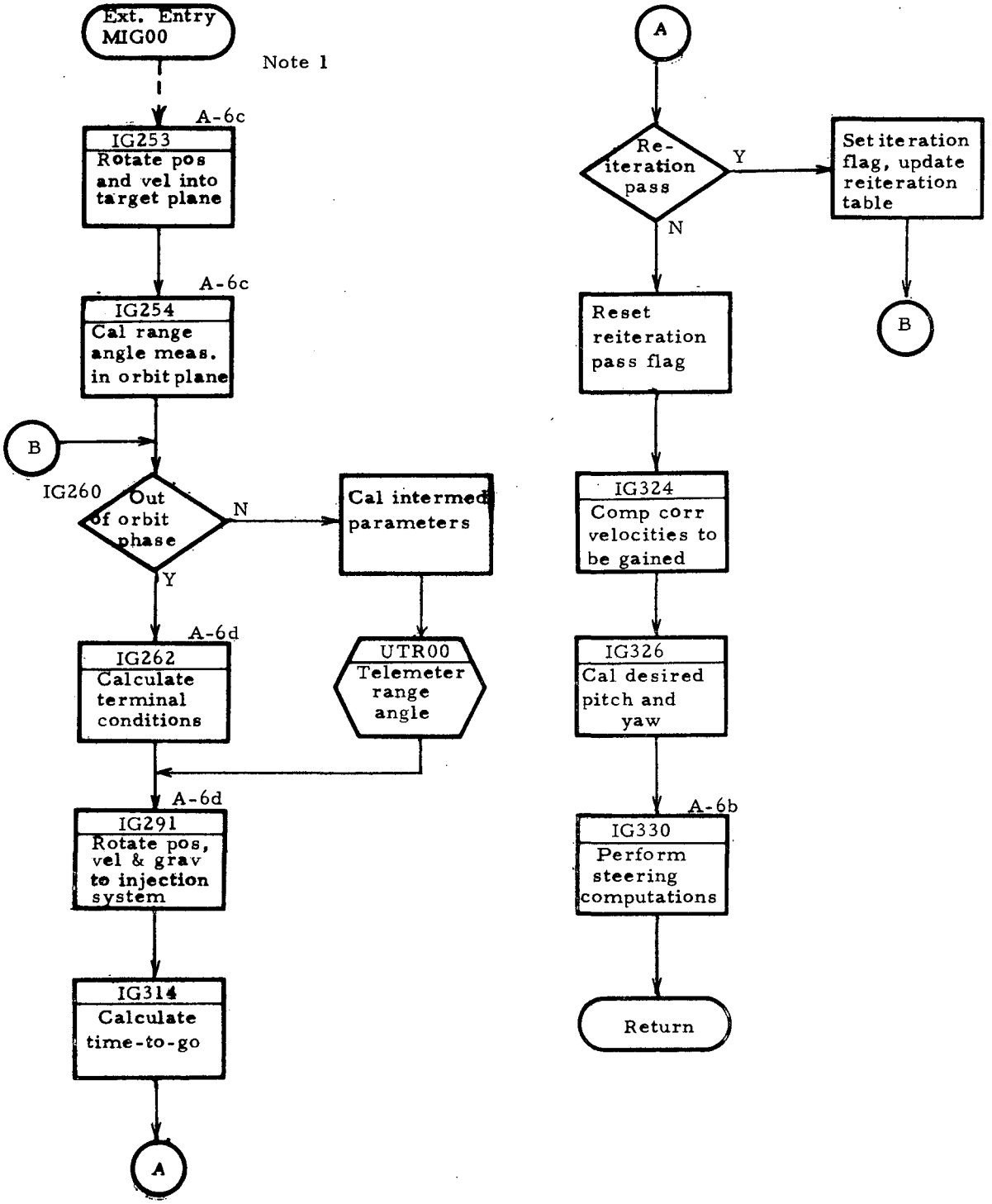


Figure A-6a

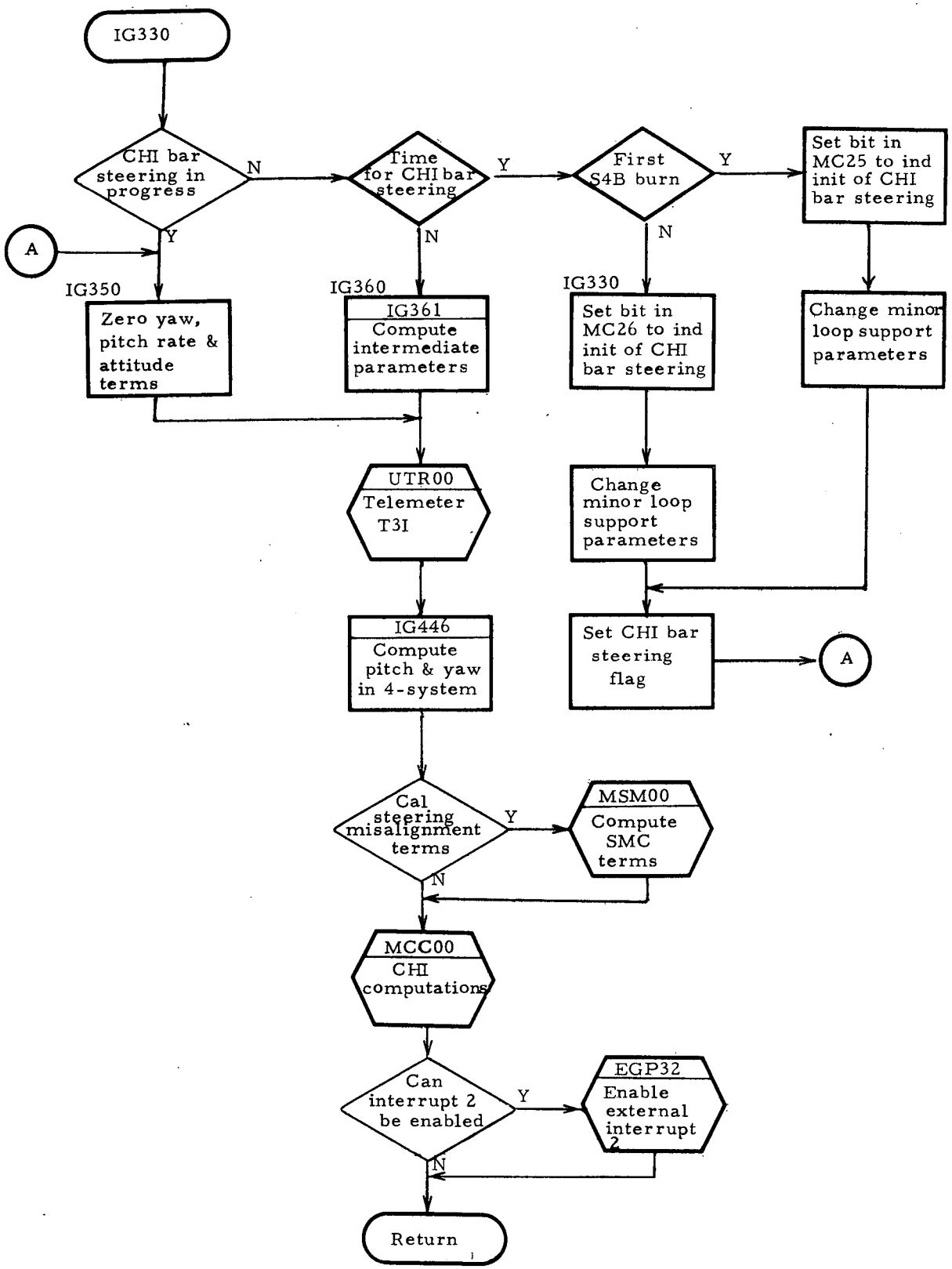

IG330
CHI bar steering in progress
N
Y
Time for CHI bar steering
Y
N
First S4B burn
Y
N
Set bit in MC25 to ind init of CHI bar steering
A
IG350
Zero yaw, pitch rate & attitude terms
IG360
IG361
Compute intermediate parameters
IG330
Set bit in MC26 to ind init of CHI bar steering
Change minor loop support parameters
UTR00
Telemeter T3I
Change minor loop support parameters
IG446
Compute pitch & yaw in 4-system
Set CHI bar steering flag
A
Cal steering misalignment terms
Y
N
MSM00
Compute SMC terms
MCC00
CHI computations
Can interrupt 2 be enabled
Y
N
EGP32
Enable external interrupt 2
Return

Figure A-6b

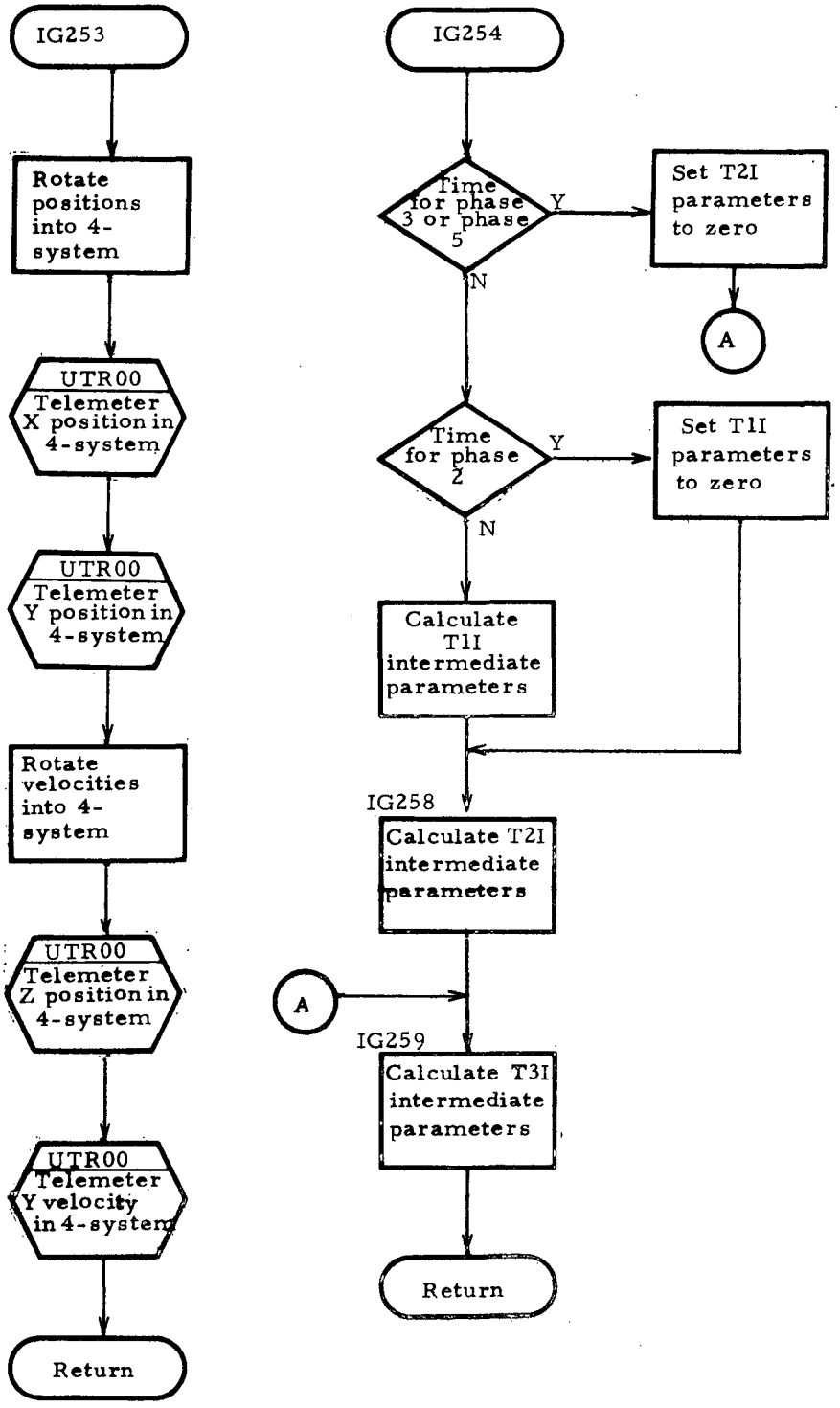

IG253
Rotate positions into 4-system
UTR00
Telemeter X position in 4-system
UTR00
Telemeter Y position in 4-system
Rotate velocities into 4-system
UTR00
Telemeter Z position in 4-system
UTR00
Telemeter Y velocity in 4-system
Return
IG254
Time for phase 3 or phase 5
Y
N
Set T2I parameters to zero
A
Time for phase 2
Y
N
Set T1I parameters to zero
Calculate T1I intermediate parameters
IG258
Calculate T2I intermediate parameters
A
IG259
Calculate T3I intermediate parameters
Return

Figure A-6c

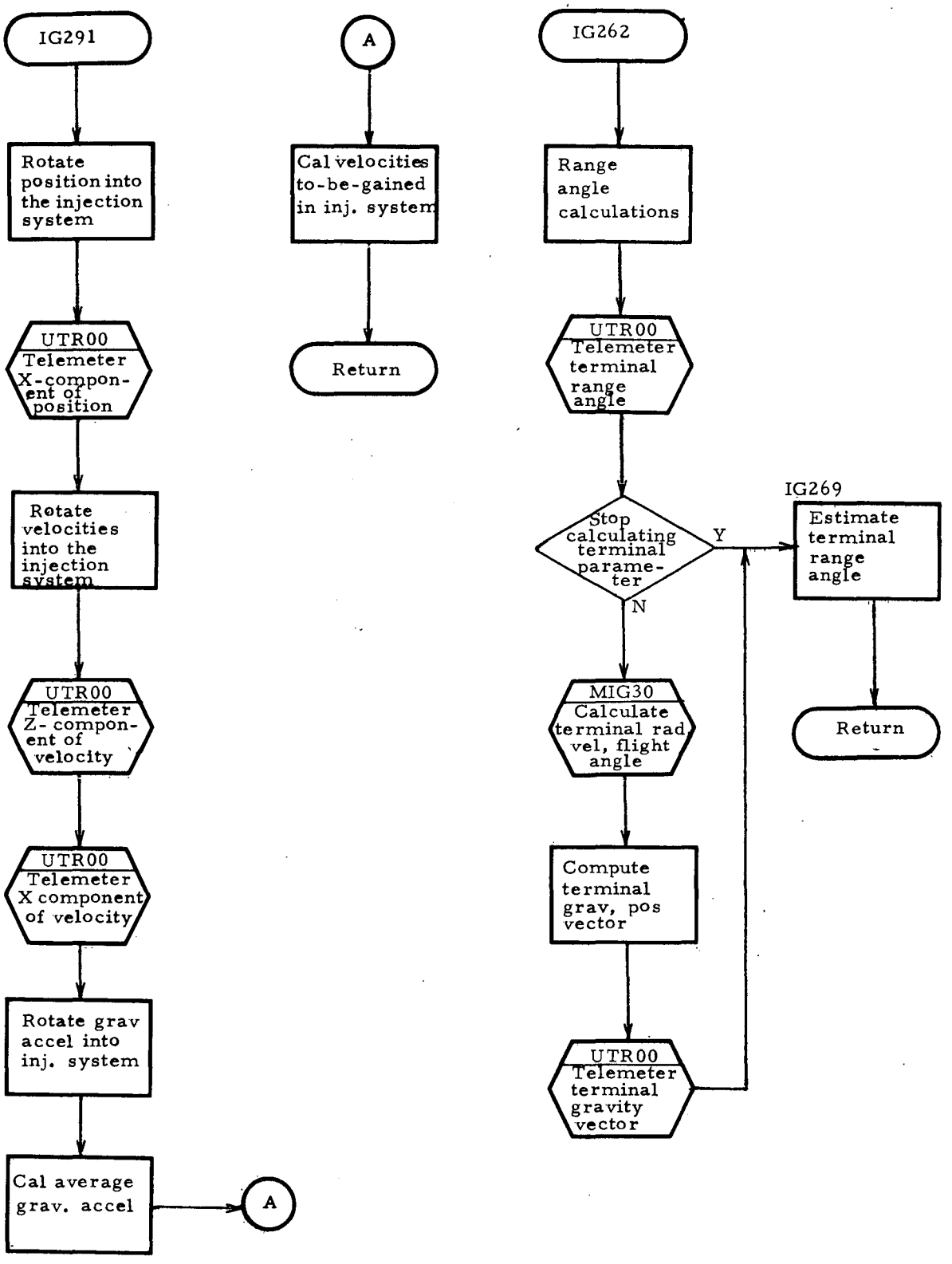

IG291
Rotate position into the injection system
UTR00 Telemeter X-component of position
Rotate velocities into the injection system
UTR00 Telemeter Z-component of velocity
UTR00 Telemeter X component of velocity
Rotate grav accel into inj. system
Cal average grav. accel
A
A
Cal velocities to-be-gained in inj. system
Return
IG262
Range angle calculations
UTR00 Telemeter terminal range angle
Stop calculating terminal parameter
Y
N
IG269
Estimate terminal range angle
Return
MIG30 Calculate terminal rad vel, flight angle
Compute terminal grav, pos vector
UTR00 Telemeter terminal gravity vector

Figure A-6d

A.7 Digital Command System (DCS)

A.7.1 Description of Operation

The Digital Command System provides communication facilities for receiving commands and data transmitted from ground stations. Capabilities exist for controlling flight program timing, navigation, guidance, targeting, and sequencing functions from the ground and for requesting specific program data to be telemetered to the ground.

Each DCS function, as received by the DCS software task, consists of a mode command to identify the function, followed by a variable number of data commands depending on the requirements of each function. The DCS task is initiated by the Interrupt Processor in response to the hardware indication that input data has been received. When a mode command is received it is tested for validity and legality and then analyzed to determine whether or not data words are required to perform the associated function. If data is required, the DCS task returns control to the operating system and is reinitiated as each data command is received. Each data word is also tested for validity and legality as it is received. When all data for a given function has been received, or if a function does not require data, the appropriate module is activated to process the function. Upon the detection of errors in the DCS inputs, error messages are formulated and transmitted back to the ground and the function is not activated.

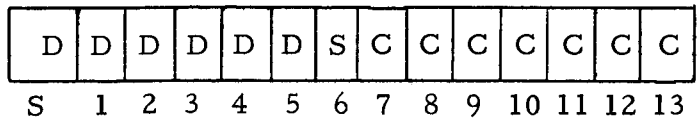
The coded kernel does not include the various application modules which are invoked to perform the requested functions. Only the central, coordinating portion of the overall DCS is demonstrated.

The format of DCS input data is shown in Table A-1 along with a list of functions in Table A-2 and error codes in Table A-3.

A.7.2 Unique Language Characteristics Required

The Digital Command System has requirements to perform real time I/O. It reads the DCS Input Register to obtain the incoming data and the Discrete Input Register to examine the bit which stipulates whether the DCS input data is a mode command or a data word for a previous mode command. It also writes to the Discrete Output Register to issue the command reset pulse for the Command Receiver.

DCS INPUT FORMAT



LVDC Bit Position	Significance
S - 5	DCS mode or data command
6	Sequence bit
7 -13	Complement of bits S-6
14 -25	Unused

Table A-1

DCS FUNCTIONS

Mode Comm.	Status Code	No. Data Words	Function
05	05	0	Maneuver inhibit
10	10	1	Time base update
11	11	35	Navigation update
12	12	2	Generalized switch selector
13	13	2	Sector dump
14	14	3	Telemeter single memory location
17	17	0	Time base 8 enable
20	20	0	Terminate
22	22	1	Maneuver update
25	25	0	Execute alternate sequence 6D
31	31	35	Target update
33	33	0	Execute communication maneuver
34	34	0	Execute evasive maneuver
45	45	0	Inhibit coolant control valve
52	52	6	S-IVB/IU lunar impact
53	77	0	Switch CCS antenna system to omni
54	77	0	Switch CCS antenna system to low gain
55	77	0	Switch CCS antenna system to high gain
60	60	0	Transposition, docking, and extraction enable

Note: The Mode Command comes from bits S-5 of the input command. The Status Code is the telemetered status word. Both are represented in octal.

Table A-2

DCS ERROR CODES

Error Code (Octal)	Description
04	Orbital Mode/Data bit is invalid; data command was received when a mode command was expected.
10	True complement test failed for mode command; information bits 7-13 are not the complement of bits S-6.
14	Mode command invalid; the mode command received is not defined for this mission.
20	Orbital Mode/Data bit is invalid; mode command was received when expecting a data command.
24	Mode command sequence bit incorrect; the sequence bit received was 1 instead of 0.
34	Unable to issue generalized switch selector command function at this time; the last requested generalized switch selector command function has not been issued.
44	True complement test failed for data command; information bits 7-13 are not the complement of bits S-6.
54	The time of implementation of a navigation update or target update command is less than 10 seconds in the future.
60	Data command sequence bit incorrect; the sequence bit must begin with 1 and alternate from 1 to 0 in each sequential data command of a set.
64	A DCS program is in progress at this time; however, no more data is required; only a terminate mode command can be processed at this time.
74	The mode command received is defined for this mission but is not acceptable in the present time frame.

Table A-3

The kernel also requires capabilities for unpacking the input data and performing validity and legality tests on the data. When an error is detected, the data must be formatted for an error message. Table accessing facilities are also required since information concerning each mode command is stored in tables. The information includes:

- o Number of data words required
- o Command activity status (enabled/disabled)
- o Status code (for telemetry)

Since a variety of functions must be invoked by DCS, a variable call facility as discussed in paragraph A.5.2 would be useful.

A.7.3 Assumptions Made During Coding

The DCS kernel was not coded as it exists in the Saturn Flight Program. It was reorganized to simplify program logic while retaining all of the necessary functions. Reorganization primarily involved the centralization of certain functions within the DCS kernel which, in the original flight program, were performed in the various DCS application sub-task modules. In particular, each application module previously was required to determine whether or not it was active, to issue status telemetry, and to make provision for obtaining any needed input data. In the coding of the DCS kernel these functions were performed in the DCS task itself to eliminate duplication and greatly simplify the operation of the application modules.

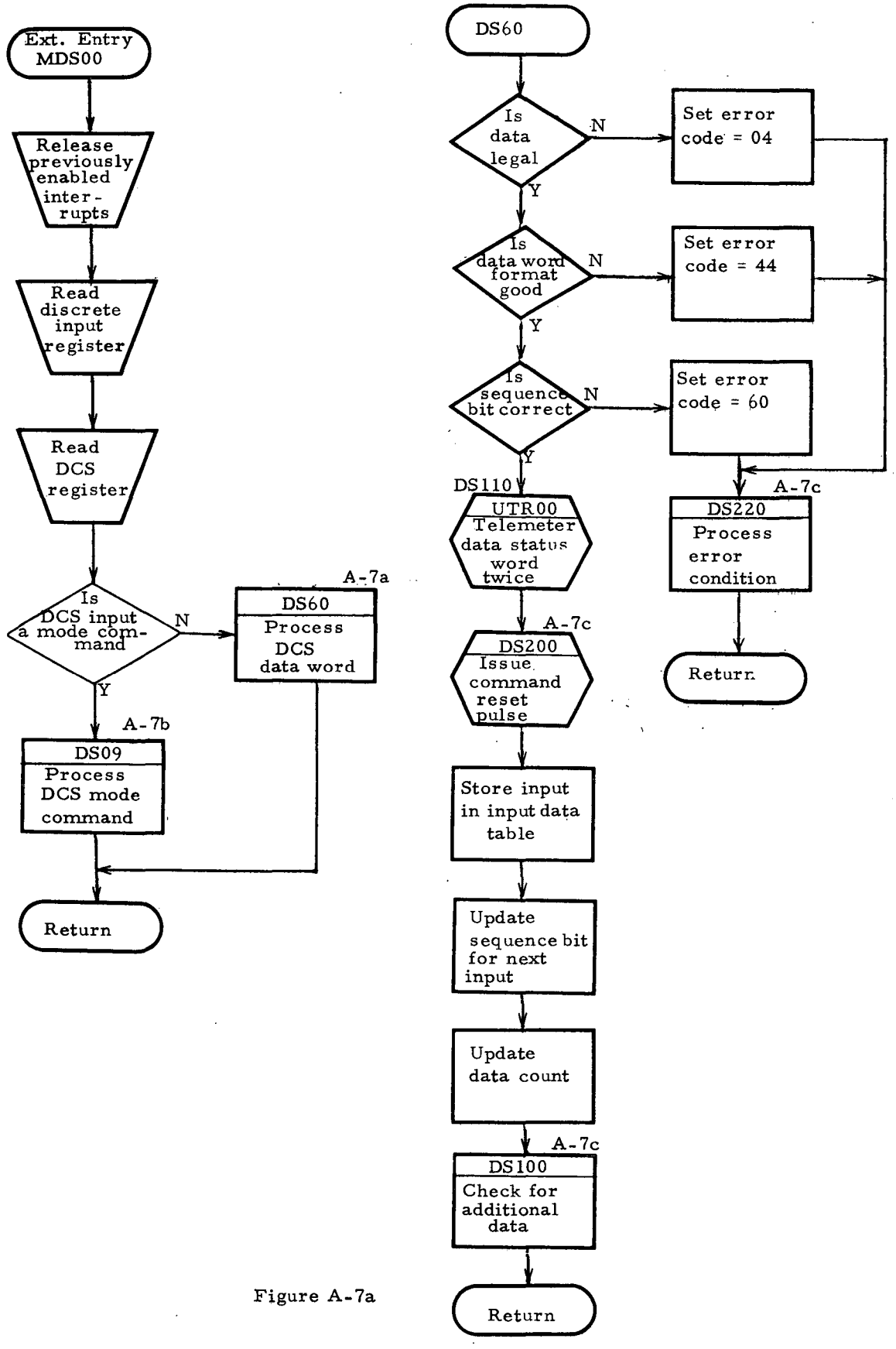

Ext. Entry MDS00
Release previously enabled inter-rupts
Read discrete input register
Read DCS register
Is DCS input a mode com-mand
N
Y
A-7a
DS60
Process DCS data word
A-7b
DS09
Process DCS mode command
Return
DS60
Is data legal
N
Y
Set error code = 04
Is data word format good
N
Y
Set error code = 44
Is sequence bit correct
N
Y
Set error code = 60
A-7c
DS220
Process error condition
Return
DS110
UTR00
Telemeter data status word twice
A-7c
DS200
Issue command reset pulse
Store input in input data table
Update sequence bit for next input
Update data count
A-7c
DS100
Check for additional data
Return

Figure A-7a

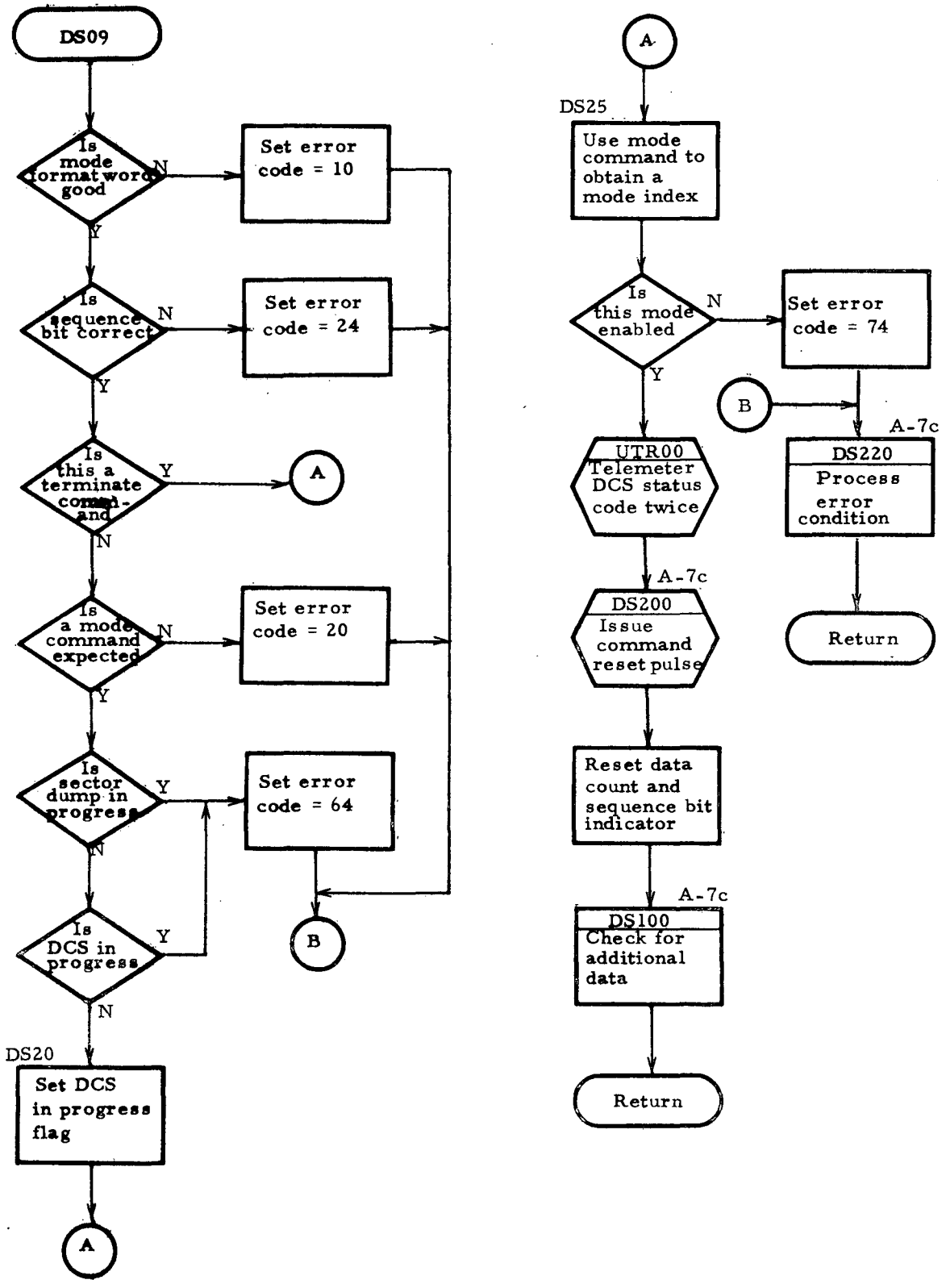

DS09
Is mode format word good
N
Set error code = 10
Y
Is sequence bit correct
N
Set error code = 24
Y
Is this a terminate command
Y
A
N
Is a mode command expected
N
Set error code = 20
Y
Is sector dump in progress
Y
Set error code = 64
N
Is DCS in progress
Y
B
N
DS20
Set DCS in progress flag
A
A
DS25
Use mode command to obtain a mode index
Is this mode enabled
N
Set error code = 74
Y
B
A-7c
UTR00
Telemeter DCS status code twice
DS220
Process error condition
A-7c
DS200
Issue command reset pulse
Return
Reset data count and sequence bit indicator
A-7c
DS100
Check for additional data
Return

Figure A-7b

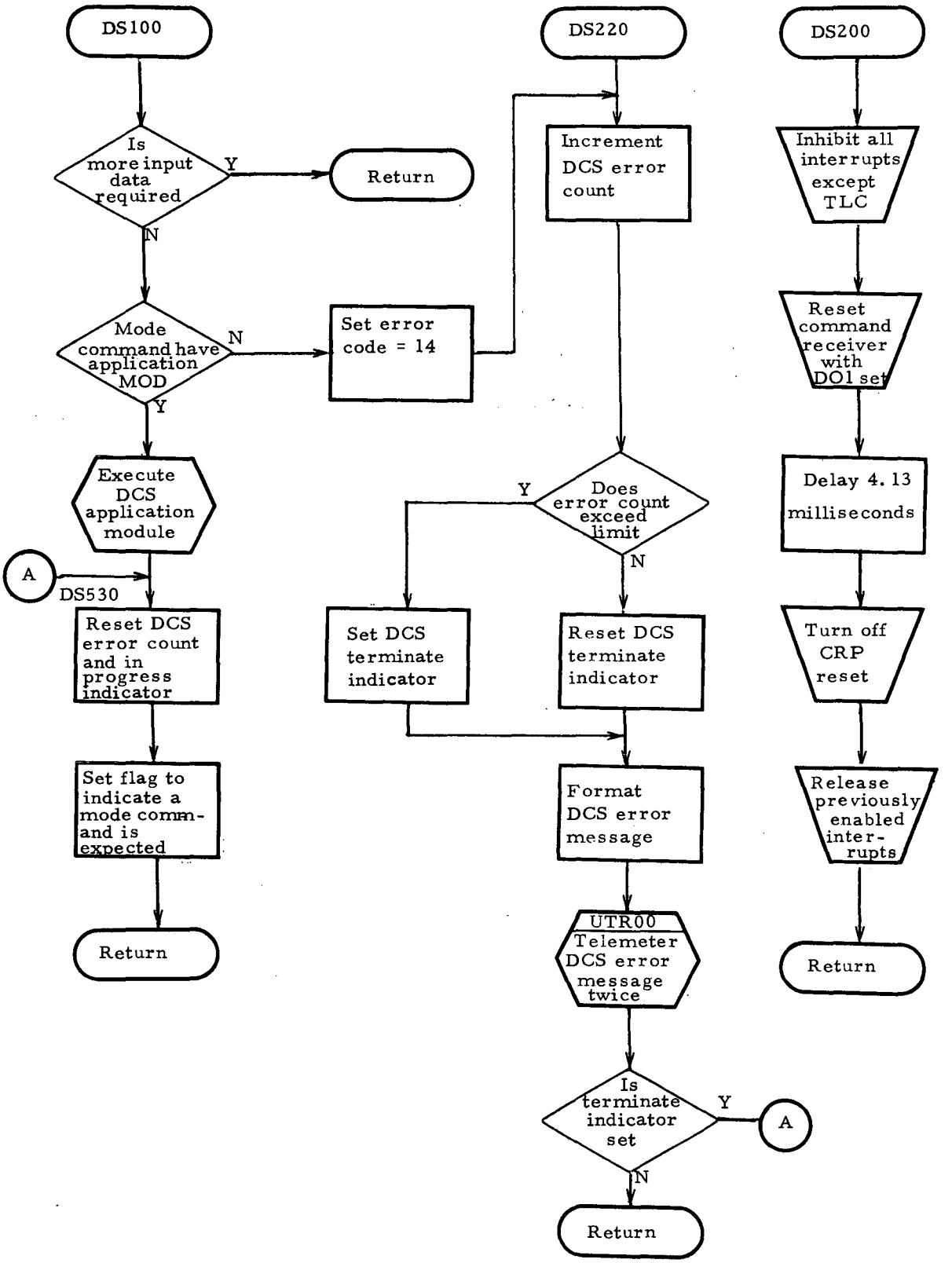

DS100
Is more input data required
Y
Return
N
Mode command have application MOD
N
Set error code = 14
Y
Execute DCS application module
A
DS530
Reset DCS error count and in progress indicator
Set flag to indicate a mode command is expected
Return
DS220
Increment DCS error count
Y
Does error count exceed limit
N
Set DCS terminate indicator
Reset DCS terminate indicator
Format DCS error message
UTR00
Telemeter DCS error message twice
Is terminate indicator set
Y
A
N
Return
DS200
Inhibit all interrupts except TLC
Reset command receiver with DO1 set
Delay 4.13 milliseconds
Turn off CRP reset
Release previously enabled interrupts
Return

Figure A-7c

A.8 Accelerometer Processing

A.8.1 Descriptions of Operation

The accelerometers attached to the inertial platform of the vehicle provide data which serve as the basis for performing navigation during boost phases of a mission. Accelerometer Processing, as its name implies, reads the accelerometers and refines the data into a form suitable for updating vehicle position and velocity.

During periods when it is enabled, Accelerometer Processing is executed once each iteration of the flight program background loop by the Non-Interrupt Sequencer (paragraph A.3). It first inhibits interrupts, reads the accelerometers for all three platform axes, reads the real time clock, and then releases the interrupts. Interrupts are inhibited to insure that the input data are all obtained at a given point in time rather than separated in time by the execution of an interrupt-driven task.

Before the input data can be used for navigation, each accelerometer reading is subjected to three tests. Each reading provides two pulse counts for redundancy. These pulse counts are subtracted from the pulse counts of the previous computation cycle to obtain two delta readings which represent the change in vehicle velocity along that axis during the previous computation cycle. The two delta readings are then compared and if they disagree by more than two pulses, an error indication is set. The delta closest to a predicted value is selected for further processing.

A zero test is performed next to detect an unchanging accelerometer. Finally, a reasonableness test is performed in which the actual delta is required to fall within a band of plus or minus fifty percent of the predicted value enlarged by a reasonableness constant. If a reading does not pass the reasonableness test, it is replaced by a backup value derived from an internally calculated acceleration profile. Error indications are set to indicate failure to pass any of the tests.

After the tests are performed, the readings are used to calculate vehicle acceleration and to update vehicle velocity.

An additional function performed by the Accelerometer Processing kernel is the calculation of mission time at the time the accelerometers are read.

A.8.2 Unique Lanugage Characteristics Required

Accelerometer Processing requires facilities for reading real time data (acceleration and time) and for converting the data to an internally usable form. The need also exists for controlling interrupts via a momentary inhibit as discussed in paragraph A.8.1.

A.8.3 Flowchart Notes

Note 1

The computation of the average CHIs for the SMC calculations (see A-8b) is shown in the flowcharts as coded for SPL and CLASP, where PIRADS were used. In HAL, PIRADS were not used so the special test shown for the averaging of the pitch commanded CHI was unnecessary.

Note 2

Likewise, for the computation of the expected velocity changes (see A-8b), usage of the special SIN/COS routine (USC00) for PIRADS was replaced by the usage of the built-in SIN/COS functions in HAL.

ACCELEROMETER PROCESSING

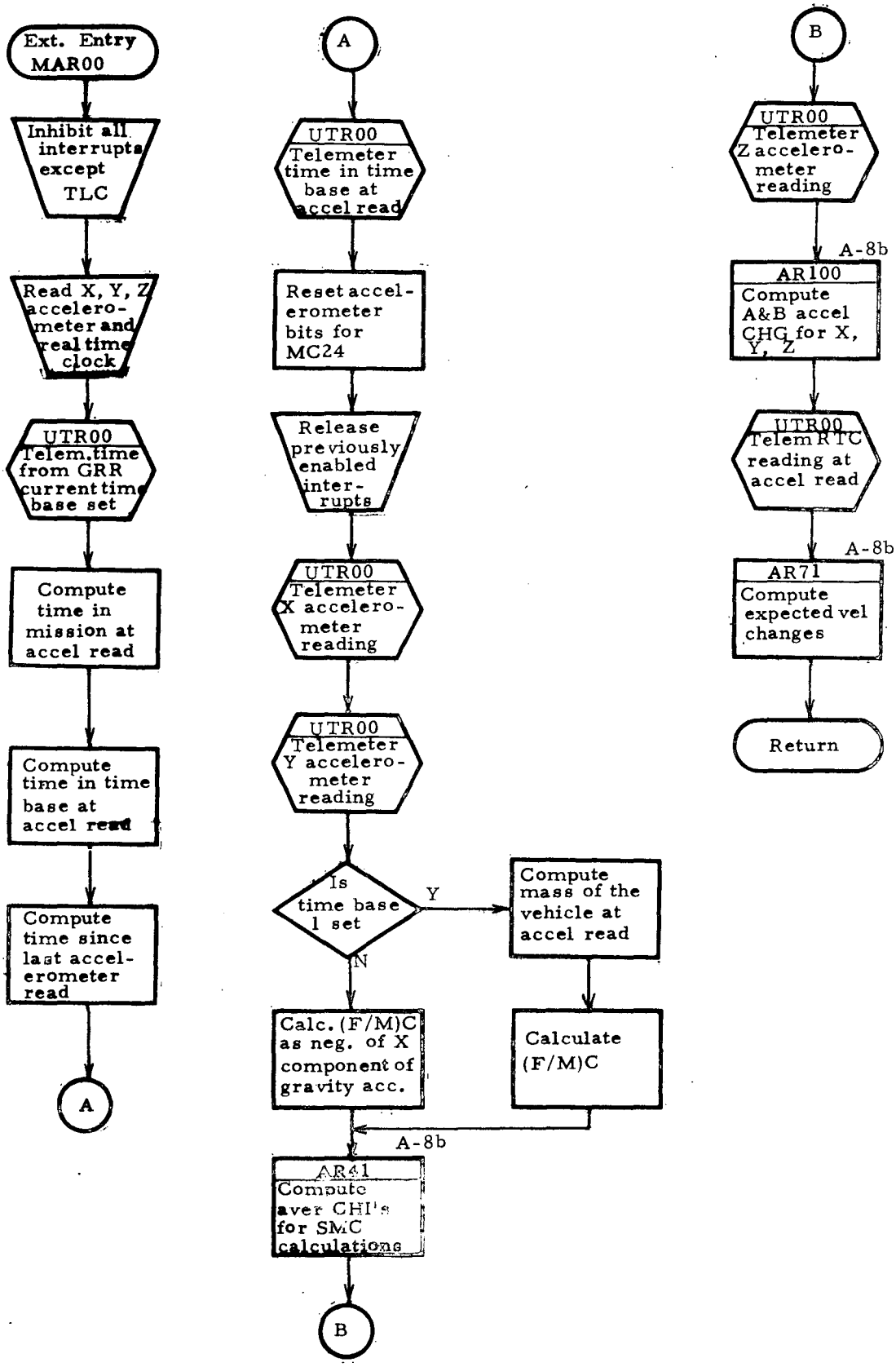


Figure A-8a

ACCELEROMETER PROCESSING
(continued)

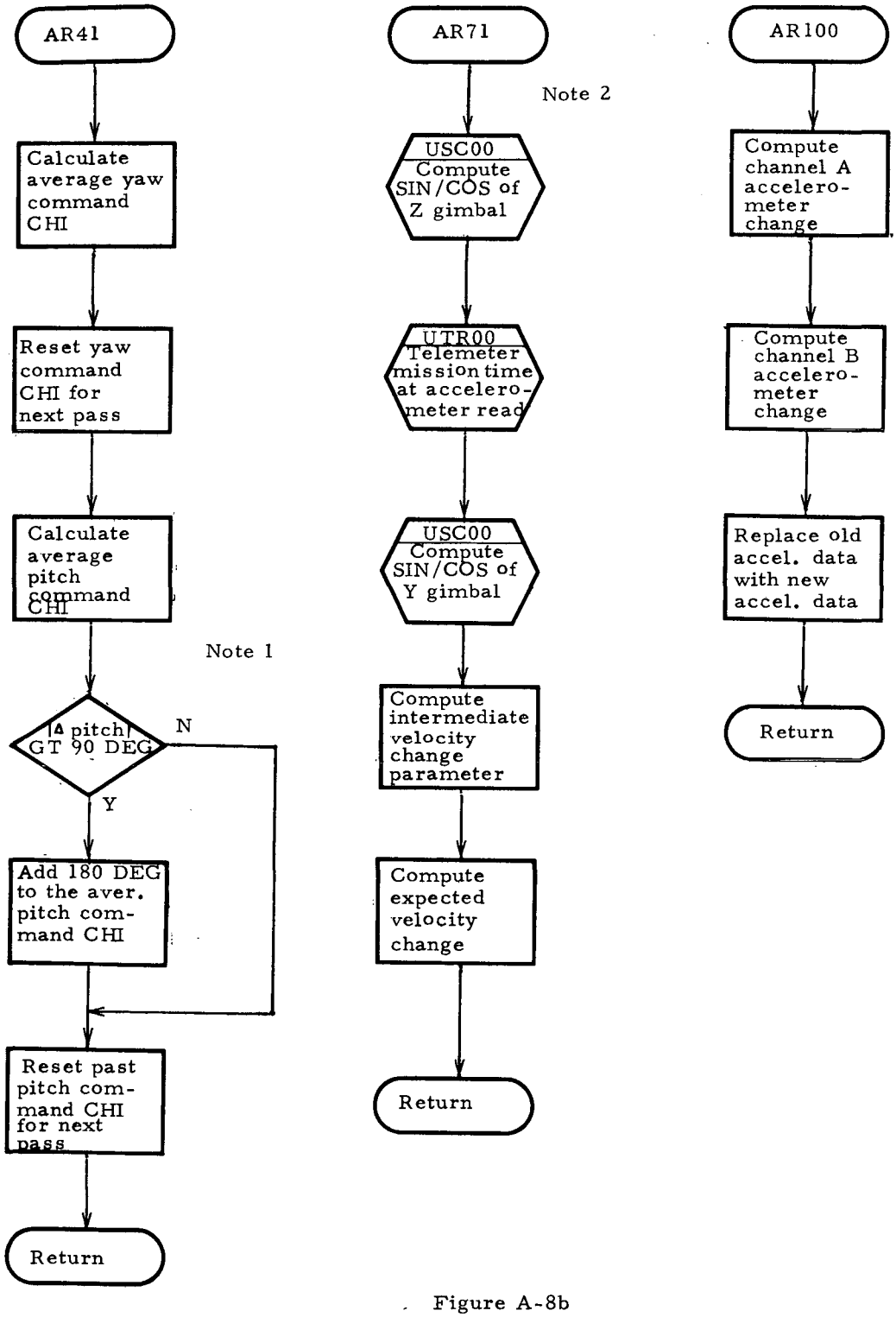


Figure A-8b

ACCELEROMETER PROCESSING
(continued)

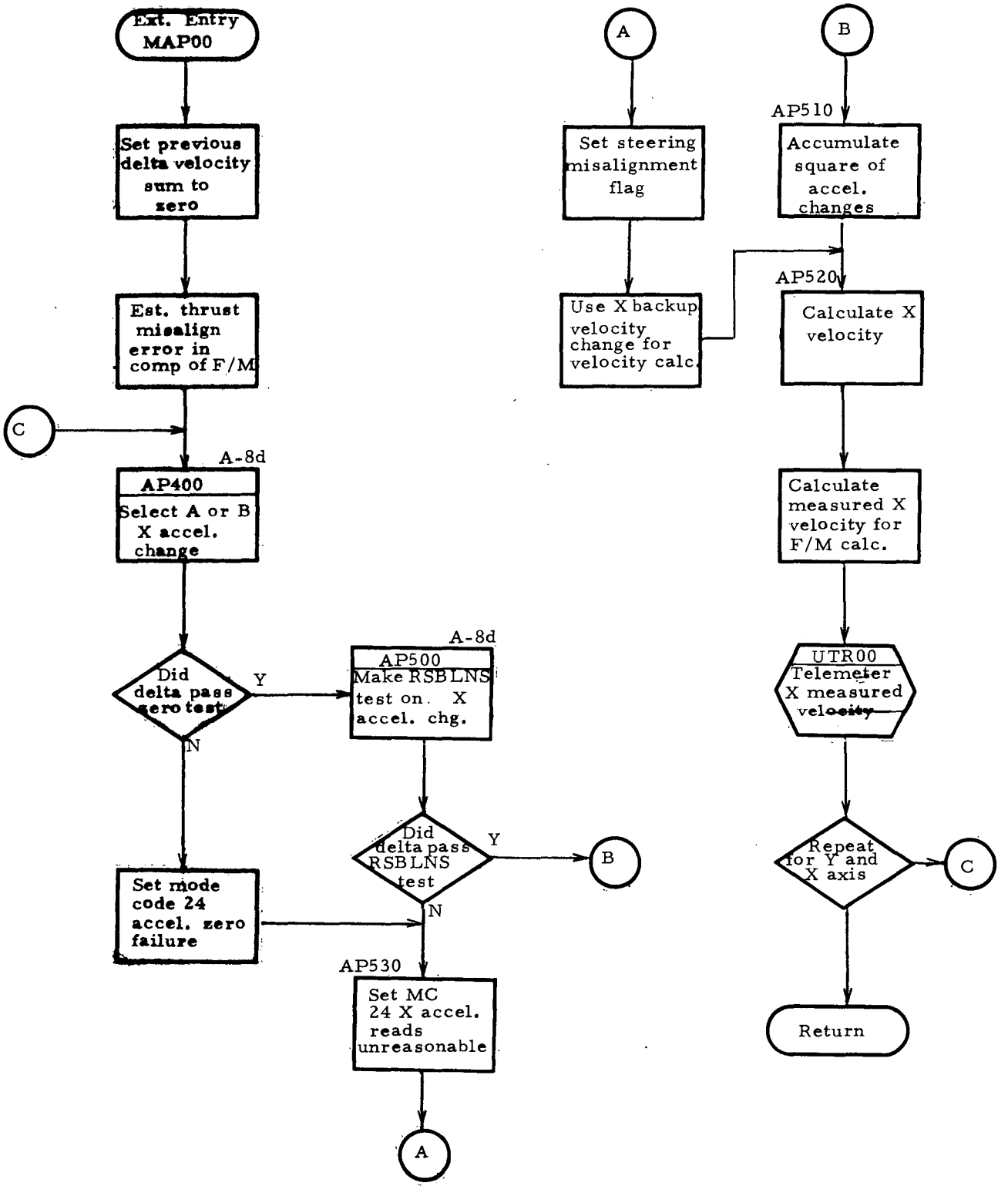


Figure A-8c

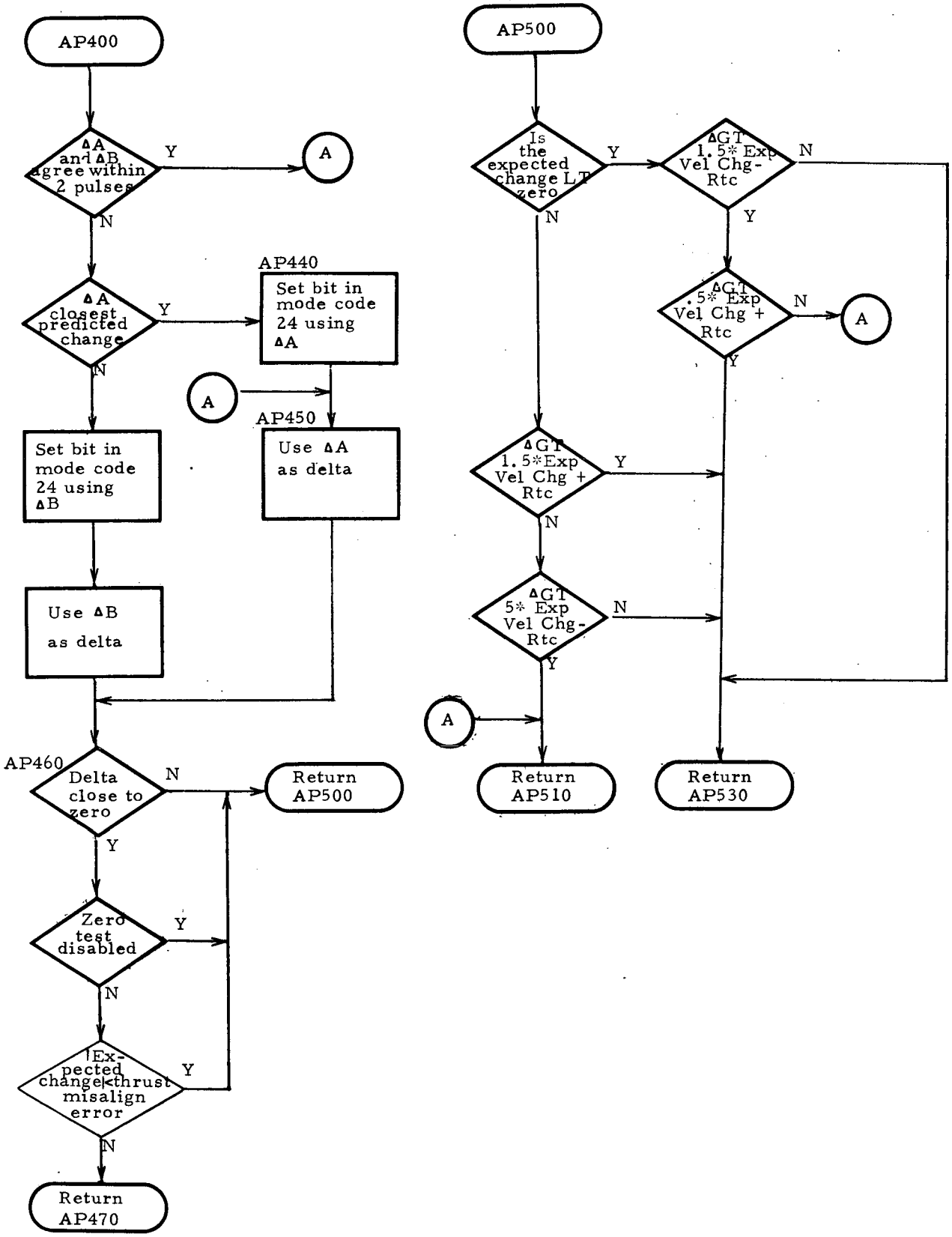

AP400
ΔA and ΔB agree within 2 pulses
Y
A
N
ΔA closest predicted change
Y
AP440
Set bit in mode code 24 using ΔA
N
A
AP450
Use ΔA as delta
Set bit in mode code 24 using ΔB
Use ΔB as delta
AP460
Delta close to zero
N
Return AP500
Y
Zero test disabled
Y
N
Ex-pected change<thrust misalign error
Y
N
Return AP470
AP500
Is the expected change LT zero
Y
ΔGT 1.5* Exp Vel Chg- Rtc
N
N
Y
ΔGT .5* Exp Vel Chg + Rtc
N
A
Y
ΔGT 1.5*Exp Vel Chg + Rtc
Y
N
ΔGT 5* Exp Vel Chg- Rtc
N
Y
A
Return AP510
Return AP530

Figure A-8d

A.9 Minor Loop

A.9.1 Description of Operation

Vehicle attitude control is performed by the Minor Loop. In general terms, attitude control consists of determining actual attitude as indicated by vehicle sensors, calculating the attitude correction required to achieve the desired attitude specified by a guidance task, limiting the correction command, and issuing properly formatted attitude control commands to the vehicle control system.

To maintain vehicle stability, the Minor Loop is executed twenty-five times per second during boost phases and ten times per second in orbit. These high frequencies require the Minor Loop to be scheduled via the high-priority timer of the Interrupt Processor.

Vehicle attitude angles for yaw, pitch, and roll are sensed by inertial platform resolvers which measure the angles between the platform gimbals and the mounting frame. A fine and a coarse (backup) resolver are provided for each gimbal. The fine resolvers are selected until repeated errors cause a switch to be made to the backup resolvers. Each resolver contains redundant counter readings and a disagreement indicator which are used by the Minor Loop for validity checking.

After reading a resolver, the Minor Loop performs disagreement processing to select the proper counter. Reasonableness tests are then performed to detect invalid zero readings or an unreasonably large change from the previous reading. In the event that both counters of a resolver are bad, or if the selected counter fails the reasonableness tests, the corresponding vehicle attitude angle is not updated and the previous attitude control command is reissued. Error indicators are set to identify the type of failure. If the occurrence of resolver failures exceeds predefined frequencies, a switch is made to the corresponding backup resolver. Backup failures result in guidance reference failure indications and the last valid attitude command is issued repeatedly for the remainder of the mission.

Resolver readings which have been determined to be valid are converted to internal units and used to determine actual vehicle attitude. The actual attitude is then compared with the desired attitude and the difference is used to calculate attitude error commands to be issued to the attitude control system. Before the commands

are issued, however, they are limited to not exceed rate and magnitude tolerances.

A special entry point in the Minor Loop is provided for flight simulation tests so that ladder profiles may be generated.

A.9.2 Unique Language Characteristics Required

While not specifically required, an indirect I/O capability would be useful. In the Minor Loop it may be desirable to read either fine or backup gimbals depending upon whether or not previous gimbal failures have occurred, or it may be desirable to not issue a read command at all as in a repeatable flight simulation test run. An indirect I/O capability is not mandatory since tests could be made to determine the type of I/O required. However, in a program such as the Minor Loop where time is of utmost importance, such tests would impose timing penalties.

Techniques are required for insuring that a given amount of time has elapsed between the issuance of gimbal read commands. Since the programmer loses sight of execution time in a high level language, the language should provide a means for determining such delta times and for specifying required time delays.

The relatively high execution frequencies of the Minor Loop (25/second in boost and 10/second in orbit) make minimizing execution time particularly desirable for this kernel. The ability to direct the compiler to minimize execution time, even at some cost in increased memory requirements, would be useful if the flight computer processing time capacity was near saturation.

A.9.3 Flowchart Notes

Note 1

> The Flight Simulation entry to the Minor Loop (MML00) is coded as a separate subroutine in CLASP, CMS-2, and HAL since these languages restrict a program module to a single entry point. It then calls the normal Minor Loop (MML20) rather than transferring control to a point within it as shown in the flowchart.

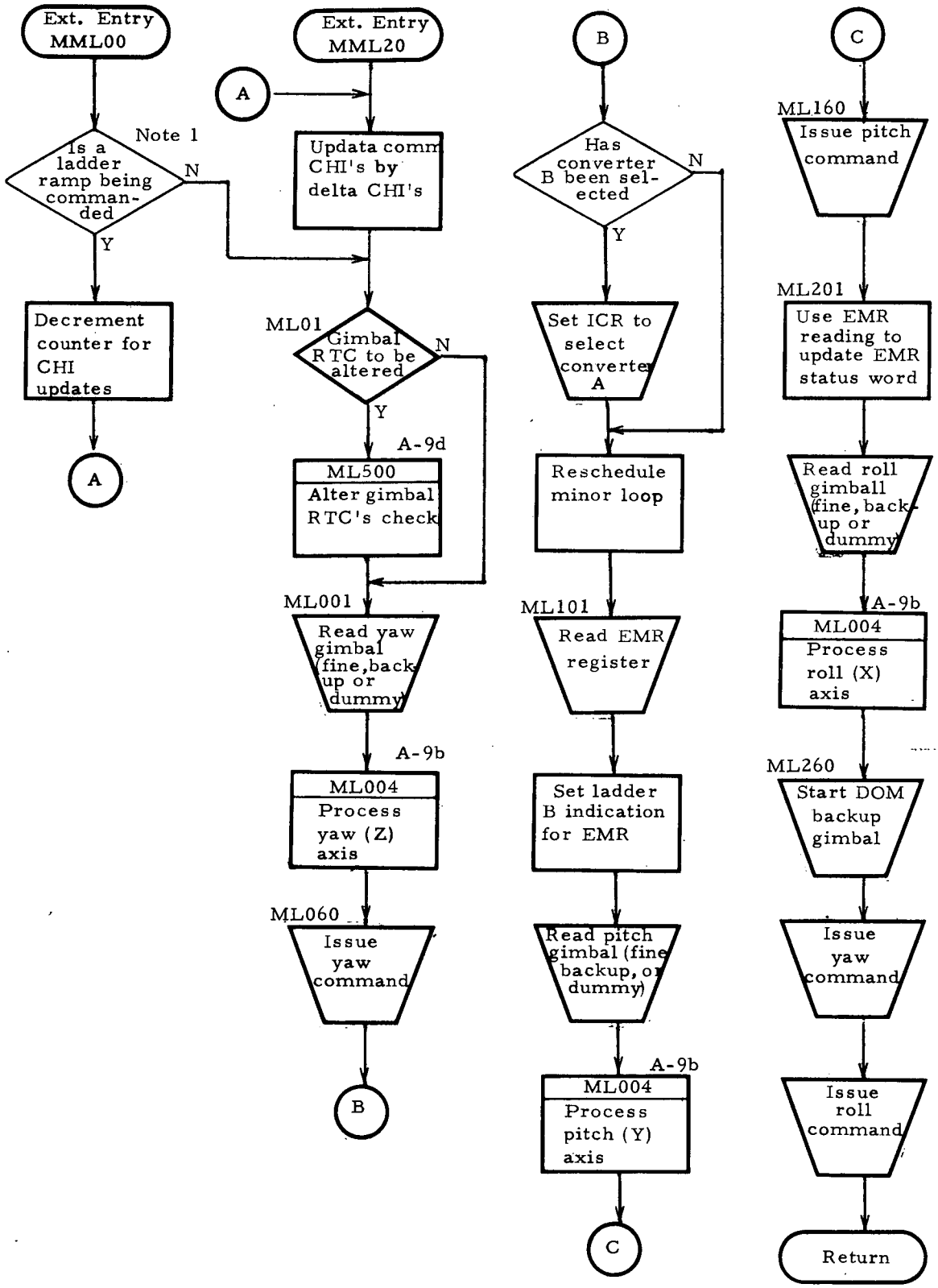

Ext. Entry MML00
Is a ladder ramp being commanded
Note 1
N
Y
Decrement counter for CHI updates
A
Ext. Entry MML20
A
Updata comm CHI's by delta CHI's
ML01
Gimbal RTC to be altered
N
Y
A-9d
ML500
Alter gimbal RTC's check
ML001
Read yaw gimbal (fine, back up or dummy)
A-9b
ML004
Process yaw (Z) axis
ML060
Issue yaw command
B
B
Has converter B been selected
N
Y
Set ICR to select converter A
Reschedule minor loop
ML101
Read EMR register
Set ladder B indication for EMR
Read pitch gimbal (fine backup, or dummy)
A-9b
ML004
Process pitch (Y) axis
C
C
ML160
Issue pitch command
ML201
Use EMR reading to update EMR status word
Read roll gimball (fine, back up or dummy)
A-9b
ML004
Process roll (X) axis
ML260
Start DOM backup gimbal
Issue yaw command
Issue roll command
Return

Figure A-9a

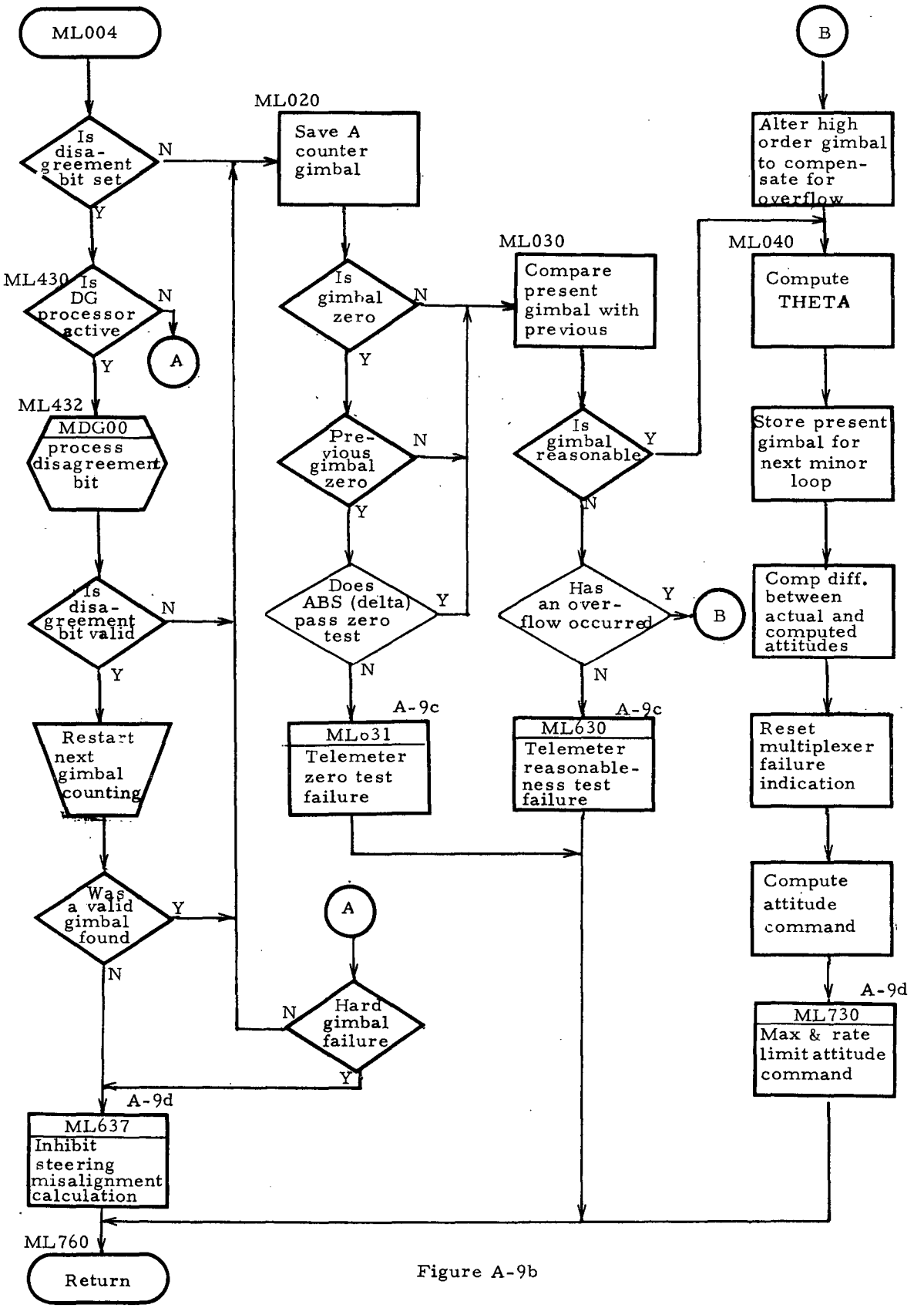

ML004
Is disa-greement bit set
N
Y
ML020
Save A counter gimbal
ML430
Is DG processor active
N
Y
A
ML432
MDG00
process disagreement bit
Is disa-greement bit valid
N
Y
Restart next gimbal counting
Was a valid gimbal found
Y
N
A
N
Hard gimbal failure
Y
A-9d
ML637
Inhibit steering misalignment calculation
ML760
Return
Is gimbal zero
N
Y
Pre-vious gimbal zero
N
Y
Does ABS (delta) pass zero test
Y
N
A-9c
ML031
Telemeter zero test failure
ML030
Compare present gimbal with previous
Is gimbal reasonable
Y
N
Has an over-flow occurred
Y
B
N
A-9c
ML630
Telemeter reasonable-ness test failure
B
Alter high order gimbal to compen-sate for overflow
ML040
Compute THETA
Store present gimbal for next minor loop
Comp diff. between actual and computed attitudes
Reset multiplexer failure indication
Compute attitude command
A-9d
ML730
Max & rate limit attitude command

Figure A-9b

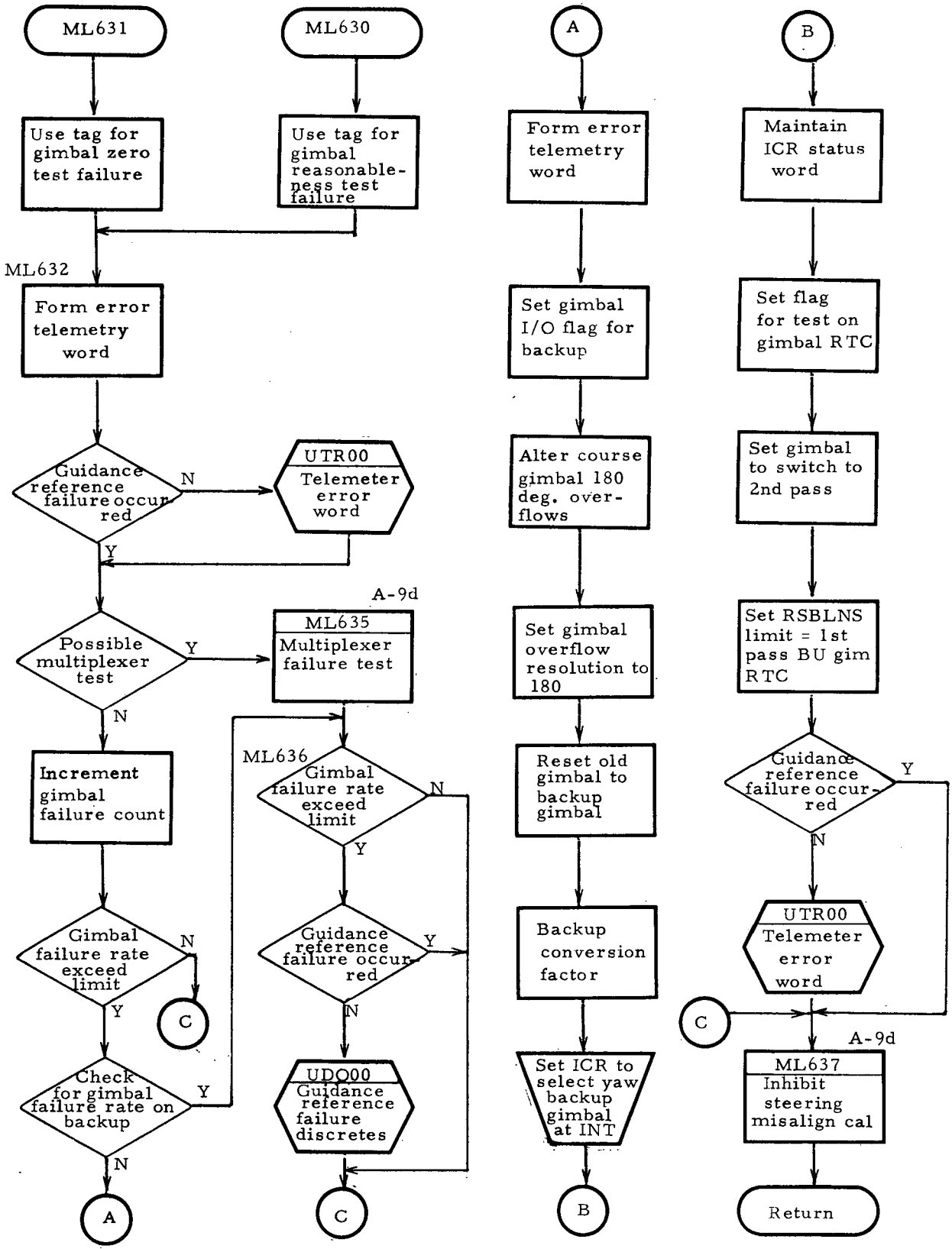

ML631
ML630
A
B
Use tag for gimbal zero test failure
Use tag for gimbal reasonable-ness test failure
Form error telemetry word
Maintain ICR status word
ML632
Form error telemetry word
Set gimbal I/O flag for backup
Set flag for test on gimbal RTC
Guidance reference failure occurred
N
UTR00
Telemeter error word
Y
Alter course gimbal 180 deg. over-flows
Set gimbal to switch to 2nd pass
A-9d
Possible multiplexer test
Y
ML635
Multiplexer failure test
Set gimbal overflow resolution to 180
Set RSBLNS limit = 1st pass BU gim RTC
N
Increment gimbal failure count
ML636
Gimbal failure rate exceed limit
N
Y
Reset old gimbal to backup gimbal
Guidance reference failure occurred
Y
N
Gimbal failure rate exceed limit
N
Y
C
Guidance reference failure occurred
Y
N
Backup conversion factor
UTR00
Telemeter error word
C
Check for gimbal failure rate on backup
Y
N
UDQ00
Guidance reference failure discretes
Set ICR to select yaw backup gimbal at INT
A-9d
ML637
Inhibit steering misalign cal
A
C
B
Return

Figure A-9c

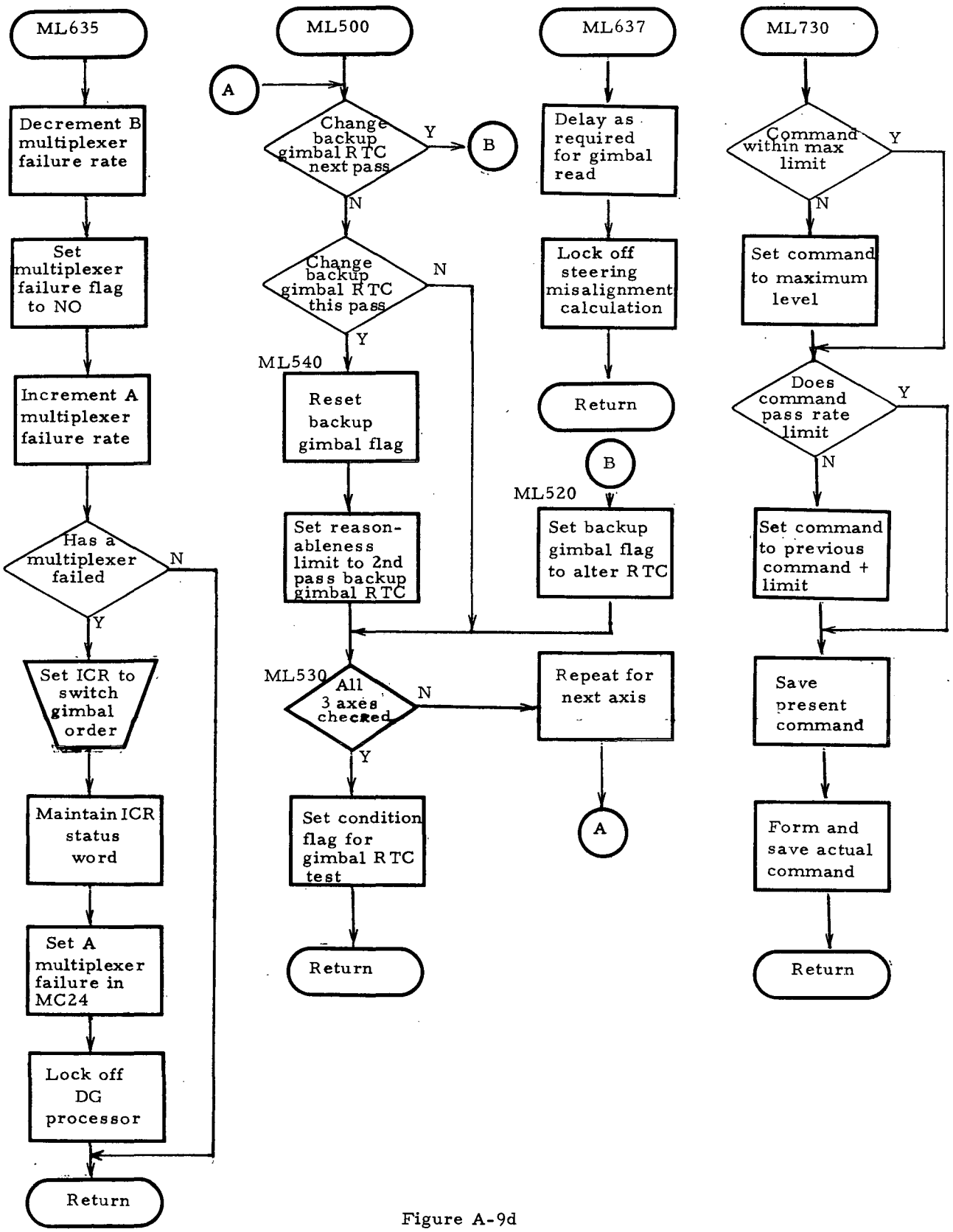

ML635
Decrement B multiplexer failure rate
Set multiplexer failure flag to NO
Increment A multiplexer failure rate
Has a multiplexer failed
N
Y
Set ICR to switch gimbal order
Maintain ICR status word
Set A multiplexer failure in MC24
Lock off DG processor
Return
ML500
A
Change backup gimbal RTC next pass
Y
B
N
Change backup gimbal RTC this pass
N
Y
ML540
Reset backup gimbal flag
Set reasonableness limit to 2nd pass backup gimbal RTC
ML530
All 3 axes checked
N
Y
Set condition flag for gimbal RTC test
Return
ML637
Delay as required for gimbal read
Lock off steering misalignment calculation
Return
B
ML520
Set backup gimbal flag to alter RTC
Repeat for next axis
A
ML730
Command within max limit
Y
N
Set command to maximum level
Does command pass rate limit
Y
N
Set command to previous command + limit
Save present command
Form and save actual command
Return

Figure A-9d

A.10 Switch Selector Processor

A.10.1 Description of Operation

Certain hardware functions of the Saturn vehicle are activated by the flight program via the issuance of switch selector output commands. The Switch Selector Processing task functions in much the same way as the Events Processor, in that it utilizes a predefined table containing the switch selector commands and their associated times for issuance. The time of activation for a given entry is used to schedule the Switch Selector Processor via the high-priority timer of the Interrupt Processor.

However, the process of issuing a switch selector is more involved than the function of initiating tasks performed by the Events Processor. The issuance of a single switch selector function requires at least five I/O operations to be performed:

- o Hung stage test
- o Issue stage and address
- o Verify address
- o Issue read command
- o Reset read command

In addition, if the hung stage test fails, a forced reset must be issued before the stage and address is issued. Also, if an address verification fails, a forced reset must be issued followed by the issuance of the stage and complemented address. Depending on the type of verification error, the system may be reconfigured to issue future switch selectors via different circuitry.

Hardware restrictions require timing delays between command issuance. Since the switch selector delays are on the order of ten to twenty-five milliseconds, the Switch Selector Processor reschedules itself for execution at the proper time and returns control to the operating system. The interval is too long to be accomplished through an in-line delay.

In addition to the nominal sequence of switch selector functions,

provision is made for alternate sequences which can be activated as specified by other application tasks. Depending on the type of alternate sequence, the alternate switch selector functions will be issued instead of, or intermixed with, those of the nominal sequence.

Numerous entry points exist for the Switch Selector Processing kernel. Most of the entires are used for scheduling its various functions via the Timer 1 Scheduler as discussed above. Three additional entries are used to request an alternate sequence, to issue a forced reset, or to initialize Switch Selector Table pointers for a new time base.

A.10.2 Unique Language Characteristics Required

Requirements for an indirect I/O capability and for measuring short time periods are similar to those discussed for the Minor Loop (see paragraph A.9.3).

Although the decision-making statements are a common feature of nearly all programming languages, special emphasis on them here is warranted due to the unusually large number of decisions made in the Switch Selector Processor. This kernel places a premium on language capabilities which enable the programmer to express complex decision sequences in a logical and concise manner. The extent to which a language provides such capabilities contributes directly to the elimination of program logic errors and to an improvement in readability. Decision tables are particularly useful in this environment.

Another relatively common characteristic of the Switch Selector Processor is the manipulation of data at the bit level. It utilizes features for setting, resetting, and testing bits in status/control words and also for formatting and analyzing I/O data words. These functions require a language to provide bit-string handling facilities.

Also required is the ability to access data from tables. A subroutine is utilized to select the next switch selector command to be issued from one of a number of tables. Since alternate sequences can be interspersed and/or interleaved with switch selectors from the nominal sequence, the subroutine must be able to jump from table to table based on sequence decisions made by other programs.

A.10.3 Flowchart Notes

Note 1

Switch Selector Processing consists of a number of interrelated functions, some of which use common program logic. In order to minimize program duplication, the functions were all combined into a single program module and invoked via multiple entry points as shown in the flowcharts. The kernel was actually coded that way in SPL. However, for the other three languages, where multiple entry points are not allowed, a common entry point (MSS00) was utilized wherein control was transferred to the appropriate function. The decision logic for this transfer of control is not shown on the flowcharts but in each of the three languages (CLASP, CMS-2, and HAL) it consisted of a computed GOTO.

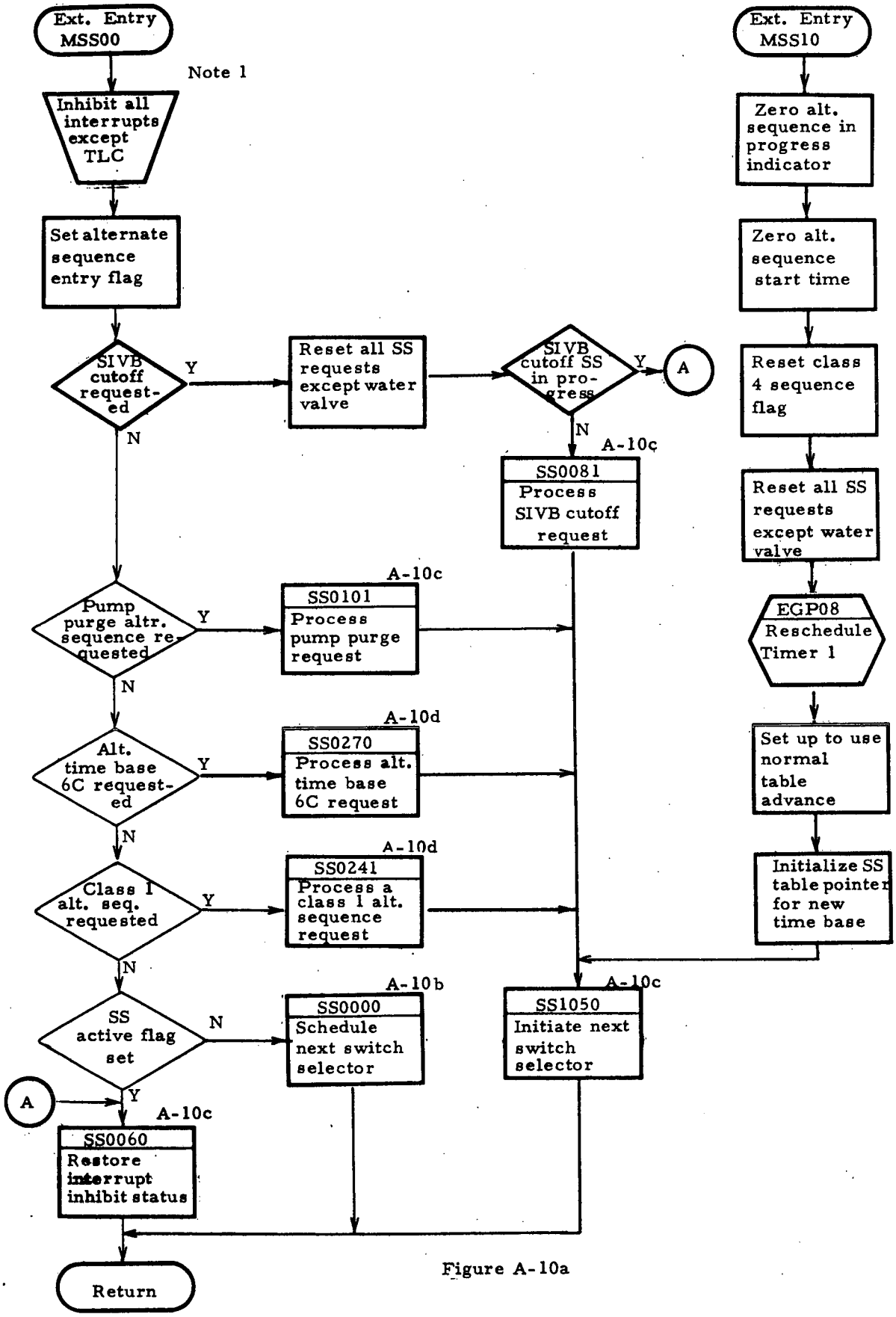

Ext. Entry MSS00
Note 1
Inhibit all interrupts except TLC
Set alternate sequence entry flag
SIVB cutoff requested
Y
N
Reset all SS requests except water valve
SIVB cutoff SS in progress
Y
A
N
A-10c
SS0081
Process SIVB cutoff request
Pump purge altr. sequence requested
Y
N
A-10c
SS0101
Process pump purge request
Alt. time base 6C requested
Y
N
A-10d
SS0270
Process alt. time base 6C request
Class 1 alt. seq. requested
Y
N
A-10d
SS0241
Process a class 1 alt. sequence request
SS active flag set
N
Y
A-10b
SS0000
Schedule next switch selector
A
A-10c
SS0060
Restore interrupt inhibit status
Return
A-10c
SS1050
Initiate next switch selector
Ext. Entry MSS10
Zero alt. sequence in progress indicator
Zero alt. sequence start time
Reset class 4 sequence flag
Reset all SS requests except water valve
EGP08
Reschedule Timer 1
Set up to use normal table advance
Initialize SS table pointer for new time base

Figure A-10a

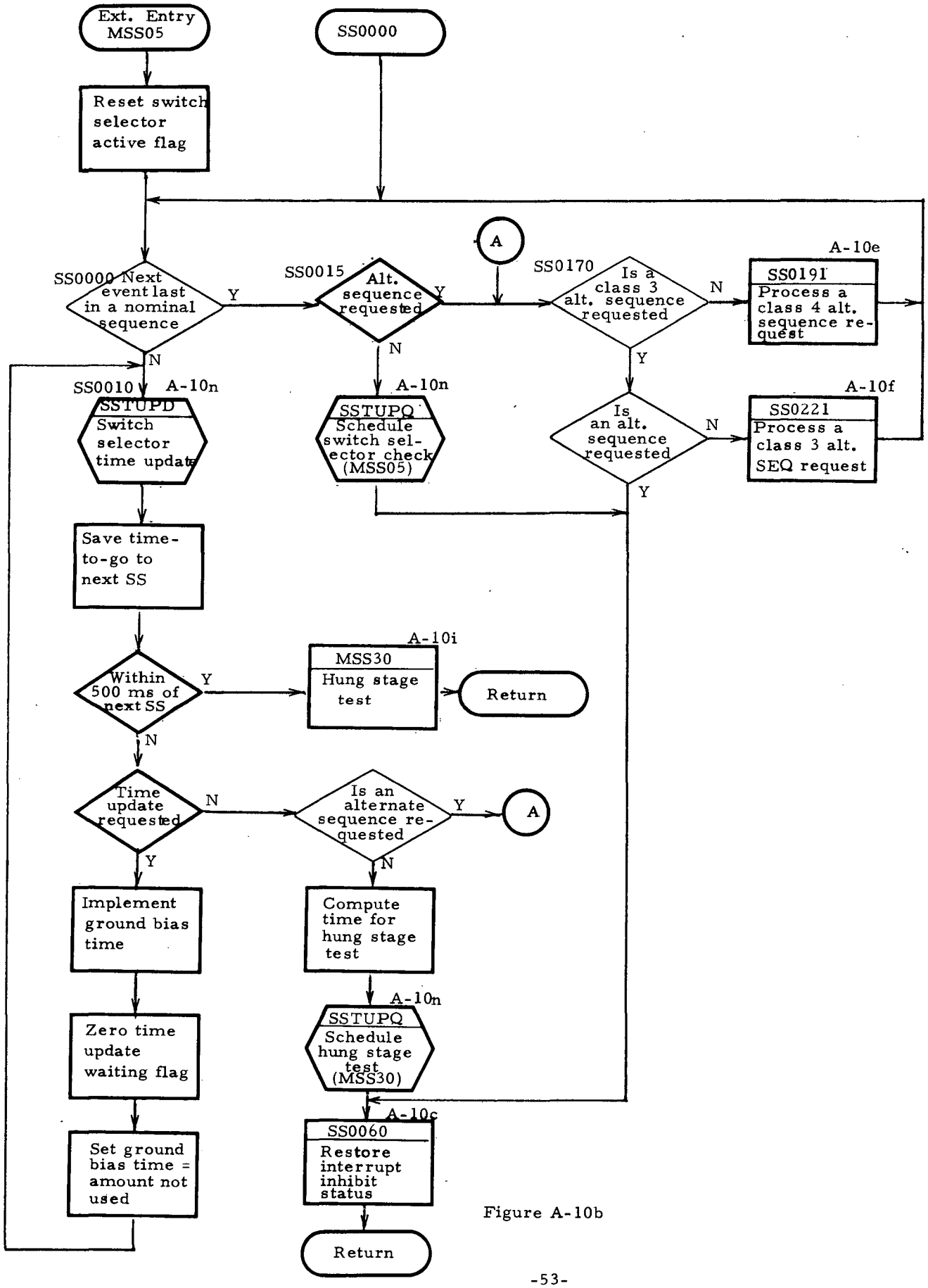

Ext. Entry MSS05
SS0000
Reset switch selector active flag
A
SS0000 Next event last in a nominal sequence
Y
N
SS0015 Alt. sequence requested
Y
N
SS0170 Is a class 3 alt. sequence requested
N
Y
A-10e
SS0191
Process a class 4 alt. sequence request
SS0010
A-10n
SSTUPD
Switch selector time update
A-10n
SSTUPQ
Schedule switch selector check (MSS05)
Is an alt. sequence requested
N
Y
A-10f
SS0221
Process a class 3 alt. SEQ request
Save time-to-go to next SS
A-10i
Within 500 ms of next SS
Y
N
MSS30
Hung stage test
Return
Time update requested
N
Y
Is an alternate sequence requested
Y
N
A
Implement ground bias time
Compute time for hung stage test
A-10n
SSTUPQ
Schedule hung stage test (MSS30)
Zero time update waiting flag
A-10c
SS0060
Restore interrupt inhibit status
Set ground bias time = amount not used
Return

Figure A-10b

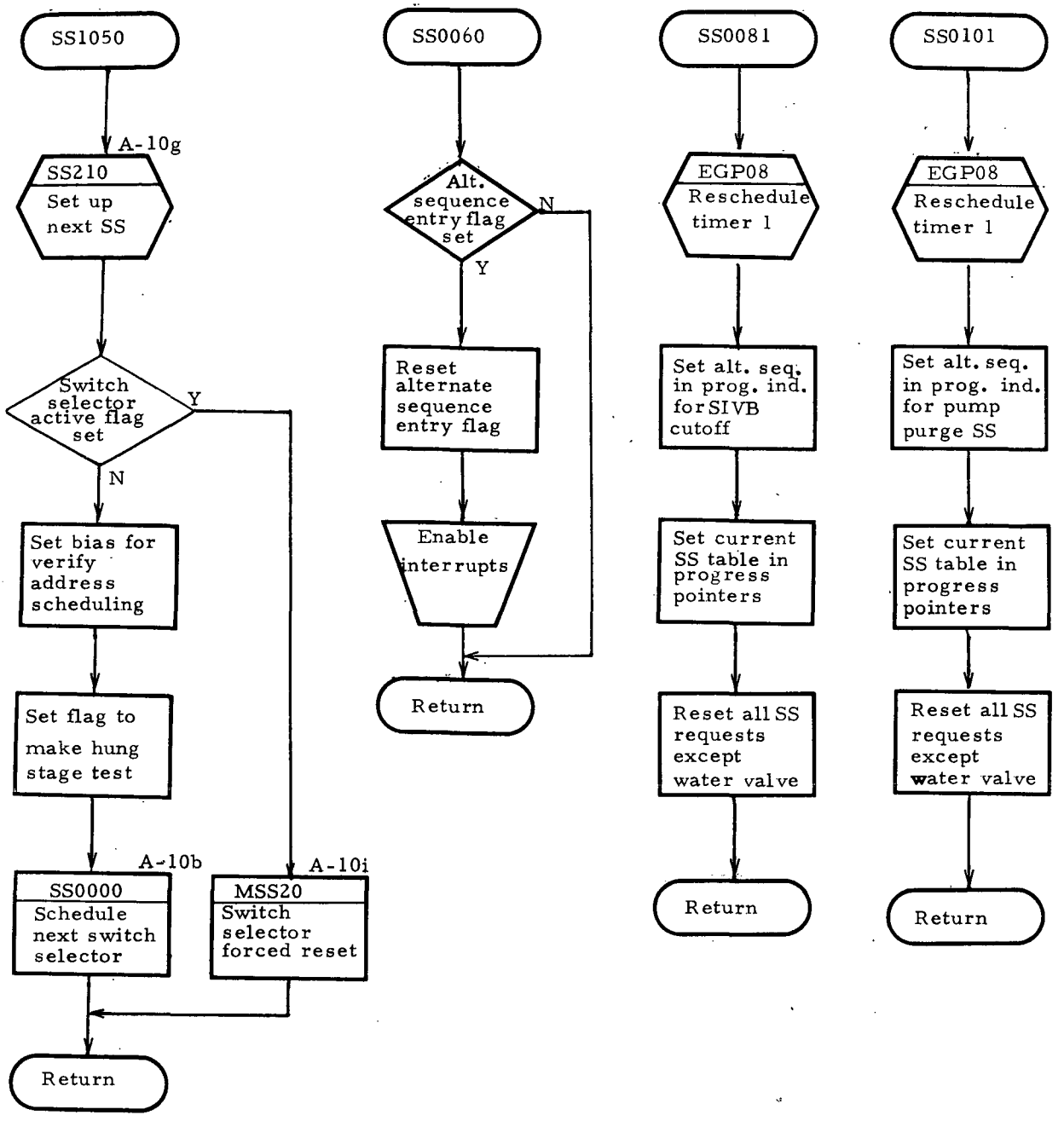

SS1050
A-10g
SS210
Set up next SS
Switch selector active flag set
Y
N
Set bias for verify address scheduling
Set flag to make hung stage test
A-10b
SS0000
Schedule next switch selector
A-10i
MSS20
Switch selector forced reset
Return
SS0060
Alt. sequence entry flag set
N
Y
Reset alternate sequence entry flag
Enable interrupts
Return
SS0081
EGP08
Reschedule timer 1
Set alt. seq. in prog. ind. for SIVB cutoff
Set current SS table in progress pointers
Reset all SS requests except water valve
Return
SS0101
EGP08
Reschedule timer 1
Set alt. seq. in prog. ind. for pump purge SS
Set current SS table in progress pointers
Reset all SS requests except water valve
Return

Figure A-10c

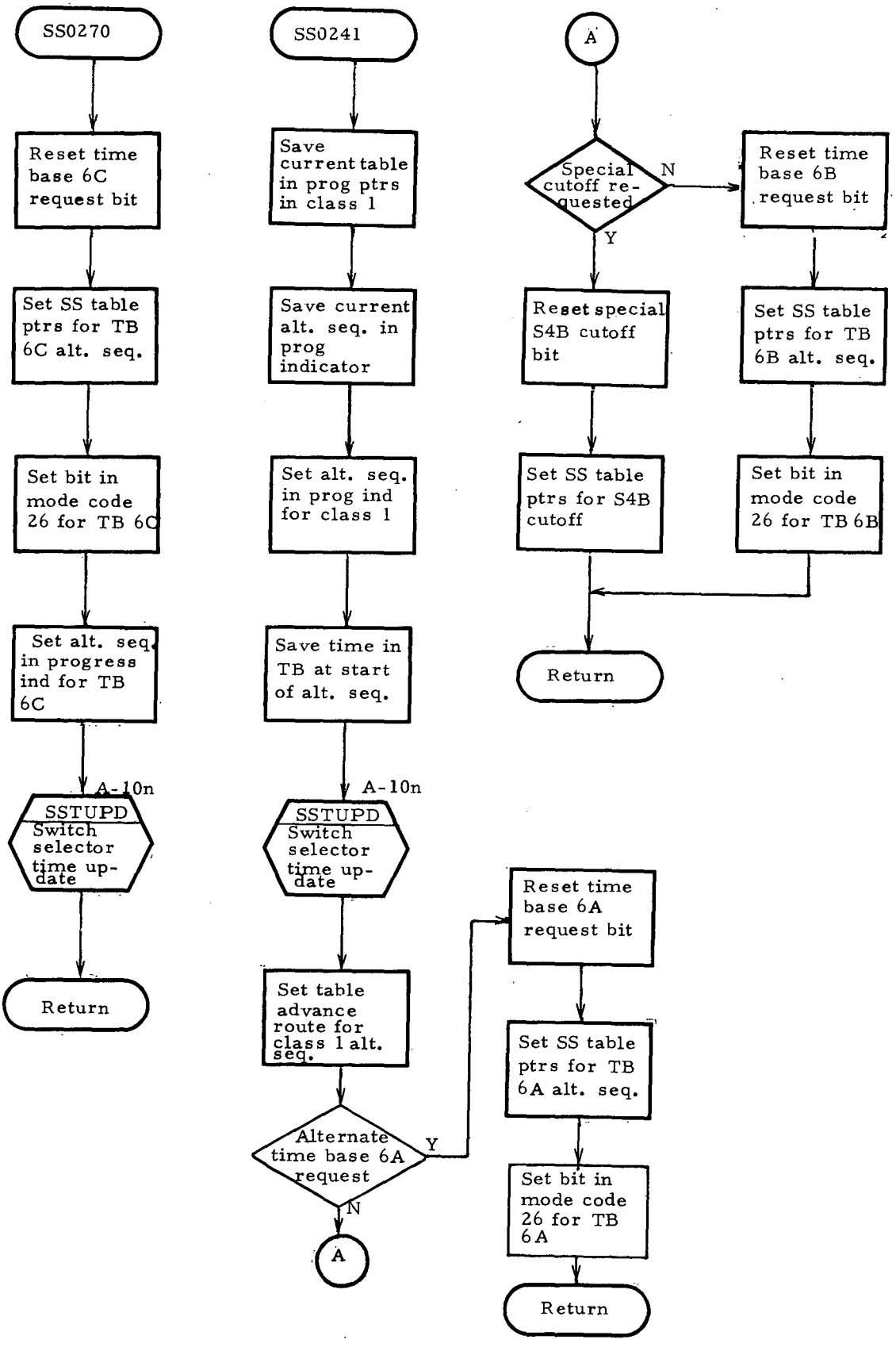

SS0270
Reset time base 6C request bit
Set SS table ptrs for TB 6C alt. seq.
Set bit in mode code 26 for TB 6C
Set alt. seq. in progress ind for TB 6C
A-10n
SSTUPD
Switch selector time update
Return
SS0241
Save current table in prog ptrs in class 1
Save current alt. seq. in prog indicator
Set alt. seq. in prog ind for class 1
Save time in TB at start of alt. seq.
A-10n
SSTUPD
Switch selector time update
Set table advance route for class 1 alt. seq.
Alternate time base 6A request
Y
N
A
A
Special cutoff requested
N
Y
Reset special S4B cutoff bit
Set SS table ptrs for S4B cutoff
Return
Reset time base 6B request bit
Set SS table ptrs for TB 6B alt. seq.
Set bit in mode code 26 for TB 6B
Reset time base 6A request bit
Set SS table ptrs for TB 6A alt. seq.
Set bit in mode code 26 for TB 6A
Return

Figure A-10d

SWITCH SELECTOR PROCESSOR
(continued)

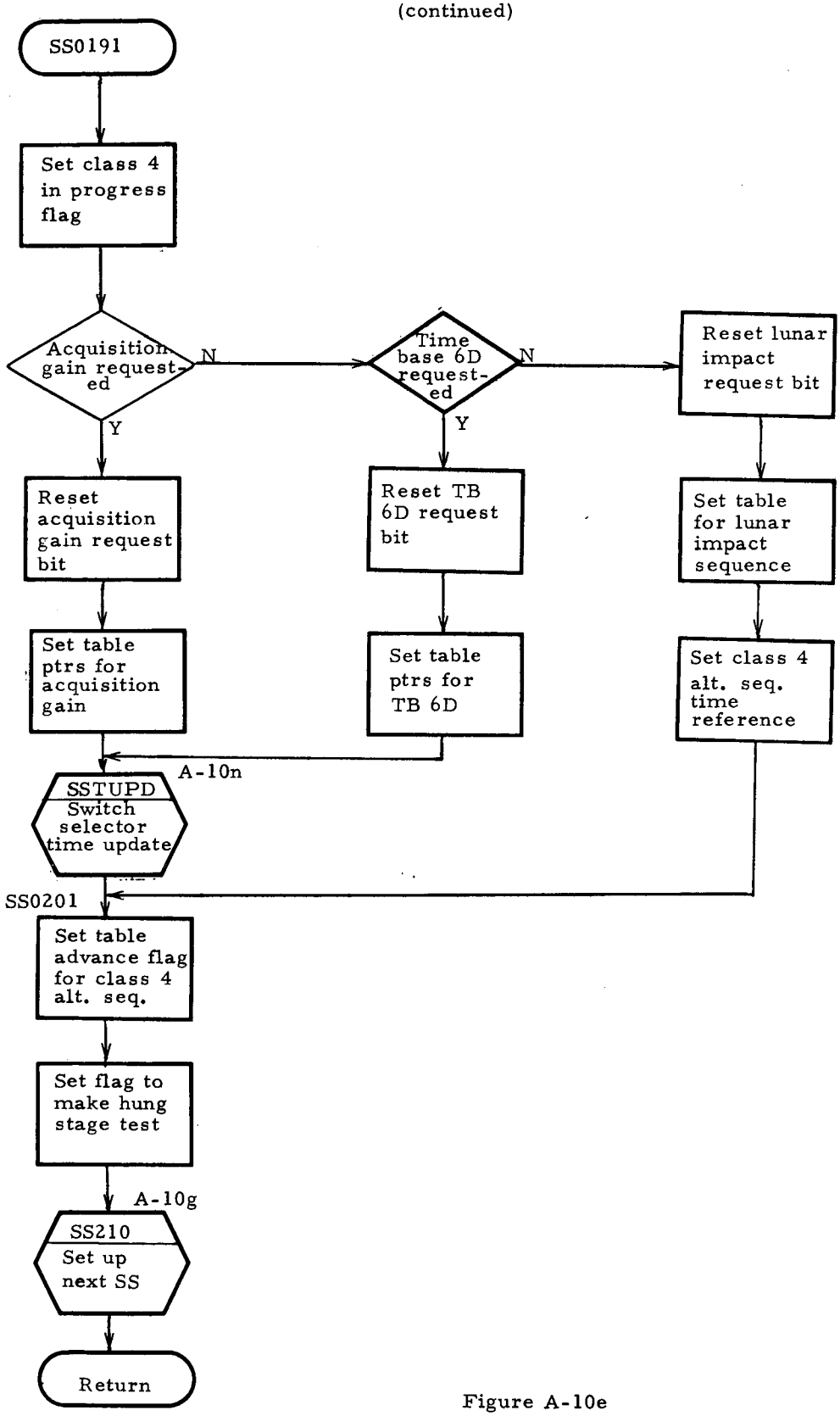


Figure A-10e

SWITCH SELECTOR PROCFSSOR
(continued)

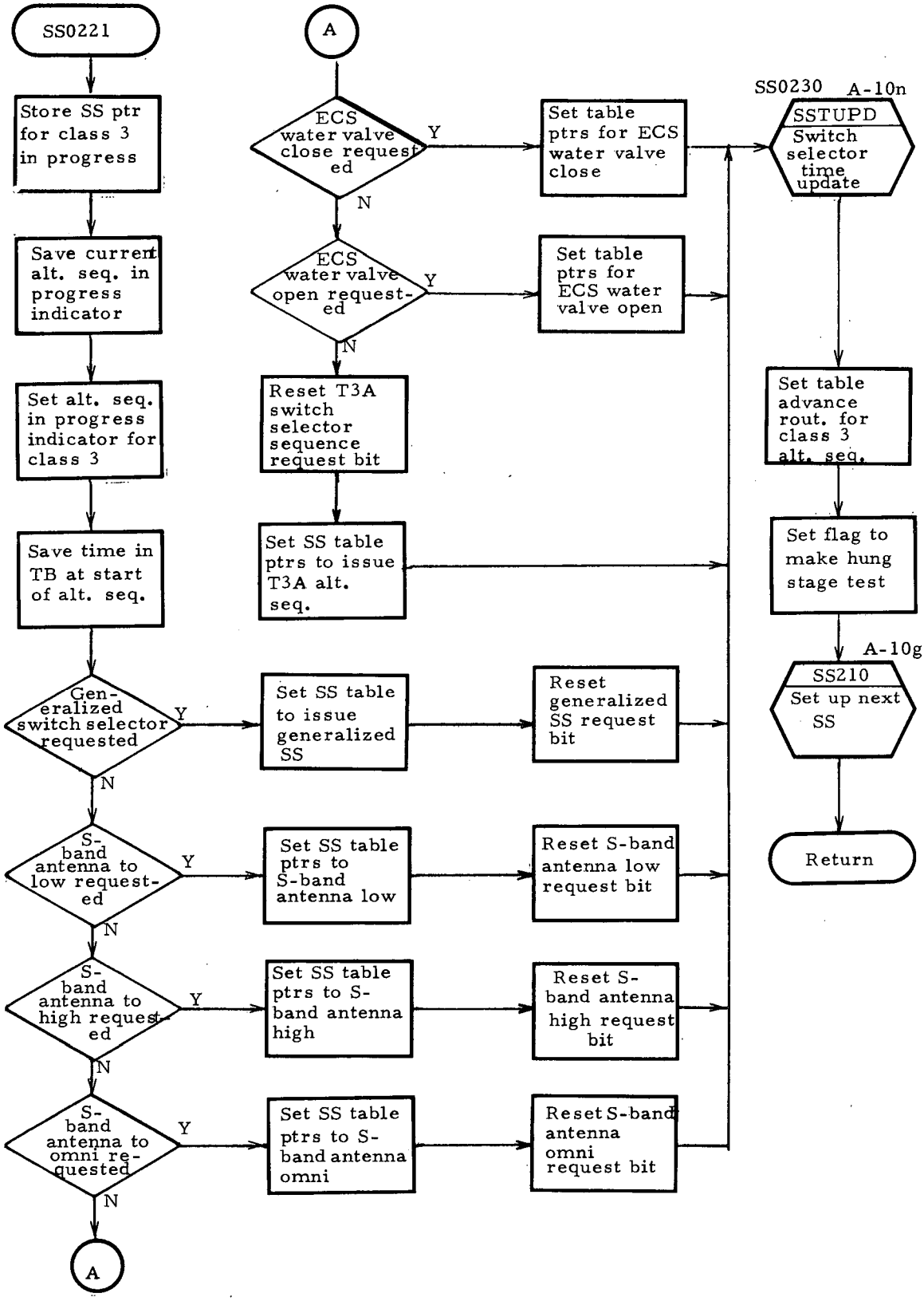


Figure A-10f

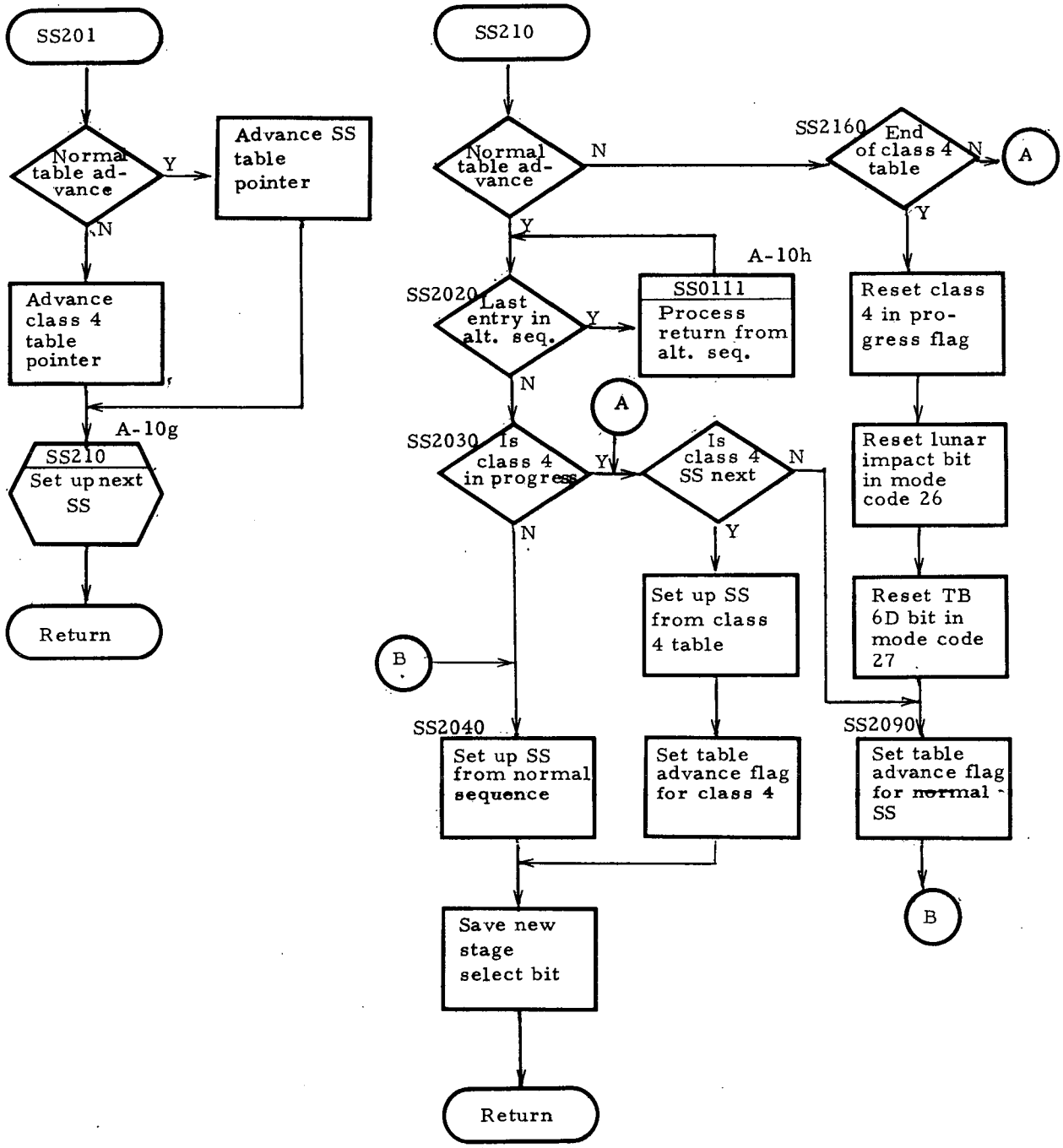

SS201
Normal table advance
Y
N
Advance SS table pointer
Advance class 4 table pointer
A-10g
SS210
Set up next SS
Return
SS210
Normal table advance
N
Y
SS2160
End of class 4 table
N
A
Y
A-10h
SS2020
Last entry in alt. seq.
Y
SS0111
Process return from alt. seq.
N
Reset class 4 in progress flag
A
SS2030
Is class 4 in progress
Y
Is class 4 SS next
N
Y
N
Reset lunar impact bit in mode code 26
Set up SS from class 4 table
Reset TB 6D bit in mode code 27
B
SS2040
SS2090
Set up SS from normal sequence
Set table advance flag for class 4
Set table advance flag for normal SS
B
Save new stage select bit
Return

Figure A-10g

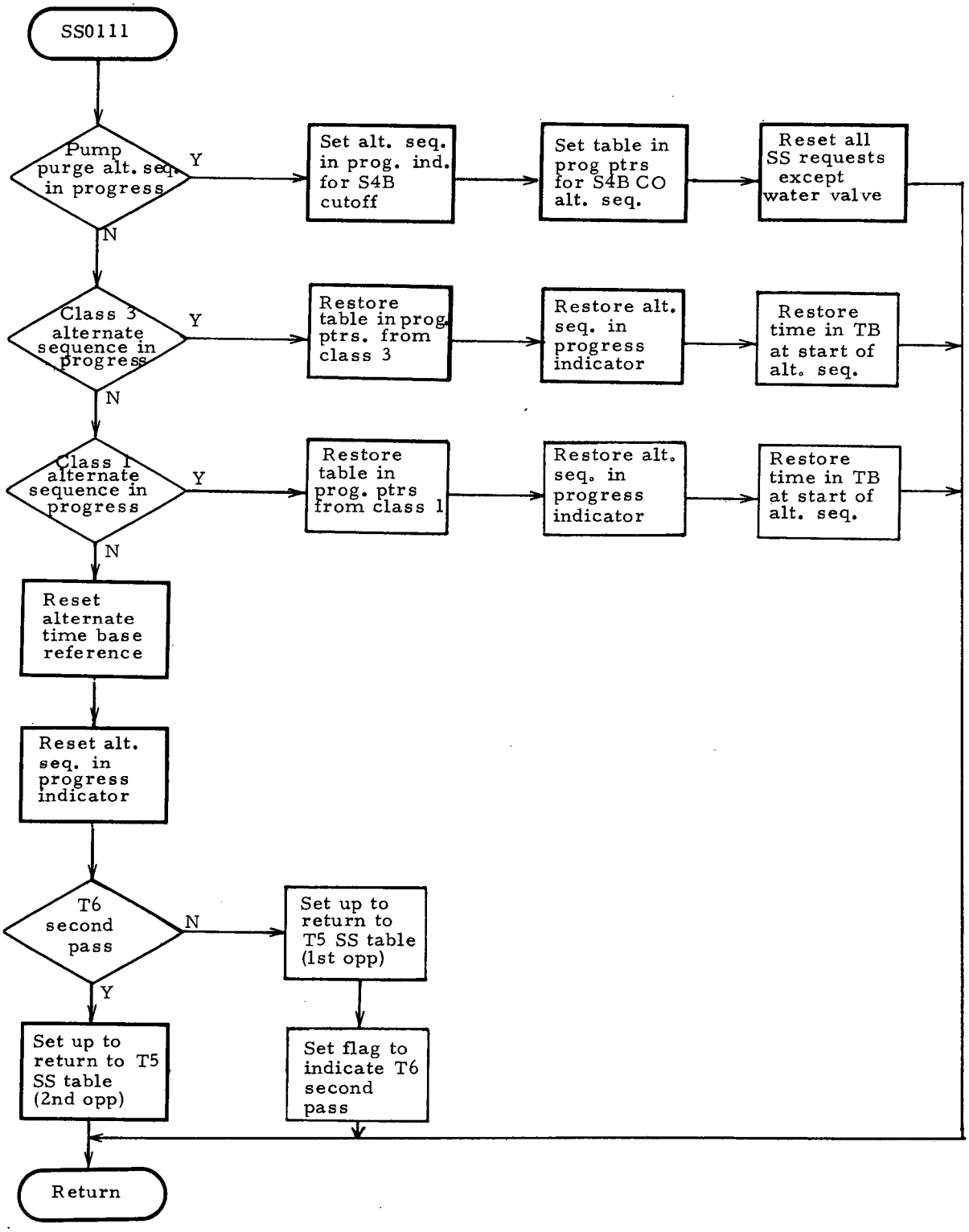

SS0111
Pump purge alt. seq. in progress
Y
N
Set alt. seq. in prog. ind. for S4B cutoff
Set table in prog ptrs for S4B CO alt. seq.
Reset all SS requests except water valve
Class 3 alternate sequence in progress
Y
N
Restore table in prog. ptrs. from class 3
Restore alt. seq. in progress indicator
Restore time in TB at start of alt. seq.
Class 1 alternate sequence in progress
Y
N
Restore table in prog. ptrs from class 1
Restore alt. seq. in progress indicator
Restore time in TB at start of alt. seq.
Reset alternate time base reference
Reset alt. seq. in progress indicator
T6 second pass
N
Y
Set up to return to T5 SS table (1st opp)
Set up to return to T5 SS table (2nd opp)
Set flag to indicate T6 second pass
Return

Figure A-10h

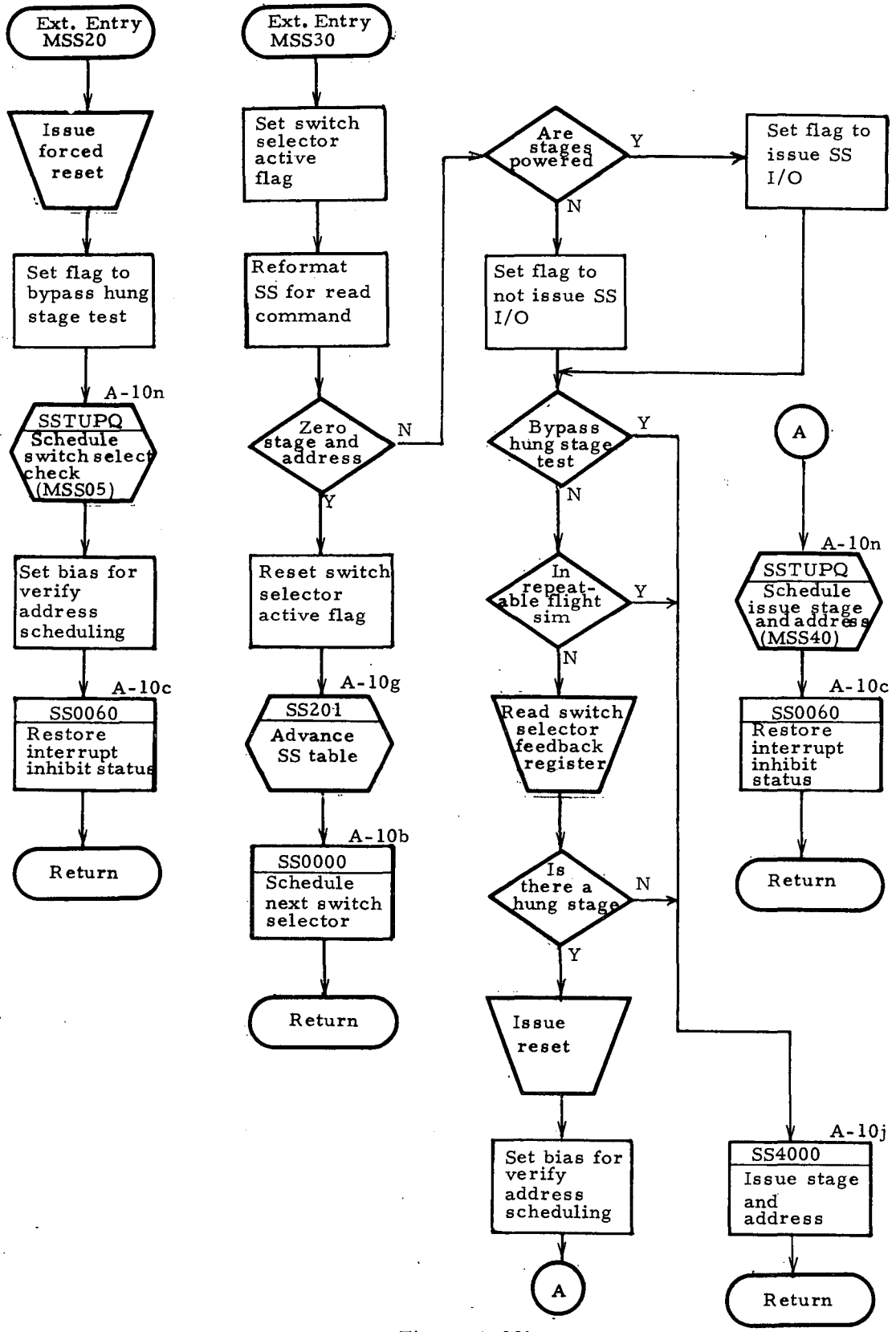

Ext. Entry MSS20
Issue forced reset
Set flag to bypass hung stage test
A-10n
SSTUPQ
Schedule switch select check (MSS05)
Set bias for verify address scheduling
A-10c
SS0060
Restore interrupt inhibit status
Return
Ext. Entry MSS30
Set switch selector active flag
Reformat SS for read command
Zero stage and address
N
Y
Reset switch selector active flag
A-10g
SS201
Advance SS table
A-10b
SS0000
Schedule next switch selector
Return
Are stages powered
Y
N
Set flag to issue SS I/O
Set flag to not issue SS I/O
Bypass hung stage test
Y
N
In repeat-able flight sim
Y
N
Read switch selector feedback register
Is there a hung stage
N
Y
Issue reset
Set bias for verify address scheduling
A
A
A-10n
SSTUPQ
Schedule issue stage and address (MSS40)
A-10c
SS0060
Restore interrupt inhibit status
Return
A-10j
SS4000
Issue stage and address
Return

Figure A-10i

SWITCH SELECTOR PROCESSOR
(continued)

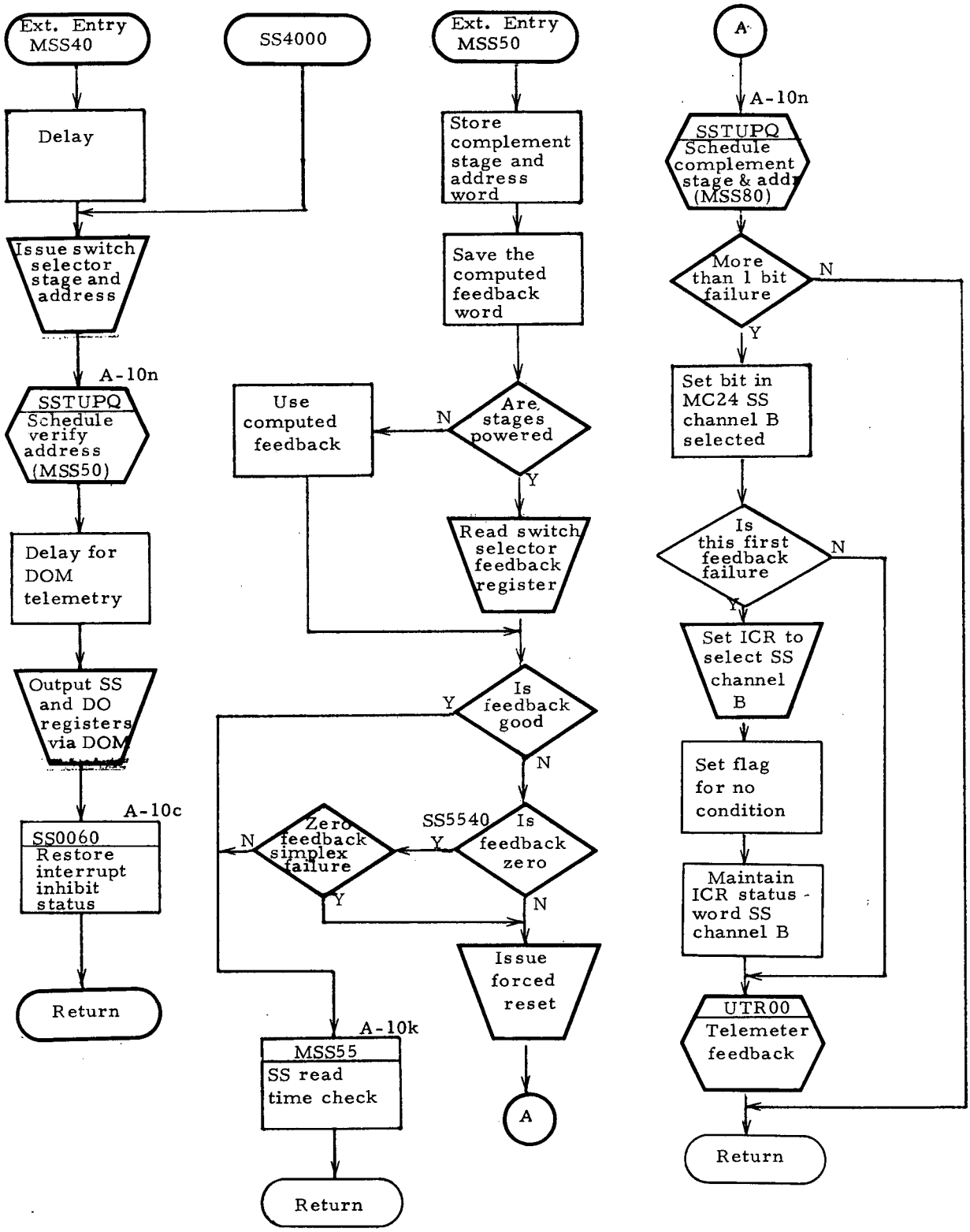


Figure A-10j

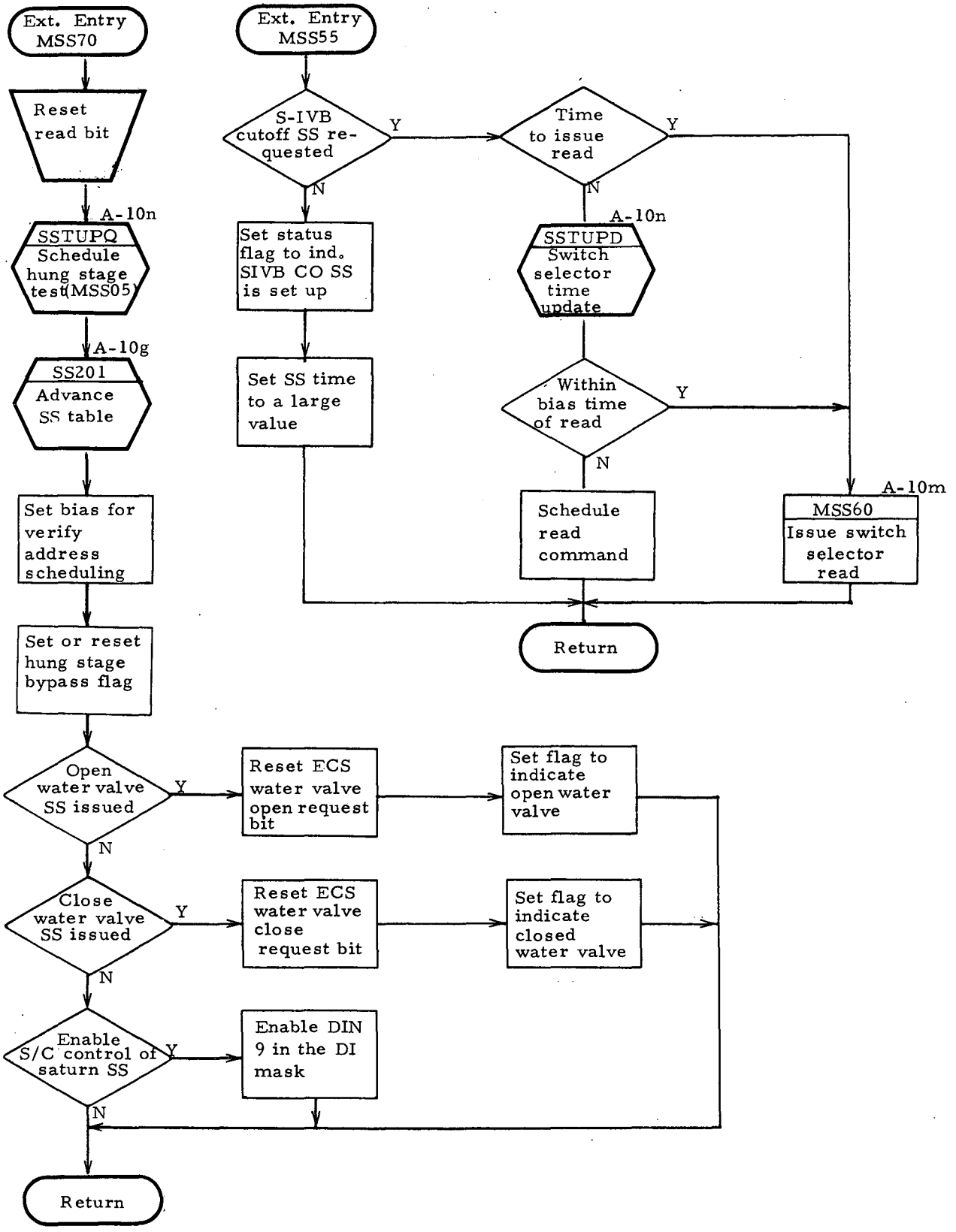

Ext. Entry MSS70
Reset read bit
A-10n
SSTUPQ
Schedule hung stage test(MSS05)
A-10g
SS201
Advance SS table
Set bias for verify address scheduling
Set or reset hung stage bypass flag
Open water valve SS issued
Y
N
Reset ECS water valve open request bit
Set flag to indicate open water valve
Close water valve SS issued
Y
N
Reset ECS water valve close request bit
Set flag to indicate closed water valve
Enable S/C control of saturn SS
Y
N
Enable DIN 9 in the DI mask
Return
Ext. Entry MSS55
S-IVB cutoff SS requested
Y
N
Set status flag to ind. SIVB CO SS is set up
Set SS time to a large value
Time to issue read
Y
N
A-10n
SSTUPD
Switch selector time update
Within bias time of read
Y
N
Schedule read command
A-10m
MSS60
Issue switch selector read
Return

Figure A-10k

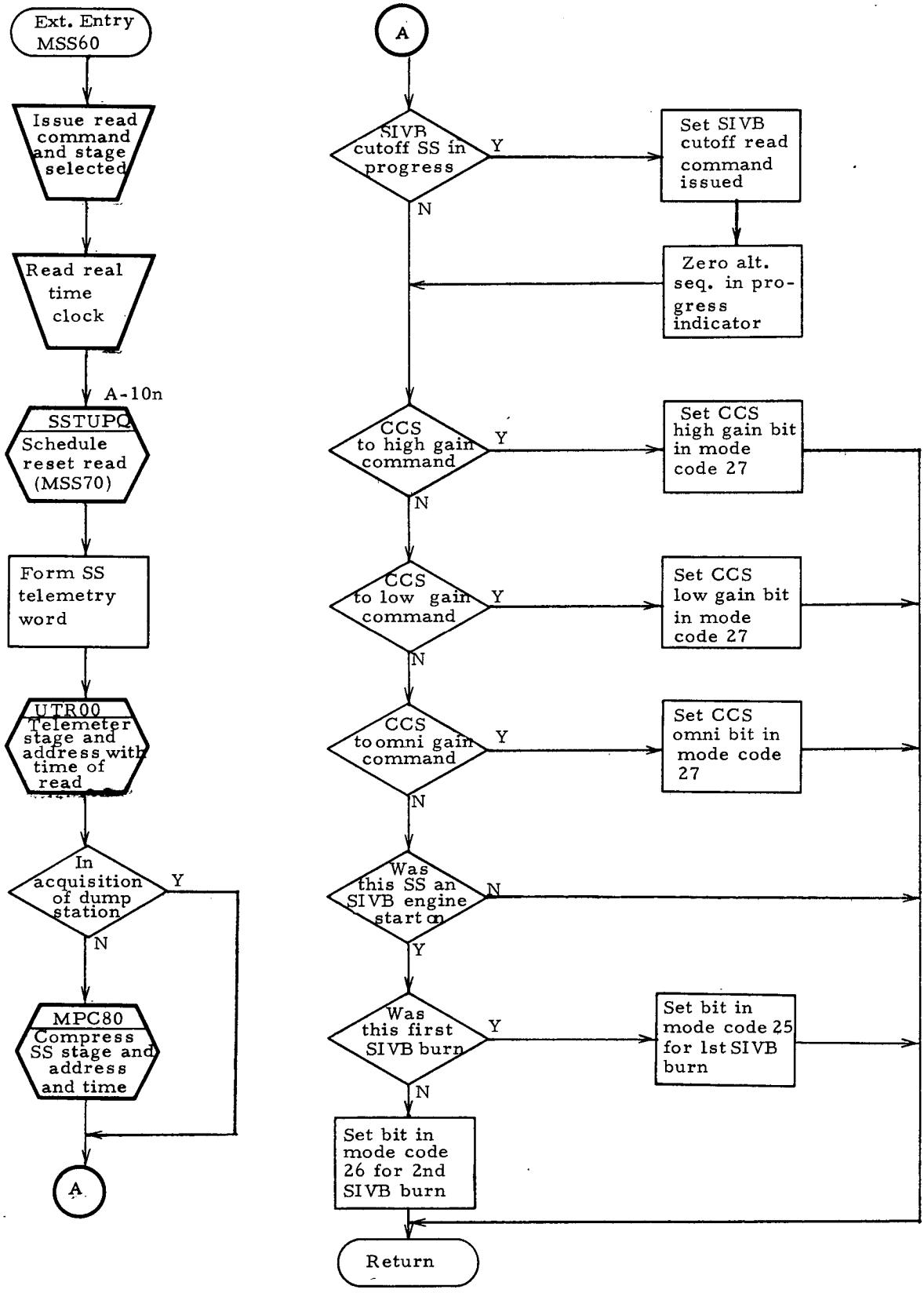

Ext. Entry MSS60
Issue read command and stage selected
Read real time clock
A-10n
SSTUPQ
Schedule reset read (MSS70)
Form SS telemetry word
UTR00
Telemeter stage and address with time of read
In acquisition of dump station
Y
N
MPC80
Compress SS stage and address and time
A
A
SIVB cutoff SS in progress
Y
N
Set SIVB cutoff read command issued
Zero alt. seq. in progress indicator
CCS to high gain command
Y
N
Set CCS high gain bit in mode code 27
CCS to low gain command
Y
N
Set CCS low gain bit in mode code 27
CCS to omni gain command
Y
N
Set CCS omni bit in mode code 27
Was this SS an SIVB engine start on
N
Y
Was this first SIVB burn
Y
N
Set bit in mode code 25 for 1st SIVB burn
Set bit in mode code 26 for 2nd SIVB burn
Return

Figure A-10m

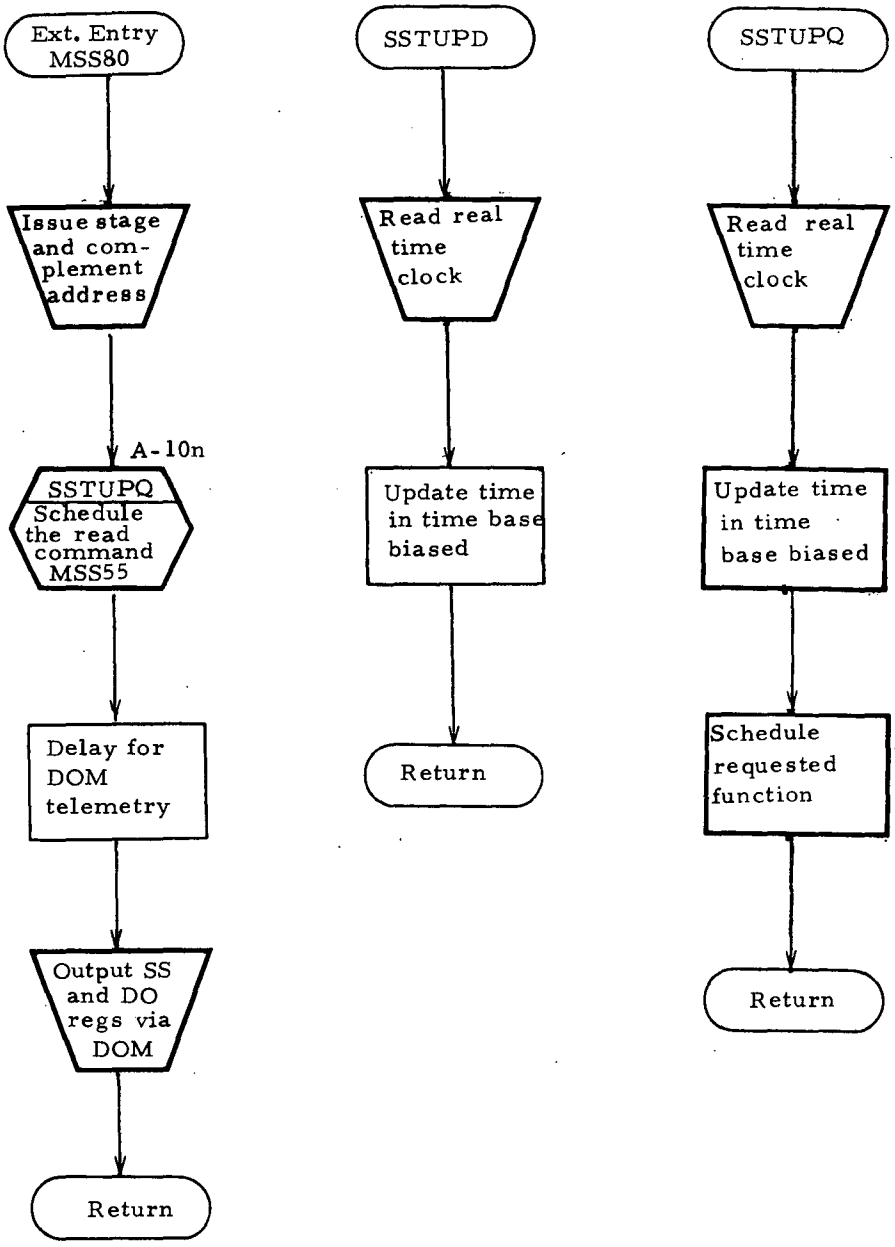

Ext. Entry MSS80
Issue stage and complement address
A-10n
SSTUPQ
Schedule the read command MSS55
Delay for DOM telemetry
Output SS and DO regs via DOM
Return
SSTUPD
Read real time clock
Update time in time base biased
Return
SSTUPQ
Read real time clock
Update time in time base biased
Schedule requested function
Return

Figure A-10n

A.11 Task Keying (ATMDC)

A.11.1 Description of Operation

Task Keying is an operating system function associated with priority task scheduling; it is the process of entering information concerning a task into a Priority Control Table to enable the task to be dispatched (initiated) on a priority basis. The information includes such items as task priority level, the in-core address of the task, and initial register contents for the task.

Since multiple tasks can usually be keyed for execution on a given priority level, various techniques are used for stacking the additional entries. In the ATMDC operating system, the Priority Control Table (Table A-4) holds a single entry for each priority level. Additional entries are stored in a Priority Overflow Table (Table A-5) with all entries for a given priority level chained together.

Requirements for task keying vary with the design of the operating system. For the ATMDC Flight Program, tasks are keyed in response to events (interrupts or discretes), based on time, or as requested by another application task.

A.11.2 Unique Language Characteristics Required

The Task Keying kernel requires facilities for formatting and accessing tables. Techniques for linking the overflow entries together in an efficient manner are also desirable.

The kernel also implies a requirement for the capability to identify the task to be keyed. The keying process itself does not require it since the Task ID is simply stored into a table. However, since this is done for the express purpose of dispatching the task (passing control to it) at a later time, the Task ID must provide the means by which the task can be located in core.

A.11.3 Assumptions Made During Coding

Several assumptions were made for the purpose of organizing the control tables. It was assumed that there were ten priority levels in the operating system and that twenty-five entries in the overflow table would suffice. Also, it was assumed that three hardware registers required saving for each task. These assumptions affect only the size of the control tables and could be easily adjusted.

PRIORITY CONTROL TABLE

	Task ID	Reg 1 Contents	Reg 2 Contents	Reg 3 Contents	Overflow Chain Link
Level 0					
Level 1					
Level 2					
⋮					
Level N-1					

Notes:

1) Number of priority levels (N) depends on system requirements. Ten levels were assumed for the kernel.

2) During the keying process, the Task ID is either the memory address of the task entry point or some other indicator which can be used to locate the task in memory. After a task has been initiated, this word is used to store the address where task execution is to resume following an interruption. A value of zero for a Task ID indicates that no tasks are currently assigned to that priority level.

3) Register storage words are used to save task registers when a task is interrupted. They are initialized to zero when a task first receives control. The number saved depends on system requirements and was arbitrarily chosen as three for the kernel.

4) The Overflow Chain Link is either a pointer or an index used to chain task entries together whenever more than one task has been assigned to a given priority level. The additional entries are stored in the Priority Overflow Table. A value of zero indicates no overflow entries exist for that priority level.

Table A-4

PRIORITY OVERFLOW TABLE

	Overflow Chain Link	Task ID
Entry 0		
Entry 1		
Entry 2		
⋮		
Entry M		

Notes:

1) The Overflow Chain Link has the same meaning as its counterpart in the Priority Control Table. A value of zero indicates end of chain.

2) The Task ID also has the same meaning as its counterpart in the Priority Control Table. A value of zero indicates that the entry is not currently assigned.

Table A-5

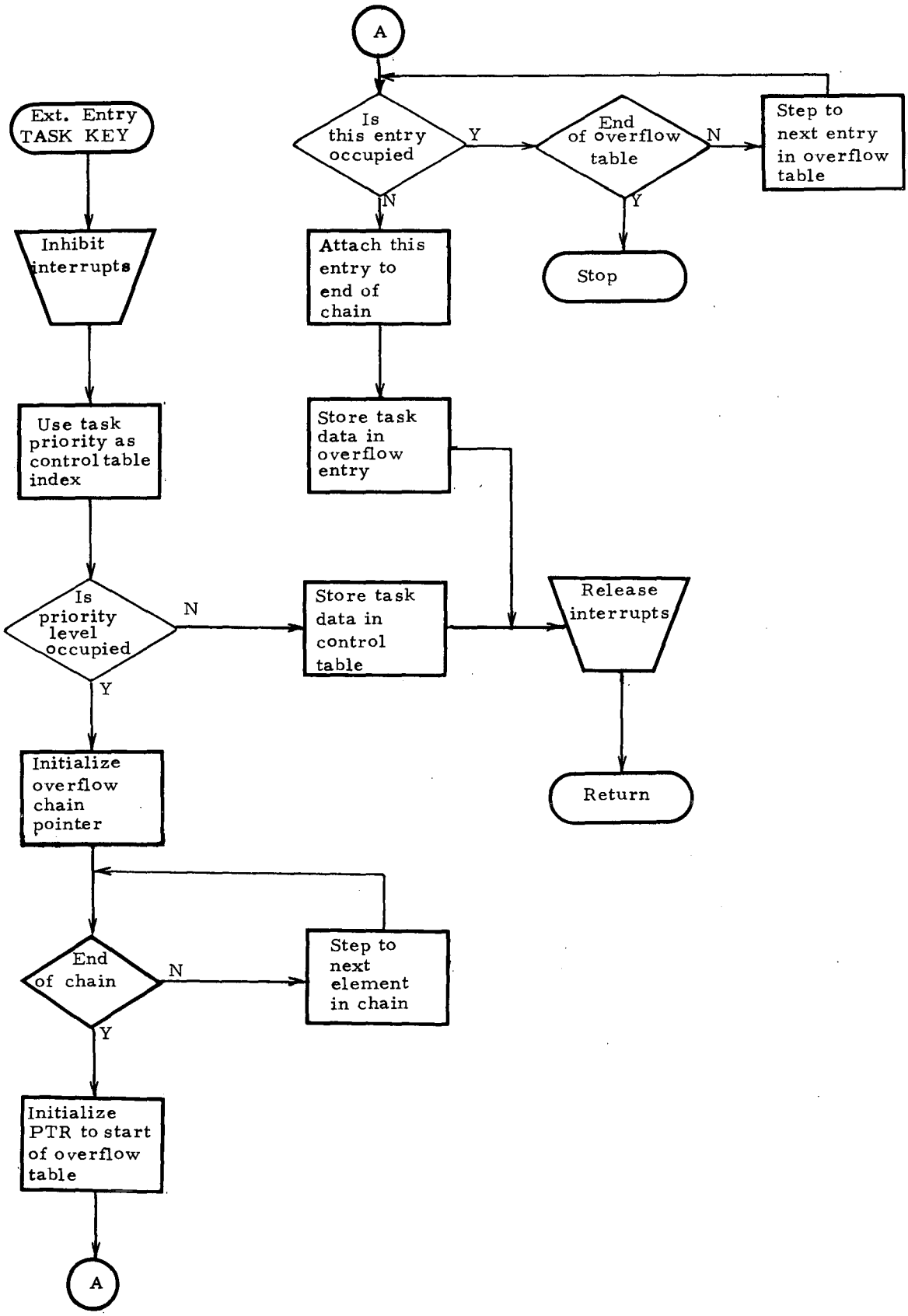

A
Ext. Entry TASK KEY
Inhibit interrupts
Use task priority as control table index
Is priority level occupied
N
Y
Initialize overflow chain pointer
End of chain
N
Y
Initialize PTR to start of overflow table
A
Is this entry occupied
Y
N
End of overflow table
N
Y
Step to next entry in overflow table
Stop
Attach this entry to end of chain
Store task data in overflow entry
Store task data in control table
Release interrupts
Return
Step to next element in chain

Figure A-11

A.12 Glossaries

The Glossary Tables provided in this paragraph document most of the names declared in the flight program coding. These glossaries are provided as an assistance to reading the flight program listings in Appendix B. It also documents assumptions made about system-defined names.

A.12.1 Input/Output Glossary

Table A-6 contains names and brief descriptions of external devices accessed by the flight program kernels. The File Names are the names used in the actual Input/Output statements. In the HAL coding it is assumed that these names are assigned by the system and are known to the compiler, because of HAL's device-oriented input/output. In SPL the names assigned by the system cannot be used directly in Input/Output statements; a FILE statement must be used to define input/output arguments in terms of system-assigned names. Therefore, for SPL the Device Names of Table A-6 were assumed to be assigned by the system, and the File Names were declared through the FILE statement. In CLASP and CMS-2 input/output is indicated by comments rather than statements of the language.

A.12.2 Interrupt Glossary

Table A-7 contains names of computer interrupts which were assumed to be assigned by the system. The Description identifies the LVDC interrupt corresponding to the Interrupt Name.

A.12.3 Data Glossary

Table A-8 contains names and brief descriptions of common data items declared in the kernel coding. Minor deviations appear in the listings such as break characters in HAL names, and truncation of some names to meet CLASP's eight-character limitation. However, these deviations are easily associated with the corresponding names listed in the Data Glossary.

INPUT/OUTPUT GLOSSARY

File Name	Device Name	Description
CLOCK	TIMER	Real time clock
DBG	DOMBUGIM	DOM backup gimbal
DCS	DCSINREG	Digital command system input
DIR	DISINREG	Discrete input register
DOM	SSDOM	Switch selector DOM output
DOR	DISOUTRES	Reset discrete output register
DOS	DISOUTSET	Set discrete output register
EMR	EMREG	Error monitor register
ICR	ICREG	Internal control register
SS	SSREG	Switch selector command output
SSFB	SSFDBK	Switch selector feedback
TIM1	TIMER1	Timer 1 counter
TIM2	TIMER2	Timer 2 counter
XACC	XACCEL	X-axis accelerometer
XBGIM	XBACKUP	X-axis backup gimbal
XGIM	XGIMBAL	X-axis fine gimbal
XLAB	XLADDER	X-axis ladder
YACC	YACCEL	Y-axis accelerometer
YBGIM	YBACKUP	Y-axis backup gimbal
YGIM	YGIMBAL	Y-axis fine gimbal
YLAD	YLADDER	Y-axis ladder
ZACC	ZACCEL	Z-axis accelerometer
ZBGIM	ZBACKUP	Z-axis backup gimbal
ZGIM	ZGIMBAL	Z-axis fine gimbal
ZLAD	ZLADDER	Z-axis ladder

Table A-6

INTERRUPT GLOSSARY

Interrupt Names	Description
T1INT	Timer 1 interrupt
T2INT	Timer 2 interrupt
TLCINT	TLC interrupt
EX1INT	External 1 interrupt
EX2INT	External 2 interrupt
EX3INT	External 3 interrupt
EX4INT	External 4 interrupt
EX5INT	External 5 interrupt
EX6INT	External 6 interrupt
EX7INT	External 7 interrupt
EX8INT	External 8 interrupt
EX9INT	External 9 interrupt

Table A-7

DATA GLOSSARY

Data Name	Description
CHIBARSTEER	CHI bar steering in progress flag
COSTHETA	Cosine of angle between pseudo-nodal vector and descending node
DCSDATACOUNT	Input data word count
DCSDATCT	Table of function data word requirements
DCSERLIM	Limit on errors for a given function
DCSERmm	Error tags
DCSINDX	Table index derived from mode command
DCSMODE	Mode command table
DCSMSTAT	Function status table
DCSSTCOD	Function telemetry status code table
DELTAL3	Correction to velocity-to-be gained
DELTAVVP	Estimated velocity to be gained
DELTA2	IGM intermediate parameter
DFACQ	Acquisition gain indicator
DFDBF	Disagreement multiplexer failure flag
DFDTL	Sector dump in progress flag
DFILE	Flight program status word
DFIL1	Timer 2 interrupt level in progress indicator
DFIL2	External interrupt level in progress indicator
DFIL3	Timer 1 interrupt level in progress indicator
DFLT	Flight/sim flight indicator word
DFMDI	Flight mode indicator
DFSMC	Steering misalignment flag
DFTBCEP	Time base change indicator for events processor
DFTUP	Time update waiting indicator
DFWV	Flag which indicates state of water valve (open or close)
DFZER	Zero test enable flag
DGSSM	Switch selector function to be scheduled
DGST2	Timer 2 function to be scheduled
DKAPI	Flight phase status table
DKMIR	Minor loop initial rate
DKT1	Timer from GRR when time base 1 was set
DLPRL	Periodic processor task rate table
DLPTL	Periodic processor task delta T table

Table A-8

DATA GLOSSARY
(continued)

Data Name	Description
DLTTL	Timer 2 task execution time table
DPHII	Rate of change of range angle
DPHIT	Rate of change of predicted terminal range angle
DQST2	Timer 2 function to be en queued
DTBID	Time base indicator
DVAC	Accelerometer reading
DVACT	Real time clock (RTC) reading associated with DVTAS
DVASW	Switch Selector Request status
DVA1 DVA2 DVA3 DVA4 DVA5 DVA6	Coefficients used to convert the attitude corrections from the inertial platform frame to the body frame
DVCA	Average of present and past Minor Loop commanded CHI at the time of major computer cycle accelerometer read
DVCC	Commanded CHI used in Minor Loop
DVD	Intermediate velocity change parameter
DVDA	Optisyn A change in velocity
DVDB	Optisyn B change in velocity
DVDC	Delta CHI
DVDGS	Count of disagreement bit hardware failures
DVDM	Measured velocity of platform
DVDPM	Mask word that specifies which DIN's are to be processed when they change from OFF to ON
DVDT	Elapsed time between current and previous major computer cycle accelerometer readings in seconds
DVEMR	Error Monitor Register
DVEOF	Engine out multiplication factor for backup F/M calculation

Table A-8
(continued)

DATA GLOSSARY
(continued)

Data Name	Description
DVERT	Time error associated with time update
DVF	Expected platform velocity change
DVFMC	Generated acceleration (backup)
DVFOM	Total vehicle acceleration determined from accelerometer readings
DVFOR	Thrust of vehicle (backup)
DVG	Gravity acceleration
DVHDA	Count of A multiplexer failures
DVHDB	Count of B multiplexer failures
DVIA5	Temporary storage
DVICR	Internal Control Register
DVIH	Interrupt inhibit image
DVLDB	Ladder converter B selection rate per second
DVLRC	Ladder ramp commanded CHI update counter
DVMAS	Mass of vehicle (backup)
DVMC4	Mode Code 24
DVMC5	Mode Code 25
DVMC6	Mode Code 26
DVMC7	Mode Code 27
DVMFR	Mass flow rate of vehicle (backup)
DVMLD	Minor Loop
DVMLR	Number of minor loops per computation cycle
DVMLT	Execution time for next minor loop
DVM05	Rate limit for ladders in Minor Loop
DVM06	Magnitude limit for ladders in Minor Loop
DVP	Flight phase indicator
DVPTG	Previous periodic processor execution time
DVRC	Accelerometer reasonableness test constant
DVRE	Gimbal failure count
DVRTC	Real time clock at last time update
DVSST	Switch selector execution time
DVTAS	Mission time at major computer cycle accelerometer read in seconds

Table A-8
(continued)

DATA GLOSSARY
(continued)

Data Name	Description
FSSAC	Switch selector processing in progress flag
FSSIO	Flag for issuing or bypassing SS I/O
FTADV	Normal or class 4 table advance flag
FTGOP	Time base 6 second opportunity flag
GS	Gravity acceleration in plumbline system
GST1M	Timer 1 function to be scheduled
GT	Terminal gravity acceleration magnitude
GV	Gravity acceleration in injection plane system
GVSTAR	Estimated average gravity acceleration for remaining boost flight path
GVT	Terminal gravity acceleration vector
J1	IGM intermediate parameter
J12	IGM intermediate parameter
J2	IGM intermediate parameter
J3	IGM intermediate parameter
J3P	IGM intermediate parameter
KCCT4	Nominal computation cycle length during first S4B CHI bar steering
KCCT8	Nominal computation cycle length during second S4B CHI bar steering
KMU	Gravitational constant
KT	Cosine (THETAT)/RT
K1	Coefficient of IGM steering equation
K2	Coefficient of IGM steering equation
K3	Coefficient of IGM steering equation
K4	Coefficient of IGM steering equation
LYP	IGM intermediate parameter
L1	IGM intermediate parameter
L12	IGM intermediate parameter
L2	IGM intermediate parameter
L3	IGM intermediate parameter
L3P	IGM intermediate parameter
MS4	Rotation matrix from S-system to 4-system
M4V	Rotation matrix from 4-system to V-system

Table A-8
(continued)

DATA GLOSSARY
(continued)

Data Name	Description
DVTB	Time in time base at major computer cycle accelerometer read in seconds
DVTEX	Real time clock reading at last interrupt
DVTGB	Accumulated ground bias time update
DVTH	Total gimbal angle
DVTI	Time from GRR that the current time base was set
DVTMM	Elapsed time in mission from GRR at last time update
DVTMR	Mission time at start of reference
DVTRB	Elapsed time in current time base including ground bias time updates
DVTRR	Elapsed total time in current reference
DVTRS	Real time clock recording at start of reference
DVVSQ	Sum of the squares of X, Y and Z accelerometer changes
DVIMR	Computation cycles per minor loop
DV2TG	Time for next timer 2 function
EPSILON2	Time to begin CHI bar steering for first S4B burn
EPSILON3	Time to stop calculating terminal conditions
EPTINDX	Events processor table index
EPTPTR	Pointer to task for processing an event
EPTTBINDX	Table of index values at beginning of time bases
EPTTIM	Time of execution for an event
FASE	Alternate sequence in progress flag
FBRNI	S4B first/second burn flag
FBUG	Backup gimbal active, alter RTC
FBUGS	RTC conditions flag for gimbals
FCLS4	Class 4 SS sequence in progress flag
FDSEN	Mode or data acceptable flag
FDSPG	DCS function in progress flag
FDSRE	DCS function termination required
FFBCH	Switch selector feedback channel flag
FGNC	G and C steering in progress flag
FHST	Hung stage test flag

Table A-8
(continued)

DATA GLOSSARY
(continued)

Data Name	Description
PHASE	IGM first/second burn indicator
PHII	Range angle traveled since liftoff
PHIIT	Predicted range angle-to-go
PHIT	Predicted terminal range angle
P1	IGM intermediate parameter
P12	IGM intermediate parameter
P2	IGM intermediate parameter
PPSTAT	Periodic processor task status table
Q1	IGM intermediate parameter
Q12	IGM intermediate parameter
Q2	IGM intermediate parameter
R	Position magnitude
REITERATE	Alteration flag
ROVEX3	Biased reciprocal of third phase IGM exhaust velocity
RS	Position in plumbline coordinate system
RT	Terminal radius magnitude
RV	Position in injection plane coordinate system
RVT	Terminal position vector
R4	Position in 4-system
SINTHETA	Sine of angle between pseudo-nodal vector and descending node
SMCFLAG	Steering misalignment corrections flag
SSTTBPTR	Table of pointers to switch selector table for each time base
SST1PTR	Normal switch selector table pointer
SST2PTR	Class 4 switch selector table pointer
S1	IGM intermediate parameter
S12	IGM intermediate parameter
S2	IGM intermediate parameter
S4BURN	S4B first/second burn flag
TAU1	First phase IGM ideal burn time
TAU2	Second or fourth phase IGM ideal burn time
TAU3	Third or fifth phase IGM ideal burn time

Table A-8
(continued)

DATA GLOSSARY
(continued)

Data Name	Description
TCI	Time remaining in S4B coast
THETAT	Desired terminal path angle
TSTAR	Predicted IGM total time-to-go
T1C	Time-to-go to IGM initiation in third phase
T1I	First phase IGM time-to-go
T2I	Second or fourth phase IGM time-to-go
T2STAT	Timer 2 task status table
T3I	Third or fifth phase IGM time-to-go
U1	IGM intermediate parameter
U12	IGM intermediate parameter
U2	IGM intermediate parameter
V	Velocity magnitude
VASPI	Alternate sequence in progress status word
VATRR	Alternate SS sequence time start
VATR4	Class 4 SS sequence time start
VBUB	Gimbal backup bias error
VCCYA	Previous pitch command CHI
VCCZA	Previous yaw command CHI
VCG	High order gimbal, coarse or backup resolution
VCG0	Gimbal reasonableness rate limit constant (backup 2nd pass)
VCG1	Gimbal reasonableness rate limit constant (backup 2nd pass) (crossover)
VCG10	First pass gimbal reasonableness test constant
VCG11	First pass gimbal reasonableness test constant
VCMND	Present attitude command
VCMND1	Previous attitude command
VCMND2	Actual attitude command
VCOD	Platform gimbal used to compute attitude
VDEL	Difference between actual and commanded attitude
VDSBL	Storage table for input data

Table A-8
(continued)

DATA GLOSSARY
(continued)

Data Name	Description
VDSER	Temporary storage for error telemetry
VDSRC	Error count
VDSSB	Sequence bit indicator
VDS01	Temporary storage for error input data
VEX1	First phase IGM exhaust velocity
VEX2	Second or fourth phase IGM exhaust velocity
VEX3	Third or fifth phase IGM exhaust velocity
VF10	I/O flag for fine or backup gimbals
VGBIA	Time base bias to be implemented
VGR	Gimbal angle reading
VHSTW	Previous stage and address
VIRE	Resolver failure limit
VMEMR	Temporary storage for EMR reading
VMLET	Temporary storage for error telemetry
VML0	Gimbal reasonableness test limits
VML1	Gimbal reasonableness test limits (crossover)
VML2	Low order gimbal resolution
VOAC	Previous accelerometer readings
VOACT	Mission time (in RTC units) at accelerometer read
VOLD	Previous platform gimbal
VPOV	Previous measured velocity
VPPOT	Periodic processor current mission time
VPSTG	Powered stage indicators
VS	Velocity in plumbline coordinate system
VSCCA	Complimented address
VSC1	Class 1 temporary storage for SST1PTR, VASPI, VATRR
VSC3	Class 3 temporary storage for SST1PTR, VASPI, VATRR
VSF	Conversion factor for gimbal angles
VSNA	Stage and address word
VSNA1	Stage and address in true form
VSSCA	Computed feedback
VSSFB	Switch selector feedback in error

Table A-8
(continued)

DATA GLOSSARY
(continued)

Data Name	Description
VSSRT	Switch selector time of issuance
VSSTM	Temporary SS time storage
VSSW	Bias time
VSTG	Powered stage temporary storage
VSTGO	Time-to-go to next SS function
VT	Terminal velocity magnitude
VTD	Elapsed time into launch window
VTOLD	Events processor previous event time
VV	Velocity in injection plane coordinate system
VVT	Terminal velocity vector
V0CK	Gimbal angle zero test constant
V4	Velocity in 4-system

Table A-8
(continued)

APPENDIX B

FLIGHT PROGRAM KERNEL CODING

Each of the four major paragraphs of this Appendix contains all of the coding for one language. The following table indicates on which page the coding of a given kernel (table row) in a given language (table column) begins.

Descriptions and flowcharts of these kernels can be found in Appendix A. The blank entries in the table indicate kernels which were not coded in CMS-2.

Kernels \ Languages	SPL	CLASP	HAL	CMS-2
Common Data Pool	83	129	175	229
1. Initialization	92	135	181	
2. Interrupt Processor	94	137	184	
3. Non-Interrupt Sequencer	98	141	188	
4. Periodic Processor	100	142	190	
5. Events Processor	101	143	191	
6. Iterative Guidance Mode	103	146	194	234
7. Digital Command System	107	150	199	238
8. Accelerometer Processing	110	154	204	
9. Minor Loop	113	157	207	244
10. Switch Selector Processor	117	162	213	249
11. ATM Task Keying	126	172	226	258

(BLANK)

SPL COMMON DATA DECLARATIONS

```
START     .COMPOOL   '' SPL COMMON DATA AND UTILITY ROUTINES ''
          DECLARE CONTEXTUAL,
               TEMP,
               TEMP1
          DECLARE FLOATING R,
               DKT1       ,
               DVDT       ,
               DVEOF      ,
               DVFMC      ,
               DVFOM      ,
               DVFOR      ,
               DVMAS      ,
               DVMFR      ,
               DVMLR      ,
               DVTAS   27,
               DVTB       ,
               DVTI       ,
               DVVSQ      ,
               DV1MR
          DECLARE ARRAY (3) FLOATING R,
               DVD        ,
               DVDM       ,
               DVFM       ,
               DVGM       ,
               DVRC
          DECLARE FIXED,
               DKMIR          0     CONSTANT = 162.53968 ,''40 MILLI-SEC''
               DKTD           0     CONSTANT = 13.676,
               DVACT          0,
               DVA1           4,
               DVA2           4,
               DVA3           4,
               DVA4           4,
               DVA5           4,
               DVA6           4,
               DVERT          0,
               DVMLD          0,
               DVMLT         -2,
               DVM05          0,
               DVM06          0,
               DVPTG         -2,
               DVRTC          0,
               DVSST         -2,
               DVTD           0,
               DVTEX          0,
               DVTGB         -2,
               DVTMM         -2,
               DVTMR         -2,
               DVTRB         -2,
               DVTRR         -2,
               DVTRS         -2,
               DVTT1          0,
               DV2TG         -2
          DECLARE ARRAY (3) FIXED,
               DLPRL      -2  CONSTANT =(203174, 243809, 406349.),
```

```
      DLPTL       -2  ,
      DLTTL (12)  -2  ,
      DVCA        25 R,
      DVCC        25 R,
      DVDA         7  ,
      DVDB         7  ,
      DVDC        25 R,
      DVTH        25 R
DECLARE INTEGER,
      DTBID       ,
      DVDBS       ,
      DVHDA       ,
      DVHDB       ,
      DVLRC       ,
      DVP
ARRAY DVRE (3) INTEGER
DECLARE STATUS,
      DFACQ       (LOSS,GAIN)                 ,
      DFDBF       (GOOD,FAILED)               ,
      DFDTL       (INPROG,NOTINPROG)          ,
      DFLT        (FLIGHT,SIM,REP)            ,
      DFPHC       (NOTCHANGE,CHANGE)          ,
      DFSMC       (ENABLE,DISABLE)            ,
      DFTBCEP     (CHANGE,NOCHANGE)           ,
      DFTUP       (NO,YES)                    ,
      DFWV        (CLOSE,OPEN)                ,
      DFZER       (ENABLE,DISABLE)            ,
      DGMLM       (MLFS,MLNORM)               ,
      DGSSM(MLFS,MLNORM,SS05,SS30,SS40,SS50,SS55,SS60,SS70,SS80),
      DGST2       (T2S,UM00,LR10,EP00,TT10,NU00,EE00,CM00,CM10,
                   CM20,EPWM,ER00),
      DQST2       (T2S,UM00,LR10,EP00,TT10,NU00,EE00,CM00,CM10,
                   CM20,EPWM,ER00),
      GST1M(MLFS,MLNORM,SS05,SS30,SS40,SS50,SS55,SS60,SS70,SS80)
DECLARE STATUS (IN,OUT), ARSTAT  ,
                         SASTAT  ,
                         APSTAT  ,
                         DVSTAT  ,
                         DPSTAT  ,
                         NESTAT  ,
                         TCSTAT  ,
                         PASTAT  ,
                         TTSTAT  ,
                         IGSTAT  ,
                         HSSTAT  ,
                         OGSTAT  ,
                         TGSTAT  ,
                         RSSTAT  ,
                         CSSTAT  ,
                         MSSTAT  ,
                         PGSTAT  ,
                         EBSTAT  ,
                         CC1STAT ,
                         TB1STAT ,
                         TB57STAT,
```

```
                          CTSTAT  ,
                          DTSTAT
ARRAY DKAPI (4) STATUS (ACTIVE,INACTIVE)
DECLARE ARRAY STATUS (IN,OUT),
     PPSTAT    (3),
     T2STAT   (12)
DECLARE LOGICAL,
     DFILE     ,
     DFIL1     ,
     DFIL2     ,
     DFIL3     ,
     DVASW     ,
     DVDPM     ,
     DVEMR     ,
     DVICR     ,
     DVIH      ,
     DVLDB     ,
     DVMC4     ,
     DVMC5     ,
     DVMC6     ,
     DVMC7
ARRAY DVAC (3) LOGICAL
DECLARE LOGICAL CONSTANT,
     MSKABSLADDER          =OCT'000001000',
     MSKACCELA             =OCT'777700000',
     MSKACCELB             =OCT'000017776',
     MSKDCSCOMP            =OCT'774000000',
     MSKDCSDO              =OCT'000040000',
     MSKDCSER              =OCT'000077776',
     MSKDCSMC              =OCT'770000000',
     MSKDCSMODE            =OCT'000000020',
     MSKDCSSB              =OCT'004000000',
     MSKDCSTERM            =OCT'200000000',
     MSKDIN9               =OCT'000004000',
     MSKEMRLADB            =OCT'000001000',
     MSKERRORTAG           =OCT'000070000',
     MSKFMDREP             =OCT'000100000',
     MSKFPSCORD            =OCT'100000000',
     MSKFPSINT2            =OCT'000040000',
     MSKFPSISSA            =OCT'001000000',
     MSKGIMBALA            =OCT'377700000',
     MSKICRBG              =OCT'000000020',
     MSKICRCA              =OCT'000040000',
     MSKICRSSCB            =OCT'000010000',
     MSKICRSWG             =OCT'000002000',
     MSKINT                =OCT'157740000',
     MSKMOD180DEG          =OCT'377777776',
     MSKRTC                =OCT'000037776',
     MSKRTCRESET           =OCT'007777540',
     MSKSCCO               =OCT'000100000',
     MSKSSCLS1             =OCT'000003770',
     MSKSSCLS3             =OCT'077774000',
     MSKSSDCS              =OCT'500000000',
     MSKSSDCT              =OCT'405400000',
     MSKSSHIG              =OCT'100720000',
```

```
                MSKSSHS             =OCT'003770000',
                MSKSSLOG            =OCT'100520000',
                MSKSSNSEND          =OCT'377777776',
                MSKSSOMG            =OCT'100070000',
                MSKSSREAD           =OCT'400000000',
                MSKSSRESET          =OCT'200000000',
                MSKSSSCC            =OCT'100310000',
                MSKSSSIVB           =OCT'020230000',
                MSKSSSNA            =OCT'135770000',
                MSKSSSSB            =OCT'174000000',
                MSKSSWV             =OCT'003000000',
                MSKSSWVC            =OCT'101050000',
                MSKSSWVO            =OCT'101450000',
                MSKSSZFSF           =OCT'002000000',
                MSKTMC0             =OCT'700000000',
                MSKTMC1             =OCT'710000000',
                MSKTMC2             =OCT'720000000',
                MSKTMC3             =OCT'730000000',
                MSKTMC4             =OCT'740000000',
                MSKT2INT            =OCT'100000000',
                MSK18UDEG           =OCT'400000000'
MC24.     DECLARE, MSK0               LOGICAL CONSTANT  =OCT'400000000',
                   MSK1               LOGICAL CONSTANT  =OCT'200000000',
                   MSK2               LOGICAL CONSTANT  =OCT'100000000',
                   MSK3               LOGICAL CONSTANT  =OCT'040000000',
                   MSK4               LOGICAL CONSTANT  =OCT'020000000',
                   MSK5               LOGICAL CONSTANT  =OCT'010000000',
                   MSK6               LOGICAL CONSTANT  =OCT'004000000',
                   MSK7               LOGICAL CONSTANT  =OCT'002000000',
                   MSK8               LOGICAL CONSTANT  =OCT'001000000',
                   MSK9               LOGICAL CONSTANT  =OCT'000400000',
                   MSK10              LOGICAL CONSTANT  =OCT'000200000',
                   MSK11              LOGICAL CONSTANT  =OCT'000100000',
                   MSK12              LOGICAL CONSTANT  =OCT'000040000',
                   MSK13              LOGICAL CONSTANT  =OCT'000020000',
                   MSK14              LOGICAL CONSTANT  =OCT'000010000',
                   MSK15              LOGICAL CONSTANT  =OCT'000004000',
                   MSK16              LOGICAL CONSTANT  =OCT'000002000',
                   MSKMC4SSCR         LOGICAL CONSTANT  =OCT'000001000',
                   MSK18              LOGICAL CONSTANT  =OCT'000000400',
                   MSK19              LOGICAL CONSTANT  =OCT'000000200',
                   MSKMC4AMF          LOGICAL CONSTANT  =OCT'000000100',
                   MSK21              LOGICAL CONSTANT  =OCT'000000040',
                   MSK22              LOGICAL CONSTANT  =OCT'000000020',
                   MSK23              LOGICAL CONSTANT  =OCT'000000010',
                   MSK24              LOGICAL CONSTANT  =OCT'000000004',
                   MSK25              LOGICAL CONSTANT  =OCT'000000002'
MC25.     DECLARE, MSK0               LOGICAL CONSTANT  =OCT'400000000',
                   MSK1               LOGICAL CONSTANT  =OCT'200000000',
                   MSK2               LOGICAL CONSTANT  =OCT'100000000',
                   MSK3               LOGICAL CONSTANT  =OCT'040000000',
                   MSK4               LOGICAL CONSTANT  =OCT'020000000',
                   MSK5               LOGICAL CONSTANT  =OCT'010000000',
                   MSK6               LOGICAL CONSTANT  =OCT'004000000',
                   MSK7               LOGICAL CONSTANT  =OCT'002000000',
```

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                    MSK8            LOGICAL CONSTANT  =OCT'001000000',
                    MSK9            LOGICAL CONSTANT  =OCT'000400000',
                    MSK10           LOGICAL CONSTANT  =OCT'000200000',
                    MSK11           LOGICAL CONSTANT  =OCT'000100000',
                    MSK12           LOGICAL CONSTANT  =OCT'000040000',
                    MSK13           LOGICAL CONSTANT  =OCT'000020000',
                    MSK14           LOGICAL CONSTANT  =OCT'000010000',
                    MSK15           LOGICAL CONSTANT  =OCT'000004000',
                    MSK16           LOGICAL CONSTANT  =OCT'000002000',
                    MSK17           LOGICAL CONSTANT  =OCT'000001000',
                    MSK18           LOGICAL CONSTANT  =OCT'000000400',
                    MSK19           LOGICAL CONSTANT  =OCT'000000200',
                    MSKMC54B1I      LOGICAL CONSTANT  =OCT'000000100',
                    MSK21           LOGICAL CONSTANT  =OCT'000000040',
                    MSK22           LOGICAL CONSTANT  =OCT'000000020',
                    MSK23           LOGICAL CONSTANT  =OCT'000000010',
                    MSK24           LOGICAL CONSTANT  =OCT'000000004',
                    MSK25           LOGICAL CONSTANT  =OCT'000000002'
MC26.     DECLARE,  MSKMC68BRI      LOGICAL CONSTANT  =OCT'400000000',
                    MSK1            LOGICAL CONSTANT  =OCT'200000000',
                    MSK2            LOGICAL CONSTANT  =OCT'100000000',
                    MSK3            LOGICAL CONSTANT  =OCT'040000000',
                    MSK4            LOGICAL CONSTANT  =OCT'020000000',
                    MSK5            LOGICAL CONSTANT  =OCT'010000000',
                    MSK6            LOGICAL CONSTANT  =OCT'004000000',
                    MSK7            LOGICAL CONSTANT  =OCT'002000000',
                    MSK8            LOGICAL CONSTANT  =OCT'001000000',
                    MSK9            LOGICAL CONSTANT  =OCT'000400000',
                    MSK10           LOGICAL CONSTANT  =OCT'000200000',
                    MSK11           LOGICAL CONSTANT  =OCT'000100000',
                    MSK12           LOGICAL CONSTANT  =OCT'000040000',
                    MSK13           LOGICAL CONSTANT  =OCT'000020000',
                    MSKMC6LUI       LOGICAL CONSTANT  =OCT'000010000',
                    MSK15           LOGICAL CONSTANT  =OCT'000004000',
                    MSKMC6TB6A      LOGICAL CONSTANT  =OCT'000002000',
                    MSK17           LOGICAL CONSTANT  =OCT'000001000',
                    MSKMC6D04       LOGICAL CONSTANT  =OCT'000000400',
                    MSK19           LOGICAL CONSTANT  =OCT'000000200',
                    MSK20           LOGICAL CONSTANT  =OCT'000000100',
                    MSKMC6TB6C      LOGICAL CONSTANT  =OCT'000000040',
                    MSK22           LOGICAL CONSTANT  =OCT'000000020',
                    MSKMC6TB6B      LOGICAL CONSTANT  =OCT'000000010',
                    MSK24           LOGICAL CONSTANT  =OCT'000000004',
                    MSK25           LOGICAL CONSTANT  =OCT'000000002'
MC27.     DECLARE,  MSK0            LOGICAL CONSTANT  =OCT'400000000',
                    MSK1            LOGICAL CONSTANT  =OCT'200000000',
                    MSKMC7T6D       LOGICAL CONSTANT  =OCT'100000000',
                    MSK3            LOGICAL CONSTANT  =OCT'040000000',
                    MSKMC70MB       LOGICAL CONSTANT  =OCT'020000000',
                    MSKMC7LOB       LOGICAL CONSTANT  =OCT'010000000',
                    MSKMC7HIB       LOGICAL CONSTANT  =OCT'004000000',
                    MSK7            LOGICAL CONSTANT  =OCT'002000000',
                    MSK8            LOGICAL CONSTANT  =OCT'001000000',
                    MSK9            LOGICAL CONSTANT  =OCT'000400000',
                    MSK10           LOGICAL CONSTANT  =OCT'000200000',
```

```
                MSK11           LOGICAL CONSTANT  =OCT'000100000',
                MSK12           LOGICAL CONSTANT  =OCT'000040000',
                MSK13           LOGICAL CONSTANT  =OCT'000020000',
                MSK14           LOGICAL CONSTANT  =OCT'000010000',
                MSK15           LOGICAL CONSTANT  =OCT'000004000',
                MSK16           LOGICAL CONSTANT  =OCT'000002000',
                MSK17           LOGICAL CONSTANT  =OCT'000001000',
                MSK18           LOGICAL CONSTANT  =OCT'000000400',
                MSK19           LOGICAL CONSTANT  =OCT'000000200',
                MSK20           LOGICAL CONSTANT  =OCT'000000100',
                MSK21           LOGICAL CONSTANT  =OCT'000000040',
                MSK22           LOGICAL CONSTANT  =OCT'000000020',
                MSK23           LOGICAL CONSTANT  =OCT'000000010',
                MSK24           LOGICAL CONSTANT  =OCT'000000004',
                MSK25           LOGICAL CONSTANT  =OCT'000000002'
SSDVASW.  DECLARE, MSKSSS4C0    LOGICAL CONSTANT  =OCT'400000000',
                MSKSSSPEC       LOGICAL CONSTANT  =OCT'200000000',
                MSKSSTR6C       LOGICAL CONSTANT  =OCT'100000000',
                MSKSSGNSS       LOGICAL CONSTANT  =OCT'040000000',
                MSKSSSRLO       LOGICAL CONSTANT  =OCT'020000000',
                MSKSSSRHI       LOGICAL CONSTANT  =OCT'010000000',
                MSKSSSROM       LOGICAL CONSTANT  =OCT'004000000',
                MSKSSECSV       LOGICAL CONSTANT  =OCT'002000000',
                MSKSSECS1       LOGICAL CONSTANT  =OCT'001000000',
                MSKSST3A        LOGICAL CONSTANT  =OCT'000400000',
                MSKSSTR6D       LOGICAL CONSTANT  =OCT'000200000',
                MSK11           LOGICAL CONSTANT  =OCT'000100000',
                MSK12           LOGICAL CONSTANT  =OCT'000040000',
                MSK13           LOGICAL CONSTANT  =OCT'000020000',
                MSK14           LOGICAL CONSTANT  =OCT'000010000',
                MSK15           LOGICAL CONSTANT  =OCT'000004000',
                MSKSSTR6A       LOGICAL CONSTANT  =OCT'000002000',
                MSKSSTR6B       LOGICAL CONSTANT  =OCT'000001000',
                MSKSSS4C1       LOGICAL CONSTANT  =OCT'000000400',
                MSK19           LOGICAL CONSTANT  =OCT'000000200',
                MSK20           LOGICAL CONSTANT  =OCT'000000100',
                MSK21           LOGICAL CONSTANT  =OCT'000000040',
                MSK22           LOGICAL CONSTANT  =OCT'000000020',
                MSK23           LOGICAL CONSTANT  =OCT'000000010',
                MSKSSACCU       LOGICAL CONSTANT  =OCT'000000004',
                MSKSSLI         LOGICAL CONSTANT  =OCT'000000002'
SSVASPI.  DECLARE, MSKSSS4C0    LOGICAL CONSTANT  =OCT'400000000',
                MSKSSSPEC       LOGICAL CONSTANT  =OCT'200000000',
                MSKSSCL3        LOGICAL CONSTANT  =OCT'100000000',
                MSKSSCL1        LOGICAL CONSTANT  =OCT'040000000',
                MSK4            LOGICAL CONSTANT  =OCT'020000000',
                MSK5            LOGICAL CONSTANT  =OCT'010000000',
                MSKSST6C        LOGICAL CONSTANT  =OCT'004000000',
                MSK7            LOGICAL CONSTANT  =OCT'002000000',
                MSK8            LOGICAL CONSTANT  =OCT'001000000',
                MSK9            LOGICAL CONSTANT  =OCT'000400000',
                MSK10           LOGICAL CONSTANT  =OCT'000200000',
                MSK11           LOGICAL CONSTANT  =OCT'000100000',
                MSK12           LOGICAL CONSTANT  =OCT'000040000',
                MSK13           LOGICAL CONSTANT  =OCT'000020000',
```

```
          MSK14              LOGICAL CONSTANT  =OCT'000010000',
          MSK15              LOGICAL CONSTANT  =OCT'000004000',
          MSK16              LOGICAL CONSTANT  =OCT'000002000',
          MSK17              LOGICAL CONSTANT  =OCT'000001000',
          MSK18              LOGICAL CONSTANT  =OCT'000000400',
          MSK19              LOGICAL CONSTANT  =OCT'000000200',
          MSK20              LOGICAL CONSTANT  =OCT'000000100',
          MSK21              LOGICAL CONSTANT  =OCT'000000040',
          MSK22              LOGICAL CONSTANT  =OCT'000000020',
          MSK23              LOGICAL CONSTANT  =OCT'000000010',
          MSK24              LOGICAL CONSTANT  =OCT'000000004',
          MSK25              LOGICAL CONSTANT  =OCT'000000002'
OVERLAY MC24 = MC25 = MC26 = MC27 = SSDVASW = SSVASPI
DECLARE   FILE      CLOCK     DEVICE =  TIMER     ,
          FILE      DBG       DEVICE =  DOMBUGIM  ,
          FILE      DCS       DEVICE =  DCSINREG  ,
          FILE      DIR       DEVICE =  DISINREG  ,
          FILE      DOM       DEVICE =  SSDOM     ,
          FILE      DOR       DEVICE =  DISOUTRES ,
          FILE      DOS       DEVICE =  DISOUTSET ,
          FILE      EMR       DEVICE =  ERRMONREG ,
          FILE      ICR       DEVICE =  INTCONREG ,
          FILE      MODREG    DEVICE =  MODEREG   ,
          FILE      SS        DEVICE =  SSREG     ,
          FILE      SSFB      DEVICE =  SSFDBK    ,
          FILE      TELDCSDW  DEVICE = PI0574     ,
          FILE      TELDCSEC  DEVICE = PI0055     ,
          FILE      TELDCSSC  DEVICE = PI0030     ,
          FILE      TELGT     DEVICE = PI0574     ,
          FILE      TELMLER   DEVICE = PI0570     ,
          FILE      TELPHIT   DEVICE = PI0414     ,
          FILE      TELRTC    DEVICE = PI0174     ,
          FILE      TELSSFB   DEVICE = PI0500     ,
          FILE      TELSSSA   DEVICE = PI0075     ,
          FILE      TELTAS    DEVICE = PI0000     ,
          FILE      TELTB     DEVICE = PI0031     ,
          FILE      TELTI     DEVICE = PI0561     ,
          FILE      TELT3I    DEVICE = PI0464     ,
          FILE      TELXAC    DEVICE = PI0010     ,
          FILE      TELXDM    DEVICE = PI0024     ,
          FILE      TELX4     DEVICE = PI0444     ,
          FILE      TELYAC    DEVICE = PI0014     ,
          FILE      TELYDM    DEVICE = PI0030     ,
          FILE      TELYD4    DEVICE = PI0450     ,
          FILE      TELY4     DEVICE = PI0450     ,
          FILE      TELZAC    DEVICE = PI0004     ,
          FILE      TELZDM    DEVICE = PI0020     ,
          FILE      TELZ4     DEVICE = PI0434     ,
          FILE      TIM1      DEVICE =  TIMER1    ,
          FILE      TIM2      DEVICE =  TIMER2    ,
          FILE      XACC      DEVICE =  XACCEL    ,
          FILE      XBGIM     DEVICE =  XBACKUP   ,
          FILE      XGIM      DEVICE =  XGIMBAL   ,
          FILE      XLAD      DEVICE =  XLADDER   ,
          FILE      YACC      DEVICE =  YACCEL    ,
```

SPL COMMON DATA DECLARATIONS

```
FILE      YBGIM      DEVICE = YBACKUP  ,
FILE      YGIM       DEVICE = YGIMBAL  ,
FILE      YLAD       DEVICE = YLADDER  ,
FILE      ZACC       DEVICE = ZACCEL   ,
FILE      ZBGIM      DEVICE = ZBACKUP  ,
FILE      ZGIM       DEVICE = ZGIMBAL  ,
FILE      ZLAD       DEVICE = ZLADDER
```

```
PROC       .UTR00     ''TELEMETRY DELAY FOR MODE REG SETTING OF 70''
ENTRANCE   .UTR01     ''TELEMETRY DELAY FOR MODE REG SETTING OF 71''
ENTRANCE   .UTR02     ''TELEMETRY DELAY FOR MODE REG SETTING OF 72''
ENTRANCE   .UTR03     ''TELEMETRY DELAY FOR MODE REG SETTING OF 73''
ENTRANCE   .UTR04     ''TELEMETRY DELAY FOR MODE REG SETTING OF 74''
           ITEM KTELBIAS FIXED 0 CONSTANT = 2.
           ITEM VTIM FIXED 0
           ITEM VTMC LOGICAL
ENDDATA
           VTMC = MSKTMC0
           GOTO TR00
UTR01.     VTMC = MSKTMC1
           GOTO TR00
UTR02.     VTMC = MSKTMC2
           GOTO TR00
UTR03.     VTMC = MSKTMC3
           GOTO TR00
UTR04.     VTMC = MSKTMC4
TR00 .     LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
                EX7INT,EX8INT,EX9INT
           READ CLOCK,VTIM
           IF VTIM - DVTD LAND MSKRTC GQ DKTD      GOTO TR05
           UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
      ''ALLOW HIGH PRIORITY TASKS TO INTERRUPT''
           GOTO TR00
TR05 .     WRITE MODREG,VTMC
           DVTD = VTIM + KTELBIAS
EXIT       ''COMMON TELEMETRY DELAY RETURN''
PROC       .UTR30     ''TELEMETRY DELAY FOR INTERRUPT LEVEL 3''
           ITEM KTELBIAS FIXED 0 CONSTANT = 2.
           ITEM VTIM FIXED 0
ENDDATA
TR35.      READ CLOCK,VTIM
           IF VTIM - DVTD LAND MSKRTC LS DKTD      GOTO TR35
           WRITE MODREG,MSKTMC0
           DVTD = VTIM + KTELBIAS
EXIT       ''UTR30''
PROC       .UTR24     ''TELEMETRY DELAY FOR INTERRUPT LEVEL 2''
           ITEM KTELBIAS FIXED 0 CONSTANT = 2.
           ITEM VTIM FIXED 0
ENDDATA
TR20 .     LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
                EX7INT,EX8INT,EX9INT
           READ CLOCK,VTIM
           IF VTIM - DVTD LAND MSKRTC GQ DKTD      GOTO TR25
           UNLOCK T1INT
           GOTO TR20
TR25 .     WRITE MODREG,MSKTMC4
           DVTD = VTIM + KTELBIAS
EXIT       ''UTR24''
TERM
```

```
                    SPL   KERNEL  1      INITIALIZATION


START       .EGP0       ''MISSION INITIALIZATION''
ENTRANCE    .MPA00      ''PHASE TERMINATION''
            ITEM VTD FLOATING
            ITEM FGNC STATUS (INACTIVE,ACTIVE)
ENDDATA
            LOCK TLCINT,T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,
                 EX6INT,EX7INT,EX8INT,EX9INT
            READ XACC,VOAC(0)
            READ YACC,VOAC(1)
            READ ZACC,VOAC(2)
            READ CLOCK,DVACT
            IF DFMDI LAND MSKFMDREP NQ 0
                 THEN ON T1INT
                           READ CLOCK,DVACT
                           LOCK T1INT
                           TEMP = 0
                           END
                           TEMP = 1
                           WRITE TIM1,TEMP
                           UNLOCK T1INT
                           IF TEMP EQ 1    WAIT
            END
            DFIL1, DFIL2, DFIL3 = 'ACTIVE'
            DVRTC,DVTEX,VPPOT = DVACT
            DVTMM,DVTRR,DVERT,DVTGB,DVTRS,DVTMR,DTBID,VTD = 0.
            .EGP1       ''ACTIVATE INTERRUPT PROCESSOR CHRONIC STATEMENTS''
            UNLOCK TLCINT
            FGNC = 'INACTIVE'
            DVSST = 1.E10
            DVMLT = DVMLD = DKMIR
            .EGP15            ''SCHEDULE FIRST TIMER 1 FUNCTION''
            DVP = 1
GP002.      IF DVP GR 4             WAIT
            IF DKAPI(DVP-1) EQ 'ACTIVE'
                 THEN .EGP20     ''START PHASE TIME REFERENCE''
                      GOTO (INP13, INP24, INP13, INP24, *) DVP - 1
                 ELSE DVP = DVP + 1
                      GOTO GP002
            END
MPA00.      DFPHC = 'CHANGE'
            LOCK TLCINT,T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,
                 EX6INT,EX7INT,EX8INT,EX9INT
            WRITE TIM2,MSKRTC ''LOAD TIMER 2 WITH A LARGE VALUE TO PREVENT
                              TIMER 2 INTERRUPTS FROM OCCURRING''
            WRITE ISR,MSKT2INT  ''RESET ANY PENDING TIMER 2 INTERRUPT''
            DFIL1, DFIL2 = 'ACTIVE'
            UNLOCK TLCINT,T1INT
            GOTO GP002
INP13.      ARSTAT = 'IN'
            SASTAT = 'OUT'
            APSTAT = 'IN'
            DVSTAT = 'OUT'
            DPSTAT = 'IN'
            NESTAT = 'IN'
            TCSTAT = 'OUT'
```

```
          PASTAT = 'OUT'
          TTSTAT = 'OUT'
          CC1STAT = 'IN'
          IGSTAT = 'OUT'
          HSSTAT = 'OUT'
          OGSTAT = 'OUT'
          TGSTAT = 'OUT'
          RSSTAT = 'OUT'
          CSSTAT = 'OUT'
          TB1STAT = 'OUT'
          TB57STAT = 'OUT'
          MSSTAT = 'IN'
          PGSTAT = 'OUT'
          EBSTAT = 'IN'
          DLPTL = 0.
          PPSTAT = 'OUT'
          T2STAT = 'OUT', 'IN', 'OUT'
          .MIN00    ''PERFORM PHASE 1/3 APPLIC PGM INIT    (NOT CODED)''
          .EGP18    ''SCHEDULE NEXT TIMER 2 FUNCTION''
          DFIL1, DFIL2, DFIL3 = 'INACTIVE'
          DFPHC = 'NOTCHANGE'
          UNLOCK ''UNLOCK PREVIOUSLY ENABLED INTERRUPTS''
          .NONINTSEQ1 ''PASS CONTROL TO PHASE 1/3 NON-INTERRUPT SEQ''
INP24.    CTSTAT = 'OUT'
          DTSTAT = 'OUT'
          DLPTL = 0.
          PPSTAT = 'IN'
          T2STAT = 'OUT', 'OUT', 'IN', 'IN', 'IN', 'OUT', 'OUT', 'IN'
          .MIN10    ''PERFORM PHASE 2/4 APPLIC PGM INIT    (NOT CODED)''
          .EGP18    ''SCHEDULE NEXT TIMER 2 FUNCTION''
          DFIL1, DFIL2, DFIL3 = 'INACTIVE'
          DFPHC = 'NOTCHANGE'
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          .NONINTSEQ2 ''PASS CONTROL TO PHASE 2/4 NON-INTERRUPT SEQ''
PROC      .EGP1          EXTERNAL  EXIT
PROC      .EGP15         EXTERNAL  EXIT
PROC      .EGP20         EXTERNAL  EXIT
PROC      .EGP18         EXTERNAL  EXIT
PROC      .MIN00         EXTERNAL  EXIT
PROC      .MIN10         EXTERNAL  EXIT
PROC      .NONINTSEQ1    EXTERNAL  EXIT
PROC      .NONINTSEQ2    EXTERNAL  EXIT
TERM      ''EGP0''
```

```
START     .EGP1      ''INTERRUPT PROCESSOR''
ENTRANCE  .EGP15     ''TIMER 1 SCHEDULER''
ENTRANCE  .EGP18     ''TIMER 2 SCHEDULER''
ENTRANCE  .EGP20     ''SYSTEM TIME UPDATE ROUTINE''
          DECLARE FIXED CONSTANT,
               KT1BIAS  0  = 9.,
               KT2BIAS  0  = 12.,
               K4SEC   -2  = 16253.968
ENDDATA
      ''                                                              ''
      ''RESPONSE FOR TLC INTERRUPT                                    ''
      ''                                                              ''
          ON TLCINT
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
               EX7INT,EX8INT,EX9INT
          READ CLOCK,DVTEX
          DFIL2,DFIL3 = 'ACTIVE'
          .MTS00     ''PROCESS TLC INTERRUPT                (NOT CODED)''
      ''THE TLC APPLICATION PROGRAM DOES NOT RETURN CONTROL           ''
          END
      ''                                                              ''
      ''RESPONSE FOR TIMER 1 INTERRUPT                                ''
      ''                                                              ''
          ON T1INT
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
               EX7INT,EX8INT,EX9INT
          READ CLOCK,DVTT1
          DFIL3 = 'ACTIVE'
          GOTO ( ,GP11,GP12,GP13,GP14,GP15,GP16,GP17,GP18,GP19) GST1M
          .MML00     ''FLIGHT SIMULATION MINOR LOOP''        GOTO EGP11
GP11.     .MML20     ''NORMAL MINOR LOOP''                   GOTO EGP11
GP12.     .MSS05     ''SWITCH SELECTOR CHECK''               GOTO EGP11
GP13.     .MSS30     ''SWITCH SELECTOR HUNG STAGE TEST''     GOTO EGP11
GP14.     .MSS40     ''SWITCH SELECTOR STAGE,ADDRESS ISSUE'' GOTO EGP11
GP15.     .MSS50     ''SWITCH SELECTOR VERIFY ADDRESS''      GOTO EGP11
GP16.     .MSS55     ''SWITCH SELECTOR READ TIME CHECK''     GOTO EGP11
GP17.     .MSS60     ''SWITCH SELECTOR READ ISSUANCE''       GOTO EGP11
GP18.     .MSS70     ''SWITCH SELECTOR RESET''               GOTO EGP11
GP19.     .MSS80     ''SWITCH SELECTOR COMPLEMENT STAGE,ADD''
EGP11.    .EGP15     ''SCHEDULE NEXT TIMER 1 FUNCTION''
          DFIL3 = 'INACTIVE'
          UNLOCK   ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
      ''                                                              ''
      ''RESPONSE FOR TIMER 2 INTERRUPT                                ''
      ''                                                              ''
          ON T2INT
          LOCK T2INT
          DFIL1 = 'ACTIVE'
          GO TO (EGP12,GP21,GP22,GP23,GP24,GP25,GP26,GP27,GP28,GP29,
                 GP30,GP31) DGST2
GP21.     .MUM00     ''TIME UPDATE            (NOT CODED) '' GOTO EGP12
GP22.     .MLP10     ''LADDER RAMP PROCESSOR  (NOT CODED) '' GOTO EGP12
GP23.     .MEP00     ''EVENTS PROCESSOR''                    GOTO EGP12
GP24.     .MTT10     ''TIME TILT GUIDANCE     (NOT CODED) '' GOTO EGP12
```

```
GP25.     .MNU00    ''NAVIGATION UPDATE IMPL (NOT CODED) '' GOTO EGP12
GP26.     .MEE00    ''TIME BASE 8 ENABLE     (NOT CODED) '' GOTO EGP12
GP27.     .MCM00    ''PHASE 2/4 CONTROL MOD  (NOT CODED) '' GOTO EGP12
GP28.     .MCM10    ''PHASE 2/4 CONTROL MOD  (NOT CODED) '' GOTO EGP12
GP29.     .MCM20    ''PHASE 2/4 CONTROL MOD  (NOT CODED) '' GOTO EGP12
GP30.     .MEPWM    ''WATER METHANOL ACTIVATE(NOT CODED) '' GOTO EGP12
GP31.     .MER00    ''EXTRA ACCELEROMETER RD (NOT CODED) ''
EGP12.    .EGP18    ''SCHEDULE NEXT TIMER 2 FUNCTION''
          DFIL1 = 'INACTIVE'
          UNLOCK T2INT
          END
      ''                                                              ''
      ''RESPONSE FOR EXTERNAL 2 INTERRUPT                             ''
      ''                                                              ''
          ON EX2INT
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
              EX7INT,EX8INT,EX9INT
          READ CLOCK,DVTEX    ''READ REAL TIME CLOCK''
          DFIL2 = DFIL3 = 'ACTIVE'
          .MDP28    ''SC INITIATION OF S2/S4B SEPARATION   (NOT CODED)''
          DFIL2 = DFIL3 = 'INACTIVE'
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
      ''                                                              ''
      ''RESPONSE FOR EXTERNAL 4 INTERRUPT                             ''
      ''                                                              ''
          ON EX4INT
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
              EX7INT,EX8INT,EX9INT
          READ CLOCK,DVTEX    ''READ REAL TIME CLOCK''
          DFIL2 = DFIL3 = 'ACTIVE'
          .MTB50    ''S4B ENGINE OUT                        (NOT CODED)''
          DFIL2 = DFIL3 = 'INACTIVE'
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
      ''                                                              ''
      ''RESPONSE FOR EXTERNAL 5 INTERRUPT                             ''
      ''                                                              ''
          ON EX5INT
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
              EX7INT,EX8INT,EX9INT
          READ CLOCK,DVTEX    ''READ REAL TIME CLOCK''
          DFIL2 = DFIL3 = 'ACTIVE'
          .MTB30    ''SIC OUTBOARD ENGINE OUT               (NOT CODED)''
          DFIL2 = DFIL3 = 'INACTIVE'
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
      ''                                                              ''
      ''RESPONSE FOR EXTERNAL 6 INTERRUPT                             ''
      ''                                                              ''
          ON EX6INT
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
              EX7INT,EX8INT,EX9INT
          READ CLOCK,DVTEX    ''READ REAL TIME CLOCK''
          DFIL2 = DFIL3 = 'ACTIVE'
```

```
          .MTB40    ''S2 PROPELLANT DEPLETION                (NOT CODED)''
          DFIL2 = DFIL3 = 'INACTIVE'
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
      ''                                                                  ''
      ''RESPONSE FOR EXTERNAL 8 INTERRUPT                                 ''
      ''                                                                  ''
          ON EX8INT
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
              EX7INT,EX8INT,EX9INT
          READ CLOCK,DVTEX    ''READ REAL TIME CLOCK''
          DFIL2 = DFIL3 = 'ACTIVE'
          .MDS00    ''PROCESS DCS INPUT''
          DFIL2 = DFIL3 = 'INACTIVE'
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
RETURN    ''EGP1''
EGP15.    READ CLOCK,TEMP
          TEMP1 = DVTMM + (TEMP - DVRTC LAND MSKRTC) SCL 0 + KT1BIAS
          CONDITIONS
               DVMLT LQ TEMP1              ,(Y,  ,  ,  )
               DVMLT LQ DVSST              ,(  , Y,  ,  )
               DVSST LQ TEMP1              ,(  ,  , Y, N)
          ACTIONS
               TEMP = 1                    ,(Y,  , Y,  )
               TEMP = (DVMLT - TEMP1) LSH 1,(  , Y,  ,  )
               TEMP = (DVSST - TEMP1) LSH 1,(  ,  ,  , Y)
               GST1M = DGMLM               ,(Y, Y,  ,  )
               GST1M = DGSSM               ,(  ,  , Y, Y)
          ELSE GOTO EGP150 ''THIS POINT SHOULD NEVER BE REACHED LOGICALLY''
          END
          WRITE TIM1,TEMP ''LOAD TIMER 1 WITH TIME-TO-GO FOR FUNCTION''
EGP150.   RETURN    ''EGP15''
EGP18.    DGST2 = 'T2S'
          DV2TG = DVTMM + K4SEC
          FOR I = 1 BY 1 UNTIL 12
               IF T2STAT(I) EQ 'OUT'       GOTO T2S10
               IF DLTTL(I) GR DV2TG        GOTO T2S10
               DGST2 = I
               DV2TG = DLTTL(I)
T2S10.    END
          LOCK T1INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,EX7INT
               EX8INT,EX9INT
          IF DV2TG LQ DVTMM                GOTO T2S20
          READ CLOCK,TEMP     ''READ REAL TIME CLOCK''
          TEMP = ((DV2TG - DVTMM) SCL 0 + DVERT - (TEMP - DVRTC LAND
                 MSKRTC) - KT2BIAS) SCL -1
          IF TEMP LQ 0
T2S20.    TEMP = 1
          WRITE TIM2,TEMP     ''LOAD TIMER 2''
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          RETURN    ''EGP18''
EGP20.    LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
               EX7INT,EX8INT,EX9INT
          READ CLOCK,TEMP1
```

```
          DVERT = TEMP1 - DVRTC LAND 3
          DVTMM = DVTMM + (TEMP1 - DVRTC LAND MSKRTC) RSH 2
          DVRTC = TEMP1 - DVERT
          DVTRR = DVTMM - DVTMR
          CONDITIONS
               DFIL3 EQ 'ACTIVE'                          ,(Y,  ,  )
               DFIL2 EQ 'ACTIVE'                          ,(  , Y,  )
               DFIL1 EQ 'ACTIVE'                          ,(  ,  , Y)
          ACTIONS
               UNLOCK T1INT                               ,(  , Y,  )
               UNLOCK ''RELEASE PREVIOUSLY ENABLED
                       INTERRUPTS EXCEPT TIMER 2''        ,(  ,  , Y)
               RETURN '' EXIT EGP20''                     ,(Y, Y, Y)
          ELSE UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
          RETURN     ''EGP20''
PROC      .MTS00     EXTERNAL        EXIT
PROC      .MML00     EXTERNAL        EXIT
PROC      .MML20     EXTERNAL        EXIT
PROC      .MSS05     EXTERNAL        EXIT
PROC      .MSS30     EXTERNAL        EXIT
PROC      .MSS40     EXTERNAL        EXIT
PROC      .MSS50     EXTERNAL        EXIT
PROC      .MSS55     EXTERNAL        EXIT
PROC      .MSS60     EXTERNAL        EXIT
PROC      .MSS70     EXTERNAL        EXIT
PROC      .MSS80     EXTERNAL        EXIT
PROC      .MUM00     EXTERNAL        EXIT
PROC      .MLR10     EXTERNAL        EXIT
PROC      .MEP00     EXTERNAL        EXIT
PROC      .MTT10     EXTERNAL        EXIT
PROC      .MNU00     EXTERNAL        EXIT
PROC      .MEE00     EXTERNAL        EXIT
PROC      .MCM00     EXTERNAL        EXIT
PROC      .MCM10     EXTERNAL        EXIT
PROC      .MCM20     EXTERNAL        EXIT
PROC      .MEPWM     EXTERNAL        EXIT
PROC      .MER00     EXTERNAL        EXIT
PROC      .MDP28     EXTERNAL        EXIT
PROC      .MTB50     EXTERNAL        EXIT
PROC      .MTB30     EXTERNAL        EXIT
PROC      .MTB40     EXTERNAL        EXIT
PROC      .MDS00     EXTERNAL        EXIT
TERM      ''EGP1''
```

SPL KERNEL 3 NON-INTERRUPT SEQUENCER

```
START     .NONINTSEQ1     ''NON-INTERRUPT SEQUENCER FOR PHASES 1 AND 3''
ENTRANCE  .NONINTSEQ2     ''NON-INTERRUPT SEQUENCER FOR PHASES 2 AND 4''
NIS1.     IF ARSTAT   EQ 'IN'      THEN .MAR00    .PERPROC       END
                                   ''ACCELEROMETER READ''
          IF SASTAT   EQ 'IN'      THEN .MSA00    .PERPROC       END
                                   ''SIMULATED ACCEL       (NOT CODED)''
          IF APSTAT   EQ 'IN'      THEN .MAP00    .PERPROC       END
                                   ''ACCELEROMETER PROCESSING''
          IF DVSTAT   EQ 'IN'      THEN .MDV00    .PERPROC       END
                                   ''F/M CALCULATIONS      (NOT CODED)''
          IF DPSTAT   EQ 'IN'      THEN .MDP00    .PERPROC       END
                                   ''DISCRETE PROCESSOR    (NOT CODED)''
          IF NESTAT   EQ 'IN'      THEN .MNE00    .PERPROC       END
                                   ''BOOST NAVIGATION      (NOT CODED)''
          IF TCSTAT   EQ 'IN'      THEN .MTC00    .PERPROC       END
                                   ''RESTART CALCULATIONS  (NOT CODED)''
          IF PASTAT   EQ 'IN'      THEN .MPA00    .PERPROC       END
                                   ''PHASE ACTIVATOR''
          IF TTSTAT   EQ 'IN'      THEN .MTT00    .PERPROC       END
                                   ''TIME TILT GUIDANCE    (NOT CODED)''
          IF CC1STAT  EQ 'IN'      THEN .MCC10    .PERPROC       END
                                   ''CHI COMPUTATIONS      (NOT CODED)''
          IF IGSTAT   EQ 'IN'      THEN .MIG00    .PERPROC       END
                                   ''ITERATIVE GUIDANCE MODE''
          IF HSSTAT   EQ 'IN'      THEN .MHS00    .PERPROC       END
                                   ''S4B CUTOFF PREDICTION (NOT CODED)''
          IF OGSTAT   EQ 'IN'      THEN .MOG00    .PERPROC       END
                                   ''ORBITAL GUIDANCE      (NOT CODED)''
          IF TGSTAT   EQ 'IN'      THEN .MTG00    .PERPROC       END
                                   ''TARGET UPDATE         (NOT CODED)''
          IF RSSTAT   EQ 'IN'      THEN .MRS00    .PERPROC       END
                                   ''TIME-TO-GO TO RESTART (NOT CODED)''
          IF CSSTAT   EQ 'IN'      THEN .MCS00    .PERPROC       END
                                   ''TIME BASE 6 CHECK     (NOT CODED)''
          IF TB1STAT  EQ 'IN'      THEN .MTB10    .PERPROC       END
                                   ''TIME BASE 1           (NOT CODED)''
          IF TB57STAT EQ 'IN'      THEN .MTB57    .PERPROC       END
                                   ''TIME BASE 5/7         (NOT CODED)''
          IF MSSTAT   EQ 'IN'      THEN .MMS00    .PERPROC       END
                                   ''MINOR LOOP SUPPORT    (NOT CODED)''
          IF PGSTAT   EQ 'IN'      THEN .MPG00    .PERPROC       END
                                   ''SIM PLATFORM GIM ANGLE(NOT CODED)''
          IF EBSTAT   EQ 'IN'      THEN .MEB00    .PERPROC       END
                                   ''ETC/BTC               (NOT CODED)''
          GOTO NIS1
NONINTSEQ2. IF CTSTAT EQ 'IN'      THEN .MCT00    .PERPROC       END
                                   ''DATA COMPRESSION TELEM(NOT CODED)''
            IF DTSTAT EQ 'IN'      THEN .MDT00                   END
                                   ''SECTOR DUMP TELEMETRY (NOT CODED)''
            .PERPROC     ''INSURE PERIODIC PROCESSOR GETS EXECUTED''
            GOTO NONINTSEQ2
PROC      .MCT00    EXTERNAL  EXIT
PROC      .MDT00    EXTERNAL  EXIT
PROC      .MAR00    EXTERNAL  EXIT
PROC      .MSA00    EXTERNAL  EXIT
```

```
PROC      .MAP00    EXTERNAL  EXIT
PROC      .MDV00    EXTERNAL  EXIT
PROC      .MDP00    EXTERNAL  EXIT
PROC      .MNE00    EXTERNAL  EXIT
PROC      .MTC00    EXTERNAL  EXIT
PROC      .MPA00    EXTERNAL  EXIT
PROC      .MTT00    EXTERNAL  EXIT
PROC      .MCC10    EXTERNAL  EXIT
PROC      .MJG00    EXTERNAL  EXIT
PROC      .MHS00    EXTERNAL  EXIT
PROC      .MOG00    EXTERNAL  EXIT
PROC      .MTG00    EXTERNAL  EXIT
PROC      .MRS00    EXTERNAL  EXIT
PROC      .MCS00    EXTERNAL  EXIT
PROC      .MTB10    EXTERNAL  EXIT
PROC      .MTB57    EXTERNAL  EXIT
PROC      .MMS00    EXTERNAL  EXIT
PROC      .MPG00    EXTERNAL  EXIT
PROC      .MEB00    EXTERNAL  EXIT
PROC      .PERPROC  EXTERNAL  EXIT
TERM      ''NONINTSEQ1''
```

```
START     .PERPROC        ''PERIODIC PROCESSOR''
          ITEM VPPOT FIXED 0
ENDDATA
          READ CLOCK,TEMP      ''READ REAL TIME CLOCK''
          DVPTG = (TEMP - VPPOT LAND MSKRTC) RSH 2
          VPPOT = TEMP
          FOR I = 0 BY 1 UNTIL 3
               IF PPSTAT(I) EQ 'OUT'          GOTO PP20
               DLPTL(I) = DLPTL(I) + DVPTG
               IF DLPTL(I) LS DLPRL(I)        GOTO PP20
               GOTO ( , PP1, PP2, *) I
               .MPC50     '' 50 SEC DATA COMP (NOT CODED)'' GOTO PP10
PP1.           .MPC60     '' 60 SEC DATA COMP (NOT CODED)'' GOTO PP10
PP2.           .MPC99     ''100 SEC DATA COMP (NOT CODED)''
PP10.          DLPTL(I) = 0
PP20.     END
          RETURN          ''PERPROC''
PROC      .MPC50     EXTERNAL  EXIT
PROC      .MPC60     EXTERNAL  EXIT
PROC      .MPC99     EXTERNAL  EXIT
TERM      ''PERPROC''
```

```
START     .MEP00          ''EVENTS PROCESSOR TIMER 2 ENTRY''
ENTRANCE  .MEP05          ''EVENTS PROCESSOR TIME BASE CHANGE ENTRY''
ENTRANCE  .MEP10          ''EVENTS PROCESSOR RESCHEDULE ENTRY''
      ''                                                              ''
      ''  EVENTS PROCESSOR TABLE  (THROUGH THE END OF TIME BASE 3)    ''
      ''                                                              ''
      ''    THE POINTERS WITH A VALUE OF ZERO ARE TO BE SET DURING    ''
      ''    PROGRAM EXECUTION OR ARE USED TO DISABLE THE EXECUTION    ''
      ''    OF THE EVENTS PROCESSOR FOR THE REMAINDER OF A TIME BASE. ''
      ''                                                              ''
          TABLE EPTABLE 131 S 2 (EPTPTR LOCATION, EPTTIM FIXED 13)
          PRESET EPTABLE = (LOC'LE285.'    0.0   ''START OF TB0 TABLE''
                            0              16.0
                            0              17.0
                            0              17.5
                            0               0.0
                            LOC'LE25.'      0.0   ''START OF TB1 TABLE''
                            LOC'LE30.'      1.0
                            0               6.0
                            LOC'LE35.'      9.0
                            LOC'LE40.'     10.0
                            0              14.0
                            LOC'LE50.'    134.7
                            0               0.0
                            LOC'LE55.'      0.0   ''START OF TB2 TABLE''
                            0               0.0
                            0              18.4
                            0              27.5
                            0               0.0
                            LOC'LE75.'      0.0   ''START OF TB3 TABLE''
                            LOC'LE70.'      0.0
                            LOC'LE250.'     0.0
                            0               0.0
                            LOC'LE355.'     0.0
                            LOC'LE365.'     0.0
                            LOC'LE82.'      1.4
                            LOC'LE100.'     4.4
                            LOC'LE95.'      4.4
                            LOC'LE90.'      6.7
                            0               6.7
                            LOC'LE96.'      6.7
                            LOC'LE105.'    40.6
                            LOC'LE115.'    40.6
                            LOC'LE111.'    58.6
                            LOC'LE110.'    60.6
                            0             299.0
                            0             355.0
                            0             388.5
                            0               0.0)
          ITEM VTOLD FIXED 13
          ITEM EPTINDX INTEGER
          ARRAY EPTTBINDX(10) INTEGER CONSTANT = (0 5 13 18 38 55 71 93
                                                  107 110)
ENDDATA
EP00.     IF DFTBCEP EQ 'CHANGE'
```

```
EP04A.          THEN DFTBCEP = 'NOCHANGE'
                     GOTO EP02
                END
                GOTO EPTPTR(EPTINDX) ''EXECUTE REQUIRED MODULE  (NONE CODED)''
EPRET.          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
                     EX7INT,EX8INT,EX9INT
                IF DFTBCEP EQ 'CHANGE'          GOTO EP04A
                EPTINDX = EPTINDX + 1
                DQST2 = 'EP00'
                IF FPTPTR(EPTINDX) NQ 0         GOTO EP03
                T2STAT(DQST2) = 'OUT'
                IF DFIL1 EQ 'INACTIVE' .EGP07 ''RESCHEDULE TIMER2(NOT CODED)''
EP02.           UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
                RETURN     ''MEP00''
EP03.           IF EPTTIM(EPTINDX) EQ VTOLD
                     THEN UNLOCK ''REL PREV ENABLED INTERRUPTS''
                          GOTO EP00
                END
                VTOLD = EPTTIM(EPTINDX)
                DLTTL(DQST2) = DVTMR + VTOLD*4063.492A10
                GOTO EP02
MEP05.          EPTINDX = EPTTBINDX(DTBID) - 1
MEP10.          EPTINDX = EPTINDX + 1
                DQST2 = 'EP00'
                IF EPTPTR(EPTINDX) NQ 0         GOTO EP08
                T2STAT(DQST2) = 'OUT'
EP20.           IF DFIL1 EQ 'INACTIVE' .EGP07 ''RESCHEDULE TIMER2(NOT CODED)''
                RETURN          ''MEP05, MEP10''
EP08.           VTOLD = EPTTIM(EPTINDX)
                DLTTL(DQST2) = DVTMR + VTOLD*4063.492A10
                T2STAT(DQST2) = 'IN'
                GOTO EP20
PROC            .EGP07          EXTERNAL  EXIT
TERM            ''MEP00''
```

```
START     .MIG00    ''ITERATIVE GUIDANCE MODE''
      ''DUE TO THE SIZE OF IGM, ONLY A SECTION OF IT HAS BEEN CODED.  ''
      ''PART OF THE GUIDANCE COMPUTATIONS HAVE BEEN SELECTED TO DEMON-''
      ''STRATE MATHEMATICAL OPERATIONS.  THE PHASING PORTION OF IGM   ''
      ''HAS NOT BEEN CODED SINCE SIMILAR CAPABILITIES ARE ILLUSTRATED ''
      ''BY OTHER KERNELS.                                             ''
      ''                                                              ''
          DECLARE ARRAY (3) FLOATING R, GS, GV, GVT, GVSTAR,
                                        RS, RV, R4, RVT,
                                        VS, VV, V4, VVT, DELTAVVP,
                                        MS4 (3,3), M4V (3,3)
          DECLARE STATUS, CHIBARSTEER (INPROG, NOTINPROG),
                          PHASE (BURN1, BURN2),
                          REITERATE (YES, NO),
                          SMCFLAG (CALCULATE, NOCALC),
                          S4BURN (BURN1, BURN2)
          DECLARE FLOATING R, L1, L2, L12, L3, L3P, LYP, DELTAL3,
                              J1, J2, J12, J3, J3P,
                              Q1, Q2, Q12,
                              P1, P2, P12,
                              S1, S2, S12,
                              U1, U2, U12,
                              T1I, T2I, T3I, T1C, TCI, TSTAR,
                              TAU1, TAU2, TAU3,
                              VEX1, VEX2, VEX3, ROVEX3,
                              K1, K2, K3, K4,
                              PHII, PHIT, PHIIT, DPHII, DPHIT,
                              DELTA2, EPSILON2, EPSILON3,
                              SINTHETA, COSTHETA, THETAT,
                              GT, R, RT, V, VT
          DECLARE FLOATING CONSTANT, KT    = .48497964E-7,
                                     KMU   = -.39860320E15,
                                     KCCT4 = 1.53,
                                     KCCT8 = 1.55
ENDDATA
      ''                                                              ''
      '' IG251 - IGM GUIDANCE PARAMETERS COMPUTATIONS                 ''
      ''                                                              ''
      '' ROTATE POSITION AND VELOCITY INTO TARGET PLANE               ''
      ''                                                              ''
IG253.    R4 = MS4*RS
          .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
          WRITE TELX4,R4(0)   ''TELEMETER X POSITION IN 4 SYSTEM''
          .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
          WRITE TELY4,R4(1)   ''TELEMETER Y POSITION IN 4 SYSTEM''
          UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE''
          V4 = MS4*VS
          .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
          WRITE TELZ4,R4(2)   ''TELEMETER Z POSITION IN 4 SYSTEM''
          .UTR02    ''DELAY FOR TELEMETRY AS REQUIRED''
          WRITE TELYD4,V4(1)  ''TELEMETER Y VELOCITY IN 4 SYSTEM''
          UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE''
      ''                                                              ''
      '' CALCULATE RANGE ANGLE MEASURED IN ORBIT PLANE                ''
      ''                                                              ''
```

```
IG254.    IF T2I EQ 0.
               THEN L12,J12,S12,Q12,P12,U12 = 0.
                    GOTO IG259
          END
          IF T1I EQ 0.
               THEN L1,J1,S1,Q1,P1,U1 = 0.
                    GOTO IG258
          END
          L1 = VEX1*.LOG(TAU1/(TAU1 - T1I))
          J1 = L1*TAU1 - VEX1*T1I
          S1 = L1*T1I - J1
          Q1 = S1*TAU1 - .5*VEX1*T1I**2
          P1 = J1*TAU1 - .5*VEX1*T1I**2
          U1 = Q1*TAU1 - VEX1*T1I**3/6.
IG258.    L2 = VEX2*.LOG(TAU2/(TAU2 - T2I))
          J2 = L2*TAU2 - VEX2*T2I
          S2 = L2*T2I - J2
          Q2 = S2*TAU2 - .5*VEX2*T2I**2
          P2 = J2*TAU2 - .5*VEX2*T2I**2
          U2 = Q2*TAU2 - VEX2*T2I**3/6.
          L12 = L1 + L2
          J12 = J1 + J2 + L2*T1I
          S12 = S1 - J2 + L12*(T2I + TCI)
          Q12 = Q1 + Q2 + S2*T1I + J1*T2I
          P12 = P1 + P2 + T1I*(2.*J2 + L2*T1I)
          U12 = U1 + U2 + T1I*(2.*Q2 + S2*T1I) + T2I*P1
IG259.    L3P = VEX3*.LOG(TAU3/(TAU3 - T3I))
          LYP = L12 + L3P
          J3P = L3P*TAU3 - VEX3*T3I
          T1C = T1I + T2I + TCI
          TSTAR = T1C + T31
          PHII = .ATAN(R4(2),R4(0))
     ''                                                              ''
     ''DETERMINE PHASE                                               ''
     ''                                                              ''
IG260.    IF PHASE EQ 'BURN2'  ''OUT OF ORBIT''
IG262.         THEN ''CALCULATE TERMINAL CONDITIONS''
                    SINTHETA = RS*VS/(R*V)
                    COSTHETA = .SQRT(1. - SINTHETA**2)
                    DPHII = V/R*COSTHETA
                    DPHIT = VT/RT*.COS(THETAT)
                    PHIIT = .5*(DPHII + DPHIT)*TSTAR
                    PHIT = PHII + PHIIT
                    .UTR02    ''DELAY FOR TELEMETRY AS REQUIRED''
                    WRITE TELPHIT,PHIT  ''TELEMETER TERMINAL RANGE ANGLE''
                    UNLOCK ''RELEASE INT LOCKED BY TELEM DELAY ROUTINE''
                    IF TSTAR LQ EPSILON3                GOTO IG269
                    .MIG30 ''CALC TERM RAD, VEL, FLT ANGLE (NOT CODED)''
                    GT= -KMU/RT**2
                    .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
                    WRITE TELGT,GT      ''TELEMETER TERMINAL GRAVITY VECT''
                    UNLOCK ''RELEASE INT LOCKED BY TELEM DELAY ROUTINE''
                    GVT  =   GT*.COS(THETAT), 0, GT*.SIN(THETAT)
                    RVT = RT*.COS(THETAT), 0, 0
IG269.              PHIT = PHIT - THETAT
```

```
            ELSE ''CALCULATE INTERMEDIATE PARAMETERS''
                 DELTA2 = V*TSTAR - J3P + LYP*T3I - ROVEX3*((TAU1 -
                          T1I)*L1 + (TAU2 - T2I)*L2 + (TAU3 - T3I)
                          *L3P)*(LYP + V - VT)
                 PHIIT = KT*(S12 + DELTA2)  ''KT = COSTHETAT/RT''
                 PHIT = PHII + PHIIT
                 .UTR02    ''DELAY FOR TELEMETRY AS REQUIRED''
                 WRITE TELPHIT,PHIT  ''TELEMETER TERMINAL RANGE ANGLE''
                 UNLOCK ''RELEASE INT LOCKED BY TELEM DELAY ROUTINE''
        END
      ''                                                              ''
      ''ROTATE POSITION, VELOCITY, GRAVITY TO INJECTION SYSTEM        ''
      ''                                                              ''
IG291.  M4V = .COS(PHIT), 0., .SIN(PHIT),
                  0.,     1.,      0.,
            -.SIN(PHIT), 0., .COS(PHIT)
        RV = M4V*R4
        VV = M4V*V4
        GV = M4V*MS4*GS
        GVSTAR = .5*(GVT + GV)
        DELTAVVP = VVT - VV - TSTAR*GVSTAR
      ''                                                              ''
      '' IG314 - CALCULATE TIME TO GO                    (NOT CODED)''
      ''                                                              ''
        IF REITERATE EQ 'YES'
            THEN REITERATE = 'NO'
                 L3P = L3
                 J3P = J3
                 LYP = LYP + DELTAL3
                 GOTO IG260
        END
        REITERATE = 'YES'
      ''                                                              ''
      '' IG324 - COMPUTE CORRECTED VELOCITIES TO BE GAINED (NOT CODED)''
      ''                                                              ''
      '' IG326 - CALCULATE DESIRED PITCH AND YAW          (NOT CODED)''
      ''                                                              ''
        IF CHIBARSTEER EQ 'INPROG'          GOTO IG350
        IF TSTAR GQ EPSILON2                GOTO IG360
        IF S4BURN EQ 'BURN1'
            THEN DVMC5 = DVMC5 LXOR MSKMC5CBS
                 DVMLR = 25.*KCCT4
                 DV1MR = .04/KCCT4
            ELSE DVMC6 = DVMC6 LXOR MSKMC6CBS
                 DVMLR = 25.*KCCT8
                 DV1MR = .04/KCCT8
        END
IG340.  CHIBARSTEER = 'INPROG'
IG350.  K1,K2,K3,K4 = 0
        GOTO IG440
      ''                                                              ''
IG360.''IG361 - COMPUTE INTERMEDIATE PARAMETERS             (NOT CODED)''
      ''                                                              ''
IG440.  .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
        WRITE TELT3I,T3I    ''TELEMETER T3I''
```

```
        UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE''
    ''                                                                  ''
    ''IG446 - COMPUTE PITCH AND YAW IN 4-SYSTEM          (NOT CODED)''
    ''                                                                  ''
        IF SMCFLAG EQ 'CALCULATE' .MSM00 ''COMP SMC TERMS(NOT CODED)''
        .MCC00  ''PERFORM CHI COMPUTATIONS               (NOT CODED)''
        IF DFILE LAND MSKFPSINT2
            .EGP32(MSKSCC0) ''ENABLE INTERRUPT 2         (NOT CODED)''
        RETURN ''MIG00''
PROC    .MSM00    EXTERNAL  EXIT
PROC    .MCC00    EXTERNAL  EXIT
PROC    .EXP32 (MASK)  EXTERNAL
        ITEM MASK LOGICAL
EXIT
TERM    ''MIG00''
```

```
START     .MDS00    ''DIGITAL COMMAND SYSTEM''
          DECLARE INTEGER, DCSDATACOUNT,
                           DCSERLIM CONSTANT = 7,
                           VDSRC
          DECLARE LOGICAL, VDS01,
                           VDSER,
                           VDSSB
          DECLARE LOGICAL CONSTANT, DCSER04  =0'040000000',
                                    DCSER10  =0'100000000',
                                    DCSER14  =0'140000000',
                                    DCSER20  =0'200000000',
                                    DCSER24  =0'240000000',
                                    DCSER44  =0'440000000',
                                    DCSER60  =0'600000000',
                                    DCSER64  =0'640000000',
                                    DCSER74  =0'740000000'
          DECLARE STATUS, FDSEN (MODE,DATA),
                          FDSPG (INPROG,NOTINPROG),
                          FDSRE (TERM,NOTERM),
                          DCSINDX (ILLEGAL,TRUP,NAVUP,GENSS,SECDMP,
                                   TELSML,TERM,M5UP,M5IN,TARGUP,SWANO,
                                   SWANLO,SWANHI,INWCVL,TB8EN,EXMANA,
                                   TDEEN,EXMANB,S4LI,ALTSEQ6D)
          DECLARE ARRAY (20), DCSMSTAT STATUS (ACTIVE,INACTIVE),
                              DCSSTCOD LOGICAL CONSTANT,
                              DCSDATCT INTEGER CONSTANT,
                              DCSMODE (64) INTEGER CONSTANT,
                              VDSBL (35) LOGICAL
          PRESET DCSSTCOD=(0'000000000' 0'100000000' 0'110000000'
                           0'120000000' 0'130000000' 0'140000000'
                           0'200000000' 0'220000000' 0'050000000'
                           0'310000000' 0'770000000' 0'770000000'
                           0'770000000' 0'450000000' 0'170000000'
                           0'330000000' 0'600000000' 0'340000000'
                           0'520000000' 0'250000000'),
                  DCSDATCT=(0 1 35 2 2 3 3(0) 35 8(0) 6 0),
                  DCSMODE =(5(0) 8 2(0) 1 2 3 4 5 2(0) 14 6 0 7 2(0) 19
                           3(0) 9 0 15 17 8(0) 13 4(0) 18 10 11 12 2(0)
                           16 15(0))
ENDDATA
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          READ DIR,TEMP       ''READ DISCRETE INPUT REGISTER''
          READ DCS,VDS01      ''READ DCS INPUT REGISTER''
          IF TEMP LAND MSKDCSMODE EQ 0       GOTO DS60
     ''                                                              ''
     '' PROCESS DCS MODE COMMAND                                     ''
     ''                                                              ''
DS09.     CONDITIONS
               (VDS01 LSH 7 LXOR VDS01) LAND MSKDCSCOMP
                    EQ MSKDCSCOMP                          ,(Y, N,  ,  ,  )
               VDS01 LAND MSKDCSSB EQ 0                    ,(Y,  , N,  ,  )
               VDS01 LAND MSKDCSMC EQ MSKDCSTERM           ,(N,  ,  ,  ,  )
               FDSEN EQ 'MODE'                             ,(Y,  ,  , N,  )
               DFDTL NQ 'INPROG' AND FDSPG NQ 'INPROG',(Y,  ,  ,  , N)
          ACTIONS
```

```
                VDSER  = DCSER10                          ,(  ,  Y,  ,  ,  )
                VDSER  = DCSER24                          ,(  ,  ,  Y,  ,  )
                VDSER  = DCSER20                          ,(  ,  ,  ,  Y,  )
                VDSER  = DCSER64                          ,(  ,  ,  ,  ,  Y)
                GOTO DS220                                ,(  ,  Y,  Y,  Y,  Y)
                GOTO DS20                                 ,(Y,  ,  ,  ,  )
           ELSE GOTO DS25
           END
DS20.      FDSPG = 'INPROG'
DS25.      DCSINDX = DCSMODE(VDS01 RSH 20)
           IF DCSMSTAT(DCSINDX) EQ 'INACTIVE'
                THEN FDSPG = 'NOTINPROG'
                     VDSER = DCSER74
                     GOTO DS220
           END
         ''TELEMETER STATUS CODE TWICE''
           .UTR24     ''DELAY FOR TELEMETRY AS REQUIRED''
           WRITE TELDCSSC,DCSSTCOD(DCSINDX)
           .UTR24     ''DELAY FOR TELEMETRY AS REQUIRED''
           WRITE TELDCSSC,DCSSTCOD(DCSINDX)
           UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE''
           GOTO DS200      ''ISSUE CRP''
           DCSDATACOUNT, VDSSB = 0
           GOTO DS100
         ''                                                              ''
         '' PROCESS DCS DATA WORD                                        ''
         ''                                                              ''
DS60.      CONDITIONS
                FDSEN EQ 'DATA'                           ,(Y, N,  )
                (VDS01 LSH 7 LXOR VDS01) LAND MSKDCSCOMP
                     EQ MSKDCSCOMP                        ,(Y,  , N)
                VDS01 LAND MSKDCSSB EQ VDSSB              ,(Y,  ,  )
           ACTIONS
                GOTO DS110                                ,(Y,  ,  )
                VDSER = DCSER04                           ,(  , Y,  )
                VDSER = DCSER44                           ,(  ,  , Y)
           ELSE VDSER = DCSER60
           END  GOTO DS220
DS110.''TELEMETER DATA WORD TWICE''
           .UTR24     ''DELAY FOR TELEMETRY AS REQUIRED''
           WRITE TELDCSDW,VDS01
           .UTR24     ''DELAY FOR TELEMETRY AS REQUIRED''
           WRITE TELDCSDW,VDS01
           UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE''
           GOTO DS200          ''ISSUE CRP''
           VDSBL(DCSDATACOUNT) = VDS01 LAND MSKDCSMC
           VDSSB = VDSSB LXOR MSKDCSSB
           DCSDATACOUNT = DCSDATACOUNT + 1
DS100.     IF DCSDATACOUNT LS DCSDATCT(DCSINDX)
                RETURN     ''MDS00,    MORE DATA IS TO BE RECEIVED''
           GOTO (,DS01,DS02,DS03,DS04,DS05,DS06,DS07,DS08,DS09A,DS10,DS11,
                  DS12,DS13,DS14,DS15,DS16,DS17,DS18,DS19) DCSINDX
           FDSPG = 'NOTINPROG'
           VDSER = DCSER14
           GOTO DS220
```

```
DS01.     .DS260              ''TIME BASE UPDATE  (NOT CODED)'' GOTO DS530
DS02.     .DS330 (= DS235.)   ''NAVIGATION UPDATE (NOT CODED)'' GOTO DS530
DS03.     .DS380 (= DS220.)   ''GENERALIZED SS    (NOT CODED)'' GOTO DS530
DS04.     .DS430              ''SECTOR DUMP       (NOT CODED)'' GOTO DS530
DS05.     .DS470              ''SINGLE MEM LOC TEL(NOT CODED)'' GOTO DS530
DS06.     .DS510              ''TERMINATE         (NOT CODED)'' GOTO DS530
DS07.     .DS540              ''MANEUVER UPDATE   (NOT CODED)'' GOTO DS530
DS08.     .DS550              ''MANEUVER INHIBIT  (NOT CODED)'' GOTO DS530
DS09A.    .DS670 (= DS235.)   ''TARGET UPDATE     (NOT CODED)'' GOTO DS530
DS10.     .DS700              ''ANTENNA TO OMNI   (NOT CODED)'' GOTO DS530
DS11.     .DS720              ''ANTENNA TO LOW    (NOT CODED)'' GOTO DS530
DS12.     .DS740              ''ANTENNA TO HIGH   (NOT CODED)'' GOTO DS530
DS13.     .DS770              ''INHIBIT WATER CONT(NOT CODED)'' GOTO DS530
DS14.     .DS790              ''TIME BASE 8 ENABLE(NOT CODED)'' GOTO DS530
DS15.     .DS810              ''EXECUTE MANEUVER A(NOT CODED)'' GOTO DS530
DS16.     .DS840              ''TD AND E ENABLE   (NOT CODED)'' GOTO DS530
DS17.     .DS860              ''EXECUTE MANEUVER B(NOT CODED)'' GOTO DS530
DS18.     .DS900              ''S4B/IU LUNAR IMPCT(NOT CODED)'' GOTO DS530
DS19.     .DS960              ''ENABLE TB6D ALT SQ(NOT CODED)'' GOTO DS530
      ''                                                                ''
      '' PROCESS DCS ERROR CONDITION                                    ''
      ''                                                                ''
DS220.    VDSRC = VDSRC + 1
          IF VDSRC LS DCSERLIM
               THEN FDSRE = 'NOTERM'
               ELSE FDSRE = 'TERM'
          END
          VDSER = VDSER + VDSRC + (VDS01 RSH 12 LAND MSKDCSER)
DS235.''TELEMETER ERROR CODE TWICE''
          .UTR24    ''DELAY FOR TELEMETRY AS REQUIRED''
          WRITE TELDCSEC,VDSER
          .UTR24    ''DELAY FOR TELEMETRY AS REQUIRED''
          WRITE TELDCSEC,VDSER
          UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE''
          IF FDSRE EQ 'NOTERM'
               RETURN    ''MDS00''
DS530.    VDSRC = 0
          FDSEN = 'MODE'
          FDSPG = 'NOTINPROG'
          RETURN    ''MDS00''
CLOSE     DS200     ''ISSUE DCS COMMAND RESET PULSE''
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
               EX7INT,EX8INT,EX9INT
          WRITE DOS,MSKDSCDO  ''RESET COMMAND RECEIVER''
          FOR I = 35 WHILE I GR 0       ''DELAY 4.13 MS''
               I = I - 1
          END
          WRITE DOR,MSKDCSDO  ''RESET THE RESET COMMAND''
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
EXIT      ''DS200''
TERM      ''MDS00''
```

```
                    SPL   KERNEL  8     ACCELEROMETER PROCESSING

START       .MAR00     ''ACCELEROMETER READ ROUTINE''
ENTRANCE    .MAP00     ''ACCELEROMETER PROCESSING ROUTINE''
            DECLARE FLOATING R, KSN2D CONSTANT =.0348994697,''SIN 2 DEG''
                                COSTHY,
                                COSTHZ,
                                SINTHY,
                                SINTHZ,
                                VACZR
            ARRAY VPOV (3) FIXED 7
            DECLARE FIXED, DELTA    7  ,
                           VCCYA   25 R,
                           VCCYZ   25 R,
                           VOACT 28 -2
            DECLARE ARRAY (3) LOGICAL, VOAC,
                                       MSKAPDG CONSTANT =(OCT'040000000'
                                                          OCT'010000000'
                                                          OCT'200000000'),
                                       MSKAPOF CONSTANT =(OCT'000000010'
                                                          OCT'000000200'
                                                          OCT'000000020')
ENDDATA
            LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
                 EX7INT,EX8INT,EX9INT
            READ XACC,DVAC(0)    ''READ X ACCELEROMETER''
            READ YACC,DVAC(1)    ''READ Y ACCELEROMETER''
            READ ZACC,DVAC(2)    ''READ Z ACCELEROMETER''
            READ CLOCK,DVACT     ''READ REAL TIME CLOCK''
            .UTR00     ''DELAY FOR TELEMETRY AS REQUIRED''
            WRITE TELTI,DVTI      ''TELEMETER START TIME OF CURRENT TIME BASE''
            TEMP = DVTAS
            VOACT = DVTMM + (DVACT - DVRTC - DVERT LAND MSKRTC) SCL 0
            DVTAS = .24609375E-3 * VOACT
            DVTB = DVTAS - DVTI
            DVDT = DVTAS - TEMP
            .UTR00     ''DELAY FOR TELEMETRY AS REQUIRED''
            WRITE TELTB,DVTB      ''TELEMETER TIME IN CURRENT TIME BASE''
            DVMC4 = DVMC4 LAND MSKRTCRESET
            UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
            .UTR00     ''DELAY FOR TELEMETRY AS REQUIRED''
            WRITE TELXAC,DVAC(0) ''TELEMETER X ACCELEROMETER READING''
            .UTR00     ''DELAY FOR TELEMETRY AS REQUIRED''
            WRITE TELYAC,DVAC(1) ''TELEMETER Y ACCELEROMETER READING''
            UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE''
            IF ''TIME BASE 1'' DKT1 EQ 0. ''NOT SET''
                 THEN DVFMC = - DVG(0)
                 ELSE DVMAS = DVMAS - DVEOF*DVMFR*DVDT
                      DVFMC = DVEOF*DVFOR/DVMAS
            END
      ''                                                              ''
      ''COMPUTE AVERAGE CHI'S FOR SMC CALCULATIONS                    ''
      ''                                                              ''
AR41.       DVCA(2) =  DVCC(2) RSH 1 + VCCZA RSH 1
            VCCZA = DVCC(2)
            DVCA(1) =  DVCC(1) RSH 1 + VCCYA RSH 1
            IF ABS(DVCC(1) - VCCYA) GQ .5A25
```

```
            DVCA(1) = DVCA(1) + MSK180DEG
        VCCYA = DVCC(1)
        .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
        WRITE TELZAC,DVAC(2) ''TELEMETER Z ACCELEROMETER READING''
        UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE''
    ''                                                              ''
    ''COMPUTE CHANGES BETWEEN CURRENT AND PREVIOUS ACCELEROMETER    ''
    ''READINGS                                                      ''
    ''                                                              ''
AR100.  DVDA = ((DVAC LAND MSKACCELA) - (VOAC LAND MSKACCELA)) RSH 7
        DVDR = ((DVAC LAND MSKACCELB) - (VOAC LAND MSKACCELB)) LSH 14)
               RSH 7
        VOAC = DVAC
        .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
        WRITE TELRTC,DVACT   ''TELEMETER REAL TIME CLOCK AT ACCEL READ''
        UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE''
    ''                                                              ''
    ''COMPUTE THE EXPECTED VELOCITY CHANGES                         ''
    ''                                                              ''
AR71.   .USC00 (DVTH(2) = SINTHZ COSTHZ)   ''SIN/COS     (NOT CODED)''
        .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
        WRITE TELTAS,DVTAS   ''TELEMETER MISSION ELAPSED TIME''
        UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE''
        .USC00 (DVTH(1) = SINTHY,COSTHY)   ''SIN/COS     (NOT CODED)''
        DVD = 20.*DVDT*(COSTHY*COSTHZ, SINTHZ, -SINTHY*COSTHZ)
        DVF = DVFOM*DVD
        RETURN    ''MAR00''
MAP00.  DVVSQ = 0.
        VACZR = 20.*DVFOM*DVDT*KSN2D
        FOR I = 0 BY 1 UNTIL 3
AP400.      IF ABS(DVDA(I) - DVDB(I)) LQ 2.A7  GOTO AP450
            IF ABS(DVDA(I) - DVF(I)) LS ABS(DVDR(I) - DVF(I))
                GOTO AP440
            DVMC4 = DVMC4 LOR MSKAPDG(I) LSH 1
            DELTA = DVDR(I)
            GOTO AP460
AP440.      DVMC4 = DVMC4 LOR MSKAPDG(I)
AP450.      DELTA = DVDA(I)
AP460.      IF ABS(DELTA) GR 1.A7    GOTO AP500
            IF DFZER EQ 'DISABLE'    GOTO AP500
            IF ABS(DVF(I)) LS VACZR  GOTO AP500
AP470.      DVMC4 = DVMC4 LOR MSKAPOF(I)
AP530.      DVMC4 = DVMC4 LOR MSKAPDG(I) LOR MSKAPDG(I) LSH 1
            DFSMC = 'DISABLE'
            DELTA = DVFMC*DVD(I)
            GOTO AP520
AP500.      IF DVF(I) LS 0.
                THEN IF DELTA LS 1.5*DVF(I) - DVRC(I)*DVDT
                     OR DELTA GR  .5*DVF(I) + DVRC(I)*DVDT GOTO AP530
                ELSE IF DELTA GR 1.5*DVF(I) + DVRC(I)*DVDT
                     OR DELTA LS  .5*DVF(I) - DVRC(I)*DVDT GOTO AP530
            END
AP510.      DVVSQ = DVVSQ + DELTA**2
AP520.      VPOV(I) = VPOV(I) + DELTA
            DVDM(I) = .05*VPOV(I)
```

```
                    SPL   KERNEL  8     ACCELEROMETER PROCESSING

                .UTR01 ''DELAY FOR TELEMETRY AS REQUIRED''
                GOTO (AP521, AP522, AP523, *) I
AP521.          WRITE TELXDM,DVDM(0) ''TELEMETER X MEASURED VELOCITY''
                GOTO AP524
AP522.          WRITE TELYDM,DVDM(1) ''TELEMETER Y MEASURED VELOCITY''
                GOTO AP524
AP523.          WRITE TELZDM,DVDM(2) ''TELEMETER Z MEASURED VELOCITY''
AP524.          UNLOCK ''RELEASE INTERRUPTS LOCKED BY TELEM DELAY ROUT''
        END
        RETURN      ''MAP00''
TERM                ''MAR00''
```

```
                    SPL   KERNEL  9     MINOR LOOP

START     .MML00    ''FLIGHT SIM ENTRY TO MINOR LOOP''
ENTRACE   .MML20    ''NORMAL MINOR LOOP ENTRY''
          DECLARE ARRAY (3) FIXED, VML0 14,
                                   VML1 14,
                                   VML2 25,
                                   VCG0 14,
                                   VCG1 14,
                                   VCOD 14,
                                   VOLD 14,
                                   VDEL 25,
                                   VCG  25,
                                   VSF  35 R,
                                   VBUB 25,
                                   VCMND  0 R,
                                   VCMND1 0 R,
                                   VCMND2 0 R
          DECLARE FIXED,
                        KCPBG 14 CONSTANT = 2016.,
                        VOCK  25,
                        VCG10 14,
                        VCG11 14
          DECLARE INTEGER, VIRE
          DECLARE ARRAY (3) STATUS, FBUG (NONE,PASS1,PASS2),
                                    VFIO (NORMAL,BACKUP,DUMMY)
          DECLARE STATUS FBUGS (NONE,PASS1,PASS2)
          DECLARE ARRAY (3) LOGICAL, VGR, VPGR
          DECLARE LOGICAL, VMEMR, VMLET
          ITEM J INTEGER
ENDDATA
          IF DVLRC EQ 0  GOTO ML01
          DVLRC = DVLRC - 1
MML20.    DVCC = DVCC + DVDC
ML01.     IF FBUGS NQ 'NONE' GOTO ML500
ML001.    FOR I = 2  BY -1 WHILE I GQ 0
               GOTO (ML201, ML101, , * ) I
               IF VFIO(2) EQ 'NORMAL'         THEN READ ZGIM,VGR(2)
                    ORIF VFIO(2) EQ 'BACKUP' THEN READ ZBGIM,VGR(2)
                    ELSE VGR(2) = VPGR(2)
               END
               GOTO ML004
ML101.         READ EMR,VMEMR                 ''READ ERROR MONITOR REG''
               DVLDR = DVLDR - (VMEMR LAND MSKEMRLADB)
               IF VFIO(1) EQ 'NORMAL'         THEN READ YGIM,VGR(1)
                    ORIF VFIO(1) EQ 'BACKUP' THEN READ YBGIM,VGR(1)
                    ELSE VGR(1) = VPGR(1)
               END
               GOTO ML004
ML201.         DVEMR = DVEMR LOR VMEMR
               IF VFIO(0) EQ 'NORMAL'         THEN READ XGIM,VGR(0)
                    ORIF VFIO(0) EQ 'BACKUP' THEN READ XBGIM,VGR(0)
                    ELSE VGR(0) = VPGR(0)
               END
ML004.         IF VGR(I) GQ 0       GOTO ML020
ML430.         IF DVDGS LS 0        GOTO ML432
               IF DVDGS EQ 0        GOTO ML020
```

```
                GOTO ML637
ML432.          ,MDGOO (= J, ML434.)''PROCESS DISAGREEMENT BIT(UNCODED)''
        ''DISAGREEMENT BIT PROCESSING WILL TAKE A NORMAL RETURN IF THE  ''
        ''DISAGREEMENT BIT IS FOUND TO BE INVALID.  OTHERWISE IT WILL   ''
        ''TAKE THE ERROR EXIT TO ML434 AND SET J = 0 IF THE GIMBAL IS   ''
        ''VALID OR J = 1 IF THE GIMBAL IS NOT VALID.                    ''
        ''                                                              ''
                GOTO ML020
ML434.          GOTO (ML4352, ML4351, ML4350, *) I
ML4350.         IF VFIO(2) EQ 'NORMAL'
                     THEN READ ZGIM,TEMP      ''RESTART COD COUNTER''
                     ELSE READ ZBGIM,TEMP     ''RESTART COD COUNTER''
                END
                GOTO (ML020, ML637, *) J
ML4351.         IF VFIO(1) EQ 'NORMAL'
                     THEN READ YGIM,TEMP      ''RESTART COD COUNTER''
                     ELSE READ YBGIM,TEMP     ''RESTART COD COUNTER''
                END
                GOTO (ML020, ML637, *) J
ML4352.         IF VFIO(0) EQ 'NORMAL'
                     THEN READ XGIM,TEMP      ''RESTART COD COUNTER''
                     ELSE READ XBGIM,TEMP     ''RESTART COD COUNTER''
                END
                GOTO (ML020, ML637, *) J
ML020.          VCOD(I) = VGR(I) LAND MSKGIMBALA
                CONDITIONS
                     VCOD(I) EQ 0                                  ,(Y, , , )
                     VOLD(I) EQ 0                                  ,(Y, , , )
                     ABS(VDEL(I)) GQ VOCK                          ,(Y, , , )
                     ABS(VCOD(I) - VOLD(I)) LS VML0(I)             ,( ,Y, , )
                     ABS(VCOD(I) - VOLD(I))+ VML0(I) GQ VML1(I),( , ,Y,Y)
                     VCOD(I) - VOLD(I) LS 0                        ,( , ,Y,N)
                ACTIONS
                     GOTO ML631                                    ,(Y, , , )
                     VCG(I) = VCG(I) + VML2(I)                     ,( , ,Y, )
                     VCG(I) = VCG(I) - VML2(I)                     ,( , , ,Y)
                     GOTO ML040                                    ,( ,Y,Y,Y)
                ESLE GOTO ML630
                END
ML040.          DVTH(I) = VSF(I)*VCOD(I) + VCG(I)
                VOLD(I) = VCOD(I)
                VDEL(I) = DVTH(I) - DVCC(I)
                DFDBF = 'GOOD'
                GOTO (ML245, ML145, ML045, * ) I
ML045.          VCMND(2) = DVA5*VDEL(2) - DVA4*VDEL(1)
                GOTO ML730
ML145.          VCMND(1) = DVA1*VDEL(1) + DVA2*VDEL(2)
                GOTO ML730
ML245.          VCMND(0) = DVA6*(VDEL(0) + DVA3*VDEL(1))
                GOTO ML730
ML630.          VMLET = I + 3
                GOTO ML632
ML631.          VMLET = I
ML632.          VMLET = VMLET LSH 11 + VCOD(I) RSH 14 + VOLD(I)
                IF DVMC6 LAND MSKMC6D04 EQ 0    THEN
```

```
                    .UTR30    ''DELAY FOR TELEMETRY AS REQUIRED''
                    WRITE TELMLER,VMLET ''TELEM MINOR LOOP ERROR MESSAGE''
                END
                IF DFDBF EQ 'FAILED'        GOTO ML635
                DVRE(I) = DVRE(I) + 1
                IF DVRE(I) LS 0             GOTO ML637
                IF DVRE(I) GR 0             GOTO ML636
                VMLET = VCOD(I) RSH 14 + VOLD(I) + MSKERRORTAG
                VFIO(I) = 'BACKUP'
                VCG(I) = (VCG(I) LAND MSK180DEG) - VBUB(I)
                VML2(I) = MSK180DEG
                VOLD(I) = (DVTH(I) LAND MSKMOD180DEG)*KCPBG
                          LAND MSKGIMBALA
                VSF(I) = 1./KCPBG
                IF I EQ 2
                    THEN WRITE ICR,MSKICRBG     ''SET INTERNAL CON REG''
                         DVICR = DVICR LXOR MSKICRBG
                END
                FBUGS = FBUG(I) = 'PASS1'
                VML0(I) = VCG10
                VML1(I) = VCG11
                IF DVMC6 LAND MSKMC6D04 EQ 0    THEN
                    .UTR30    ''DELAY FOR TELEMETRY AS REQUIRED''
                    WRITE TELMLER,VMLET ''TELEM MINOR LOOP ERROR MESSAGE''
                END
                GOTO ML637
ML635.          DVHDB = DVHDB - 1
                DFDBF = 'GOOD'
                DVHDA = DVHDA + 1
                IF DVHDA LS 0               GOTO ML636
                WRITE ICR,MSKICRSWG         ''SET INTERNAL CONTROL REG.''
                DVICR = DVICR LXOR MSKICRSWG
                DVMC4 = DVMC4 LOR MSKMC4AMF
                DVDGS = 0
ML636.          IF DVRE(I) LS VIRE          GOTO ML637
                IF DVMC6 LAND MSKMC6D04 EQ 0 .UD000(MSKGRF) ''SET
                   GUIDANCE REFERENCE FAILURE DISCRETES     (NOT CODED)''
ML637.          DFSMC = 'DISABLE'
                GOTO ML760
ML730.          IF ABS(VCMND(I)) GR DVM06    VCMND(I) = DVM06
                IF ABS(VCMND(I) - VCMND1(I)) GR DVM05
                                             VCMND(I) = VCMND1(I) + DVM05
                VCMND1(I) = VCMND(I)
                IF VCMND(I) LS 0
                    THEN VCMND2(I) = MSKABSLADDER - VCMND(I)
                    ELSE VCMND2(I) = VCMND(I)
                END
ML760.          GOTO (ML260, ML160, ML060, * ) I
ML060.          WRITE ZLAD,VCMND2(2)        ''ISSUE YAW COMMAND''
                IF DVLDB LS 0  WRITE ICR,MSKICRCA
                DVMLT = DVTMM + DVMLD + (DVTT1 - DVRTC LAND MSKRTC) RSH 2
                GOTO LOOPEND
ML160.          WRITE YLAD,VCMND2(1)        ''ISSUE PITCH COMMAND''
                GOTO LOOPEND
ML260.          READ DBG,TEMP ''START SPECIAL DOM BACKUP GIMBAL''
```

```
              WRITE ZLAD,VCMND2(2)      ''ISSUE YAW COMMAND''
              WRITE XLAD,VCMND2(0)      ''ISSUE ROLL COMMAND''
LOOPEND. END
         RETURN      ''MML00, MML20''
ML500.    FOR I=0 BY 1 UNITL 3
              GOTO (ML530, ML520, ML540, * ) FBUG(I)
ML520.        FBUG(I) = 'PASS2'
              GOTO ML530
ML540.        FBUG(I) = 'NONE'
              VML0(I) = VCG0(I)
              VML1(I) = VCG1(I)
ML530.    END
          FBUGS = FBUG(0) LOR FBUG(1) LOR FBUG(2)
          GOTO ML001.
    PROC .MDG00 (= J, EREXIT.)      EXTERNAL
    EXIT
TERM      ''MML00''
```

```
START     .MSS00    ''SWITCH SELECTOR CHECK FOR ALTERNATE SEQUENCE''
ENTRANCE  .MSS05    ''NORMAL SWITCH SELECTOR CHECK''
ENTRANCE  .MSS10    ''SWITCH SELECTOR INITIALIZATION FOR TIME BASE SET''
ENTRANCE  .MSS20    ''SWITCH SELECTOR FORCED RESET''
ENTRANCE  .MSS30    ''SWITCH SELECTOR HUNG STAGE TEST''
ENTRANCE  .MSS40    ''SWITCH SELECTOR STAGE AND ADDRESS ISSUANCE''
ENTRANCE  .MSS50    ''SWITCH SELECTOR VERIFY ADDRESS''
ENTRANCE  .MSS55    ''SWITCH SELECTOR READ TIME CHECK''
ENTRANCE  .MSS60    ''SWITCH SELECTOR READ ISSUANCE''
ENTRANCE  .MSS70    ''SWITCH SELECTOR RESET''
ENTRANCE  .MSS80    ''SWITCH SELECTOR COMPLEMENT STAGE AND ADDRESS''
      ''                                                              ''
      ''  SWITCH SELECTOR TABLE                                       ''
      ''                                                              ''
      ''    SSTTB1 IS THE SS TABLE FOR TIME BASE 1.  OTHER TABLES     ''
      ''    WITH IDENTICAL FORMATS WOULD BE PROVIDED FOR THE OTHER    ''
      ''    TIME BASES AND THE ALTERNATE SEQUENCES.                   ''
      ''                                                              ''
          TABLE SSTTB1 28 SERIAL 2 CONSTANT
               (TIME    FIXED  10  0 0,
                STAGE   LOGICAL 5  1 0,
                ADDRESS LOGICAL 8  1 5 )
               =(  5.0     OCT'00'   OCT'000'
                   6.0     OCT'04'   OCT'152'
                  14.0     OCT'01'   OCT'142'
                  19.8     OCT'20'   OCT'151'
                  20.0     OCT'20'   OCT'131'
                  20.2     OCT'20'   OCT'147'
                  24.0     OCT'01'   OCT'137'
                  27.0     OCT'20'   OCT'042'
                  29.0     OCT'01'   OCT'177'
                  30.0     OCT'20'   OCT'061'
                  32.0     OCT'20'   OCT'022'
                  49.5     OCT'01'   OCT'002'
                  75.0     OCT'00'   OCT'000'
                  90.0     OCT'20'   OCT'042'
                  95.0     OCT'20'   OCT'022'
                  95.3     OCT'01'   OCT'055'
                 105.0     OCT'20'   OCT'175'
                 115.1     OCT'01'   OCT'137'
                 119.8     OCT'20'   OCT'157'
                 120.0     OCT'20'   OCT'137'
                 120.1     OCT'01'   OCT'177'
                 130.0     OCT'20'   OCT'101'
                 132.4     OCT'01'   OCT'035'
                 133.6     OCT'20'   OCT'016'
                 133.8     OCT'20'   OCT'036'
                 134.4     OCT'01'   OCT'037'
                 134.6     OCT'01'   OCT'077'
           OCT'377777776' OCT'00'   OCT'000')
          DECLARE FIXED -2 CONSTANT, KSS500MS    = 2031.7460,
                                     KSS500SEC   = 2031746.0,
                                     KCSSK       = 812.69840,
                                     KSSB1       = 70.142856,
                                     KSSB2       = 103.58730,
```

```
                                KSSB3       = 66.206348,
                                KSSB4       = 35.825396,
                                KSSB5       = 102.65079,
                                KSSB6       = 50.825396,
                                KSSB7       = 87.460316,
                                KSSB8       = 43.825396,
                                KSSCK       = 2031.7460,
                                KSSRB       = 201.17460,
                                KCSR    13  = 4063.492
        DECLARE FIXED -2, VATRR,
                          VATR4,
                          VGBIA,
                          VSSRT,
                          VSSTM,
                          VSSW,
                          VSTGO
        DECLARE LOCATION, SST1PTR,
                          SST2PTR
        ARRAY (8) SSTTBPTR LOCATION =( LOC'SSTTB1'
                                       LOC'SSTTB2'
                                       LOC'SSTTB3'
                                       LOC'SSTTB4'
                                       LOC'SSTTB5'
                                          0
                                       LOC'SSTTB7'
                                       LOC'SSTTB8')
        DECLARE ARRAY (3) LOGICAL, VSC1,
                                   VSC3
        DECLARE LOGICAL, VASPI,
                         VHSTW,
                         VPSTG,
                         VSCCA,
                         VSNA,
                         VSNA1,
                         VSSCA,
                         VSSFB,
                         VSTG
        DECLARE STATUS, FASE  (NORMAL,ALTERNATE),
                        FBRNI (FIRST,SECOND),
                        FCLS4 (NOTINPROG,INPROG),
                        FFBCH (CHANA,CHANB),
                        FHST  (NOTEST,TEST),
                        FSSAC (INACTIVE,ACTIVE),
                        FSSIO (YES,NO),
                        FTADV (NORMAL,CLASS4),
                        FT6OP (PASS1,PASS2)
ENDDATA
        LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,
             EX7INT,EX8INT,EX9INT
        FASE = 'ALTERNATE'
        CONDITIONS
             DVASW LAND MSKSSS4CO NQ 0     ,(Y, Y,  ,  ,  ,  ,  ,  )
             DVASW LAND MSKSSSPEC NQ 0     ,(  ,  , Y,  ,  ,  ,  )
             DVASW LAND MSKSSTB6C NQ 0     ,(  ,  ,  , Y,  ,  ,  )
             DVASW LAND MSKSSCLS1 NQ 0     ,(  ,  ,  ,  , Y, Y, Y,  )
```

```
          DVASW LAND MSKSSTB6A NQ 0     ,(  ,  ,  ,  , Y, N, N,  )
          DVASW LAND MSKSSS4C1 NQ 0     ,(  ,  ,  ,  ,  , Y, N,  )
          VASPI LAND MSKSSS4CO NQ 0     ,(Y, N,  ,  ,  ,  ,  ,  )
          FSSAC EQ 'ACTIVE'             ,(  ,  ,  ,  ,  ,  ,  , Y)
     ACTIONS
          VSC1(0) = SST1PTR             ,(  ,  ,  ,  , Y, Y, Y,  )
          VSC1(1) = VASPI               ,(  ,  ,  ,  , Y, Y, Y,  )
          VSC1(2) = VATRR               ,(  ,  ,  ,  , Y, Y, Y,  )
          DVASW = DVASW LAND MSKSSWV    ,(Y, Y, Y,  ,  ,  ,  ,  )
          DVASW = DVASW LXOR MSKSSTB6C  ,(  ,  ,  , Y,  ,  ,  ,  )
          DVASW = DVASW LXOR MSKSSTB6A  ,(  ,  ,  ,  , Y,  ,  ,  )
          DVASW = DVASW LXOR MSKSSS4C1  ,(  ,  ,  ,  ,  , Y,  ,  )
          DVASW = DVASW LXOR MSKSSTB6B  ,(  ,  ,  ,  ,  ,  , Y,  )
          .EGP08''RESCHED T1(UNCODED)'',(  , Y, Y,  ,  ,  ,  ,  )
          VASPI = MSKSSS4CO             ,(  , Y,  ,  ,  ,  ,  ,  )
          VASPI = MSKSSSPEC             ,(  ,  , Y,  ,  ,  ,  ,  )
          VASPI = VASPI LOR MSKSST6C    ,(  ,  ,  , Y,  ,  ,  ,  )
          VASPI = MSKSSCL1              ,(  ,  ,  ,  , Y, Y, Y,  )
          DVMC6 = DVMC6 LOR MSKMC6TB6C  ,(  ,  ,  , Y,  ,  ,  ,  )
          DVMC6 = DVMC6 LOR MSKMC6TB6A  ,(  ,  ,  ,  , Y,  ,  ,  )
          DVMC6 = DVMC6 LOR MSKMC6TB6B  ,(  ,  ,  ,  ,  ,  , Y,  )
          SST1PTR = LOC'SSTSIVB'        ,(  , Y,  ,  ,  ,  ,  ,  )
          SST1PTR = LOC'SSTSIVA'        ,(  ,  , Y,  ,  ,  ,  ,  )
          SST1PTR = LOC'SSTTB6C'        ,(  ,  ,  , Y,  ,  ,  ,  )
          SST1PTR = LOC'SSTTB6A'        ,(  ,  ,  ,  , Y,  ,  ,  )
          SST1PTR = LOC'SSTS4C1'        ,(  ,  ,  ,  ,  , Y,  ,  )
          SST1PTR = LOC'SSTTB6B'        ,(  ,  ,  ,  ,  ,  , Y,  )
          .SSTUPD (= VATRR)             ,(  ,  ,  , Y, Y, Y, Y,  )
               ''UPDATE SS TIME''
          FTADV = 'NORMAL'              ,(  ,  ,  ,  , Y, Y, Y,  )
          GOTO SS0060                   ,(Y,  ,  ,  ,  ,  ,  , Y)
          GOTO SS1050                   ,(  , Y, Y, Y, Y, Y, Y,  )
     ELSE GOTO SS0000
     END
MSS05.    FSSAC = 'INACTIVE'
SS0000.   IF IND(SST1PTR) NQ MSKSSNSEND
SS0010.        THEN .SSTUPD (= VSTGO)   ''UPDATE SS TIME''
                    VSTGO = VSSRT - VSTGO
                    IF VSTGO LS KSS500MS     GOTO MSS30
                    IF DFTUP EQ 'YES'
                         THEN DVTGB = DVTGB + VGBIA
                              VGBIA = 0
                              DFTUP = 'NO'
                              GOTO SS0010
                         ELSE IF DVASW NQ 0        GOTO SS0170
                              VSSTM = VSTGO + DVTRB - DVTGB - KCSSK
                              DVSST = VSSTM + DVTMR
                              DGSSM = 'SS30'
                              IF DFIL3 EQ 'INACTIVE' .EGP08 ''RESCHEDT1''
                    END
                    GOTO SS0060
     END
SS0015.   IF DVASW NQ 0                          GOTO SS0170
          READ CLOCK,TEMP      ''READ REAL TIME CLOCK''
          DVSST = DVTMM + KSS500SEC + (TEMP - DVRTC LAND MSKRTC) SCL 0
```

```
          DGSSM = 'SS05'
          IF DFIL3 EQ 'INACTIVE' .EGP08 ''RESCHED TIMER 1  (NOT CODED)''
          GOTO SS0060
SS0170.   CONDITIONS
               DVASW LAND MSKSSCLS3 EQ 0    ,(Y, Y, Y,  ,  ,  ,  ,  ,  ,  )
               DVASW LAND MSKSSACQU NQ 0    ,(Y,  ,  ,  ,  ,  ,  ,  ,  ,  )
               DVASW LAND MSKSSTB6D NQ 0    ,(  , Y, N,  ,  ,  ,  ,  ,  ,  )
               VASPI EQ 0                   ,(  ,  ,  , Y, Y, Y, Y, Y,Y,Y)
               DVASW LAND MSKSSGNSS NQ 0    ,(  ,  ,  , Y,  ,  ,  ,  ,  ,  )
               DVASW LAND MSKSSSBLO NQ 0    ,(  ,  ,  ,  , Y,  ,  ,  ,  ,  )
               DVASW LAND MSKSSSBHI NQ 0    ,(  ,  ,  ,  ,  , Y,  ,  ,  ,  )
               DVASW LAND MSKSSSBOM NQ 0    ,(  ,  ,  ,  ,  ,  , Y,  ,  ,  )
               DVASW LAND MSKSSECSV NQ 0    ,(  ,  ,  ,  ,  ,  ,  , Y,  ,  )
               DVASW LAND MSKSSECS1 NQ 0    ,(  ,  ,  ,  ,  ,  ,  ,  ,Y,N)
          ACTIONS
               VSC3(0) = SST1PTR            ,(  ,  ,  , Y, Y, Y, Y, Y,Y,Y)
               VSC3(1) = VASPI              ,(  ,  ,  , Y, Y, Y, Y, Y,Y,Y)
               VSC3(2) = VATRR              ,(  ,  ,  , Y, Y, Y, Y, Y,Y,Y)
               DVASW = DVASW LXOR MSKSSACQU,(Y,  ,  ,  ,  ,  ,  ,  ,  ,  )
               DVASW = DVASW LXOR MSKSSTB6D,(  , Y,  ,  ,  ,  ,  ,  ,  ,  )
               DVASW = DVASW LXOR MSKSSLI  ,(  ,  , Y,  ,  ,  ,  ,  ,  ,  )
               DVASW = DVASW LXOR MSKSSGNSS,(  ,  ,  , Y,  ,  ,  ,  ,  ,  )
               DVASW = DVASW LXOR MSKSSSBLO,(  ,  ,  ,  , Y,  ,  ,  ,  ,  )
               DVASW = DVASW LXOR MSKSSSBHI,(  ,  ,  ,  ,  , Y,  ,  ,  ,  )
               DVASW = DVASW LXOR MSKSSSBOM,(  ,  ,  ,  ,  ,  , Y,  ,  ,  )
               DVASW = DVASW LXOR MSKSST3A ,(  ,  ,  ,  ,  ,  ,  ,  ,  ,Y)
               SST2PTR = LOC'SSTGAIN'       ,(Y,  ,  ,  ,  ,  ,  ,  ,  ,  )
               SST2PTR = LOC'SSTTB6D'       ,(  , Y,  ,  ,  ,  ,  ,  ,  ,  )
               SST2PTR = LOC'SSTALU'        ,(  ,  , Y,  ,  ,  ,  ,  ,  ,  )
               SST1PTR = LOC'SSTGSS'        ,(  ,  ,  , Y,  ,  ,  ,  ,  ,  )
               SST1PTR = LOC'SSTSBLO'       ,(  ,  ,  ,  , Y,  ,  ,  ,  ,  )
               SST1PTR = LOC'SSTSBHI'       ,(  ,  ,  ,  ,  , Y,  ,  ,  ,  )
               SST1PTR = LOC'SSTSBOM'       ,(  ,  ,  ,  ,  ,  , Y,  ,  ,  )
               SST1PTR = LOC'SSTECSV'       ,(  ,  ,  ,  ,  ,  ,  , Y,  ,  )
               SST1PTR = LOC'SSTECS1'       ,(  ,  ,  ,  ,  ,  ,  ,  ,Y,  )
               SST1PTR = LOC'SSTTB3A'       ,(  ,  ,  ,  ,  ,  ,  ,  ,  ,Y)
               VATR4 = 0                    ,(  ,  , Y,  ,  ,  ,  ,  ,  ,  )
               .SSTUPD (= VATR4)''SS T UP'',(Y, Y,  ,  ,  ,  ,  ,  ,  ,  )
               GOTO SS0201                  ,(Y, Y, Y,  ,  ,  ,  ,  ,  ,  )
               GOTO SS0230                  ,(  ,  ,  , Y, Y, Y, Y, Y,Y,Y)
          ELSE GOTO SS0060 ''THIS POINT SHOULD NEVER BE REACHED LOGICALLY''
          END
SS0201.   FCLS4 = 'INPROG'
          FTADV = 'CLASS4'
          GOTO SS0235
SS0230.   VASPI = MSKSSCL3
          .SSTUPD (= VATRR) ''UPDATE SS TIME''
          FTADV = 'NORMAL'
SS0235.   .SS210    ''SET UP NEXT SS''
          FHST = 'TEST'
          GOTO SS0000
SS0060.   IF FASE EQ 'ALTERNATE'
               THEN FASE = 'NORMAL'
                    UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
```

```
          RETURN     ''SWITCH SELECTOR COMMON RETURN''
MSS10.    VASPI = 0
          VATRR = 0
          FCLS4 = 'NOTINPROG'
          DVASW = DVASW LAND MSKSSWV
          .EGP08              ''RESCHEDULE TIMER 1          (NOT CODED)''
          FTADV = 'NORMAL'
          SST1PTR = SSTTBPTR(DTBID - 1)
SS1050.   .SS210      ''SET UP NEXT SS''
          IF FSSAC EQ 'ACTIVE'                GOTO MSS20
          VSSW = KSSB1
          GOTO SS0235
MSS20.    IF FSSIO EQ 'YES'    WRITE SS,MSKSSRESET ''ISSUE FORCED RESET''
          FHST = 'NOTEST'
          DGSSM = 'SS05'
          .SSTUPQ (KSSB8)   ''SCHEDULE SWITCH SELECTOR CHECK''
          VSSW = KSSB5
          GOTO SS0060
MSS30.    FSSAC = 'ACTIVE'
          VSNA, VSNA1 = VSNA RSH 2 LAND MSKSSSNA
          IF VSNA EQ 0
               THEN FSSAC = 'INACTIVE'
                    .SS201     ''ADVANCE SS TABLE, SET UP NEXT SS''
                    GOTO SS0000
          END
          VSTG = VSNA LAND VPSTG
          IF VSTG EQ 0
               THEN FSSIO = 'NO'
               ELSE FSSIO = 'YES'
          END
          IF FHST EQ 'NOTEST'                 GOTO SS4000
          IF DFLT EQ 'REP'                    GOTO SS4000
          READ SSFB,TEMP   ''READ SS FEEDBACK REGISTER''
          IF TEMP LAND MSKSSHS EQ 0           GOTO SS4000
          IF FSSIO EQ 'YES'    WRITE SS,MSKSSRESET   ''ISSUE RESET''
          DGSSM = 'SS40'
          .SSTUPQ (KSSB4)   ''SCHEDULE STAGE AND ADDRESS ISSUANCE''
          VSSW = KSSB5
          GOTO SS0060
MSS40.    FOR I = 22 WHILE I GR 0   ''DELAY BEFORE ISSUING STAGE,ADDR''
               I = I - 1
          END
SS4000.   IF FSSIO EQ 'YES'    WRITE SS,VSNA   ''ISSUE STAGE AND ADDRESS''
          DGSSM = 'SS50'
          .SSTUPQ (VSSW) ''SCHEDULE ADDRESS VERIFICATION''
          FOR I = 17 WHILE I GR 0   ''DELAY FOR DOM TELEMETRY''
               I = I - 1
          END
          WRITE DOM           ''OUTPUT SS AND DO REGS VIA DOM TELEMETRY''
          GOTO SS0060
MSS50.    VSCCA = VSNA LXOR MSKSSHS
          VSSCA = VSCCA LAND MSKSSHS
          IF VSTG NQ 0
               THEN READ SSFB,TEMP       ''READ SS FEEDBACK REGISTER''
                    VSSFB = TEMP LAND MSKSSHS
```

```
          ELSE VSSFB = VSSCA
     END
     IF VSSFB NQ VSSCA                        GOTO SS5540
MSS55.  IF VASPI LAND MSKSSS4CO NQ 0
          THEN DFILE = DFILE LOR MSKFPSISSA
               DVSST = 1.E10
               RETURN    ''MSS50, MSS55''
     END
     IF VSSRT EQ 0                            GOTO MSS60
     .SSTUPD (= DVTRB)   ''UPDATE SS TIME
     IF VSSRT - DVTRB LQ KSSRB                GOTO MSS60
     VSSTM = VSSRT - DVTRB - KSSRB
     DVSST = VSSTM + DVTMR
     DGSSM = 'SS60'
     IF DFIL3 EQ 'INACTIVE' .EGP08 ''RESCHED TIMER 1  (NOT CODED)''
     RETURN    ''MSS50, MSS55''
SS5540. IF VSSFB EQ 0 AND VSSCA NQ MSKSSZFSF    GOTO MSS55
     IF FSSIO EQ 'YES' WRITE SS,MSKSSRESET ''ISSUE RESET''
     DGSSM = 'SS80'
     .SSTUPQ (KSSB6)  ''SCHEDULE COMPLEMENTED STAGE AND ADDRESS''
     TEMP = (VSSCA LXOR VSSFB) LSH 7
SS5570. IF TEMP LS 0                             GOTO SS5580
     TEMP = TEMP LSH 1
     GOTO SS5570
SS5580. TEMP = TEMP LSH 1
     IF TEMP EQ 0                             RETURN ''MSS50''
     DVMC4 = DVMC4 LOR MSKMC4SSCB
     IF FFBCH EQ 'CHANA'
          THEN FFBCH = 'CHANB'
               WRITE ICR,MSKICRSSCB  ''SWITCH TO CHANNEL B''
               DVICR = DVICR LOR MSKICRSSCB
     END
     .UTR30    ''DELAY FOR TELEMETRY AS REQUIRED''
     WRITE TELSSFB,VSSFB ''TELEMETER SS FEEDBACK''
     RETURN    ''MSS50, MSS55''
MSS60.  TEMP = VSTG LXOR MSKSSREAD
     IF FSSIO EQ 'YES' WRITE SS,TEMP    ''ISSUE READ COMMAND''
     READ CLOCK,TEMP     ''READ REAL TIME CLOCK FOR SS TELEMETRY''
     DGSSM = 'SS70'
     .SSTUPQ (KSSB2)  ''SCHEDULE READ RESET''
     TEMP = VSNA LSH 2 LOR TEMP LAND MSKRTC
     .UTR30    ''DELAY FOR TELEMETRY AS REQUIRED''
     WRITE TELSSSA,TEMP  ''TELEMETER STAGE/ADDRESS AND READ TIME''
     IF DFACQ NQ 'GAIN' ''COMPRESS DATA BETWEEN STA.  (NOT CODED)''
          THEN .MPC80 (DVDCT + MSKKSDCT) ''COMP TIME AND TAG''
               .MPC80 (VSNA RSH 3 + MSKSSDCS) ''COMP STAGE,ADD''
     END
     IF VASPI LAND MSKSS4CO NQ 0
          THEN VASPI = 0
               DFILE = DFILE LOR MSKFPSCORD
     END
     CONDITIONS
          VSNA1 EQ MSKSSHIG              ,(Y,  ,  ,  ,  )
          VSNA1 EQ MSKSSLOG              ,(  , Y,  ,  ,  )
          VSNA1 EQ MSKSSOMG              ,(  ,  , Y,  ,  )
```

```
                VSNA1 EQ MSKSSSIVB              ,( ,  ,  , Y, Y)
                FBRNI EQ 'FIRST'                ,( ,  ,  , Y, N)
           ACTIONS
                DVMC7 = DVMC7 LOR MSKMC7HIG     ,(Y,  ,  ,  ,  )
                DVMC7 = DVMC7 LOR MSKMC7LOG     ,( , Y,  ,  ,  )
                DVMC7 = DVMC7 LOR MSKMC7OMG     ,( ,  , Y,  ,  )
                DVMC5 = DVMC5 LOR MSKMC54B1I    ,( ,  ,  , Y,  )
                DVMC6 = DVMC6 LOR MSKMC68BRI    ,( ,  ,  ,  , Y)
           ELSE RETURN
           END
           RETURN     ''MSS60''
MSS70.     IF FFSIO EQ 'YES'   WRITE SS,0  ''RESET READ COMMAND''
           DGSSM = 'SS05'
           .SSTUPQ (KSSR3)  ''SCHEDULE HUNG STAGE TEST''
           .SS201     ''ADVANCE SS TABLE, SET UP NEXT SS''
           VSSW = KSSB1
           IF VHSTW LAND VSTG EQ VSTG
                THEN FHST = 'NOTEST'
                ELSE FHST = 'TEST'
           END
           CONDITIONS
                VSNA1 EQ MSKSSWVO               ,(Y,  ,  )
                VSNA1 EQ MSKSSWVC               ,( , Y,  )
                VSNA1 EQ MSKKSSSCC              ,( ,  , Y)
           ACTIONS
                DVASW = DVASW LXOR MSKSSECS1    ,(Y,  ,  )
                DVASW = DVASW LXOR MSKSSECSV    ,( , Y,  )
                DFWV = 'OPEN'                   ,(Y,  ,  )
                DFWV = 'CLOSE'                  ,( , Y,  )
                DVDPM = DVDPM LOR MSKDIN9       ,( ,  , Y)
           ELSE RETURN     ''MSS70''
           END
           RETURN     ''MSS70''
MSSRQ.     VSNA = VSCCA
           IF FSSIO EQ 'YES'   WRITE SS,VSNA  ''ISSUE STAGE/COMP. ADDR.''
           DGSSM = 'SS55'
           .SSTUPQ (KSSR7)  ''SCHEDULE THE READ COMMAND''
           FOR I = 41 WHILE I GR 0  ''DELAY FOR DOM TELEMETRY''
                I = I - 1
           END
           WRITE DOM            ''OUTPUT SS AND DO REGS VIA DOM TELEMETRY''
           RETURN     ''MSS80''
PROC       .SS201     ''SS TABLE ADVANCE ROUTINE''
ENTRANCE   .SS210     ''SS SETUP ROUTINE''
           IF FTADV EQ 'NORMAL'
                THEN SST1PTR = SST1PTR + 2     GOTO SS2020
                ELSE SST2PTR = SST2PTR + 2     GOTO SS2160
           END
SS210.     IF FTADV EQ 'NORMAL'           GOTO SS2020
SS2160.    IF IND(SST2PTR) GQ 0                GOTO SS2070
           FCLS4 = 'NOTINPROG'
           DVMC6 = DVMC6 LXOR MSKMC6LUI
           DVMC7 = DVMC7 LXOR MSKMC7T6D
           GOTO SS2090
SS2020.    IF IND(SST1PTR) GQ 0           GOTO SS2030
```

```
          CONDITIONS
               VASPI LAND MSKSSSPEC NQ 0     ,(Y,  ,  ,  ,  )
               VASPI LAND MSKSSCL3 NQ 0      ,(  , Y,  ,  ,  )
               VASPI LAND MSKSSCL1 NQ 0      ,(  ,  , Y,  ,  )
               FT6OP EQ 'PASS1'              ,(  ,  ,  , Y, N)
          ACTIONS
               VASPI = MSKSSS4CO             ,(Y,  ,  ,  ,  )
               VASPI = VSC3(1)               ,(  , Y,  ,  ,  )
               VASPI = VSC1(1)               ,(  ,  , Y,  ,  )
               VASPI = 0                     ,(  ,  ,  , Y, Y)
               VATRR = VSC3(2)               ,(  , Y,  ,  ,  )
               VATRR = VSC1(2)               ,(  ,  , Y,  ,  )
               VATRR = 0                     ,(  ,  ,  , Y, Y)
               DVASW = DVASW LAND MSKSSWV    ,(Y,  ,  ,  ,  )
               FT6OP = 'PASS2'               ,(  ,  ,  , Y,  )
               SST1PTR = LOC'SSTSIVB'        ,(Y,  ,  ,  ,  )
               SST1PTR = VSC3(0)             ,(  , Y,  ,  ,  )
               SST1PTR = VSC1(0)             ,(  ,  , Y,  ,  )
               SST1PTR = LOC'SSTTB5A'        ,(  ,  ,  , Y,  )
               SST1PTR = LOC'SSTTB5B'        ,(  ,  ,  ,  , Y)
          ELSE GOTO SS2020 ''THIS POINT SHOULD NEVER BE REACHED LOGICALLY''
          END
          GOTO SS2020
SS2030.   IF FCLS4 EQ 'INPROG'                GOTO SS2070
SS2040.   VSSRT = IND(SST1PTR)*KCSR + VATRR
          VSNA = IND(SST1PTR,1)
SS2050.   VHSTW = VSNA RSH 2 LAND MSKSSSSB
          RETURN    ''SS201, SS210, SS2110, SS2160''
SS2070.   IF IND(SST1PTR)*KCSR+VATRR-KSSCK GQ IND(SST2PTR)*KCSR+VATR4
               THEN FTADV = 'CLASS4'
                    VSSRT = IND(SST2PTR)*KCSR + VATR4
                    VSNA = IND(SST2PTR,1)
                    GOTO SS2050
SS2090.             ELSE FTADV = 'NORMAL'
                    GOTO SS2040
          END
EXIT      ''SS201,SS210''
PROC      .SSTUPD (= TIME)     ''UPDATE SWITCH SELECTOR TIME''
          ITEM TIME FIXED -2
ENDDATA
          READ CLOCK,TEMP      ''READ REAL TIME CLOCK''
          TIME, DVTRB = DVTGR + DVTRR + (TEMP - DVRTC LAND MSKRTC) RSH 2
EXIT      ''SSTUPD''
PROC      .SSTUPQ (BIAS)       ''UPDATE SS TIME AND SCHEDULE SS FUNCT.''
          ITEM BIAS FIXED -2
ENDDATA
          READ CLOCK,TEMP      ''READ REAL TIME CLOCK''
          DVTRB = DVTGR + DVTRR + (TEMP - DVRTC LAND MSKRTC) RSH 2
          VSSTM = BIAS + DVTRR + (TEMP - DVRTC LAND MSKRTC) RSH 2
          DVSST = VSSTM + DVTMR
          IF DFIL3 EQ 'INACTIVE' .EGP08 ''RESCHED TIMER 1  (NOT CODED)''
EXIT      ''SSTUPQ''
PROC      .EGP08    EXTERNAL  EXIT
PROC      .MPC80    EXTERNAL  EXIT
TERM      ''MSS00''
```

SPL KERNEL 11 ATM TASK KEYING

```
START     .TASKKEY (PRIORITY,TSKPTR) ''ATM TASK KEYING ROUTINE''
          ITEM PRIORITY INTEGER ''PRIORITY LEVEL OF TASK BEING KEYED''
          ITEM TSKPTR LOCATION  ''POINTER TO TASK BEING KEYED''
          ITEM CHAIN  LOCATION  ''OVERFLOW CHAIN POINTER''
          ITEM SLOT   LOCATION CONSTANT = LOC'ATMPOVFT'
      ''                                                              ''
      ''PRIORITY CONTROL TABLE CONTAINS ONE ENTRY FOR EACH SYSTEM     ''
      ''PRIORITY LEVEL.  FOR EACH ENTRY THERE ARE FIVE ITEMS.         ''
      ''     1. LOCATION POINTER TO THE NEXT EXECUTABLE INSTRUCTION  ''
      ''        OF THE TASK CURRENTLY ASSIGNED TO THAT PRIORITY LEVEL ''
      ''        OR ZERO IF NO TASK IS CURRENTLY ASSIGNED.             ''
      ''     2. )                                                     ''
      ''     3. ) TASK REGISTER CONTENTS (INITIALLY SET TO ZERO).     ''
      ''     4. )                                                     ''
      ''     5. POINTER TO THE BEGINNING OF THE PRIORITY OVERFLOW     ''
      ''        TABLE CHAIN FOR THAT PRIORITY LEVEL.  A VALUE OF ZERO ''
      ''        INDICATES END OF CHAIN.                               ''
      ''                                                              ''
      '' NOTE  THE NUMBER OF REGISTERS SAVED FOR A TASK WAS ARBITRARI-''
      ''       LY CHOSEN FOR THIS EXAMPLE AND MAY BE ADJUSTED AS      ''
      ''        REQUIRED.                                             ''
      ''                                                              ''
          TABLE ATMPCT 10 SERIAL 5
                (ATMTSKPTR   LOCATION,
                 ATMTSKREG1  LOGICAL,
                 ATMTSKREG2  LOGICAL,
                 ATMTSKREG3  LOGICAL,
                 ATMOVFPTR   LOCATION)
      ''                                                              ''
      ''THE PRIORITY OVERFLOW TABLE IS USED FOR KEYING TASKS ON A     ''
      ''PRIORITY LEVEL WHICH IS CURRENTLY ASSIGNED TO ANOTHER TASK.   ''
      ''THE ENTRIES ARE NOT ALLOCATED TO A FIXED PRIORITY BUT ARE     ''
      ''ASSIGNED DYNAMICALLY AS REQUIRED.  ALL OVERFLOW ENTRIES FOR   ''
      ''EACH PRIORITY LEVEL ARE CHAINED TOGETHER SUCH THAT THE TASKS  ''
      ''CAN BE EXECUTED ON A FIRST-IN-FIRST-OUT BASIS.  EACH ENTRY    ''
      ''CONSISTS OF TWO ITEMS.                                        ''
      ''     1. POINTER TO NEXT ENTRY IN THE CHAIN. A VALUE OF ZERO   ''
      ''        INDICATES END OF CHAIN.                               ''
      ''     2. LOCATION POINTER TO THE BEGINNING OF THE TASK FOR     ''
      ''        THAT ENTRY.  A VALUE OF ZERO INDICATES THAT THE ENTRY ''
      ''        IS CURRENTLY NOT ASSIGNED TO ANY TASK.                ''
      ''                                                              ''
          TABLE ATMPOVFT 25 SERIAL 2
                (ATMOVFPTR LOCATION,
                 ATMTSKPTR LOCATION)
ENDDATA
          LOCK ''INHIBIT ALL INTERRUPTS''
      ''                                                              ''
      ''IF THE REQUESTED PRIORITY LEVEL IS NOT CURRENTLY ASSIGNED,    ''
      ''INITIALIZE THE ENTRY FOR THIS TASK.                           ''
      ''                                                              ''
          IF ATMPCT'ATMTSKPTR(PRIORITY) EQ 0
               THEN ATMPCT'ATMTSKPTR(PRIORITY) = TSKPTR
                    ATMTSKREG1(PRIORITY) ,
                    ATMTSKREG2(PRIORITY) ,
```

```
                    ATMTSKREG3(PRIORITY) = 0
      ''                                                                  ''
      ''OTHERWISE, SEARCH FOR THE END OF THE OVERFLOW POINTER CHAIN.      ''
      ''                                                                  ''
              ELSE CHAIN = LOC'ATMPCT'ATMOVFPTR(0)'+ 5*PRIORITY
CHNSRCH.            IF IND(CHAIN) NQ 0
                         THEN CHAIN = IND(CHAIN)
                              GOTO CHNSRCH
      ''                                                                  ''
      ''WHEN THE END OF THE OVERFLOW POINTER CHAIN HAS BEEN               ''
      ''FOUND, SEARCH FOR AN EMPTY SLOT IN THE OVERFLOW TABLE.            ''
      ''                                                                  ''
                         ELSE FOR I = 0 BY 2 UNTIL 50
                                   IF IND(SLOT, I+1) EQ 0   GOTO SLTFND
                              END  WAIT ''STOP IF OVERFLOW TABLE FULL''
      ''                                                                  ''
      ''ADD THIS ENTRY TO THE END OF THE OVERFLOW POINTER CHAIN AND       ''
      ''STORE THE TASK POINTER IN IT.                                     ''
      ''                                                                  ''
SLTFND.                    IND(CHAIN) = SLOT + I
                           IND(SLOT, I) = 0
                           IND(SLOT, I+1) = TSKPTR
                    END
          END
          UNLOCK
          RETURN    ''TASKKEY''
TERM      ''TASKKEY''
```

CLASP COMMON DATA DECLARATIONS

```
START                   '' CLASP KERNELS ''
      DECLARE FIXED,                                                          X
          DKRTCSEC     10 CONSTANT = 4063.492,                              X
          DKMIR         0 CONSTANT = .040*DKRTCSEC,                         X
          DKTD          0 CONSTANT = .00413*DKRTCSEC,                       X
          DKT1         10 ,                                                 X
          DLPRL(3) -2 CONSTANT=(50.*DKRTCSEC,60.*DKRTCSEC,100.*DKRTCSEC)X
,         DLPTL   (3)  -2 ,                                                 X
          DLTTL  (12)  -2 ,                                                 X
          DVACT         0 ,                                                 X
          DVA1          4 ,                                                 X
          DVA2          4 ,                                                 X
          DVA3          4 ,                                                 X
          DVA4          4 ,                                                 X
          DVA5          4 ,                                                 X
          DVA6          4 ,                                                 X
          DVCA    (3)  25 ,                                                 X
          DVCC    (3)  25 ,                                                 X
          DVDC    (3)  13 ,                                                 X
          DVDA    (3)   7 ,                                                 X
          DVDR    (3)   7 ,                                                 X
          DVDC    (3)  25 ,                                                 X
          DVDM    (3)  11 ,                                                 X
          DVDT         23 ,                                                 X
          DVEOF        25 ,                                                 X
          DVERT         0 ,                                                 X
          DVF     (3)   7 ,                                                 X
          DVFMC        19 ,                                                 X
          DVFOM        19 ,                                                 X
          DVFOR        -1 ,                                                 X
          DVG     (3)  21 ,                                                 X
          DVMAS         3 ,                                                 X
          DVMFR         5 ,                                                 X
          DVMLD         0 ,                                                 X
          DVMLR        19 ,                                                 X
          DVMLT        -2 ,                                                 X
          DVM05         0 ,                                                 X
          DVM06         0 ,                                                 X
          DVPTG        -2 ,                                                 X
          DVRC    (3)   7 ,                                                 X
          DVRTC         0 ,                                                 X
          DVSST        -2 ,                                                 X
          DVTAS        10 ,                                                 X
          DVTB         10 ,                                                 X
          DVTD          0 ,                                                 X
          DVTEX         0 ,                                                 X
          DVTGB        -2 ,                                                 X
          DVTH    (3)  25 ,                                                 X
          DVTI         10 ,                                                 X
          DVTMM        -2 ,                                                 X
          DVTMR        -2 ,                                                 X
          DVTRB        -2 ,                                                 X
          DVTRR        -2 ,                                                 X
          DVTRS        -2 ,                                                 X
          DVTT1         0 ,                                                 X
```

```
     DVVSQ          3 ,                                                  X
     DV1MR         25 ,                                                  X
     DV2TG         -2 ,                                                  X
     TEMP  TEMP       ,                                                  X
     TEMP1 TEMP
DECLARE INTEGER,          ''NUMERIC INTEGER DATA''                       X
     DFLT       ,                                                       X
     DGMLM      ,                                                       X
     DGSSM      ,                                                       X
     DGST2      ,                                                       X
     DQST2      ,                                                       X
     DTBID      ,                                                       X
     DVDGS      ,                                                       X
     DVHDA      ,                                                       X
     DVHDB      ,                                                       X
     DVLRC      ,                                                       X
     DVP        ,                                                       X
     DVRE (3)   ,                                                       X
     EPTINDX    ,                                                       X
     GST1M
DECLARE BOOLEAN,                                                        X
     APSTAT     ,                                                       X
     ARSTAT     ,                                                       X
     CC1STAT    ,                                                       X
     CSSTAT     ,                                                       X
     CTSTAT     ,                                                       X
     DFACQ      ,                                                       X
     DFDBF      ,                                                       X
     DFDTL      ,                                                       X
     DFIL1      ,                                                       X
     DFIL2      ,                                                       X
     DFIL3      ,                                                       X
     DFPHC      ,                                                       X
     DFSMC      ,                                                       X
     DFTBCEP    ,                                                       X
     DFTUP      ,                                                       X
     DFWV       ,                                                       X
     DFZER      ,                                                       X
     DKAPI (4)  ,                                                       X
     DTSTAT     ,                                                       X
     DPSTAT     ,                                                       X
     DVSTAT     ,                                                       X
     EBSTAT     ,                                                       X
     HSSTAT     ,                                                       X
     IGSTAT     ,                                                       X
     MSSTAT     ,                                                       X
     NESTAT     ,                                                       X
     OGSTAT     ,                                                       X
     PASTAT     ,                                                       X
     PGSTAT     ,                                                       X
     PPSTAT (3),                                                        X
     RSSTAT     ,                                                       X
     SASTAT     ,                                                       X
     TB1STAT    ,                                                       X
     TB57STAT   ,                                                       X
```

```
    TCSTAT    ,                                                    X
    TGSTAT    ,                                                    X
    TTSTAT    ,                                                    X
    T2STAT (11)
DECLARE INTEGER,       ''LOGICAL INTEGER DATA''                    X
    DFILE     ,                                                    X
    DFMDI     ,                                                    X
    DVAC (3)  ,                                                    X
    DVASW     ,                                                    X
    DVDPM     ,                                                    X
    DVEMR     ,                                                    X
    DVICR     ,                                                    X
    DVIH      ,                                                    X
    DVLDB     ,                                                    X
    DVMC4     ,                                                    X
    DVMC5     ,                                                    X
    DVMC6     ,                                                    X
    DVMC7     ,                                                    X
    MSKABLAD        CONSTANT =0'000001000',                        X
    MSKACCA         CONSTANT =0'777700000',                        X
    MSKACCR         CONSTANT =0'000017776',                        X
    MSKDIN9         CONSTANT =0'000004000',                        X
    MSKDCSCM        CONSTANT =0'774000000',                        X
    MSKDCSDO        CONSTANT =0'000040000',                        X
    MSKDCSER        CONSTANT =0'000077776',                        X
    MSKDCSMC        CONSTANT =0'770000000',                        X
    MSKDCSMD        CONSTANT =0'000000020',                        X
    MSKDCSSB        CONSTANT =0'004000000',                        X
    MSKDCSTR        CONSTANT =0'200000000',                        X
    MSKEMRLB        CONSTANT =0'000001000',                        X
    MSKERTAG        CONSTANT =0'000070000',                        X
    MSKFMREP        CONSTANT =0'000100000',                        X
    MSKFPSCR        CONSTANT =0'100000000',                        X
    MSKFPSI2        CONSTANT =0'000040000',                        X
    MSKFPSIS        CONSTANT =0'001000000',                        X
    MSKGIMA         CONSTANT =0'377700000',                        X
    MSKICRRG        CONSTANT =0'000000020',                        X
    MSKICRCA        CONSTANT =0'000040000',                        X
    MSKICRSB        CONSTANT =0'000010000',                        X
    MSKICRSG        CONSTANT =0'000002000',                        X
    MSKINT          CONSTANT =0'157740000',                        X
    MSKM180D        CONSTANT =0'377777776',                        X
    MSKM4AMF        CONSTANT =0'000000100',                        X
    MSKM4SSB        CONSTANT =0'000001000',                        X
    MSKM54B1        CONSTANT =0'000000100',                        X
    MSKM6D04        CONSTANT =0'000000400',                        X
    MSKM6LUI        CONSTANT =0'000010000',                        X
    MSKM6T6A        CONSTANT =0'000002000',                        X
    MSKM6T6B        CONSTANT =0'000000010',                        X
    MSKM6T6C        CONSTANT =0'000000040',                        X
    MSKM68BR        CONSTANT =0'400000000',                        X
    MSKM7HIG        CONSTANT =0'004000000',                        X
    MSKM7LOG        CONSTANT =0'010000000',                        X
    MSKM7OMG        CONSTANT =0'020000000',                        X
    MSKM7T6D        CONSTANT =0'100000000',                        X
```

```
MSKRTC          CONSTANT =O'000037776',                              X
MSKRTCRS        CONSTANT =O'007777540',                              X
MSKSCCO         CONSTANT =O'000100000',                              X
MSKSSACQ        CONSTANT =O'000000004',                              X
MSKSSCL1        CONSTANT =O'040000000',                              X
MSKSSCL3        CONSTANT =O'100000000',                              X
MSKSSCS1        CONSTANT =O'000003770',                              X
MSKSSCS3        CONSTANT =O'077774000',                              X
MSKSSDCS        CONSTANT =O'500000000',                              X
MSKSSDCT        CONSTANT =O'405400000',                              X
MSKSSECV        CONSTANT =O'002000000',                              X
MSKSSEC1        CONSTANT =O'001000000',                              X
MSKSSEND        CONSTANT =O'377777776',                              X
MSKSSGNS        CONSTANT =O'040000000',                              X
MSKSSHIG        CONSTANT =O'100720000',                              X
MSKSSHS         CONSTANT =O'003770000',                              X
MSKSSLI         CONSTANT =O'000000002',                              X
MSKSSLOG        CONSTANT =O'100520000',                              X
MSKSSOMG        CONSTANT =O'100070000',                              X
MSKSSRD         CONSTANT =O'400000000',                              X
MSKSSRS         CONSTANT =O'200000000',                              X
MSKSSSBH        CONSTANT =O'010000000',                              X
MSKSSSBL        CONSTANT =O'020000000',                              X
MSKSSSBO        CONSTANT =O'004000000',                              X
MSKSSSCC        CONSTANT =O'100310000',                              X
MSKSSSNA        CONSTANT =O'135770000',                              X
MSKSSSPC        CONSTANT =O'200000000',                              X
MSKSSSSB        CONSTANT =O'174000000',                              X
MSKSSS4B        CONSTANT =O'020230000',                              X
MSKSSS4C        CONSTANT =O'400000000',                              X
MSKSSS41        CONSTANT =O'000000400',                              X
MSKSST3A        CONSTANT =O'000400000',                              X
MSKSST6         CONSTANT =O'004000000',                              X
MSKSST6A        CONSTANT =O'000002000',                              X
MSKSST6B        CONSTANT =O'000001000',                              X
MSKSST6C        CONSTANT =O'100000000',                              X
MSKSST6D        CONSTANT =O'000200000',                              X
MSKSSWV         CONSTANT =O'003000000',                              X
MSKSSWVC        CONSTANT =O'101050000',                              X
MSKSSWVO        CONSTANT =O'101450000',                              X
MSKSSZFS        CONSTANT =O'002000000',                              X
MSKTMC0         CONSTANT =O'700000000',                              X
MSKTMC1         CONSTANT =O'710000000',                              X
MSKTMC2         CONSTANT =O'720000000',                              X
MSKTMC3         CONSTANT =O'730000000',                              X
MSKTMC4         CONSTANT =O'740000000',                              X
MSKT2INT        CONSTANT =O'100000000',                              X
MSK180DG        CONSTANT =O'400000000',                              X
VTMC                                                                 X
VTOLD
```

```
PROC      .UTR00    ''TELEMETRY DELAY FOR MODE REG SETTING OF 70''
          VTMC = MSKTMC0
          .UTR0     ''PERFORM DELAY AS REQUIRED''
EXIT      ''UTR00''
PROC      .UTR01    ''TELEMETRY DELAY FOR MODE REG SETTING OF 71''
          VTMC = MSKTMC1
          .UTR0     ''PERFORM DELAY AS REQUIRED''
EXIT      ''UTR01''
PROC      .UTR02    ''TELEMETRY DELAY FOR MODE REG SETTING OF 72''
          VTMC = MSKTMC2
          .UTR0     ''PERFORM DELAY AS REQUIRED''
EXIT      ''UTR02''
PROC      .UTR03    ''TELEMETRY DELAY FOR MODE REG SETTING OF 73''
          VTMC = MSKTMC3
          .UTR0     ''PERFORM DELAY AS REQUIRED''
EXIT      ''UTR03''
PROC      .UTR04    ''TELEMETRY DELAY FOR MODE REG SETTING OF 74''
          VTMC = MSKTMC4
          .UTR0     ''PERFORM DELAY AS REQUIRED''
EXIT      ''UTR04''
PROC      .UTR0     ''TELEMETRY DELAY FOR LEVEL 0''
          DECLARE FIXED 0,
               VTIM,
               KTELBIAS CONSTANT = 2.
TR00.     LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
               EX7INT,EX8INT,EX9INT
          DIRECT
               ''READ CLOCK INTO VTIM''
          END
          IF VTIM - DVTD LAND MSKRTC GQ DKTD    THEN GOTO TR05        END
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
      ''ALLOW HIGH PRIORITY TASKS TO INTERRUPT''
          GOTO TR00
TR05.     DIRECT
               ''SET MODE REG WITH CONTENTS OF VTMC''
          END
          DVTD = VTIM + KTELBIAS
EXIT      ''UTR0''
PROC      .UTR30    ''TELEMETRY DELAY FOR INTERRUPT LEVEL 3''
          DECLARE FIXED 0,
               KTELBIAS CONSTANT = 2. ,
               VTIM
TR35.     DIRECT
               ''READ CLOCK INTO VTIM''
          END
          IF VTIM - DVTD LAND MSKRTC LS DKTD   THEN GOTO TR35         END
          DIRECT
               ''SET MODE REG WITH MSKTMC0''
          END
          DVTD = VTIM + KTELBIAS
EXIT      ''UTR30''
PROC      .UTR24    ''TELEMETRY DELAY FOR INTERRUPT LEVEL 2''
          DECLARE FIXED 0,
               KTELBIAS CONSTANT = 2. ,
               VTIM
```

```
TR20.     LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
               EX7INT,EX8INT,EX9INT
          DIRECT
               ''READ CLOCK INTO VTIM''
          END
          IF VTIM - DVTD LAND MSKRTC GQ DKTD   THEN GOTO TR25         END
          UNLOCK T1INT
          GOTO TR20
TR25.     DIRECT
               ''SET MODE REG WITH MSKTMC4''
          END
          DVTD = VTIM + KTELBIAS
EXIT      ''UTR24''
```

```
      ''SYSTEM INITIALIZATION''
EGP0.      LOCK TLCINT T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,    X
                EX6INT,EX7INT,EX8INT,EX9INT
           DIRECT
                ''READ X ACCELEROMETER INTO VOAC(0)''
                ''READ Y ACCELEROMETER INTO VOAC(1)''
                ''READ Z ACCELEROMETER INTO VOAC(2)''
                ''READ REAL TIME CLOCK INTO DVACT''
           END
           IF DFMDI LAND MSKFMREP
                THEN ON T1INT
                     DIRECT
                          ''READ REAL TIME CLOCK INTO DVACT''
                     END
                     LOCK T1INT
                     TEMP = 0
                     END
                     TEMP = 1
                     DIRECT
                          ''LOAD TIMER 1 WITH 1 BIT''
                     END
                     UNLOCK T1INT
LOOP.                IF TEMP        THEN GOTO LOOP.                          END
           END
           DFIL1,DFIL2,DFIL3 = TRUE
           DVRTC,DVTEX,VPPOT = DVACT
           DVTMM,DVTRR,DVERT,DVTGR,DVTRS,DVTMR,DTBID,VTD = 0.
           .EGP1 ''ACTIVATE INTERRUPT PROCESSOR CHRONIC STATEMENTS''
           UNLOCK TLCINT
           FGNC = FALSE
           DVSST = 1.E10
           DVMLT, DVMLD = DKMIR
           .EGP15     ''SCHEDULE FIRST TIMER 1 FUNCTION''
           DVP = 1
           .GP002     ''PASS CONTROL TO PHASE ACTIVATION ROUTINE''
PROC .MPA00     ''PHASE TERMINATION ROUTINE''
           DFPHC = TRUE
           LOCK TLCINT,T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,    X
                EX6INT,EX7INT,EX8INT,EX9INT
           DIRECT
                ''LOAD TIMER 2 WITH A LARGE VALUE''
                ''RESET ANY PENDING TIMER 2 INTERRUPT''
           END
           DFIL1, DFIL2 = TRUE
           UNLOCK TLCINT,T1INT
           .GP002          ''ACTIVATE THE NEXT MISSION PHASE''
EXIT       ''MPA00''
PROC .GP002          ''MISSION PHASE ACTIVATION AND CONTROL ROUTINE''
           DECLARE BOOLEAN, FGNC
           DECLARE FIXED, VTD 10
GP0020.    IF DVP GR 4     THEN STOP                                          END
           IF DKAPI (DVP - 1)
                THEN .EGP20     ''START PHASE TIME REFERENCE''
                     GOTO (INP13, INP24, INP13, INP24, *) DVP - 1
                ELSE DVP = DVP + 1
```

```
                GOTO GP0020
        END
INP13.  ARSTAT,APSTAT,DPSTAT,NESTAT,CC1STAT,MSSTAT,EBSTAT = TRUE
        SASTAT,DVSTAT,TCSTAT,PASTAT,TTSTAT,IGSTAT,HSSTAT,OGSTAT,      X
        TGSTAT,RSSTAT,CSSTAT,TB1STAT,TB57STAT,PGSTAT = FALSE
        DLPTL(*) = 0.
        PPSTAT(*) = FALSE
        T2STAT(*) = FALSE
        T2STAT(0) = TRUE
        MIN00 ''PERFORM PHASE 1/3 APPLICATION PGM INIT  (NOT CODED)''
        .EGP18  ''SCHEDULE NEXT TIMER 2 FUNCTION''
        DFIL1, DFIL2, DFIL3, DFPHC = FALSE
        UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
        .NINTSEQ1 ''PASS CONTROL TO PHASE 1/3 NON-INTERRUPT SEQ''
INP24.  CTSTAT,DTSTAT = FALSE
        DLPTL(*) = 0.
        PPSTAT(*) = TRUE
        T2STAT(0),T2STAT(4),T2STAT(5) = FALSE
        T2STAT(1),T2STAT(2),T2STAT(3),T2STAT(6),T2STAT(7),T2STAT(8),  X
        T2STAT( 9),T2STAT(10) = TRUE
        .MIN10  ''PERFORM PHASE 2/4 APPLICATION PGM INIT (NOT CODED)''
        .EGP18 ''SCHEDULE NEXT TIMER 2 FUNCTION''
        DFIL1,DFIL2,DFIL3, DFPHC = FALSE
        UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
        .NINTSEQ2 ''PASS CONTROL TO PHASE 2/4 NON-INTERRUPT SEQ''
EXIT    ''GP002''
```

```
PROC .EGP1          ''INTERRUPT PROCESSOR''
          OPTIMIZE TIME(20)
     ''                                                                    ''
     ''RESPONSE FOR TLC INTERRUPT                                          ''
     ''                                                                    ''
          ON TLCINT
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
               EX7INT,EX8INT,EX9INT
          DIRECT
               ''READ REAL TIME CLOCK INTO DVTEX''
          END
          DFIL2, DFIL3 = TRUE
          .MTS00    ''PROCESS TLC INTERRUPT                  (NOT CODED)''
     ''THE TLC APPLICATION PROGRAM DOES NOT RETURN CONTROL                 ''
          END
     ''                                                                    ''
     ''RESPONSE FOR TIMER 1 INTERRUPT                                      ''
     ''                                                                    ''
          ON T1INT
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
               EX7INT,EX8INT,EX9INT
          DIRECT
               ''READ REAL TIME CLOCK INTO DVTT1''
          END
          DFIL3 = TRUE
          GOTO ( ,GP11,GP12) GST1M
          .MML00              ''FLIGHT SIM MINOR LOOP''      $ GOTO EGP11
GP11.     .MML20              ''NORMAL MINOR LOOP''          $ GOTO EGP11
GP12.     .MSS00              ''SWITCH SELECTOR PROCCESSOR''
EGP11.    .EGP15              ''SCHEDULE NEXT T1 FUNCTION''
          DFIL3 = FALSE
          UNLOCK '' RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
     ''                                                                    ''
     ''RESPONSE FOR TIMER 2 INTERRUPT                                      ''
     ''                                                                    ''
          ON T2INT
          LOCK T2INT
          DFIL1 = TRUE
          GOTO (EGP12,GP21,GP22,GP23,GP24,GP25,GP26,GP27,GP28,GP29,GP30,X
               GP31) DGST2
GP21.     .MUM00 ''TIME UPDATE            (NOT CODED)'' $ GOTO EGP12
GP22.     .MLR10 ''LADDER RAMP PROCESSOR  (NOT CODED)'' $ GOTO EGP12
GP23.     .MEP00 ''EVENTS PROCESSOR''                   $ GOTO EGP12
GP24.     .MTT10 ''TIME TILT GUIDANCE     (NOT CODED)'' $ GOTO EGP12
GP25.     .MNU00 ''NAVIGATION UPDATE IMPL (NOT CODED)'' $ GOTO EGP12
GP26.     .MEE00 ''TIME BASE 8 ENABLE     (NOT CODED)'' $ GOTO EGP12
GP27.     .MCM00 ''PHASE 2/4 CONTROL MOD  (NOT CODED)'' $ GOTO EGP12
GP28.     .MCM10 ''PHASE 2/4 CONTROL MOD  (NOT CODED)'' $ GOTO EGP12
GP29.     .MCM20 ''PHASE 2/4 CONTROL MOD  (NOT CODED)'' $ GOTO EGP12
GP30.     .MEPWM ''WATER METHANOL ACTIVATE(NOT CODED)'' $ GOTO EGP12
GP31.     .MER00 ''EXTRA ACCELEROMETER RD (NOT CODED)''
EGP12.    .EGP18 ''SCHEDULE NEXT T2 FUNCTION''
          DFIL1 = FALSE
          UNLOCK T2INT
```

```
    END
''                                                                    ''
''RESPONSE FOR EXTERNAL 2 INTERRUPT                                   ''
''                                                                    ''
    ON EX2INT
    LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
         EX7INT,EX8INT,EX9INT
    DIRECT
         ''READ REAL TIME CLOCK INTO DVTEX''
    END
    DFIL2, DFIL3 = TRUE
    .MDP28     ''SC INITIATION OF S2/S4B SEPARATION   (NOT CODED)''
    DFIL2, DFIL3 = FALSE
    UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
    END
''                                                                    ''
''RESPONSE FOR EXTERNAL 4 INTERRUPT                                   ''
''                                                                    ''
    ON EX4INT
    LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
         EX7INT,EX8INT,EX9INT
    DIRECT
         ''READ REAL TIME CLOCK INTO DVTEX''
    END
    DFIL2, DFIL3 = TRUE
    .MTB50     ''S4B ENGINE OUT                        (NOT CODED)''
    DFIL2, DFIL3 = FALSE
    UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
    END
''                                                                    ''
''RESPONSE FOR EXTERNAL 5 INTERRUPT                                   ''
''                                                                    ''
    ON EX5INT
    LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
         EX7INT,EX8INT,EX9INT
    DIRECT
         ''READ REAL TIME CLOCK INTO DVTEX''
    END
    DFIL2, DFIL3 = TRUE
    .MTB30     ''S1C OUTBOARD ENGINE OUT               (NOT CODED)''
    DFIL2, DFIL3 = FALSE
    UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
    END
''                                                                    ''
''RESPONSE FOR EXTERNAL 6 INTERRUPT                                   ''
''                                                                    ''
    ON EX6INT
    LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
         EX7INT,EX8INT,EX9INT
    DIRECT
         ''READ REAL TIME CLOCK INTO DVTEX''
    END
    DFIL2, DFIL3 = TRUE
    .MTB40     ''S2 PROPELLANT DEPLETION               (NOT CODED)''
    DFIL2, DFIL3 = FALSE
```

```
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
     ''                                                                    ''
     ''RESPONSE FOR EXTERNAL 8 INTERRUPT                                   ''
     ''                                                                    ''
          ON EX8INT
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
               EX7INT,EX8INT,EX9INT
          DIRECT
               ''READ REAL TIME CLOCK INTO DVTEX''
          END
          DFIL2, DFIL3 = TRUE
          .MDS00    ''PROCESS DIGITAL COMMAND SYSTEM INPUT''
          DFIL2, DFIL3 = FALSE
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
EXIT      ''EGP1''
PROC .EGP15         ''TIMER 1 SCHEDULER''
     DECLARE FIXED, KT1BIAS 0 CONSTANT = 9.
          DIRECT
               ''READ REAL TIME CLOCK INTO TEMP''
          END
          TEMP1 = DVTMM + ((TEMP - DVRTC LAND MSKRTC) + KT1BIAS) RSH 2
          IF DVMLT LQ TEMP1
               THEN TEMP = 1
                    GST1M = DGMLM
                    GOTO EGP150
          END
          IF DVMLT LQ DVSST
               THEN GST1M = DGMLM
                    TEMP = (DVMLT - TEMP1) LSH 1
               ELSE GST1M = 2
                    IF DVSST LQ TEMP1
                         THEN TEMP = 1
                         ELSE TEMP = (DVSST - TEMP1) LSH 1
                    END
          END
EGP150.   DIRECT
               ''LOAD TIMER 1 WITH TEMP''
          END
EXIT      ''EGP15''
PROC .EGP18         ''TIMER 2 SCHEDULER''
     DECLARE FIXED, KT2BIAS 0 CONSTANT = 12.0,                              X
                    K4SEC  -2 CONSTANT = 4.*DKRTCSEC
          DGST2 = 0
          DV2TG = DVTMM + K4SEC
          FOR I = 0 TO 10
               IF NOT T2STAT(I)          THEN GOTO T2S10              END
               IF DLTTL(I) GR DV2TG      THEN GOTO T2S10              END
               DGST2 = I + 1
               DV2TG = DLTTL(I)
T2S10.    END
          LOCK T1INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,EX7INT,  X
               EX8INT,EX9INT
          IF DVT2G LQ DVTMM              THEN GOTO T2S20              END
```

```
          DIRECT
               ''READ REAL TIME CLOCK INTO TEMP''
          END
          TEMP = (DV2TG - DVTMM + DVERT - (TEMP - DVRTC LAND MSKRTC)     X
                - KT2BIAS) RSH 1
          IF TEMP LQ 0
T2S20.         THEN TEMP = 1
          END
          DIRECT
               ''LOAD TIMER 2 WITH TEMP''
          END
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
EXIT      ''EGP18''
          UNTIME
PROC .EGP20        ''SYSTEM TIME UPDATE ROUTINE''
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
               EX7INT,EX8INT,EX9INT
          DIRECT
               ''READ REAL TIME CLOCK INTO TEMP1''
          END
          DVERT = TEMP1 - DVRTC LAND 3
          DVTMM = DVTMM + (TEMP1 - DVRTC LAND MSKRTC)
          DVRTC = TEMP1 - DVERT
          DVTRR = DVTMM - DVTMR
          IF DFIL3
               THEN GOTO OUT
          END
          IF DFIL2
               THEN UNLOCK T1INT
                    GOTO OUT
          END
          IF DFIL1
               THEN UNLOCK ''RELEASE PREVIOUSLY ENABLED INT. EXCEPT T2''
                    GOTO OUT
          END
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
OUT.  EXIT ''EGP20''
```

```
PROC .NINTSEQ1      ''NON-INTERRUPT SEQUENCER FOR PHASES 1 AND 3''
NIS1.       IF ARSTAT       THEN .MAR00 $ .PERPROC                    END
                                 ''ACCELEROMETER READ''
            IF SASTAT       THEN .MSA00 $ .PERPROC                    END
                                 ''SIMULATED ACCEL        (NOT CODED)''
            IF APSTAT       THEN .MAP00 $ .PERPROC                    END
                                 ''ACCELEROMETER PROCESSING''
            IF DVSTAT       THEN .MDV00 $ .PERPROC                    END
                                 ''F/M CALCULATIONS       (NOT CODED)''
            IF DPSTAT       THEN .MDP00 $ .PERPROC                    END
                                 ''DISCRETE PROCESSOR     (NOT CODED)''
            IF NESTAT       THEN .MNE00 $ .PERPROC                    END
                                 ''BOOST NAVIGATION       (NOT CODED)''
            IF TCSTAT       THEN .MTC00 $ .PERPROC                    END
                                 ''RESTART CALCULATIONS   (NOT CODED)''
            IF PASTAT       THEN .MPA00 $ .PERPROC                    END
                                 ''PHASE ACTIVATOR''      (NOT CODED)''
            IF TTSTAT       THEN .MTT00 $ .PERPROC                    END
                                 ''TIME TILT GUIDANCE     (NOT CODED)''
            IF CC1STAT      THEN .MCC10 $ .PERPROC                    END
                                 ''CHI COMPUTATIONS       (NOT CODED)''
            IF IGSTAT       THEN .MIG00 $ .PERPROC                    END
                                 ''ITERATIVE GUIDANCE MODE''
            IF HSSTAT       THEN .MHS00 $ .PERPROC                    END
                                 ''S4B CUTOFF PREDICTION (NOT CODED)''
            IF OGSTAT       THEN .MOG00 $ .PERPROC                    END
                                 ''ORBITAL GUIDANCE       (NOT CODED)''
            IF TGSTAT       THEN .MTG00 $ .PERPROC                    END
                                 ''TARGET UPDATE          (NOT CODED)''
            IF RSSTAT       THEN .MRS00 $ .PERPROC                    END
                                 ''TIME-TO-GO TO RESTART (NOT CODED)''
            IF CSSTAT       THEN .MCS00 $ .PERPROC                    END
                                 ''TIME BASE 6-CHECK      (NOT CODED)''
            IF TB1STAT      THEN .MTB10 $ .PERPROC                    END
                                 ''TIME BASE 1            (NOT CODED)''
            IF TB57STAT     THEN .MTB57 $ .PERPROC                    END
                                 ''TIME BASE 5/7          (NOT CODED)''
            IFMSSTAT        THEN .MMS00 $ .PERPROC                    END
                                 ''MINOR LOOP SUPPORT     (NOT CODED)''
            IF PGSTAT       THEN .MPG00 $ .PERPROC                    END
                                 ''SIM PLATFORM GIM ANGLE(NOT CODED)''
            IF EBSTAT       THEN .MEB00 $ .PERPROC                    END
                                 ''ETC/BTC                (NOT CODED)''
            GOTO NIS1                                                 END
EXIT        ''NINTSEQ1''                                              END
PROC .NINTSEQ2      ''NON-INTERRUPT SEQUENCER FOR PHASES 2 AND 4''
NIS2.       IF CTSTAT       THEN .MCT00 $ .PERPROC                    END
                                 ''DATA COMPRESSION TELEM(NOT CODED)''
            IF DTSTAT       THEN .MDT00                               END
                                 ''SECTOR DUMP TELEMETRY (NOT CODED)''
            .PERPROC ''INSURE PERIODIC PROCESSOR GETS EXECUTED''
            GOTO NIS2
EXIT        ''NINTSEQ2''
```

```
PROC .PERPROC       ''PERIODIC PROCESSOR''
     DECLARE FIXED, VPPOT 0
         DIRECT
              ''READ REAL TIME CLOCK INTO TEMP''
         END
         DVPTG = (TEMP - VPPOT LAND MSKRTC) RSH 2
         VPPOT = TEMP
         FOR I = 0 TO 2
              IF NOT PPSTAT(I)     THEN GOTO PP20                    END
              DLPTL(I) = DLPTL(I) + DVPTG
              IF DLPTL(I) LS DLPRL(I)  THEN GOTO PP20                END
              GOTO ( , PP1, PP2, *) I
              .MPC50     ''50 SEC DATA COMP (NOT CODED)'' $ GOTO PP10
PP1.          .MPC60     ''60 SEC DATA COMP (NOT CODED)'' $ GOTO PP10
PP2.          .MPC99    ''100 SEC DATA COMP (NOT CODED)''
PP10.         DLPTL(I) = 0
PP20.    END
EXIT     ''PERPROC''
```

```
PROC .MEP00        ''EVENTS PROCESSOR (TIMER 2 ENTRY)''
      ''                                                                ''
      ''  EVENTS PROCESSOR TABLE                                       ''
      ''                                                                ''
      ''       ONLY A PORTION OF THE TABLE (THROUGH TIME BASE 3)        ''
      ''       HAS BEEN CODED.                                          ''
      ''                                                                ''
      ''       EACH ENTRY CONSISTS OF TWO WORDS:                        ''
      ''            1. AN INDEX IDENTIFYING THE APPLICATION MODULE TO   ''
      ''               PERFORM PROCESSING FOR THE EVENT.                ''
      ''            2. EVENT EXECUTION TIME.                            ''
      ''                                                                ''
      ''       NOTE: AN ENTRY INDEX WITH A VALUE OF ZERO IS EITHER SET  ''
      ''             DYNAMICALLY IN REAL TIME OR IS USED TO DISABLE     ''
      ''             THE EVENTS PROCESSOR FOR THE REMAINDER OF A TIME   ''
      ''             BASE.                                              ''
      ''                                                                ''
          DECLARE INTEGER, EPTABLE (2, 131)                              X
               = (  1         0      ''START OF TIME BASE 0 TABLE''      X
                    0      16.0*DKRTCSEC                                 X
                    0      17.0*DKRTCSEC                                 X
                    0      17.5*DKRTCSEC                                 X
                    0        0                                           X
                    2        0      ''START OF TIME BASE 1 TABLE''      X
                    3       1.0*DKRTCSEC                                 X
                    0       6.0*DKRTCSEC                                 X
                    4       9.0*DKRTCSEC                                 X
                    5      10.0*DKRTCSEC                                 X
                    0      14.0*DKRTCSEC                                 X
                    6     134.7*DKRTCSEC                                 X
                    0        0                                           X
                    7        0      ''START OF TIME BASE 2 TABLE''      X
                    0        0                                           X
                    0      18.4*DKRTCSEC                                 X
                    0      27.5*DKRTCSEC                                 X
                    0        0                                           X
                    8        0      ''START OF TIME BASE 3 TABLE''      X
                    9        0                                           X
                   10        0                                           X
                    0        0                                           X
                   11        0                                           X
                   12        0                                           X
                   13       1.4*DKRTCSEC                                 X
                   14       4.4*DKRTCSEC                                 X
                   15       4.4*DKRTCSEC                                 X
                   16       6.7*DKRTCSEC                                 X
                    0       6.7*DKRTCSEC                                 X
                   17       6.7*DKRTCSEC                                 X
                   18      40.6*DKRTCSEC                                 X
                   19      40.6*DKRTCSEC                                 X
                   20      58.6*DKRTCSEC                                 X
                   21      60.6*DKRTCSEC                                 X
                    0     299.0*DKRTCSEC                                 X
                    0     355.0*DKRTCSEC                                 X
                    0     388.5*DKRTCSEC                                 X
```

```
                0         0)
EP00.       IF DFTBCEP
EP04A.           THEN DFTBCEP = FALSE
                     GOTO EP02
            END
            GOTO (EP100,EP101,EP102,EP103,EP104,EP105,EP106,EP107,EP108,  X
                  EP109,EP110,EP111,EP112,EP113,EP114,EP115,EP116,EP117,  X
                  EP118,EP119) EPTABLE(0,EPTINDX) - 1
EP100.      .LE285 ''SCHEDULE WATER METHANOL      (NOT CODED)'' $ GOTO EP01
EP101.      .LE25  ''TIME BASE 1 SETUP            (NOT CODED)'' $ GOTO EP01
EP102.      .LE30  ''COMMAND INIT OF YAW MANEUVER(NOT CODED)'' $ GOTO EP01
EP103.      .LE35  ''COMMAND TERM OF YAW MANEUVER(NOT CODED)'' $ GOTO EP01
EP104.      .LE40  ''SET ACCEL REASON, TEST CONST(NOT CODED)'' $ GOTO EP01
EP105.      .LE50  ''START TIME BASE 2            (NOT CODED)'' $ GOTO EP01
EP106.      .LE55  ''DISABLE THRUST CONSTRAINT    (NOT CODED)'' $ GOTO EP01
EP107.      .LE75  ''TIME BASE 3 SETUP            (NOT CODED)'' $ GOTO EP01
EP108.      .LE70  ''SET ACCEL REASON, TEST CONST(NOT CODED)'' $ GOTO EP01
EP109.      .LE250 ''CHNG GIMB REASON, TEST CONST(NOT CODED)'' $ GOTO EP01
EP110.      .LE355 ''DEQUEUE TIME TILT            (NOT CODED)'' $ GOTO EP01
EP111.      .LE365 ''F/M UNCERT FOR THRUST MISAL  (NOT CODED)'' $ GOTO EP01
EP112.      .LE82  ''ENABLE DIN 22 AND INT 2      (NOT CODED)'' $ GOTO EP01
EP113.      .LE100 ''SET ACCEL BACKUP PROFILE     (NOT CODED)'' $ TOTO EP01
EP114.      .LE95  ''SET ACCEL REASON, TEST CONST(NOT CODED)'' $ GOTO EP01
EP115.      .LE90  ''ENABLE DIN 19                (NOT CODED)'' $ GOTO EP01
EP116.      .LE96  ''ENQUEUE F/M CALC, SMOOTHING  (NOT CODED)'' $ GOTO EP01
EP117.      .LE105 ''ENQUEUE IGM                  (NOT CODED)'' $ GOTO EP01
EP118.      .LE115 ''SET MINOR LOOP PARAMETERS    (NOT CODED)'' $ GOTO EP01
EP119.      .LE111 ''SET SMC FLAG                 (NOT CODED)'' $ GOTO EP01
EP120.      .LE110 ''ENQUEUE SMC                  (NOT CODED)''
EP01.       LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,   X
                 EX7INT,EX8INT,EX9INT
            IF DFTBCEP      THEN GOTO EP04A                                 END
            EPTINDX = EPTINDX + 1
            DQST2 = 3 ''SET INDEX FOR EP ENTRY IN T2 SCHED CONT TABLE''
            IF EPTABLE(0,EPTINDX)
EP03.            THEN IF EPTABLE(1,EPTINDX) EQ VTOLD
                          THEN UNLOCK ''RELEASE PREVIOUSLY ENABLED INT''
                               GOTO EP00
                     END
                     VTOLD = EPTABLE(1,EPTINDX)
                     DLTTL(DQST2) = DVTMR + VTOLD
                ELSE T2STAT(DQST2) = FALSE
                     IF NOT DFIL1
                          THEN .EGP07       ''RESCHEDULE T2  (NOT CODED)''
                     END
            END
EP02.       UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
EXIT        ''MEP00''
PROC .MEP05          ''EVENTS PROCESSOR (TIME BASE CHANGE ENTRY)''
      DECLARE INTEGER, EPTBC(10)CONSTANT = 0 5 13 18 38 55 71 93 107 110
            EPTINDX = EPTBC(DTBID) - 1
            .MEP10
EXIT        ''MEP05''
PROC .MEP10          ''EVENTS PROCESSOR (RESCHEDULE ENTRY)''
            EPTINDX = EPTINDX + 1
```

```
          DQST2 = 3 ''SET INDEX FOR EP ENTRY IN T2 SCHED CONT TABLE''
          IF EPTABLE(0,EPTINDX)
EP0A,          THEN VTOLD = EPTABLE(1,EPTINDX)
                    DLTTL(DQST2) = DVTMR + VTOLD
                    T2STAT(DQST2) = TRUE
               ELSE T2STAT(DQST2) = FALSE
          END
          IF NOT DFIL1
               THEN .EGP07        ''RESCHEDULE TIMER 2       (NOT CODED)''
          END
EXIT      ''MEP10''
```

```
PROC .MIG00        ''ITERATIVE GUIDANCE MODE''
     DECLARE BOOLEAN,                                                    X
         CHIBARST  ,                                                     X
         REITERAT  ,                                                     X
         PHASE     ,                                                     X
         SMCFLAG   ,                                                     X
         S4BURN
     DECLARE FIXED,                                                      X
         COSTHETA     25,    DELTAL3      12,    DELTAVVP (3) 11,      X
         DELTA2        2,    DPHII        33,    DPHIT        33,      X
         EPSILON2     15,    EPSILON3     15,    GS (3)       21,      X
         GT           20,    GV (3)       21,    GVSTAR (3)   21,      X
         GVT (3)      20,    J1            4,    J12           2,      X
         J2            4,    J3            2,    J3P           2,      X
         KCCT4        23     CONSTANT = 1.53          ,                X
         KCCT8        23     CONSTANT = 1.55          ,                X
         KMU         -24     CONSTANT = -.39860320E15 ,                X
         KT           48     CONSTANT = .48497964E-7  ,                X
         K1            2,    K2            2,    K3           -2,      X
         K4           -2,    LYP          12,    L1           12,      X
         L12          12,    L2           12,    L3           12,      X
         L3P          12,    MS4(3,3)     25,    M4V(3,3)     25,      X
         PHII         25,    PHIIT        25,    PHIT         25,      X
         P1           -5,    P12          -6,    P2           -5,      X
         Q1           -5,    Q12          -5,    Q2           -5,      X
         R             2,    ROVEX3       36,    RS (3)        2,      X
         RT            2,    RV (3)        2,    RVT (3)       2,      X
         R4 (3)        2,    SINTHETA     25,    S1            4,      X
         S12           2,    S2            4,    TAU1         15,      X
         TAU2         15,    TAU3         15,    TCI          15,      X
         THETAT       25,    TSTAR        15,    T1C          15,      X
         T1I          15,    T2I          15,    T3I          15,      X
         U1          -12,    U12         -13,    U2          -12,      X
         V            11,    VEX1         12,    VEX2         12,      X
         VEX3         12,    VS (3)       11,    VT           11,      X
         VV (3)       11,    VVT (3)      11,    V4 (3)       11
     ''DUE TO THE SIZE OF IGM, ONLY A SECTION OF IT HAS BEEN CODED.  ''
     ''PART OF THE GUIDANCE COMPUTATIONS HAVE BEEN SELECTED TO DEMON-''
     ''STRATE MATHEMATICAL OPERATIONS.  THE PHASING PORTION OF IGM   ''
     ''HAS NOT BEEN CODED SINCE SIMILAR CAPABILITIES ARE ILLUSTRATED ''
     ''BY OTHER KERNELS.                                             ''
     ''                                                              ''
     '' IG251 - IGM GUIDANCE PARAMETERS COMPUTATIONS                 ''
     ''                                                              ''
     '' ROTATE POSITION AND VELOCITY INTO TARGET PLANE               ''
     ''                                                              ''
IG253.    R4 = MS4/*/RS
          .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
          DIRECT
               ''TELEMETER X POSITION IN 4 SYSTEM, R4(0)''
          END
          .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
          DIRECT
               ''TELEMETER Y POSITION IN 4 SYSTEM, R4(1)''
          END
```

```
          UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUT''
          V4 = MS4/*/VS
          .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
          DIRECT
               ''TELEMETER Z POSITION IN 4 SYSTEM, R4(2)''
          END
          .UTR02    ''DELAY FOR TELEMETRY AS REQUIRED''
          DIRECT
               ''TELEMETER Y VELOCITY IN 4 SYSTEM, V4(1)''
          END
          UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUT''
     ''                                                                  ''
     '' CALCULATE RANGE ANGLE MEASURED IN ORBIT PLANE                    ''
     ''                                                                  ''
IG254.    IF T2I EQ 0.
               THEN L12,J12,S12,Q12,P12,U12 = 0.
                    GOTO IG259
          END
          IF T1I EQ 0.
               THEN L1,J1,S1,Q1,P1,U1 = 0.
                    GOTO IG258.
          END
          L1 = VEX1*.LOG(TAU1/(TAU1 - T1I))
          J1 = L1*TAU1 - VEX1*T1I
          S1 = L1*T1I - J1
          Q1 = S1*TAU1 - .5*VEX1*T1I**2
          P1 = J1*TAU1 - .5*VEX1*T1I**2
          U1 = Q1*TAU1 - VEX1*T1I**3/6.
IG258.    L2 = VEX2*.LOG(TAU2/(TAU2 - T2I))
          J2 = L2*TAU2 - VEX2*T2I
          S2 = L2*T2I - J2
          Q2 = S2*TAU2 - .5*VEX2*T2I**2
          P2 = J2*TAU2 - .5*VEX2*T2I**2
          U2 = Q2*TAU2 - VEX2*T2I**3/6.
          L12 = L1 + L2
          J12 = J1 + J2 + L2*T1I
          S12 = S1 - J2 + L12*(T2I + TCI)
          Q12 = Q1 + Q2 + S2*T1I + J1*T2I
          P12 = P1 + P2 + T1I*(2.*J2 + L2*T1I)
          U12 = U1 + U2 + T1I*(2.*Q2 + S2*T1I) + T2I*P1
IG259.    L3P = VEX3*.LOG(TAU3/(TAU3 - T3I))
          LYP = L12 + L3P
          J3P = L3P*TAU3 - VEX3*T3I
          T1C = T1I + T2I + TCI
          TSTAR = T1C + T3I
          PHII = .ATAN(R4(2),R4(0))
     ''                                                                  ''
     ''DETERMINE PHASE                                                   ''
     ''                                                                  ''
IG260.    IF PHASE ''IS FOR LEAVING ORBIT''
IG262.         THEN ''CALCULATE TERMINAL CONDITIONS''                              X
                    SINTHETA =(RS/*/VS)/(R*V)
                    COSTHETA = .SQRT(1. - SINTHETA**2)
                    DPHII = V/R*COSTHETA
                    DPHIT = VT/RT*.COS(THETAT)
```

```
                    PHIIT = .5*(DPHII + DPHIT)*TSTAR
                    PHIT = PHII + PHIIT
                    .UTR02    ''DELAY FOR TELEMETRY AS REQUIRED''
                    DIRECT
                         ''TELEMETER TERMINAL RANGE ANGLE, PHIT''
                    END
                    UNLOCK ''RELEASE INT LOCKED BY TELEM DELAY ROUTINE''
                    IF TSTAR LQ EPSILON3     THEN GOTO IG269          END
                    .MIG30 ''CALL TERM RAD, VEL, FLT ANGLE (NOT CODED)''
                    GT = - KMU/RT**2
                    .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
                    DIRECT
                         ''TELEMETER TERMINAL GRAVITY VECTOR, GT''
                    END
                    UNLOCK ''RELEASE INT LOCKED BY TELEM DELAY ROUTINE''
                    GVT(0) = GT*.COS(THETAT)
                    GVT(1) = 0.
                    GVT(2) = GT*.SIN(THETAT)
                    RVT(0) = RT*.COS(THETAT)
                    RVT(1), RVT(2) = 0.
IG269.              PHIT = PHIT - THETAT
               ELSE ''CALCULATE INTERMEDIATE PARAMETERS''                    X
                    DELTA2 = V*TSTAR - J3P + LYP*T3I - ROVEX3*((TAU1 -       X
                             T1I)*L1 + (TAU2 - T2I)*L2 + (TAU3 - T3I)        X
                             *L3P)*(LYP + V -VT)
                    PHIIT = KT*(S12 + DELTA2)
                    PHIT = PHII + PHIIT
                    .UTR02    ''DELAY FOR TELEMETRY AS REQUIRED''
                    DIRECT
                         ''TELEMETER TERMINAL RANGE ANGLE, PHIT''
                    END
                    UNLOCK ''RELEASE INT LOCKED BY TELEM DELAY ROUTINE''
          END
     ''                                                                    ''
     ''ROTATE POSITION, VELOCITY, GRAVITY TO INJECTION SYSTEM              ''
     ''                                                                    ''
IG291.    M4V(0,0), M4V(2,2) = .COS(PHIT)
          M4V(0,2) = .SIN(PHIT)
          M4V(2,0) = -.SIN(PHIT)
          M4V(1,1) = 1.
          M4V(1,0), M4V(0,1), M4V(2,1), M4V(1,2) = 0.
          RV = M4V/*/R4
          VV = M4V/*/V4
          GV = M4V/*/MS4/*/GS
          GVSTAR(*) = .5*(GVT(*) + GV(*))
          DELTAVVP(*) = VVT(*) - VV(*) - TSTAR*GVSTAR(*)
     ''                                                                    ''
     '' IG314 - CALCULATE TIME-TO-GO                          (NOT CODED)''
     ''                                                                    ''
          IF REITERAT
               THEN REITERAT = FALSE
                    L3P = L3
                    J3P = J3
                    LYP = LYP + DELTAL3
                    GOTO IG260
```

```
                ELSE REITERAT = TRUE
            END
        ''IG324 - COMPUTE CORRECTED VELOCITIES TO BE GAINED  (NOT CODED)''
        ''IG326 - CALCULATE DESIRED PITCH AND YAW            (NOT CODED)''
            IF CHIBARST              THEN GOTO IG350                 END
            IF TSTAR GQ EPSILON2     THEN GOTO IG360                 END
            IF S4BURN
                THEN DVMC5 = DVMC5 LXOR MSKM5CBS
                     DVMLR = 25.*KCCT4
                     DV1MR = .04/KCCT4
                ELSE DVMC6 = DVMC6 LXOR MSKM6CBS
                     DVMLR = 25.*KCCT8
                     DV1MR = .04/KCCT8
            END
IG340.      CHIBARST = TRUE
IG350.      K1, K2, K3, K4 = 0.
            GOTO IG440
IG360.''IG361 - COMPUTE INTERMEDIATE PARAMETERS              (NOT CODED)''
IG440.      .UTR00     ''DELAY FOR TELEMETRY AS REQUIRED''
            DIRECT
                ''TELEMETER T3I''
            END
            UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUT''
        ''IG446 - COMPUTE PITCH AND YAW IN 4 SYSTEM          (NOT CODED)''
            IF SMCFLAG THEN .MSM00 END ''COMP SMC TERMS       (NOT CODED)''
            .MCC00   ''PERFORM CHI COMPUTATIONS''            (NOT CODED)''
            IF DFILE LAND MSKFPSI2
                THEN .EGP32(MSKSCC0) ''ENABLE INTERRUPT 2    (NOT CODED)''
            END
EXIT        ''MIG00''
```

```
PROC ,MDS00        ''DIGITAL COMMAND SYSTEM''
     DECLARE BOOLEAN,                                                    X
         DCSMSTAT (20),                                                  X
         FDSEN        ,                                                  X
         FDSPG        ,                                                  X
         FDSRE
     DECLARE INTEGER,                                                    X
         DCSDATCT (20) CONSTANT =(0 1 35 2 2 3 3(0) 35 8(0) 6 0),        X
         DCSDTCNT ,                                                      X
         DCSERLIM      CONSANT = 7,                                      X
         DCSER04       CONSANT = 0'040000000',                           X
         DCSER10       CONSANT = 0'100000000',                           X
         DCSER14       CONSANT = 0'140000000',                           X
         DCSER20       CONSANT = 0'200000000',                           X
         DCSER24       CONSANT = 0'240000000',                           X
         DCSER44       CONSANT = 0'440000000',                           X
         DCSER60       CONSANT = 0'600000000',                           X
         DCSER64       CONSANT = 0'640000000',                           X
         DCSER74       CONSANT = 0'740000000',                           X
         DCSINDX  ,                                                      X
         DCSMODE (64) CONSTANT = (5(0) 8 2(0) 1 2 3 4 5 2(0) 14 6 0 7    X
                                  2(0) 19 3(0) 9 0 15 17 8(0) 13 4(0)    X
                                  18 10 11 12 2(0) 16 15(0)),            X
         DCSSTCOD(20) CONSTANT =(0'000000000' 0'100000000' 0'110000000'X
                                0'120000000' 0'130000000' 0'140000000'X
                                0'200000000' 0'220000000' 0'050000000'X
                                0'310000000' 0'770000000' 0'770000000'X
                                0'770000000' 0'450000000' 0'170000000'X
                                0'330000000' 0'600000000' 0'340000000'X
                                0'520000000' 0'250000000'),             X
         VDSBL (35),                                                     X
         VDSER ,                                                         X
         VDSRC ,                                                         X
         VDSSB ,                                                         X
         VDS01
         UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
         DIRECT
              ''READ DISCRETE INPUT REGISTER INTO TEMP''
              ''READ DIGITAL COMMAND SYSTEM INPUT INTO VDS01''
         END
         IF NOT TEMP LAND MSKDCSMD      THEN GOTO DS60                END
     ''                                                                  ''
     ''PROCESS DCS MODE COMMAND                                          ''
     ''                                                                  ''
DS09.    IF (VDS01 LSH 7 LXOR VDS01) LAND MSKDCSCM NQ MSKDCSCM
              THEN VDSER = DCSER10
                   GOTO DS220
         END
         IF VDS01 LAND MSKDCSSB
              THEN VDSER = DCSER24
                   GOTO DS220
         END
         IF VDS01 LAND MSKDCSMC EQ MSKDCSTR       THEN GOTO DS25      END
         IF NOT FDSEN
              THEN VDSER = DCSER20
```

```
                    GOTO DS220
               END
               IF DFDTL OR FDSPG
                    THEN VDSER = DCSER64
                         GOTO DS220
               END
DS20.          FDSPG = TRUE
DS25.          DCSINDX = DCSMODE(VDS01 RSH 20)
               IF NOT DCSMSTAT(DCSINDX)
                    THEN FDSPG = FALSE
                         VDSER = DCSER74
                         GOTO DS220
               END
          ''TELEMETER STATUS CODE TWICE''
               .UTR24    ''DELAY FOR TELEMETRY AS REQUIRED''
               DIRECT
                    ''TELEMETER DCS STATUS CODE, DCSSTCOD(DCSINDX)''
               END
               .UTR24    ''DELAY FOR TELEMETRY AS REQUIRED''
               DIRECT
                    ''TELEMETER DCS STATUS CODE, DCSSTCOD(DCSINDX)''
               END
               UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUT''
               .DS200  ''ISSUE CRP''
               DCSDTCNT, VDSSB = 0
               GOTO DS100
          ''                                                              ''
          ''PROCESS DCS DATA WORD                                         ''
          ''                                                              ''
DS60.          IF FDSEN
                    THEN VDSER = DCSER04
                         GOTO DS220
               END
               IF (VDS01 LSH 7 LXOR VDS01) LAND MSKDCSCM NQ MSKDCSCM
                    THEN VDSER = DCSER44
                         GOTO DS220
               END
               IF VDS01 LAND MSKDCSSB NQ VDSSB
                    THEN VDSER = DCSER60
                         GOTO DS220
               END
DS110.''TELEMETER DATA WORD TWICE''
               .UTR24    ''DELAY FOR TELEMETRY AS REQUIRED''
               DIRECT
                    ''TELEMETER DCS DATA WORD, VDS01''
               END
               .UTR24    ''DELAY FOR TELEMETRY AS REQUIRED''
               DIRECT
                    ''TELEMETER DCS DATA WORD, VDS01''
               END
               UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUT''
               .DS200    ''ISSUE CRP''
               VDSBL(DCSDTCNT) = VDS01 LAND MSKDCSMC
               VDSSB = VDSSB LXOR MSKDCSSB
               DCSDTCNT = DCSDTCNT + 1
```

```
DS100.    IF DCSDTCNT LS DCSDATCT(DCSINDX)   THEN GOTO DCSEXIT        END
          GOTO (,DS01,DS02,DS03,DS04,DS05,DS06,DS07,DS08,DS09A,DS10,     X
                DS11,DS12,DS13,DS14,DS15,DS16,DS17,DS18,DS19) DCSINDX
          FDSPG = FALSE
          VDSER = DCSER14
          GOTO DS220
DS01.     .DS260           ''TIME BASE UPDATE  (NOT CODED)'' $ GOTO DS530
DS02.     .DS330(=DS235.)  ''NAVIGATION UPDATE (NOT CODED)'' $ GOTO DS530
DS03.     .DS380(=DS220.)  ''GENERALIZED SS    (NOT CODED)'' $ GOTO DS530
DS04.     .DS430           ''SECTOR DUMP       (NOT CODED)'' $ GOTO DS530
DS05.     .DS470           ''SINGLE MEM LOC TEL(NOT CODED)'' $ GOTO DS530
DS06.     .DS510           ''TERMINATE         (NOT CODED)'' $ GOTO DS530
DS07.     .DS540           ''MANEUVER UPDATE   (NOT CODED)'' $ GOTO DS530
DS08.     .DS550           ''MANEUVER INHIBIT  (NOT CODED)'' $ GOTO DS530
DS09A.    .DS670(=DS235.)  ''TARGET UPDATE     (NOT CODED)'' $ GOTO DS530
DS10.     .DS700           ''ANTENNA TO OMNI   (NOT CODED)'' $ GOTO DS530
DS11.     .DS720           ''ANTENNA TO LOW    (NOT CODED)'' $ GOTO DS530
DS12.     .DS740           ''ANTENNA TO HIGH   (NOT CODED)'' $ GOTO DS530
DS13.     .DS770           ''INHIBIT WATER CONT(NOT CODED)'' $ GOTO DS530
DS14.     .DS790           ''TIME BASE 8 ENABLE(NOT CODED)'' $ GOTO DS530
DS15.     .DS810           ''EXECUTE MANEUVER A(NOT CODED)'' $ GOTO DS530
DS16.     .DS840           ''TD AND E ENABLE   (NOT CODED)'' $ GOTO DS530
DS17.     .DS860           ''EXECUTE MANEUVER B(NOT CODED)'' $ GOTO DS530
DS18.     .DS900           ''S4B/IU LUNAR IMPCT(NOT CODED)'' $ GOTO DS530
DS19.     .DS960           ''ENABLE TB6D ALT SQ(NOT CODED)'' $ GOTO DS530
     ''                                                                 ''
     ''PROCESS DCS ERROR CONDITION                                      ''
     ''                                                                 ''
DS220.    VDSRC = VDSRC + 1
          IF VDSRC LS DCSERLIM
               THEN FDSRE = FALSE
               ELSE FDSRE = TRUE
          END
          VDSER = VDSER + VDSRC + (VDS01 RSH 12 LAND MSKDCSER)
DS235.''TELEMETER ERROR CODE TWICE''
          .UTR24     ''DELAY FOR TELEMETRY AS REQUIRED''
          DIRECT
               ''TELEMETER DCS ERROR CODE, VDSER''
          END
          .UTR24     ''DELAY FOR TELEMETRY AS REQUIRED''
          DIRECT
               ''TELEMETER DCS ERROR CODE, VDSER''
          END
          UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUT''
          IF NOT FDSRE   THEN GOTO DCSEXIT                          END
DS530.    VDSRC = 0
          FDSEN = TRUE
          FDSPG = FALSE
CLOSE     .DS200     ''ISSUE DCS COMMAND RESET PULSE''
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
               EX7INT,EX8INT,EX9INT
          DIRECT
               ''SET COMMAND RESET BIT IN DISCRETE OUTPUT REGISTER''
               ''DELAY 4.13 MS''
               ''RESET COMMAND RESET BIT IN DISCRETE OUTPUT REGISTER''
```

```
          END
          UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
EXIT      ''DS200''
DCSEXIT   EXIT ''MDS00''
```

```
PROC .MAR00        ''ACCELEROMETER READ ROUTINE''
      DECLARE FIXED,                                                    X
          COSTHY  25,                                                   X
          COSTHZ  25,                                                   X
          SINTHY  25,                                                   X
          SINTHZ  25,                                                   X
          VCCYA   25,                                                   X
          VCCZA   25,                                                   X
          VOACT 25 -2
      DECLARE INTEGER,                                                  X
          VOAC (3)
     LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,EX7INT, X
          EX8INT,EX9INT
     DIRECT          ''ENTER DIRECT MODE TO PERFORM I/O''
                     ''READ X ACCELEROMETER INTO DVAC(0)''
                     ''READ Y ACCELEROMETER INTO DVAC(1)''
                     ''READ Z ACCELEROMETER INTO DVAC(2)''
                     ''READ REAL TIME CLOCK INTO DVACT''
     END
     .UTR00     ''DELAY FOR TELEMETRY AS REQUIRED''
     DIRECT
          ''TELEMETER START TIME OF CURRENT TIME BASE, DVTI''
     END
     TEMP = DVTAS
     VOAXT = DVTMM + (DVACT - DVRTC - DVERT LAND MSKRTC)
     DVTAS = .24609375E-3 * VOACT
     DVTB = DVTAS - DVTI
     DVDT = DVTAS - TEMP
     .UTR00     ''DELAY FOR TELEMETRY AS REQUIRED''
     DIRECT
          ''TELEMETER TIME IN CURRENT TIME BASE, DVTB''
     END
     DVMC4 = DVMC4 LAND MSKRTCRS
     UNLOCK              ''RELEASE INTERRUPT INHIBITS''
     .UTR00     ''DELAY FOR TELEMETRY AS REQUIRED''
     DIRECT
          ''TELEMETER X ACCELEROMETER READING, DVAC(0)''
     END
     .UTR00     ''DELAY FOR TELEMETRY AS REQUIRED''
     DIRECT
          ''TELEMETER Y ACCELEROMETER READING, DVAC(1)''
     END
     UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE''
     IF ''TIME BASE 1'' DKT1 EQ 0.     ''NOT SET''
          THEN DVFMC = - DVG(0)
          ELSE DVMAS = DVMAS - DVEOF*DVFMR*DVDT
               DVFMC = DVEOF*DVFOR/DVMAS
     END
AR41,DVCA(2) = (DVCC(2) RSH 1) + (VCCZA RSH 1)
     VCCZA = DVCC(2)
     DVCA(1) = (DVCC(1) RSH 1) + (VCCYA RSH 1)
     IF ABS(DVCC(1) - VCCYA) GQ .5       ''COMPARE TO 90 DEG IN PIRADS''
          THEN DVCA(1) = DVCA(1) - 1. ''ADJUST BY 180 DEG IN PIRADS''END
     VCCYA = DVCC(1)
     .UTR00     ''DELAY FOR TELEMETRY AS REQUIRED''
```

```
     DIRECT
          ''TELEMETER Z ACCELEROMETER READING, DVAC(2)''
     END
     UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE''
AR100.    DVDA(*) = (DVAC(*) LAND MSKACCA) - (VOAC(*) LAND MSKACCA)RSH 7
          DVDB(*) = ((DVAC(*) LAND MSKACCB) - (VOAC(*) LAND MSKACCB)    X
                    LSH 14) RSH 7
          VOAC(*) = DVAC(*)
     .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
     DIRECT
          ''TELEMETER REAL TIME CLOCK AT ACCEL READ, DVACT''
     END
     UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE''
AR71..USC00 (DVTH(2) = SINTHZ,COSTHZ) ''OBTAIN SIN/COS     (NOT CODED)''
     .UTR00    ''DELAY FOR TELEMETRY AS REQUIRED''
     DIRECT
          ''TELEMETER MISSION ELAPSED TIME, DVTAS''
     END
     UNLOCK ''RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE''
     .USC00 (DVTH(1) = SINTHY,COSTHY) ''OBTAIN SIN/COS     (NOT CODED)''
      DVD(0) = 20.*DVDT*COSTHY*COSTHZ
     DVD(1) = 20.*DVDT*SINTHZ
     DVD(2) = - 20.*DVDT*SINTHY*COSTHZ
     DVF(*) = DVFOM*DVD(*)
EXIT ''MAR00''
PROC .MAP00         ''ACCELEROMETER PROCESSING ROUTINE''
      DECLARE FIXED,                                                  X
          DELTA    7,                                                 X
          KSN2D   25 CONSTANT = .0348994967, ''SINE 2 DEGREES''       X
          VACZR    7,                                                 X
          VPOV (3) 7
      DECLARE INTEGER (3) CONSTANT,                                   X
          MSKAPDG = (0'040000000',                                    X
                     0'010000000',                                    X
                     0'200000000'),                                   X
          MSKAPOF = (0'000000010',                                    X
                     0'000000200',                                    X
                     0'000000020')
     DVVSQ = 0.
     VACZR = 20.*DVFOM*DVDT*KSN2D
     FOR I = 0 TO 2
AP400.    IF ABS(DVDA(I) - DVDB(I)) LQ 2. THEN GOTO AP450          END
          IF ABS(DVDA(I) - DVF(I)) LS ABS(DVDH(I) - DVF(I))
               THEN GOTO AP440                                     END
          DVMC4 = DVMC4 LOR MSKAPDG(I) LSH 1
          DELTA = DVDB(I)
          GOTO AP460
AP440.    DVMC4 = DVMC4 LOR MSKAPDG(I)
AP450.    DELTA = DVDA(I)
AP460.    IF ABS(DELTA) GR 1. THEN GOTO AP500                       END
          IF DFZER EQ FALSE          THEN GOTO AP500                END
          IF ABS(DVF(I)) LS VACZR THEN GOTO AP500                   END
          DVMC4 = DVMC4 LOR MSKAPOF(I)
AP530.    DVMC4 = DVMC4 LOR MSKAPDG(I) LOR MSKAPDG(I) LSH 1
          DFSMC = FALSE
```

```
          DELTA = DVFMC*DVD(I)
          GOTO AP520
AP500.    IF DVF(I) LS 0.
               THEN IF DELTA LS 1.5*DVF(I) - DVRC(I)*DVDT                    X
                    OR DELTA GR  .5*DVF(I) + DVRC(I)*DVDT
                         THEN GOTO AP530                                    END
               ELSE IF DELTA GR 1.5*DVF(I) + DVRC(I)*DVDT                    X
                    OR DELTA LS  .5*DVF(I) - DVRC(I)*DVDT
                         THEN GOTO AP530                                    END
          END
AP510.    DVVSQ = DVVSQ + DELTA**2
AP520.    VPOV(I) = VPOV(I) + DELTA
          DVDM(I) = .05*VPOV(I)
          .UTR01 ''DELAY FOR TELEMETRY AS REQUIRED''
          GOTO (AP521, AP522, AP523, *) I
AP521.    DIRECT
               ''TELEMETER X MEASURED VELOCITY, DVDM(0)''
          END
          GOTO AP524
AP522.    DIRECT
               ''TELEMETER Y MEASURED VELOCITY, DVDM(1)''
          END
          GOTO AP524
AP523.    DIRECT
               ''TELEMETER Z MEASURED VELOCITY, DVDM(2)''
          END
AP524.    UNLOCK ''RELEASE INTERRUPTS LOCKED BY TELEMETRY DELAY ROUT''
     END
EXIT ''MAP00''
```

```
PROC .MML00          ''FLIGHT SIM ENTRY TO MINOR LOOP''
     IF DVLRC EQ 0
          THEN DVCC(*) = DVCC(*) - DVDC(*)
          ELSE DVLRC = DVLRC - 1
     END
     .MML20          ''EXECUTE MINOR LOOP''
EXIT ''MML00''
PROC .MML20          ''NORMAL MINOR LOOP ENTRY''
     OPTIMIZE TIME(20)
      DECLARE BOOLEAN,                                                    X
          FBUGS
      DECLARE FIXED,                                                      X
          KCPRG          14  CONSTANT = 2016.,                            X
          VBUB (3)       25 ,                                             X
          VCG  (3)       25 ,                                             X
          VCG0 (3)       14 ,                                             X
          VCG1 (3)       14 ,                                             X
          VCG10          14 ,                                             X
          VCG11          14 ,                                             X
          VCMND (3,3)     0 ,                                             X
          VCOD (3)       14 ,                                             X
          VDEL (3)       25 ,                                             X
          VGR  (3)        0 ,                                             X
          VML0 (3)       14 ,                                             X
          VML1 (3)       14 ,                                             X
          VML2 (3)       14 ,                                             X
          VOLD (3)       14 ,                                             X
          VPGR (3)        0 ,                                             X
          VSF  (3)       35 ,                                             X
          VOCK           25
      DECLARE INTEGER,                                                    X
          FBUG (3),                                                       X
          VFIO (3),                                                       X
          VIRE    ,                                                       X
          VMEMR   ,                                                       X
          VMLET
     DVCC(*) = DVCC(*) + DVDC(*)
     IF FBUGS    THEN GOTO ML500                                          END
ML001.FOR I = 2 BY -1 TO 0
          GOTO (ML201, ML101, , *) I
          IF VFIO(2) EQ 0 ''NORMAL''
               THEN DIRECT ''READ Z GIMBAL INTO VGR(2)''                  END
               ELSE IF VFIO(2) EQ 1 ''BACKUP''
                         THEN DIRECT''READ Z BACKUP INTO VGR(2)''         END
                         ELSE VGR(2) = VPGR(2)
                    END
          END
          GOTO ML004
ML101.    DIRECT
          ''READ ERROR MONITOR REGISTER INTO VMEMR''
          END
          DVLDB = DVLDB - (VMEMR LAND MSKEMRLB)
          IF VFIO(1) EQ 0 ''NORMAL''
               THEN DIRECT ''READ Y GIMBAL INTO VGR(1)''                  END
               ELSE IF VFIO(1) EQ 1 ''BACKUP''
```

```
                    THEN DIRECT ''READ Y BACKUP INTO VGR(1)''   END
                    ELSE VGR(1) = VPGR(1)
               END
          END
          GOTO ML004
ML201.    DVEMR = DVEMR LOR VMEMR
          IF VFIO(0) EQ 0 ''NORMAL''
               THEN DIRECT ''READ X GIMBAL INTO VGR (0)''            END
               ELSE IF VFIO(0) EQ 1  ''BACKUP''
                    THEN DIRECT ''READ X BACKUP INTO VGR(0)''   END
                    ELSE VGR(0) = VPGR(0)
               END
          END
ML004.    IF VGR(I) GQ 0.      THEN GOTO ML020                      END
          IF DVDGS LS 0        THEN GOTO ML432                      END
          IF DVDGS EQ 0        THEN GOTO ML020
                               ELSE GOTO ML637                      END
ML432.    .MDG00 (= J, ML434.) ''PROCESS DISAGREEMENT BIT  (NOT CODED)''
     ''DISAGREEMENT BIT PROCESSING WILL TAKE A NORMAL RETURN IF THE  ''
     ''DISAGREEMENT BIT IS FOUND TO BE INVALID.  OTHERWISE IT WILL   ''
     ''TAKE THE ERROR EXIT TO ML434 AND SET J = 0 IF THE GIMBAL IS   ''
     ''VALID OR J = 1 IF THE GIMBAL IS NOT VALID.                    ''
     ''                                                              ''
          GOTO ML020
ML434.    GOTO (ML4352, ML4351, ML4350, *) I
ML4350.   IF VFIO(2) EQ 0 ''NORMAL''
               THEN DIRECT
                    ''RESTART Y COD COUNTER''
                    END
               ELSE DIRECT
                    ''RESTART Y COD COUNTER (BACKUP)''
                    END
          END
          GOTO (ML020, ML637, *) J
ML4351.   IF VFIO(1) EQ 0 ''NORMAL''
               THEN DIRECT
                    ''RESTART X COD COUNTER''
                    END
               ELSE DIRECT
                    ''RESTART X COD COUNTER (BACKUP)''
                    END
          END
          GOTO (ML020, ML637, *) J
ML4352.   IF VFIO(0) EQ 0 ''NORMAL''
               THEN DIRECT
                    ''RESTART Z COD COUNTER''
                    END
               ELSE DIRECT
                    ''RESTART Z COD COUNTER (BACKUP)''
                    END
          END
          GOTO (ML020, ML637, *) J
ML020.    VCOD(I) = VGR(I) LAND MSKGIMA
          IF VCOD(I) EQ 0. AND VOLD(I) EQ 0. AND ABS(VDEL(I)) GQ VOCK
               THEN GOTO ML631
```

```
          END
          IF ABS(VCOD(I) - VOLD(I)) LS VML0(I)
               THEN GOTO ML040
          END
          IF ABS(VCOD(I) - VOLD (I)) + VML0(I) GQ VML1(I)
               THEN IF VCOD(I) LS VOLD(I)
                         THEN VCG(I) = VCG(I) + VML2(I)
                         ELSE VCG(I) = VCG(I) - VML2(I)
                    END
                    GOTO ML040
               ELSE GOTO ML630
          END
ML040.    DVTH(I) = VSF(I)*VCOD(I) + VCG(I)
          VOLD(I) = VCOD(I)
          VDEL(I) = DVTH(I) - DVCC(I)
          DFDBF = TRUE
          GOTO (ML245, ML145, ML045, *) I
ML045.    VCMND(2,0) = DVA5*VDEL(2) - DVA4*VDEL(1)
          GOTO ML730
ML145.    VCMND(1,0) = DVA1*VDEL(1) + DVA2*VDEL(2)
          GOTO ML730
ML245.    VCMND(0,0) = DVA6*(VDEL(0) + DVA3*VDEL(1))
          GOTO ML730
ML630.    VMLET = I + 3
          GOTO ML632
ML631.    VMLET = I
ML632.    VMLET = VMLET LSH 11 LOR VCOD(I) RSH 14 LOR VOLD(I)
          IF DVMC6 LAND MSKM6D04 EQ 0 THEN
                    .UTR30    ''DELAY FOR TELEMETRY AS REQUIRED''
                    DIRECT
                         ''TELEMETER MINOR LOOP ERROR MESSAGE, VMLET''
                    END
          END
          IF NOT DFDBF              THEN GOTO ML635                    END
          DVRE(I) = DVRE(I) + 1
          IF DVRE(I) LS 0           THEN GOTO ML637                    END
          IF DVRE(I) GR 0           THEN GOTO ML636                    END
          VMLET =  VCOD(I) RSH 14 LOR VOLD(I) LOR MSKERTAG
          VFIO(I) = 1 ''BACKUP''
          VCG(I) = (VCG(I) LAND MSK180DG) - VBUB(I)
          VML2(I) = -1. ''180 DEGREES IN PIRADS''
          VOLD(I) = (DVTH(I) LAND MSKM180D)*KCPBG LAND MSKGIMA
          VSF(I) = 1./KCPBG
          IF I EQ 2
               THEN DIRECT
                    ''SET INTERNAL CONTROL REGISTER TO SELECT BU GIM''
                    END
                    DVICR = DVICR LXOR MSKICRBG
          END
          FBUGS,FBUG(I) = 1 ''PASS1''
          VML0(I) = VCG10
          VML1(I) = VCG11
          IF DVMC6 LAND MSKM6D04 EQ 0 THEN
                    .UTR30    ''DELAY FOR TELEMETRY AS REQUIRED''
                    DIRECT
```

```
                    ''TELEMETER MINOR LOOP ERROR MESSAGE, VMLET''
                END
        END
        GOTO ML637
ML635.  DVHDB = DVHDB - 1
        DFDBF = TRUE
        DVHDA = DVHDA + 1
        IF DVHDA LS 0           THEN GOTO ML636                    END
        DIRECT
        ''SET INTERNAL CONTROL REGISTER TO SWITCH GIMBAL ORDER''
        END
        DVICR = DVICR LXOR MSKICRSG
        DVMC4 = DVMC4 LOR MSKM4AMF
        DVDGS =0
ML636.  IF DVRE(I) GQ VIRE AND DVMC6 LAND MSKM6D04 EQ 0
            THEN .UD000(MSKGRF) ''SET GUID REF FAIL DISC(NOT CODED)''
        END
ML637.  DFSMC = FALSE
        GOTO ML760
ML730.  IF ABS(VCMND(I,0)) GR DVM06   THEN VCMND(I,0) = DVM06      END
        IF ABS(VCMND(I,0) - VCMND(I,1)) GR DVM05
            THEN VCMND(I,0) = VCMND(I,1) + DVM05
        END
        VCMND(I,1) = VCMND(I,0)
        IF VCMND(I,0) LS 0.
            THEN VCMND(I,2) = MSKABLAD - VCMND(I,0)
            ELSE VCMND(I,2) = VCMND(I,0)
        END
ML760.  GOTO (ML260, ML160, ML060, *) I
ML060.  DIRECT
        ''ISSUE YAW COMMAND''
        END
        IF DVLDB LS 0
            THEN DIRECT
                ''SET INTERNAL CONTROL REG TO SELECT CONVERTER A''
                END
        END
        DVMLT = DVTMM + DVMLD + (DVTT1 - DVRTC LAND MSKRTC) RSH 2
        GOTO ML900
ML160.  DIRECT
        ''ISSUE PITCH COMMAND''
        END
        GOTO ML900
ML260.  DIRECT
        ''START SPECIAL DOM BACKUP GIMBAL''
        ''ISSUE YAW COMMAND''
        ''ISSUE ROLL COMMAND''
        END
ML900. END
       GOTO MLEXIT
ML500. FOR I = 0 TO 2
        GOTO (ML530, ML520, ML540, *) FBUG(I)
ML520.  FBUG(I) = 2
        GOTO ML530
ML540.  FBUG(I) = 0
```

```
          VML0(I) = VCG0(I)
          VML1(I) = VCG1(I)
ML530. END
     FBUGS = FBUG(0) LOR FBUG(1) LOR FBUG(2)
     GOTO ML001
     UNTIME
MLEXIT. EXIT ''MML20''
```

```
PROC .MSSOO        ''SWITCH SELECTOR PROCESSING''
      ''                                                              ''
      '' SWITCH SELECTOR TABLE                                        ''
      ''                                                              ''
      ''       THE SWITCH SELECTOR TABLE IS MADE UP OF A NUMBER OF    ''
      ''       SMALLER TABLES, ONE FOR EACH TIME BASE AND FOR EACH    ''
      ''       OF THE ALTERNATE SS SEQUENCES.  THE SMALLER TABLES ARE ''
      ''       ORGANIZED INTO ONE LARGE TABLE BY AN OVERLAY.  ONLY    ''
      ''       THE TIME BASE 1 SEQUENCE HAS BEEN CODED.               ''
      ''                                                              ''
      ''       EACH TABLE ENTRY REPRESENTS A SINGLE SS COMMAND AND    ''
      ''       CONSISTS OF TWO WORDS.                                 ''
      ''            1. TIME OF SS ISSUANCE.                           ''
      ''            2. SS STAGE AND ADDRESS.                          ''
      ''                                                              ''
      DECLARE INTEGER, SSTABLE (2,1000)
      DECLARE INTEGER, SSTTB1 (2,28) CONSTANT                          X
                              =(  5.0*DKRTCSEC    0'000000000'        X
                                  6.0*DKRTCSEC    0'106500000'        X
                                 14.0*DKRTCSEC    0'026100000'        X
                                 16.8*DKRTCSEC    0'406440000'        X
                                 20.0*DKRTCSEC    0'405440000'        X
                                 20.2*DKRTCSEC    0'406340000'        X
                                 24.0*DKRTCSEC    0'025740000'        X
                                 27.0*DKRTCSEC    0'402100000'        X
                                 29.0*DKRTCSEC    0'027740000'        X
                                 30.0*DKRTCSEC    0'403040000'        X
                                 32.0*DKRTCSEC    0'401100000'        X
                                 49.5*DKRTCSEC    0'020100000'        X
                                 75.0*DKRTCSEC    0'000000000'        X
                                 90.0*DKRTCSEC    0'402100000'        X
                                 95.0*DKRTCSEC    0'401100000'        X
                                 95.3*DKRTCSEC    0'022640000'        X
                                105.0*DKRTCSEC    0'407640000'        X
                                115.1*DKRTCSEC    0'025740000'        X
                                119.8*DKRTCSEC    0'406740000'        X
                                120.0*DKRTCSEC    0'405740000'        X
                                120.1*DKRTCSEC    0'027740000'        X
                                130.0*DKRTCSEC    0'404040000'        X
                                132.4*DKRTCSEC    0'021640000'        X
                                133.6*DKRTCSEC    0'400700000'        X
                                133.8*DKRTCSEC    0'401700000'        X
                                134.4*DKRTCSEC    0'021740000'        X
                                134.6*DKRTCSEC    0'023740000'        X
                                  0'377777776'    0'000000000')
      ''                                                              ''
      ''    ALTHOUGH THE REMAINING GROUPS OF SWITCH SELECTORS HAVE    ''
      ''    NOT BEEN CODED, THEY ARE REFERENCED IN THE FOLLOWING      ''
      ''    OVERLAY STATEMENT TO INDICATE HOW THE OVERALL SS TABLE    ''
      ''    WOULD BE ORGANIZED.                                       ''
      ''                                                              ''
          OVERLAY  SSTABLE = SSTTB1,SSTTB2,SSTTB3,SSTTB4,SSTTB5,SSTTB6, X
               SSTTB7,SSTTB8,SSTSIVB,SSTSIVA,SSTTB6A,SSTTB6B,SSTTB6C,   X
               SSTS4C1,SSTGAIN,SSTTB6D,SSTALU,SSTGSS,SSTSBLO,SSTSBHI,   X
               SSTSROM,SSTECSV,SSTECS1,SSTTB3A,SSTTB5A,SSTTB5B
```

```
DECLARE BOOLEAN,                                                    X
    FASE    ,                                                       X
    FBRNI   ,                                                       X
    FCLS4   ,                                                       X
    FFBCH   ,                                                       X
    FHST    ,                                                       X
    FSSAC   ,                                                       X
    FSSIO   ,                                                       X
    FTADV   ,                                                       X
    FT60P
DECLARE FIXED -2 CONSTANT,                                          X
    KCSSK     = .200*DKRTCSEC ,                                     X
    KSSB1     = .018*DKRTCSEC - 3. ,                                X
    KSSB2     = .025*DKRTCSEC - 2. ,                                X
    KSSB3     = .019*DKRTCSEC - 11.,                                X
    KSSB4     = .013*DKRTCSEC - 17.,                                X
    KSSB5     = .026*DKRTCSEC - 3. ,                                X
    KSSB6     = .013*DKRTCSEC - 2. ,                                X
    KSSB7     = .023*DKRTCSEC - 6. ,                                X
    KSSB8     = .013*DKRTCSEC - 9. ,                                X
    KSSRB     = .050*DKRTCSEC - 2. ,                                X
    KSS500MS  = .500*DKRTCSEC      ,                                X
    KSS500S   = 500.*DKRTCSEC
DECLARE FIXED -2,                                                   X
    VATRR   ,                                                       X
    VATR4   ,                                                       X
    VGBIA   ,                                                       X
    VSSRT   ,                                                       X
    VSSTM   ,                                                       X
    VSSW    ,                                                       X
    VSTGO
DECLARE INTEGER,                                                    X
    SSTTBPTR (8) CONSTANT = ( L'SSTTB1'-L'SSTABLE',                 X
                              L'SSTTB2'-L'SSTABLE',                 X
                              L'SSTTB3'-L'SSTABLE',                 X
                              L'SSTTB4'-L'SSTABLE',                 X
                              L'SSTTB5'-L'SSTABLE',                 X
                                        0          ,                X
                              L'SSTTB7'-L'SSTABLE',                 X
                              L'SSTTB8'-L'SSTABLE'),                X
    SST1PTR   ,                                                     X
    SST2PTR   ,                                                     X
    VASPI     ,                                                     X
    VHSTW     ,                                                     X
    VPSTG     ,                                                     X
    VSCCA     ,                                                     X
    VSC1 (3)  ,                                                     X
    VSC3 (3)  ,                                                     X
    VSNA      ,                                                     X
    VSNA1     ,                                                     X
    VSSCA     ,                                                     X
    VSSFB     ,                                                     X
    VSTG
    GOTO ( ,MSS05,MSS10,MSS20,MSS30,MSS40,MSS50,MSS55,MSS60,MSS70,X
          MSS80) DGSSM
```

```
          LOCK T1INT,T2INT,EX1INT,EX2INT,EX3INT,EX4INT,EX5INT,EX6INT,    X
               EX7INT,EX8INT,EX9INT
          FASE = FALSE
          IF DVASW LAND MSKSSS4C
               THEN DVASW = DVASW LAND MSKSSWV
                    IF VASPI LAND MSKSSS4C THEN GOTO SS0060          END
                    .EGP08       ''RESCHEDULE TIMER 1      (NOT CODED)''
                    VSAPI = MSKSSS4C
                    SST1PTR = L'SSTSIV8'-L'SSTABLE'
                    GOTO SS1050
          END
          IF DVASW LAND MSKSSSPC
               THEN DVASW = DVASW LAND MSKSSWV
                    .EGP08       ''RESCHEDULE TIMER 1      (NOT CODED)''
                    VASPI = MSKSSSPC
                    SST1PTR = L'SSTSIVA'-L'SSTABLE'
                    GOTO SS1050
          END
          IF DVASW LAND MSKSST6C
               THEN DVASW = DVASW LXOR MSKSST6C
                    VASPI = VASPI LOR  MSKSST6
                    DVMC6 = DVMC6 LOR  MSKM6T6C
                    SST1PTR = L'SSTTB6C'-L'SSTABLE'
                    .SSTUPD(=VATRR)  ''UPDATE SS TIME''
                    GOTO SS1050
          END
          IF DVASW LAND MSKSSCS1
               THEN VSC1(0),VSC1(1),VSC1(2) = SST1PTR,VASPI,VATRR
                    VASPI = MSKSSCL1
                    .SSTUPD(= VATRR) ''UPDATE SSTIME''
                    FTADV = TRUE
                    IF DVASW LAND MSKSST6A
                         THEN DVASW = DVASW LXOR MSKSST6A
                              DVMC6 = DVMC6 LOR MSKM6T6A
                              SST1PTR = L'SSTTB6A'-L'SSTABLE'
                         ELSE IF DVASW LAND MSKSSS41
                                   THEN DVASW = DVASW LXOR MSKSSS41
                                        SST1PTR = L'SSTS4C1'-L'SSTABLE'
                                   ELSE DVASW = DVASW LXOR MSKSST6B
                                        DVMC6 = DVMC6 LOR MSKM6T6B
                                        SST1PTR = L'SSTTB6B'-L'SSTABLE'
                              END
                    END
                    GOTO SS1050
          END
          IF FSSAC
               THEN GOTO SS0060
               ELSE GOTO SS0000
          END
MSS05.    FSSAC = FALSE
SS0000.   IF SSTABLE(0,SST1PTR) NQ MSKSSEND
SS0010.        THEN .SSTUPD(= VSTGO) ''UPDATE SS TIME''
                    VSTGO = VSSRT - VSTGO
                    IF VSTGO LS KSS500MS     THEN GOTO MSS30         END
                    IF DFTUP
```

```
                    THEN DVTGB = DVTGB + VGBIA
                         VGBIA = 0.
                         DFTUP = FALSE
                         GOTO SS0010
                    ELSE IF DVASW       THEN GOTO SS0170        END
                         VSSTM = VSTGO + DVTRB - DVTGB - KCSSK
                         DVSST = VSSTM + DVTMR
                         DGSSM = 4  ''SET SS ENTRY FOR MSS30''
                         IF NOT DFIL3
                              THEN .EGP08 ''RESCHED T1(NOT CODED)''
                         END
               END
               GOTO SS0060
          END
SS0015.   IF DVASW       THEN GOTO SS0170                        END
          DIRECT
               ''READ REAL TIME CLOCK INTO TEMP''
          END
          DVSST = DVTMM + KSS500S + ((TEMP - DVRTC LAND MSKRTC) RSH 2)
          DGSSM = 1 ''SET SS ENTRY INDEX FOR MSS05''
          IF NOT DFIL3 THEN .EGP08       ''RESCHEDULE T1(NOT CODED)''END
          GOTO SS0060
SS0170.   IF NOT DVASW LAND MSKSSCS3
               THEN IF DVASW LAND MSKSSACQ
                         THEN DVASW = DVASW LXOR MSKSSACQ
                              SST2PTR = L'SSTGAIN'-L'SSTABLE'
                              .SSTUPD(= VATR4) ''UPDATE SS TIME''
                         ELSE IF DVASW LAND MSKSST6D
                                   THEN DVASW = DVASW LXOR MSKSST6D
                                        SST2PTR = L'SSTTB6D'-L'SSTABLE'
                                        .SSTUPD(= VATR4)''UPDATE SS TM''
                                   ELSE DVASW = DVASW LXOR MSKSSLI
                                        SST2PTR = L'SSTALU'-L'SSTABLE'
                                        VATR4 = 0.
                              END
                    END
                    FCLS4 = TRUE
                    FTADV = FALSE
                    FHST = TRUE
                    .SS210   ''SET UP CLASS 4 ALTERNATE SEQUENCE''
                    GOTO SS0000
          END
          IF VASPI       THEN GOTO SS0060                          END
          VSC3(0), VSC3(1), VSC3(2) = SST1PTR, VASPI, VATRR
          VASPI = MSKSSCL3
          .SSTUPD(= VATRR) ''UPDATE SS TIME''
          FTADV = TRUE
          FHST = TRUE
          IF DVASW LAND MSKSSGNS
               THEN DVASW = DVASW LXOR MSKSSGNS
                    SST1PTR = L'SSTGSS'-L'SSTABLE''
                    GOTO SS0230
          END
          IF DVASW LAND MSKSSSBL
               THEN DVASW = DVASW LXOR MSKSSSBL
```

```
                SST1PTR = L'SSTSBLO'-L'SSTABLE''
                GOTO SS0230
          END
          IF DVASW LAND MSKSSSBH
               THEN DVASW = DVASW LXOR MSKSSSBH
                    SST1PTR = L'SSTSBHI'-L'SSTABLE''
                    GOTO SS0230
          END
          IF DVASW LAND MSKSSSBO
               THEN DVASW= DVASW LXOR MSKSSSBO
                    SST1PTR = L'SSTSBOM'-L'SSTABLE'
                    GOTO SS0230
          END
          IF DVASW LAND MSKSSECV
               THEN SST1PTR = L'SSTECSV'-L'SSTABLE'
                    GOTO SS0230
          END
          IF DVASW LAND MSKSSEC1
               THEN SST1PTR = L'SSTECS1'-L'SSTABLE'
               ELSE SST1PTR = L'SSTTB3A'-L'SSTABLE'
                    DVASW = DVASW LXOR MSKSST3A
          END
SS0230.   .SS210 ''SET UP SS TABLE''
          GOTO SS0000
SS0060.   IF NOT FASE
               THEN FASE = TRUE
                    UNLOCK ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''
          END
          GOTO SSEXIT
MSS10.    VASPI, VATRR, FCLS4 = 0
          DVASW = DVASW LAND MSKSSWV
          .EGP08          ''RESCHEDULE TIMER 1            (NOT CODED)''
          FTADV = TRUE
          SST1PTR = SSTTBPTR(DTBID - 1)
SS1050.   .SS210  ''SET UP NEXT SS''
          IF FSSAC       THEN GOTO MSS20                              END
          VSSW = KSSB1
          FHST = TRUE
          GOTO SS0000
MSS20.    IF FSSIO
               THEN DIRECT
                         ''ISSUE FORCED SS RESET''
                    END
          END
          FHST = FALSE
          SSTUPQ (KSSB8,1) ''SCHEDULE SS CHECK, MSS05''
          VSSW = KSSB5
          GOTO SS0060
MSS30.    FSSAC = TRUE
          VSNA, VSNA1 = VSNA RSH 2 LAND MSKSSSNA
          IF NOT VSNA
               THEN FSSAC = FALSE
                    .SS201  ''ADVANCE TO NEXT SS''
                    GOTO SS0000
          END
```

```
          VSTG = VSNA LAND VPSTG
          FSSIO = VSTG
          IF NOT FHST          THEN GOTO SS4000                    END
          IF DFLT EQ 2         THEN GOTO SS4000                    END
          DIRECT
               ''READ SS FEEDBACK REGISTER INTO TEMP''
          END
          IF NOT TEMP LAND MSKSSHS      THEN GOTO SS4000           END
          IF FSSIO
               THEN DIRECT
                         ''ISSUE SS RESET''
                    END
          END
          .SSTUPQ(KSSB4,5) ''SCHEDULE STAGE AND ADDRESS ISSUANCE MSS40''
          VSSW = KSSB5
          GOTO SS0060
MSS40.    FOR I = 0 TO 22 ''DELAY BEFORE ISSUING STAGE AND ADDRESS''
               A = I
          END
SS4000.   IF FSSIO
               THEN DIRECT
                         ''ISSUE STAGE AND ADDRESS FROM VSNA''
                    END
          END
          .SSTUPQ(VSSW,6) ''SCHEDULE ADDRESS VERIFICATION, MSS50''
          FOR I = 0 TO 17 ''DELAY FOR DOM TELEMETRY''
               A = I
          END
          DIRECT
               ''OUTPUT SS AND DO REGISTERS VIA DOM TELEMETRY''
          END
          GOTO SS0060
MSS50.    VSCCA = VSNA  LXOR MSKSSHS
          VSSCA = VSCCA LAND MSKSSHS
          IF VSTG
               THEN DIRECT
                         ''READ SS FEEDBACK REGISTER INTO TEMP''
                    END
                    VSSFB = TEMP LAND MSKSSHS
               ELSE VSSFB = VSSCA
          END
          IF VSSFB NQ VSSCA         THEN GOTO SS5540                END
MSS55.    IF VASPI LAND MSKSSS4C
               THEN DFILE = DFILE LOR MSKFPSIS
                    DVSST = 1.E10
                    GOTO SSEXIT
          END
          IF NOT VSSRT              THEN GOTO MSS60                 END
          .SSTUPD(= DVTRB) ''UPDATE SS TIME''
          IF VSSRT - DVTRB LQ KSSRB      THEN GOTO MSS60            END
          VSSTM = VSSRT - DVTGB - KSSRB
          DVSST = VSSTM + DVTMR
          DGSSM = 8 ''SET SS ENTRY INDEX FOR MSS60''
          IF NOT DFIL3
               THEN .EGP08       ''RESCHEDULE TIMER 1       (NOT CODED)''
```

```
        END
SS5540. IF VSSFB EQ 0 AND VSSCA NQ MSKSSZFS     THEN GOTO MSS55    END
        GOTO SSEXIT
        IF FSSIO
             THEN DIRECT
                       ''ISSUE SS RESET''
                  END
        END
        .SSTUPQ(KSSB6,10) ''SCHED COMPLEMENTED STAGE,ADDRESS, MSS80''
        TEMP = (VSSCA LXOR VSSFB) LSH 7
SS5570. IF TEMP LS 0         THEN GOTO SS5580                        END
        TEMP = TEMP LSH 1
        GOTO SS5570
SS5580. TEMP = TEMP LSH 1
        IF NOT TEMP               THEN GOTO SSEXIT                  END
        DVMC4 = DVMC4 LOR MSKM4SSB
        IF FFBCH
             THEN FFBCH = FALSE
                  DIRECT
                       ''SET SS CHANNEL B BIT IN INTERNAL CONT REG''
                  END
                  DVICR = DVICR LOR MSKICRSB
        END
        .UTR30    ''DELAY FOR TELEMETRY AS REQUIRED''
        DIRECT
             ''TELEMETER SS FEEDBACK, VSSFB''
        END
        GOTO SSEXIT
MSS60.  TEMP = VSTG LXOR MSKSSRD
        IF FSSIO
             THEN DIRECT
                       ''ISSUE READ COMMAND FROM TEMP''
                  END
        END
        DIRECT
             ''READ REAL TIME CLOCK INTO TEMP''
        END
        .SSTUPQ(KSSB2,9) ''SCHEDULE READ RESET, MSS70''
        TEMP = VSNA LSH 2 LOR TEMP LAND MSKRTC
        .UTR30    ''DELAY FOR TELEMETRY AS REQUIRED''
        DIRECT
             ''TELEMETER STAGE/ADDRESS AND READ TIME, TEMP''
        END
        IF NOT DFACQ ''COMPRESS DATA WHEN NOT OVER STAT. (NOT CODED)''
             THEN TEMP = DVDCT + MSKSSDCT
                  .MPC80(TEMP) ''COMPRESS TIME AND TAG''
                  TEMP = (VSNA RSH 3) + MSKSSDCS
                  .MPC80(TEMP) ''COMPRESS STAGE AND ADDRESS''
        END
        IF VASPI LAND MSKSSS4C
             THEN VASPI = 0
                  DFILE = DFILE LOR MSKFPSCR
        END
        IF VSNA1 EQ MSKSSHIG
             THEN DVMC7 = DVMC7 LOR MSKM7HIG
```

```
                GOTO SSEXIT
          END
          IF VSNA1 EQ MSKSSLOG
               THEN DVMC7 = DVMC7 LOR MSKM7LOG
                    GOTO SSEXIT
          END
          IF VSNA1 EQ MSKSSOMG
               THEN DVMC7 = DVMC7 LOR MSKM7OMG
                    GOTO SSEXIT
          END
          IF VSNA1 EQ MSKSSS4B
               THEN IF FBRNI
                         THEN DVMC5 = DVMC5 LOR MSKM54B1
                         ELSE DVMC6 = DVMC6 LOR MSKM68BR
                    END
          END
          GOTO SSEXIT
MSS70.    IF FSSIO
               THEN DIRECT
                         ''RESET SS READ COMMAND''
                    END
          END
          .SSTUPQ(KSSB3,1) ''SCHEDULE HUNG STAGE TEST, MSS05''
          .SS201  ''ADVANCE TO NEXT SS''
          VSSW = KSSB1
          FHST = VHSTW LAND VSTG LXOR VSTG
          IF VSNA1 EQ MSKSSWVO
               THEN DVASW = DVASW LXOR MSKSSEC1
                    DFWV = FALSE
                    GOTO SSEXIT
          END
          IF VSNA1 EQ MSKSSWVC
               THEN DVASW = DVASW LXOR MSKSSECV
                    DFWV = TRUE
                    GOTO SSEXIT
          END
          IF VSNA1 EQ MSKSSSCC
               THEN DVDPM = DVDPM LOR MSKDIN9
          END
          GOTO SSEXIT
MSS80.    VSNA = VSCCA
          IF FSSIO
               THEN DIRECT
                         ''ISSUE STAGE AND COMPLEMENTED ADDRESS''
                    END
          END
          .SSTUPQ(KSSB7,7) ''SCHEDULE READ COMMAND, MSS55''
          FOR I = 0 TO 41  ''DELAY FOR DOM TELEMETRY''
               A = I
          END
          DIRECT
               ''OUTPUT SS AND DO REGISTERS VIA DOM TELEMETRY''
          END
          GOTO SSEXIT
CLOSE     .SS201    ''SS TABLE ADVANCE ROUTINE''
```

```
          IF FTADV
               THEN SST1PTR = SST1PTR + 1
               ELSE SST2PTR = SST2PTR + 1
          END
          .SS210    ''SET UP NEXT SWITCH SELECTOR''
EXIT      ''SS201''
CLOSE     .SS210    ''SS SELECTION AND SETUP ROUTINE''
          IF FTADV       THEN GOTO SS2020                                END
SS2160.   IF SSTABLE(0,SST2PTR) GQ 0    THEN GOTO SS2070                 END
          FCLS4 = FALSE
          DVMC6 = DVMC6 LXOR MSKM6LUI
          DVMC7 = DVMC7 LXOR MSKM7T6D
          GOTO SS2090
               THEN VASPI = MSKSSS4C
                    DVASW = DVASW LAND MSKSSWV
                    SST1PTR = L'SSTSIVB'-L'SSTABLE'
                    GOTO SS2020
          END
          IF VASPI LAND MSKSSCL3
               THEN SST1PTR, VASPI, VATRR = VSC3(0), VSC3(1), VSC3(2)
                    GOTO SS2020
          END
          IF VASPI LAND MSKSSCL1
               THEN SST1PTR, VASPI, VATRR = VSC1(0), VSC1(1), VSC1(2)
                    GOTO SS2020
          END
          VASPI, VATRR = 0
          IF FT60P
               THEN SST1PTR = L'SSTTB5A'-L'SSTABLE'
                    FT60P = FALSE
               ELSE SST1PTR = L'SSTTB5B'-L'SSTABLE'
          END
          GOTO SS2020
SS2030.   IF NOT FCLS4         THEN GOTO SS2040                           END
SS2070.   IF SSTABLE(0,SST1PTR) + VATRR - KSS500MS GQ                      X
             SSTABLE(0,SST2PTR) + VATR4
               THEN FTADV = FALSE
                    VSSRT = SSTABLE(0,SST2PTR) + VATR4
                    VSNA = SSTABLE(1,SST2PTR)
SS2090.             ELSE FTADV = TRUE
SS2040.                  VSSRT = SSTABLE(0,SST1PTR) + VATRR
                         VSNA = SSTABLE(1,SST1PTR)
          END
SS2050.   VHSTW = VSNA RSH 2 LAND MSKSSSSB
EXIT      ''SS210''
SSEXIT.   EXIT  ''MSS00''
PROC .SSTUPD (= TIME)   ''SS TIME UPDATE ROUTINE''
     DECLARE FIXED, TIME-2
          DIRECT
               ''READ REAL TIME CLOCK INTO TEMP''
          END
          TIME, DVTRB = DVTGB + DVTRR + (TEMP - DVRTC LAND MSKRTC) RSH 2
EXIT      ''SSTUPD''
PROC .SSTUPQ (BIAS, ID) ''UPDATE SS TIME AND SCHEDULE REQUESTED FUNC''
     DECLARE FIXED BIAS -2
```

```
      DECLARE INTEGER, ID
          DIRECT
               ''READ REAL TIME CLOCK INTO TEMP''
          IF VASPI LAND MSKSSSPC
SS2020.   IF SSTABLE (0,SST1PTR) GQ 0   THEN GOTO SS2030                END
          END
          DGSSM = ID
          DVTRB = DVTGB + DVTRR + (TEMP - DVRTC LAND MSKRTC) RSH 2
          VSSTM = BIAS + DVTRR + (TEMP - DVRTC LAND MSKRTC) RSH 2
          DVSST = VSSTM + DVTMR
          IF NOT DFIL3
               THEN .EGP08        ''RESCHEDULE TIMER 1      (NOT CODED)''
          END
EXIT      ''SSTUPQ''
```

```
PROC .TASKKEY (PRIORITY,TSKPTR) ''ATM TASK KEYING ROUTINE''
     DECLARE INTEGER,                                                    X
         PRIORITY , ''PRIORITY LEVEL OF TASK BEING KEYED''               X
         TSKPTR   , ''LOCATION POINTER TO TASK BEING KEYED''             X
         I        , ''OVERFLOW TABLE POINTER CHAIN INDEX''               X
         J          ''OVERFLOW TABLE OPEN-SLOT INDEX''
     ''                                                                  ''
     ''PRIORITY CONTROL TABLE CONTAINS ONE ENTRY FOR EACH SYSTEM         ''
     ''PRIORITY LEVEL.  FOR EACH ENTRY THERE ARE FIVE ITEMS.             ''
     ''     1. LOCATION POINTER TO THE NEXT EXECUTABLE INSTRUCTION       ''
     ''        OF THE TASK CURRENTLY ASSIGNED TO THAT PRIORITY LEVEL     ''
     ''        OR ZERO IF NO TASK IS CURRENTLY ASSIGNED.                 ''
     ''     2. )                                                         ''
     ''     3. ) TASK REGISTER CONTENTS (INITIALLY SET TO ZERO).         ''
     ''     4. )                                                         ''
     ''     5. POINTER TO THE BEGINNING OF THE PRIORITY OVERFLOW         ''
     ''        TABLE CHAIN FOR THAT PRIORITY LEVEL.  A VALUE OF ZERO     ''
     ''        INDICATES END OF CHAIN.                                   ''
     ''                                                                  ''
     '' NOTE  THE NUMBER OF REGISTERS SAVED FOR A TASK WAS ARBITRARI-    ''
     ''       LY CHOSEN FOR THIS EXAMPLE AND MAY BE ADJUSTED AS          ''
     ''       REQUIRED.                                                  ''
     DECLARE INTEGER ATMPCT (5,10)
     ''                                                                  ''
     ''THE PRIORITY OVERFLOW TABLE IS USED FOR KEYING TASKS ON A         ''
     ''PRIORITY LEVEL WHICH IS CURRENTLY ASSIGNED TO ANOTHER TASK.       ''
     ''THE ENTRIES ARE NOT ALLOCATED TO A FIXED PRIORITY BUT ARE         ''
     ''ASSIGNED DYNAMICALLY AS REQUIRED. ALL OVERFLOW ENTRIES FOR        ''
     ''EACH PRIORITY LEVEL ARE CHAINED TOGETHER SUCH THAT THE TASKS      ''
     ''CAN BE EXECUTED ON A FIRST-IN-FIRST-OUT BASIS.  EACH ENTRY        ''
     ''CONSISTS OF TWO ITEMS.                                            ''
     ''     1. POINTER TO NEXT ENTRY IN THE CHAIN.  A VALUE OF ZERO      ''
     ''        INDICATES END OF CHAIN.                                   ''
     ''     2. LOCATION POINTER TO THE BEGINNING OF THE TASK FOR         ''
     ''        THAT ENTRY.  A VALUE OF ZERO INDICATES THAT THE ENTRY     ''
     ''        IS CURRENTLY NOT ASSIGNED TO ANY TASK.                    ''
     ''                                                                  ''
     DECLARE INTEGER ATMPOVFT(2,26)
     ''                                                                  ''
     ''NOTE   SINCE AN END-OF-CHAIN INDICATOR HAS A VALUE OF ZERO,       ''
     ''       THE FIRST ENTRY IN THE OVERFLOW TABLE CANNOT BE USED.      ''
     ''                                                                  ''
        LOCK      ''INHIBIT ALL INTERRUPTS''
     ''                                                                  ''
     ''IF THE REQUESTED PRIORITY LEVEL IS NOT CURRENTLY ASSIGNED,        ''
     ''INITIALIZE THE ENTRY FOR THIS TASK.                               ''
     ''                                                                  ''
        IF ATMPCT(0,PRIORITY) EQ 0
           THEN ATMPCT(0,PRIORITY) = TSKPTR
                ATMPCT(1,PRIORITY),                                      X
                ATMPCT(2,PRIORITY),                                      X
                ATMPCT(3,PRIORITY) = 0
     ''                                                                  ''
     ''OTHERWISE, SEARCH FOR THE END OF THE OVERFLOW POINTER CHAIN.      ''
     ''                                                                  ''
```

```
                ELSE I = ATMPCT(4,PRIORITY)
                     IF I NQ 0
CHNSRCH.                  THEN IF ATMPOVFT(0,I) NQ 0
                                 THEN I = ATMPOVFT(0,I)
                                      GOTO CHNSRCH
                               END
                     END
          ''                                                              ''
          ''WHEN THE END OF THE OVERFLOW POINTER CHAIN HAS BEEN FOUND,     ''
          ''SEARCH FOR AN EMPTY SLOT IN THE OVERFLOW TABLE.               ''
          ''                                                              ''
                     FOR J = 1 TO 25
                          IF ATMPOVFT(1,J) EQ 0 THEN GOTO SLTFND      END
                     END
                     STOP ''HALT IF OVERFLOW TABLE IS FULL''
          ''                                                              ''
          ''ADD THIS ENTRY TO THE END OF THE OVERFLOW POINTER CHAIN AND    ''
          ''STORE THE TASK POINTER IN IT.                                 ''
          ''                                                              ''
SLTFND.              IF I NQ 0
                          THEN ATMPOVFT(0,I) = J
                          ELSE ATMPCT(4,PRIORITY) = J
                     END
                     ATMPOVFT(0,J) = 0
                     ATMPOVFT(1,J) = TSKPTR
               END
               UNLOCK ''RELEASE INTERRUPTS AS REQUIRED''
EXIT           ''TASKKEY''
TERM
```

HAL COMMON DATA DECLARATIONS

```
DECLARE SCALAR,
      DKT1 ,
      DVA1 ,
      DVA2 ,
      DVA3 ,
      DVA4 ,
      DVA5 ,
      DVA6 ,
      DVDT ,
      DVEOF,
      DVFMC,
      DVFOM,
      DVFOR,
      DVMAS,
      DVMFR,
      DVMLR,
      DVTAS,
      DVTB ,
      DVTI ,
      DVVSQ,
      DV1MR,
      STEMP;
 DECLARE VECTOR,
      DVCA,
      DVCC,
      DVD ,
      DVDA,
      DVDB,
      DVDC,
      DVDM,
      DVF ,
      DVG ,
      DVRC,
      DVTH;
 DECLARE INTEGER,
      DFLT,
      DGMLM,
      DGSSM,
      DGST2,
      DKMIR  CONSTANT (163),
      DKRTCOVF CONSTANT (8192),
      DKRTCSEC CONSTANT (4063),
      DKTD CONSTANT (14),
      DLPRL ARRAY(3) CONSTANT (50794,60952,101562),
      DLPTL ARRAY(3),
      DLTTL ARRAY(12),
      DQST2,
      DTBID,
      DVACT,
      DVDGS,
      DVERT,
      DVHDA,
      DVHDB,
      DVLRC,
      DVMLD,
```

```
      DVMLT,
      DVM05,
      DVM06,
      DVP,
      DVPTG,
      DVRE ARRAY(3),
      DVRTC,
      DVSST,
      DVTD,
      DVTEX,
      DVTGB,
      DVTMM,
      DVTMR,
      DVTRB,
      DVTRR,
      DVTRS,
      DVTT1,
      DV2TG,
      EPTINDX,
      GST1M,
      ITEMP,
      VTOLD;
DECLARE BIT(1),
      APSTAT ,
      ARSTAT ,
      CC1STAT,
      CSSTAT ,
      CTSTAT ,
      DFACQ  ,
      DFDBF  ,
      DFDTL  ,
      DFIL1  ,
      DFIL2  ,
      DFIL3  ,
      DFPHC  ,
      DFSMC  ,
      DFTBCEP,
      DFTUP  ,
      DFWV   ,
      DFZER  ,
      DKAPI ARRAY(4),
      DTSTAT ,
      DPSTAT ,
      DVSTAT ,
      EBSTAT ,
      HSSTAT ,
      IGSTAT ,
      MSSTAT ,
      NESTAT ,
      OGSTAT ,
      PASTAT ,
      PGSTAT ,
      PPSTAT ARRAY(3),
      RSSTAT ,
      SASTAT ,
```

```
      TB1STAT,
      TB57STAT,
      TCSTAT ,
      TGSTAT ,
      TTSTAT ,
      T2STAT ARRAY (11);
DECLARE BIT(26),
      DFILE,
      DFMDI,
      DVAC ARRAY(3),
      DVASW,
      DVDPM,
      DVEMR,
      DVICR,
      DVIH ,
      DVLDB,
      DVMC4,
      DVMC5,
      DVMC6,
      DVMC7,
      VTMC,
      BTEMP;
DECLARE BIT(26) CONSTANT,
      MSKACCELA       (OCT'777700000'),
      MSKACCELB       (OCT'000017776'),
      MSKDCSCOMP      (OCT'774000000'),
      MSKDCSDO        (OCT'000040000'),
      MSKDCSER        (OCT'000077776'),
      MSKDCSMC        (OCT'770000000'),
      MSKDCSMODE      (OCT'000000020'),
      MSKDCSSB        (OCT'004000000'),
      MSKDCSTERM      (OCT'200000000'),
      MSKDIN9         (OCT'000004000'),
      MSKEMRLADB      (OCT'000001000'),
      MSKERRORTAG     (OCT'000070000'),
      MSKFMDREP       (OCT'000100000'),
      MSKFPSCORD      (OCT'100000000'),
      MSKFPSINT2      (OCT'000040000'),
      MSKFPSISSA      (OCT'001000000'),
      MSKGIMBALA      (OCT'377700000'),
      MSKICRBG        (OCT'000000020'),
      MSKICRCA        (OCT'000040000'),
      MSKICRSSCB      (OCT'000010000'),
      MSKICRSWG       (OCT'000002000'),
      MSKINT          (OCT'157740000'),
      MSKMC4AMF       (OCT'000000100'),
      MSKMC4SSCB      (OCT'000001000'),
      MSKMC54B1I      (OCT'000000100'),
      MSKMC6D04       (OCT'000000400'),
      MSKMC6LUI       (OCT'000010000'),
      MSKMC6TB6A      (OCT'000002000'),
      MSKMC6TB6B      (OCT'000000010'),
      MSKMC6TB6C      (OCT'000000040'),
      MSKMC68RRI      (OCT'400000000'),
      MSKMC7HIG       (OCT'004000000'),
```

```
MSKMC7LOG       (OCT'010000000'),
MSKMC7OMG       (OCT'020000000'),
MSKMC7T6D       (OCT'100000000'),
MSKRTC          (OCT'000037776'),
MSKRTCRESET     (OCT'007777540'),
MSKSCCO         (OCT'000100000'),
MSKSSACQU       (OCT'000000004'),
MSKSSCLS1       (OCT'000003770'),
MSKSSCLS3       (OCT'077774000'),
MSKSSCL1        (OCT'040000000'),
MSKSSCL3        (OCT'100000000'),
MSKSSDCS        (OCT'500000000'),
MSKSSDCT        (OCT'405400000'),
MSKSSECSV       (OCT'002000000'),
MSKSSECS1       (OCT'001000000'),
MSKSSGNSS       (OCT'040000000'),
MSKSSHIG        (OCT'100720000'),
MSKSSHS         (OCT'003770000'),
MSKSSLI         (OCT'000000002'),
MSKSSLOG        (OCT'100520000'),
MSKSSNSEND      (OCT'377777776'),
MSKSSOMG        (OCT'100070000'),
MSKSSREAD       (OCT'400000000'),
MSKSSRESET      (OCT'200000000'),
MSKSSSBHI       (OCT'010000000'),
MSKSSSBLO       (OCT'020000000'),
MSKSSSBOM       (OCT'004000000'),
MSKSSSCC        (OCT'100310000'),
MSKSSSIVB       (OCT'020230000'),
MSKSSSNA        (OCT'135770000'),
MSKSSSPEC       (OCT'200000000'),
MSKSSSSB        (OCT'174000000'),
MSKSSS4CO       (OCT'400000000'),
MSKSSS4C1       (OCT'000000400'),
MSKSSTB6A       (OCT'000002000'),
MSKSSTB6B       (OCT'000001000'),
MSKSSTB6C       (OCT'100000000'),
MSKSSTB6D       (OCT'000200000'),
MSKSST3A        (OCT'000400000'),
MSKSST6C        (OCT'004000000'),
MSKSSWV         (OCT'003000000'),
MSKSSWVC        (OCT'101050000'),
MSKSSWVO        (OCT'101450000'),
MSKSSZFSF       (OCT'002000000'),
MSKTMC0         (OCT'700000000'),
MSKTMC1         (OCT'710000000'),
MSKTMC2         (OCT'720000000'),
MSKTMM3         (OCT'730000000'),
MSKTMC4         (OCT'740000000'),
MSKT2INT        (OCT'100000000');
```

```
 UTR00:   PROGRAM; /*TELEMETRY DELAY FOR MODE REG SETTING OF 70*/
E
          .       .
          VTMC = MSKTMC0;
          CALL UTR0; /*PERFORM DELAY AS REQUIRED*/
 CLOSE    UTR00;
 UTR01:   PROGRAM; /*TELEMETRY DELAY FOR MODE REG SETTING OF 71*/
E
          .       .
          VTMC = MSKTMC1;
          CALL UTR0; /*PERFORM DELAY AS REQUIRED*/
 CLOSE    UTR01;
 UTR02:   PROGRAM; /*TELEMETRY DELAY FOR MODE REG SETTING OF 72*/
E
          .       .
          VTMC = MSKTMC2;
          CALL UTR0; /*PERFORM DELAY AS REQUIRED*/
 CLOSE    UTR02;
 UTR03:   PROGRAM; /*TELEMETRY DELAY FOR MODE REG SETTING OF 73*/
E
          .       .
          VTMC = MSKTMC3;
          CALL UTR0; /*PERFORM DELAY AS REQUIRED*/
 CLOSE    UTR03;
 UTR04:   PROGRAM; /*TELEMETRY DELAY FOR MODE REG SETTING OF 74*/
E
          .       .
          VTMC = MSKTMC4;
          CALL UTR0; /*PERFORM DELAY AS REQUIRED*/
 CLOSE    UTR04;
 UTR0:    PROGRAM;  /*TELEMETRY DELAY FOR LEVEL 0*/
          DECLARE INTEGER,
               KTELBIAS CONSTANT (2),
               VTIM;
 TR00:    /*INHIBIT ALL INTERRUPTS EXCEPT TCL*/;
          READ (CLOCK) VTIM;
          IF BIT          (VTIM - DVTD) >= DKTD  THEN GO TO TR05;
S               14 TO 26
C         RELEASE PREVIOUSLY ENABLED INTERRUPTS
          GO TO TR00;
E                         .
 TR05:    WRITE (MODREG) VTMC;
          DVTD = VTIM + KTELBIAS;
 CLOSE    UTR0;
 UTR30:   PROGRAM;  /*TELEMETRY DELAY FOR INTERRUPT LEVEL 3*/
          DECLARE INTEGER,
               KTELBIAS CONSTANT (2),
               VTIM;
 TR35:    READ (CLOCK) VTIM;
          IF BIT          (VTIM - DVTD) < DKTD   THEN GO TO TR35;
S               14 TO 26
F                         .
          WRITE (MODREG) MSKTMC0;
          DVTD = VTIM + KTELBIAS;
 CLOSE    UTR30;
 UTR24:   PROGRAM;  /*TELEMETRY DELAY FOR INTERRUPT LEVEL 2*/
          DECLARE INTEGER,
               KTELBIAS CONSTANT (2),
               VTIM;
 TR20:    /*INHIBIT ALL INTERRUPTS EXCEPT TLC*/;
```

```
          READ (CLOCK) VTIM;
          IF BIT        (VTIM - DVTD) >= DKTD   THEN GO TO TR25;
S               14 TO 26
C         ENABLE TIMER 1 INTERRUPT
          GO TO TR20;
E                       .
 TR25:    WRITE (MODREG) MSKTMC4;
          DVTD = VTIM + KTELBIAS;
 CLOSE    UTR24;
```

```
 EGP0:    PROGRAM;  /*SYSTEM INITIALIZATION*/
C
C      INHIBIT ALL INTERRUPTS
C
           READ(XACC) VOAC ;
S                         1
           READ(YACC) VOAC ;
S                         2
           READ(ZACC VOAC ;
S                         3
           READ(CLOCK) DVACT;
E            .            .
           IF DFMDI AND MSKFMDREP ¬= 0
                THEN DO;
                     SCHEDULE CLOCK SYNC ON T1INT;
                     WRITE (TIM1) 1;
C                    ENABLE TIMER 1 INTERRUPT
                     WAIT FOR T1INT;
                END;
           DVRTC,DVTEX,VPPOT = DVACT;
           DVTMM,DVTRR,DVERT,DVTGB,DVTRS,DVTMR,DTBID,VTD = 0;
E          .      .      .
           DFIL1, DFIL2, DFIL3 = TRUE;
           CALL EGP1; /*ACTIVATE INTERRUPT PROCESSOR*/
C
C          ENABLE TLC INTERRUPT
C
E          .
           FGNC = FALSE;
           DVSST = 1.E10;
           DVMLT, DVMLD = DKMIR;
           CALL EGP15; /*SCHEDULE FIRST TIMER 1 FUNCTION*/
           DVP = 1;
           CALL GP002;/*PASS CONTROL TO PHASE ACTIVATION ROUTINE*/
 CLOCK SYNC: TASK;  /*RESPONSE TO TIMER 1 INTERRUPT*/
           READ (CLOCK) DVACT;
C
C          INHIBIT TIMER 1 INTERRUPT
C
           CLOSE CLOCK SYNC;
           CLOSE EGP0;
 MPA00:    PROGRAM;  /*PHASE TERMINATION*/
E          .
           DFPHC = TRUE;
C
C          INHIBIT ALL INTERRUPTS
C
E                    .
           WRITE(TIM2) MSKRTC;/*LOAD TIMER 2 WITH A LARGE VALUE*/
E                    .
           WRITE(ISR) MSKT2INT;/*RESET ANY PENDING TIMER 2 INTERRUPT*/
E          .      .      .
           DVIS1 = DVIH AND NOT MSKT2INT;
F          .      .
           DFIL1, DFIL2 = TRUE;
```

```
C
C          ENABLE TLC AND TIMER 1 INTERRUPTS
C
           CALL GP002;/*ACTIVATE THE NEXT MISSION PHASE*/
           CLOSE MPA00;
 GP002:    PROGRAM;/*MISSION PHASE CONTROL AND ACTIVATION ROUTINE*/
           DECLARE FGNC BIT(1);
           DECLARE VTD INTEGER;
 GP0020:   IF DVP > 4 THEN ;   /*HALT WHEN EXECUTION IS COMPLETED*/
E
           IF DKAPI
S                DVP-1
                 THEN DO;
                      CALL EGP20;/*START PHASE TIME REFERENCE*/
                      DO CASE DVP;
                           GO TO INP13;
                           GO TO INP24;
                           GO TO INP13;
                           GO TO INP24;
                      END;
                 END;
                 ELSE DO;
                      DVP = DVP + 1;
                      GO TO GP0020;
                 END;
E
 INP13:    ARSTAT,APSTAT,DPSTAT,NESTAT,CC1STAT,MSSTAT,EBSTAT = TRUE;
E
           SASTAT,DVSTAT,TCSTAT,PASTAT,TTSTAT,IGSTAT,HSSTAT,OGSTAT,TGSTAT,
E
           RSSTAT,CSSTAT,TB1STAT,TB57STAT,PGSTAT = FALSE;
           [DLPTL] = 0;
F
           [PPSTAT] = FALSE;
F
           [T2STAT] = FALSE;
E
           T2STAT  = TRUE;
S               1
           CALL MIN00;/*PERFORM PHASE 1/3 APPLIC PGM INIT   (NOT CODED)*/
           CALL EGP18; /*SCHEDULE NEXT TIMER 2 FUNCTION*/
E
           DFIL1, DFIL2, DFIL3, DFPHC = FALSE;
C
C          RELEASE PREVIOUSLY ENABLED INTERRUPTS
C
           CALL NONINTSEQ1;/*PASS CONTROL TO PHASE 1/3 NON-INTERRUPT SEQ*/
E
 INP24:    CTSTAT, DTSTAT = FALSE;
           [DLPTL] = 0;
F
           [PPSTAT] = TRUE;
E
           [T2STAT] = BIT(0,1,1,1,0,0,1,1,1,1,1);
           CALL MIN10;/*PERFORM PHASE 2/4 APPLIC PGM INIT   (NOT CODED)*/
```

```
            CALL EGP18;/*SCHEDULE NEXT TIMER 2 FUNCTION*/
E           .     .     .     .
            DFIL1, DFIL2, DFIL3, DFPHC = FALSE;
C
C           RELEASE PREVIOUSLY ENABLED INTERRUPTS
C
            CALL NONINTSEQ2;/*PASS CONTROL TO PHASE 2/4 NON-INTERRUPT SEQ*/
            CLOSE GP002;
```

```
 EGP1:    PROGRAM;  /*INTERRUPT PROCESSOR*/
          SCHEDULE EGPTLC ON TLCINT;
          SCHEDULE EGPT1  ON T1INT;
          SCHEDULE EGPT2  ON T2INT;
          SCHEDULE EGPEX2 ON EX2INT;
          SCHEDULE EGPEX4 ON EX4INT;
          SCHEDULE EGPEX5 ON EX5INT;
          SCHEDULE EGPEX6 ON EX6INT;
          SCHEDULE EGPEX8 ON EX8INT;
          RETURN; /* EGP1 */
C
 EGPTLC:  TASK;     /* TLC INTERRUPT PROCESSOR */
C
C         INHIBIT ALL INTERRUPTS EXCEPT TLC
C
          READ(CLOCK) DVTEX;
          DFIL2, DFIL3 = TRUE;
          CALL MTS00;    /*PROCESS TLC INTERRUPT*/
C       THE TLC APPLICATION PROGRAM DOES NOT RETURN CONTROL
 CLOSE    EGPTLC;
C
 EGPT1:   TASK;     /* TIMER 1 INTERRUPT PROCESSOR */
C
C         INHIBIT ALL INTERRUPTS EXCEPT TLC
C
          READ(CLOCK) DVTT1;
          DFIL3 = TRUE;
          DO CASE GST1M;
               CALL MML00; /*PROCESS MINOR LOOP FOR FLIGHT SIM*/
               CALL MML20; /*PROCESS NORMAL MINOR LOOP*/
               CALL MSS00; /*PROCESS SWITCH SELECTOR*/
          END;
          CALL EGP15;  /*SCHEDULE NEXT TIMER 1 FUNCTION*/
          DFIL3 = FALSE;
C
C         RELEASE PREVIOUSLY ENABLED INTERRUPTS
C
 CLOSE    EGPT1;
C
 EGPT2:   TASK;     /* TIMER 2 INTERRUPT PROCESSOR */
C
C         INHIBIT TIMER 2 INTERRUPT
C
          DFIL1 = TRUE;
          DO CASE DGST2;
               CALL MUM00;  /*TIME UPDATE                    (NOT CODED)*/
               CALL MLR10;  /*LADDER RAMP PROCESSOR          (NOT CODED)*/
               CALL MEP00;  /*EVENTS PROCESSOR                         */
               CALL MTT10;  /*TIME TILT GUIDANCE             (NOT CODED)*/
               CALL MNU00;  /*NAVIGATION UPDATE IMPLEMENT    (NOT CODED)*/
               CALL MEE00;  /*TIME BASE 8 ENABLE             (NOT CODED)*/
               CALL MCM00;  /*PHASE 2/4 CONTROL MODULE       (NOT CODED)*/
               CALL MCM10;  /*PHASE 2/4 CONTROL MODULE       (NOT CODED)*/
               CALL MCM20;  /*PHASE 2/4 CONTROL MODULE       (NOT CODED)*/
               CALL MEPWM;  /*WATER METHANOL ACTIVATE        (NOT CODED)*/
```

```
            CALL MER00; /*EXTRA ACCELEROMETER READ      (NOT CODED)*/
          END;
          CALL EGP18;    /*SCHEDULE NEXT TIMER 2 FUNCTION*/
          DFIL1 = FALSE;
C
C         RELEASE TIMER 2 INTERRUPT
C
 CLOSE    EGPT2;
C
 EGPEX2:  TASK;      /* EXTERNAL 2 INTERRUPT PROCESSOR */
C
C         INHIBIT ALL INTERRUPTS EXCEPT TLC
          READ(CLOCK) DVTEX;
          DFIL2, DFIL3 = TRUE;
          CALL MDP28; /*SC INITIATION OF S2/S4B SEPARATION (NOT CODED)*/
          DFIL2, DFIL3 = FALSE;
C
C         RELEASE PREVIOUSLY ENABLED INTERUPTS
C
 CLOSE    EGPEX2;
C
C
 EGPEX4:  TASK;      /* EXTERNAL 4 INTERRUPT PROCESSOR */
C
C         INHIBIT ALL INTERRUPTS EXCEPT TLC
          READ(CLOCK) DVTEX;
          DFIL2, DFIL3 = TRUE;
          CALL MTB50; /*S4B ENGINE OUT                 (NOT CODED)*/
          DFIL2, DFIL3 = FALSE;
C
C         RELEASE PREVIOUSLY ENABLED INTERUPTS
C
 CLOSE    EGPEX4;
C
C
 EGPEX5:  TASK;      /* EXTERNAL 5 INTERRUPT PROCESSOR */
C
C         INHIBIT ALL INTERRUPTS EXCEPT TLC
          READ(CLOCK) DVTEX;
          DFIL2, DFIL3 = TRUE;
          CALL MTB30; /*S1C OUTBOARD ENGINE OUT       (NOT CODED)*/
          DFIL2, DFIL3 = FALSE;
C
C         RELEASE PREVIOUSLY ENABLED INTERUPTS
C
 CLOSE    EGPEX5;
C
C
 EGPEX6:  TASK;      /* EXTERNAL 6 INTERRUPT PROCESSOR */
C
C         INHIBIT ALL INTERRUPTS EXCEPT TLC
          READ(CLOCK) DVTEX;
          DFIL2, DFIL3 = TRUE;
          CALL MTB40; /*S2 PROPELLANT DEPLETION       (NOT CODED)*/
          DFIL2, DFIL3 = FALSE;
```

```
C
C          RELEASE PREVIOUSLY ENABLED INTERUPTS
C
 CLOSE     EGPEX6;
C
C
 EGPEX8:   TASK;      /* EXTERNAL 8 INTERRUPT PROCESSOR */
C
C          INHIBIT ALL INTERRUPTS EXCEPT TLC
           READ(CLOCK) DVTEX;
           DFIL2, DFIL3 = TRUE;
           CALL MDS00; /*PROCESS DIGITAL COMMAND SYSTEM INPUT*/
           DFIL2, DFIL3 = FALSE;
C
C          RELEASE PREVIOUSLY ENABLED INTERUPTS
C
 CLOSE     EGPEX8;
C
           CLOSE EGP1;
EGP15:     PROGRAM;  /*TIMER 1 SCHEDULER*/
           DECLARE KT1BIAS INTEGER CONSTANT (2);
           READ(CLOCK) ITEMP;
           ITEMP = ITEMP - DVRTC;
           IF ITEMP < 0 THEN ITEMP = ITEMP + DKRTCOVF;
           ITEMP = DVTMM + ITEMP/4 + KT1BIAS;
           IF DVMLT <= ITEMP
                THEN DO;
                     ITEMP = 1 ;
                     GST1M = DGMLM;
                END;
                ELSE IF DVMLT <= DVSST
                          THEN DO;
                               ITEMP = 2 (DVMLT - ITEMP);
                               GST1M = DGMLM;
                          END;
                          ELSE DO;
                               GST1M = 3;
                               IF DVSST <= ITEMP
                                    THEN ITEMP = 1;
                                    ELSE ITEMP = 2 (DVSST - ITEMP);
                          END;
          WRITE(TIM1) ITEMP;
          CLOSE EGP15;
 EGP18:   PROGRAM;  /*TIMER 2 SCHEDULER*/
          DECLARE INTEGER CONSTANT, KT2BIAS (3),
                                    K4SEC (4063);
          DGST2 = 1;
          DV2TG = DVTMM + K4SEC;
          DO FOR I = 1 TO 11;
E
               IF NOT T2STAT   THEN GO TO TS210;
S                        I
               IF DLTTL  > DV2TG   THEN GO TO TS210;
S                   I
               DGST2 = I + 1;
```

```
                DV2TG = DLTTL ;
S                              I
 TS210:     END;
C
C           INHIBIT ALL INTERRUPTS EXCEPT T2 AND TLC
C
            IF DVT2G <= DVTMM   THEN GO TO T2S20;
            READ(CLOCK) ITEMP;
            ITEMP = ITEMP - DVRTC;
            IF ITEMP < 0   THEN ITEMP = ITEMP + DKRTCOVF;
            ITEMP = (DV2TG - DVTMM + DVERT - ITEMP/4 -KT2BIAS)/2;
            IF ITEMP <=0   THEN
 T2S20:          ITEMP = 1;
            WRITE(TIM2) ITEMP;
C
C           RELEASE PREVIOUSLY ENABLED INTERRUPTS
C
            CLOSE EGP18;
 EGP20:     PROGRAM;  /*SYSTEM TIME UPDATE ROUTINE*/
C
C           INHIBIT ALL INTERRUPTS EXCEPT TLC
C
            READ(CLOCK) ITEMP;
            ITEMP1 = ITEMP - DVRTC;
            DVERT = BIT        (ITEMP1);
S                    25 TO 26
            IF ITEMP1 < 0  THEN ITEMP1 = ITEMP1 + DKRTCOVF;
            DVTMM = DVTMM + ITEMP1/4;
            DVRTC = ITEMP - DVERT;
            DVTRR = DVTMM - DVTMR;
E
            IF DFIL3
                 THEN ;
E
                 ELSE IF DFIL2
                           THEN /*RELEASE TIMER 1 INTERRUPT*/ ;
E
                           ELSE IF DFIL1
                                     THEN /*RELEASE PREVIOUSLY ENABLED
                                            INTERRUPTS EXCEPT TIMER 2*/ ;
                                     ELSE /*RELEASE PREV ENABLED INT*/;
            CLOSE EGP20;
```

```
NONINTSEQ1: PROGRAM; /*NON-INTERRUPT SEQUENCER FOR PHASES 1 AND 3 */
E
 NIS1:    IF ARSTAT      THEN DO;
            CALL MAR00;          /*ACCELEROMETER READ*/
            CALL PERPROC;  END;
E
          IF SASTAT      THEN DO;
            CALL MSA00;          /*SIMULATED ACCEL       (NOT CODED)*/
            CALL PERPROC;  END;
E
          IF APSTAT      THEN DO;
            CALL MAP00;          /*ACCELEROMETER PROCESSING*/
            CALL PERPROC;  END;
E
          IF DVSTAT      THEN DO;
            CALL MDV00;          /*F/M CALCULATIONS      (NOT CODED)*/
            CALL PERPROC;  END;
E
          IF DPSTAT      THEN DO;
            CALL MDP00;          /*DISCRETE PROCESSOR    (NOT CODED)*/
            CALL PERPROC;  END;
E
          IF NESTAT      THEN DO;
            CALL MNE00;          /*BOOST NAVIGATION      (NOT CODED)*/
            CALL PERPROC;  END;
E
          IF TCSTAT      THEN DO;
            CALL MTC00;          /*RESTART CALCULATIONS  (NOT CODED)*/
            CALL PERPROC;  END;
E
          IF PASTAT      THEN DO;
            CALL MPA00;          /*PHASE ACTIVATOR*/
            CALL PERPROC;  END;
E
          IF TTSTAT      THEN DO;
            CALL MTT00;          /*TIME TILT GUIDANCE    (NOT CODED)*/
            CALL PERPROC;  END;
E
          IF CC1STAT     THEN DO;
            CALL MCC10;          /*CHI COMPUTATIONS      (NOT CODED)*/
            CALL PERPROC;  END;
E
          IF IGSTAT      THEN DO;
            CALL MIG00;          /*ITERATIVE GUIDANCE MODE*/
            CALL PERPROC;  END;
E
          IF HSSTAT      THEN DO;
            CALL MHS00;          /*S4B CUTOFF PREDICTION (NOT CODED)*/
            CALL PERPROC;  END;
E
          IF OGSTAT      THEN DO;
            CALL MOG00;          /*ORBITAL GUIDANCE      (NOT CODED)*/
            CALL PERPROC;  END;
E
          IF TGSTAT      THEN DO;
```

```
                CALL MTG00;          /*TARGET UPDATE          (NOT CODED)*/
                CALL PERPROC;  END;
E
          IF RSSTAT      THEN DO;
                CALL MRS00;          /*TIME-TO-GO TO RESTART (NOT CODED)*/
                CALL PERPROC;  END;
E
          IF CSSTAT      THEN DO;
                CALL MCS00;          /*TIME BASE 6 CHECK      (NOT CODED)*/
                CALL PERPROC;  END;
E
          IF TB1STAT     THEN DO;
                CALL MTB10;          /*TIME BASE 1            (NOT CODED)*/
                CALL PERPROC;  END;
E
          IF TB57STAT    THEN DO;
                CALL MTB57;          /*TIME BASE 5/7          (NOT CODED)*/
                CALL PERPROC;  END;
E
          IF MSSTAT      THEN DO;
                CALL MMS00;          /*MINOR LOOP SUPPORT     (NOT CODED)*/
                CALL PERPROC;  END;
E
          IF PGSTAT      THEN DO;
                CALL MPG00;          /*SIM PLATFORM GIM ANGLE(NOT CODED)*/
                CALL PERPROC;  END;
E
          IF EBSTAT      THEN DO;
                CALL MEB00;          /*ETC/BTC                (NOT CODED)*/
                CALL PERPROC;  END;
          GO TO NIS1;
          CLOSE NONINTSEQ1;
NONINTSEQ2: PROGRAM; /*NON-INTERRUPT SEQUENCER FOR PHASES 2 AND 4 */
E
NIS2:     IF CTSTAT  THEN DO;
                CALL MCT00;/* DATA COMPRESSION TELEMENTRY   (NOT CODED)*/
                CALL PERPROC;  END;
E
          IF DTSTAT  THEN
                CALL MDT00;/*SECTOR DUMP TELEMENTRY         (NOT CODED)*/
          CALL PERPROC;   /*INSURE PERIODIC PROCESSOR GETS EXECUTED*/
          GO TO NIS2;
          CLOSE NONINTSEQ2;
```

HAL KERNEL 4 PERIODIC PROCESSOR

```
 PERPROC: PROGRAM;  /*PERIODIC PROCESSOR*/
          DECLARE VPPOT INTEGER;
          READ(CLOCK) ITEMP;
          DVPTG = (ITEMP - VPPOT)/4;
          VPPOT = ITEMP;
          IF DVPTG < 0   THEN DVPTG = DVPTG + DKRTCOVF/4;
          DO FOR I = 1 TO 3;
E                    .
               IF NOT PPSTAT       THEN GO TO PP20;
S                          1
               DLPTL  = DLPTL  + DVPTG;
S                 I        I
               IF DLPTL  < DLPRL   THEN GO TO PP20;
S                    I        I
               DO CASE I;
                    CALL MPC50; /*PERFORM  50 DATA COMPRESS(NOT CODED)*/
                    CALL MPC60; /*PERFORM  60 DATA COMPRESS(NOT CODED)*/
                    CALL MPC99; /*PERFORM 100 DATA COMPRESS(NOT CODED)*/
               END;
               DLPTL  =0;
S                   I
 PP20:    END;
          CLOSE PERPROC;
```

```
MEP00:  PROGRAM;  /*EVENTS PROCESSOR (TIMER 2 ENTRY)*/
C
C          EVENTS PROCESSOR TABLE
C
C               ONLY A PORTION OF THE TABLE (THROUGH TIME BASE 3)
C               HAS BEEN CODED.
C
C               EACH ENTRY CONSISTS OF TWO WORDS:
C                    1. AN INDEX IDENTIFYING THE APPLICATION MODULE TO
C                       PERFORM PROCESSING FOR THE EVENT.
C                    2. EVENT EXECUTION TIME (IN TENTHS OF A SECOND).
C
C               NOTE: AN ENTRY INDEX WITH A VALUE OF ZERO IS EITHER SET
C                     DYNAMICALLY IN REAL TIME OR IS USED TO DISABLE
C                     THE EVENTS PROCESSOR FOR THE REMAINDER OF A TIME
C                     BASE
          DECLARE EPTABLE ARRAY(2,131) INTEGER INITIAL
                 (  1 ,      0 , /*  START OF TIME BASE 0 TABLE  */
                    0 ,    160 ,
                    0 ,    170 ,
                    0 ,    175 ,
                    0 ,      0 ,
                    2 ,      0 ,   /*START OF TIME BASE 1 TABLE*/
                    3 ,     10 ,
                    0 ,     60 ,
                    4 ,     90 ,
                    5 ,    100 ,
                    0 ,    140 ,
                    6 ,   1347 ,
                    0 ,      0 ,
                    7 ,      0 ,   /*START OF TIME BASE 2 TABLE*/
                    0 ,      0 ,
                    0 ,    184 ,
                    0 ,    275 ,
                    0 ,      0 ,
                    8 ,      0 ,   /*START OF TIME BASE 3 TABLE*/
                    9 ,      0 ,
                   10 ,      0 ,
                    0 ,      0 ,
                   11 ,      0 ,
                   12 ,      0 ,
                   13 ,     14 ,
                   14 ,     44 ,
                   15 ,     44 ,
                   16 ,     67 ,
                    0 ,     67 ,
                   17 ,     67 ,
                   18 ,    406 ,
                   19 ,    406 ,
                   20 ,    586 ,
                   21 ,    606 ,
                    0 ,   2990 ,
                    0 ,   3550 ,
                    0 ,   3885 ,
                    0 ,      0);
```

```
E
 EP00:    IF DFTBCEP THEN
 EP004A:       DO;
E
                    .
                    DFTBCEP = FALSE;
                    GO TO EP02;
               END;
          DO CASE EPTABLE          ;
S                        1,EPTINDX
               CALL LE285;  /*SCHEDULE WATER METHANOL       (NOT CODED)*/
               CALL LE25;   /*TIME BASE 1 SETUP             (NOT CODED)*/
               CALL LE30;   /*COMMAND INIT OF YAW MANEUVER  (NOT CODED)*/
               CALL LE35;   /*COMMAND TERM OF YAW MANEUVER  (NOT CODED)*/
               CALL LE40;   /*SET ACCEL REASON TEST CONST   (NOT CODED)*/
               CALL LE50;   /*START TIME BASE 2             (NOT CODED)*/
               CALL LE55;   /*DISABLE THRUST CONSTRAINT     (NOT CODED)*/
               CALL LE75;   /*TIME BASE 3 SETUP             (NOT CODED)*/
               CALL LE70;   /*SET ACCEL REASON TEST CONST   (NOT CODED)*/
               CALL LE250;  /*CHNG GIMB REASON TEST CONST   (NOT CODED)*/
               CALL LE355;  /*DISABLE TIME TILT             (NOT CODED)*/
               CALL LE365;  /*F/M UNCERT FOR THUST  MISALIN(NOT CODED)*/
               CALL LE82;   /*ENABLE DIN 22 AND INT 2       (NOT CODED)*/
               CALL LE100;  /*SET ACCEL BACKUP PROFILE      (NOT CODED)*/
               CALL LE95;   /*SET ACCEL REASON TEST CONST   (NOT CODED)*/
               CALL LE90;   /*ENABLE DIN 19                 (NOT CODED)*/
               CALL LE96;   /*ENQUEUE F/M CALC, SMOOTHING   (NOT CODED)*/
               CALL LE105;  /*ENQUEUE IGM                   (NOT CODED)*/
               CALL LE115;  /*SET MINOR LOOP PARAMETERS     (NOT CODED)*/
               CALL LE111;  /*SET SMC FLAG                  (NOT CODED)*/
               CALL LE110;  /*ENQUEUE SMC                   (NOT CODED)*/
          END;
 EP01:    ;
C
C      INHIBIT ALL INTERRUPTS EXCEPT TLC
C
E
                    .
          IF DFTBCEP THEN GO TO EP04A;
          EPTINDX = EPTINDX + 1;
          DQST2 = 4; /*SET INDEX FOR EP ENTRY IN T2 SCHED CONTROL TABLE*/
          IF EPTABLE          ¬= 0
S                   1,EPTINDX
               THEN DO;
                    IF EPTABLE          = VTOLD
S                             2,EPTINDX
                         THEN DO;
C
C      RELEASE PREVIOUSLY ENABLED INTERRUPTS
C
                              GO TO EP00;
                         END;
                    VTOLD = EPTABLE          ;
S                             2,EPTINDX
                    DLTTL      = DVTMR + VTOLD DKRTCSEC/40;
S                        DQST2
               END;
```

```
                ELSE DO;
E                    .
                     T2STAT      = FALSE;
S                          DQST2
                     IF NOT DFIL1
                          THEN CALL EGP07;  /*RESCHEDULE T2 (NOT CODED)*/
                END;
 EP02:    ;
C
C      RELEASE PREVIOUSLY ENABLED INTERRUPTS
C
           CLOSE MEP00;
 MEP05:    PROGRAM;  /*EVENTS PROCESSOR (TIME BASE CHANGE ENTRY)*/
           DECLARE ARRAY(10) EPTTBINDX INTEGER CONSTANT
                (1,6,14,19,39,56,72,94,108,111);
           EPTINDX = EPTTBINDX          - 1;
S                            DTBID+1
           CALL MEP10;
           CLOSE MEP05;
 MEP10:    PROGRAM;  /*EVENTS PROCESSOR (RESCHEDULE ENTRY)*/
           EPTINDX = EPTINDX + 1;
           DQST2 = 4;/*SET INDEX FOR EP ENTRY IN T2 SCHED CONTROL TABLE*/
           IF EPTABLE           ¬=0
S                    1,EPTINDX
                THEN DO;
                     VTOLD = EPTABLE          ;
S                                  2,EPTINDX
                     DLTTL       = DVTMR + VTOLD DKRTCSEC/40;
S                         DQST2
E                    .
                     T2STAT      = TRUE;
S                          DQST2
                END;
E                    .
                ELSE T2STAT      = FALSE;
S                          DQST2
           IF NOT DFIL1 THEN CALL EGP07;    /*RESCHED TIMER2(NOT CODED)*/
           CLOSE MEP10;
```

```
MIG00:  PROGRAM;  /*ITERATIVE GUIDANCE MODE*/
        DECLARE BIT(1) ,
             CHI_BAR_STEERING,
             PHASE,
             REITERATE,
             SMC_FLAG,
             S4BURN;
        DECLARE SCALAR,
             COSTHETA,          DELTAL3,          DELTA2,
             DPHII,             DPHIT,            EPSILON2,
             EPSILON3,          GT,               J1,
             J12,               J2,               J3,
             J3P,
             KCCT4   CONSTANT (1,53),
             KCCT8   CONSTANT (1,55),
             KMU     CONSTANT (-.39860320E15),
             KT      CONSTANT (.48497964E-7),
             K1,                K2,               K3,
             K4,                LYP,              L1,
             L12,               L2,               L3,
             L3P,               PHII,             PHIIT,
             PHIT,              P1,               P12,
             P2,                Q1,               Q12,
             Q2,                R,                ROVEX3,
             RT,                SINTHETA,         S1,
             S12,               S2,               TAU1,
             TAU2,              TAU3,             TC1,
             THETAT,            TSTAR,            T1C,
             T1I,               T2I,              T3I,
             U1,                U12,              U2,
             V,                 VEX1,             VEX2,
             VEX3,              VT;
        DECLARE VECTOR,
             DELTAVVP,          GS,               GV,
             GVSTAR,            GVT,              RS,
             RV,                RVT,              R4,
             VS,                VV,               VVT,
             V4;
        DECLARE MATRIX,
             MS4,
             M4V;
C
C       DUE TO THE SIZE OF IGM, ONLY A SECTION OF IT HAS BEEN CODED.
C       PART OF THE GUIDANCE COMPUTATIONS HAVE BEEN SELECTED TO DEMON-
C       STRATE MATHEMATICAL OPERATIONS.  THE PHASING PORTION OF IGM
C       HAS NOT BEEN CODED SINCE SIMILAR CAPABILITIES ARE ILLUSTRATED
C       BY OTHER KERNELS.
C
C        IG251 - IGM GUIDANCE PARAMETERS COMPUTATIONS
C
C        ROTATE POSITION AND VELOCITY INTO TARGET PLANE
C
E               *
 IG253:  R4 = MS4 RS;
         CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
```

```
          WRITE (TELX4) R4 ;/*TELEMETER X POSITION IN 4 SYSTEM*/
S                        1
          CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELY4) R4 ;/*TELEMETER Y POSITION IN 4 SYSTEM*/
S                        2
C         RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE
E                *
          V̄4 = MS4·V̄S;
          CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELZ4) R4 ;/*TELEMETER Z POSITION IN 4 SYSTEM*/
S                        3
          CALL UTR02 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELYD4)V4 ;/*TELEMETER Y VELOCITY IN 4 SYSTEM*/
S                        2
C         RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE
C
C       CALCULATE RANGE ANGLE MEASURED IN ORBIT PLANE
C
 IG254:   IF T2I = 0
            THEN DO;
                 L12,J12,S12,Q12,P12,U12 = 0;
                 GO TO IG259;
            END;
          IF T1I = 0
            THEN DO;
                 L1, J1, S1, Q1, P1, U1 = 0;
                 GO TO IG258;
            END;
          L1 = VEX1 LOG(TAUI/(TAUI - T1I));
          J1 = L1 TAU1 - VEX1 T1I;
          S1 = L1 T1I - J1;
E                                  2
          Q1 = S1 TAU1 - .5 VEX1 T1I ;
E                                  2
          P1 = J1 TAU1 - .5 VEX1 T1I ;
E                                 3
          U1 = Q1 TAU1 - VEX1 T1I /6.;
 IG258:   L2 = VEX2 LOG(TAU2/(TAU2 - T2I));
          J2 = L2 TAU2 - VEX2 T2I;
          S2 = L2 T2I - J2;
E                                  2
          Q2 = S2 TAU2 - .5 VEX2 T2I ;
E                                  2
          P2 = J2 TAU2 - .5 VEX2 T2I
E                                 3
          U2 = Q2 TAU2 - VEX2 T2I /6.;
          L12 = L1 + L2;
          J12 = J1 + J2 + L2 T1I;
          S12 = S1 - J2 + L12(T2I + TCI);
          Q12 = Q1 + Q2 + S2 T1I + J1 T2I;
          P12 = P1 + P2 + T1I (2 J2 + L2 T1I);
          U12 = U1 + U2 + T1I (2 Q2 + S2 T1I) + T2I P1;
 IG259:   L3P = VEX3 LOG(TAU3/(TAU3 -T3I));
          LYP = L12 + L3P;
          J3P = L3P TAU3 - VEX3 T3I;
```

```
          T1C = T1I + T2I + TCI;
          TSTAR = T1C + T3I;
          PHII = ATAN(R4 , R4 );
S                      3    1
C
C       DETERMINE PHASE
C
E
 IG260:   IF PHASE       THEN /*CALCULATE TERMINAL CONDITIONS*/
 IG262:        DO;
E
                    SINTHETA = RS.VS/(R*V);
E                                          2
                    COSTHETA = SQRT(1 - SINTHETA );
                    DPHII = (V/R) COSTHETA;
                    DPHIT = (VT/RT) COS(THETAT);
                    PHIIT = .5 TSTAR (DPHII + DPHIT);
                    PHIT = PHII + PHIIT;
                    CALL UTR02; /*DELAY FOR TELEMETRY AS REQUIRED*/
                    WRITE (TELPHIT) PHIT;/*TELEMETER TERMINAL RANGE ANGLE*/
C                   RELEASE INTERRUPTS LOCKED BY TELEMETRY DELAY ROUTINE
                    IF TSTAR <= EPSILON3  THEN GO TO IG269;
                    CALL MIG30;/*CALC TERM RAD,VEL,FLT ANGLE(NOT CODED)*/
E                                 2
                    GT = - KMU/RT  ;
                    CALL UTR00; /*DELAY FOR TELEMETRY AS REQUIRED*/
                    WRITE (TELGT) GT; /*TELEMETER TERMINAL GRAVITY VECTOR*/
C                   RELEASE INTERRUPTS LOCKED BY TELEMETRY DELAY ROUTINE

                    GVT = VECTOR(GT COS(THETAT), 0, GT SIN(THETAT));

                    RVT = VECTOR(RT COS(THETAT), 0, 0);
 IG269:             PHIT = PHIT - THETAT;
               END;
               ELSE DO; /*CALCULATE INTERMEDIATE PARAMETERS*/
                    DELTA2 = V TSTAR - J3P + LYP T3I - ROVEX3((TAU1 -
                             T1I) L1 + (TAU2 - T2I) L2 + (TAU3 - T3I) L3P)
                              (LYP + V - VT);
                    PHIIT= KT (S12 + DELTA2); /*KT = COS(THETAT)/RT*/
                    PHIT = PHII + PHIIT;
                    CALL UTR02; /*DELAY FOR TELEMETRY AS REQUIRED*/
                    WRITE (TELPHIT) PHIT;/*TELEMETER TERMINAL RANGE ANGLE*/
C                   RELEASE INTERRUPTS LOCKED BY TELEMETRY DELAY ROUTINE
               END;
C
C       ROTATE POSITION, VELOCITY, GRAVITY TO INJECTION SYSTEM
C
E         *
 IG291:   M4V = MATRIX(COS(PHIT), 0, SIN(PHIT),
                       0,       1,     0,
                    -SIN(PHIT), 0, COS(PHIT));
E         _   *
          RV = M4V R4;
E         _   *   _
          VV = M4V V4;
```

```
E          _     *   *   _
           GV = M4V MS4 GS;
E          _          _   _
           GVSTAR = .5(GVT + GV);
E          _          _   _
           DELTAVVP = VVT - VV - TSTAR GVSTAR;
C
C       IG314 - CALCULATE TIME-TO-GO                          (NOT CODED)
C
E
             .
           IF REITERATE
                THEN DO;
E                    .
                     REITERATE = FALSE;
                     L3P = L3;
                     J3P = J3;
                     LYP = LYP + DELTAL3;
                     GO TO IG260;
                END;
E                    .
                ELSE REITERATE = TRUE;
C
C       IG324 - COMPUTE CORRECTED VELOCITIES TO BE GAINED     (NOT CODED)
C
C       IG326 - CALCULATE DESIRED PITCH AND YAW               (NOT CODED)
C
E
             .
           IF CHI_BAR_STEERING       THEN GO TO IG350;
           IF TSTAR >= EPSILON2      THEN GO TO IG360;
E          .
           IF S4BURN
                THEN DO;
F                    .       .       .
                     DVMC5 = DVMC5 OR MSKMC5CBS;
                     DVMLR = 25 KCCT4;
                     DV1MR = .04/KCCT4;
                END;
                ELSE DO;
E                    .       .       .
                     DVMC6 = DVMC6 OR MSKMC6CBS;
                     DVMLR = 25 KCCT8;
                     DV1MR = .04/KCCT8;
                END;
E          .
 IG340:    CHI_BAR_STEERING = TRUE;
 IG350:    K1, K2, K3, K4 = 0;
           GO TO IG440;
C
 IG360: ;/*IG361 - COMPUTE INTERMEDIATE PARAMETERS          (NOT CODED)*/
C
 IG440.    CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
           WRITE (TELT3I) T3I;  /*TELEMETER T3I*/
C          RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE
C
C       IG446 - COMPUTE PITCH AND YAW IN 4-SYSTEM             (NOT CODED)
```

```
C
E
      .
IF SMC_FLAG THEN CALL MSM00;/*COMPUTE SMC TERMS  (NOT CODED)*/
CALL MCC00; /*PERFORM CHI COMPUTATIONS           (NOT CODED)*/
E
      .           .
IF DFILE AND MSKFPSINT2 ¬= 0
E
                  .
     THEN CALL EGP32(MSKSCC0);/*ENABLE INTERRUPT 2(NOT CODED)*/
CLOSE MIG00;
```

```
MDS00:    PROGRAM;  /*DIGITAL COMMAND SYSTEM*/
          DECLARE INTEGER,
               DCSDATACOUNT,
               DCSDATCT ARRAY(20) CONSTANT
                    (0,1,35,2,2,3,3 0,35,8 0,6,0),
               DCSERLIM CONSTANT (7),
               DCSINDX,
               DCSMODE ARRAY (64) CONSTANT
                    (5#0,8,2#0,1,2,3,4,5,2#0,14,6,0,7,2#0,19,3#0,9,0,15,
                     17,8#0,13,4#0,18,10,11,12,2#0,16,15#0),
               VDSRC;
          DECLARE BIT(1),
               DCMSTAT ARRAY(20),
               FDSEN,
               FDSPG,
               FDSRE,
               VDSSR;
          DECLARE BIT(26),
               DCSER04   CONSTANT (OCT'040000000'),
               DCSER10   CONSTANT (OCT'100000000'),
               DCSER14   CONSTANT (OCT'140000000'),
               DCSER20   CONSTANT (OCT'200000000'),
               DCSER24   CONSTANT (OCT'240000000'),
               DCSER44   CONSTANT (OCT'440000000'),
               DCSER60   CONSTANT (OCT'600000000'),
               DCSER64   CONSTANT (OCT'640000000'),
               DCSER74   CONSTANT (OCT'740000000'),
               DCSSTCOD ARRAY(20) CONSTANT
                    (OCT'000000000', OCT'100000000', OCT'110000000',
                     OCT'120000000', OCT'130000000', OCT'140000000',
                     OCT'200000000', OCT'220000000', OCT'050000000',
                     OCT'310000000', OCT'770000000', OCT'770000000',
                     OCT'770000000', OCT'450000000', OCT'170000000',
                     OCT'330000000', OCT'600000000', OCT'340000000',
                     OCT'520000000', OCT'250000000'),
               VDSER,
               VDS01;
          DECLARE ARRAY(35) VDSBL BIT(6);
C
C     RELEASE PREVIOUSLY ENABLED INTERRUPTS
C
E
               .
          READ(DIR) BTEMP; /*READ DISCRETE INPUT REGISTER*/
F
               .
          READ(DCS) VDS01; /*READ DCS INPUT REGISTER*/
E
               .         .
          IF BTEMP AND MSKDCSMODE = 0 THEN GO TO DS60;
C
C     PROCESS DCS MODE COMMAND
C
E
               .         .
 DS09:    IF VDS01       ¬= NOT VDS01
S              1 TO 7            8 TO 14
               THEN DO;
E              .    .
```

```
                    VDSER = DCSER10;
                    GO TO DS220;
               END;
E                   .       .
          IF VDS01 AND MSKDCSSB ¬= 0
               THEN DO;
E                   .       .
                    VDSER = DCSER24;
                    GO TO DS220;
               END;
E                   .       .       .
          IF VDS01 AND MSKDCSMC = MSKDCSTERM THEN GO TO DS25;
E                   .
          IF NOT FDSEN
               THEN DO;
E                   .       .
                    VDSER = DCSER20;
                    GO TO DS220;
               END;
E                   .       .
          IF DFDTL OR FDSPG
               THEN DO;
E                   .       .
                    VDSER = DCSER64;
                    GO TO DS220;
               END;
E                   .
 DS20:    FDSPG = TRUE;
 DS25:    ITEMP = INTEGER(VDS01       );
S                              1 TO 6
          DCSINDX = DCSMODE          + 1;
S                         ITEMP+1
E                   .
          IF NOT DCSMSTAT
S                       DCSINDX
               THEN DO;
E                   .
                    FDSPG = FALSE;
E                   .       .
                    VDSER = DCSER74;
                    GO TO DS220;
               END;
C         TELEMETER STATUS CODE TWICE
          CALL UTR24 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELDCSSC) DCSSTCOD        ;
S                                  DCSINDX
          CALL UTR24 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELDCSSC) DCSSTCOD        ;
S                                  DCSINDX
C         RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE
          CALL DS200;    /*ISSUE CRP*/
          DCSDATACOUNT = 0;
E                   .
          VDSSB = BIN'0';
          GO TO DS100;
```

```
C
C     PROCESS DATA WORD
C
E
 DS60:    IF FDSEN
               THEN DO;
E                   .                .
                    VDSER = DCSER04;
                    GO TO DS220;
               END;
E                  .                .
          IF VDS01        ¬= NOT VDS01
S              1 TO 7               8 TO 14
               THEN DO;
E                   .                .
                    VDSER = DCSER44;
                    GO TO DS220;
               END;
E                  .                .
          IF VDS01   ¬= VDSSB
S              7
               THEN DO;
E                   .                .
                    VDSER = DCSER60;
                    GO TO DS220;
               END;
 DS110:   /*TELEMETER DATA WORD TWICE*/
          CALL UTR24 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
E                   .
          WRITE (TELDCSDW) VDS01;
          CALL UTR24 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
E                   .
          WRITE (TELDCSDW) VDS01;
C         RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE
          CALL DS200:    /*ISSUE CRP*/
E         .                    .
          VDSBL                = VDS01      ;
S              DCSDATACOUNT + 1         1 TO 6
E         .                .
          VDSSB = NOT VDSSB;
          DCSDATACOUNT = DCSDATACOUNT + 1;
 DS100:   IF DCSDATACOUNT < DCSDATCT          THEN RETURN; /*MDS00*/
S                                  DCSINDX
          DO CASE DCSINDX;
               DO;
E                   .
                    FDSPG = FALSE;
E                   .                .
                    VDSER = DCSER14;
                    GO TO DS220;
               END;
               CALL DS260;    /*TIME BASE UPDATE            (NOT CODED)*/
               DO;
                    CALL DS330 ASSIGN(EXIT);/*NAV UPDATE    (NOT CODED)*/
                    IF EXIT THEN GO TO DS235;
```

```
                END;
                DO;
                     CALL DS380 ASSIGN(EXIT);/*GENERAL SS   (NOT CODED)*/
                     IF EXIT THEN GO TO DS220;
                END;
                CALL DS430;    /*SECTOR DUMP                (NOT CODED)*/
                CALL DS470;    /*TELEMETER SINGLE MEMORY LOC(NOT CODED)*/
                CALL DS510;    /*TERMINATE                  (NOT CODED)*/
                CALL DS540;    /*MANEUVER UPDATE            (NOT CODED)*/
                CALL DS550;    /*MANEUVER INHIBIT           (NOT CODED)*/
                DO;
                     CALL DS670 ASSIGN(EXIT);/*TARGET UPDATE(NOT CODED)*/
                     IF EXIT THEN GO TO DS235;
                END;
                CALL DS700;    /*ANTENNA TO OMNI            (NOT CODED)*/
                CALL DS720;    /*ANTENNA TO LOW             (NOT CODED)*/
                CALL DS740;    /*ANTENNA TO HIGH            (NOT CODED)*/
                CALL DS770;    /*INHIBIT WATER CONTROL VALVE(NOT CODED)*/
                CALL DS790;    /*TIME BASE 8 ENABLE         (NOT CODED)*/
                CALL DS810;    /*EXECUTE MANEUVER A         (NOT CODED)*/
                CALL DS840;    /*TD AND E ENABLE            (NOT CODED)*/
                CALL DS860;    /*EXECUTE MANEUVER B         (NOT CODED)*/
                CALL DS900;    /*S4B/IU LUNAR IMPACT        (NOT CODED)*/
                CALL DS960;    /*ENABLE TB6D ALTERNATE SEQ  (NOT CODED)*/
          END;
          GO TO DS530;
C
C     PROCESS DCS ERROR CONDITION
C
 DS220:   VDSRC = VDSRC + 1;
          IF VDSRC < DCSERLIM
E
               THEN FDSRE = FALSE;
F
               ELSE FDSRE = TRUE;
E
          VDSER = VDSER OR BIT(VDSRC) OR VDS01       ;
S                                              1 TO 14
 DS235:   /*TELEMETER ERROR CODE TWICE*/
          CALL UTR24 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
E
          WRITE (TELDCSEC) VDSER;
          CALL UTR24 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
F
          WRITE (TELDCSEC) VDSER;
C         RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE
E
          IF NOT FDSRE  THEN RETURN;    /*MDS00*/
 DS530:   VDSRC = 0;
F
          FDSEN = TRUE;
E
          FDSPG = FALSE;
          RETURN;   /*MDS00*/
 DS200:   PROCEDURE;  /*ISSUE DCS COMMAND RESET PULSE*/
```

```
C
C     INHIBIT ALL INTERRUPTS EXCEPT TLC
C
C
E
                    .
          WRITE(DOS) MSKDCSDO;/*SET COMMAND RESET BIT IN DOR*/
          WAIT  /* 4.13 MILLI-SEC*/;
E
                    .
          WRITE(DOR) MSKDCSDO;/*RESET COMMAND RESET BIT IN DOR*/
C
C     RELEASE PREVIOUSLY ENABLED INTERRUPTS
C
          CLOSE DS200;
          CLOSE MDS00;
```

```
 MAR00:   PROGRAM;  /*ACCELEROMETER READ ROUTINE*/
          DECLARE VOAC ARRAY(3) BIT(26);
          DECLARE SCALAR,
               VCCYA ,
               VCCZA ;
C
C         INHIBIT ALL INTERRUPTS EXCEPT TLC
C
          READ(XACC) DVAC ;
S                      1
          READ(YACC) DVAC ;
S                      2
          READ(ZACC) DVAC ;
S                      3
          READ(CLOCK) DVACT;
          CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELTI) DVTI;   /*TELEMETER TIME OF CURRENT TIME BASE*/
          STEMP = DVTAS;
          ITEMP = DVACT - DVRTC - DVERT;
          IF ITEMP <0 THEN ITEMP = ITEMP + DKRTCOVF;
          DVTAS = DVTMM DKRTCSEC + (DKRTCSEC/4) ITEMP;
          DVTB = DVTAS - DVTI;
          DVDT = DVTAS - STEMP;
          CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELTB) DVTB;  /*TELEMETER TIME IN CURRENT TIME BASE*/
E         .          .          .
          DVMC4 = DVMC4 AND MSKRTCRESET;
C
C         RELEASE PREVIOUSLY ENABLED INTERRUPTS
C
          CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELXAC) DVAC ; /*TELEMETER X ACCELEROMETER READING*/
S                        1
          CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELYAC) DVAC ; /*TELEMETER Y ACCELEROMETER READING*/
S                        2
C         RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE
          IF DKT1 = 0. THEN DVFMC = - DVG ;
S                                   1
               ELSE DO;
                    DVMAS = DVMAS - DVEOF DVMFR DVDT;
                    DVFMC = DVEOF DVFOR/DVMAS;
               END;
C
C     COMPUTE AVERAGE CHI'S FOR SMC CALCULATIONS
C
 AR41:    DVCA  =(DVCC  + VCCZA)/2.;
S           3        3
          VCCZA = DVCC ;
S                 3
          DVCA  =(DVCC  + VCCYA)/2.;
S           2        2
          VCCYA = DVCC ;
S                 2
          CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
```

```
          WRITE (TELZAC) DVAC ; /*TELEMETER Z ACCELEROMETER READING*/
S                        3
C         RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE
C
C     COMPUTE CHANGES BETWEEN CURRENT AND PREVIOUS ACCELEROMETER READINGS
C
E
 AR100:   DVDA = VECTOR([DVAC       ]) - VECTOR([VOAC       ]);
S                       1 TO 12                 1 TO 12
E
          DVDB = VECTOR([DVAC       ]) - VECTOR([VOAC       ]);
S                       15 TO 26                15 TO 26
E
          [VOAC] = [DVAC];
          CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELRTC) DVACT; /*TELEMETER REAL TIME CLOCK AT ACCEL READ*/
C         RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE
C
C     COMPUTE EXPECTED VELOCITY CHANGES
C
 AR71:    DVD  = 20 DVDT COS(DVTH ) COS(DVTH );
S           1                  2          3
          DVD  = 20 DVDT SIN(DVTH );
S            2                 3
          DVD  = - 20 DVDT SIN(DVTH ) COS(DVTH );
S            3                 2          3
          CALL UTR00 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
          WRITE (TELTAS) DVTAS; /*TELEMETER MISSION ELAPSED TIME*/
C         RELEASE INTERRUPTS DISABLED BY TELEMETRY DELAY ROUTINE
E
          DVF = DVFOM DVD;
          CLOSE MAR00;
 MAP00:   PROGRAM;  /*ACCELEROMETER PROCESSING*/
          DECLARE SCALAR,
               DELTA,
               KSN2D CONSTANT (.0348994967), /*SIN 2 DEGREES*/
               VACZR,
               VPOV ARRAY(3);
          DECLARE ARRAY(3) BIT(26) CONSTANT,
               MSKAPDG (OCT'040000000',OCT'010000000',OCT'200000000'),
               MSKAPOF (OCT'000000010',OCT'000000200',OCT'000000020');
          DVVSQ = 0;
          VACZR = 20 DVFOM DVDT KSN2D;
          DO FOR I = 1 TO 3;
 AP400:        IF ABS(DVDA  - DVDB ) <= 2 THEN GO TO AP450;
S                      I       I
               IF ABS(DVDA  - DVF ) < ABS(DVDB  - DVF ) THEN GO TO AP440;
S                     I      I            I      I
F
               DVMC4 = DVMC4 OR MSKAPDG         CAT BIN'0';
S                                  I:2 TO 26
               DELTA = DVDB ;
S                      I
               GO TO AP460;
E              .      .       .
```

```
 AP440:         DVMC4 = DVMC4 OR MSKAPDG ;
S                                      I
 AP450:         DELTA = DVDA ;
S                      I
E                                      .
 AP460:         IF ABS(DELTA) > 1 OR NOT DFZER OR ABS(DVF ) < VACZR
S                                                          I
                    THEN GO TO AP500;
E                   .          .          .
 AP470:         DVMC4 = DVMC4 OR MSKAPOF ;
S                                      I
E                   .          .          .          .
 AP530:         DVMC4 = DVMC4 OR MSKAPDG  OR MSKAPDG          CAT BIN'0';
S                                      I            I:2 TO 26
E                   .
                    DFSMC = FALSE;
                    DELTA = DVFMC DVD ;
S                                I
                    GO TO AP520;
 AP500:             IF DVF  < 0
S                     I
                         THEN DO;
                              IF DELTA < 1.5 DVF  - DVDT DVRC  OR
S                                        I                 I
                                 DELTA >  .5 DVF  + DVDT DVRC
S                                        I                 I
                                 THEN GO TO AP530;
                         END;
                         ELSE IF DELTA > 1.5 DVF  + DVDT DVRC  OR
S                                        I                 I
                                 DELTA <  .5 DVF  - DVDT DVRC
S                                        I                 I
                                 THEN GO TO AP530;
E                                  2
 AP510:             DVVSQ = DVVSQ + DELTA ;
 AP520:             VPOV  = VPOV  + DELTA;
S                   I       I
                    DVDM  = .05 VPOV ;
S                   I         I
                    CALL UTR01; /*DELAY FOR TELEMETRY AS REQUIRED*/
                    DO CASE I;
                         WRITE (TELXDM) DVMD ;/*TELEMETER X MEASURED VELOCITY*/
S                                       1
                         WRITE (TELYDM) DVDM ;/*TELEMETER Y MEASURED VELOCITY*/
S                                       2
                         WRITE (TELZDM) DVDM ;/*TELEMETER Z MEASURED VELOCITY*/
S                                       3
                    END;
C                   RELEASE INTERRUPTS LOCKED BY TELEMETRY DELAY ROUTINE
               END;
               CLOSE MAP00;
```

```
 MML00:   PROGRAM;  /*FLIGHT SIMULATION MINOR LOOP*/
          IF DVLRC = 0
F
               THEN DVCC = DVCC - DVDC;
               ELSE DVLRC = DVLRC - 1 ;
          CALL MML20;     /*EXECUTE NORMAL MINOR LOOP*/
          CLOSE MML00;
 MML20:   PROGRAM;  /*MINOR LOOP*/
          DECLARE BIT(26),
               VGR ARRAY(3),
               VMEMR,
               VMLET;
          DECLARE SCALAR,
               KCPBG CONSTANT (641.5839),
               VOCK;
          DECLARE ARRAY (3) SCALAR,
               VBUB,
               VCG ,
               VDEL,
               VML2,
               VSF ;
          DECLARE ARRAY(3) INTEGER,
               FBUG ,
               VCG0 ,
               VCG1 ,
               VCMND (3,3),
               VCOD ,
               VFIO ,
               VML0 ,
               VML1 ,
               VOLD ,
               VPGR ;
          DECLARE INTEGER,
               FBUGS,
               KMAXLAD CONSTANT (256),
               VCG10,
               VCG11,
               VIRE ;
E
          DVCC = DVCC + DVDC;
          IF FBUGS ¬= 0   THEN GO TO ML500;
 ML001:   DO FOR I = 3 TO 1 BY -1;
               DO CASE I;
 ML201:             DO;
E                        .     .     .
                         DVEMR = DVEMR OR VMEMR;
                         DO CASE VFIO  + 1;
S                                  1
E                             .
                              VGR  = VPGR ;/*USE INTERNAL X GIMBAL VALUE*/
S                                1        1
E                                          .
                              READ(XGIM) VGR ;/*READ X GIMBAL*/
S                                           1
E                                           .
```

```
                        READ(XBGIM) VGR ;/*READ X BACKUP GIMBAL*/
S                                       1
                    END;
                END ML201;
 ML101;         DO;
E                   .
                    READ(EMR) VMEMR;
E                   .       .       .       .
                    DVLDB = DVLDB - (VMEMR AND MSKEMRLADB);
                    DO CASE VFIO  + 1;
S                           2
E
                        .
                        VGR  = VPGR ;/*USE INTERNAL Y GIMBAL VALUE*/
S                       2       2
E                       .
                        READ(YGIM) VGR ;/*READ Y GIMBAL*/
S                               2
E                       .
                        READ(YBGIM) VGR ;/*READ Y VACKUP GIMBAL*/
S                               2
                    END;
                END ML101;
 ML001A;        DO CASE VFIO + 1;
S                       3
E                   .
                    VGR  = VPGR ; /*USE INTERNAL Z GIMBAL VALUE*/
S                   3       3
F                   .
                    READ(ZGIM) VGR ; /*READ Z GIMBAL*/
S                           3
F                   .
                    READ(ZBGIM) VGR ; /*READ Z BACKUP GIMBAL*/
S                           3
            END ML001A;
        END;
E           .
        IF VGR    = 0 THEN GO TO ML020;
S         I:1
 ML430: IF DVDGS < 0  THEN GO TO ML432;
        IF DVDGS = 0  THEN GO TO ML020;
        GO TO ML637;
 ML432: CALL MDG00 ASSIGN(J);/*PROCESS DISAGREEMENT BIT(NOT CODED)*/
C
C     DISAGREEMENT BIT PROCESSING WILL RETURN ONE OF THE FOLLOWING FOR J:
C           J = 0 FOR INVALID DISAGREEMENT BIT
C           J = 1 FOR VALID GIMBAL, VALID DISAGREEMENT BIT
C           J = 2 INVALID GIMBAL, VALID DISAGREEMENT BIT
C
        IF J = 0 THEN GO TO ML020;
 ML434: DO CASE I;
 ML4352:    DO CASE VFIO ;
S                   1
F                   .
                    READ(XGIM) BTEMP;/*RESTART Z COD COUNTER*/
E                       .
```

```
                    HAL   KERNEL  9     MINOR LOOP

                         READ(XBGIM) BTEMP;/*RESTART Z COD COUNTER*/
                    END ML4352;
 ML4351:            DO CASE VFIO ;
S                             2
E
                         READ(YGIM) BTEMP;/*RESTART X COD COUNTER*/
F
                         READ(YBGIM) BTEMP;/*RESTART X COD COUNTER*/
                    END ML4351;
 ML4350:            DO CASE VFIO ;
S                             3
E
                         READ(ZGIM) BTEMP;/*RESTART Y COD COUNTER*/
F
                         READ(ZBGIM) BTEMP;/*RESTART Y COD COUNTER*/
                    END ML4350;
               END ML434;
               IF J = 2 THEN GO TO ML637;
E
 ML020:        VCOD  = VGR          ;
S                 I       I:2 TO 12
               IF VCOD  = 0 AND VOLD  = 0 AND ABS(VDEL ) >= VOCK
S                     I              I                    I
                    THEN GO TO ML631;
               IF ABS(VCOD  - VOLD ) < VML0  THEN GO TO ML040;
S                        I       I       I
               IF ABS(VCOD  - VOLD ) + VML0  < VML1  THEN GO TO ML630;
S                        I       I       I       I
               IF VCOD  < VOLD
S                     I       I
                    THEN VCG  = VCG  + VML2 ;
S                        I       I       I
                    ELSE VCG  = VCG  - VML2 ;
S                        I       I       I
 ML040:        DVTH  = VSF  VCOD  + VCG ;
S                  I       I     I       I
               VOLD  = VCOD ;
S                  I       I
               VDEL  = DVTH  - DVCC ;
S                  I       I       I
E
               DFDBF = TRUE;
               DO CASE I;
                    VCMND   = DVA6 (VDEL  + DVA3 VDEL );
S                        1,1             1          2
                    VCMND   = DVA1 VDEL  + DVA2 VDEL );
S                        2,1        2          3
                    VCMND   = DVA5 VDEL  - DVA4 VDEL );
S                        3,1        3          2
               END;
               GO TO ML730;
E
 ML630:        VMLET  = I + 2;
               GO TO ML632;
E
```

```
 ML631:        VMLET = I - 1;
E
 ML632:        VMLET = VMLET        CAT BIN(11)'0' OR BIT(VCOD )
S                          12 TO 26                          I
                     OR BIT        (VOLD ) CAT BIN(15)'0';
S                           16 TO 26     I
F
              IF DVMC6 AND MSKMC6DO4 = 0
                   THEN DO;
                        CALL UTR30;/*DELAY FOR TELEMETRY AS REQUIRED*/
E
                        WRITE (TELMLER) VMLET;/*TELEMETER ERROR MESSAGE*/
                   END;
E
              IF NOT DFDBF   THEN GO TO ML635;
              DVRE  = DVRE  + 1;
S                 I       I
              IF DVRE  < 0 THEN GO TO ML637;
S                    I
              IF DVRE  > 0 THEN GO TO ML636;
S                    I
F
              VMLET = BIT(VCOD ) OR BIT        (VOLD ) CAT OCT'34000';
S                           I        16 TO 26     I
              VFIO  = 2;/*SET I/O FLAG FOR BACKUP GIMBAL*/
S                  I
              IF VCG  >=PI THEN VCG  = PI - VBUB ;
S                    I             I          I
                           ELSE VCG  = - VBUB ;
S                                  I         I
              VML2  = PI;
S                  I
              IF DVTH  >= PI THEN VOLD  = (DVTH  - PI) KCPBG;
S                    I                 I        I
                              ELSE VOLD  = DVTH  KCPBG;
S                                   I       I
              VSF  = 1/KCPBG;
S                I
              IF I = 3  THEN DO;
E
                   WRITE(ICR) MSKICRBG;/*SET ICR TO SELECT BACKUP*/
E
                   DVICR = DVICR OR MSKICRBG;
              END;
              FBUGS, FBUG  = 2;
S                         I
              VML0  = VCG10;
S                  I
              VML1  = VCG11;
S                  I
E
              IF DVMC6 AND MSKMC6DO4 = 0
                   THEN DO;
                        CALL UTR30;/*DELAY FOR TELEMETRY AS REQUIRED*/
E
```

```
                        WRITE (TELMLER) VMLET;/*TELEMETER ERROR MESSAGE*/
                    END;
                GO TO ML637;
 ML635:         DVHDB = DVHDB - 1;
E
                .
                DFDBF = TRUE;
                DVHDA = DVHDA + 1;
                IF DVHDA < 0 THEN GO TO ML636;
E
                .
                WRITE(ICR) MSKICRSWG;/*SET ICR TO SWITCH GIMBAL ORDER*/
E               .       .       .
                DVICR = DVICR OR MSKICRSWG;
E               .       .       .
                DVMC4 = DVMC4 OR MSKMC4AMF;
                DVDGS = 0;
E                                       .       .
 ML636:         IF DVRE  >= VIRE AND (DVMC6 AND MSKMC6D04) = 0
S                      I
F                                       .
                    THEN CALL UD000(MSKGRF);/*SET GUIDANCE FAILURE DISC.*/
E               .
 ML637:         DFSMC = FALSE;
                GO TO ML760;
 ML730:         IF ABS(VCMND    ) > DVM06 THEN VCMND    = DVM06;
S                       I,1                             I,1
                IF ABS(VCMND     - VCMND    ) > DVM05
S                       I,1          I,2
                    THEN VCMND     = VCMND     + DVM05;
S                           I,1          I,2
                VCMND     = VCMND    ;
S               I,2           1,1
                IF VCMND    < 0
S                      I,1
                    THEN VCMND     = KMAXLAD - VCMND    ;
S                           I,3                     I,1
                    ELSE VCMND     = VCMND    ;
S                           I,3          I,1
 ML760:         DO CASE I;
 ML260:             DO;
                        READ(DBG) ITEMP;/*START SPECIAL DOM BACKUP GIMBAL*/
                        WRITE(ZLAD) VCMND    ;/*ISSUE YAW COMMAND*/
S                                   3,3
                        WRITE(XLAD) VCMND    ;/*ISSUE ROLL COMMAND*/
S                                   1,3
                    END ML260;
 ML160:             WRITE (YLAD) VCMND   ;/*ISSUE PITCH COMMAND*/
S                              2,3
 ML060:             DO;
                        WRITE(ZLAD) VCMND    ;/*ISSUE YAW COMMAND*/
S                                   3,3
E                                               .
                        IF DVLDB < 0 THEN WRITE(ICR) MSKICRCA;
                        ITEMP = DVTT1 - DVRTC;
                        IF ITEMP < 0 THEN ITEMP = ITEMP + DKRTCOVF;
                        DVMLT = DVTMM + DVMLD + ITEMP/4;
```

```
                    END ML060;
               END ML760;
          END ML001;
          RETURN; /*MML20*/
 ML500:   DO FOR I = 1 TO 3:
               DO CASE FBUG  + 1;
S                           I
                    GO TO ML530;
                    DO;
                         FBUG  = 0;
S                           I
                         VML0  = VCG0 ;
S                           I       I
                         VML1  = VCG1 ;
S                           I       I
                    END;
                    FBUG  = 1;
S                       I
               END;
 ML530:   END;
          FBUGS = SUM([FBUG]);
          GO TO ML001;
          CLOSE MML20;
```

```
 MS00:    PROGRAM; /*SWITCH SELECTOR PROCESSING*/
C
C       SWITCH SELECTOR TABLE
C
C            THE SWITCH SELECTOR TABLE IS MADE UP OF A NUMBER OF
C            SMALLER TABLES, ONE FOR EACH TIME BASE AND FOR EACH
C            OF THE ALTERNATE SS SEQUENCES.  THE SMALLER TABLES ARE
C            ORGANIZED INTO ONE LARGE TABLE.  HOWEVER, ONLY THE
C            TIME BASE 1 TABLE HAS BEEN CODED.
C
C            EACH TABLE ENTRY REPRESENTS A SINGLE SS COMMAND AND
C            CONSISTS OF TWO WORDS.
C                 1. TIME OF SS ISSUANCE (IN TENTHS OF A SECOND).
C                 2. SS STAGE AND ADDRESS.
C
         DECLARE SSTABLE ARRAY(2,1000) INTEGER CONSTANT
                        ( 50 ,  OCT'000000000',
                          60 ,  OCT'106500000',
                         140 ,  OCT'026100000',
                         198 ,  OCT'406440000',
                         200 ,  OCT'405440000',
                         202 ,  OCT'406340000',
                         240 ,  OCT'025740000',
                         270 ,  OCT'402100000',
                         290 ,  OCT'027740000',
                         300 ,  OCT'403040000',
                         320 ,  OCT'401100000',
                         495 ,  OCT'020100000',
                         750 ,  OCT'000000000',
                         900 ,  OCT'402100000',
                         950 ,  OCT'401100000',
                         953 ,  OCT'022640000',
                        1050 ,  OCT'407640000',
                        1151 ,  OCT'025740000',
                        1198 ,  OCT'406740000',
                        1200 ,  OCT'405740000',
                        1201 ,  OCT'027740000',
                        1300 ,  OCT'404040000',
                        1324 ,  OCT'021640000',
                        1336 ,  OCT'400700000',
                        1338 ,  OCT'401700000',
                        1344 ,  OCT'021740000',
                        1346 ,  OCT'023740000',
              0'377777776',  OCT'000000000');
         DECLARE BIT(1),
              FASE  ,
              FBRNI ,
              FCLS4 ,
              FFBCH ,
              FHST  ,
              FSSAC ,
              FSSIO ,
              FTADV ,
              FT60P ;
         DECLARE INTEGER CONSTANT,
```

```
      KCSSK       (203) ,
      KSSB1       ( 18) ,
      KSSB2       ( 26) ,
      KSSB3       ( 17) ,
      KSSB4       (  9) ,
      KSSB5       ( 26) ,
      KSSB6       ( 13) ,
      KSSB7       ( 22) ,
      KSSB8       ( 11) ,
      KSSRB       ( 50) ,
      KSS500MS    (508) ,
      KSS500SEC (507937),
      KSSINDXALU      (410) ,
      KSSINDXECSV     (386) ,
      KSSINDXECS1     (384) ,
      KSSINDXGAIN     (405) ,
      KSSINDXGSS      (378) ,
      KSSINDXSBHI     (388) ,
      KSSINDXSBLO     (390) ,
      KSSINDXSBOM     (392) ,
      KSSINDXSIVA     (380) ,
      KSSINDXSIVB     (382) ,
      KSSINDXS4C1     (304) ,
      KSSINDXTB3A     (301) ,
      KSSINDXTB5A     (394) ,
      KSSINDXTB5B     (399) ,
      KSSINDXTB6A     (343) ,
      KSSINDXTB6B     (348) ,
      KSSINDXTB6C     (352) ,
      KSSINDXTB6D     (373) ;
DECLARE INTEGER,
      SSTIBPTR ARRAY (8) CONSTANT (0, 28, 41, 84, 113, 151,
                                   230, 281),
      SST1PTR,
      SST2PTR,
      VATRR   ,
      VATR4   ,
      VGBIA   ,
      VSC10   ,
      VSC12   ,
      VSC30   ,
      VSC32   ,
      VSSRT   ,
      VSSTM   ,
      VSSW    ,
      VSTGO   ;
DECLARE BIT(26),
      VASPI   ,
      VHSTW   ,
      VPSTG   ,
      VSCCA   ,
      VSC11   ,
      VSC31   ,
      VSNA    ,
      VSNA1   ,
```

```
                VSSCA  ,
                VSSFB  ,
                VSTG   ;
          DO CASE DGSSM;
                GO TO MSS000;
                GO TO MSS05;
                GO TO MSS10;
                GO TO MSS20;
                GO TO MSS30;
                GO TO MSS40;
                GO TO MSS50;
                GO TO MSS55;
                GO TO MSS60;
                GO TO MSS70;
                GO TO MSS80;
           END;
MSS000:    ;
C
C      INHIBIT ALL INTERRUPTS EXCEPT TLC
C
F
           .
           FASE = FALSE;
E          .           .
           IF DVASW AND MSKSSS4CO ¬=0
                THEN DO;
E                    .           .           .
                     DVASW = DVASW AND MSKSSWV;
F                    .           .
                     IF VASPI AND MSKSSS4CO ¬= 0  THEN GO TO SS0060;
                     CALL EGP08;        /*RESCHEDULE TIMER 1 (NOT CODED)*/
E                    .           .
                     VASPI = MSKSSS4CO;
                     SST1PTR = KSSINDXSIVB;
                     GO TO SS1050;
                END;
E          .           .
           IF DVASW AND MSKSSSPEC ¬= 0
                THEN DO;
E                    .           .           .
                     DVASW = DVASW AND MSKSSWV;
                     CALL EGP08;        /*RESCHEDULE TIMER 1 (NOT CODED)*/
E                    .           .
                     VASPI = MSKSSSPEC;
                     SST1PTR = KSSINDXSIVA;
                     GO TO SS1050;
                END;
F          .           .
           IF DVASW AND MSKSSTB6C ¬= 0
                THEN DO;
E                    .           .
                     DVASW = DVASW AND NOT MSKSSTB6C;
F                    .           .           .
                     VASPI = VASPI OR MSKSST6C;
F                    .           .
                     DVMC6 = DVMC6 OR MSKMC6TB6C;
```

```
                    SST1PTR = KSSINDXTB6C;
                    CALL SSTUPD ASSIGN (VATRR); /*UPDATE SS TIME*/
                    GO TO SS1050;
               END;
F
          IF DVASW AND MSKSSCLS1 ¬= 0
               THEN DO;
                    VSC10 = SST1PTR;
E
                    VSC11 = VASPI;
                    VSC12 = VATRR ;
E
                    VASPI = MSKSSCL1;
                    CALL SSTUPD ASSIGN (VATRR); /*UPDATE SS TIME*/
F
                    FTADV = TRUE;
E
                    IF DVASW AND MSKSSTB6A ¬= 0
                         THEN DO;
F
                              DVASW = DVASW AND NOT MSKSSTB6A;
F
                              DVMC6 = DVMC6 OR MSKMC6TB6A;
                              SST1PTR = KSSINDXTB6A;
                         END;
E
                         ELSE IF DVASW AND MSKSSS4C1 ¬= 0
                              THEN DO;
F
                                   DVASW = DVASW AND NOT MSKSSS4C1;
                                   SST1PTR = KSSINDXS4C1;
                              END;
                              ELSE DO;
F
                                   DVASW = DVASW AND NOT MSKSSTB6B;
E
                                   DVMC6 = DVMC6 OR MSKMC6TB6B;
                                   SST1PTR = KSSINDXTB6B;
                              END;
                    GO TO SS1050;
               END;
F
          IF FSSAC  THEN GO TO SS0060;
                    ELSE GO TO SS0000;
E
 MSS05:   FSSAC = FALSE;
E
 SS0000:  IF SSTABLE          ¬= MSKSSNSEND  THEN
S
                    1,SST1PTR
 SS0010:       DO;
                    CALL SSTUPD ASSIGN (VSTGO); /*UPDATE SS TIME*/
                    VSTGO = VSSRT - VSTGO;
                    IF VSTGO < KSS500MS THEN GO TO MSS30;
F
                    IF DFTUP
```

```
                    THEN DO;
                         DVTGB = DVTGB + VGBIA;
                         VGBIA = 0;
E                        .
                         DFTUP = FALSE;
                         GO TO SS0010;
                    END;
E                   .
                    IF DVASW ¬= 0 THEN GO TO SS0170;
                    VSSTM = VSTGO + DVTRB - DVTGB - KCSSK;
                    DVSST = VSSTM + DVTMR;
                    DGSSM = 5; /*SET SS ENTRY INDEX FOR MSS30*/
                    IF NOT DFIL3 THEN CALL EGP08;/*RESCHED T1(NOT CODED)*/
                    GO TO SS0060;
               END;
F              .
 SS0015:  IF DVASW ¬= 0 THEN GO TO SS0170;
          READ(CLOCK) ITEMP;
          IF ITEMP - DVRTC < 0
               THEN ITEMP = ITEMP - DVRTC + DKRTCOVF;
               ELSE ITEMP = ITEMP - DVRTC;
          DVSST = DVTMM + KSS500SEC + ITEMP/4;
          DGSSM = 2; /*SET SS ENTRY INDEX FOR MSS05*/
          IF NOT DFIL3 THEN CALL EGP08;      /*RESCHD T1   (NOT CODED)*/
          GO TO SS0060;
E         .              .
 SS0170:  IF DVASW AND MSKSSCLS3 = 0
               THEN DO;
F                   .              .
                    IF DVASW AND MSKSSACQU ¬= 0
                         THEN DO;
F                        .         .         .
                              DVASW = DVASW AND NOT MSKSSACQU;
                              SST2PTR = KSSINDXGAIN;
                              CALL SSTUPD ASSIGN (VATR4);/*UPDATE SS T*/
                         END;
                         ELSE DO;
E                             .              .
                              IF DVASW AND MSKSSTB6D ¬= 0
                                   THEN DO;
E                                       .              .
                                        DVASW = DVASW AND NOT MSKSSTB6D;
                                        SST2PTR = KSSINDXTB6D;
                                        CALL SSTUPD ASSIGN(VATR4);
C                                            /*UPDATE SS TIME*/
                                   END;
                                   ELSE DO;
E                                       .              .         .
                                        DVASW = DVASW AND NOT MSKSSLI;
                                        SST2PTR = KSSINDXALU;
                                        VATR4 = 0;
                                   END;
                         END;
E                   .
                    FCLS4 = TRUE;
```

```
E                   .
                    FTADV = FALSE;
E                   .
                    FHST = TRUE;
                    CALL SS210; /*SET UP CLASS 4 ALTERNATE SEQUENCE*/
                    GO TO SS0060;
               END;
E              .
          IF VASPI ¬= 0 THEN GO TO SS0060;
          VSC30 = SST1PTR;
E         .    .
          VSC31 = VASPI;
          VSC32 = VATRR;
E         .    .
          VASPI = MSKSSCL3;
          CALL SSTUPD ASSIGN (VATRR); /*UPDATE SS TIME*/
E         .
          FTADV = TRUE;
E         .
          FHST = TRUE;
E              .    .
          IF DVASW AND MSKSSGNSS ¬= 0
               THEN DO;
E                   .    .    .
                    DVASW = DVASW AND NOT MSKSSGNSS;
                    SST1PTR = KSSINDXGSS;
                    GO TO SS0230;
               END;
E              .    .
          IF DVASW AND MSKSSSBLO ¬= 0
               THEN DO;
E                   .    .    .
                    DVASW = DVASW AND NOT MSKSSSBLO;
                    SST1PTR = KSSINDXSBLO;
                    GO TO SS0230;
               END;
E              .    .
          IF DVASW AND MSKSSSBHI ¬= 0
               THEN DO;
E                   .    .    .
                    DVASW = DVASW AND NOT MSKSSSBHI;
                    SST1PTR = KSSINDXSBHI;
                    GO TO SS0230;
               END;
E              .    .
          IF DVASW AND MSKSSSBOM ¬= 0
               THEN DO;
E                   .    .    .
                    DVASW = DVASW AND NOT MSKSSSBOM;
                    SST1PTR = KSSINDXSBOM;
                    GO TO SS0230;
               END;
E              .    .
          IF DVASW AND MSKSSECSV ¬= 0
               THEN DO;
```

```
                    SST1PTR = KSSINDXECSV;
                    GO TO SS0230;
               END;
E
          IF DVASW AND MSKSSECS1 ¬= 0 THEN SST1PTR = KSSINDXECS1;
               ELSE DO;
                    SST1PTR = KSSINDXTB3A;
E
                    DVASW = DVASW AND NOT MSKSST3A;
               END;
 SS0230:  CALL SS210; /*SET UP SS TABLE*/
          GO TO SS0000;
E
 SS0060:  IF NOT FASE
               THEN DO;
E
                    FASE = TRUE;
C
C      RELEASE PREVIOUSLY ENABLED INTERRUPTS
C
               END;
          RETURN;  /*COMMON SS EXIT*/
E
 MSS10:   VASPI = BIN(26)'0';
          VATRR = 0;
E
          FCLS4 = FALSE;
F
          DVASW = DVASW AND MSKSSWV;
          CALL EGP08;          /*RESCHEDULE TIMER 1        (NOT CODED)*/
E
          FTADV = TRUE;
          SST1PTR = SSTTBPTR       ;
S                           DTBID
 SS1050:  CALL SS210;  /*SET UP NEXT SS*/
E
          IF FSSAC       THEN GO TO MSS20;
          VSSW = KSSB1;
F
          FHST = TRUE;
          GO TO SS0000;
E
 MSS20:   IF FSSIO THEN WRITE(SS) MSKSSRESET;
E
          FHST = FALSE;
          CALL SSTUPQ(KSSB8,2); /*SCHEDULE SS CHECK, MSS05*/
          VSSW = KSSB5;
          GO TO SS0060;
E
 MSS30:   FSSAC = TRUE;
E
          VSNA       , VSNA1       = (VSNA AND MSKSSSNA)       ;
S             1 TO 26       1 TO 26                       1 TO 24
E
          IF VSNA = 0
```

```
                THEN DO;
E
                     FSSAC = FALSE;
                     CALL SS201;    /*ADVANCE TO NEXT SS*/
                     GO TO SS0000;
                END;
E
          VSTG = VSNA AND VPSTG;
F
          FSSIO = VSTG ¬= 0;

          IF NOT FHST THEN GO TO SS4000;
          IF DFLT = 2 THEN GO TO SS4000;
E
          READ (SSFB) BTEMP;  /*READ SS FEEDBACK REGISTER*/
F
          IF BTEMP AND MSKSSHS = 0 THEN GO TO SS4000;
E
          IF FSSIO THEN WRITE(SS) MSKSSRESET;  /* ISSUE SS RESET*/
          CALL SSTUPQ(KSSB4,6);/*SCHEDULE STAGE/ADDRESS ISSUANCE MSS40*/
          VSSW = KSSB5;
          GO TO SS0060;
 MSS40:   WAIT    ;            /*DELAY BEFORE ISSUING STAGE AND ADDRESS*/
E
          IF FSSIO THEN WRITE(SS) VSNA;/*ISSUE STAGE AND ADDRESS*/
          CALL SSTUPQ(VSSW,7);/*SCHEDULE ADDRESS VERIFICATION, MSS50 */
          WAIT       ;         /*DELAY FOR DOM TELEMETRY*/
          WRITE(DOM); /*OUTPUT SS AND DO REGISTERS VIA DOM TELEMETRY*/
          GO TO SS0060;
E
 MSS50:   VSCCA = VSNA       CAT NOT VSNA        CAT BIN(11)'0';
S                   1 TO 7              8 TO 15
E
          VSSCA = VSCCA AND MSKSSHS;
E
          IF VSTG ¬= 0
F
               THEN READ(SSFB) BTEMP;/*READ SS FEEDBACK REGISTER*/
F
               ELSE BTEMP = VSCCA;
E
          VSSFB = BTEMP AND MSKSSHS;
F
          IF VSSFB ¬= VSSCA THEN GO TO SS5540;
E
 MSS55:   IF VASPI AND MSKSSS4CO ¬= 0
               THEN DO;
E
                    DFILE = DFILE OR MSKFPSISSA;
                    DVSST = 1.E10;
                    RETURN; /*MSS50, MSS55*/
               END;
          IF VSSRT = 0 THEN GO TO MSS60;
          CALL SSTUPD ASSIGN(DVTRB); /*UPDATE SS TIME*/
          IF VSSRT - DVTRB <= KSSRB THEN GO TO MSS60;
```

```
          VSSTM = VSSRT - DVTGB - KSSRB;
          DVSST = VSSTM + DVTMR;
          DGSSM = 9;  /*SET SS ENTRY INDEX FOR MSS60*/
          IF NOT DFIL3 THEN CALL EGP08;/*RESCHEDULE T1      (NOT CODED)*/
          RETURN; /*MSS50, MSS55*/
E
 SS5540:  IF VSSFB = 0 AND VSSCA ¬= MSKSSZFSF THEN GO TO MSS55;
E
          IF FSSIO THEN WRITE(SS) MSKSSRESET; /*ISSUE RESET*/
          CALL SSTUPQ(KSSB6,11); /*SCHEDULE COMP STAGE/ADDRESS, MSS80*/
          ITEMP = 0;
          DO FOR I = 8 TO 15;
E
               IF VSSFB  ¬= VSSCA        THEN ITEMP = ITEMP + 1;
S                      I         I
          END;
          IF ITEMP < 2   THEN RETURN; /*MSS50*/
E
          DVMC4 = DVMC4 OR MSKMC4SSCB;
E
          IF FFBCH
               THEN DO;
F
                    FFBCH = FALSE;
E
                    WRITE(ICR) MSKICRSSCB; /*SWITCH SS TO CHANNEL B*/
F
                    DVICR = DVICR OR MSKICRSSCB;
               END;
          CALL UTR30 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
E
          WRITE (TELSSFB) VSSFB; /*TELEMETER SS FEEDBACK*/
          RETURN; /*MSS50*/
F
 MSS60:   BTEMP = VSTG OR MSKSSREAD;
E
          IF FSSIO THEN WRITE(SS) BTEMP; /*ISSUE READ COMMAND*/
          READ(CLOCK) ITEMP; /*GET TIME FOR SS TELEMETRY WORD*/
          CALL SSTUPQ(KSSB2,10);/*SCHEDULE READ RESET, MSS70*/
F
          BTEMP = VSNA        CAT BIN'00' OR BIT(ITEMP) AND MSKRTC;
S                  3 TO 26
          CALL UTR30 ; /*DELAY FOR TELEMETRY AS REQUIRED*/
E
          WRITE (TELSSSA) BTEMP; /*TELEMETER STAGE/ADDRESS AND READ TIME*/
E
          IF NOT DFACQ
               THEN DO; /*COMPRESS DATA WHEN NOT OVER A STATION*/
E
                    BTEMP = DVDCT OR MSKSSDCT;
F
                    CALL MPC80(BTEMP);/*COMPRESS TIME AND TAG*/
E
                    BTEMP = VSNA        OR MSKSSDCS;
S                           1 TO 23
```

```
E
                    CALL MPC80(BTEMP);/*COMPRESS STAGE AND ADDRESS*/
               END;
E
          IF VASPI AND MSKSSS4CO ¬= 0
               THEN DO;
E
                    VASPI = BIN(26)'0';
E
                    DFILE = DFILE OR MSKFPSCORD;
               END;
E
          IF VSNA1 = MSKSSHIG THEN DVMC7 = DVMC7 OR MSKMC7HIG;
E
          ELSE IF VSNA1 = MSKSSLOG THEN DVMC7 = DVMC7 OR MSKMC7LOG;
E
               ELSE IF VSNA1 = MSKSSOMG THEN DVMC7 = DVMC7 OR MSKMC70MG;
E
                    ELSE IF VSNA1 = MSKSSSIVB
                              THEN DO;
E
                                   IF FBRNI
E
                                        THEN DVMC5 = DVMC5 OR MSKMC54B1I;
                                        ELSE DVMC6 = DVMC6 OR MSKMC68BRI;
                              END;
          RETURN; /*MSS60*/
E
 MSS70:   IF FSSIO THEN WRITE(SS) 0; /*RESET READ COMMAND*/
          CALL SSTUPQ(KSSB3,2);/*SCHEDULE HUNG STAGE TEST, MSS05*/
          CALL SS201; /*ADVANCE TO NEXT SS*/
          VSSW = KSSB1;
E
          FHST = (VHSTW AND VSTG) ¬= VSTG;
E
          IF VSNA1 = MSKSSWVO
               THEN DO;
F
                    DVASW = DVASW AND NOT MSKSSECS1;
E
                    DFWV = FALSE;
               END;
E
               ELSE IF VSNA1 = MSKSSWVC
                    THEN DO;
E
                         DVASW = DVASW AND NOT MSKSSECSV;
E
                         DFWV = TRUE;
                    END;
F
                    ELSE IF VSNA1 = MSKSSSCC
E
                              THEN DVDPM = DVDPM OR MSKDIN9;
```

```
          RETURN; /*MSS70*/
E
 MSS80;   VSNA = VSCCA;
F
          IF FSSIO THEN WRITE(SS) VSNA;/*ISSUE STAGE/COMPLEMENTED ADDR*/
          CALL SSTUPQ(KSS87,8);/*SCHEDULE READ COMMAND, MSS55*/
          WAIT      ;         /*DELAY FOR DOM TELEMETRY*/
          WRITE(DOM);/*OUTPUT SS AND DO REGISTERS VIA DOM TELEMETRY*/
          RETURN; /*MSS80*/
 SS201:   PROCEDURE; /*SS TABLE ADVANCE ROUTINE*/
E
          IF FTADV
               THEN SST1PTR = SST1PTR + 1;
               ELSE SST2PTR = SST2PTR + 1;
          CALL SS210: /*SET UP NEXT SWITCH SELECTOR*/
          CLOSE SS201:
 SS210:   PROCEDURE: /*SS SELECTION AND SETUP ROUTINE*/
E
          IF FTADV THEN GO TO SS2020;
 SS2160:  IF SSTABLE          >= 0  THEN GO TO SS2070;
S                 1,SST2PTR
E
          FCLS4 = FALSE;
E
          DVMC6 = DVMC6 AND NOT MSKMC6LUI;
E
          DVMC7 = DVMC7 AND NOT MSKMC7T6D;
          GO TO SS2090:
 SS2020:  IF SSTABLE          >= 0  THEN GO TO SS2030;
S                 1,SST1PTR
E
          IF VASPI AND MSKSSSPEC ¬= 0
               THEN DO;
E
                    VASPI = MSKSSS4C0;
E
                    DVASW = DVASW AND MSKSSWV;
                    SST1PTR = KSSINDXSIVB;
                    GO TO SS2020;
               END;
E
          IF VASPI AND MSKSSCL3 ¬= 0
               THEN DO;
                    SST1PTR = VSC30;
F
                    VASPI = VSC31;
                    VATRR = VSC32;
                    GO TO SS2020;
               END;
E
          IF VASPI AND MSKSSCL1 ¬= 0
               THEN DO:
                    SST1PTR = VSC10;
F
                    VASPI = VSC11;
```

```
                    VATRR = VSC12;
                    GO TO SS2020;
               END;
E              .
               VASPI = FALSE;
               VATRR = 0;
F              .
               IF FT60P
                    THEN DO;
E                   .
                    FT60P = FALSE;
                    SST1PTR = KSSINDXTB5A;
               END;
               ELSE SST1PTR = KSSINDXTB5B;
               GO TO SS2020;
E              .
 SS2030:  IF NOT FCLS4   THEN GO TO SS2040;
 SS2070:  IF SSTABLE          DKRTCSEC/40 + VATRR - KSS500MS >=
S                   1,SST1PTR
            SSTABLE          DKRTCSEC/40 + VATR4
S                   1,SST2PTR
               THEN DO;
E                   .
                    FTADV = FALSE;
                    VSSRT = SSTABLE          DKRTCSEC/40 + VATR4;
S                                 1,SST2PTR
E                   .
                    VSNA = BIT(SSTABLE          );
S                                   2,SST2PTR
               END;
               ELSE
 SS2090:            DO;
F                       .
                        FTADV = TRUE;
 SS2040:                VSSRT = SSTABLE          DKRTCSEC/40 + VATRR;
S                                   1,SST1PTR
E                       .
                        VSNA = BIT(SSTABLE          );
S                                   2,SST1PTR
                    END;
E              .    .
 SS2050:  VHSTW = VSNA          AND MSKSSSB;
S                   1 TO 24
               CLOSE SS210;
 SSTUPD:  PROCEDURE ASSIGN(TIME); /*SS TIME UPDATE ROUTINE*/
               DECLARE TIME INTEGER;
               READ(CLOCK) ITEMP;
               ITEMP = ITEMP - DVRTC;
               IF ITEMP < 0 THEN ITEMP = ITEMP + DKRTCOVF;
               TIME, DVTRB = DVTGB + DVTRR + ITEMP/4;
               CLOSE SSTUPD;
 SSTUPQ:  PROCEDURE(BIAS,ID); /*UPDATE SS TIME AND SCHEDULE SS FUNCT*/
               DECLARE INTEGER, BIAS, ID;
               READ(CLOCK) ITEMP;
               ITEMP = ITEMP - DVRTC;
```

```
        IF ITEMP < 0 THEN ITEMP = ITEMP + DKRTCOVF;
        DVTRB = DVTGB + DVTRR + ITEMP/4;
        VSSTM = BIAS + DVTRR + ITEMP/4;
        DVSST = VSSTM + DVTMR;
        IF NOT DFIL3 THEN CALL EGP08;/*RESCHEDULE T1      (NOT CODED)*/
        CLOSE SSTUPQ;
CLOSE MSS00;
```

```
TASKKEY: PROGRAM(PRIORITY,TSKID); /*ATM TASK KEYING ROUTINE*/
         DECLARE INTEGER,
              PRIORITY, /*PRIORITY LEVEL OF TASK BEING KEYED*/
              TSKID,    /*IDENTIFICATION INDEX FOR TASK BEING KEYED*/
              I,        /*OVERFLOW TABLE POINTER CHAIN INDEX*/
              J;        /*OVERFLOW TABLE OPEN-SLOT INDEX*/
C
C      PRIORITY CONTROL TABLE CONTAINS ONE ENTRY FOR EACH PRIORITY LEVEL.
C      EACH ENTRY CONSISTS OF FIVE ITEMS.
C              1. EITHER THE TASK ID OR THE LOCATION OF THE NEXT
C                 EXECUTABLE INSTRUCTION OF THE TASK CURRENTLY ASSIGNED
C                 TO A GIVEN PRIORITY LEVEL.  IN ORDER TO DISTINGUISH
C                 BETWEEN THE TWO THE ID WILL BE STORED AS A NEGATIVE
C                 VALUE.  A VALUE OF ZERO WILL SIGNIFY THAT NO TASK IS
C                 CURRENTLY ASSIGNED TO THAT PRIORITY LEVEL.
C              2. TASK REGISTER CONTENTS (INITIALLY SET TO ZERO).
C              3. TASK REGISTER CONTENTS (INITIALLY SET TO ZERO).
C              4. TASK REGISTER CONTENTS (INITIALLY SET TO ZERO).
C              5. INDEX POINTER TO THE BEGINNING OF THE PRIORITY OVERFLOW
C                 TABLE CHAIN FOR THAT PRIORITY LEVEL.  A VALUE OF ZERO
C                 INDICATES END OF CHAIN.
C
         DECLARE ARRAY(5,10) ATMPCT INTEGER;
C
C      THE PRIORITY OVERFLOW TABLE IS USED FOR KEYING TASKS ON A
C      PRIORITY LEVEL WHICH IS CURRENTLY ASSIGNED TO ANOTHER TASK.
C      THE ENTRIES ARE NOT ALLOCATED TO A FIXED PRIORITY BUT ARE
C      ASSIGNED DYNAMICALLY AS REQUIRED.  ALL OVERFLOW ENTRIES FOR
C      EACH PRIORITY LEVEL ARE CHAINED TOGETHER SUCH THAT THE TASKS
C      CAN BE EXECUTED ON A FIRST-IN-FIRST-OUT BASIS.  EACH ENTRY
C      CONSISTS OF TWO ITEMS.
C          1. INDEX POINTER TO THE NEXT ENTRY IN THE CHAIN.  A VALUE OF
C             ZERO INDICATES END OF CHAIN.
C          2. TASK ID INDEX.  A VALUE OF ZERO SIGNIFIES AN UNASSIGNED
C             ENTRY.
C
         DECLARE ARRAY(2,25) ATMPOVFT INTEGER;
C
C      INHIBIT ALL INTERRUPTS.
C
C      IF THE REQUESTED PRIORITY LEVEL IS NOT CURRENTLY ASSIGNED,
C      INITIALIZE THE ENTRY FOR THIS TASK.
C
         IF ATMPCT           =0
S                 1,PRIORITY
              THEN DO;
                   ATMPCT           = - TSKID;
S                        1,PRIORITY
                   [ATMPCT]                 = 0;
S                          2 TO 4,PRIORITY
              END;
C
C      OTHERWISE, SEARCH FOR THE END OF THE OVERFLOW POINTER CHAIN.
C
              ELSE DO;
```

```
                    I = ATMPCT          ;
S                           5,PRIORITY
                    IF I ¬= 0 THEN
 CHAIN_SEARCH;              IF ATMPOVFT    ¬= 0
S                                   1,I
                                THEN DO;
                                     I = ATMPOVFT    ;
S                                                1,I
                                     GO TO CHAIN_SEARCH;
                                END;
C
C       WHEN THE END OF THE OVERFLOW POINTER CHAIN HAS BEEN FOUND, SEARCH
C       FOR AN EMPTY SLOT IN THE OVERFLOW TABLE.
C
                    DO FOR J = 1 TO 25;
                         IF ATMPOVFT    = 0 THEN GO TO SLOT_FOUND;
S                                 2,J
                    END;
C
C       FALLING THROUGH THE LOOP INDICATES A FULL OVERFLOW TABLE AND SHOULD
C       CAUSE AN ERROR HALT.
C
 SLOT_FOUND;
C
C       ADD THIS ENTRY TO THE END OF THE OVERFLOW POINTER CHAIN AND STORE
C       THE TASK POINTER IN IT.
C
                    IF I ¬= 0
                         THEN ATMPOVFT    =J;
S                                   1,I
                         ELSE ATMPCT            = J;
S                                 5,PRIORITY
                    ATMPOVFT    = 0;
S                         1,J
                    ATMPOVFT    = TSKID;
S                         2,J
               END;
C
C       RELEASE INTERRUPTS AS REQUIRED
C
          CLOSE TASKKEY;
```

CMS-2 COMMON DATA DECLARATIONS

```
COMPOOL SYS-DD     ''COMMON DATA DECLARATIONS'' $
          VRBL  DVMLR    F                                    $
          VRBL  DV1MR    F                                    $
          VRBL  DKMIR    A  26D S 0 P 163D                    $
          VRBL  DKRTCOVF A  26D S 0    P 8192D                $
          VRBL  DKRTCSEC A  26D S 10D  P 4063.492D            $
          VRBL  DVA1     A  26D S 4                           $
          VRBL  DVA2     A  26D S 4                           $
          VRBL  DVA3     A  26D S 4                           $
          VRBL  DVA4     A  26D S 4                           $
          VRBL  DVA5     A  26D S 4                           $
          VRBL  DVA6     A  26D S 4                           $
          VRBL  DVMLD    A  26D S 0                           $
          VRBL  DVMLT    A  26D S -2                          $
          VRBL  DVM05    A  26D S 0                           $
          VRBL  DVM06    A  26D S 0                           $
          VRBL  DVRTC    A  26D S 0                           $
          VRBL  DVSST    A  26D S -2                          $
          VRBL  DVTGR    A  26D S -2                          $
          VRBL  DVTMM    A  26D S -2                          $
          VRBL  DVTMR    A  26D S -2                          $
          VRBL  DVTRB    A  26D S -2                          $
          VRBL  DVTRR    A  26D S -2                          $
          VRBL  DVTT1    A  26D S 0                           $
          TABLE DVCC     V  NONE  3 $
                    FIELD F1  A 26D S 25D $
          LIKE-TABLE DVDC $
          LIKE-TABLE DVTH $
          END TABLE DVCC  $
          VRBL  DTBID    I  26D S                             $
          VRBL  DVDGS    I  26D S                             $
          VRBL  DVEMR    I  26D U                             $
          VRBL  DVHDA    I  26D S                             $
          VRBL  DVHDB    I  26D S                             $
          VRBL  DVLDR    I  26D S                             $
          VRBL  DVLRC    I  26D S                             $
          VRBL  TEMP     I  26D S                             $
          TABLE DVRE     V  NONE  3 $
                    FIELD F2  I 26D S      $
          END-TABLE DVRE $
          VRBL  MSKABSLAD     I 26D U P  1E3                  $
          VRBL  MSKSSCL3      I 26D U P  1E10                 $
          VRBL  MSKSSDCS      I 26D U P  5E10                 $
          VRBL  MSKSSDCT      I 26D U P  4054E5               $
          VRBL  MSKSSHIG      I 26D U P  10072E4              $
          VRBL  MSKSSLOG      I 26D U P  10052E4              $
          VRBL  MSKSSNSEND    I 26D U P  377777776            $
          VRBL  MSKSSOMG      I 26D U P  10007E4              $
          VRBL  MSKSSSCC      I 26D U P  10031E4              $
          VRBL  MSKSSSIVB     I 26D U P  02023E4              $
          VRBL  MSKSSSPEC     I 26D U P  4E10                 $
          VRBL  MSKSSS4CO     I 26D U P  2E10                 $
          VRBL  MSKSSWVC      I 26D U P  10105E4              $
          VRBL  MSKSSWVO      I 26D U P  10145E4              $
          VRBL  DFACQ    S  'LOSS',      'GAIN'               $
```

CMS-2 COMMON DATA DECLARATIONS

```
VRBL   DFDBF    S   'GOOD',      'FAILED'      $
VRBL   DFDTL    S   'INPROG',    'NOTINPROG'   $
VRBL   DFLT     S   'FLIGHT',    'SIM',      'REP' $
VRBL   DFTUP    S   'NO',        'YES'         $
VRBL   DFSMC    S   'ENABLE',    'DISABLE'     $
VRBL   DFWV     S   'CLOSE',     'OPEN'        $
VRBL   DGSSM    S   'SS00','SS05','SS10','SS20','SS30'
          'SS40','SS50','SS55','SS60','SS70','SS80'$
VRBL   DFIL1    B                              $
VRBL   DFIL2    B                              $
VRBL   DFIL3    B                              $
TABLE  DVASW V 1 1 $
            FIELD  S4C0  B 0 25D $
            FIELD  SPEC  B 0 24D $
            FIELD  TB6C  B 0 23D $
            FIELD  GNSS  B 0 22D $
            FIELD  SBLO  B 0 21D $
            FIELD  SBHI  B 0 20D $
            FIELD  SBOM  B 0 19D $
            FIELD  ECSV  B 0 18D $
            FIELD  ECS1  B 0 17D $
            FIELD  T3A   B 0 16D $
            FIELD  TB6D  B 0 15D $
            FIELD  TB6A  B 0  9D $
            FIELD  TB6B  B 0  8D $
            FIELD  S4C1  B 0  7D $
            FIELD  ACQU  B 0  1D $
            FIELD  LI    B 0  0D $
END-TABLE DVASW $
TABLE  DVDPM   V 1 1 $
            FIELD DIN24  B 0 25D $
            FIELD DIN23  B 0 24D $
            FIELD DIN22  B 0 23D $
            FIELD DIN21  B 0 22D $
            FIELD DIN20  B 0 21D $
            FIELD DIN19  B 0 20D $
            FIELD DIN18  B 0 19D $
            FIELD DIN17  B 0 18D $
            FIELD DIN16  B 0 17D $
            FIELD DIN15  B 0 16D $
            FIELD DIN14  B 0 15D $
            FIELD DIN13  B 0 14D $
            FIELD DIN12  B 0 13D $
            FIELD DIN11  B 0 12D $
            FIELD DIN10  B 0 11D $
            FIELD DIN9   B 0 10D $
            FIELD DIN8   B 0  9D $
            FIELD DIN7   B 0  8D $
            FIELD DIN6   B 0  7  $
            FIELD DIN5   B 0  6  $
            FIELD DIN4   B 0  5  $
            FIELD DIN3   B 0  4  $
            FIELD DIN2   B 0  3  $
            FIELD DIN1   B 0  2  $
END-TABLE DVDPM $
```

```
TABLE DFILE    V 1 1 $
            FIELD COSS    B 0 24D $
            FIELD CORD    B 0 23D $
            FIELD S4CK    B 0 22D $
            FIELD SCGC    B 0 21D $
            FIELD T6SO    B 0 20D $
            FIELD S2EO    B 0 19D $
            FIELD T6BI    B 0 18D $
            FIELD ISSA    B 0 17D $
            FIELD NU      B 0 16D $
            FIELD EMTL    B 0 15D $
            FIELD TU      B 0 14D $
            FIELD INT2    B 0 13D $
            FIELD LIOG    B 0 12D $
            FIELD FPAT    B 0 11D $
END-TABLE DFILE $
TABLE DVICR    V 1 1 $
            FIELD CA      B 0 13D $
            FIELD SSCB    B 0 11D $
            FIELD SWG     B 0  9D $
            FIELD BG      B 0  3  $
END-TABLE DVICR $
TABLE DVMC4    V 1 1 $
            FIELD ZAC1    B 0 25D $
            FIELD ZAC2    B 0 24D $
            FIELD XAC1    B 0 23D $
            FIELD XAC2    B 0 22D $
            FIELD YAC1    B 0 21D $
            FIELD YAC2    B 0 20D $
            FIELD ZGA1    B 0 19D $
            FIELD ZGA2    B 0 18D $
            FIELD XGA1    B 0 17D $
            FIELD XGA2    B 0 16D $
            FIELD YGA1    B 0 15D $
            FIELD YGA2    B 0 14D $
            FIELD DG1     B 0 13D $
            FIELD DG2     B 0 12D $
            FIELD ACDG    B 0 11D $
            FIELD BCDG    B 0 10D $
            FIELD MLLB    B 0  9D $
            FIELD SSCB    B 0  8D $
            FIELD EAZT    B 0  7  $
            FIELD YAOF    B 0  6  $
            FIELD AMF     B 0  5  $
            FIELD BMF     B 0  4  $
            FIELD ZAOF    B 0  3  $
            FIELD XAOF    B 0  2  $
END-TABLE DVMC4 $
TABLE DVMC5    V 1 1 $
            FIELD T0MC    B 0 25D $
            FIELD T1MC    B 0 24D $
            FIELD ICGM    B 0 23D $
            FIELD RCMC    B 0 22D $
            FIELD ICTA    B 0 20D $
            FIELD T2MC    B 0 19D $
```

```
            FIELD T3MC    B 0 18D $
            FIELD ICIO    B 0 17D $
            FIELD ICOO    B 0 16D $
            FIELD IISS    B 0 14D $
            FIELD II1G    B 0 13D $
            FIELD IIRC    B 0 12D $
            FIELD T4MC    B 0 11D $
            FIELD IIOO    B 0 10D $
            FIELD IIEO    B 0  9D $
            FIELD DI10    B 0  8D $
            FIELD ESTG    B 0  7  $
            FIELD S4BIG   B 0  6  $
            FIELD S4B1I   B 0  5  $
            FIELD S4B3G   B 0  4  $
            FIELD S4BTG   B 0  3  $
            FIELD S4BCC   B 0  2  $
            FIELD T5MC    B 0  1  $
            FIELD T6MC    B 0  0  $
END-TABLE DVMC5 $
TABLE DVMC6   V 1 1 $
            FIELD S8RRI   B 0 25D $
            FIELD S8BTG   B 0 22D $
            FIELD S8BCC   B 0 21D $
            FIELD T7MC    B 0 19D $
            FIELD SCCC    B 0 18D $
            FIELD SDO4    B 0 17D $
            FIELD SC4A    B 0 16D $
            FIELD LUI     B 0 11D $
            FIELD SMC     B 0 10D $
            FIELD BMFA    B 0  9D $
            FIELD TLC     B 0  8D $
            FIELD DO4     B 0  7  $
            FIELD TLI2    B 0  6  $
            FIELD TLI1    B 0  5  $
            FIELD T6C     B 0  4  $
            FIELD SCTG    B 0  3  $
            FIELD BMFB    B 0  2  $
            FIELD PABT    B 0  0  $
END-TABLE DVMC6 $
TABLE DVMC7   V 1 1 $
            FIELD DCSI    B 0 25D $
            FIELD T8EN    B 0 24D $
            FIELD COMM    B 0 21D $
            FIELD LOG     B 0 20D $
            FIELD HIG     B 0 19D $
            FIELD OMG     B 0 18D $
            FIELD NUMC    B 0 17D $
            FIELD TBU     B 0 16D $
            FIELD MTLR    B 0 15D $
            FIELD MIH     B 0 14D $
            FIELD MSC     B 0 13D $
            FIELD TDE     B 0 12D $
            FIELD TARU    B 0 11D $
            FIELD TB8S    B 0 10D $
            FIELD SCLR    B 0  9D $
```

```
                    FIELD SCAH    B 0  8D $
                    FIELD WCVL    B 0  7  $
                    FIELD M1I     B 0  6  $
                    FIELD M2I     B 0  5  $
                    FIELD M3I     B 0  4  $
                    FIELD M4I     B 0  3  $
                    FIELD M5I     B 0  2  $
                    FIELD M6I     B 0  1  $
                    FIELD M7I     B 0  0  $
          END-TABLE DVMC7 $
END-SYS-DD COMPOOL $
```

```
MIGOO SYS-PROC ''ITERATIVE GUIDANCE MODE'' $
     LOC-DD $
          VRBL  CHIBARSTEER   S 'INPROG', 'NOTINPROG'  $
          VRBL  PHASE         S 'BURN1',  'BURN2'       $
          VRBL  REITERATE     S 'YES',    'NO'          $
          VRBL  SMCFLAG       S 'NOCALC', 'CALCULATE'   $
          VRBL  S4BURN        S 'BURN1',  'BURN2'       $
          VRBL (COSTHETA,      DELTAL3,       DELTA2,
                DPHII,         DPHIT,         EPSILON2,
                EPSILON3,      GT,            J1,
                J12,           J2,            J3,
                J3P,           K1,            K2,
                K3,            K4,            LYP,
                L1,            L12,           L2,
                L3,            L3P,           PHII,
                PHIIT,         PHIT,          P1,
                P12,           P2,            Q1,
                Q12,           Q2,            R,
                ROVEX3,        RT,            SINTHETA,
                S1,            S12,           S2,
                TAU1,          TAU2,          TAU3,
                TCI,           T1I,           T2I,
                T3I,           U1,            U12,
                U2,            V,             VEX1,
                VEX2,          VEX3,          VT)      F  $
          VRBL  KCCT4     F  P  1.53D            $
          VRBL  KCCT8     F  P  1.55D            $
          VRBL  KMU       F  P  -.39860320E15D   $
          VRBL  KT        F  P  .48497964E-7D    $
          TABLE DELTAVVP  V NONE  3    $
                    FIELD F1 F $
          LIKE-TABLE GS       $
          LIKE-TABLE GV       $
          LIKE-TABLE GVSTAR   $
          LIKE-TABLE GVT      $
          LIKE-TABLE G1       $
          LIKE-TABLE RS       $
          LIKE-TABLE RV       $
          LIKE-TABLE RVT      $
          LIKE-TABLE R4       $
          LIKE-TABLE VS       $
          LIKE-TABLE VV       $
          LIKE-TABLE VVT      $
          LIKE-TABLE V4       $
          END-TABLE DELTAVVP $
          TABLE MS4    A 1 3,3 $
                    FIELD F2 F $
          LIKE-TABLE M4V $
          END-TABLE MS4  $
          (EXTREF)  FUNCTION ATAN(ARG) $
          (EXTREF)  FUNCTION COS(ARG)  $
          (EXTREF)  FUNCTION LOG(ARG)  $
          (EXTREF)  FUNCTION SIN(ARG)  $
          (EXTREF)  FUNCTION SQRT(ARG) $
          (EXTREF)  PROCEDURE EGP32 INPUT MASK $
```

```
          (EXTREF)  PROCEDURE MATMPY INPUT MATRIX,VEC1 OUTPUT VEC2 $
          (EXTREF)  PROCEDURE MCM00    $
          (EXTREF)  PROCEDURE MSM00    $
     END-LOC-DD $
PROCEDURE MIG00 $
COMMENT                                                          $
COMMENT   DUE TO THE SIZE OF IGM, ONLY A SECTION OF IT HAS       $
COMMENT   BEEN CODED.  PART OF THE GUIDANCE COMPUTATIONS HAVE    $
COMMENT   BEEN SELECTED TO DEMONSTRATE MATHEMATICAL OPERA-       $
COMMENT   TIONS.  THE PHASING PORTION OF IGM HAS NOT BEEN        $
COMMENT   CODED SINCE SIMILAR CAPABILITIES ARE ILLUSTRATED       $
COMMENT   BY OTHER KERNELS.                                      $
COMMENT                                                          $
COMMENT   IG251 - IGM GUIDANCE PARAMETERS COMPUTATIONS           $
COMMENT                                                          $
COMMENT   ROTATE POSITION AND VELOCITY INTO TARGET PLANE         $
COMMENT                                                          $
IG253.    MATMPY INPUT CORAD(MS4), CORAD(RS) OUTPUT CORAD(R4)$
          UTR00 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER X POSITION IN 4 SYSTEM, R4(0) $
          UTR00 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER Y POSITION IN 4 SYSTEM, R4(1) $
COMMENT   RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE $
          MATMPY INPUT CORAD(MS4), CORAD(VS) OUTPUT CORAD(V4)$
          UTR00 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER Z POSITION IN 4 SYSTEM, R4(2) $
          UTR02 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER Y VELOCITY IN 4 SYSTEM, V4(1) $
COMMENT   RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE $
COMMENT                                                          $
COMMENT   CALCULATE RANGE ANGLE MEASURED IN ORBIT PLANE          $
COMMENT                                                          $
IG254.    IF T2I EQ 0
               THEN SET L12,J12,S12,Q12,P12,U12 TO 0
               THEN GOTO IG259 $
          IF T1I EQ 0
               THEN SET L1,J1,S1,Q1,P1,U1 TO 0
               THEN GOTO IG258 $
          SET L1 TO VEX1*LOG(TAU1/(TAU1 - T1I)) $
          SET J1 TO L1*TAU1 - VEX1*T1I $
          SET S1 TO L1*T1I- J1 $
          SET Q1 TO S1*TAU1 - .5D*VEX1*T1I**2 $
          SET P1 TO J1*TAU1 - .5D*VEX1*T1I**2 $
          SET U1 TO Q1*TAU1 - VEX1*T1I**3/6 $
IG258.    SET L2 TO VEX2*LOG(TAU2/(TAU2 - T2I)) $
          SET J2 TO L2*TAU2 - VEX2*T2I $
          SET S2 TO L2*T2I - J2 $
          SET Q2 TO S2*TAU2 - .5D*VEX2*T2I**2 $
          SET P2 TO J2*TAU2 - .5D*VEX2*T2I**2 $
          SET U2 TO Q2*TAU2 - VEX2*T2I**3/6 $
          SET L12 TO L1 + L2 $
          SET J12 TO J1 + J2 + L2*T1I $
          SET S12 TO S1 - J2 + L12*(T2I + TCI) $
          SET Q12 TO Q1 + Q2 + S2*T1I + J1*T2I $
          SET P12 TO P1 + P2 + T1I*(2*J2 + L2*T1I) $
```

```
         SET U12 TO U1 + U2 + T1I*(2*Q2 + S2*T1I) + T2I*P1 $
IG259.   SET L3P TO VEX3*LOG(TAU3/(TAU3 - T3I)) $
         SET LYP TO L12 + L3P $
         SET J3P TO L3P*TAU3 - VEX3*T3I $
         SET T1C TO T1I + T2I + TCI $
         SET TSTAR TO T1C + T3I $
         SET PHII TO ATAN(R4(2)/R4(0)) $
COMMENT                                                          $
COMMENT  DETERMINE PHASE                                         $
COMMENT                                                          $
IG260.   IF PHASE EQ 'BURN2' THEN GOTO IG262 $
         SET DELTA2 TO V*TSTAR - J3P + LYP*T3I - ROVEX3*((TAU1
                   - T1I)*L1 + (TAU2 - T2I)*L2 + (TAU3 - T3I)
                   *L3P)*(LYP + V - VT) $
         SET PHIIT TO KT*(S12 + DELTA2) $
         SET PHIT TO PHII + PHIIT $
         UTR02 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT  TELEMETER TERMINAL RANGE ANGLE, PHIT $
COMMENT  RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE $
         GOTO IG291 $
IG262.   SET SINTHETA TO (RS(0)*VS(0) + RS(1)*VS(1) + RS(2)*VS(2))
                        /(R*V) $
         SET COSTHETA TO SQRT(1 - SINTHETA**2) $
         SET DPHII TO V/R*COSTHETA $
         SET DPHIT TO VT/RT*COS(THETAT) $
         SET PHIIT TO .5D*(DPHII + DPHIT)*TSTAR $
         SET PHIT TO PHII + PHIIT $
         UTR02 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT  TELEMETER TERMINAL RANGE ANGLE, PHIT $
COMMENT  RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE $
         IF TSTAR LTEQ EPSILON3   THEN GOTO IG269 $
         MIG30 $ ''CALC TERM RAD, VEL, FLT ANGLE(NOT CODED)''
         SET GT TO - KMU/RT**2 $
         UTR00 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT  TELEMETER TERMINAL GRAVITY VECTOR, GT $
COMMENT  RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE $
         SET GVT(0) TO GT*COS(THETAT) $
         SET GVT(1) TO 0 $
         SET GVT(2) TO GT*SIN(THETAT) $
         SET RVT(0) TO RT*COS(THETAT) $
         SET RVT(1), RVT(2) TO 0 $
IG269.   SET PHIT = PHIT - THETAT $
COMMENT                                                          $
COMMENT  ROTATE POSITION, VELOCITY, GRAVITY TO INJECTION SYSTEM''$
COMMENT                                                          $
IG291.   SET M4V(0), M4V(8) TO COS(PHIT) $
         SET M4V(2) TO SIN(PHIT) $
         SET M4V(6) TO - SIN(PHIT) $
         SET M4V(1), M4V(3), M4V(5), M4V(7) TO 0 $
         SET M4V(4) TO 1 $
         MATMPY INPUT CORAD(M4V), CORAD(R4) OUTPUT CORAD(RV) $
         MATMPY INPUT CORAD(M4V), CORAD(V4) OUTPUT CORAD(VV) $
         MATMPY INPUT CORAD(MS4), CORAD(GS) OUTPUT CORAD(G1) $
         MATMPY INPUT CORAD(M4V), CORAD(G1) OUTPUT CORAD(GV) $
IG293.   VARY I FROM 0 THRU 2 $
```

```
          SET GVSTAR(I) TO .5*(GVT(I) + GV(I)) $
          SET DELTAVVP(I) TO VVT(I) - VV(I) - TSTAR*GVSTAR(I)$
     END  IG293 $
COMMENT                                                          $
COMMENT   IG314 - CALCULATE TIME TO GO            (NOT CODED)  $
COMMENT                                                          $
     IF REITERATE EQ 'YES'
          THEN SET REITERATE TO 'NO'
          THEN SET L3P TO L3
          THEN SET J3P TO J3
          THEN SET LYP TO LYP + DELTAL3
          THEN GOTO IG260 $
     SET REITERATE TO 'YES' $
COMMENT                                                            $
COMMENT   IG324 - COMPUTE CORRECTED VEL TO BE GAINED(NOT CODED)$
COMMENT                                                            $
COMMENT   IG326 - CALCULATE DESIRED PITCH AND YAW   (NOT CODED)$
COMMENT                                                            $
     IF CHIBARSTEER EQ 'INPROG' THEN GOTO IG350 $
     IF TSTAR GTEQ EPSILON2     THEN GOTO IG360 $
     IF S4BURN EQ 'BURN1'
          THEN SET DVMC5(0,CBS) TO 1
          THEN SET DVMLR TO 25D*KCCT4
          THEN SET DV1MR TO .04D/KCCT4
          THEN GOTO IG340 $
     SET DVMC6(0,CBS) TO 1 $
     SET DVMLR TO 25D*KCCT8 $
     SET DV1MR TO .04D/KCCT8 $
IG340.    SET CHIBARSTEER TO 'INPROG' $
IG350.    SET K1, K2, K3, K4 TO 0 $
     GOTO IG440 $
COMMENT                                                          $
IG360.    ''IG361 - COMPUTE INTERMEDIATE PARAMETERS(NOT CODED)''$
COMMENT                                                          $
IG440.    UTR00 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER T3I $
COMMENT   RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE $
COMMENT                                                           $
COMMENT   IG446 - COMPUTE PITCH AND YAW IN 4-SYSTEM(NOT CODED)$
COMMENT                                                           $
     IF SMCFLAG EQ 'CALCULATE'
          THEN MSM00 $ ''COMPUTE SMC TERMS  (NOT CODED)''
     MCM00 $ ''PERFORM CHI COMPUTATIONS     (NOT CODED)''
     IF DFILE(0,INT2)
          THEN EGP32 INPUT MSKSCC0 $ ''ENABLE INTERRUPT 2''
     RETURN $ ''MIG00''
END-PROC MIG00 $
END-SYS-PROC MIG00 $
```

```
MDS00     SYS-PROC  ''DIGITAL COMMAND SYSTEM'' $
     LOC-DD  $
          SWITCH DCSRET (DCSRETURN) $
               'NORMAL',  DS530 $
               'ERROR1',  DS220 $
               'ERROR2',  DS235 $
          END-SWITCH DCSRET $
          P-SWITCH DCS $
               P  DS105 $ ''ERROR PATH''
               P  DS260 $ ''TIME BASE UPDATE      (NOT CODED)''
               P  DS330 $ ''NAVIGATION UPDATE     (NOT CODED)''
               P  DS380 $ ''GENERALIZED SS        (NOT CODED)''
               P  DS430 $ ''SECTOR DUMP           (NOT CODED)''
               P  DS470 $ ''SINGLE MEM LOC TELEM (NOT CODED)''
               P  DS510 $ ''TERMINATE             (NOT CODED)''
               P  DS540 $ ''MANEUVER UPDATE       (NOT CODED)''
               P  DS550 $ ''MANEUVER INHIBIT      (NOT CODED)''
               P  DS670 $ ''TARGET UPDATE         (NOT CODED)''
               P  DS700 $ ''ANTENNAE TO OMNI      (NOT CODED)''
               P  DS720 $ ''ANTENNAE TO LOW       (NOT CODED)''
               P  DS740 $ ''ANTENNAE TO HIGH      (NOT CODED)''
               P  DS770 $ ''INHIBIT WATER CONTROL(NOT CODED)''
               P  DS790 $ ''TIME BASE 8 ENABLE    (NOT CODED)''
               P  DS810 $ ''EXECUTE MANEUVER A    (NOT CODED)''
               P  DS840 $ ''TD AND E ENABLE       (NOT CODED)''
               P  DS860 $ ''EXECUTE MANEUVER B    (NOT CODED)''
               P  DS900 $ ''S4B/IU LUNAR IMPACT   (NOT CODED)''
               P  DS960 $ ''ENABLE TB6D ALT SEQ   (NOT CODED)''
          END-P-SW DCS $
          VRBL  DCSDATACOUNT I 26D $
          VRBL  DCSERLIM     I 26D  P 7 $
          VRBL  DCSER04      I 26D  P 040000000 $
          VRBL  DCSER10      I 26D  P 100000000 $
          VRBL  DCSER14      I 26D  P 140000000 $
          VRBL  DCSER20      I 26D  P 200000000 $
          VRBL  DCSER24      I 26D  P 240000000 $
          VRBL  DCSER44      I 26D  P 440000000 $
          VRBL  DCSER60      I 26D  P 600000000 $
          VRBL  DCSER64      I 26D  P 640000000 $
          VRBL  DCSER74      I 26D  P 740000000 $
          VRBL  DCSINDX      I 26D $
          VRBL  DCSRETURN    S 'NORMAL', 'ERROR1', 'ERROR2' $
          VRBL  FDSEN        S 'MODE', 'DATA' $
          VRBL  FDSPG        S 'INPROG', 'NOTINPROG' $
          VRBL  FDSRE        S 'TERM', 'NOTERM' $
          VRBL  VDSER        I 26D $
          VRBL  VDSRC        I 26D $
          VRBL  VDSSB        B     $
          VRBL  VDS01        I 26D $
          TABLE DCSDATCT     V  1 20D  $
                    FIELD F1 I  26D S  $
          LIKE-TABLE DCSSTCOD $
          END-TABLE DCSDATCT  $
          TABLE DCSMODE      V  1 64D  $
                    FIELD F2 I  26D S  $
```

```
END-TABLE DCSMODE  $
TABLE DCSMSTAT     V  1 20D  $
          FIELD F3 S 'ACTIVE', 'INACTIVE' $
END-TABLE DCSMSTAT $
TABLE VDSBL        V  1 35D  $
          FIELD F4 I  26D U  $
END-TABLE VDSBL $
DCSSTCOD  DATA   000000000   $
          DATA   100000000   $
          DATA   110000000   $
          DATA   120000000   $
          DATA   130000000   $
          DATA   140000000   $
          DATA   200000000   $
          DATA   220000000   $
          DATA   050000000   $
          DATA   310000000   $
          DATA   770000000   $
          DATA   770000000   $
          DATA   770000000   $
          DATA   450000000   $
          DATA   170000000   $
          DATA   330000000   $
          DATA   600000000   $
          DATA   340000000   $
          DATA   520000000   $
          DATA   250000000   $
DCSDATCT  DATA     0  $
          DATA     1  $
          DATA    35D $
          DATA     2  $
          DATA     2  $
          DATA     3  $
          DATA     0  $
          DATA     0  $
          DATA     0  $
          DATA    35D $
          DATA     0  $
          DATA     0  $
          DATA     0  $
          DATA     0  $
          DATA     0  $
          DATA     0  $
          DATA     0  $
          DATA     0  $
          DATA     6  $
          DATA     0  $
DCSMODE   DATA     0    $
          DATA     0    $
          DATA     0    $
          DATA     0    $
          DATA     0    $
          DATA    8D    $
          DATA     0    $
          DATA     0    $
```

```
DATA    1     $
DATA    2     $
DATA    3     $
DATA    4     $
DATA    5     $
DATA    0     $
DATA    0     $
DATA    14D   $
DATA    6     $
DATA    0     $
DATA    7     $
DATA    0     $
DATA    0     $
DATA    19D   $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    9D    $
DATA    0     $
DATA    15D   $
DATA    17D   $
DATA    0D    $
DATA    0D    $
DATA    0D    $
DATA    0D    $
DATA    0D    $
DATA    0D    $
DATA    0D    $
DATA    0D    $
DATA    13D   $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    18D   $
DATA    10D   $
DATA    11D   $
DATA    12D   $
DATA    0     $
DATA    0     $
DATA    16D   $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
DATA    0     $
```

```
                DATA     0     $
           COM  EQUALS  0          $
           LEN  EQUALS  6          $
           MESG EQUALS 12D         $
           MLEN EQUALS 14D         $
           SEQ  EQUALS  6          $
           TERM EQUALS 200000000   $
      END-LOC-DD $
PROCEDURE MDS00  $
COMMENT    RELEASE PREVIOUSLY ENABLED INTERRUPTS                    $
COMMENT    READ DISCRETE INPUT REG INTO TEMP                        $
COMMENT    READ DIGITAL COMMAND SYSTEM INPUT INTO VDS01             $
           IF BIT(22D)(TEMP) EQ 0   THEN GOTO DS60 $
COMMENT                                                             $
COMMENT    PROCESS DCS MODE COMMAND                                 $
COMMENT                                                             $
DS09.      VARY I FROM COM THRU LEN $
                IF BIT(I)(VDS01) EQ BIT(I+7)(VDS01)
                     THEN SET VDSER TO DCSER10
                     THEN GOTO DS220 $
           END DS09 $
           IF BIT(SEQ)(VDS01) EQ 1
                THEN SET VDSER TO DCSER24
                THEN GOTO DS220 $
           IF BIT(COM,LEN)(VDS01) EQ TERM  THEN GOTO DS25 $
           IF FDSEN EQ 'DATA'
                THEN SET VDSER TO DCSER20
                THEN GOTO DS220 $
           IF DFDTL EQ 'INPROG' OR FDSPG EQ 'INPROG'
                THEN SET VDSER TO DCSER64
                THEN GOTO DS220 $
DS20.      SET FDSPG TO 'INPROG' $
DS25.      SET DCSINDX TO DCSMODE(BIT(COM,LEN)(VDS01)) $
           IF DCSMSTAT(DCSINDX) EQ 'INACTIVE'
                THEN SET FDSPG TO 'NOTINPROG'
                THEN SET VDSER TO DCSER74
                THEN GOTO DS220 $
COMMENT    TELEMETER STATUS CODE TWICE $
           UTR24 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT    TELEMETER DCSSTCOD(DCSINDX) $
           UTR24 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT    TELEMETER DCSSTCOD(DCSINDX) $
COMMENT    RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE $
           DS200 $ ''ISSUE CRP''
           SET DCSDATACOUNT TO 0 $
           SET VDSSB TO 0 $
           GOTO DS100 $
COMMENT                                                             $
COMMENT    PROCESS DATA WORD                                        $
COMMENT                                                             $
DS60.      IF FDSEN EQ 'MODE'
                THEN SET VDSER TO DCSER04
                THEN GOTO DS220 $
DS61.      VARY I FROM COM THRU LEN $
                IF BIT(I)(VDS01) EQ BIT(I+7)(VDS01)
```

```
                THEN SET VDSER TO DCSER44
                THEN GOTO DS220 $
          END DS61 $
          IF BIT(SEQ)(VDS01) NOT VDSSB
               THEN SET VDSER TO DCSER60
               THEN GOTO DS220 $
DS110.    ''TELEMETER DATA WORD TWICE''
          UTR24 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER VDS01 $
          UTR24 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER VDS01 $
COMMENT   RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE $
          DS200 $ ''ISSUE CRP''
          SET VDSBL(DCSDATACOUNT) TO BIT(COM,LEN)(VDS01) $
          SET VDSSB TO COMP VDSSB $
          SET DCSDATACOUNT TO DCSDATACOUNT + 1 $
DS100.    IF DCSDATACOUNT LT DCSDATCT(DCSINDX) THEN RETURN $
          SET DCSRETURN TO 'NORMAL' $
          DCS USING DCSINDX INVALID DS105 $
          GOTO DCSRET DCSRETURN $
DS105.    SET FDSPG TO 'NOTINPROG' $
          SET VDSER TO DCSER14 $
COMMENT                                    $
COMMENT   PROCESS DCS ERROR CONDITION      $
                                           $
DS220.    SET VDSRC TO VDSRC + 1 $
          SET FDSRE TO 'TERM' $
          IF VDSRC LT DCSERLIM THEN SET VDSRC TO 'NOTERM' $
          SET VDSER TO VDSER + VDSRC $
          SET BIT(MESG,MLEN)(VDSER) TO BIT(COM,MLEN)(VDS01) $
DS235.    ''TELEMETER ERROR CODE TWICE''
          UTR24 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER VDSER $
          UTR24 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER VDSER $
COMMENT   RELEASE INTERRUPTS DISABLED BY TELEM DELAY ROUTINE $
          IF FDSRE EQ 'NOTERM' THEN RETURN $ ''MDS00''
DS530.    SET VDSRC TO 0 $
          SET FDSEN TO 'MODE' $
          SET FDSPG TO 'NOTINPROG' $
          RETURN $ ''MDS00''
END-PROC MDS00 $
PROCEDURE DS200 $ ''ISSUE DCS COMMAND RESET PULSE''
COMMENT                                                    $
COMMENT   INHIBIT ALL INTERRUPTS EXCEPT TLC                $
COMMENT                                                    $
COMMENT   ISSUE COMMAND RESET PULSE                        $
COMMENT                                                    $
COMMENT   DELAY 4.13 MS                                    $
COMMENT                                                    $
COMMENT   RESET THE COMMAND RESET PULSE                    $
COMMENT                                                    $
COMMENT   RELEASE PREVIOUSLY ENABLED INTERRUPTS            $
COMMENT                                                    $
          RETURN $  ''DS200''
```

```
END-PROC DS200$
END-SYS-PROC MDS00 $
```

```
MML00 SYS-PROC ''MINOR LOOP'' $
     LOC-DD $
     (EXTREF)  PROCEDURE MDG00 OUTPUT J EXIT ERR $
          SWITCH MLSW1 ML201, ML101, ML001A $
          SWITCH MLSW2 ML4352,ML4351,ML4350 $
          SWITCH MLSW3 ML245, ML145, ML045  $
          SWITCH MLSW4 ML260, ML160, ML060  $
          VRBL, FBUGS    I  26D S  $
          VRBL, KCPBG    A  26D S 14D P 2016D $
          VRBL, VCG10    I  12D S $
          VRBL, VCG11    I  12D S $
          VRBL, VIRE     I  26D S  $
          VRBL, VMEMR    I  26D U  $
          VRBL, VOCK     A  26D S 25D $
          TABLE FBUG     V  NONE   3    $
                    FIELD F1 I 26D S  $
          LIKE-TABLE VGR   3 $
          LIKE-TABLE VPGR  3 $
          END-TABLE FBUG $
          TABLE VCOD     V  NONE   3    $
                    FIELD F2   I 12D S $
          LIKE-TABLE VOLD    3  $
          LIKE-TABLE VCG0    3  $
          LIKE-TABLE VCG1    3  $
          LIKE-TABLE VML0    3  $
          LIKE-TABLE VML1    3  $
          END-TABLE VCOD $
          TABLE VCG      V  NONE   3    $
                    FIELD F3 A 26D S 25D $
          LIKE-TABLE VDEL    3 $
          LIKE-TABLE VBUB    3 $
          LIKE-TABLE VML2    3 $
          END-TABLE VCG $
          TABLE VSF      V  NONE   3    $
                    FIELD F4  A 26D S 35D $
          END-TABLE VSF $
          TABLE VFIO     V  NONE   3    $
                    FIELD F5 S 'NORMAL', 'BACKUP', 'DUMMY' $
          END-TABLE VFIO $
          TABLE VMLET    V  DENSE  1    $
                    FIELD OLD  I 12D S  0  25D  $
                    FIELD TAG  I  3D S  0  13D  $
                    FIELD COD  I 11D S  0  10D  $
          END-TABLE VMLET $
          TABLE VCMND    A    1  3,3    $
                    FIELD F6 I 26D S   $
          END-TABLE VMLET $
          ERTAG EQUALS 7 $
          PI    EQUALS 400000000 $
     END-LOC-DD $
PROCEDURE MML00 $   ''FLIGHT SIMULATION MINOR LOOP''
          IF DVLRC EQ 0
               THEN SET DVCC TO DVCC - DVDC
               THEN GOTO ML0 $
          SET DVLRC TO DVLRC - 1 $
```

```
ML0.        MML20 $  ''EXECUTE NORMAL MINOR LOOP''
            RETURN $  ''MML00''
END-PROC MML00 $
(EXTDEF) PROCEDURE MML20 $ ''NORMAL MINOR LOOP''
            SET DVCC TO DVCC + DVDC $
            IF FBUGS NOT 0   THEN GOTO ML500 $
ML001.      VARY I FROM 2 THRU 0 BY -1 $
                 GOTO MLSW1 I $
ML001A.          IF VFIO(2) EQ 'NORMAL'
                      THEN ''READ Z GIMBAL INTO VGR(2)''
                      THEN GOTO ML004 $
                 IF VFIO(2) EQ 'BACKUP'
                      THEN''READ Z BACKUP GIMBAL INTO VGR(2)''
                      THEN GOTO ML004 $
                 SET VGR(2) TO VPGR(2) $
                 GOTO ML004 $
ML101.           ''READ ERROR MONITOR REGISTER INTO VMEMR''$
                 SET DVLDB TO DVLDB - BIT(17D)(VMEMR) $
                 IF VFIO(1) EQ 'NORMAL'
                      THEN ''READ Y GIMBAL INTO VGR(1)''
                      THEN GOTO ML004 $
                 IF VFIO(1) EQ 'BACKUP'
                      THEN ''READ Y BACKUP GIMBAL INTO VGR(1)''
                      THEN GOTO ML004 $
                 SET VGR(1) TO VPGR(1) $
                 GOTO ML004 $
ML201.           VARY J FROM 0 THRU 25D $
                      IF VMEMR(0,J) EQ 1 THEN SET DVEMR(0,J) TO 1$
                 END ML201 $
                 IF VFIO(0) EQ 'NORMAL'
                      THEN ''READ X GIMBAL INTO VGR(0)''
                      THEN GOTO ML004 $
                 IF VFIO(0) EQ 'BACKUP'
                      THEN ''READ X BACKUP GIMBAL INTO VGR(0)''
                      THEN GOTO ML004 $
                 SET VGR(0) TO VPGR(0) $
ML004.           IF BIT(0)(VGR(I)) EQ 0   THEN GOTO ML020 $
                 IF DVDGS LT 0            THEN GOTO ML432 $
                 ID DVDGS EQ 0            THEN GOTO ML020 $
                 GOTO ML637 $
ML432.           MDG00 OUTPUT J EXIT ML434 $''PROCESS
                      DISAGREEMENT BIT              (NOT CODED)''
COMMENT                                                          $
COMMENT          DISAGREEMENT BIT PROCESSING WILL TAKE A NORMAL$
COMMENT          RETURN IF THE DISAGREEMENT BIT IS FOUND TO BE $
COMMENT          INVALID, OTHERWISE, IT WILL TAKE THE ERROR    $
COMMENT          EXIT TO ML434 AND SET J=0 IF THE GIMBAL IS    $
COMMENT          VALID OR J=1 IF THE GIMBAL IS NOT VALID.      $
COMMENT                                                          $
                 GOTO ML020 $
ML434.           GOTO MLSW2 I $
ML4350.          IF VFIO(2) EQ 'NORMAL'
                      THEN ''READ Z GIMBAL,RESTART Y COD COUNTER''
                      THEN GOTO ML450 $
                 ''READ Z BACKUP GIMBAL, RESTART Y COD COUNTER''$
```

```
                GOTO ML450 $
ML4351.         IF VFIO(1) EQ 'NORMAL'
                     THEN ''READ Y GIMBAL,RESTART X COD COUNTER''
                     THEN GOTO ML450 $
                ''READ Y BACKUP GIMBAL, RESTART X COD COUNTER''$
                GOTO ML450 $
ML4352.         IF VFIO(0) EQ 'NORMAL'
                     THEN ''READ X GIMBAL,RESTART Z COD COUNTER''
                     THEN GOTO ML450 $
                ''READ X BACKUP GIMBAL, RESTART Z COD COUNTER''$
ML450.          IF J EQ 1 THEN GOTO ML637 $
ML020.          SET VCOD(I) TO BIT(1,11D)(VGR(I)) $
                IF VCOD(I) EQ 0 AND VOLD(I) EQ 0 AND ABS(VDEL(I))
                     GTEQ VOCK      THEN GOTO ML631 $
                IF ABS(VCOD(I) - VOLD(I)) LT VML0(I)
                     THEN GOTO ML040 $
                IF ABS(VCOD(I) - VOLD(I)) + VML0(I) LT VML1(I)
                     THEN GOTO ML630 $
                IF VCOD(I) LT VOLD(I)
                     THEN SET VCG(I) TO VCG(I) + VML2(I)
                     THEN GOTO ML040 $
                SET VCG(I) TO VCG(I) - VML2(I) $
ML040.          SET DVTH(I) TO VSF(I)*VCOD(I) + VCG(I) $
                SET VOLD(I) TO VCOD(I) $
                SET VDEL(I) TO DVTH(I) - DVCC(I) $
                SET DFDBF TO 'GOOD' $
                GOTO MLSW3 I $
ML045.          SET VCMND(2,0) TO DVA5*VDEL(2) - DVA4*VDEL(1) $
                GOTO ML730 $
ML145.          SET VCMND(1,0) TO DVA1*VDEL(1) + DVA2*VDEL(2) $
                GOTO ML730 $
ML245.          SET VCMND(0,0) TO DVA6*(VDEL(0) + DVA3*VDEL(1))$
                GOTO ML730 $
ML630.          SET VMLET(0,TAG) TO I + 3 $
                GOTO ML632 $
ML631.          SET VMLET(0,TAG) TO I $
ML632.          SET VMLET(0,COD) TO VCOD(I) $
                SET VMLET(0,OLD) TO VOLD(I) $
                IF COMP DVMC6(0,D04)
                THEN UTR30 ''DELAY FOR TELEMETRY AS REQUIRED''
                THEN ''TELEMETER ERROR MESSAGE'' $
                IF DFDBF EQ 'FAILED'     THEN GOTO ML635 $
                SET DVRE(I) TO DVRE(I) + 1 $
                IF DVRE(I) LT 0      THEN GOTO ML637 $
                IF DVRE(I) GT 0      THEN GOTO ML636 $
                SET VMLET(0,TAG) TO ERTAG $
                SET VMLET(0,COD) TO VCOD(I) $
                SET VMLET(0,OLD) TO VOLD(I) $
                SET VFIO(I) TO 'BACKUP' $
                IF VCG(I) GTEQ PI
                     THEN SET VCG(I) TO PI - VBUB(I)
                     THEN GOTO ML633 $
                SET VCG(I) TO - VBUB(I) $
ML633.          SET VML2(I) TO PI $
                IF DVTH(I) GTEQ PI
```

```
                    THEN SET VOLD(I) TO (DVTH(I) - PI)*KCPBG
                    THEN GOTO ML634 $
               SET VOLD(I) TO DVTH(I)*KCPBG $
ML634.         SET VSF(I) TO 1/KCPBG $
               IF I = 2
                    THEN ''SET ICR TO SELECT BACKUP GIMBAL''
                    THEN SET DVICR(0,BG) TO 1 $
               SET FBUGS, FBUG(I) TO 2 $
               SET VML0(I) TO VCG10 $
               SET VML1(I) TO VCG11 $
               IF COMP DVMC6(0,D04)
               THEN UTR30 ''DELAY FOR TELEMETRY AS REQUIRED''
               THEN ''TELEMETER ERROR MESSAGE'' $
               GOTO ML637 $
ML635.         SET DVHDB TO DVHDB - 1 $
               SET DVHDA TO DVHDA + 1 $
               SET DFDBF TO 'GOOD' $
               IF DVHDA LT 0        THEN GOTO ML636 $
COMMENT        SET ICR TO SWITCH GIMBAL ORDER  $
               SET DVICR(0,SWG) TO 1 $
               SET DVMC4(0,AMF) TO 1 $
               SET DVDGS TO 0 $
ML636.         IF DVRE(I) GTEQ VIRE AND COMP DVMC6(0,D04)
                    THEN UD000 INPUT MSKGRF $''SET GUIDANCE
                              REFERENCE FAILURE DISC(NOT CODED)''
ML637.         SET DFSMC TO 'DISABLE' $
               GOTO ML760 $
ML730.         IF ABS(VCMND(I,0)) GR DVM06
                    THEN SET VCMND(I,0) TO DVM06 $
               IF ABS(VCMND(I,0) - VCMND(I,1)) GR DVM05
                    THEN SET VCMND(I,0) TO VCMND(I,1) + DVM05 $
               SET VCMND(I,1) TO VCMND(I,0) $
               IF VCMND(I,0) LT 0
                    THEN SET VCMND(I,2) TO MSKABSLAD - VCMND(I,0)
                    THEN GOTO ML760 $
               SET VCMND(I,2) TO VCMND(I,0) $
ML760.         GOTO MLSW4 I $
ML060.         ''ISSUE YAW COMMAND FROM VCMND(2,2)''$
               IF DVLDB LT 0  THEN ''SET ICR TO SELECT CONV A''$
               SET DVTT1 TO DVTT1 - DVRTC $
               IF DVTTI LT 0  THEN SET DVTT1 TO DVTT1 + DKRTCOVF$
               SET DVMLT TO DVTMM + DVMLD + DVTT1 $
               GOTO ML900 $
ML160.         ''ISSUE PITCH COMMAND FROM VCMND(1,2)''$
               GOTO ML900 $
ML260.         ''START SPECIAL DOM BACKUP GIMBAL''$
               ''ISSUE YAW COMMAND FROM VCMND(2,2)''$
               ''ISSUE ROLL COMMAND FROM VCMND(0,2)'' $
ML900.    END ML00 $
          RETURN $ ''MML20''
ML500.         VARY I FROM 0 THRU 2 $
                    IF FBUG(I) EQ 0 THEN GOTO ML530 $
                    IF FBUG(I) EQ 1
                         THEN SET FBUG(I) TO 0
                         THEN SET VML0(I) TO VCG0(I)
```

```
                        THEN SET VML1(I) TO VCB1(I)
                        THEN GOTO ML530 $
                    SET FBUG(I) TO 1 $
ML530.          END ML500 $
            SET FBUGS TO FBUG(0) + FBUG(1) + FBUG(2) $
            GOTO ML001 $
END-PROC MML20 $
END-SYS-PROC MML00 $
```

```
MSS00 SYS-PROC ''SWITCH SELECTOR PROCESSOR''$
     LOC-DD$
          (EXTREF)  PROCEDURE EGP08 $
          SWITCH SS (DGSSM)$
              'SS00',    SS00 $ ''SS ALTERNATE SEQUENCE CHECK''
              'SS05',   MSS05 $ ''SS NORMAL CHECK''
              'SS10',   MSS10 $ ''SS TIME BASE SET INITIALIZE''
              'SS20',   MSS20 $ ''SS FORCED RESET''
              'SS30',   MSS30 $ ''SS HUNG STAGE TEST''
              'SS40',   MSS40 $ ''SS STAGE/ADDRESS ISSUANCE''
              'SS50',   MSS50 $ ''SS VERIFY ADDRESS''
              'SS55',   MSS55 $ ''SS READ TIME CHECK''
              'SS60',   MSS60 $ ''SS READ ISSUANCE''
              'SS70',   MSS70 $ ''SS RESET''
              'SS80',   MSS80 $ ''SS COMPLEMENT STAGE/ADDRESS''
          END-SWITCH SS $
          VRBL  BIAS    A 26D S -2 $
          VRBL  ID      I 26D U $
          VRBL  TIME    A 26D S -2 $
          VRBL  FASE    S   'NORMAL',  'ALTERNATE' $
          VRBL  FBRNI   S   'FIRST',   'SECOND'    $
          VRBL  FCLS4   S   'NOTINPROG','INPROG'   $
          VRBL  FFBCH   S   'CHANA',   'CHANB'     $
          VRBL  FHST    S   'NOTEST',  'TEST'      $
          VRBL  FSSIO   B $
          VRBL  FSSAC   S   'INACTIVE','ACTIVE'    $
          VRBL  FTADV   S   'NORMAL',  'CLASS4'    $
          VRBL  FT60P   S   'PASS1',   'PASS2'     $
          VRBL  KCSSK         26D A -2  P   812.69840D  $
          VRBL  KSSB1         26D A -2  P   70.142856D  $
          VRBL  KSSB2         26D A -2  P   103.58730D  $
          VRBL  KSSB3         26D A -2  P   66.206348D  $
          VRBL  KSSB4         26D A -2  P   35.825396D  $
          VRBL  KSSB5         26D A -2  P   102.65079D  $
          VRBL  KSSB6         26D A -2  P   50.825396D  $
          VRBL  KSSB7         26D A -2  P   87.460316D  $
          VRBL  KSSB8         26D A -2  P   43.825396D  $
          VRBL  KSSRB         26D A -2  P   201.17460D  $
          VRBL  KSS500MS      26D A -2  P   2031.7460D  $
          VRBL  KSS500SEC     26D A -2  P   2031746.0D  $
          VRBL (SST1PTR,
                SST2PTR,
                VHSTW,
                VPSTG,
                VSCCA,
                VSC10,
                VSC11,
                VSC30,
                VSC31,
                VSNA,
                VSNA1,
                VSSCA,
                VSSFB,
                VSTG)     I  26D U $
          VRBL (VATRR,
```

```
      VATR4,
      VGBIA,
      VSC12,
      VSC32,
      VSSRT,
      VSSTM,
      VSSW,
      VSTGO)   A  26D S -2 $
TABLE VASPI V 1 1 $
          FIELD  S4CO  B 0 25D $
          FIELD  SPEC  B 0 24D $
          FIELD  CL3   B 0 23D $
          FIELD  CL1   B 0 22D $
          FIELD  T6C   B 0 19D $
END-TABLE VASPI $
TABLE SSTTBPTR   V 1  8D $
          FIELD F1 I  26D U $
END-TABLE SSTTBPTR $
SSTTBPTR  DATA  CORAD(SSTTB1) $
          DATA  CORAD(SSTTB2) $
          DATA  CORAD(SSTTB3) $
          DATA  CORAD(SSTTB4) $
          DATA  CORAD(SSTTB5) $
          DATA  .           0  $
          DATA  CORAD(SSTTB7) $
          DATA  CORAD(SSTTB8) $

COMMENT                                                          $
COMMENT   SWITCH SELECTOR TABLE                                  $
COMMENT                                                          $
COMMENT   THE SWITCH SELECTOR TABLE IS MADE UP OF A NUMBER OF$
COMMENT   SMALLER TABLES, ONE FOR EACH TIME BASE AND FOR EACH$
COMMENT   OF THE ALTERNATE SS SEQUENCES.  HOWEVER, ONLY THE  $
COMMENT   TIME BASE 1 TABLE HAS BEEN CODED.                      $
COMMENT                                                          $
COMMENT   EACH TABLE ENTRY REPRESENTS A SINGLE SS COMMAND AND$
COMMENT   CONSISTS OF TWO WORDS,                                 $
COMMENT        1. TIME OF ISSUANCE.                              $
COMMENT        2. SS STAGE AND ADDRESS,                          $
COMMENT                                                          $
          TABLE SSTABLE V 2 ZERO $
                    FIELD  TIME   A 26D S 10D  0 $
                    FIELD  STAGADD I 15D U 1 25D $
          END-TABLE SSTABLE      $
          TABLE SSTTB1   V  2   28D $
                    FIELD TIME  A 26D S 10D  0 $
                    FIELD STAGADD I 15D U 1 25D $
          END-TABLE SSTTB1 $
          SSTTB1    DATA     5.0  $ DATA       0     $
                    DATA     6.0  $ DATA   10650     $
                    DATA    14.0D $ DATA   02610     $
                    DATA    19.8D $ DATA   40644     $
                    DATA    20.0D $ DATA   40544     $
                    DATA    20.2D $ DATA   40634     $
                    DATA    24.0D $ DATA   02574     $
                    DATA    27.0D $ DATA   40210     $
```

```
                    DATA     29.0D $ DATA    02774     $
                    DATA     30.0D $ DATA    40304     $
                    DATA     32.0D $ DATA    40110     $
                    DATA     49.5D $ DATA    02010     $
                    DATA     75.0D $ DATA    00000     $
                    DATA     90.0D $ DATA    40210     $
                    DATA     95.0D $ DATA    40110     $
                    DATA     95.3D $ DATA    02264     $
                    DATA    105.0D $ DATA    40764     $
                    DATA    115.1D $ DATA    02574     $
                    DATA    119.8D $ DATA    40674     $
                    DATA    120.0D $ DATA    40574     $
                    DATA    120.1D $ DATA    02774     $
                    DATA    130.0D $ DATA    40404     $
                    DATA    132.4D $ DATA    02164     $
                    DATA    133.6D $ DATA    40070     $
                    DATA    133.8D $ DATA    40170     $
                    DATA    134.4D $ DATA    02174     $
                    DATA    134.6D $ DATA    02374     $
                  DATA 77777.7774 $ DATA    00000     $
     END-LOC-DD  $
PROCEDURE MSS00 $
          GOTO SS DGSSM $
SS00.     ''INHIBIT ALL INTERRUPTS EXCEPT TLC'' $
          SET FASE TO 'ALTERNATE' $
          IF COMP DVASW(0,S4C0)    THEN GOTO SS001 $
               SET BIT(0,7)(DVASW(0)),BIT(9D,17D)(DVASW(0)) TO 0$
               IF VASPI(0,S4C0)    THEN GOTO SS0060 $
                    EGP08 $ ''RESCHEDULE TIMER 1 (NOT CODED)''
                    SET VASPI(0) TO MSKSSS4C0 $
                    SET SST1PTR TO CORAD(SSTSIVB) $
                    GOTO SS1050 $
SS001.    IF DVASW(0,SPEC)
               THEN SET BIT(0,7)(DVASW(0)),
                         BIT(9D,17D)(DVASW(0)) TO 0
               THEN EGP08 ''RESCHEDULE TIMER 1   (NOT CODED)''
               THEN SET VASPI(0) TO MSKSSSPEC
               THEN SET SST1PTR TO CORAD(SSTSIVA)
               THEN GOTO SS1050 $
          IF DVASW(0,TB6C)
               THEN SET DVASW(0,TB6C) TO 0
               THEN SET VASPI(0,T6C) TO 1
               THEN SET DVMC6(0,TB6B) TO 1
               THEN SET SST1PTR TO CORAD(SSTTB6C)
               THEN SSTUPD OUTPUT VATRR ''UPDATE SS TIME''
               THEN GOTO SS1050 $
          IF COMP(DVASW(0,TB6A) OR DVASW(0,TB6B) OR DVASW(0,S4C1))
          THEN GOTO SS002 $
               SET VSC10 TO SST1PTR $
               SET VSC11 TO VASPI(0) $
               SET VSC12 TO VATRR $
               SET VASPI(0) TO MSKSSCL1 $
               SSTUPD OUTPUT VATRR $ ''UPDATE SS TIME''
               SET FTADV TO 'NORMAL' $
               IF DVASW(0,TB6A)
```

```
                    THEN SET DVASW(0,TB6A) TO 0
                    THEN SET DVMC6(0,TB6A) TO 1
                    THEN SET SST1PTR TO CORAD(SSTTB6A)
                    THEN GOTO SS1050 $
               IF DVASW(0,S4C1)
                    THEN SET DVASW(0,S4C1) TO 0
                    THEN SET SST1PTR TO CORAD(SSTS4C1)
                    THEN GOTO SS1050 $
               SET DVASW(0,TB6B) TO 0 $
               SET DVMC6(0,TB6B) TO 1 $
               SET SST1PTR TO CORAD(SSTTB6B) $
               GOTO SS1050 $
SS002.    IF FSSAC EQ 'ACTIVE'      THEN GOTO SS0060 $
          GOTO SS0000 $
MSS05.    SET FSSAC TO 'INACTIVE' $
SS0000.   IF SSTABLE(0,0)SST1PTR EQ MSKSSNSEND THEN GOTO SS0015$
SS0010.        SSTUPD OUTPUT VSTGO $ ''UPDATE SS TIME''
               SET VSTGO TO VSSRT - VSTGO $
               IF VSTGO LT KSS500MS THEN GOTO MSS30 $
               IF DFTUP EQ 'YES'
                    THEN SET DVTGB TO DVTGB + VGBIA
                    THEN SET VGBIA TO 0
                    THEN SET DFTUP TO 'NO'
                    THEN GOTO SS0010 $
               IF DVASW(0) NOT 0 THEN GOTO SS0170 $
               SET VSSTM TO VSTGO + DVTRB - DVTGB - KCSSK $
               SET DVSST TO VSSTM + DVTMR $
               SET DGSSM TO 'SS30' $
               IF COMP DFIL3 THEN EGP08 $ ''RESCHED T1(UNCODED)''
               GOTO SS0060 $
SS0015.   IF DVASW(0) NOT 0 THEN GOTO SS0170 $
COMMENT   READ REAL TIME CLOCK INTO TEMP $
          SET TEMP TO TEMP - DVRTC $
          IF TEMP LT 0 THEN SET TEMP TO TEMP + DKRTCOVF $
          SET DVSST TO DVTMM + KSS500SEC + TEMP.,0 $
          SET DGSSM TO 'SS05' $
          IF COMP DFIL3 THEN EGP08 $ ''RESCHED T1(NOT CODED)''
          GOTO SS0060 $
SS0170.   IF DVASW(0,GNSS) OR DVASW(0,SBLO) OR DVASW(0,SBHI)
          OR DVASW(0,SBOM) OR DVASW(0,ECSV) OR DVASW(0,ECS1)
          OR DVASW(0,T3A) THEN GOTO SS004 $
               IF DVASW(0,ACQU)
                    THEN SET DVASW(0,ACQU) TO 0
                    THEN SET SST2PTR TO CORAD(SSTGAIN)
                    THEN SSTUPD OUTPUT VATR4 ''UPDATE SS TIME''
                    THEN GOTO SS005 $
               IF DVASW(0,TB6D)
                    THEN SET DVASW(0,TB6D) TO 0
                    THEN SET SST2PTR TO CORAD(SSTTB6D)
                    THEN SSTUPD OUTPUT VATR4 ''UPDATE SS TIME''
                    THEN GOTO SS005 $
               SET DVASW(0,LI) TO 0 $
               SET VATR4 TO 0 $
SS005.         SET FCLS4 TO 'INPROG' $ SET FHST TO 'TEST' $
               SET FTADV TO 'CLASS4' $
```

```
          SS210 $ ''SET UP CLASS 4 ALTERNATE SEQUENCE''
          GOTO SS0000 $
SS004.    IF VASPI(0) NOT 0 THEN GOTO SS0060 $
          SET VSC30 TO SST1PTR $
          SET VSC31 TO VASPI(0) $
          SET VSC32 TO VATRR $
          SET VASPI(0) TO MSKSSCL3 $
          SSTUPD OUTPUT VATRR $ ''UPDATE SS TIME''
          SET FTADV TO 'NORMAL' $ SET FHST TO 'TEST' $
          IF DVASW(0,GNSS)
               THEN SET DVASW(0,GNSS) TO 0
               THEN SET SST1PTR TO CORAD(SSTGSS)
               THEN GOTO SS0230 $
          IF DVASW(0,SBLO)
               THEN SET DVASW(0,SBLO) TO 0
               THEN SET SST1PTR TO CORAD(SSTSBLO)
               THEN GOTO SS0230 $
          IF DVASW(0,SBHI)
               THEN SET DVASW(0,SBHI) TO 0
               THEN SET SST1PTR TO CORAD(SSTSBHI)
               THEN GOTO SS0230 $
          IF DVASW(0,SBOM)
               THEN SET DVASW(0,SBOM) TO 0
               THEN SET SST1PTR TO CORAD(SSTSBOM)
               THEN GOTO SS0230 $
          IF DVASW(0,ECSV)
               THEN SET SST1PTR TO CORAD(SSTECSV)
               THEN GOTO SS0230 $
          IF DVASW(0,ECS1)
               THEN SET SST1PTR TO CORAD(SSTECS1)
               THEN GOTO SS0230 $
          SET DVASW(0,T3A) TO 0 $
          SET SST1PTR TO CORAD(SSTTB3A) $
SS0230.   SS210 $ ''SET UP SS TABLE''
          GOTO SS0000 $
SS0060.   IF FASE EQ 'ALTERNATE'
               THEN SET FASE TO 'NORMAL'
               THEN ''RELEASE PREVIOUSLY ENABLED INTERRUPTS''$
          RETURN $''COMMON SS EXIT''
MSS10.    SET VASPI(0) TO 0 $
          SET VATRR TO 0 $
          SET FCLS4 TO 'NOTINPROG' $
          SET BIT(0,7)(DVASW(0)), BIT(9D,17D)(DVASW(0)) TO 0 $
          EGP08 $ ''RESCHEDULE TIMER 1            (NOT CODED)''
          SET FTADV TO 'NORMAL' $
          SET SST1PTR TO SSTTBPTR(DTRID - 1) $
SS1050.   SS210 $ ''SET UP SS TABLE''
          IF FSSAC EQ 'ACTIVE'     THEN GOTO MSS20 $
          SET VSSW TO KSSB1 $
          SET FHST TO 'TEST' $
          GOTO SS0000 $
MSS20.    IF FSSIO          THEN ''ISSUE FORCED RESET'' $
          SET FHST TO 'NOTEST' $
          SSTUPQ INPUT  KSSB8, 'SS05' $  ''SCHEDULE SS CHECK''
          SET VSSW TO KSSB5 $
```

```
          GOTO SS0060 $
MSS30.    SET FSSAC TO 'ACTIVE' $
          SET BIT(2)(VSNA1) TO BIT(0) VSNA $
          SET BIT(4,3)(VSNA1) TO BIT(2,3) VSNA $
          SET BIT(8,7)(VSNA1) TO BIT(6,7) VSNA $
          SET VSNA TO VSNA1 $
          IF VSNA EQ 0
               THEN SET FSSAC TO 'INACTIVE
               THEN SS201 $ ''ADVANCE SS TABLE''
               THEN GOTO SS0000 $
          SET BIT(2)(VSTG) TO BIT(2)(VSNA) AND BIT(2)(VPSTG) $
          SET BIT(4)(VSTG) TO BIT(4)(VSNA) AND BIT(4)(VPSTG) $
          SET BIT(5)(VSTG) TO BIT(5)(VSNA) AND BIT(5)(VPSTG) $
          SET BIT(6)(VSTG) TO BIT(6)(VSNA) AND BIT(6)(VPSTG) $
          SET FSSIO TO VSTG NOT 0 $
          IF FHST EQ 'NOTEST' THEN GOTO SS4000 $
          IF DFLT EQ 'REP' THEN GOTO SS4000$
COMMENT   READ SS FEEDBACK REGISTER INTO TEMP $
          IF BIT(7,8)(TEMP) EQ 0 THEN GOTO SS4000 $
          IF FSSIO THEN ''ISSUE SS RESET''$
          SSTUPQ INPUT KSSB4, 'SS40' $ ''SCHEDULE STAGE/ADDRESS''
          SET VSSW TO KSSB5 $
          GOTO SS0060 $
MSS40.    ''DELAY BEFORE ISSUING STAGE AND ADDRESS''$
SS4000.   IF FSSIO THEN ''ISSUE STAGE AND ADDRESS FROM VSNA''$
          SSTUPQ INPUT VSSW, 'SS50' $ ''SCHEDULE ADDRESS VERIF''
COMMENT   DELAY FOR DOM TELEMETRY $
COMMENT   OUTPUT SS AND DO REGISTERS VIA DOM TELEMETRY $
          GOTO SS0060 $
MSS50.    SET VSCCA TO VSNA $
          SET VSSCA TO 0 $
SS006.    VARY I FROM 7 THRU 14D $
               SET BIT(I)(VSCCA), BIT(I)(VSSCA) TO
                    COMP(BIT(I)(VSNA)) $
          END SS006 $
          IF VSTG NOT 0 THEN ''READ SS FEEDBACK REG INTO TEMP''
               THEN SET VSSFB TO 0
               THEN SET BIT (7,8D)(VSSFB) TO BIT(7,8D)(TEMP)
                    GOTO SS007 $
          SET VSSFB TO VSSCA $
SS007.    IF VSSFB NOT VSSCA  THEN GOTO SS5540 $
MSS55.    IF VASPI(0,S4CO)
               THEN SET DFILE(0,ISSA) TO 1
               THEN SET DVSST TO 1E10D
               THEN RETURN $ ''MSS50, MSS55''
          IF VSSRT EQ 0 THEN GOTO MSS60 $
          SSTUPD OUTPUT DVTRB $ ''UPDATE SS TIME''
          IF VSSRT - DVTRB LTEQ KSSRB   THEN GOTO MSS60 $
          SET VSSTM TO VSSRT - DVTGB - KSSRB $
          SET DVSST TO VSSTM + DVTMR $
          SET DGSSM TO 'SS60' $
          IF COMP DFIL3 THEN EGP08$''RESCHED TIMER 1(NOT CODED)''
          RETURN $ ''MSS50,MSS55''
SS5540.   IF VSSFB EQ 0 AND BIT(7)(VSSCA) THEN GOTO MSS55 $
          IF FSSIO THEN  ''ISSUE SS RESET'' $
```

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          SSTUPQ INPUT KSSB6, 'SS80' $''SCHED COMP STAGE/ADD''
          SET TEMP TO 0 $
SS008.    VARY I FROM 7 THRU 14D $
               IF BIT(I)(VSSCA) NOT BIT(I)(VSSFB)
                    THEN SET TEMP TO TEMP + 1 $
          END SS008 $
          IF TEMP LT 2  THEN RETURN $ ''MSS50, MSS55''
          SET DVMC4(0,SSCB) TO 1 $
          IF FFBCH EQ 'CHANA'
               THEN SET FFBCH TO 'CHANB'
               THEN ''SET SS CHAN B BIT IN INTERNAL CONTROL REG''
               THEN SET DVICR(0,SSCB) TO 1 $
          UTR30 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER SS FEED BACK, VSSFB $
          RETURN $ ''MSS50, MSS55''
MSS60.    SET TEMP TO VSTG $
          SET BIT(0)(TEMP) TO 1 $
          IF FSSIO  THEN ''ISSUE READ COMMAND FROM TEMP''$
COMMENT   READ CLOCK INTO TEMP $
          SSTUPQ INPUT KSSB2, 'SS70' $ ''SCHEDULE READ RESET''
          SET TEMP TO 0 + BIT(13D,13D)(TEMP) $
          SET BIT(0,13D)(TEMP) TO BIT(2,13)(VSNA) $
          UTR30 $ ''DELAY FOR TELEMETRY AS REQUIRED''
COMMENT   TELEMETER STAGE/ADDRESS AND READ TIME, TEMP $
          IF DFACQ NOT 'GAIN' ''COMPRESS DATA BETWEEN STATIONS''
               THEN MPC80 INPUT DVDCT + MSKSSDCT ''COMP TIME/TAG''
               THEN MPC80 INPUT MSKSSDCS + BIT(0,23)(VSNA) $
                    ''COMPRESS STAGE AND ADDRESS WITH TAG''
          IF VASPI(0,S4CO)
               THEN SET VASPI(0) TO 0
               THEN SET DFILE(0,CORD) TO 1 $
          IF VSNA1 EQ MSKSSHIG
               THEN SET DVMC7(0,HIG) TO 1
               THEN RETURN $ ''MSS60''
          IF VSNA1 EQ MSKSSLOG
               THEN SET DVMC7(0,LOG) TO 1
               THEN RETURN $ ''MSS60''
          IF VSNA1 EQ MSKSSOMG
               THEN SET DVMC7(0,OMG) TO 1
               THEN RETURN $ ''MSS60''
          IF VSNA1 NOT MSKSSSIVB   THEN RETURN $ ''MSS60''
          IF FBRNI EQ 'FIRST'
               THEN DVMC5(0,S4R1I) TO 1
               THEN RETURN $ ''MSS60''
          SET DVMC6(0,S8BRI) TO 1 $
          RETURN $ ''MSS60''
MSS70.    IF FSSIO  THEN ''RESET READ COMMAND''$
          SSTUPQ INPUT KSSB3, 'SS05' $''SCHEDULE HUNG STAGE TEST''
          SS201  $ ''ADVANCE SS TABLE''
          SET VSSW TO KSSB1 $
          SET FHST TO 'TEST' $
          IF BIT(2,5)(VHSTW) EQ BIT(2,5)(VSTG)
               THEN SET FHST TO 'NOTEST' $
          IF VSNA1 EQ MSKSSWVO
               THEN SET DVASW(0,ECS1) TO 0
```

```
                THEN SET DFWV TO 'OPEN'
                THEN RETURN $ ''MSS70''
           IF VSNA1 EQ MSKSSWVC
                THEN SET DVASW(0,ECSV) TO 0
                THEN SET DFWV TO 'CLOSE'
                THEN RETURN $ ''MSS70''
           IF VSNA1 EQ MSKSSSCC
                THEN SET DVDPM(0,DIN9) TO 1 $
           RETURN $ ''MSS70''
MSS80.     SET VSNA TO VSCCA $
           IF FSSIO  THEN ''ISSUE STAGE AND COMPLEMENTED ADDRESS''$
           SSTUPQ INPUT KSSB7, 'SS55'$ ''SCHEDULE READ COMMAND''
COMMENT    DELAY FOR DOM TELEMETRY $
COMMENT    OUTPUT SS AND DO REGS VIA DOM TELEMETRY $
           RETURN $ ''MSS80''
END-PROC MSS00 $
PROCEDURE SS201 $   ''SS TABLE ADVANCE ROUTINE''
           IF FTADV EQ 'NORMAL'
                THEN SET SST1PTR TO SST1PTR + 1
                THEN GOTO SS009 $
           SET SST2PTR TO SST2PTR + 1 $
SS009.     SS210 $ ''SET UP NEXT SWITCH SELECTOR''
           RETURN $ ''SS201''
END-PROC SS201 $
PROCEDURE SS210 $ ''SS SELECTION AND SETUP ROUTINE''
           IF FTADV EQ 'NORMAL'     THEN GOTO SS2020 $
SS2160.    IF SSTABLE(0,0)SST2PTR GTEQ 0 THEN GOTO SS2070$
           SET FCLS4 TO 'NOTINPROG' $
           SET DVMC6(0,LUI) TO 0 $
           SET DVMC7(0,T6D) TO 0 $
           GOTO SS2090 $
SS2020.    IF SSTABLE(0,0)SST1PTR GTEQ 0 THEN GOTO SS2030 $
           IF VASPI(0,SPEC)
                THEN SET VASPI(0) TO MSKSSS4C0
                THEN SET BIT(0,7)(DVASW(0)),BIT(9D,17D)(DVASW(0))
                          TO 0
                THEN SET SST1PTR TO CORAD(SSTSIVB)
                THEN GOTO SS2020 $
           IF VASPI(0,CL3)
                THEN SET SST1PTR TO VSC30
                THEN SET VASPI(0) TO VSC31
                THEN SET VATRR TO VSC32
                THEN GOTO SS2020 $
           IF VASPI(0,CL1)
                THEN SET SST1PTR TO VSC10
                THEN SET VASPI(0) TO VSC11
                THEN SET VATRR TO VSC12
                THEN GOTO SS2020 $
           SET VASPI(0), VATRR TO 0 $
           IF FT60P EQ 'PASS1'
                THEN SET FT60P TO 'PASS2'
                THEN SET SST1PTR TO CORAD(SSTTB5A)
                THEN GOTO SS2020 $
           SET SST1PTR TO CORAD(SSTTB5B) $
           GOTO SS2020 $
```

```
SS2030.   IF FCLS4 EQ 'NOTINPROG'  THEN GOTO SS2040 $
SS2070.   IF SSTABLE(0,0)SST1PTR * DKRTCSEC + VATRR - KSS500MS
          GTEQ SSTABLE(0,0)SST2PTR * DKRTCSEC + VATR4
               THEN SET FTADV TO 'CLASS4'
               THEN SET VSSRT TO SSTABLE(0,0)SST2PTR * DKRTCSEC
                                 + VATR4
               THEN SET VSNA TO SSTABLE(0,1)SST2PTR
               THEN GOTO SS2050 $
SS2090.   SET FTADV TO 'NORMAL' $
SS2040.   SET VSSRT TO SSTABLE(0,0)SST1PTR * DKRTCSEC + VATRR $
          SET VSNA TO SSTABLE(0,1)SST1PTR $
SS2050.   SET BIT(2,5)(VHSTW) TO BIT(0,5)(VSNA) $
          RETURN $ ''SS210''
END-PROC SS210 $
PROCEDURE SSTUPD OUTPUT TIME $ ''SS TIME UPDATE ROUTINE''
COMMENT   READ CLOCK INTO TEMP $
          SET TEMP TO TEMP - DVRTC $
          IF TEMP LT 0 THEN SET TEMP TO TEMP + DKRTCOVF $
          SET TIME, DVTRB TO DVTGB + DVTRR + TEMP..0 $
          RETURN $ ''SSTUPD''
END-PROC SSTUPD $
PROCEDURE SSTUPQ INPUT BIAS, ID $ ''SS SCHEDULER''
COMMENT   READ CLOCK INTO TEMP $
          SET DGSSM TO 'ID' $
          SET TEMP TO TEMP - DVRTC $
          IF TEMP LT 0   THEN SET TEMP TO TEMP + DKRTCOVF $
          SET DVTRB TO DVTGB + DVTRR + TEMP..0 $
          SET VSSTM TO BIAS + DVTRR + TEMP..0 $
          SET DVSST TO VSSTM + DVTMR
          IF COMP DFIL3 THEN EGP08 $''RESCHEDULE T1(NOT CODED)''
          RETURN $ ''SSTUPQ''
END-PROC SSTUPQ $
END-SYS-PROC MSS00 $
```

```
TASKKEY   SYS-PROC  ''ATM TASK KEYING ROUTINE'' $
     LOC-DD  $
          VRBL PRIORITY  I  10D S $ ''TASK PRIORITY LEVEL''
          VRBL TSKPTR    I  16D U $ ''TASK POINTER (ADDRESS)''
          VRBL I         I  10D S $ ''OVERFLOW TABLE CHAIN INDEX''
          VRBL J         I  10D S $ ''OVERFLOW TABLE INDEX''
COMMENT
COMMENT   THE PRIORITY CONTROL TABLE CONTAINS ONE ENTRY FOR  $
COMMENT   EACH PRIORITY LEVEL.  EACH ENTRY CONSISTS OF FIVE  $
COMMENT   ITEMS.                                             $
COMMENT        1. LOCATION POINTER TO THE NEXT EXECUTABLE    $
COMMENT           INSTRUCTION OF THE TASK CURRENTLY ASSIGNED $
COMMENT           TO THAT PRIORITY LEVEL OR ZERO IF NO TASK  $
COMMENT           IS CURRENTLY ASSIGNED.                     $
COMMENT        2. TASK REGISTER CONTENTS (INITIALLY ZERO).   $
COMMENT        3. TASK REGISTER CONTENTS (INITIALLY ZERO).   $
COMMENT        4. TASK REGISTER CONTENTS (INITIALLY ZERO).   $
COMMENT        5. INDEX POINTER TO THE BEGINNING OF THE      $
COMMENT           PRIORITY OVERFLOW TABLE CHAIN FOR THAT     $
COMMENT           PRIORITY LEVEL.  A VALUE OF ZERO INDICATES $
COMMENT           END OF CHAIN.                              $
          TABLE ATMPCT V NONE 10D $
               FIELD ATMTSKPTR  I 16D U $
               FIELD ATMTSKREG1 I 26D U $
               FIELD ATMTSKREG2 I 26D U $
               FIELD ATMTSKREG3 I 26D U $
               FIELD ATMOVFPTR  I 16D U $
          END-TABLE ATMPCT $
COMMENT                                                      $
COMMENT   THE PRIORITY OVERFLOW TABLE IS USED FOR KEYING     $
COMMENT   TASKS ON A PRIORITY LEVEL WHICH IS CURRENTLY       $
COMMENT   ASSIGNED TO ANOTHER TASK.  THE ENTRIES ARE NOT     $
COMMENT   ALLOCATED TO A FIXED PRIORITY BUT ARE ASSIGNED     $
COMMENT   DYNAMICALLY AS REQUIRED.  ALL OVERFLOW ENTRIES FOR $
COMMENT   EACH PRIORITY LEVEL ARE CHAINED TOGETHER SUCH THAT $
COMMENT   THE TASKS CAN BE EXECUTED ON A FIRST-IN/FIRST-OUT  $
COMMENT   BASIS.  EACH ENTRY CONSISTS OF TWO ITEMS.          $
COMMENT        1. INDEX POINTER TO THE NEXT ENTRY IN THE     $
COMMENT           CHAIN.  A VALUE OF ZERO INDICATES END OF   $
COMMENT           CHAIN.                                     $
COMMENT        2. POINTER TO THE BEGINNING OF THE TASK FOR   $
COMMENT           THAT ENTRY.  A VALUE OF ZERO INDICATES THAT$
COMMENT           THE ENTRY IS NOT ASSIGNED TO ANY TASK.     $
          TABLE ATMPOVFT V NONE 26D  $
               FIELD ATMOVFPTR  I 16D U $
               FIELD ATMTSKPTR  I 16D U $
          END-TABLE ATMPOVFT $
     END-LOC-DD $
PROCEDURE TASKKEY INPUT PRIORITY, TSKPTR $
COMMENT                                                      $
COMMENT   INHIBIT ALL INTERRUPTS                             $
COMMENT                                                      $
COMMENT   IF THE REQUESTED PRIORITY LEVEL IS NOT CURRENTLY   $
COMMENT   ASSIGNED, INITIALIZE THE ENTRY FOR THIS TASK.      $
COMMENT                                                      $
```

```
          IF ATMPCT(PRIORITY,ATMTSKPTR) EQ 0
               THEN SET ATMPCT(PRIORITY,ATMTSKPTR) TO TSKPTR
               THEN SET ATMPCT(PRIORITY,ATMTSKREG1),
                        ATMPCT(PRIORITY,ATMTSKREG2),
                        ATMPCT(PRIORITY,ATMTSKREG3) TO 0
               THEN GOTO FINI $
COMMENT                                                          $
COMMENT   OTHERWISE, SEARCH FOR THE END OF THE OVERFLOW          $
COMMENT   POINTER CHAIN.                                         $
COMMENT                                                          $
          SET I TO ATMPCT(PRIORITY,ATMOVFPTR) $
          IF I EQ 0 THEN GOTO SLTSRCH $
CHNSRCH.       IF ATMPOVFT(I,ATMOVFPTR) NOT 0
                    THEN SET I TO ATMPOVFT(I,ATMOVFPTR)
                    THEN GOTO CHNSRCH $
COMMENT                                                          $
COMMENT   WHEN THE END OF THE OVERFLOW POINTER CHAIN HAS BEEN$
COMMENT   FOUND, SEARCH FOR AN EMPTY SLOT IN THE OVERFLOW        $
COMMENT   TABLE.                                                 $
COMMENT                                                          $
SLTSRCH.  VARY J FROM 1 THRU 25D $
               IF ATMPOVFT(J,ATMTSKPTR) EQ 0 THEN GOTO SLTFND$
          END SLTSRCH $
          STOP $ ''HALT IF OVERFLOW TABLE IS FULL''
COMMENT                                                          $
COMMENT   ADD THE NEW ENTRY TO THE END OF THE OVERFLOW CHAIN     $
COMMENT   AND STORE THE TASK POINTER IN IT.                      $
COMMENT                                                          $
SLTFND.   IF I EQ 0
               THEN SET ATMPCT(PRIORITY,ATMOVFPTR) TO J
               THEN GOTO AROUND $
          SET ATMPOVT(I,ATMOVFPTR) TO J $
AROUND.   SET ATMPOVT(J,ATMOVFPTR) TO 0 $
          SET ATMPOVT(J,ATMTSKPTR) TO TSKPTR $
FINI.     ''RELEASE INTERRUPTS AS REQUIRED''$
          RETURN $
END-PROC TASKKEY $
END-SYS-PROC TASKKEY $
```