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COMPUTER PROGRAM DEVELOPMENT SPECIFICATION FOR IDAMST OPERATION--ETC(U)
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1.0 SCOPE

1.1 Identification

This specification establishes the requirements for the Application Software Program of the IDAMST System. This program, the Executive Software and the EHARS Software are the segments of the Operational Flight Program (OFP).

1.2 Functional Summary

The paragraphs below describe the IDAMST software specifications for the Application Software. This computer program together with the Executive will be executed in the IDAMST avionics processors for control and integration of the avionics system elements to satisfy mission requirements. These requirements are from two sources:

Scenario Analysis in the FSD diagrams

System Specifications

This software contains a top level control structure and lower level controller/calculator modules. The control system includes a master sequencer, a request processor, a configurator and a subsystem status monitor. The lower level modules are organized into Operational Sequencers (OPS), Specialist Functions (SPEC), Display Processes (DISP) and Equipment Processes (EQUIP).

2.0 APPLICABLE DOCUMENTS

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflice between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superceding requirement.

Specifications:

SD2041 Computer Program Development Specification for IDAMST Operational Flight Program Executive Software, Type B5

SI1010 System Specification for IDAMST, Type A

SR5020 System Segment Specification for the IDAMST Control/Display Subsystem, Type A

SS7020 Subsystem Interface Specification for IDAMST, Type A

Other Publications:

Specifications for IDAMST Software
Final Technical Report, MDC-J7271, 30 July 1976

3.0 REQUIREMENTS

The functional requirements of the Application Software segment of the IDAMST Operational Flight Program (OFP) is given in this section. This Application Software together with the Executive Software segment comprise the OFP. The Executive Software specification is provided in a separate document.

The OFP is to reside within the processors of the IDAMST federated architecture. The Application Software interfaces with the Executive Software and, via the MIL-STD-1553 Multiplex Data Bus, with the avionic subsystems, flight control system, the controls/displays, engine sensors, and airframe sensors.

3.1 Computer Program Definition

A description of the major functions of the Application Software is given in this paragraph. The detailed functional interfaces with equipment and computer programs are delineated.

The Application Software is an integral segment of the IDAMST system. It performs the computations required to integrate AMST avionic functions on a set of multi-purpose controls and displays. Redundancy management is provided within the software to provide recovery from subsystem failures by utilizing available components to complete mission essential functions. The complement of subsystems along with the computational support of the IDAMST federated processors provide the capability for accomplishing the following major functions:

1. Mission Management
2. Navigation
3. Communication
4. Vehicle Defense/Identification
5. Cargo Delivery
6. Target Acquisition
7. Guidance
8. Airframe Monitor

3.1.1 Interface Requirements

The Application Software segment of the IDAMST OFP interfaces with various types of equipment as well as with the Executive Software segment of the OFP. The interfaces are described in greater detail in the following subparagraphs.

3.1.1.1 Interface Block Diagram

Figure 1 shows the interface block diagram for the Application Software. The hardware interfaces include the subsystems, and controls/displays, as listed below:

a. Subsystems (Navigation)

(1) Inertial Navigation System - Carousel IV

(2) Attitude Heading Reference System - 6000A

(3) OMEGA, APN-XXX

(4) TACAN, ARN-118

b. Subsystems (Guidance)

(1) Radar Set, APQ-122 (V) 5

(2) Station Keeping Equipment, APN-169B

(3) Radar Beacon, UPN - 25

(4) Instrument Landing System, ARN-108 - (2 Sets)

(5) Radar Altimeter, APN-194 (V), (2 Sets)

(6) UHF/ADF, DF-301E

(7) ADF, DF-206

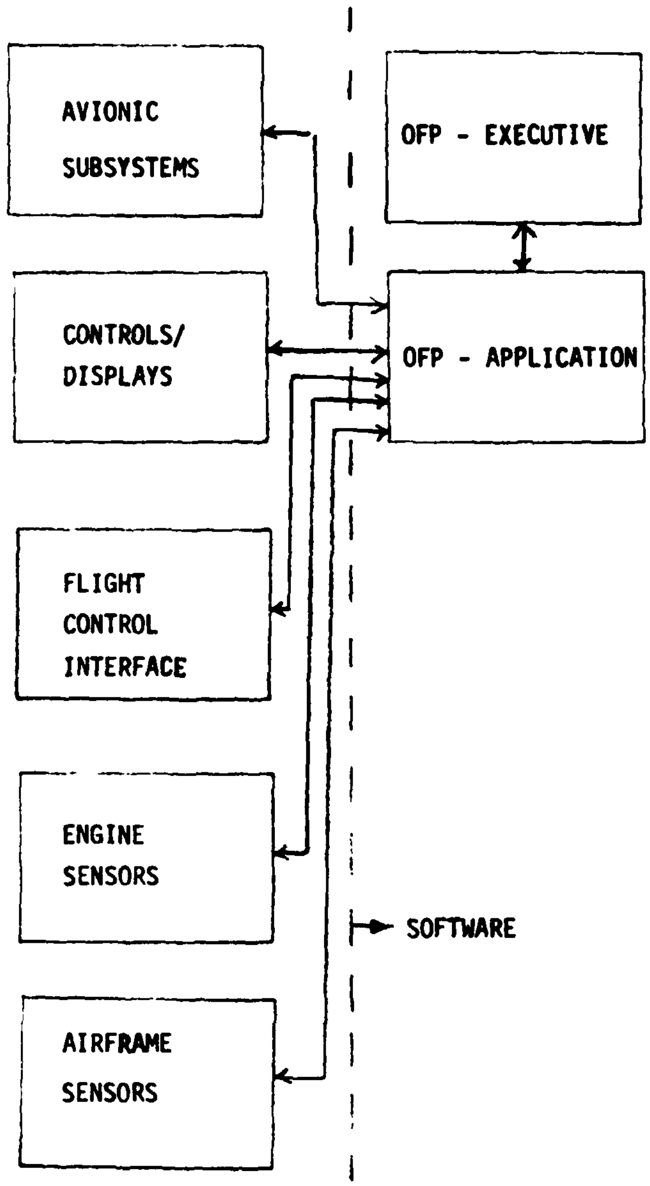

FIGURE 1 APPLICATION SOFTWARE INTERFACE BLOCK DIAGRAM

c. Subsystems (Communication)

(1) UHF Transceiver, ARC-164 - (2 Sets)

(2) VHF/AM Transceiver, ARC-115R

(3) VHF/FM Transceiver, FM-622

(4) HF Transceiver, ARC-123

(5) Public Address, AIC-13

(6) Intercomm, AIE-18

(7) Secure Voice, TSEC/KY-58

d. Subsystems (Vehicle Defence/Identification)

(1) Infra Red Detection & Warning

(2) ESM

(3) IFF, APX-101

e. Controls and Displays

(1) Integrated Multifunction Keyboard (IMK) - (2 units)

(2) Master Mode Keyboard (MMK)

(3) Data Entry Keyboard (DEK) - (2 Units)

(4) Control Column Assembly (CCA)- (2 Units)

(5) Hand Control Unit (HCU)

(6) Sensor Control Panel (SCP)

(7) Head-Up Display(HUD)-(2 Units)

(8) Multi-Purpose Display (MPD)- (3 Units)

(9) Horizontal Situation Display (HSD) - (2 Units)

3.1.1.2 Detailed Interface Definition

3.1.1.2.1 Subsystems

The subsystem interfaces are given in Document SS7020 . The following sections provide brief summaries of the primary input/output parameters and modes.

3.1.1.2.1.1 Inertial Navigation System

The Inertial Navigation System provides present position (latitude/longitude), ground velocity (North, East), attitude (pitch, roll and true heading). The modes of the INS are: OFF, STANDBY, NORMAL ALIGNMENT, REFERENCE ALIGNMENT, NAVIGATION TEST, and ATTITUDE.

3.1.1.2.1.2 Attitude Heading Reference System

The Attitude Heading Reference System is used as a back-up source for attitude (pitch and roll) and heading. The primary source is the INS.

3.1.1.2.1.3 OMEGA

The OMEGA system provides present position (latitude/longitude) and ground velocity (North, East). It requires an initial position at start-up. The modes of the OMEGA system are OFF, NAVIGATION, and TEST.

3.1.1.2.1.4 TACAN

The TACAN system provides range and bearing measurements to a TACAN transmitter. It provides an independent source for determining present position when the transmitter location is known (prestored in the IDAMST processor).

3.1.1.2.1.5 Radar Set

The Radar Set modes are OFF, STANDBY, MAP, BEACON, and WEATHER. The function of the Application Software for the Radar Set is primarily that of monitoring the radar including BITE data and providing control inputs.

3.1.1.2.1.6 Station Keeping Equipment

The Station Keeping Equipment (SKE) provides location information of cooperating aircraft in formation. The aircraft locations will be displayed in a horizontal situation on the HSD. Lead aircraft commands and the steering commands will be displayed on the SKE panel. The modes of the SKE are OFF, STANDBY and TRANSMIT.

3.1.1.2.1.7 Radar Beacon

The Application Software functions associated with the radar beacon are primarily monitor and control.

3.1.1.2.1.8 Instrument Landing System

The Instrument Landing System will provide localizer and glide slope deviations to be displayed on the HUD. The data are obtained from the FCS interface when the FCS is operating. If not, the data will be obtained directly from the ILS. The modes for the ILS are OFF and ON.

3.1.1.2.1.9 Radar Altimeter

The Radar Altimeter is used to provide an accurate indication of altitude above ground from 0 to 5000 ft.

3.1.1.2.1.10 UHF/ADF, DF-301E

The UHF/Automatic Direction Finding (ADF) set is used to provide bearing data with respect to a selected transmitting radio station. Channel frequency selection will be provided through the IMK.

3.1.1.2.1.11 ADF, DF206

The Automatic Direction Finding (ADF) set is used to provide bearing data with respect to a selected transmitting station. Channel frequency selection will be provided through the IMK.

3.1.1.2.1.12 UHF Transceiver ARC-164

The UHF Transceiver is the primary radio for voice communications both Air-to-Air and Air-to-Ground. Application Software provides frequency selection as well as control of operating modes. Twenty (20) preset frequency selections will be provided in addition to direct selection via the Data Entry Keyboard. Modes include OFF, MAIN (main receiver), BOTH (main receiver plus guard receiver). Squelch control will also be provided.

3.1.1.2.1.13 VHF/AM Transceiver

The VHF/AM Transceiver is used primarily for communications with the ground tower. Application software provides frequency selection as well as control of operating modes. The modes include OFF, T/R (main transceiver), and T/R-GUARD (T/R plus guard channel). Squelch control will also be provided.

3.1.1.2.1.14 VHF/FM Transceiver

The VHF/FM Transceiver is used primarily for communication in the tactical area. Application software provides frequency selection as well as control of operating modes. The modes include OFF, T/R (normal mode), and HOME (direction finding). Squelch control will also be provided.

3.1.1.2.1.15 <u>HF Transceiver</u>

The HF Transceiver is used primarily for long range communication. Application software provides frequency selection as well as control of operating modes which include SSB (Single Side Band), FSK) (Frequency Shift Keying) and AME (Amplitude Modulation Equivalent). Squelch control will also be provided.

3.1.1.2.1.16 <u>Public Address</u>

The Public Address System provides voice transmission to the cargo area as well as outside the aircraft during cargo loading. The Application Software will provide control of the system.

3.1.1.2.1.17 <u>Intercom</u>

The Intercom Set will be utilized for communication between the pilots and the loadmaster. The Application Software will provide control of this system.

3.1.1.2.1.18 <u>Secure Voice</u>

The Secure Voice Set is used in conjunction with the transceivers to provide coded communication. The Application Software will provide control of this system.

3.1.1.2.1.19 <u>Infra Red Detection Warning</u>

Infra Red Detection and Warning System provides detection of hostile activities such as gunfire, rocket fire, etc. The Application Software will provide control of this system.

3.1.1.2.1.20 ESM

Electronic Support Measure (ESM) set provides detection of hostile activities involving radars. The Application Software will provide control of this system.

3.1.1.2.1.21 IFF

The IFF set provides identification of the aircraft to other friendly aircraft. The Application Software provides monitor and control of the modes: STANDBY, NORMAL, LOW EMERGENCY, CODE SELECTION, SIF MODE ENABLE, SELF-TEST ENABLE, MODE 4 ENABLE. It will also monitor the IFF status.

3.1.1.2.2 Controls and Displays

The interfaces for the IDAMST Controls and Displays are given in Reference . The following sub-paragraphs provide brief summaries of the primary input/output parameters and modes.

3.1.1.2.2.1 Master Mode Keyboard (MMK)

The Master Mode Keyboard allows the pilot to request Application Software services to establish high level mission phases. These mission phases are:

a. Preflight
b. Take-off/Climb
c. Cruise
d. Refuel
e. Air Drop
f. Descend
g. Approach /Land
h. Postflight

3.1.1.2.2.2 Integrated Multifunction Keyboard (IMK)

The Integrated Multifunction Keyboard provides controls and displays to allow the operator to interact with the IDAMST system. Checklists and selection menu are provided on the CRT of the IMK through ten keys located on the two sides of the CRT. Whenever checklists and selection menu items require data entry, the Data Entry Keyboard is enabled by the software.

Number of different pages of checklists and selection menus are controlled either by the MMK or by the "brute force" buttons on top of the IMK. The "brute force" options are:

a. Communication

b. Navigation

c. Cargo

d. Sensors

e. Controls/Displays

f. System

g. Library

h. Checklist

3.1.1.2.2.3 Data Entry Keyboard (DEK)

The Data Entry Keyboard allows the pilot to enter numeric data, north/south/east/west indications, and a x/y/z indications. The DEK has a ten character buffer and display. It has a clear button to clear the buffer and display, and an enter button to enter the buffer content into the processor.

3.1.1.2.2.4 Column Control Assembly (CCA)

The Column Control Assembly allows the pilot to control the Intercom System.

3.1.1.2.2.5 Hand Control Unit (HCU)

The Hand Control Unit provides control of the cursors on the HSD Radar Set output display and on the HUD. The control discretes include sensor selection, activation, and designation. At designation, the cursor data is inputted into the Application Software.

3.1.1.2.2.6 Sensor Control Panel (SCP)

The Sensor Control Panel provides control required for radar operation. (Cursor Brightness, Tilt, Azimuth, Sector Width, and Scan Rate).

3.1.1.2.2.7 Head-Up Display (HUD)

The Head-Up Display is used to display primarily flight director data (vertical situation). A single format display is to be provided to both the pilot and co-pilot with provisions for declutter. The HUD in conjunction with the HCU can be used to perform either navigation update or storing away target data within the Application Software.

3.1.1.2.2.8 Multi-Purpose Display (MPD)

Three Multi-Purpose Displays will be used primarily to display textual data of system status and monitoring functions such as engine performance, control surfaces, fuel, etc. MPD's have the same capability as HSD for displaying raster sensor video. A switching capability will be provided to allow any MPD to display the data from any other MPD or HSD.

3.1.1.2.2.9 Horizontal Situation Display (HSD)

Two Horizontal Situation Displays (HSD) will be provided one each for the pilot and copilot. The HSD's will display primarily the horizontal situation obtained through pre-stored maps, scan converted radar data, and computer generated symbols displaying aircraft locations, waypoints, target locations, etc. The HSD will have the back-up capability for the HUD and MPD displays.

3.1.1.2.3 Flight Control System (FCS) Interface

The interfaces to the Flight Control System are given in MDC Document J7271 . This paragraph provides a brief summary of the primary input/output parameters and modes.

This interface is to the FCS computer via RT terminals. The FCS computer provides display data to the HUD, BITE display data, and FCS Mode Annunciator data. Included in this group of data are information regarding the functioning of the autopilot function (altitude hold, atttitude hold, and heading hold). The output from the Application Software to the FCS includes course deviation information derived from Waypoint, ADF, and TACAN steering calculations.

3.1.1.2.4 Engine Sensor Interface

The interfaces to the engine sensors are given in Document SS7020.

The data from engine sensors are inputted to the Application Software so that it can be displayed to the pilots. The data is used as well to compute take-off and landing speed requirements. The inputs include such quantity, fuel flow, fuel temperature, oil quantity, oil pressure, percent RPM, etc.

3.1.1.2.5 Air Frame Sensor Interface

The interfaces to the air frame sensors are given in Document SS7020 .

The data from the air frame sensors are inputted to the Application Software so that it can be displayed to the pilots. The data groups include air data, angle of attack, control surfaces, aerial refueling parameters, and anti-skid.

3.1.1.2.6 Executive Software Interface

The Application Software elements recognized by the Executive Software are Tasks, Comsubs, Compool Blocks, and Events. Executive service requests utilizing these elements are made by the Application Software through real time pseudo-statements. This interface is defined extensibly in Document SD2041 . A summary is given in this paragraph.

Tasks are program modules which can either be controllers or calculators. Application software is organized in tasks (program modules) with each performing a function as described in Section 3.2.

Comsubs are program modules which differ from tasks in that they are required to be re-entrant. Comsubs can be used by many tasks, so that one task using a particular comsub can be suspended in the middle of the comsub routine by another task using the same comsub.

Compool Blocks provide data communication between tasks and between tasks and the external hardware equipment. A buffer system is provided by the use of "global copy" and "local copy" to prevent a compool block from being read when it has been partially updated. Every task, except "privileged" tasks, interfaces with a local copy while performing its calculations. The local copy is updated from the global copy with the read statement and the local copy updates the global copy by the write statement.

In a "privileged" task, communication is performed directly with the global copy in the processor in which the task resides. Copies of the global copies in other processors are updated by the Write statement.

Events are used to control communication between tasks. An event has two possible values: on and off. There are two general classes of events: Application Events and System Events. Application Events are set on and off explicitly by tasks; whereas System Events are set by the Executive. The Application Events are, therefore, found within the Application Software flow charts.

The Application Software requests services of the Executive through the following Real Time Pseudo-Statements.

a. Schedule

b. Cancel

c. Terminate

d. Wait

e. Signal

f. Read

g. Write

The first four statements affect the task state and are best explained with reference to Figure 2 .

Schedule statements are used to place in uninvoked task into an invoked state. An invoked task becomes active and dispatchable upon satisfaction of event conditions. A dispatched task is placed into execution by the executive if it has the highest priority among the tasks which are dispatchable. A schedule statement includes the following information.

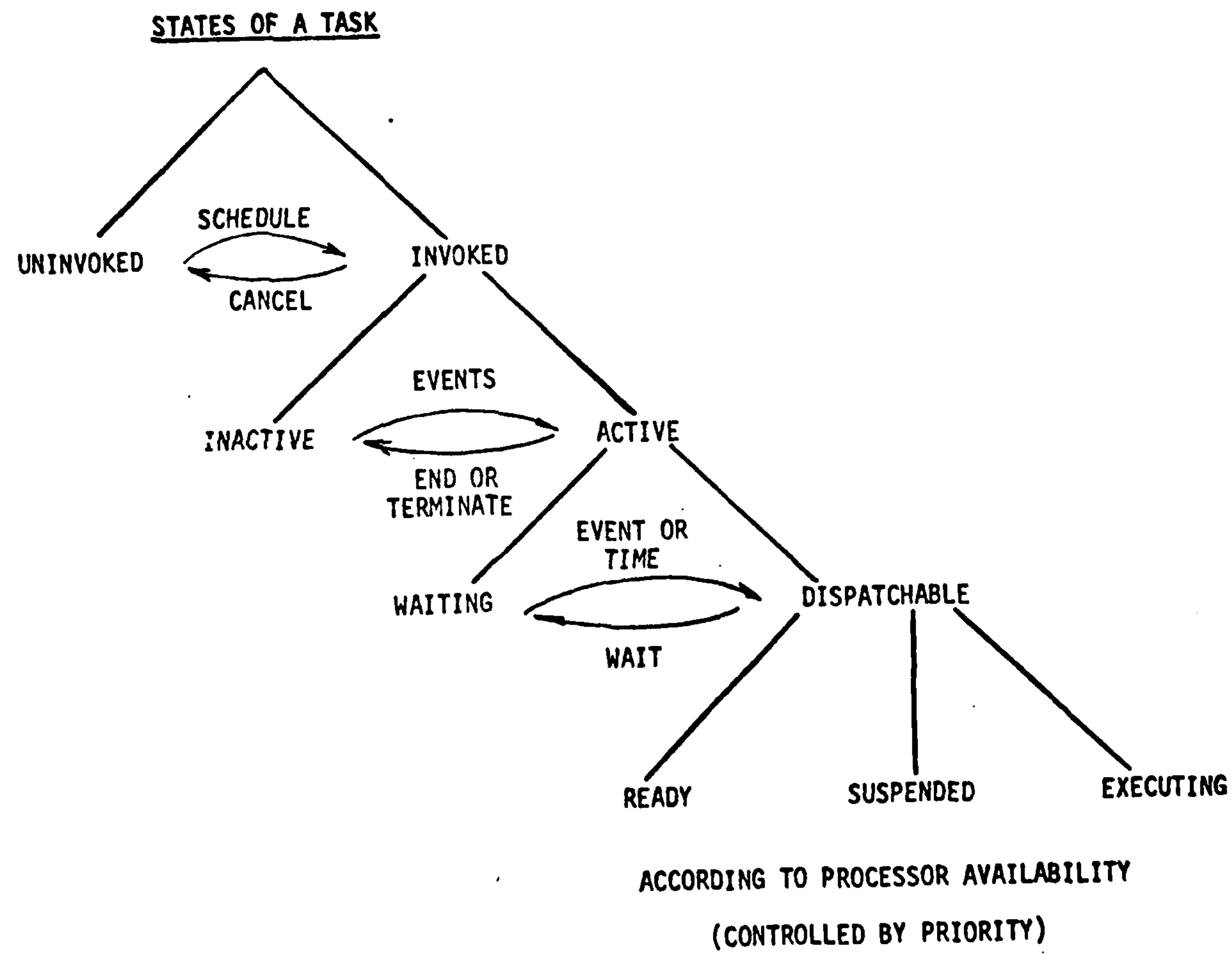

Figure 2 Real Time Pseudo Statements Relationship with Task States

a. The name of the task

b. The priority of the task (privileged tasks will be designated here).

c. The latched conditions (if any) in the event condition set of the task (use IF).

d. The unlatched conditions (if any) in the event condition set of the task (use UPON).

e. The period and phase of a Minor Cycle Event (if any) in the event condition set of the task.

Cancel statement are used to place an invoked task into an uninvoked state. The Cancel statement need simply to include the name of the task. If a task is cancelled all the lower branches of the task in the control tree structure are cancelled.

Terminate statements are used to place an active task into an inactive state. When the event condition set for the terminated task becomes true, the task will become dispatchable.

Wait statements are used by tasks to place themselves into a Wait state pending occurrence of one of the following conditions:

a. Absolute Time

b. Relative Time

c. Latched Event

d. Unlatched Event

Signal statements are used by tasks to place specified events to a specified value.

Read statements are used by tasks to copy the values of a specified compool block (global copy) into a local copy to be used by the task.

Write statements are used by tasks (except "privileged" tasks) to copy the local copy into the corresponding global copy. In a privileged task in which no local copy exists, the write statement causes the global copies in other processors to be updated and causes signalling of an event associated with the global copy.

3.2.1 System Control

System Control Modules include the Master Sequencer, Request Processor, Configurator, and the Subsystem Status Monitor. These top level controllers on a hierarchical control tree are responsible for initializing and controlling the application tasks. The Master Sequencer initializes the compools and schedules the other three system control modules. When a pilot request is made, the particular EQUIP servicing the controls and displays will set the Request Processor event causing the Request Processor module to be activated. The Request Processor interprets the request and in turn activates the Configurator which schedules the needed lower level controller/calculator tasks to satisfy the pilot request. When a subsystem error is indicated by the software tasks servicing the subsystems (EQUIP's), the Subsystem Status Monitor is activated in order to determine the severity of the error. If significant, the Configurator is activated to change the application software configuration as appropriate for the failure detected.

3.2.1.1 Function 1.1 Master Sequencer

The Master Sequencer is the highest level system control in the application software. It is initiated by the Master Executive module. It initiates the data initialization at startup and schedules the Request Processor, Configurator, and the Subsystem Status Monitor. The computer requirements for this module are:

Memory Size	41	16 bit words
Throughput	0	ms/sec
Update Rate	0.	times/sec

3.2.1.1.1 Inputs

There are no inputs to the Master Sequencer.

3.2.1.1.2 Processing

The Master Sequencer shall perform the processing specified in Figure 3 . This processing

1) Upon initial startup as commanded by the executive. schedule the Request Processor, Configurator, Subsystem Status Monitor

2) The Configurator Initialization Event is turned on so that the Configurator can initiate the initialization of compools.

3.2.1.1.3 Outputs

The outputs from the Master Sequencer shall be as shown in Table

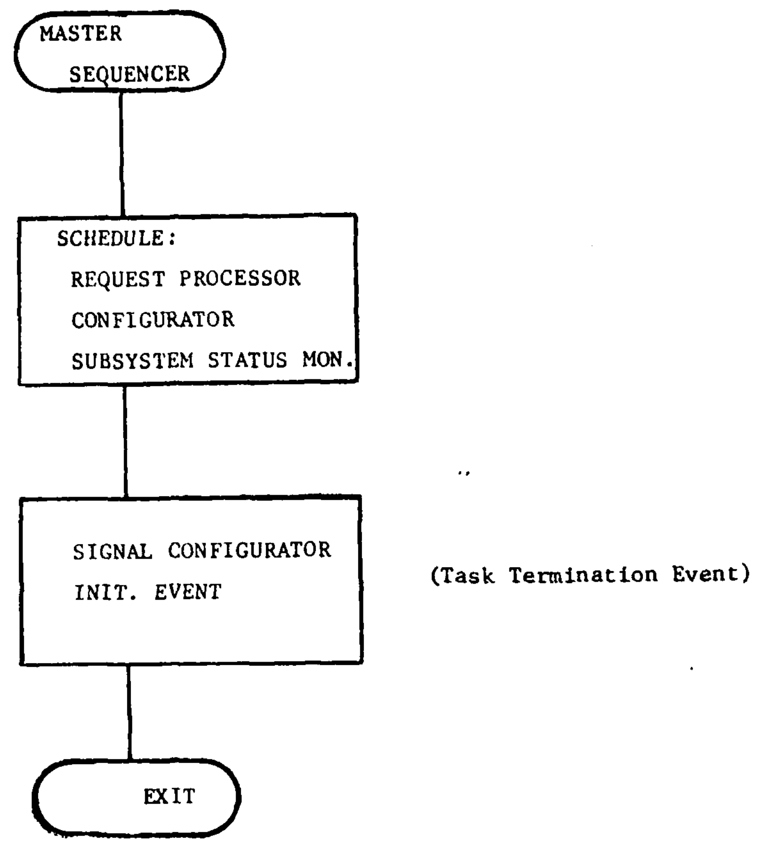

Figure 3 MASTER SEQUENCER

TABLE I - OUTPUTS FROM MASTER SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
Configurator		Initialization Event	3.2.1.3

3.2.1.2 Function 1.2 Request Processor

The Request Processor interprets pilot inputs from the MMK and the IMK. It determines the legality of the request; and if legal, 1) lights the green light on the depressed switch notifying the acceptance of the request and 2) signals the configurator to provide new OPS or Brute Force SPECS as requested. The computer requirements for this module are:

Memory Size	111	16 bit words
Throughput	0	ms/sec
Update rate	0	times/sec

3.2.1.2.1 Inputs

The inputs to the Request Processor shall be as specified in Table II.

3.2.1.2.2 Processing

The Request Processor shall perform the processing specified in Figure 4 . This processing

1) Pilot requests on the MMK. It establishes legality of the request based on the currently active OPS. If legal, the green light on the depressed button is lit and the configurator is signaled to provide the requested OPS.

2) Pilot requests on an IMK for a Brute Force SPEC. It establishes legality of the request based on the currently active OPS. If legal, the green light on the depressed button is lit and the configurator is signaled to provide the requested Brute Force SPEC.

TABLE II Inputs to the Request Processor

DATA NAME	SYMBOL	SOURCE	REFERENCE
MMK Input Indicator		MMK EQUIP	
IMK1 Brute Force Indicator		IMK1 Disp	
IMK2 Brute Force Indicator		IMK2 Disp	

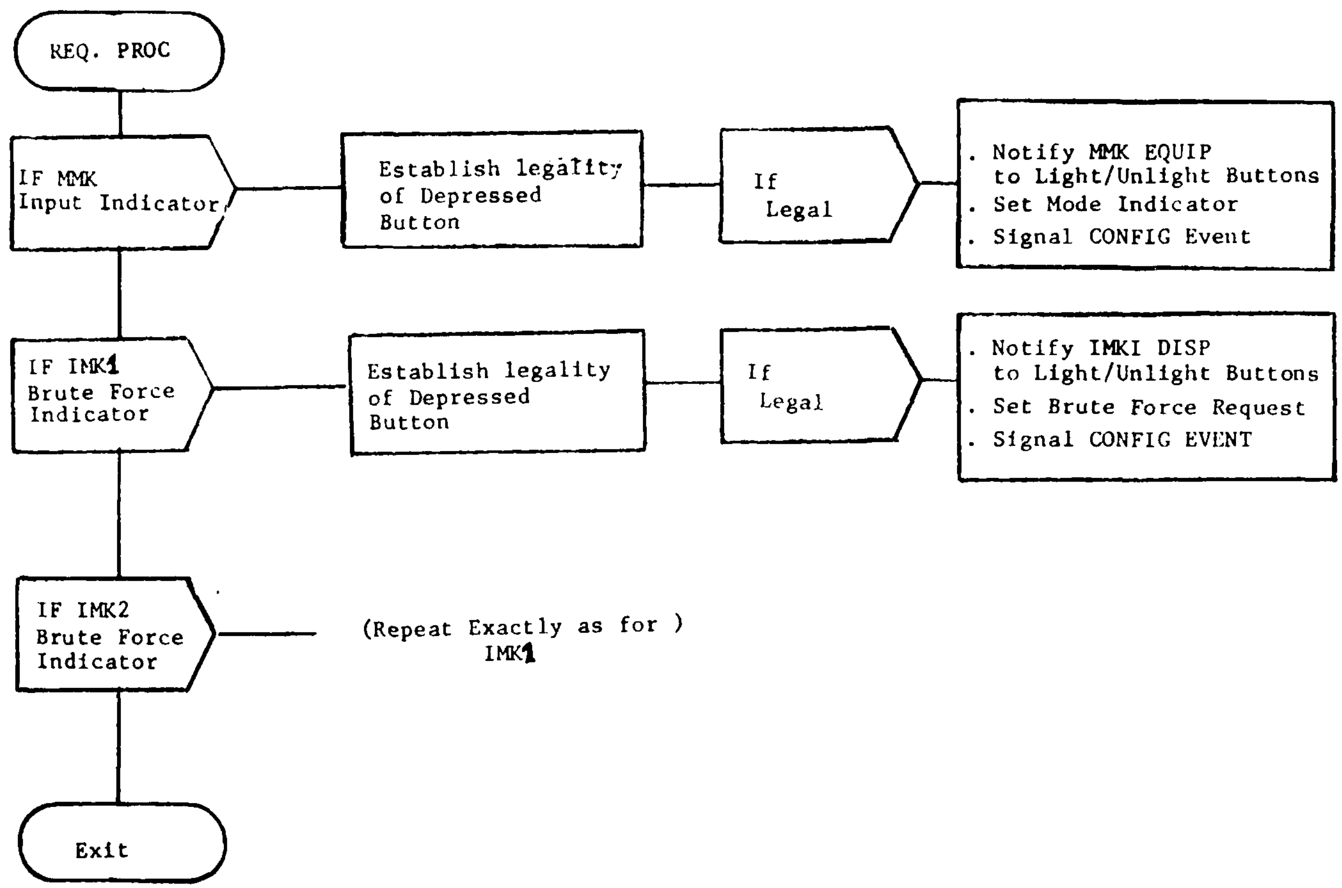

Figure 4 Request Processor

3.2.1.2.3 Outputs

The outputs from the Request Processor shall be as specified in Table III .

3.2.1.3 Function 1.3 - Subsystem Status Monitor

The Subsystem Status Monitor maintains the status of the avionic subsystems (core-element status are maintained within OFP-EHARS) by collecting error information from the EQUIP modules servicing the subsystems. It determines the severity and if significant activates the configurator to take appropriate actions. The computer requirements for this module are:

Memory Size	1239	16 bit words
Throughput	0	ms/sec
Update rate	0	times/sec

3.2.1.3.1 Inputs

The inputs to the Subsystem Status Monitor shall be as specified in Table IV .

3.2.1.3.2 Processing

The Subsystem Status Monitor shall perform the processing specified in Figure 5 . This processing includes:

1) A branch in the program flows for each subsystem.

2) For every branch, it calculates statistics for the particular error signaled by the EQUIP module. These error statistics are stored in a status table. If a statistic is determined to be significant, it is displayed to the operator. The operator makes the final decision

TABLE III OUTPUTS FROM THE REQUEST PROCESSOR

DATA NAME	SYMBOL	DESTINATION	REFERENCE
MMK Light		MMK Equip	
Configure Event		Configurator	
IMK1 Light		IMK1 Disp	
IMK2 Light		IMK2 Disp	
Mode Indicator		Configurator	
Brute Force Request		Configurator	

TABLE IV INPUTS TO THE SUBSYSTEM STATUS MONITOR

DATA NAME	SYMBOL	SOURCE	REFERENCE
INS Error Indicator (Includes Type of Error)			
OMEGA Error Indicator			
UHF #1 Error Indicator			
o			
o			
o			
Subsystem OFF Acknowledge			

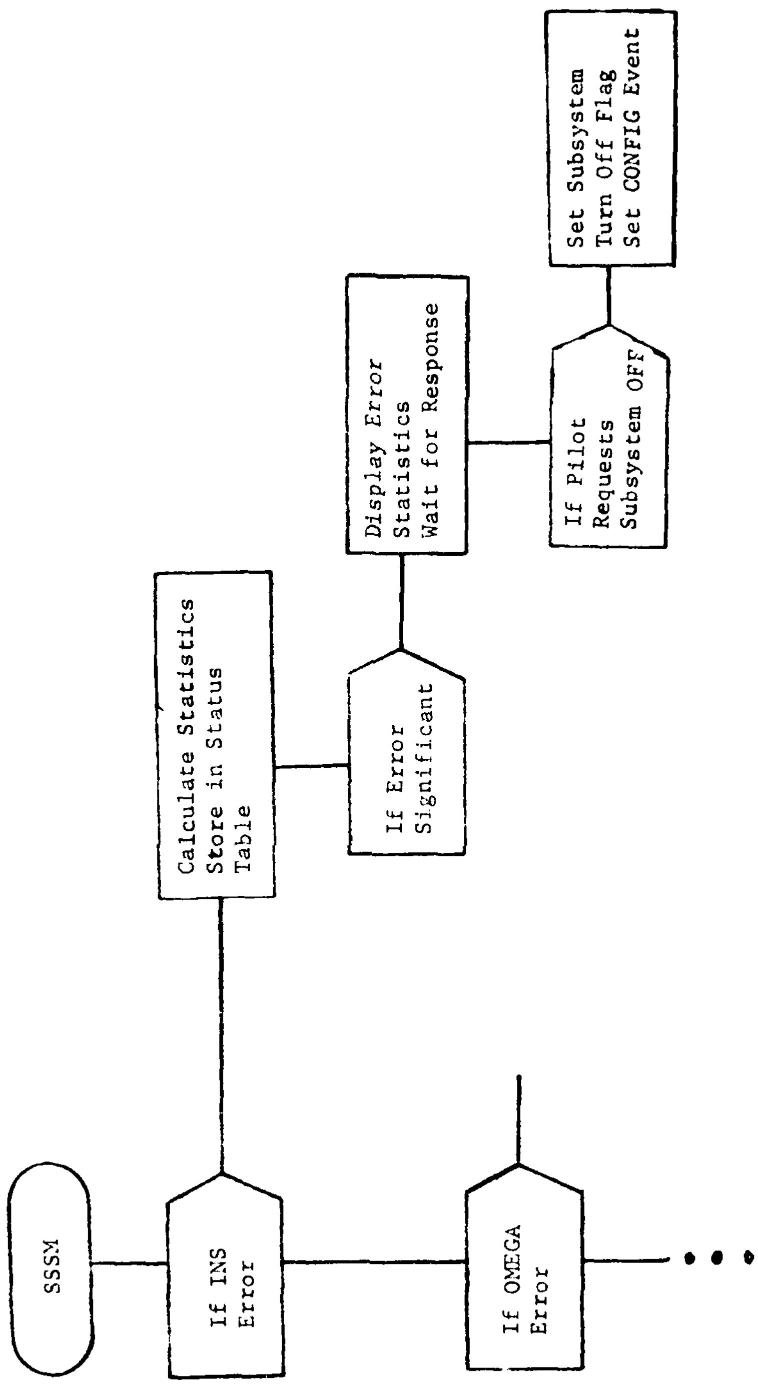

Figure 5 Subsystem Status Monitor

to determine whether the subsystem should be turned off. When the pilot requests the system to be turned off, the Subsystem Failure Flag is set and the Configurator is signaled to take appropriate action.

3.2.1.3.2 Outputs

The outputs from the Subsystem Status Monitor shall be as specified in Table V .

3.2.1.4 Function 1.4 - Configurator

The Configurator is activated whenever a new OPS or Brute Force SPEC is required or a subsystem shutdown is to be commanded because of failure determination. It sets up the needed lower level controller/calculator tasks. The computer requirements for this module are:

Memory Size	899	16 bit words
Throughput	0	ms/sec
Update rate	0	times/sec

3.2.1.4.1 Inputs

The inputs to the Configurator shall be as specified in Table VI.

3.2.1.4.2 Processing

The configurator shall perform the processing specified in Figure 6. . This processing includes:

1) Data initialization at startup as signaled by the Startup Flag set in the Master Sequencer. This data initialization is performed by setting the initiali-

TABLE V OUTPUTS FROM THE SUSBSYSTEM STATUS MONITOR

DATA NAME	SYMBOL	DESTINATION	REFERENCE
Error statistics		MPD Disp	
INS Off		INS EQUIP	
OMEGA Off		OMEGA EQUIP	
UHF #1 Off		UHF #1 EQUIP	
o			
o			
o			
Configure Event		Configurator	

TABLE VI INPUTS TO CONFIGURATOR

DATA NAME	SYMBOL	SOURCE	REFERENCE
Configurator Initialization Event		Master Sequencer	
Mode Indicator, Case (I) (Vector Valued indicating modes)		Request Processor	
Brute Force Request Indicator, Case (I) (Indicates Specifc Request)		Request Processor	
Subsystem Turnoff Indicator (Indicate Specific Subsystem)		Subsystem STatus Monitor	
Configure Event		Request Processor Subsystem Status Monitor	

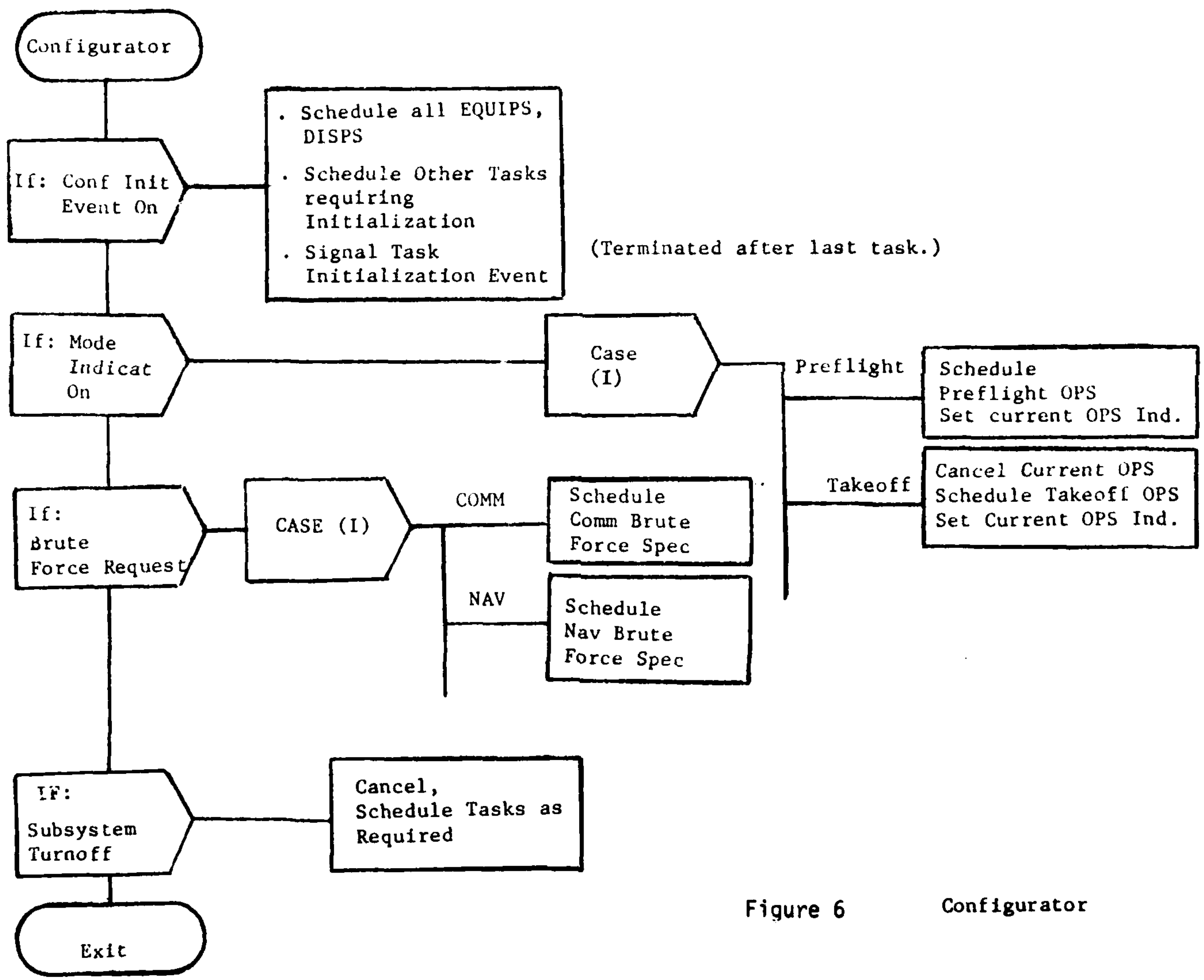

Figure 6 Configurator

zation flags in all the modules requiring initialization and scheduling these modules. Also, all the EQUIPs and DISPs are scheduled.

2) OPS activiation based on the Mode Flag set in the Request Processor. The currently active OPS is cancelled before scheduling the new OPS.

3) Brute Force SPEC activation based on the Brute Force Request flag set in the Request Processor.

4) Cancellation of tasks associated with a failed subsystem and invocation of preplanned back-up tasks. This action is based on the Subsystem Failure indicator set in the Subsystem Status Monitor.

3.2.1.4.3 Outputs

The outputs from the configurator shall be as specified in Table VII.

3.2.1.5 Mode Sequence Validity Checks SPEC

The Mode Sequence Validity Checks SPEC is scheduled asynchronously by the Request Processor. The SPEC performs legality checks on the inputs received from the MMK and provides the results to the Request Processor. The computer requirements for this module are:

Memory Size	101	16 bit words
Throughput.	0	ms/sec
Update rate	0	times/sec

TABLE VII OUTPUTS FROM CONFIGURATOR

TABLE NAME	SYMBOL	DESTINATION	REFERENCE
Task Initialization Event o		All Tasks requring initialization	

3.2.1.5.1 Inputs

The inputs to the Mode Sequence Validity Checks SPEC shall be as specified in Table VIII .

3.2.1.5.2 Processing

The Modes Sequence Validity Checks SPEC shall compare the current flight mode (Input 3.2.1.5.1.1) with the MMK requested mode (Input 3.2.1.5.1.2) The SPEC shall check for legal flight mode sequencing as specified by Table IX. If this check is failed the SPEC shall provide an indication to the Request Processor of validity failure (Output 3.2.1.5.3.1). If the check is passed, the SPEC shall check the weight on the landin g gear. If weight is on the landing gear only the Preflight, Takeoff/Climb, Approach/Land or Postflight OPS may be initiated. If weight is not on the landing gear only Takeoff/Climb, Cruise, Refuel, Air Drop, Descend, and Approach/Land may be initiated. Failure of the check shall result in an indication to the Request Processor of validity failure (Output 3.2.1.5.3.1). If all checks are successful, the Request Processor shall be notified of the validity of the MMK selection. The processing is summarized in Figure 7 .

3.2.1.5.3.3 Outputs

The outputs from the Mode Sequence Validity Checks SPEC shall be as specified in Table X .

3.2.2 Mission Management

Mission Management consists of controller modules which manage the processing, scheduling, and operator interfaces for each of the major operational flight modes - Preflight, Takeoff/Climb, Cruise, Refuel, Air Drop, Descend, Approach/Land, and Postflight. These controller modules are referred

TABLE VIII INPUTS TO THE MODE SEQUENCE VALIDITY CHECKS SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. FLAG INDICATING CURRENT OPERATIONAL SEQUENCER ACTIVE		REQUEST PROCESSOR	
2. INDICATION OF MMK SELECTED OPERATIONAL SEQUENCER		REQUEST PROCESSOR	
3. WEIGHT ON THE LANDING GEAR		AIR FRAME SPEC	

TABLE IX MODES TRANSITION VALIDITY MATRIX

NEW MODE / PRIOR MODE	PREFLIGHT	TAKEOFF/ CLIMB	CRUISE	REFUEL	AIR DROP	DESCEND	APPROACH/ LAND	POSTFLIGHT
PREFLIGHT		X						
TAKEOFF/ CLIMB	X		X	X	X	X	X	
CRUISE		X		X	X	X	X	
REFUEL		X	X		X	X	X	
AIR DROP		X	X	X		X	X	
DESCEND		X	X	X	X		X	
APPROACH/ LAND		X	X		X	X		X
POSTFLIGHT	X							

TABLE X OUTPUTS FROM THE MODE SEQUENCE VALIDITY CHECKS SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. VALIDITY FAILURE INDICATION FOR MMK SELECTION		REQUEST PROCESSOR	
2. VALIDITY SUCCESS INDICATION FOR MMK SELECTION		REQUEST PROCESSOR	

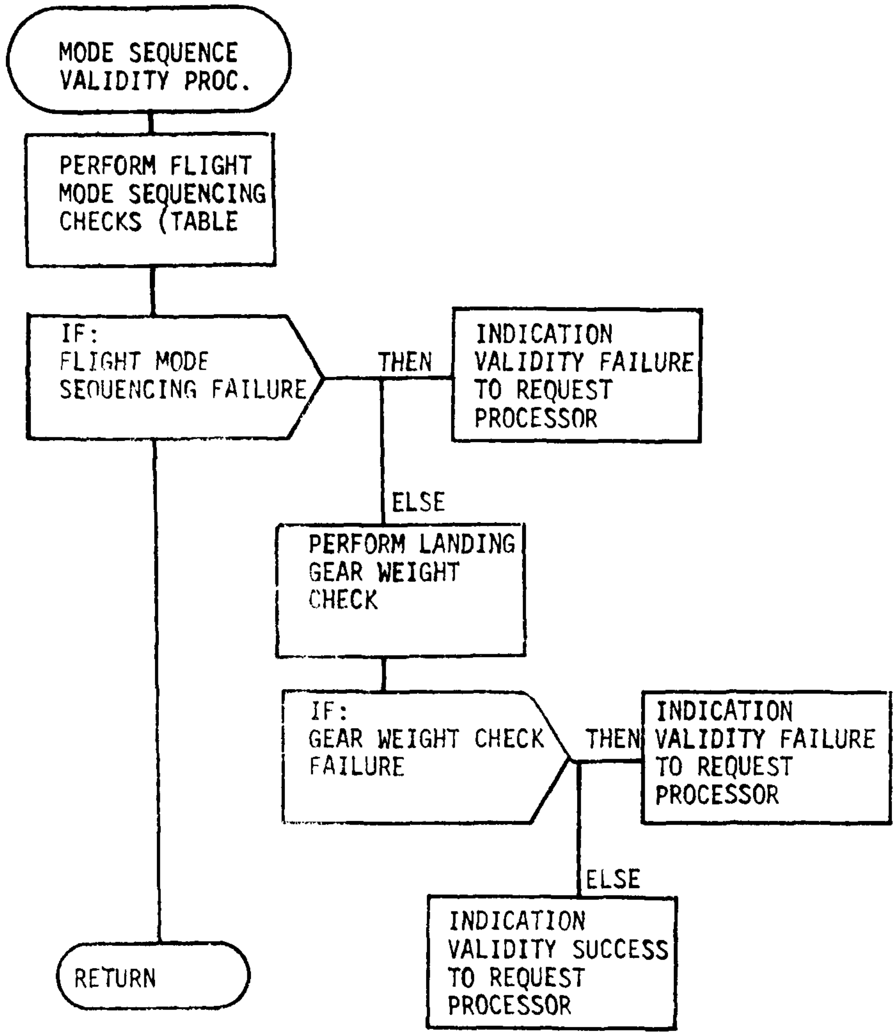

Figure 7 Mode Sequences Validity Checks Processing

to as Operational Sequencers (OPS). The OPS are initiated with pilot selection on the IMK of a particular operational flight mode. Major tasks of the OPS are scheduling of tasks continuing to be required from previous OPS, scheduling of new tasks, and processing associated with a checklist. The checklist provides a dual function. Through the checklist the crew is guided through mandatory sequences, though overrides are provided as appropriate. Secondly, through the checklist the crew makes option selections, confirms existing data and enters new data.

3.2.2.1 Function 2.1 - Preflight OPS

The Preflight Operational Sequencer controls processing during the preflight phase. During this phase the pilot interacts through a computer automated checklist which permits the pilot to initiate software processing, verify previously entered or default data, and input new data. The computer requirements for this module are:

Memory Size	482	16 bit words
Throughput	7.5	ms/sec
Update rate	4	times/sec

3.2.2.1 Inputs

The inputs for the Preflight OPS shall be as specified in Table XI .

3.2.2.12 Processing

The Preflight Operational Sequencer guides the pilots through an automated checklist displayed on the IMK. Through this checklist the pilot may initiate software processes, confirm previously entered data, and insert

TABLE XI INPUTS TO THE PRE-FLIGHT OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Indication weight of plane on landing gear		Air Frame SPEC	
2. Indication of checklist item on page which is selected (side key depressed)		IMK EQUIP	
3. Event indicating ENTER command received		DEK EQUIP	
4. Data from DEK		DEK EQUIP	

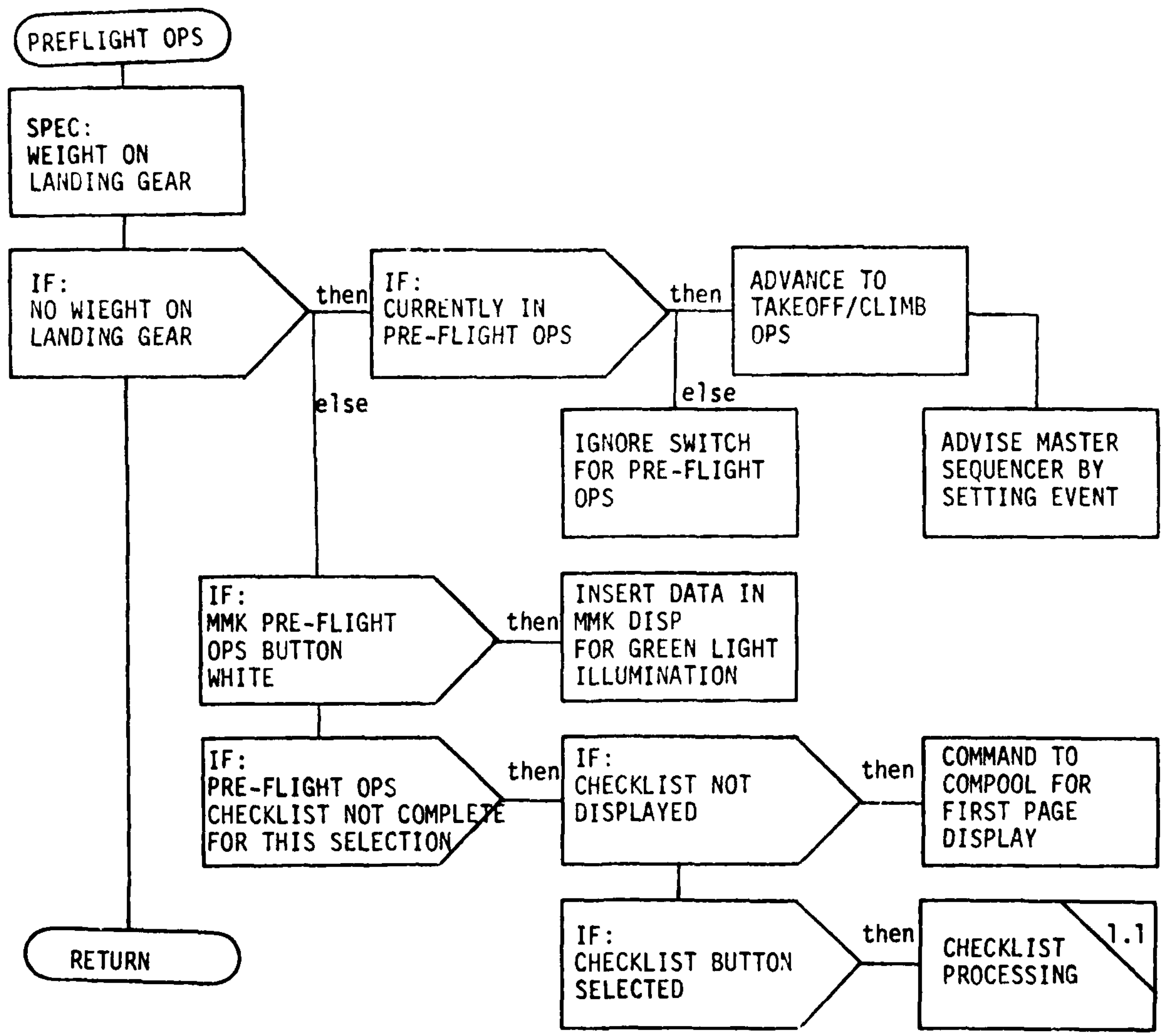

Figure 8 PRE-FLIGHT OPS PROCESSING

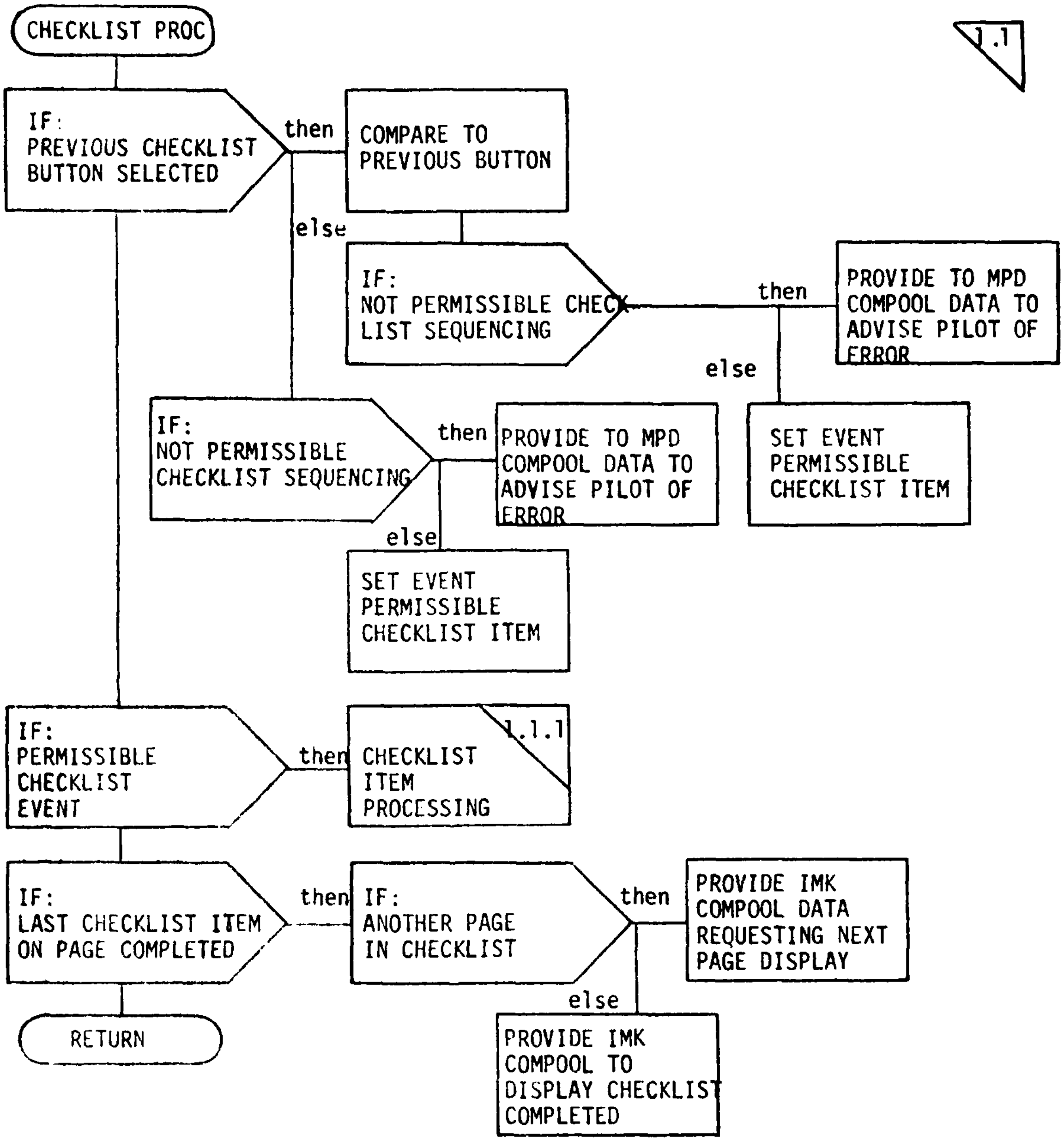

Figure 9 PRE-FLIGHT CHECKLIST PROCESSING

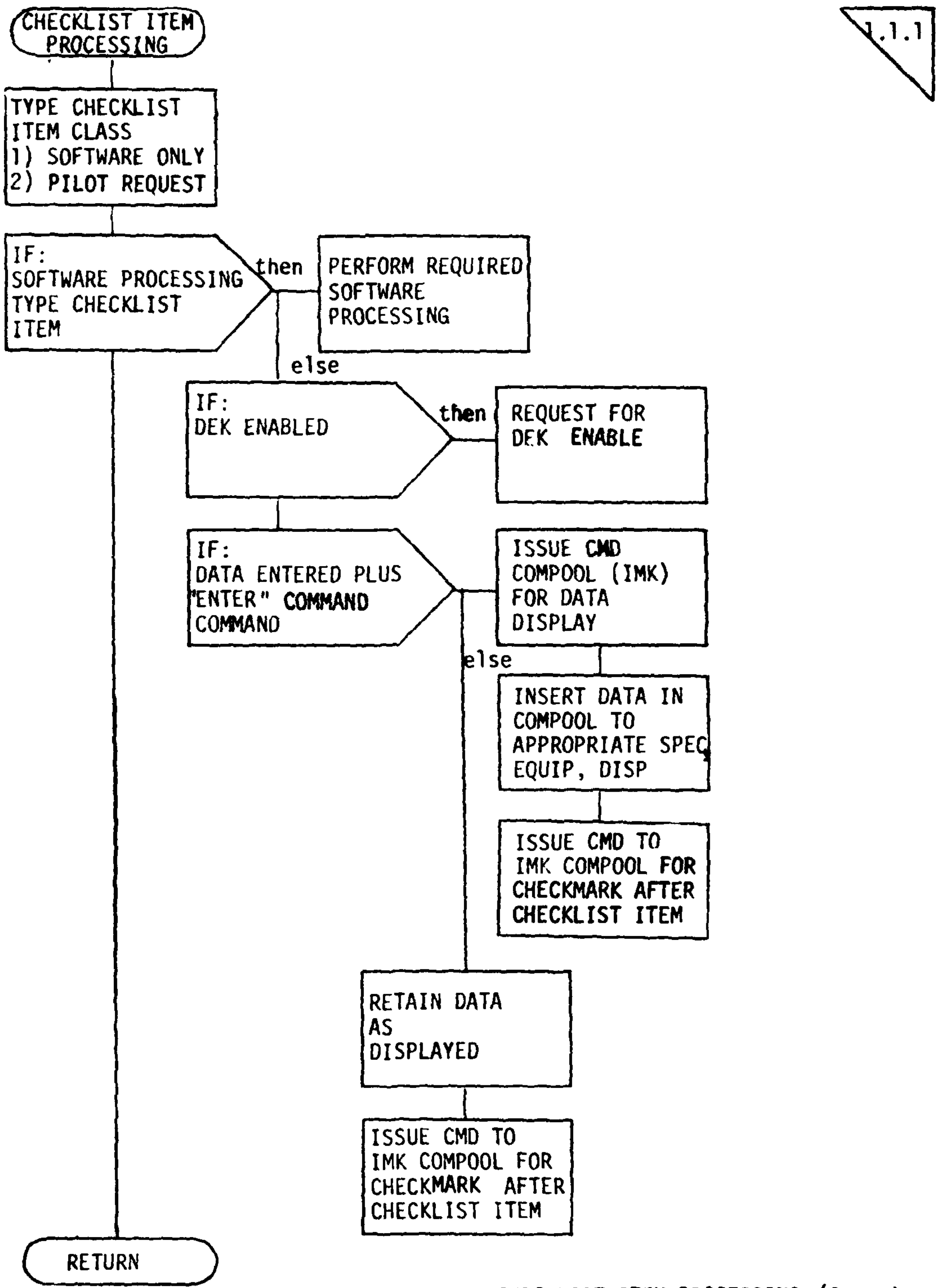

Figure 9 CHECKLIST ITEM PROCESSING (Cont.)

new data. The Preflight Operational Sequencer is scheduled by the Master Sequencer upon receipt of an indication through the Request Processor that the pilot has depressed the Preflight OPS MMK button. The Preflight OPS shall perform the processing specified in Figure 8 .

3.2.2.1.2.1 Preflight OPS

The Preflight OPS shall only be operable when the weight of the plane is on the landing gear. If the weight is not on the landing gear and the Preflight OPS was previously scheduled, the Preflight OPS shall terminate processing and set an event (Output 3.2.2.1.3.1) indicating the Takeoff/Climb OPS should be scheduled by the Configurator. When the Preflight OPS is first invoked and the weight is on the landing gear, the Preflight OPS shall cause the IMK to display the first page of the checklist (Output 3.2.2.1.3.3). This page shall be processed as specified in Section 3.2.2.1.2.2.

3.2.2.1.2.2 Checklist Processing

The Preflight OPS shall perform the checklist processing specified by Figure 9 . Checklist processing shall be composed of permissible checklist sequencing checks (Section 3.2.4.2.2.1), checklist item processing (Section 3.2.2.1.2.2.2), checklist page processing and checklist termination (Section 3.2.2.1.2.2.3).

3.2.2.1.2.2.1 Permissible Checklist Sequencing Checks

The Preflight OPS shall establish an event set which must be established in order to process a particular item in the checklist. The Preflight OPS shall ascertain that the selected checklist item must either be performed sequentially to others or in any order on the page. The OPS shall verify that the sequence is permissible. If the selected checklist item is not permissible the Preflight OPS shall provide an indication to the pilot (Output XII-4).

3.2.2.1.2.2.2 Checklist Item Processing

Checklist items are divided into two general categories, those requiring software processing only and those requiring pilot inputs, either to confirm data or to enter data. The checklist items (Input 3.2.2.1.1.2) shall be processed as specified in Figure . If the checklist item requires software processing only, the Preflight OPS shall provide for a check mark after the checklist item selected (Output 3.2.2.1.3.5). The Preflight OPS shall initiate and control the checklist item specified processing. It shall schedule the required SPEC, EQUP, and DISP (Output 3.2.2.1.3.6). For those checklist items requiring pilot response, the Preflight OPS shall provide the data value to be confirmed along with the checklist item name. If no data value is stored and there exists no default data value, then a blank shall be displayed with the checklist item name. Preflight OPS shall enable the DEK for pilot input (Output 3.2.2.1.3.7). If only the ENTER command (Input 3.2.2.1.1.3) is received, the Preflight OPS shall process the checklist item data as confirmed by the pilot. The OPS shall provide for a check mark after the item (Output 3.2.2.1.3.5). If data (Input 3.2.2.1.1.4) is received with the ENTER command, the Preflight OPS shall update the appropriate compools (Output 3.2.2.1.3.8) shall update the checklist displayed data value (Output 3.2.2.1.3.9), and shall provide a check mark after that checklis+ (Output 3.2.2.1.3.5).

3.2.2.1.2.2.3 Checklist Page Processing and Checklist Termination

The Preflight OPS shall cause the next page of the checklist (Output 3.2.2.3.3) to be displayed when either the last item of the checklist on a page has been completed or when the checklist item processing specifies another page (Input 3.2.2.1.1.2). If all pages of the checklist have been completed, the Preflight OPS shall cause a display on the IMK of ready for takeoff (Output 3.2.2.1.3.10).

3.2.2.1.3 Outputs

The outputs for the Preflight OPS shall be as specified in Table XII .

3.2.2.2 Function 2.2 - TaKeoff/Climb OPS

The Takeoff/Climb Operational Sequencer provides options selection, instrument control, steering data, and displays during the takeoff and climb phase. The Takeoff/Climb OPS interfaces with the pilot through a checklist. The Takeoff/Climb OPS is initiated either by selection on the MMK or by automatic sequencing from the Preflight OPS when weight is determined off the landing gear. The computer requirements for this module are:

Memory Size	471	16 bit words
Throughput	7.3	ms/sec
Update rate	4	times/sec

3.2.2.2.1 Inputs

The inputs to the Takeoff/Climb OPS shall be as specified in Table XIII .

TABLE XII OUTPUTS FROM THE PREFLIGHT OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Indication (Event) to schedule Takeoff/Climb OPS		Master Sequencer	
2. Indication to illuminate MMK Preflight OPS key green		MMK EQUIP	
3. Indication to display next page of checklist		IMK DISP	
4. Indication to provide MPD printout of unacceptable checklist item selection		MPD DISP	
5. Indication to provide checkmark after checklist item		IMK DISP	
6. Indications for task scheduling		Executive	
7. DEK Enable		DEK EQUIP	

TABLE XIII INPUTS TO THE TAKEOFF/CLIMB OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Takeoff/Climb OPS key depressed		MMK EQUIP	
2. Event indicating plane weight not on landing gear.		Air Frame SPEC	
3. Minimum liftoff speed		Navigation Filter Update SPEC	
4. Indication of checklist item on page which is selected (side key depressed)		IMK DISP	
5. Event indicating ENTER command received		DEK EQUIP	
6. Data from DEK		DEK EQUIP	
7. Waypoint data		DEK EQUIP	
8. Heading data		DEK EQUIP	
9. Stationkeeping function desired		IMK DISP	

TABLE XIII INPUTS TO THE TAKEOFF/CLIMB OPERATIONAL SEQUENCER (Cont'd)

DATA NAME	SYMBOL	SOURCE	REFERENCE
10. SKE HSD 2nd HUD displays requested		IMK DISP	
11. Items pertaining to thrust as requested		IMK DISP	
12. Antiskid on/off		Air Frame Sensor	
13. Flap Position		Air Frame Sensor	
14. TACAN channel selection		IMK DISP	
15. Altimeter selection (radar or pressure display)		IMK DISP	
16. IFF selection		IMK DISP	
17. IRD&W selection		IMK DISP	
18. IAS, TAS, ground speed on Mach display request		IMK DISP	
19. Enable WX data for display on HSD		IMK DISP	
20. Radio unit and channel change		IMK DISP MEK EQUIP	

3.2.2.2.2 Processing

The Takeoff/Climb OPS can be entered either manually or automatically under conditions specified in Section 3.2.2.2.2.1. The configurator cancels the OPS when the events specified in Section 3.2.2.2.2.2 are true. The pilot interfaces with the OPS through a checklist (Section 3.2.2.2.2.3). The Takeoff/Climb OPS controls tasks (Section 3.2.2.2.2.4) required during the takeoff and climb phases of the missions and modifies those tasks as requested by the crew.

3.2.2.2.2.1 Takeoff/Climb OPS Initiation

The Takeoff/Climb OPS is initiated by either selection by the pilot through the MMK (Input 3.2.2.2.1.1) or by the setting of an event (Input 3.2.2.2.1.2) by the Air FRame Sensor SPEC which indicates the plane's weight is no longer on the landing gear. The Takeoff/Climb OPS shall consist of two parts under normal circumstances sequentially following each other. These shall be Takeoff and Climb. When the OPS is selected through the MMK, the checklist, option selections, and displays associated with takeoff shall be initiated. The progression to the Climb phase of the OPS shall be performed automatically upon the setting of the events a) weight off the landing gear (Input 3.2.2.2.1.2), b) minimum liftoff speed obtained (Input 3.2.2.2.1.3), and c) currently in the Takeoff mode. The progression to the climb phase shall occur automatically directly from the Preflight OPS when the events a) weight off land gear (Input 3.2.2.2.1.2) and b) currently in Preflight OPS processing are true. In this case the Takeoff mode shall be bypassed. When the OPS is initiated automatically, the Takeoff/Climb OPS shall cause the light to be illuminated green (Output 3.2.2.2.3.1).

3.2.2.2.2.2 Takeoff/Climb OPS Cancellation

The Takeoff/Climb OPS is cancelled when any of the following are true:

a. If currently in the Takeoff mode and Preflight OPS is selected on the MMK;

b. If currently in the Climb mode and the Cruise OPS is selected;

c. If currently in the Climb mode and the Refuel OPS is selected;

d. If currently in the Climb mode and the Air Drop OPS is selected;

e. If currently in the Climb mode and the Descent OPS is selected;

f. If currently in the Climb mode, weight is detected on the landing gear and the Approach/Landing OPS is automatically entered.

3.2.2.2.2.3 Checklist Processing

The Takeoff/Climb OPS shall interface with the pilot through a checklist. The checklist items shall serve to initiate software processing, verify stored data, enter new data, or remind the pilot of actions required. Checklist processing shall be performed sequentially on a page or in non-specified order. Checklist processing shall be as specified for the Preflight checklist (Inputs 3.2.2.2.1.4,5,6 and Outputs 3.2.2.2.3.2,3,4,5,6,7).

3.2.2.2.2.4 Takeoff/Climb OPS Task Control

The Takeoff/Climb OPS is the controller of a task tree. Controlled task and pilot inputs and system outputs are described below.

3.2.2.2.2.4.1 Navigation

The Takeoff/Climb OPS shall schedule the Navigation Controller SPEC. Displays of Navigation data on the HSD and HUD (Output 3.2.2.2.3.8,9) shall be provided.

3.2.2.2.2.4.2 Guidance

The Takeoff/Climb OPS shall schedule the Guidance Controller/Autopilot SPEC which in turn controls the Steering and Waypoint Steering SPECS. The Takeoff/Climb OPS checklist shall provide for the verification, modification, or entry of stored waypoint data (Input 3.2.2.2.1.7 and Output 3.2.2.2.3.10). The OPS shall provide for the commanding of a new heading (Input 3.2.2.2.1.8 and Output 3.2.2.2.3.11).

3.2.2.2.2.4.3 Communications

The Takeoff/Climb OPS checklist shall provide options for communication channel change for radio sets, UHF1, UHF2, VHF/AM, VHF/FM, and HF (Input 3.2.2.2.1.20 and Output 3.2.2.2.3.12).

3.2.2.2.2.4.4 Stationkeeping

The Takeoff/Climb OPS shall provide for stationkeeping during the Climb mode (Input 3.2.2.2.1.9 and Output 3.2.2.2.3.13). This shall include the SKE display on the HSD and HUD displays (Input 3.2.2.2.10 and Output 3.2.2.2.3.14).

3.2.2.2.2.4.5 Critical Velocities

The Takeoff/Climb OPS shall include in the checklist items on critical velocities during takeoff (Input 3.2.2.2.1.11). Displays of velocity data shall be depicted on HUD and MPD (Output 3.2.2.2.3.15).

3.2.2.2.2.4.6 Craft Takeoff Checks

The Takeoff/Climb OPS shall provide checks for antiskid on/off, gear up, and flaps positioned (Inputs 3.2.2.2.1.2,12,13). Data shall be displayed on the MPD's. (Outputs 3.2.2.2.3.16,17,18).

3.2.2.2.2.4.7 Flight Options Selection

The Takeoff/Climb OPS shall enable the pilot to change TACAN channels (Input 3.2.2.2.1,14 and Output 3.2.2.2.3,19), to choose between display of the radar altimeter or pressure altimeter data (Input 3.2.2.2.1,15 and Output 3.2.2.2.3,20), to set the IFF and IRD&W (Inputs 3.2.2.2.1.16,17 and Outputs 3.2.2.2.3.21,22), and to select/deselect the display of IAS, TAS, ground speed or Mach (Input 3.2.2.2.1.18 and Output 3.2.2.2.3.23). The OPS shall enable the display of WX data on the HSD (Input 3.2.2.2.1.19 and Output 3.2.2.2.3.24).

3.2.2.2.2.4.8 Air Frame Monitor

The Takeoff/Climb OPS shall schedule the Air Frame SPEC and center of gravity SPEC which in turn monitors and controls displays for center of gravity, engines, electrical power, cargo, and hatches in addition to those referenced in Section 3.2.2.2.2.4.6.

3.2.2.2.3 Outputs

The outputs to the Takeoff/Climb OPS shall be as specified in Table XIV

3.2.2.3 Function 2.3 Cruise OPS

The Cruise Operational Sequencer provide options selection, instrument control, steering data, and displays during the cruise phase of the mission.

TABLE XIV OUTPUTS FROM THE TAKEOFF/CLIMB OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Indication to illuminate MMK Takeoff/Climb OPS Key green		MMK EQUIP	
2. Indication to display next page of checklist		IMK DISP	
3. Indication to provide MPD printout of unacceptable checklist item selection		MPD EQUIP	
4. Indication to provide checkmark after checklist item		IMK DISP	
5. DEK Enable		DEK EQUIP	
6. Pilot specified data for checklist item		SPEC, EQUIP, and or DISP compools as required	
7. Pilot specified data formatted for IMK display		IMK DISP	
8. Navigation data for HUD display		HUD DISP	
9. Navigation data for HSD display		HSD DISP	

TABLE XIV OUTPUTS FROM THE TAKEOFF/CLIMB OPERATIONAL SEQUENCER (Cont'd)

DATA NAME	SYMBOL	DESTINATION	REFERENCE
10. Waypoint data		W/P Steering, Steering SPEC	
11. Heading data		Steering SPEC	
12. Communication channel selected		Radio EQUIP referenced	
13. Event to initiate Stationkeeping SPEC Processing		Executive	
14. Indication to display Stationkeeping data on HSD and HUD		Stationkeeping SPEC	
15. Indication to compile and display thrust data on HUD and MPG		FCS EQUIP, Takeoff Speed Requirements 3.2.9.3,3.2.2.11,12 SPEC, Landing Speed Reqmts.SPEC	
16. Indication to display anti-skid on/off		Air Frame SPEC	
17. Indication to display gear up		Air Frame SPEC	
18. Indication to display flap position		Air Frame SPEC	
19. Channel selection for TACAN		TACAN EQUIP	

TABLE XIV - OUTPUTS FROM THE TAKEOFF/CLIMB OPERATIONAL SEQUENCER (Cont'd)

DATA NAME	SYMBOL	DESTINATION	REFERENCE
20. Altimeter display		HUD EQUIP	
21 ON/OFF IFF		IFF EQUIP	
22. ON/OFF IRD&W		IRD&W EQUIP	
23. Display IAS, TAS, ground speed, or Mach		FCS EQUIP	
24. Display WX data on HSD		WX EQUIP	

The Cruise OPS provides control over mission functions that may be desired when entering the cruise phase. Subsequent changes during cruise could be accommodated either by again calling up different pages of the Cruise OPS checklist or by the Brute Force Specialist Functions. The Cruise OPS is initiated by selection on the MMK. The computer requirements for this module are:

Memory Size	492	16 bit words
Throughput	7.7	ms/sec
Update rate	4	times/sec

3.2.2.3.1 Inputs

The inputs to the Cruise Operational Sequencer shall be as specified in Table XV .

3.2.2.3.2 Processing

The Cruise OPS shall act as controller to tasks required during the cruise phase of the mission. It is initiated (Section 3.2.2.3.2.1) and cancelled (Section 3.2.2.3.2.2) by the Configurator. The OPS shall control checklist processing (Section 3.2.2.3.2.3) and subsystem functions (Section 3.2.2.3.2.4) required during cruise.

3.2.2.3.2.1 Cruise OPS Initiation

The Cruise OPS is initiated by selection by the pilot through the MMK. The Cruise OPS is not initiated if the plane's weight is on the landing gear. (Input 3.2.2.3.1.2). The light for the Cruise OPS MMK Key is illuminated green to indicate acceptance of the Cruise OPS request. The selection of the Cruise OPS shall cause the Cruise OPS checklist to be displayed on the IMK (Output 3.2.2.3.3.2). Option selections and displays associated with cruise shall become available.

TABLE XV INPUTS TO THE CRUISE OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. ESM on/off		IMK DISP	
2. Plane weight on landing gear		Air Frame Sensor EQUIP	
3. Indication of checklist item on page which is selected (side key depressed)			
4. Event indicating ENTER command received		DEK EQUIP	
5. Data from DEK		DEK EQUIP	
6. Waypoint data		DEK EQUIP	
7. Autopilot data a. Heading b. Attitude c. Altitude		DEK EQUIP	
8. Autopilot seleet/deselect		DEK EQUIP	
9. Autopilot display selections a. HSD b. HUD c. MPD		IMK DISP	

TABLE XV INPUTS TO THE CRUISE OPERATIONAL SEQUENCER (Cont'd)

DATA NAME	SYMBOL	SOURCE	REFERENCE
10. Channel selection a. UHF1 b. UHF2 c. VHF/AM d. VHF/FM e. HF		IMK DISP DEK EQUIP	
11. Indication to select Stationkeeping		IMK DISP	
12. IFF on/off		IMK DISP	
13. IRD&W on/off		IMK DISP	
14. Indication to enable (secure message) (transmission)		IMK DISP	
15. TACAN channel selection		IMK DISP DEK EQUIP	
16. Altimeter reading displayed (pressure or radar)		IMK DISP DEK EQUIP	
17. Velocity display selection (IAS, TAS, ground speed or MACH number)		IMK DISP DEK EQUIP	
18. Enable WX data display on HSD		IMK DISP	
19. ESM on/off		IMK DISP	

3.2.2.3.2.2 Cruise OPS cancellation

The Cruise OPS is cancelled by the Configurator by selection on the MMK of the Takeoff/Climb, Refuel, Air Drop, Descend, and Approach/Land OPS. If weight is detected on the landing gear (Input 3.2.2.3.1.2), when in the Cruise OPS, the OPS is cancelled and Approach/Land scheduled by the Configurator.

3.2.2.3.2.3 Checklist Processing

The Cruise OPS shall interface with the pilot through a checklist on theIMK. The checklist items shall serve to initiate software processing, verify stored data, enter new data, or remind the pilot of actions required. Checklist processing shall be performed either item by item sequentially through a page or in non-specified order. Checklist processing shall be performed by the Cruise OPS similar to that specified for the Preflight OPS. (Inputs 3.2.2.3.1.3-5 and Output 3.2.2.3.3.2-8).

3.2.2.3.2.4 Cruise OPS Task Control

The Cruise OPS shall perform the control functions for the tasks described in the following sections.

3.2.2.3.2.4.1 Navigation

The cruise OPS shall schedule the Navigation Controller SPEC. Displays of navigation data for the cruise phase of the mission shall be provided on the HSD and HUD (Output 3.2.2.3.3.9,10). Through the checklist (Input 3.2.2.3.1.3) the pilot shall be able to enter navigation updates (Output 3.2.2.3.3.11).

3.2.2.3.2.4.2 Guidance

The Cruise OPS shall schedule the Guidance/Autopilot Controller SPEC which controls the Steering and Air Data SPECS. Through selection of an item on the checklist (Input 3.2.2.3.1.3), the Cruise OPS shall provide for the selection of which waypoint (Output 3.2.2.3.3.12), the Steering SPEC is to acquire. The Cruise OPS shall permit the change of waypoint data (Input 3.2.2.3.1.7 and Output 3.2.2.3.3.13). The Cruise OPS shall provide for input of new heading, attitude, altitude data for the autopilot (Input 3.2.2.3.1.7 and Output 3.2.2.3.3.14). The pilot shall be able to select or deselect the autopilot (Input 3.2.2.3.1.8, Output 3.2.2.3.3.15) and to modify the HSD, HUD, and MPD displays accordingly (Inputs 3.2.2.3.1.9, Output 3.2.2.3.3.16).

3.2.2.3.2.4 Communication

The Cruise OPS shall provide through the checklist the option to change channels for each of UHF1, UHF2, VHF/AM, VHF/FM, and HF radio sets (Input 3.2.2.3.1.10 and Output 3.2.2.3.3.17).

3.2.2.3.2.5 Stationkeeping

The Cruise OPS shall provide for either fly alone or stationkeeping (Input 3.2.2.3.1.11 and Output 3.2.2.3.3.18). When using SKE the Cruise OPS shall provide the SKE displays (Output 3.2.2.3.1.19) on the HSD and the HUD.

3.2.2.3.2.6 IFF and IRD&W

The Cruise OPS shall enable, upon pilot request (Inputs 3.2.2.3.1.1.12,13) the ECM, IFF and/or the IRD&W subsystems (Outputs 3.2.2.3.3.20,21).

3.2.2.3.2.7 Air Frame Monitor

The Cruise OPS shall schedule the Air Frame SPEC to monitor and control displays for center of gravity, engines, electrical power, cargo, hatches, gear, and flaps.

3.2.2.3.2.8 Miscellaneous Flight Option Selections

The Cruise OPS shall provide the capability through the checklist (Input 3.2.2.3.1.14) to enable secured message transmission (Output 3.2.2.3.3.22). This capability is also available through the communication Brute Force SPEC. The OPS shall also provide the capability to change TACAN channels. (Input 3.2.2.3.1.15, Output 3.2.2.3.3.23). The pilot shall be able to specify (Input 3.2.2.3.1.16 which altimeter rading (pressure or radar) is to be displayed (Output 3.2.2.3.3.24). The velocity display for either IAS, TAS, ground speed or Mach number shall be subject to pilot specification (Input 3.2.2.3.1.17 and Output 3.2.2.3.3.25). The OPS shall enable the display on the HSD of WX data (Input 3.2.2.3.1.18, Output 3.2.2.3.3.26).

3.2.2.3.3 Outputs

The outputs from the Cruise Operational Sequencer shall be as specified in Table XVI .

3.2.2.4 Function 2.4 Refuel OPS

The Refuel Operational Sequencer provides option selections, displays, and pilot checklist guides prior to and during refueling operations. The computer requirements for this module are:

Memory Size	432	16 bit words
Throughput	7.5	ms/sec
Update rate	4	times/sec

TABLE XVI OUTPUTS FROM THE CRUISE OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Not used			
2. Indication to display next page of Cruise OPS display		IMK DISP	
3. Indication to provide MPD printout of unacceptable checklist item selection		MPD DISP	
4. Indication to provide check mark after checklist item		IMK DISP	
5. Indications for task scheduling		Executive	
6. DEK Enable		DEK EQUIP	
7. Pilot specified data for for checklist item		DEK EQUIP	
8. Pilot specified data formatted for IMK display		IMK DISP	
9. Navigation display for Cruise phase for HSD		HSD DISP	

TABLE XVI OUTPUTS FROM THE CRUISE OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	DESTINATION	REFERENCE
10. Navigation display for cruise phase for HUD		HUD DISP	
11. Navigation update data		Navigation Filter Update SPEC	
12. Waypoint selection		Steering SPEC	
13. Waypoint data		Steering SPEC	
14. Heading, attitude, and altitude data		Guidance/Autopilot Controller SPEC	
15. Autopilot select/deselect		Guidance SPEC	
16. Autopilot display selections a. HSD b. HUD c. MPD		Guidance/Autopilot Controller SPEC	
17. Channel selection a. UHF 1 b. UHF 2 c. VHF/AM d. VHF/FM e. HF		UHF 1 SPEC UHF 2 SPEC VHF/AM SPEC VHF/FM SPEC HF SPEC	

TABLE XVI OUTPUTS FROM THE CRUISE OPERATIONAL SEQUENCER (Cont'd)

DATA NAME	SYMBOL	DESTINATION	REFERENCE
18. Indication to enable Station Keeping		Guidance SPEC	
19. SKE Display selection on HSD and HUD		SKE SPEC	
20. IFF on/off		IFF EQUIP	
21. IRD&W on/off		IRD&W EQUIP	
22. Secure Data Unit on/off		Secure Data Unit EQUIP Radio Unit EQUIPs	
23. TACAN channel selection		TACAN EQUIP	
24. Altimeter reading displayed (pressure or radar)		Air Data SPEC	
25. Velocity display selection (IAS, TAS, ground speed, or MACH number)		Air Data SPEC	
26. Display WX data on HSD		RADAR SPEC	
27. ESM on/off		ESM EQUIP	

3.2.2.4.1 Inputs

The inputs to the Refuel Operational Sequencer shall be as specified in Table XVII .

3.2.2.4.2 Processing

The Refuel OPS shall control and schedule tasks required during the refuel phase of the mission. The Refuel OPS shall be requested by pilot depression of the MMK Key. When the Refuel OPS has been selected, the MMK Key Light shall be illuminated green (Output 3.2.2.4.3.1). The OPS is scheduled and cancelled (Section 3.2.2.4.2.1) by the Configurator. The unique operation and checks are accessed through the Refuel OPS checklist (Section 3.2.2.4.2.2). The Refuel OPS schedules controller and calculator tasks to accomplish the refueling mission (Section 3.2.2.4.2.3).

3.2.2.4.2.1 Refuel OPS Initiation and Cancellation

The Refuel OPS is scheduled by the Configurator when selected by the pilot through the Refuel OPS Key on the MMK. It shall be permissible to enter the Refuel OPS from the Takeoff/Climb, Cruise, Air Drop, or Descend OPS. The Refuel OPS shall not be entered from the Takeoff/Climb OPS if the plane's weight is on the landing gear.

3.2.2.4.2.2 Checklist Processing

Unique tasks and pilot guidance, as well as routine option selections shall be provided by the Refuel OPS checklist. Checklist processing (Inputs 3.2.2.4.1.1.3, 3.2.2.4.1.4, Output 3.2.2.4.3.8). The checklist shall provide aids for target acquisition. Through the checklist the pilot shall be able to change channels on the communications equipment (Input 3.2.2.4.1.5, Output 3.2.2.4.3.9). The checklist shall enable the pilot to turn the Auto-

TABLE XVII INPUTS TO THE REFUEL OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Indication of checklist item on page which is selected (side key depressed)		IMK EQUIP	
2. Indication of ENTER command received		DEK EQUIP	
3. Data from DEK		DEK EQUIP	
4. Request to display radar detected location of tanker		IMK DISP	
5. Channel selection for indicated communication equipment		IMK DISP	
a. HF			
b. VHF/AM			
c. VHF/FM			
d. UHF 1			
e. UHF 2			
6. Autopilot on/off		IMK DISP	

TABLE XVII INPUTS TO THE REFUEL OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	SOURCE	REFERENCE
7. Stationkeeping on/off		IMK DISP	
8. Navigation update data		IMK DISP	
		DEK EQUIP	
9. Stationkeeping on/off		IMK DISP	

pilot off (Input 3.2.2.4.1.6, Output 3.2.2.4.3.10) and to adjust for station-keeping (normally off during refueling operation) (Input 3.2.2.4.1.7), Output 3.2.2.4.3.11). The checklist shall caution the pilot to set the speed brake on (Output 3.2.2.4.1.12a) to monitor the radar beacon (Output 3.2.2.4.1.12b), to monitor the flaps (Output 3.2.2.4.3.12c) and to monitor current position, velocity, heading, altitude, pitch, bank, yaw, and angle-of-attack (Output 3.2.2.4.3.12d). Prior to refueling the pilot shall be alerted to adjust valves and intertank connections (Output 3.2.2.4.3.12e). During refueling operation the pilot shall be cautioned to monitor fuel pressure and tank loadings (Outputs 3.2.2.4.3.12f, g). Finally, refueling completion shall result in checklist cautions for refuel disconnect (Output 3.2.2.4.3.12h), and refueling door closed (Output 3.2.2.4.3.12i).

3.2.2.4.2.3 Refuel OPS Task Control

The Refuel OPS shall perform the control functions for the tasks delineated below.

3.2.2.4.2.3.1 Navigation

The Refuel OPS shall schedule the Navigation Controller SPEC. Displays of navigation data for the refuel phase of the mission shall be provided on the HSD and HUD (Output 3.2.2.4.3.13). Through the checklist (Input 3.2.2.4.1.8) the pilot shall be able to enter navigation updates (Output 3.2.2.4.3.8).

3.2.2.4.2.3.2 Guidance

The Refuel OPS shall schedule the Guidance SPEC which controls the Steering, and Air Data SPECs. Through the checklist the pilot shall be able to deselect Autopilot for refueling operations. Tanker acquisition is accomplished with the aid of steering displays.

3.2.2.4.3 Outputs

The outputs for the Refuel Operational Sequencer shall be as specified in Table XVIII.

3.2.2.5 Function 2.5 Air Drop OPS

The Air Drop Operational Sequencer provides calculation aids, steering data, option selections, and displays for air drop operations. An additional aid is provided in the form of a checklist. The Air Drop Operational Sequencer is initiated by depression of the Air Drop Key on the MMK. The computer requirements for this module are:

Memory Size	559	16 bit words
Throughput	10.0	ms/sec
Update rate	4	times/sec

3.2.2.5.1 Inputs

The inputs for the Air Drop Operational Sequencer shall be as specified in Table XIX.

3.2.2.5.2 Processing

The Air Drop OPS shall provide for pilot verification or specification of air drop type and characteristics (Section 3.2.2.5.2.1). The OPS shall schedule the SPECS performing functions unique to Air Drop (Sections 3.2.2.5.2.2, 3, 4, 5, 6) and those which are flight general (Section 3.2.2.5.2.3, 7). The Air Drop OPS shall provide operation selection and flight guidance through an automated checklist (Section 3.2.2.5.2.8).

The Air Drop OPS will be scheduled by the Configurator when the Master Sequencer determines through the Request Processor that the MMK Air Drop Key has been selected. Termination will occur upon selection of another opera-

TABLE XVIII OUTPUTS FROM THE REFUEL OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Indication to illuminate Refuel OPS key green		MMK EQUIP	
2. Indication to display next page of checklist		IMK DISP	
3. Indication to provide MPD printout of unacceptable checklist item selection		MPD DISP	
4. Indication to provide checkmark after checklist item		IMK DISP	
5. DEK Enable		DEK EQUIP	
6. Pilot specified data for checklist item		DEK EQUIP	
7. Pilot specified data formatted for IMK display		IMK DISP	
8. Indication to display radar detected location of tanker on HSD		RADAR EQUIP	

TABLE XVIII OUTPUTS FROM THE REFUEL OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
9. Channel selection for communication equipment			
a. HF			
b. VHF/AM			
c. VHF/FM			
d. UHF 1			
e. UHF 2			
10. Autopilot *on/off*		GUIDANCE SPEC	
11. Stationkeeping on/off		GUIDANCE SPEC	
12. Checklist Item		IMK DISP	
a. Set speed brake			
b. Monitor radar beacon			
c. Monitor trim			
d. Monitor current position, velocity, heading, altitude, pitch, bank,yaw, and angle-*of-attack*			
e. Adjust valves and inter-tank connections			

TABLE XVIII OUTPUTS FROM THE REFUEL OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
13. Display of navigation data on HSD, HUD		NAVIGATION CONTROLLER SPEC	
14. Navigation update data		NAVIGATION CONTROLLER SPEC	
15. Stationkeeping on/off		GUIDANCE SPEC	

TABLE XIX INPUTS TO THE AIR DROP OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Indication of checklist item on page which is selected (side key depressed)		IMK DISP	
2. Event indicating ENTER command received		DEK EQUIP	
3. Data from DEK			
a. Lat,Lon at Impact Point			
b. Lat, Lon of Trailing Edge			
c. Bearing and length drop zone			
d. Width of drop zone			
e. Pilot selected deviation type			
f. Bearing, Lat, Lon type of any point on Cargo Release Path			
g. Bearing and Along Track Deviation of Impact Point Type 2			

TABLE XIX INPUTS TO THE AIR DROP OPERATIONAL SEQUENCER (CONT.)

DATA NAME	SYMBOL	SOURCE	REFERENCE
3. Data From DEK (Cont.)			
h. Along Track and Cross-Track Deviation of Impact Point - Type 3			
i. Parachute Characteristics			
j. Type Drop (normal or LAPES)			
k. Altitude of Drop			
l. Wind Velocity			
m. Temperature at Air Drop			
n. Pressure at Air Drop			
4. Wind Velocity			

tional Sequencer. Upon selection the Air Drop OPS shall cause the Air Drop MMK to be illuminated green (Output 3.2.2.5.3.1).

3.2.2.5.2.1 Air Drop Characteristics

The capability for Air Drop characterization shall be provided for prior to the mission or during the mission. When the pilot selects the Air Drop OPS, the ØPS shall provide for verification of previously entered data and for input or update of data. The capability to enter this data shall be provided through a checklist. The checklist shall be processed as specified for the Preflight checklist (Section 3.2.2.1.2) (Inputs 3.2.2.5.1.1-3 and Outputs 3.2.2.5.3.1-6). Data stored shall appear after the checklist item name. Confirmation of the currently stored data shall occur when only ENTER is keyed on the DEK (Input 3.2.2.5.1.2). Data insertion shall occur through the DEK (Input 3.2.2.5.1.3) followed by the ENTER command (Input 3.2.2.5.1.2). The following items shall define the air drop for calculations of flight path, CARP, and time estimates.

a. The drop zone shall be specified by the coordinates of its impact point (Input 3.2.2.5.1.a). The flight length shall be specified (Input 3.2.2.5.1b). Data entered in this checklist item shall be placed in the compool accessed by the Cargo Delivery Controller SPEC (Output 3.2.2.5.3.7).

b. Parachute characteristics shall be specified through the air drop checklist (Input 3.2.2.5.1.3.c). This shall include vertical free-fall, forward travel time, and rate of fall. This data shall be written into the Cargo Delivery Controller SPEC compool (Output 3.2.2.5.3.8).

c. Normal drop or LAPES drop shall be specified through the checklist (Input 3.2.2.5.1.3.d) and provided to the Cargo Delivery Controller SPEC (Output 3.2.2.5.3.9).

d. Altitude at which the drop is to be executed shall be specified through the checklist (Input 3.2.2.5.1.3e) and provided to the Air Drop Calculations SPEC (Output 3.2.2.5.3.10). Selection of this checklist item shall be optional. If the altitude is not specified the LAPES altitude shall be assumed.

e. Wind velocity at air drop altitude shall be included in the air drop checklist (Input 3.2.2.5.1.3f) and provided to CARP SPEC (Output 3.2.2.5.3.11). If wind velocity is not input, the wind velocity as determined by the Air Data SPEC shall be assumed (Input 3.2.2.5.1.4).

f. Temperature at air drop altitude shall be included in the Air Drop checklist (Input 3.2.2.5.13h).

g. Pressure at air drop altitude shall be included in the Air Drop checklist (Input 3.2.2.5.13h) and provided to the CARP SPEC (Output 3.2.2.5.3.13). If the pressure is not provided the Air Drop Calculation SPEC computes pressure at air drop altitude based on available pressure data.

h. CARP calculations shall be permitted to be overridden by pilot specification of a CARP coordinates (Input 3.2.2.5.1.31). This data shall be displayed on the IMK (Output 3.2.2.5.3.4).

3.2.2.5.2.2 Air Drop Calculations

The Air Drop OPS shall schedule the Cargo Delivery Controller SPEC which schedules the SPEC's to calculate flight path bearing, CARP coordinates, end of drop coordinates, and time estimates.

3.2.2.5.2.3 Guidance

The Air Drop OPS shall schedule the Guidance/Autopilot Controller SPEC which controls steering.

3.2.2.5.2.4 Steering

The Air Drop OPS shall set an event (Output 3.2.2.5.3.15) to indicate to the Waypoint Steering SPEC the requirement to calculate the along-track, cross-track, and altitude differential between the current position and the desired CARP for HUD display.

3.2.2.5.2.5 Drop Zone Warnings

The Air Drop OPS shall schedule the Drop Zone Warnings SPEC which will provide for warnings at intervals prior to CARP and, if required prior to the end of the drop zone.

3.2.2.5.2.6 Center of Gravity

The Air Drop OPS shall schedule the Center of Gravity SPEC which calculates center of gravity variation in one dimensional controls center of gravity displays.

3.2.2.5.2.7 Air Frame Monitor

The Air Data OPS shall schedule the Air Frame Monitor SPEC which monitors the engines, electrical power, energy, hatches, and cargo.

3.2.2.5.3 Outputs

The outputs for the Air Drop Operational Sequencer shall be as specified in Table XX .

3.2.2.6 Function 2.6 Descend OPS

The Descend Operational Sequencer provides systemcontrols and operational checklists to perform descent functions either during flight as cruise altitudes are varied, during preparation for mission operations such as air drop, or in preparation for approach and landing. The computer requirements for this module are:

Memory Size	482	16 bit words
Throughput	7.5	ms/sec
Update rate	4	times/sec

3.2.2.6.1 Inputs

, The inputs to the Descend Operational Sequencer shall be as specified in Table XXI .

3.2.2.6.2 Processing

The Descend OPS is initiated and cancelled by the Configurator (Section 3.2.2.6.2.1). Through a checklist (Section 3.2.2.6.2.2) descend selection types are chosen, instruments are set, and operations are checked. The OPS provides task control (Section 3.2.2.6.2.3) for other controllers and calculators, instruments are set, and operations are checked. The OPS provides task control (Section 3.2.2.6.2.3) for other controllers and calculators.

TABLE XX OUTPUTS FROM THE AIR DROP OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Indication to illuminate MMK Air Drop Key green		MMK EQUIP	
2. Indication to display next page of checklist		IMK DISP	
3. Indication to provide MPD printout of unacceptable checklist item selection		MPD EQUIP	
4. Indication tc provide checkmark		IMK DISP	
5. DEK Enable		DEK EQUIP	
6. Pilot specified data for IMK display		IMK DISP	
7. Drop zone specification		Cargo Release Path and CARP SPEC	
8. Parachute characteristics		CARP SPEC	
9. Normal or LAPES drop		Cargo Delivery Path SPEC	
10. Altitude of Air Drop		CARP SPEC	
11. Wind velocity at Air Drop		CARP SPEC	
12. Temperature at Air Drop		CARP SPEC	

TABLE X.X OUTPUTS FROM THE AIR DROP OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	DESTINATION	REFERENCE
13. Pressure at Air Drop		Air Drop Calculation SPEC	
14. Impact Point			
15. Event for steering function to perform calculations for steering between current position and CARP to desired drop flight path.		Steering SPEC	

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TABLE XXI INPUTS TO THE DESCEND OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Plane weight on landing gear		Air Frame Sensor EQUIP	
2. Indication of checklist item on page which is selected (side key depressed)		IMK EQUIP	
3. Event indicating ENTER command received		DEK EQUIP	
4. Data from DEK		DEK EQUIP	
5. Type of descent		IMK EQUIP	
a. Planned			
b. Normal			
c. STOL			
d. Rapid			
e. Precision			
f. Radar			
6. Communication channel selection and radio unit		IMK EQUIP DEK EQUIP	
a. HF			
b. VHF/AM			
c. VHF/FM			

TABLE XXI INPUTS TO THE DESCEND OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	SOURCE	REFERENCE
6. d. UHF 1			
e. UHF 2			
7. TACAN hannel		IMK EQUIP DEK EQUIP	
8. Selection for display desired on:		IMK EQUIP DEK EQUIP	
a. HUD			
b. HSD			
c. MPD			
9. Autopilot selection on/off		IMK EQUIP	
10. Fly-alone/Stationkeeping selection		IMK EQUIP	
11. IFF on/off		IMK EQUIP	
12. ESM on/off		IMK EQUIP	
13. IRD&W on/off		IMK EQUIP	
14. Indication for secure voice transmissions		IMK EQUIP	
15. Pressure on radar altimeter display		IMK EQUIP	

TABLE XXI INPUTS TO THE DESCENT OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	SOURCE	REFERENCE
16. Indication of displayed velocity choice (IAS, TAS, ground speed, Mach Number)			

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3.2.2.6.2.1 Initiation and Cancellation of Descend OPS

The Descend OPS is initiated when the Descend OPS key on the MMK is depressed. The Descend OPS is entered when the previous OPS was the Takeoff/Climb, Cruise, Refuel, Air Drop, or Approach/Land OPS. Hence, the Descend OPS is entered when the plane weight is on the landing gear (Input 3.2.2.6.1.1). When the Descend OPS MMK Key is illuminated green. The Descend OPS is cancelled by the Configurator when the Takeoff/Climb, Cruise, Refuel, Air Drop, or Approach/Land OPS are initiated. If weight is detected on the landing gear while in the Descend OPS (Input 3.2.2.6.1.1), the Configurator cancels the Descend OPS and schedules the Approach/Land OPS.

3.2.2.6.2.2 Checklist

The Descend OPS shall provide a checklist upon being initiated. The processing (Inputs 3.2.2.6.1.2-4, Outputs 3.2.2.6.3.2-7) of the checklist shall be as specified for the Preflight checklist (Function 3.2.2.1). The checklist shall provide pilot selections of descend types, instrument settings, and pilot sequencing for flight operations and monitoring.

3.2.2.6.2.2.1 Descend Selection

The Descend OPS shall provide through the checklist (Input 3.2.2.6.1.5) for selection of different types of descent. The displays and subsequent checklist functions shall vary depending upon the descent type selected. Furthermore, the descent profile shall be dependent upon the descent type. The types of descent are listed in Table XXII along with a description of each.

TABLE XXII DESCENT TYPES

DESCEND TYPES	DESCRIPTION
PLANNED	A descent sequence/profile which is preplanned. Such a preplanned descent sequence would be used for a known descent where terrain obstacles are to be avoided.
NORMAL	A descen characterized by a standard descent profile to be generally used. The plane is configured conventionally (in contrast to STOL).
STOL	A descent characterized by a standard descent profile with the plane configured for short takeoff and landings.
RAPID	A descent where the profile provides a more rapid descent than that provided by the normal descent.
PRECISION	A descent where the approach is based solely on instruments.
RADAR	A descent with reduced navigation aids where only radar is utilized.

3.2.2.6.2.2.2 <u>Instrument Settings</u>

Through the checklist the pilot shall be able to adjust communication channel selections (Input 3.2.2.6.1.6, Output 3.2.2.6.3.8). The TACAN channel (Input 3.2.2.6.1.7, Output 3.2.2.6.3.9) shall be selectable. Display choices dependent upon descent type shall be made through the checklist (Input 3.2.2.6.1.8, Output 3.2.2.6.3.10) for the HUD, HSD, and MPD.

3.2.2.6.2.2.3 <u>Monitoring</u>

The checklist function shall provide pilot selectable descent sequencing checklists to include monitoring and adjusting engines, flaps, speed brakes, pitch, bank, yaw, angle-of-attack, altitude, and heading (Output 3.2.2.6.3.11). The pilot shall be alerted to check the altimeter setting when he passes through 18,000 feet (Output 3.2.2.6.3.11).

3.2.2.6.2.3 <u>Descend OPS Task Control</u>

The Descend OPS shall control the tasks delineated in the following sections.

3.2.2.6.2.3.1 <u>Navigation</u>

The Descend OPS shall synchronously schedule the Navigation Controller SPEC. Displays of navigation data for the descent phase of the mission shall be provided on the HUD and HSD (Inputs 3.2.2.6.3.8a, b).

3.2.2.6.2.3.2 <u>Guidance</u>

The Descend OPS shall schedule the Guidance SPEC which controls the Steering SPECs and FCS SPECs. Through the checklist the autopilot shall be deselected (Input 3.2.2.6.1.9, Output 3.2.2.6.3.12). The Descend OPS shall pass an indication (Output 3.2.2.6.3.13) to the Guidance SPEC as to the descent type (Section 3.2.2.6.2.2.1) in order that the Descent Profile Calculation SPEC may be scheduled and appropriate inputs to the Steering SPEC developed.

3.2.2.6.2.3.3 Stationkeeping

The Descend OPS shall provide for either fly-alone or stationkeeping (Input 3.2.2.6.1.10, Output 3.2.2.6.3.14).

3.2.2.6.2.3.4 IFF, ESM and IRD&W

The Descend OPS shall enable, upon pilot selection, (Inputs 3.2.2.6.1.11, 12, 13, Outputs 3.2.2.6.3.15, 16, 17) the IFF, ESM and IRD&W subsystems if not previously initiated.

3.2.2.6.2.3.5 Air Frame

The Descend OPS shall schedule the Air Frame SPEC to monitor and control displays for center of gravity, engine, power, cargo, hatches, gear, and flaps.

3.2.2.6.2.3.6 Altimeter Warning SPEC

The Descend OPS shall schedule the Altimeter Warning SPEC which cautions the pilot to adjust the pressure calibration of the Altimeter when passing through 18,000 feet elevation.

3.2.2.6.2.3.7 Miscellaneous Flight Option Selections

The Descend OPS shall provide the capability through the checklist (Input 3.2.2.6.1.14) to enable secured message transmission (Output 3.2.2.6.3.18). Which altimeter reading (pressure or radar) is to be displayed shall be an available option (Input 3.2.2.6.1.15, Output 3.2.2.6.3.19). The pilot shall have the capability to alter the displayed velocity - IAS, TAS, ground speed, or MACH number (Input 3.2.2.6.1.16, Output 3.2.2.6.3.20). WX data shall be displayed upon request (Input 3.2.2.6.1.8) on the HSD (Output 3.2.2.6.3.10).

3.2.2.6.3 Outputs

The outputs from the Descend Operational Sequencer shall be as specified in Table XXIII .

3.2.2.7 Function 2.7 Approach/Land OPS

The Approach/Land Operational Sequencer controls calculation tasks required during holding and final descent, provides displays with data used in approach and landing, presents a checklist, and permits operator selection of subsystem settings. Computer requirements for this module are:

Memory Size	481	16 bit words
Throughput	7.3	ms/sec
Update rate	4	times/sec

3.2.2.7.1 Inputs

The inputs to the Approach/Land Operational Sequencer shall be as specified in Table XXIV.

3.2.2.7.2 Processing

The Approach/Land OPS shall perform the synchronous (/sec) processing specified in Figure 10 The OPS shall be initiated by Configurator (Section 3.2.2.7.2.11). Pilot interface with the avionics shall include checklists (Section 3.2.2.7.2.2) and displays. The Approach/Land OPS shall schedule tasks and respond to pilot checklist inputs (Sections 3.2.2.7.2.3, 4). The OPS shall schedule the Navigation Controller SPEC,

TABLE XXIII OUTPUTS FROM THE DESCEND OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Not used			
2. Indication to display next page of checklist		IMK EQUIP	
3. Indication to provide MPD printout of unacceptable checklist item selection		MPD DISP	
4. Indication to provide checkmark after checklist imte		IMK EQUIP	
5. DEK Enable		DEK EQUIP	
6. Pilot specified data for checklist item		SPEC, EQUIP, and/or DISP com-pools as required	
7. Pilot specified data formatted for IMK display		IMK DISP	
8. Communication channel and radio			
a. HF		HF EQUIP	
b. VHF/AM		VHF/AM EQUIP	

TABLE XXIII OUTPUTS FROM THE DESCEND OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	DESTINATION	REFERENCE
9. TACAN Channel		TACAN EQUIP	
10. Display desired on:			
a. HUD		HUD DISP	
b. HSD		HSD DISP	
c. MPD		MPD DISP	
11. IMK checklist items		IMK EQUIP	
12. Autopilot on/off		Guidance SPEC	
13. Descend type		*Descent Profiles SPEC*	
a. Planned			
b. Normal			
c. ~TOL			
d. Rapid			
e. Precision			
f. Radar			
14. Stationkeeping on/off		Stationkeeping SPEC	
15. IFF on/off		IFF EQUIP	
16. ESM on/off		ESM EQUIP	
17. IRD&W on/off		IRD&W EQUIP	

TABLE XXIII OUTPUTS FROM THE DESCEND OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	DESTINATION	REFERENCE
18. Indication to secure voice transmissions		Secure Voice EQUIP, HF, VHF/AM, VHF/FM, UHF 1, UHF 2, SPECS	
19. Indication of pressure/radar altimeter display		Navigation Controller SPEC	
		Guidance SPEC	
20. Indication of displayed velocity desired IAS, TAS, ground speed, Mach Number		Navigation Controller SPEC	

TABLE XXIV INPUTS TO THE APPROACH/LAND OPERATION SEQUENCER

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Indication weight on landing gear		Air Frame Sensor EQUIP	
2. Indication of checklist item on page which is selected (side key depressed)		IMK DISP	
3. Event indicating ENTER command received		DEK EQUIP	
4. Data from DEK		DEK EQUIP	
5. Holding pattern inputs		DEK EQUIP	
a. Location			
b. Orientation			
6. Communications channel selected		IMK DISP	
a. HF			
b. VHF/AM			
c. VHF/FM			
d. UHF 1			
e. UHF 2			
7. Secure Voice Request		IMK DISP	

TABLE XXIV INPUTS TO THE APPROACH/LAND OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	SOURCE	REFERENCE
8. TACAN channel change		IMK DISP	
9. Radar display selection		IMK DISP	
10. Autopilot on/off		IMK DISP	
and/or change of		DEK EQUIP	
a. Heading hold			
b. Altitude hold			
c. Attitude hold			
11. Stationkeeping on/off		IMK DISP	
12. Display control: Select/de-		IMK DISP	
select display of:		DEK EQUIP	
a. VOR data			
b. TACAN data			
c. ADF/LF data			
d. ADF/UHF data			
on:			
a. HSD			
b. MPD			
13. Airfield position and		IMK DISP	
Approach Map		DEK EQUIP	

TABLE XXIV INPUTS TO THE APPROACH/LAND OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	SOURCE	REFERENCE
14. Events indicating Air Defense on during previous OPS a. IFF b. IRD&W c. ESM		OPS during which Air Defense initiated	
15. Request for a. IFF b. IRD&W c. ESM		IMK DISP	
16. Minimum altitude criteria for transition from Approach phase to Land Phase		Altimeter Warning SPEC	3.2.2.10

5

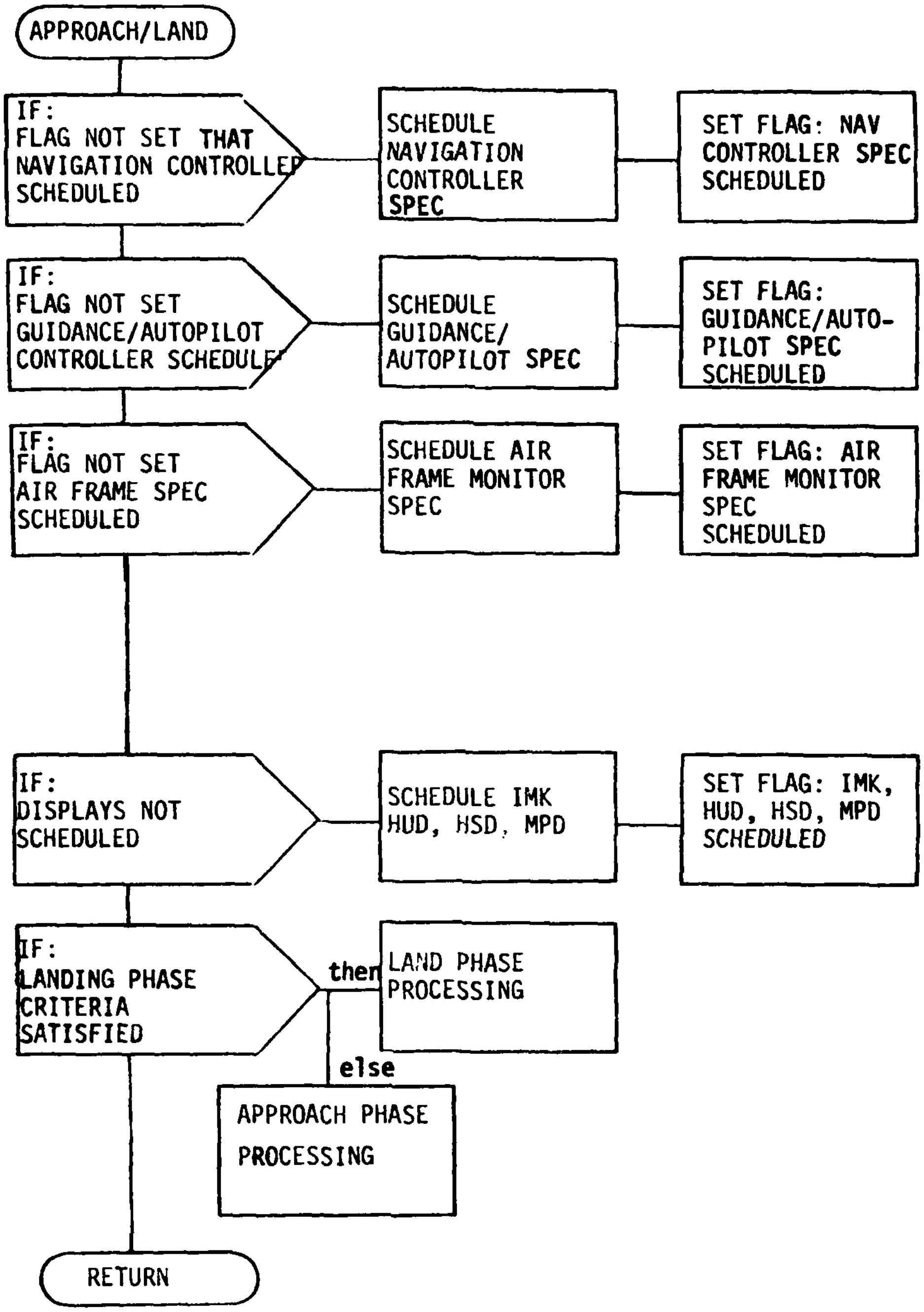


Figure 10 APPROACH/LAND OPS PROCESSING

the Guidance/Autopilot Controller SPEC, and the Air Frame SPEC. The Approach/Land OPS shall check for gear weight the Air Frame Sensor EQUIP to determine whether the OPS is in the Approach or Land phase.

3.2.2.7.2.1 Initiation and Cancellation of the Approach/Land OPS

The Approach/Land OPS is scheduled by the Configurator when the current OPS is either the Takeoff/Climb, Cruise, Refuel, Air Drop, or Descend OPS, and when either the Approach/Land key on the MMK has been depressed or weight is detected on the landing gear. The Approach/Land OPS shall be composed of two phases, the Approach and Land phases. The Approach phase shall be entered when the OPS is initiated through the MMK. When the aircraft enters the ILS flight beacon or meets a minimum altitude (Input 3.2.2.7.1.), the Approach/Land OPS shall transition to the Land phase. The Land phase shall be entered directly when the OPS is scheduled because weight is detected on the landing gear.

3.2.2.7.2.2 Checklist

The Approach/Land OPS shall include a checklist which shall provide pilot selections of plane configuration, pilot controlled calculations, instrument settings, and operations sequencing instructions. The checklist shall process inputs (Inputs 3.2.2.7.1.2-4) and supply outputs (Outputs 3.2.2.7.3.2-7) as specified by checklist processing described in Section 3.2.2.1.2.2. The pilot shall interface with the system through the checklist.

3.2.2.7.2.3 Approach Task Control

The processing specified in Figure 11 shall be performed during the Approach phase. Checklist items shall include the pilot checks on flaps,

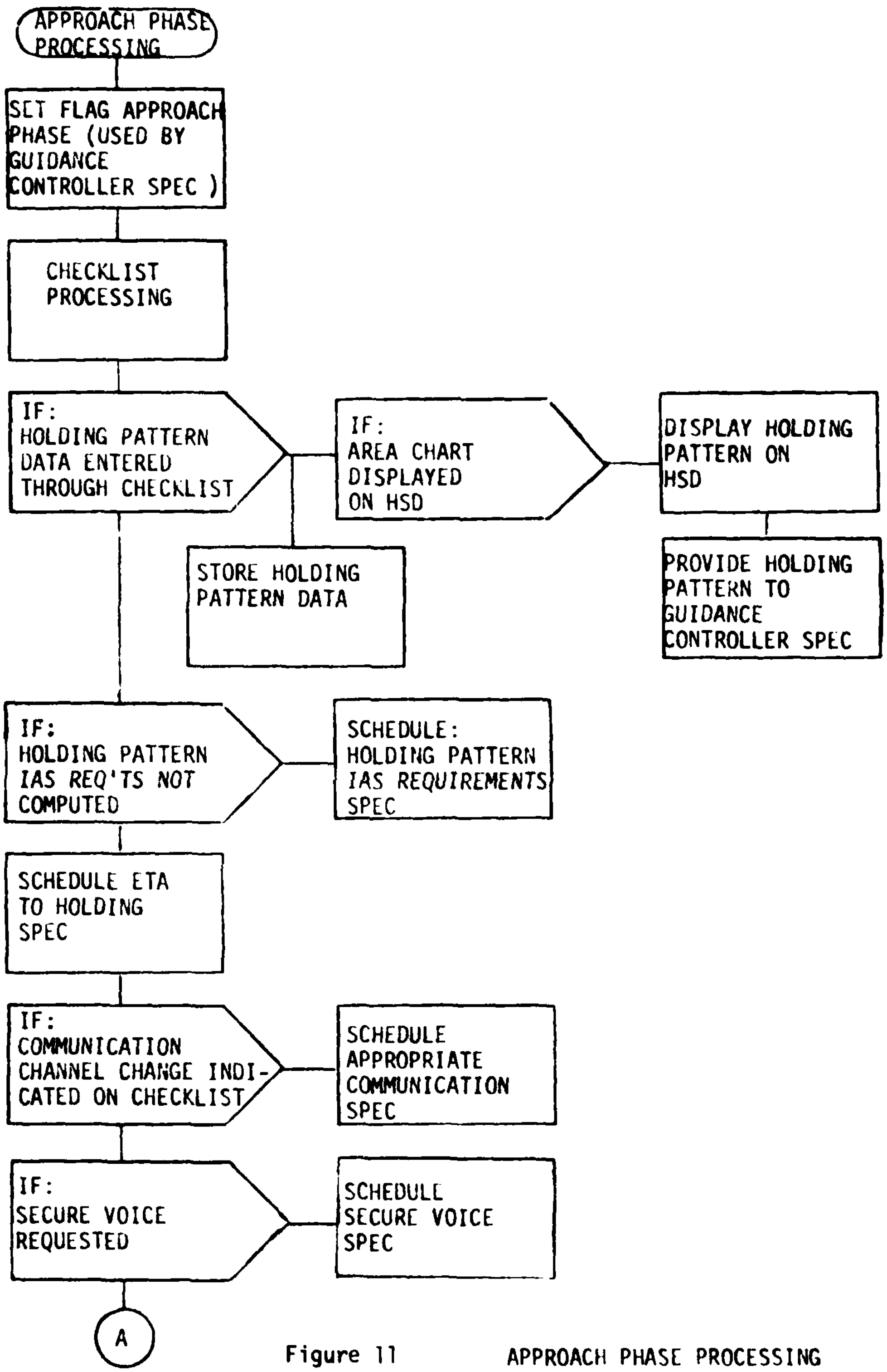


Figure 11 APPROACH PHASE PROCESSING

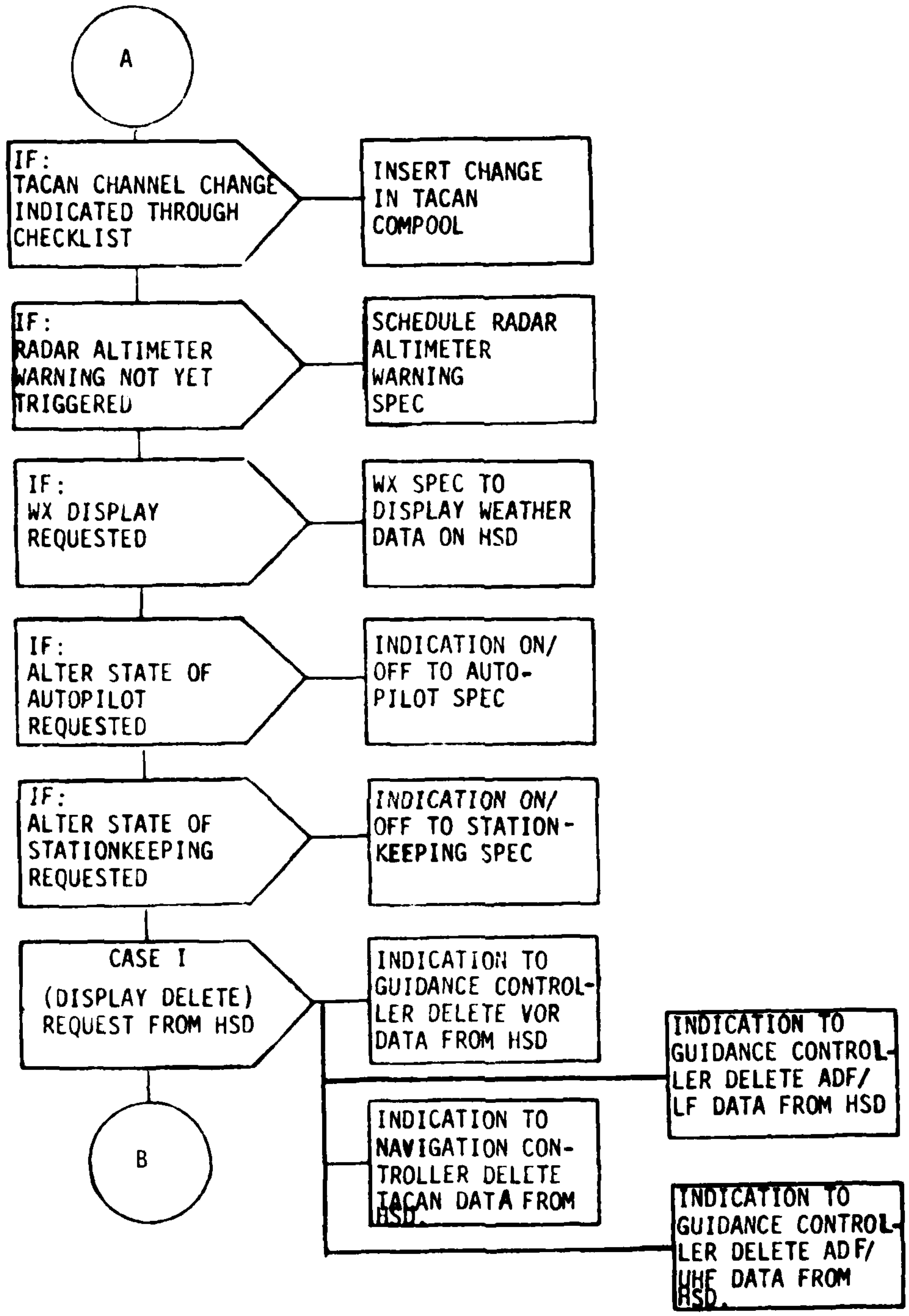


Figure 11 APPROACH PHASE PROCESSING (CONT'D)

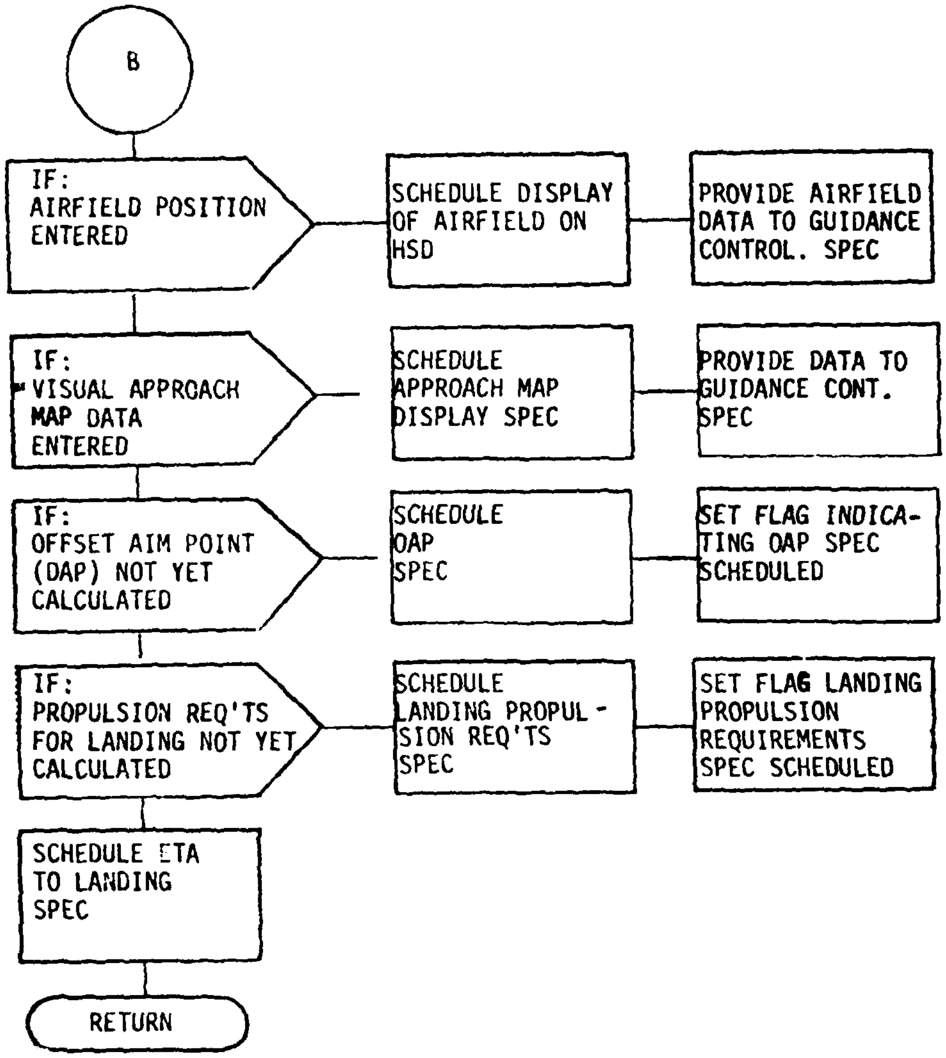


Figure 11 APPROACH PHASE PROCESSING (CONT'D)

speed brakes, air frame, and de-icing on/off. Processing shall include task control both automatically scheduled or initiated by pilot action.

3.2.2.7.2.3.2 Holding Pattern IAS Requirements

The OPS shall schedule the Holding Pattern IAS Requirements SPEC to calculate IAS requirements during holding if a holding pattern has been indicated by pilot insertion.

3.2.2.7.2.3.3 ETA to Holding

The OPS shall set an event for the calculation of ETA to holding to calculate the expected time of arrival into the holding pattern. (waypoint)

3.2.2.7.2.3.4 Communications

The OPS shall schedule the Communication SPECs for the selected radio if a channel change is requested through the checklist (Input 3.2.2.7.1.6).

3.2.2.7.2.3.5 Secure Voice

The OPS shall schedule the Secure Voice SPEC if Secure Voice is requested (Input 3.2.2.7.1.7, Output 3.2.2.7.3.7) for any one or more of the radio sets.

3.2.2.7.2.3.6 TACAN Channels

The OPS shall pass TACAN channel changes requested through the checklist (Input 3.2.2.7.1.8) to the TACAN EQUIP (Output 3.2.2.7.3.10).

3.2.2.7.2.3.7 Radar Altimeter

The OPS shall schedule the Radar Altimeter Warning SPEC which provides a warning when the plane descends to the TBD height at which the radar altimeter should be used.

3.2.2.7.2.3.8 Radar Data

The OPS shall provide the checklist for pilot selection of radar data displays including the weather display (Input 3.2.2.7.1.9, Output 3.2.2.7.1.11).

3.2.2.7.2.3.9 Autopilot

Through the OPS the pilot shall be able to turn on/off the Autopilot and to modify the heading, altitude or attitude hold (Input 3.2.2.7.1.10, Output 3.2.2.7.3.12).

3.2.2.7.2.3.10 Stationkeeping

Through the OPS checklist the pilot shall select/deselect the stationkeeping equipment (Input 3.2.2.7.1.11, Output 3.2.2.7.3.13).

3.2.2.7.2.3.11 Displays

Through the checklist the pilot shall select/deselect data displayed on the HSD and MPD to include data generated by VOR, TACAN, ADF/LF, ADF/UHF, and the radar beacon (Input 3.2.2.7.1.12, Output 3.2.2.7.1.14).

3.2.2.7.2.3.12 Air Field Position and Approach Map

Through the checklist and DEK (Inputs 3.2.2.7.1.13) the pilot shall enter the airfield for output to the Guidance/Autopilot SPEC for steering (Output 3.2.2.7.3.15) and to the HUD and HSD for display (Output 3.2.2.7.3.15). The OPS shall schedule the Approach Map Display SPEC which shall also provide the Approach Map, as well as the airfield position.

3.2.2.7.2.3.13 Offset Aim Point

The OPS shall schedule the OAP SPEC to calculate the offset aim point.

3.2.2.7.2.3.14 Landing Speed Requirements SPEC

The OPS shall schedule the Landing Speed Requirments SPEC.

3.2.2.7.2.3.15 ETA to Landing

The OPS shall schedule the ETA to Landing SPEC for calculation of the ETA to weight on the landing gear.

3.2.2.7.2.3.16 Air Defense

The OPS shall schedule the IFF SPEC, IRD&W SPEC, and ESM SPEC if active during the previous OPS (Input 3.2.2.7.1.14) or if request by input through the checklist (Input 3.2.2.7.1.15).

3.2.2.7.2.4 Land Task Control

Checklist processing during the Land phase shall provide pilot monitor functions to include flaps, speed brake, throttle, and air frame checks. Those checks shall be triggered by the weight on the landing gear (Input 3.2.2.7.1.1). The processing is specified in Figure 12 .

3.2.2.7.2.5 Outputs

The outputs to the Approach/Land Operational Sequencer are as specified in Table XXX .

3.2.2.8 Function 2.8 Post-Flight OPS

The Post-Flight Operational Sequencer initiates the checklist to guide the pilot through mission termination and plane shutdown. Computer requirements for this module are as follows:

Memory Size	338	16 bit words
Throughput	4.5	ms/sec
Update rate	4	times/sec

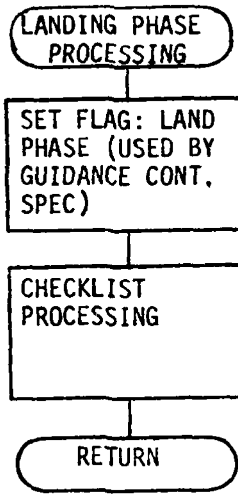


Figure 12 LAND PHASE PROCESSING

TABLE XXV OUTPUTS FROM THE APPROACH/LAND OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Not used			
2. Indication to display next page of checklist		IMK DISP	
3. Indication to provide MPD printout of unacceptable checklist item selection		MPD DISP	
4. Indication to provide check-mark after checklist item		IMK DISP	
5. DEK Enable		DEK EQUIP	
6. Pilot specified data for check-list item		DEK EQUIP	
7. Pilot specified data formulated for IMK display		IMK DISP	
8. Holding pattern		Guidance/Autopilot Controller SPEC	
a. Location		HSD DISP	
b. Orientation			

TABLE XXV OUTPUTS FROM THE APPROACH/LAND OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	DESTINATION	REFERENCE
9. Secure Voice for radio		Secure Voice SPEC	
a. HF			
b. VHF/AM			
c. VHF/FM			
d. UHF 1			
e. UHF 2			
10. TACAN channel		TACAN EQUIP	
11. Radar display selection		Radar SPEC	
12. Autopilot		Guidance Controller SPEC	
a. Heading			
b. Altitude			
c. Attitude			
13. Stationkeeping on/off		Guidance Controller SPEC	
14. Display control: select/de-select display of			
a. VOR data			
b. TACAN data			
c. ADF/LF data			
d. ADF/UHF data			

TABLE XXV OUTPUTS FROM THE APPROACH/LAND OPERATIONAL SEQUENCER (Cont.)

DATA NAME	SYMBOL	DESTINATION	REFERENCE
14. On:			
a. HSD			
b. MPD		Guidance/Autopilot Controller SPEC	
15. Airfield position and Approach map		Approach Map Display SPEC	

3.2.2.8.1 Inputs

The inputs to the Post-Flight Operational Sequencer are as specified in Table XXVI .

3.2.2.8.2 Processing

The Post-Flight OPS shall be scheduled and cancelled by the Configurator (3.2.2.8.2.1). The prime function of the Post-Flight OPS is the sequential checklist for final craft checkout and shutdown (3.2.2.8.2.2). Associated with the checklist are tasks which shall be scheduled by the Post-Flight OPS in order for the successful completion of flight termination (3.2.2.8.2.3).

3.2.2.8.2.1 Initiation and Cancellation of the Post-Flight OPS

The Post-Flight OPS is scheduled by the Configurator when the Post-Flight MMK key is selected. The Post-Flight OPS is initiated only if the plane's weight is on the landing gear. The Post-Flight OPS shall be cancelled by the Configurator when the Pre-Flight OPS is initiated.

3.2.2.8.2.2 Checklist

The processing of the Post-Flight checklist shall be as specified in Section 3.2.2.1.2.2 (Inputs 3.2.2.8.1.2-4, Outputs 3.2.2.8.3.2-7). The checklist shall provide checks to configure the aircraft for parking. This shall include checks on the anti-skid, air vents, lights, pitot, de-ice, wing flaps, engines, trim, beacon, electrical power, and fuel. Checks performed when parked shall include doors, engines off, navigation drift check, avionics shutdown, battery and fuel turnoff, and computer shutdown.

TABLE XXVI INPUTS TO THE POST-FLIGHT OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	SOURCE	REFERENCE
1.		Not used	
2. Indication of checklist item on page which is selected (side key depressed)		IMK DISP	
3. Event indicating ENTER command received		DEK EQUIP	
4. Data from DEK		DEK EQUIP	

3.2.2.8.2.3 Tasks Control

The Post-Flight OPS shall schedule the Navigation Controller SPEC and the Air Frame SPEC.

3.2.2.8.3 Outputs

The outputs from the Post-Flight Operational Sequencer shall be as specified in Table XXVII .

3.2.2.9 Function 2.9 - Descent Profiles SPEC

The Descent Profiles SPEC computes the desired rates of descent for the aircraft. The rate of descent depends on the position at the start of the descent, the final position, weight, air density and the type of descent (Table XXII). Each descent can be segmented into several parts as desired by the operator. Each part can be a different type of descent and ends at a different position. The range and altitude differentials for each part are computed. The Descent Profiles SPEC is scheduled asynchronously and event-signalled by the Guidance/Autopilot Controller SPEC (3.2.5.11). The computer requirements for this module are:

Memory Size	67	16 bit words
Throughput	0	ms/sec
Update rate	0	times/sec

3.2.2.10 Function 2.10 - Altimeter Warning SPEC

The Altimeter Warning SPEC continuously checks the radar and barometric altimeters and issues warnings accordingly. This SPEC checks the barometric altimeter 1/second to determine when passing through the 18,000 foot elevation, and then issues a message to the pilot to adjust the pressure calibration. Also,this SPEC checks the radar altimeter for two critical

TABLE XXVII - OUTPUTS FROM THE POST-FLIGHT OPERATIONAL SEQUENCER

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Not used			
2. Indication to display next page of checklist		IMK DISP	
3. Indication to provide MPD printout of unacceptable checklist item selection		MPD DISP	
4. Indication to provide check-mark after checklist item		IMK DISP	
5. DEK Enable		DEK EQUIP	
6. Pilot specified data for checklist item		DEK EQUIP	
7. Pilot specified data formatted for IMK display		IMK DISP	

altitudes. It issues messages when the radar altimeter becomes effective at 5000 feet. Also, it sends an indicator to the Approach/Land OPS (3.2.2.7) when the aircraft is within a certain height above the ground and no ILS signals have been received. The indicator is used by the Approach/Land OPS to change from the Approach Phase to the Landing Phase. The Altimeter Warning SPEC is scheduled synchronously at 1/second by the Cruise OPS (3.2.2.3), the Descend OPS (3.2.2.6) and the Approach/Land OPS. The computer requirements for this module are:

Memory size	30	16 bit words
Throughput	1.5	ms/sec
Update rate	1	times/sec

3.2.2.11 Function 2.11 - Takeoff Speed Requirements SPEC

The Takeoff Speed Requirements SPEC computes the critical velocities that need to be known for a safe takeoff. These critical velocities are the takeoff decision point speed, the rotation speed and the liftoff speed. The rotation and liftoff speeds depend on air density (altitude, temperature and relative humidity), angle-of-attack (aircraft control surface configuration) and takeoff gross weight. The takeoff decision point speed depends on runway length. The critical velocities are displayed on the HUD and the MPD. The Takeoff Speed Requirements SPEC is scheduled asynchronously and event signalled by the Takeoff/Climb OPS (3.2.2.2.4.5). The computer requirements for this module are:

Memory size	33	16 bit words
Throughput	0	ms/sec
Update rate	0	times/sec

3.2.2.12 Function 2.12 - Landing Speed Requirements SPEC

The Landing Speed Requirements SPEC computes the critical speed to maintain controllability and to prevent stalling. Both the critical IAS and TAS are determined. The critical landing speed depends on the type of sescent, the angle-of-attack, the air density and the gross weight. The critical velocities are displayed on the HUD and the MPD. The Landing Speed Requirements SPEC is scheduled synchronously at 1/second and event/signalled by the Takeoff/Land OPS (3.2.2.7.2.3.14). The computer requirements for this module are:

Memory size	21	16 bit words
Throughput	1.3	ms/sec
Update rate	1	times/sec

3.2.3 Operator Selection

The Operator Selection Group of software modules provides for the pilot or co-pilot to choose software functions for immediate use. These functions include parts of other modules as well as direct event-signalling of entire modules. The operator is provided with selection menus and check-lists on the IMK.

3.2.3.1 COMM BRUTE FORCE

The COMM BRUTE FORCE is requested by the pilot depressing the COMM button on the IMK. The pilot selects the communications system to be checked. From an item menu he chooses the items to be checked on that system.

If the pilot selects an item on this menu, the MPD DISP is signalled to display the data sent by the communication system. If it is an input item, the COMM BRUTE FORCE shall wait for data from the pilot via the DEK. If such data is received, the MPD DISP is signalled to display the new data and the communication system is notified of the change.

When the pilot has checked all items of interest, he depresses the RETURN TO COMM key. The IMK DISP is signalled to return the list of communication systems to the IMK.

After the checking of communication systems is completed, the COMM BRUTE FORCE shall return the system to its initial state.

3.2.3.1.1 Inputs

The inputs to the COMM BRUTE FORCE shall be as specified in Table XXVIII.

3.2.3.1.2 Processing

The COMM BRUTE FORCE shall perform the processing specified in Figure 13.

On its initial execution the COMM BRUTE FORCE signals IMK DISP to display a page listing the communications systems. These may include:

UHF #1

UHF #2

VHF/AM

VHF/FM

HF/SSB

Interphone

P.A. System

Sec. Voice

3.2.3.1.3 Outputs

The outputs from the COMM Brute Force shall be as specified in Table XXIX.

TABLE XXVIII INPUTS TO COMM BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
IMK REQUESTS		IMK	
DEK MESSAGE		DEK	
SUBSYSTEM DATA		DATA BASE	
SUBSYSTEM FLAGS		DATA BASE	
DATA UPDATES		DEK	

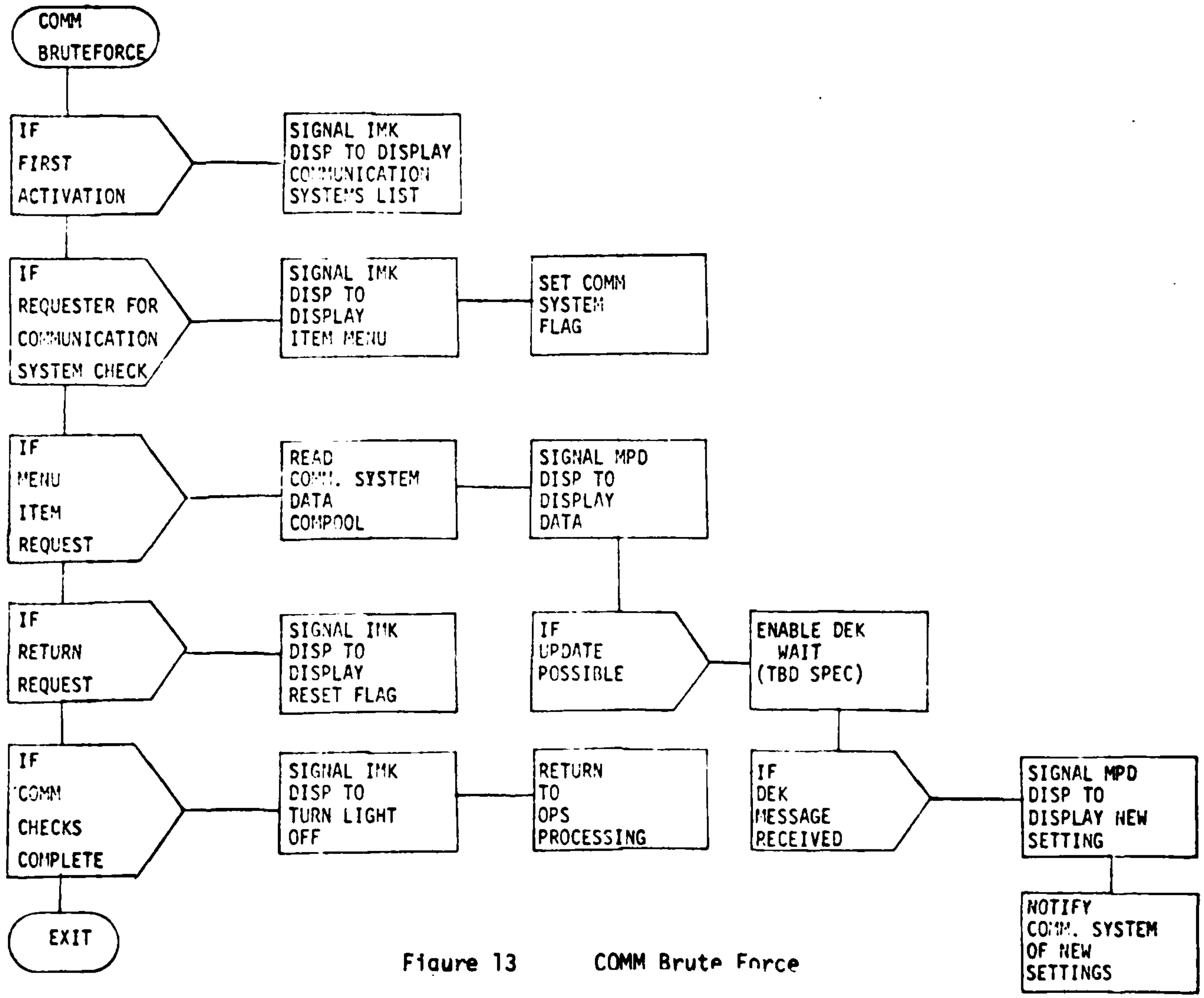


Figure 13 COMM Brute Force

TABLE XXIX OUTPUTS FROM COMM BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
DISPLAY REQUESTS		IMK DISP	
DISPLAY REQUESTS		MPD DISP	
COMM DATA		COMM. SYSTEMS	
DATA REQUEST		COMM. SYSTEMS	
COMM FLAGS		DATA BASE	
DATA UPDATES		MPD DISP	
		APPLICATION SOFTWARE	

3.2.3.2 NAV BRUTE FORCE

The NAV BRUTE FORCE is requested by the pilot depressing the NAV button on the IMK. The pilot selects the navigation subsystem which is to provide a position and/or velocity update. From an item menu he chooses the items to be checked.

Computer requirements for the module are:

Memory size	276	16 bit words
Throughput		ms/sec
Update rate		times/sec

3.2.3.2.1 Inputs

The inputs to the NAV BRUTE FORCE shall be as specified in Table XXX .

3.2.3.2.2 Processing

The NAV BRUTE FORCE shall perform the processing specified in Figure 14 .

On its initial execution the NAV BRUTE FORCE shall signal the IMK DISP to display a page listing the navigation update facilities. These may include the following:

TACAN

Air Data D.R.

INS

OMEGA

HUD

RADAR FIX

TABLE XXX INPUTS TO NAV BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
IMK REQUESTS		IMK	
DEK REQUESTS		DEK	
SUBSYSTEM FLAG		DATA BASE	
SUBSYSTEM DATA		DATA BASE	
DATA UPDATES		DEK	

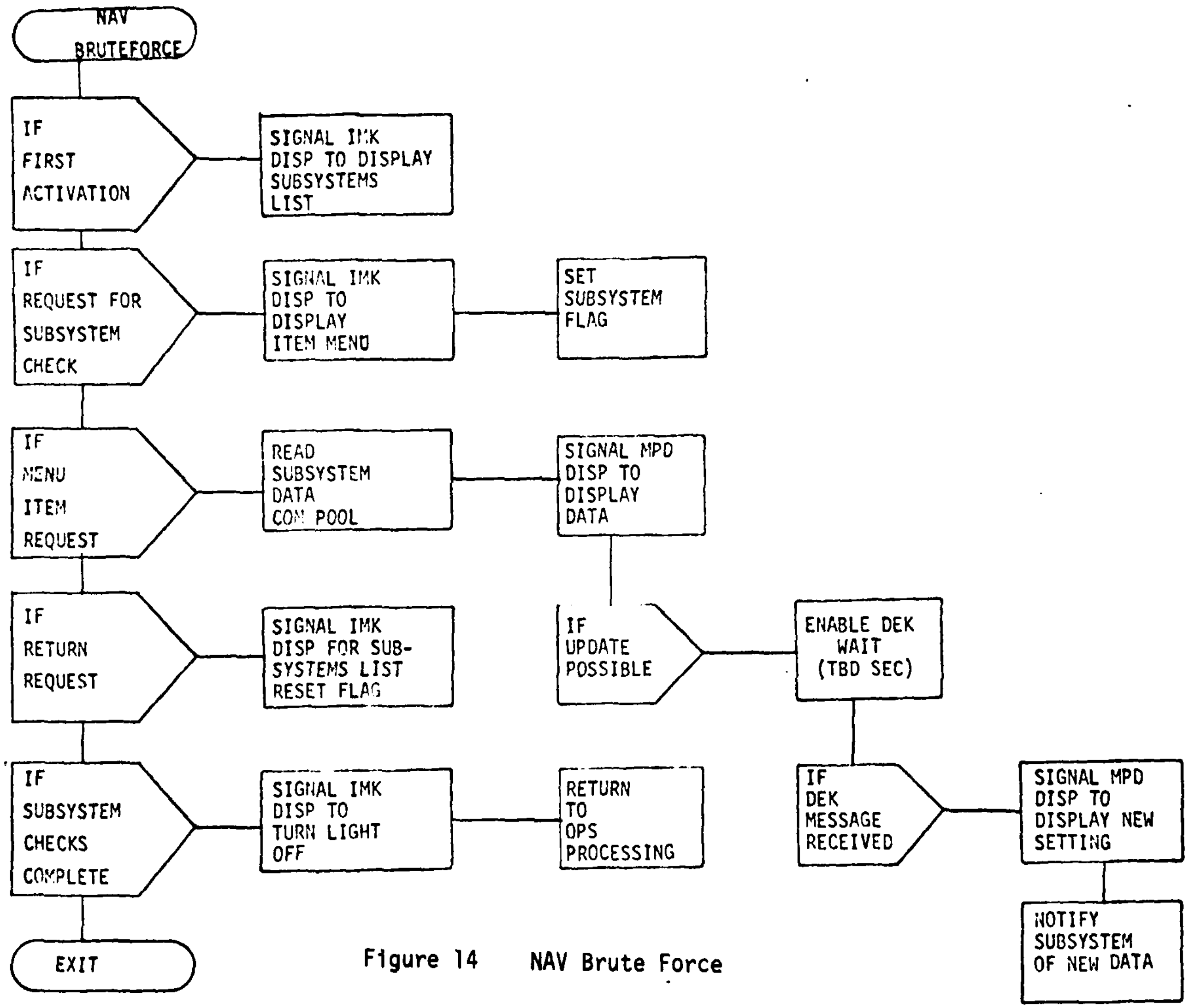


Figure 14 NAV Brute Force

SKE/ZM

FILTER ESTIMATE

WIND VELOCITY ESTIMATE

If the pilot selects a subsystem to be checked, the IMK DISP is signalled to display an item menu for the subsystem. Such items as the following may be checked:

Power	A-A Recv.
Course Set	Sta. Elev.
Sta. Ident.	Position
Freq/Chan	Velocity
Back Crs.	Fix
MDA/DH	Equipment
Air to Air	

If the pilot selects an item on this menu, the MPD DISP is signalled to display the data sent by the subsystem. If it is an input item the NAV BRUTE FORCE shall activate DEK and wait for data from the pilot via the DEK. If such data is received, the MPD DISP is signalled to display the new data and the subsystem is notified of the change.

When the pilot has checked all items of interest, he depresses the RETURN TO NAV key. The IMK DISP is signalled to return the list of navigation subsystems to the IMK.

After the checking of navigation subsystems is completed the NAV BRUTE FORCE shall return the system to its initial state.

3.2.3.2.3 Outputs

The outputs from the NAV BRUTE FORCE shall be as specified in Table XXXI .

3.2.3.3 CARGO BRUTE FORCE

The CARGO BRUTE FORCE is requested by the pilot depressing the CARGO button on the IMK. The pilot selects the items to be checked. Computer requirements for the module are:

Memory size	294	16 bit words
Throughput		m/sec
Update rate	N/A	times/sec

3.2.3.3.1 Inputs

The inputs to the CARGO BRUTE FORCE shall be as specified in Table XXXII .

3.2.3.3.2 Processing

The CARGO BRUTE FORCE shall perform the processing specified in Figure 15

On its initial execution the CARGO BRUTE FORCE signals IMK to display a page of items which can be checked.

If the pilot selects an item which is to be displayed, the data is read from a compool and MPD DISP is signalled to display it. If the pilot is allowed to change the value, the CARGO BRUTE FORCE enables DEK and waits for a new entry by the pilot. If such an entry is made, the MPD DISP is signalled to display it and the application software is notified of the change.

TABLE XXXI OUTPUTS FROM NAV BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
DISPLAY REQUESTS		IMK DISP	
LIGHT REQUESTS		MMK EQUIP	
DISPLAY REQUESTS		MPD DISP	
SUBSYSTEM DATA		SUBSYSTEMS	
DATA REQUEST		SUBSYSTEMS	
SUBSYSTEM FLAGS		DATA BASE	
DATA UPDATES		MPD DISP	
		APPLICATION SOFTWARE	

TABLE XXXII INPUTS TO CARGO BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
IMK REQUESTS		IMK	
DEK REQUESTS		DEK	
DISPLAY DATA		DATA BASE	
DATA UPDATES		DEK	

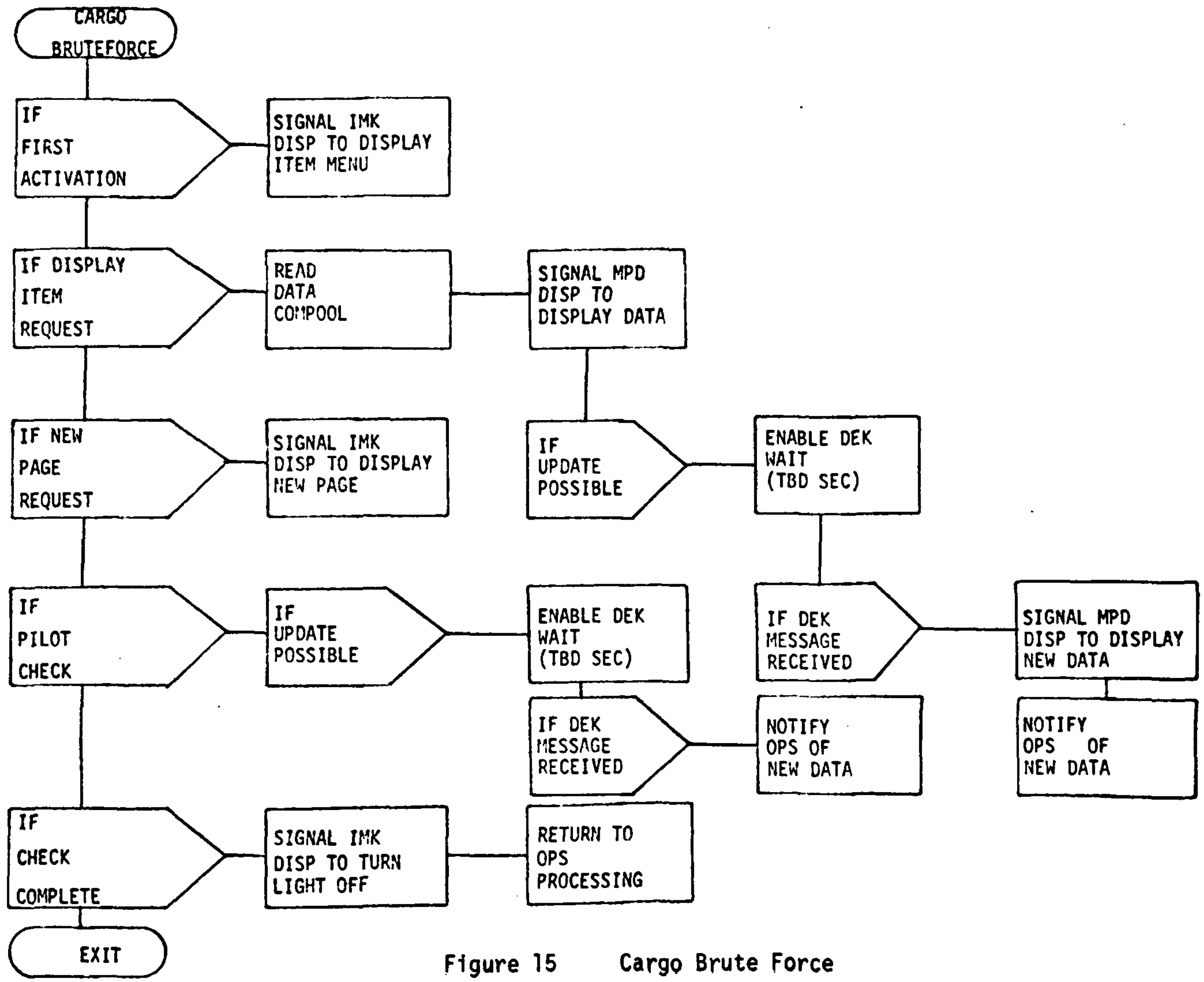


Figure 15 Cargo Brute Force

If the pilot depresses a key which requests checks of already displayed data, the CARGO BRUTE FORCE takes no action unless the value of the item may be changed by the pilot. In that case, the CARGO BRUTE FORCE enables DEK, waits a new entry and if one is received notifies the application software of the new value.

If the pilot requests a new page, the IMK DISP is signalled to display that page.

When the check is complete, the system is returned to its initial state.

3.2.3.3.3 Outputs

The outputs from the CARGO BRUTE FORCE shall be as specified in Table XXXIII .

3.2.3.4 SENSOR BRUTE FORCE

The Sensor BRUTE FORCE is requested by the pilot depressing the SENS button on the IMK. The pilot selects the sensor to be checked. From an item memo he chooses the items to be checked. Computer requirements for the module are:

Memory size	264	16 bit words
Throughput		m/sec
Update rate	N/Z	times/sec

3.2.3.4.1 Inputs

The inputs to the SENSOR BRUTE FORCE shall be as specified in Table XXXIV .

TABLE XXXIII OUTPUTS FROM CARGO BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
DISPLAY REQUESTS		IMK DISP	
DISPLAY REQUESTS		MPD DISP	
DATA UPDATES		SMPD DISP	
		APPLICATION SOFTWARE	

TABLE XXXIV INPUTS TO SENSOR BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
IMK REQUESTS		IMK	
SENSORS FLAGS		DATA BASE	
SENSOR DATA		DATA BASE	
DATA UPDATES		DEK	

3.2.3.4.2 Processing

The SENSOR BRUTE FORCE shall perform the processing specified in Figure 16.

On its initial execution the SENSOR BRUTE FORCE signals IMK DISP to display a page listing the sensors.

If the pilot selects a sensor to be checked, the IMK DISP is signalled to display an item menu for the sensor.

If the pilot selects an item on thismenu, the MPD DISP is signalled to display the data from the sensor compool. If the pilot is permitted to change the value, the SENSOR BRUTE FORCE shall enable DEK and wait for data from the pilot. If such data is received, the MPD DISP is signalled to display the new data and the sensor is notified of the change.

When the pilot has checked all items of interest, he depresses the RETURN TO SENS key. The IMK DISP is signalled to return the sensor list to the IMK.

After the sensor checking is complete, the SENSOR BRUTE FORCE shall return the system to the initial state.

3.2.3.4.3 Outputs

The outputs from the SENSOR BRUTE FORCE shall be as specified in Table XXXV.

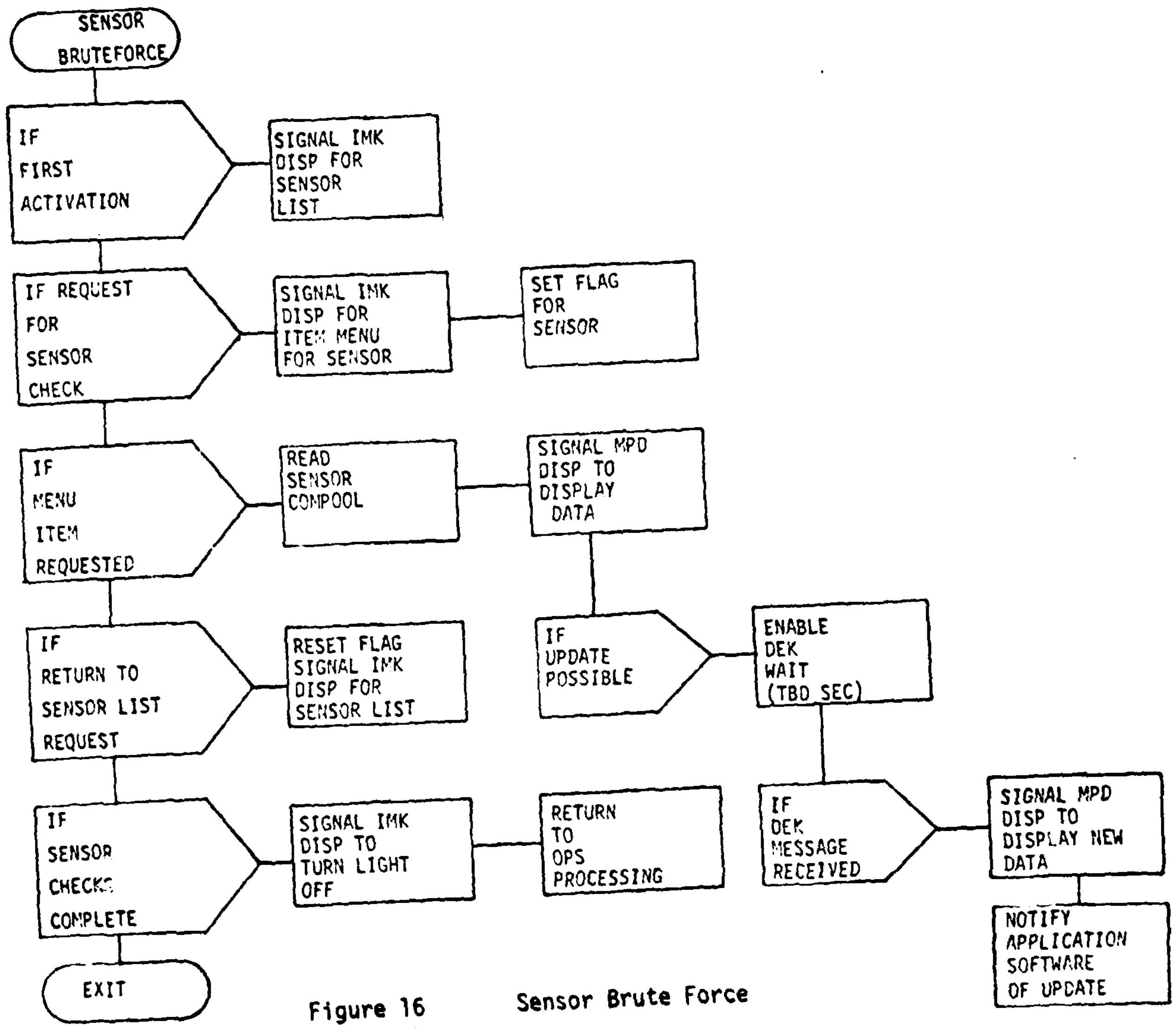


Figure 16 Sensor Brute Force

TABLE XXXV - OUTPUTS FROM SENSOR BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
DISPLAY REQUESTS		IMK DISP	
DISPLAY REQUESTS		MPD DISP	
SENSOR DATA		SENSOR	
SENSOR FLAGS		DATA BASE	

3.2.3.5 C/D BRUTE FORCE

The C/D BRUTE FORCE is requested by the pilot depressing the C/D button on the IMK. The pilot selects the display and the changes to be made. Computer requirements for the module are:

Memory size	296	16 bit words
Throughput		m/sec
Update rate	N/A	times/sec

3.2.3.5.1 Inputs

The inputs to the C/D BRUTE FORCE shall be as specified in Table XXXVI .

3.2.3.5.2 Processing

The C/D BRUTE FORCE shall perform the processing specified in Figure 17 .

On its initial activation the C/D BRUTE FORCE signals the IMK DISP to display a page listing the displays.

A selection from this page is made by depressing a side key. The IMK DISP is signalled to display the item menu for the chosen display.

If the menu item selected is a request to change display assignments, the UPDATE DISP is signalled. It shall notify the MPDG of the request.

If the menu item is a request to display input data, DEK is enabled. When the data is sent via DEK, the HUD DISP, the HSD DISP or the MPD DISP is signalled that the data is to be displayed.

TABLE XXXVI INPUTS TO C/D BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
IMK REQUESTS		IMK	
C/D FLAG		DATA BASE	
DATA UPDATES		DEK	

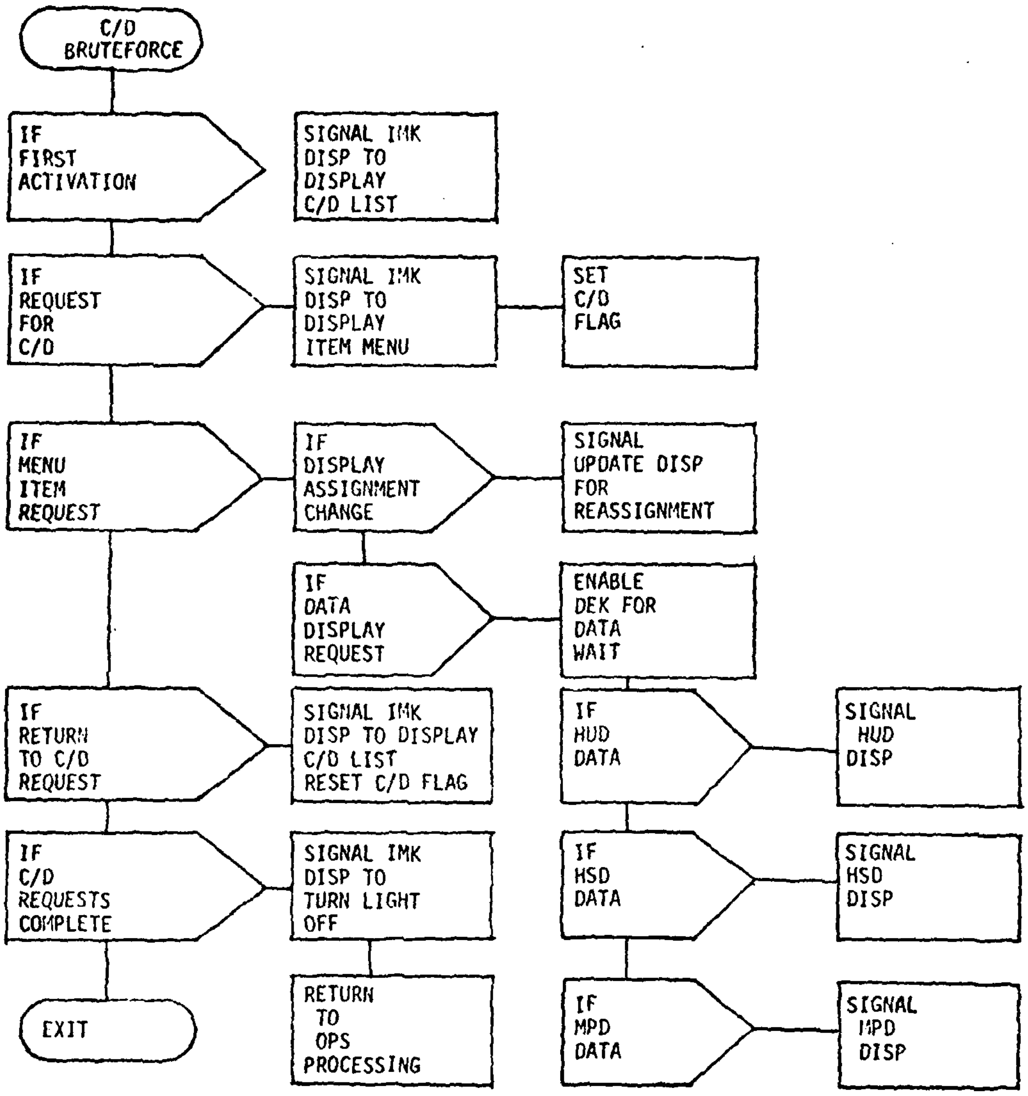


Figure 17 C/D Brute Force

When the pilot has finished with a display, he shall depress the "RETURN TO C/D" key. The C/D flag shall be reset and the IMK DISP shall be signalled to display the C/D list.

When all C/D requests have been completed, the system shall be returned to its initial state.

3.2.3.5.3 Outputs

The outputs from the C/D BRUTE FORCE shall be as specified in Table XXXVII .

3.2.3.6 SYST BRUTE FORCE

The SYST BRUTE FORCE is requested by the pilot depressing the SYST button on the IMK. The pilot selects the system to be checked. From an item menu he chooses the items to be checked. Computer requirements for the module are:

Memory size	264	16 bit words
Throughput		m/sec
Update rate		times/sec

3.2.3.6.1 Inputs

The inputs to the SYST BRUTE FORCE shall be as specified in Table XXXVIII .

3.2.3.6.2 Processing

The SYST BRUTE FORCE shall perform the processing specified in Figure 18 .

TABLE XXXVII OUTPUTS FROM C/D BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
DISPLAY REQUESTS		IMK DISP	
		MPD DISP	
		HUD DISP	
		HSD DISP	
DISPLAY DATA		UPDATE DISP	

TABLE XXXVIII INPUTS TO SYST BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
IMK REQUESTS		IMK	
SYSTEM FLAGS		DATA BASE	
SYSTEM DATA		DATA BASE	
DATA UPDATES		DEK	

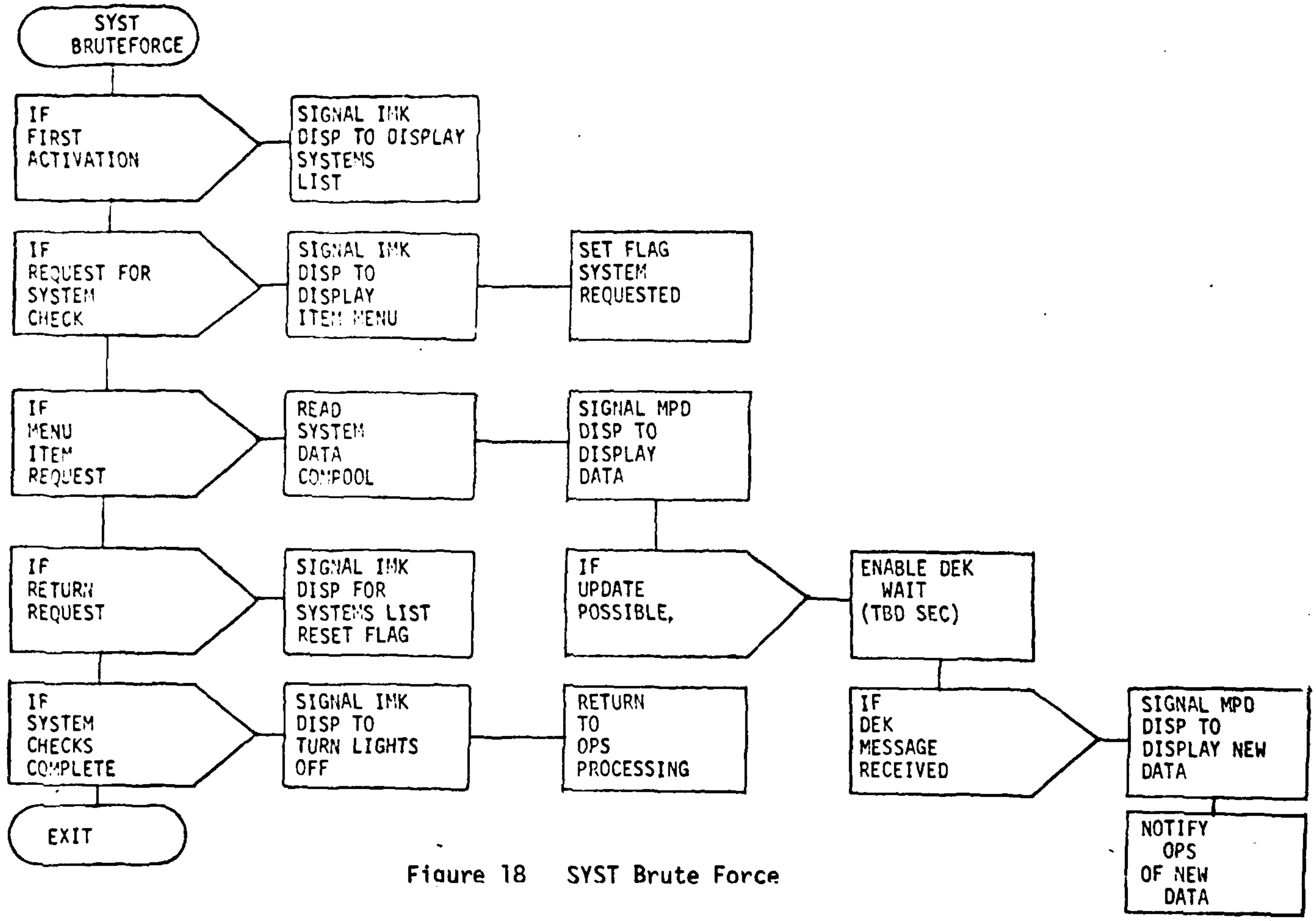


Figure 18 SYST Brute Force

On its initial execution the SYST BRUTE FORCE signals IMK DISP to display a page listing the various systems.

If the pilot selects a system to be checked, the IMK DISP is signalled to display an item menu for the system.

If the pilot selects an item on this menu, the MPD DISP is signalled to display the data sent by the system compool. If it is an input item, the SYST BRUTE FORCE shall enable the DEK and wait for data from the pilot. If such data is received, the MPD DISP is signalled to display it and the system is notified of the data update.

When the pilot has checked all items of interest, he depresses the RETURN TO SYST key. The IMK DISP is signalled to return the system list to the IMK.

After system checking is complete, the OPS processing is continued.

3.2.3.6.3 Outputs

The outputs from the SYST BRUTE FORCE shall be as specified in Table XXXIX

3.2.3.7 LIBRARY BRUTE FORCE

The LIBRARY BRUTE FORCE is requested by the pilot depressing the LIBR button on the IMK. The pilot selects tables, instructions, etc. which he would like displayed. Computer requirements for the module are:

Memory size	150	16 bit words
Throughput		m/sec
Update rate	N/A	times/sec

TABLE XXXIX OUTPUTS FROM SYST BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
DISPLAY REQUESTS		IMK DISP	
DISPLAY REQUESTS		MPD DISP	
SYSTEM DATA		SYSTEM	
SYSTEM FLAGS		DATA BASE	

3.2.3.7.1 <u>Inputs</u>

The inputs to the LIBRARY BRUTE FORCE shall be as specified in Table XL.

3.2.3.7.2 <u>Processing</u>

The LIBRARY BRUTE FORCE shall do the processing specified in Figure 19.

On its initial execution the LIBRARY BRUTE FORCE shall signal IMK to display a library listing. These listings allow the pilot read stored material such as tables, instructions, references, etc.

The pilot requests specific information by depressing a side key. The LIBRARY BRUTE FORCE shall signal the MPD DISP to display the material on the MPD allowing sufficient time for the pilot to read it.

If the pilot requests new listings the IMK DISP is signalled to display it.

When the pilot has obtained the desired information, the system is returned to its initial state.

3.2.3.7.3 <u>Outputs</u>

The outputs from the LIBRARY BRUTE FORCE shall be as specified in Table XLI.

3.2.3.8 <u>CHECKLIST BRUTE FORCE</u>

The CHECKLIST BRUTE FORCE is requested by the pilot depressing the CHK button on the IMK. The pilot selects the checklist and then checks each item in order. Computer requirements for the module are:

TABLE XL INPUTS TO LIBRARY BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
DISPLAY REQUESTS		IMK	
TEXT DATA		DATA BASE	

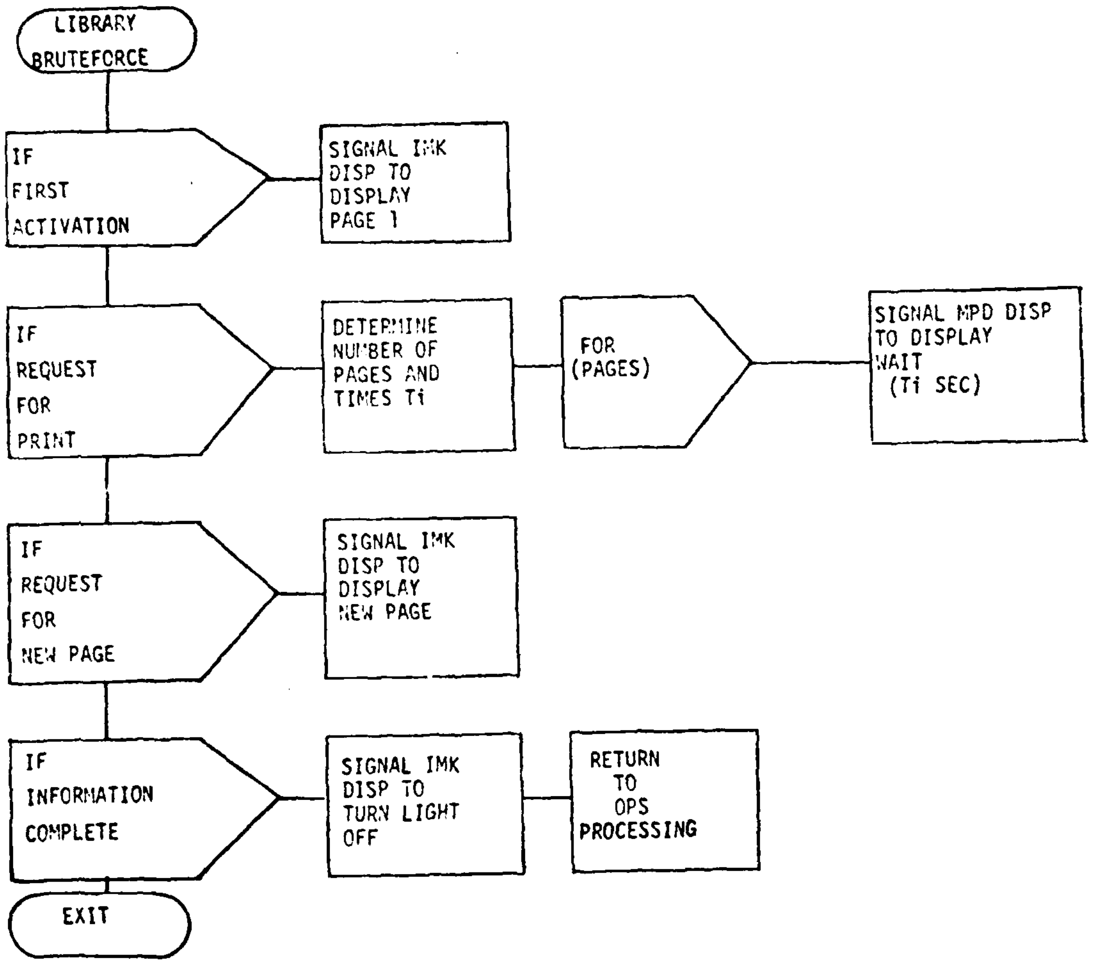


Figure 19 Library Brute Force

TABLE XLI OUTPUTS FROM LIBRARY BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
DISPLAY REQUESTS		IMK DISP	
DISPLAY REQUESTS		MPD DISP	
TEXT DATA		MPD	

Memory size	298	16 bit words
Throughput		ms/sec
Update rate		times/sec

3.2.3.8.1 Inputs

The inputs to the CHECKLIST BRUTE FORCE shall be as specified in Table XLII .

3.2.3.8.2 Processing

The CHECKLIST BRUTE FORCE shall perform the processing as specified in Figure 20 .

On its initial execution the CHECKLIST BRUTE FORCE signals IMK DISP to display the master list of checklists available.

If the pilot requests a checklist, IMK DISP is signalled to display it. A flag is set indicating that checklist processing is in progress. The light by key 1 is turned on and the index is initiatized to 1.

The pilot on observing a lighted key should eheck the item and depress thekey to indicate that the item has been checked.

If the checklist flag is on and a key is depressed, the CHECKLIST BRUTE FORCE checks that the correct key has been depressed. If so, the IMK DISP is signalled to turn the light behind that key off and behind the next key on. The index is incremented until I = 10.

When all items on the list have been checked (i.e. ɪ = 10), IMK DISP is signalled to turn all side lights off and to return the master list to the IMK. The checklist flag is reset. The pilot can now select a new checklist to run through.

TABLE XLII INPUTS TO CHECKLIST BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
CHECKLIST FLAG		DATABASE	
INDEX		DATABASE	
IMK REQUESTS		IMK	

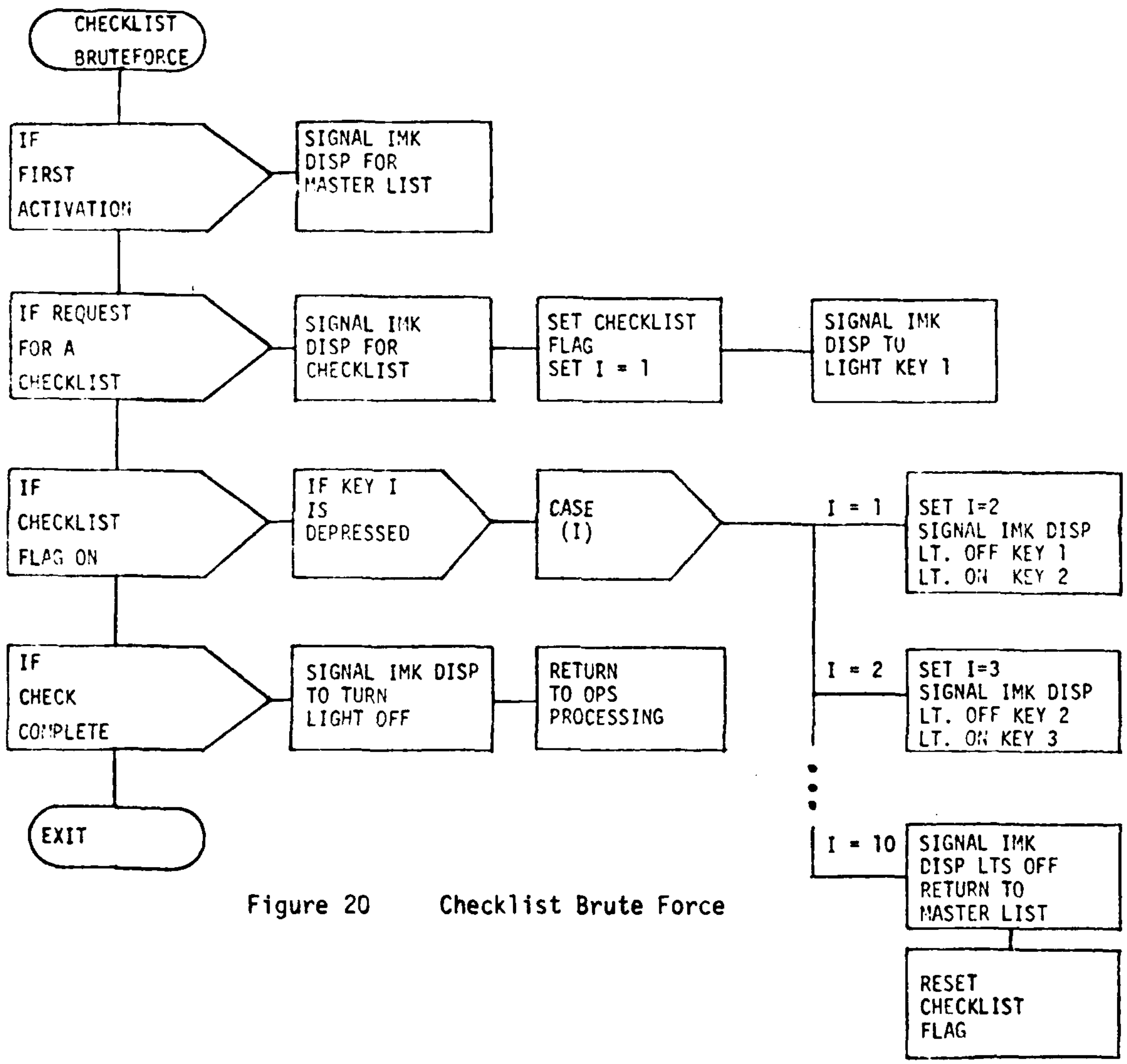


Figure 20 Checklist Brute Force

When checking is complete, the system is return to its initial state.

3.2.3.8.3 Outputs

The outputs from the CHECKLIST BRUTE FORCE shall be as specified in Table XLIII .

3.2.4 Navigation

The Navigation Group of modules consist of those tasks necessary to determine the position, velocity, and attitude of the aircraft and the wind velocity. This group includes Specialist Functions and Equipment Modules. The Equipment Modules are for handling data from the key navigational aids: INS, OMEGA, TACAN and AHRS. The Navigation SPECs determine the optimal estimate of the position and velocity based on the best set of available data. The nominal estimate, when all the NAV equipment is operating properly is a Kalman Filter estimate of the errors in the INS based on measurements from the OMEGA and TACAN systems. These errors are then used to adjust the position, velocity, and attitude indicated by the INS. Whenever any of the NAV equipment is not operating properly, a Navigation Selection SPEC determines what is the best configuration of navigation measurements. The operator is able to alter the navigation estimates by use of the Navigation BF SPEC. The estimate can be dictated by the operator to be provided from the multi-mode radar, the HUD or the SKE/Zone Marker. If the INS, TACAN and OMEGA are all inoperable, continuous navigation is done by air data dead reckoning.

TABLE XLIII - OUTPUTS FROM CHECKLIST BRUTEFORCE

DATA NAME	SYMBOL	SOURCE	REFERENCE
CHECKLIST FLAG		DATA BASE	
INDEX		DATA BASE	
DISPLAY REQUESTS		IMK DISP	
LIGHT REQUESTS		IMK DISP	

3.2.4.1 INS Equip (INS-E)

This program module processes the pitch, roll and heading outputs from the Inertial Navigation System (INS), Delco Electronics CAROUSEL IV. In the event the Automatic Data Entry Unit is employed, the program module will also process the ADEU data. The inputs are checked for validity prior to being converted to the appropriate format for further processing. The module also processes mode and function commands from the operator by converting them to appropriate formats for output to control the operation of the INS. This module processes the results of the automatic self-test operation for input to the Subsystem Status Monitor. By comparison with previously received inputs, the program module determines the reasonableness of the inputs. It also provides present position latitude and longitude, true heading and ground speed to the processor. The computer requirements for this module are:

Memory size	348	16 bit words
Throughput	3434	ms/sec
Update rate	1	times/sec

3.2.4.1.1 Inputs

The inputs to this program module shall be as specified in Table XLIV

3.2.4.1.2 Processing

The input data from the Automatic Data Entry Unit (ADEU) shall be processed by the elimination of such non-function bits as validity bits, then shall be further processed by the conversion of the data bits to the appropriate output scale factor.

TABLE XLIV INPUTS - INERTIAL NAVIGATION SYSTEM (INS) EQUIP (INS-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
Pitch 2 (X, Y, Z)		32	09	INS	
Roll 2 (X, Y, Z)		32	09	INS	
Pitch 4 (B', C')		32	09	INS	
Roll 4 (B', C')		32	09	INS	
Leg Switch		2	04	INS	
Serial INS Data		32	10	INS	
Control Data		32	10	DEK EQUIP	
Lamp Test		2	01	DEK EQUIP	
CDU Enable		2	01	INS	
Battery Operation		2	01	INS	
INS Master Warning		2	01	INS	
TAS Input		32	10	FCS EQUIP	
Altitude Input		32	10	FCS EQUIP	
Battery Warning		2	01	INS	
NAV Ready Lite		2	01	INS	
MSU Power ON		2	01	IMK EQUIP	
Mode Control (3 Bits)		2	01	DEK EQUIP	

Table XLIV INPUTS - INERTIAL NAVIGATION SYSTEM (INS) EQUIP (INS-E) (continued)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
H DME Pulse Pair		8	10	TBD	
C DME Pulse Pair		8	10	TBD	
DME Warning		2	01	TBD	
ADEU Serial Data		32	10	TBD	
Data Valid Flag		8	01	TBD	

The input values of pitch, roll and heading shall be converted to appropriate scale factors for use in the processor.

The control and function inputs shall be converted to a format for output to properly control the operation of the INS.

Improper operation of the INS shall be announced by "Master Warning", "Battery Warning" or "DME Warning" signals at which time the appropriate diagnostic flags shall be set as well as the appropriate bits on the status word.

The program module shall, upon the selection of the "ATTITUDE" mode, issue a warning for 10 seconds prior to complying with the operator's request.

The current input values of pitch, roll and heading shall be compared with the previous values to determine the reasonableness of the current input values.

The processing shall be performed as specified in Figure 21 .

This program module is a privileged task and shall be executed synchronously 32 times per second.

The input values of pitch, roll, heading and the INS data shall be processed to provide latitude, longitude and the northerly and easterly components of ground speed to the processor.

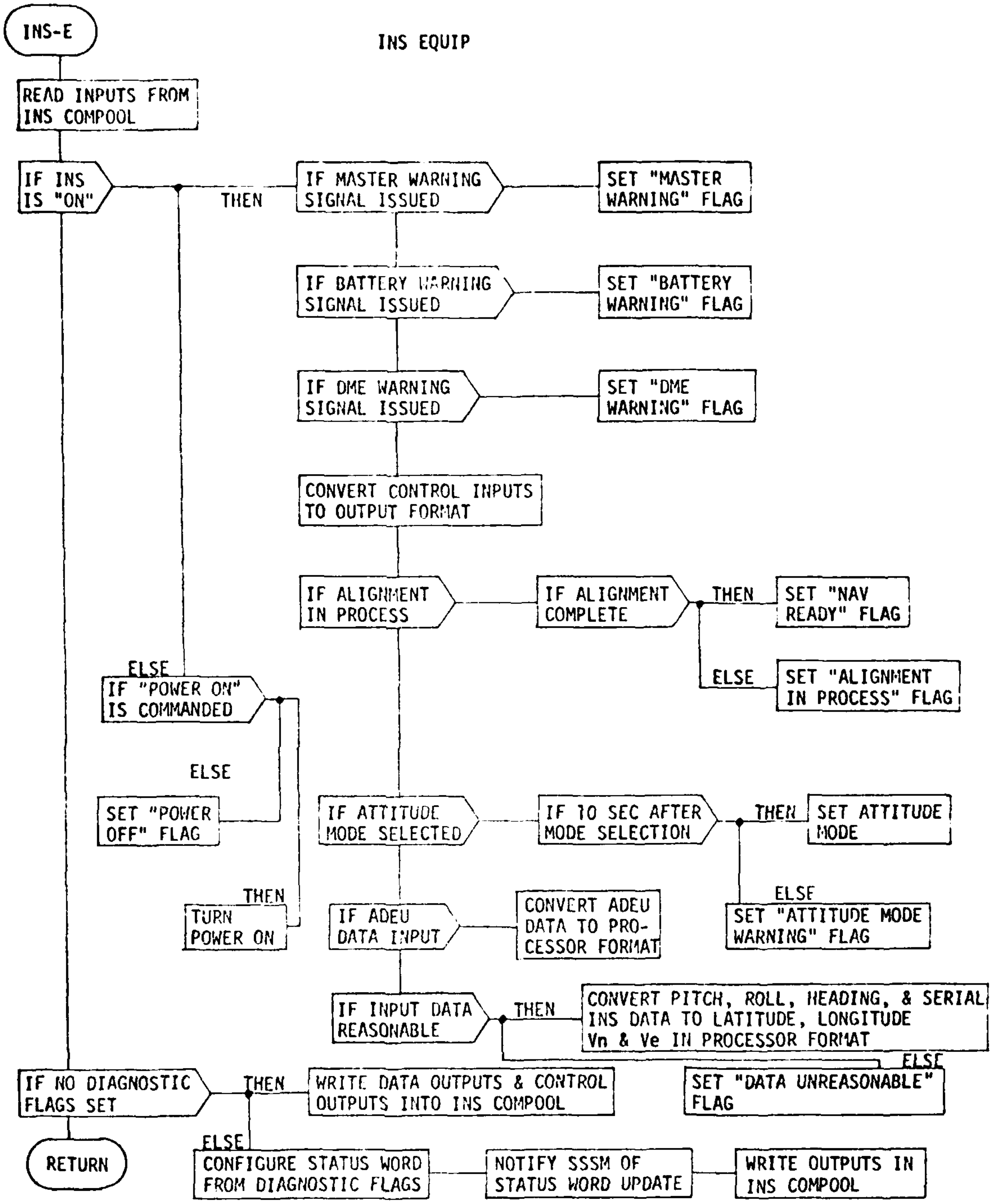


Figure 21 INS EQUIP

SUMMARY OF DIAGNOSTIC FLAGS

- "INS MASTER WARNING"
- "INS BATTERY WARNING"
- "INS DME WARNING"
- "INS ALIGNMENT IN PROCESS"
- "INS NAV READY"
- "INS ATTITUDE MODE WARNING"
- "INS DATA UNREASONABLE"

FIGURE 21 (Cont.)

INS EQUIP

3.2.4.1.3 Outputs

The outputs from this program module shall be as specified in Table XLV

3.2.4.2 OMEGA EQUIP (OMEGA-E)

This program module processes the present position latitude and longitude outputs from the OMEGA Navigational Equipment. The module also processes the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the OMEGA system. This module also processes the results of the automatic self-test operation to set the appropriate diagnostic flags and to notify the Subsystem Status Monitor. By comparison with previously received inputs, the program module determines the reasonableness of the inputs. The computer requirements for this module are:

Memory size	196	16 bit words
Throughput	5028	ms/sec
Update rate	2	times/sec

3.2.4.2.1 Inputs

The inputs to this program module are listed in Table XLVI.

3.2.4.2.2 Processing

The control inputs shall be converted to an appropriate format for output to properly control the operation of the OMEGA Receiver.

The input values of True Airspeed, Present Position Latitude and Longitude, the current date and Greenwich Mean Time shall be converted to the appropriate format for input to properly initialize the operation of the OMEGA Receiver.

TABLE XLV OUTPUTS - INERTIAL NAVIGATION SYSTEM (INS) EQUIP (INS-E)

DATA NAME	SYMBOL	UPS	TYPE	DESTINATION	REFERENCE
Pitch		32		NAVIGATION SPEC	
Poll		32		NAVIGATION SPEC	
True Heading		32		NAVIGATION SPEC	
Latitude		32		NAVIGATION SPEC	
Longitude		32		NAVIGATION SPEC	
Velocity - East		32		NAVIGATION SPEC	
Velocity - North		32		NAVIGATION SPEC	
Lamp Test		2		INS	
CDU Enable		2		NAVIGATION SPEC	
Battery Operation		2		NAVIGATION SPEC	
Control Data		32		INS	
TAS Input		32		INS	

TABLE XLV OUTPUTS - INERTIAL NAVIGATION SYSTEM (INS) EQUIP (INS-E) (Continued)

DATA NAME	SYMBOL	UPS	TYPE	DESTINATION	REFERENCE
Altitude Input		32		INS	
Control Mode (3 Bits)		2		NAVIGATION SPEC	
H DME Pulse Pair		8		TBD	
C DME Pulse Pair		8		TBD	
ADEU Serial Data		32		TBD	
Data Valid Flag		8		TBD	
INS Master Warning		2		NAVIGATION SPEC	
Battery Warning		2		NAVIGATION SPEC	
NAV Ready Lite		2		NAVIGATION SPEC	
MSU Power ON		2		NAVIGATION SPEC	
DME Warning		2		NAVIGATION SPEC	
Status Word		2		SSSM	

TABLE XLVI INPUTS - OMEGA EQUIP (OMEGA-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
DATE		2		DEK EQUIP	
GREENWICH MEAN TIME		2		" "	
INITAL LATITUDE		2		" "	
INITIAL LONGITUDE		2		" "	
MAGNETIC HEADING		2		AHRS EQUIP	
TURE AIRSPEED		2		FCS EQUIP	
MODE CONTROL		2		IMK EQUIP	
T & P ALARM		2		OMEGA RECVR	
DR INDICATOR		2		" "	
TEMP. WARNING		2		" "	
MASTER WARNING		2		" "	
COMPUTED LATITUDE		2		" "	
COMPUTED LONGITUDE		2		" "	

Improper operation of the OMEGA shall be announced by the "Master Warning", "Temperature Warning", and "DR Warning" signals at which time the appropriate diagnostic flags shall be set as well as the appropriate bits on the status word.

The current input values of latitude and longitude shall be compared with the previous values in order to determine the reasonableness of the current input values.

This program module is a privileged task and shall be executed synchronously 2 times per second.

The processing shall be performed as specified in Figure 22.

3.2.4.2.3 Outputs

The outputs from this program module are listed in Table XLVII .

3.2.4.3 TACAN Equip (TACAN-E)

This program module processes the inputs of slant range and relative bearing from the AN/ARN-118 TACAN Receiver/Transmitter. The inputs are checked for validity prior to being connected to the appropriate format for further processing. This module also processes the mode and function commands from the operator by converting them to appropriate formats for output to control the operation of the TACAN. This module activates the self-test

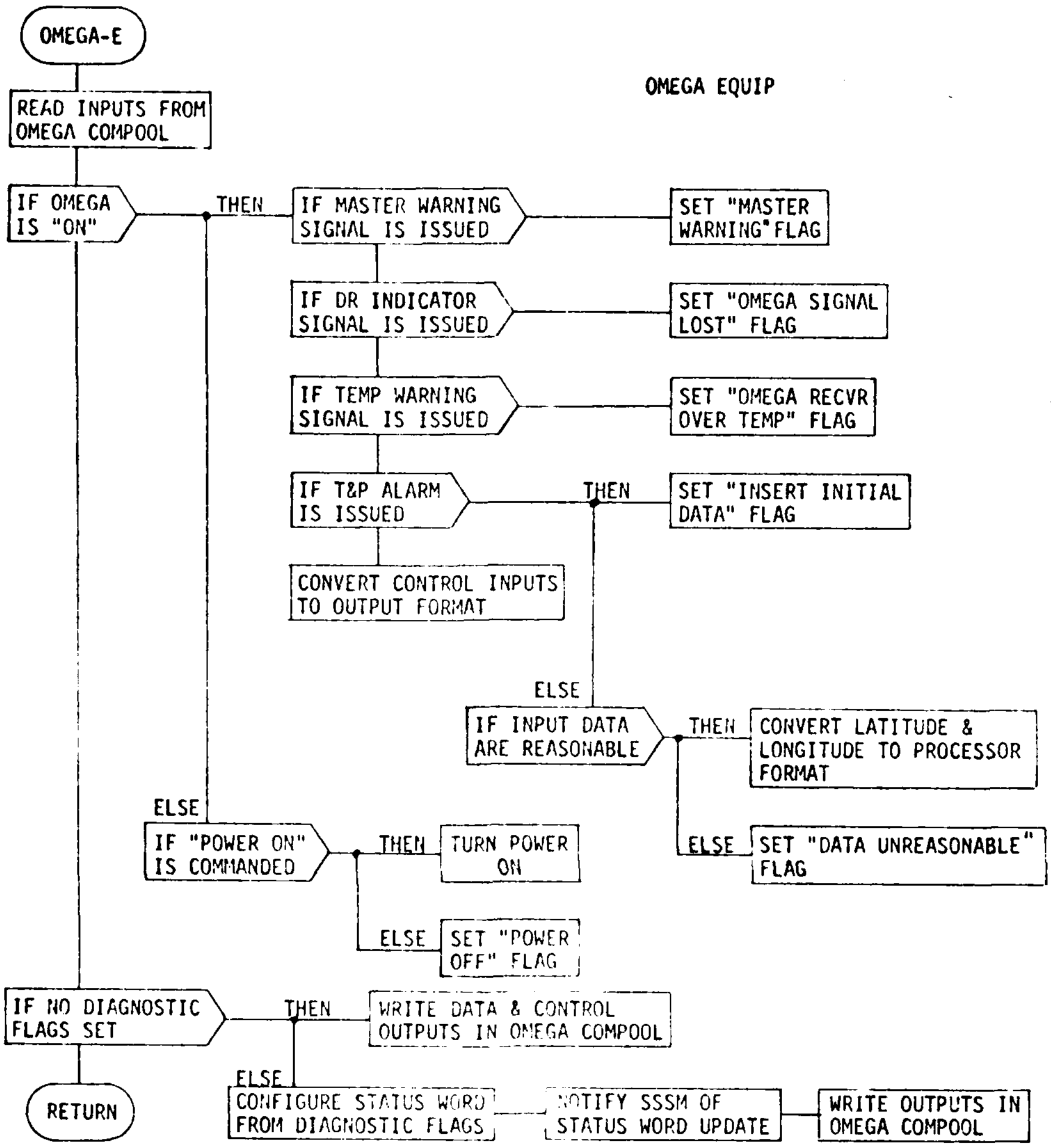


Figure 22 OMEGA EQUIP

SUMMARY OF DIAGNOSTICS

- "OMEGA MASTERWARNING"
- "OMEGA SIGNAL LOST"
- "OMEGA RECVR OVERTEMP"
- "INSERT INITIAL OMEGA DATA"
- "OMEGA DATA UNREASONABLE"
- "OMEGA POWER OFF"

FIGURE 22 (Cont.)

OMEGA EQUIP

TABLE XLVII OUTPUTS - OMEGA EQUIP (OMEGA-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
DATE		2		OMEGA RCVR	
GREENWICH MEAN TIME		2		" "	
P P LATITUDE		2		" "	
PP LONGITUDE		2		" "	
MAGNETIC HEADING		2		" "	
TRUE AIRSPEED		2		" "	
MODE CONTROL		2		" "	
LATITUDE		2		NAVIGATION SPEC	
LONGITUDE		2		" "	
T & P ALARM		2		MPDG EQUIP	
DR INDICATOR		2		MPDG EQUIP	
TEMP. WARNING		2		" "	
MASTER WARNING		2		" "	
STATUS WORD		2		SSSM	

mode of operation upon command by the operator and will process the results of the automatic self-test operation for input to the subsystem status monitor. By comparison with previously received inputs, the program module determines the reasonableness of the inputs. The computer requirements for this module are:

Memory size	100	16 bit words
Throughput	9744	ms/sec
Update rate	8	times/sec

3.2.4.3.1 Inputs

The inputs to this program module are listed in Table XLVIII.

3.2.4.3.2 Processing

The input R/T ternary data words for slant range and relative bearing shall be processed by the elimination of such non-function bits as status bits, pads or labels, then shall be further processed by the conversion of the data bits to the appropriate output scale factors.

This program module shall convert the control and function inputs to an appropriate format for output to properly control the operation of the TACAN.

Upon command from the Request Processor, the Manual Self-Test (Confidence Test) features shall be activated. The results of this test will be a distance of 000.0 miles and a bearing indication of 180 degrees if the TACAN set is functioning properly. Improper operation shall be

TABLE XLVIII INPUTS - TACAN EQUIP (TACAN-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
MODE SWITCH (3 BITS)		8	01	IMK EQUIP	
IDENT VOLUME CONTROL		8	05	ACP EQUIP	
CHANNEL SELECTOR (10 BITS)		8	01	DEK EQUIP	
TEST SWITCH		8	01	DEK EQUIP	
TEST INDICATOR		8	01	TACAN CONTROL UNIT	
RT TERNARY DATA		8	01	TACAN CONTROL UNIT	
COMPUTER TERNARY DATA		8	10	TBD	
COMPUTER FLAG		8	10	TBD	
RT FLAG		8	01	TACAN CONTROL UNIT	
TACAN SELECT		8	C1	DEK EQUIP	

announced by the test indicator signal at which time the module shall set the appropriate flags and the appropriate bits on the status word.

The loss of a reliable input signal shall initiate the Automatic Self-Test features. Improper operation shall be announced by the test indicator signal at which time the appropriate diagnostic flags shall be set as well as the appropriate bits on the status word.

The current input values of slant range and relative bearing shall be compared with the previous values in order to determine the reasonableness of the current input values.

The processing shall be performed as specified in Figure 23 .

After receipt of the "power on" command, the program module shall set the "warm up" flag, then bypass further processing until the appropriate warm-up period has transpired.

This program module is a privileged task and shall be executed synchronously 8 times per second.

3.2.4.3.3 Outputs

The outputs from this program module are listed in Table XLIX .

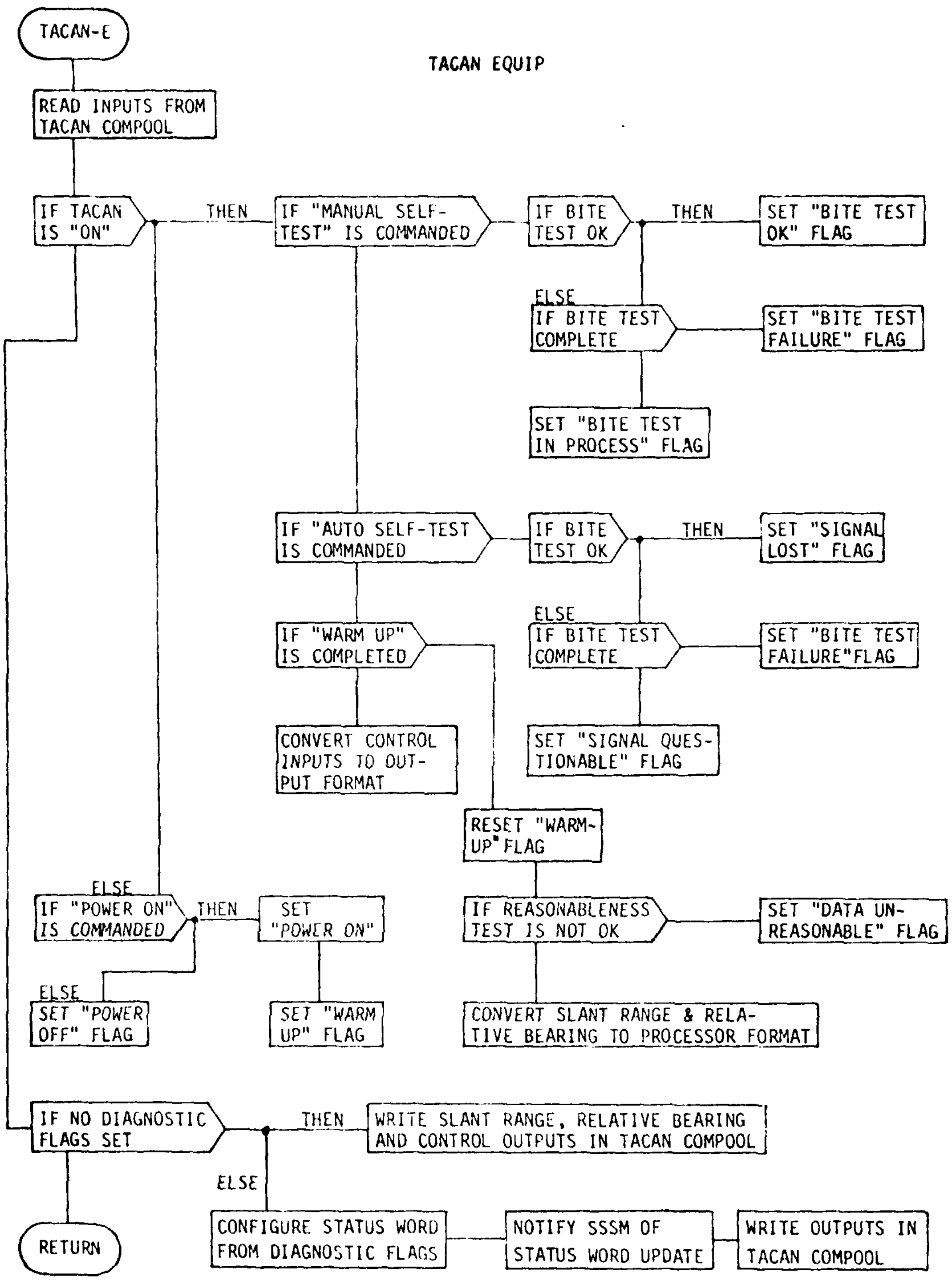


Figure 23 TACAN EQUIP

SUMMARY OF DIAGNOSTIC FLAGS

- "CONFIDENCE TEST OK"
- "CONFIDENCE TEST IN PROGRESS"
- "CONFIDENCE TEST FAILURE"
- "TACAN SIGNAL LOST"
- "SELF TEST FAILURE"
- "TACAN SIGNAL QUESTIONABLE"
- "TACAN IN WARM-UP"
- "TACAN DATA UNREASONABLE"
- "TACAN POWER OFF"

Figure 23 TACAN EQUIP (Cont.)

TABLE XLIX OUTPUTS - TACAN EQUIPS (TACAN-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
MODE SWITCH (3 BITS)		8		TACAN CONTROL UNIT	
IDENT VOLUME CONTROL		8		TACAN CONTROL UNIT	
CHANNEL SELECTOR (10 BITS)		8		TACAN CONTROL UNIT	
TEST SWITCH		8		TACAN CONTROL UNIT	
SLANT RANGE		8		(NAVIGATION SPEC (GUIDANCE SPEC	
RELATIVE BEARING		8		(NAVIGATION SPEC (GUIDANCE SPEC	
TACAN SELECT		8		TACAN CONTROL UNIT	
STATUS WORD		8		SSSM	

3.2.4.4 AHRS EQUIP (AHRS-E)

This program module processes the inputs of heading, pitch, roll and turn rate from the Attitude and Heading Reference System (AHRS), Lear Siegler #6000A. These inputs are checked for validity prior to being converted to the appropriate format for further processing. This module also processes the mode and function commands from the operator by converting them to appropriate formats for output to control the operation of the AHRS. The automatic self-test features of the AHRS are processed for input to the Subsystem Status Monitor. By comparison with previously received inputs, the program module determines the reasonableness of the inputs. The computer requirements for this module are:

Memory size	191	16 bit words
Throughput	19488	ms/sec
Update rate	8	times/sec

3.2.4.4.1 Inputs

The inputs to this program module are listed in Table L .

3.2.4.4.2 Processing

When power is initially applied to the AHRS, the program module shall set the "warm-up" flag, then bypass further processing until the appropriate warm-up period has transpired.

This program module shall convert the control and function inputs to an appropriate format for output to properly control the operation of the AHRS.

The input data words of heading, pitch, roll and rate-of-turn shall be processed by conversion to an appropriate format and scale factor for output to the processor.

TABLE L INPUTS - AHRS EQUIP (AHRS-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
HEADING		8	09	AHRS CONTROL UNIT	
PITCH		8	09	AHRS CONTROL UNIT	
ROLL		8	09	AHRS CONTROL UNIT	
VERT. MALFUNCT. IND.		1	01	AHRS CONTROL UNIT	
AZIMUTH MALFUNCT. IND.		1	01	AHRS CONTROL UNIT	
COMB. MALFUNCT. IND.		1	01	AHRS CONTROL UNIT	
COMPASS MODE FAIL		1	01	AHRS CONTROL UNIT	
DEVIATION COMPENSATION		8	05	DEK EQUIP	
COMPASS MODE SEL. (2 BIT)		8	01	DEK EQUIP	
PUSH-TO-SYNCH		8	01	DEK EQUIP	
SYNCHRONIZER CONTROL		8	05	SCP EQUIP	
LATITUDE CORRECTION		8	05	DEK EQUIP	
SYNCHRONIZER INDICATOR		1	01	AHRS CONTROL UNIT	
RATE OF TURN		8		AHRS CONTROL UNIT	

TABLE L INPUTS -AHRS EQUIP (CONT.) (AHRS-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
HEMISPHERE SELECT		8		DEK EQUIP	
FAST ERECT. COMMAND		8		DEK EQUIP	
MAGNETIC VARIATION		8		NAV SPEC	

The input data word of magnetic variation shall be processed by conversion to the appropriate format and scale factor for output to the AHRS.

The program module shall periodically check for the presence of error signal inputs indicating a vertical reference or azimith malfunction and compass mode failure, at which time the appropriate diagnostic flags shall be set as well as the appropriate bits on the status word.

The current input values of heading, pitch, roll and rate-of-turn shall be compared with their respective previous values in order to determine the reasonableness of the input values.

The processing shall be performed as specified in Figure 24 .

This program module is a privileged task and shall be executed synchronously 8 times per second.

3.2.4.4.3 Outputs

The outputs from this program module are listed in Table LI .

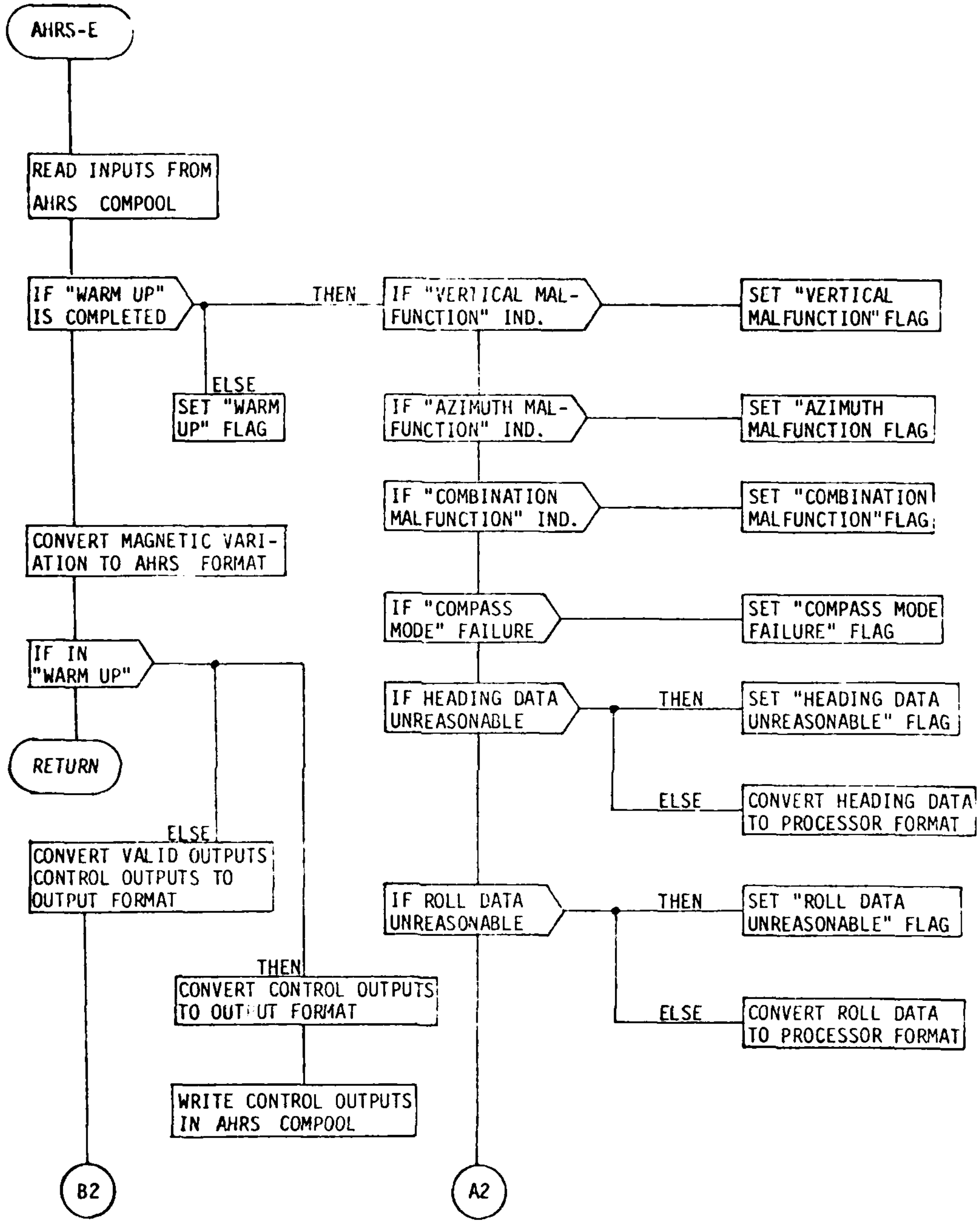
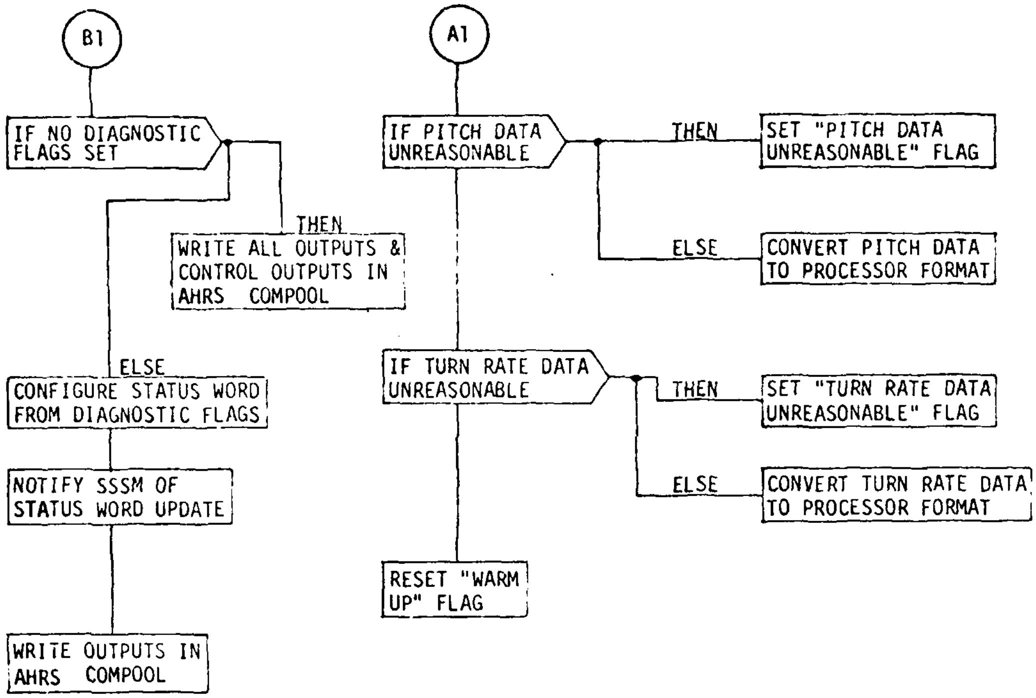


Figure 24 AHRS EQUIP



SUMMARY OF DIAGNOSTIC FLAGS

- "VERTICAL GYRO MALFUNCTION"
- "DIRECTIONAL GYRO MALFUNCTION"
- "BOTH GYRO MALFUNCTION"
- "COMPASS MODE FAILURE"
- HEADING DATA UNREASONABLE"
- "ROLL DATA UNRELIABLE"
- "PITCH DATA UNRELIABLE"
- "TURN RATE DATA UNRELIABLE"
- "AHRS IN WARM-UP"

Figure 24 AHRS EQUIP (Cont.)

TABLE LI OUTPUTS - AHRS EQUIP (AHRS-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
HEADING		8		NAV SPEC	
PITCH		8		NAV SPEC	
ROLL		8		NAV SPEC	
DEVIATION COMPENSATION		8		AHRS CONTROL UNIT	
COMPASS MODE SEL. (2 BITS)		8		AHRS CONTROL UNIT	
PUSH-TO-SYNCH		8		AHRS CONTROL UNIT	
SYNCHRONIZER CONTROL		8		AHRS CONTROL UNIT	
LATITUDE CORRECTION		8		AHRS CONTROL UNIT	
SYNCHRONIZER INDICATOR		1		AHRS CONTROL UNIT	
RATE OF TURN		8		NAV SPEC	
HEMISPHERE SELECT		8		AHRS CONTROL UNIT	
FAST ERECT. COMMAND		8		AHRS CONTROL UNIT	
MAGNETIC VARIATION		8		AHRS CONTROL UNIT	
STATUS WORD		8		SSSM	

3.2.4.5 Function 4.5 - Navigation Controller - SPEC

The Navigation Controller Function schedules the tasks necessary to provide measurement data and navigate. Also, the navigation controller signals events for the tasks necessary to compute wind velocities. The navigation is done synchronously during a mission. It is scheduled whenever a new mode is entered. The computer requirements for this module are:

Memory size	21	16 bit words
Throughput	0	ms/sec
Update rate	0	times/sec

3.2.4.5.1 Inputs

The Navigation Controller Function shall not require any inputs.

3.2.4.5.2 Processing

The Navigation Controller shall perform the processing as described in Figure 25. The Navigation Controller shall be scheduled by the appropriate OPS or by a brute force SPEC. The Navigation Controller shall schedule the Navigation Selection (3.2.4.6) and Wind Computation (3.2.4.9) functions at the appropriate rate and phase whenever a new mode is entered. The otner required functions shall be scheduled asynchrously.

3.2.4.5.3 Outputs

The Navigation Controller Function shall not provide any outputs.

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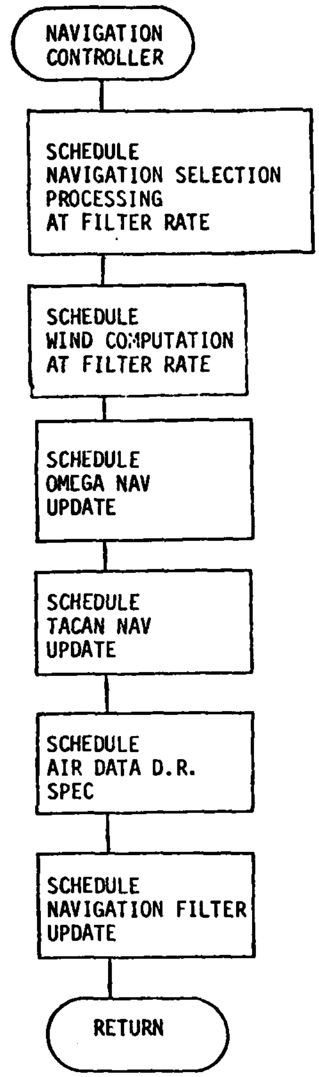


Figure 25 Navigation Controller Processing

3.2.4.6 Function 4.6 - Navigation Selection - SPEC

The Navigation Selection Function determines which navigation specialist function is to be called to provide position and velocity. The determination is made based on the status of the various navigation sensors. This task also supplies the values of control flags to determine the mode of navigation. The selection is made based on the assumption that the TACAN provides estimates with less error than either the air data or the ONE. The computer requirements for this module are;

Memory size	66	16 bit words
Throughput	0.5	ms/sec
Update rate	1	times/sec

3.2.4.6.1 Inputs

The inputs for the Navigation Selection SPEC shall be as described in Table LII .

3.2.4.6.2 Processing

The Navigation Selection SPEC shall perform the processing specified in Figure . 26 The Navigation Selection SPEC shall choose the software module to compute the position and velocity. The selection shall be based on the status of the following three sensors:

a. INS

b. OMEGA

c. TACAN

If the NAV Filter Update SPEC is called, flags shall be provided to adjust the error covariance matrix per the status of the sensors. If the INS is operable, the navigation filter shall be called. The state noise covariance and choice of measurement to be processed shall be adjusted for non-acceptable

TABLE LII INPUTS TO NAVIGATION SELECTION

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Goodness of INS Data		EQUIP: INS	3.2.4.1
2. Goodness of OMEGA Data		EQUIP: OMEGA	3.2.4.2
3. Goodness of TACAN Data		EQUIP: TACAN	3.2.4.3

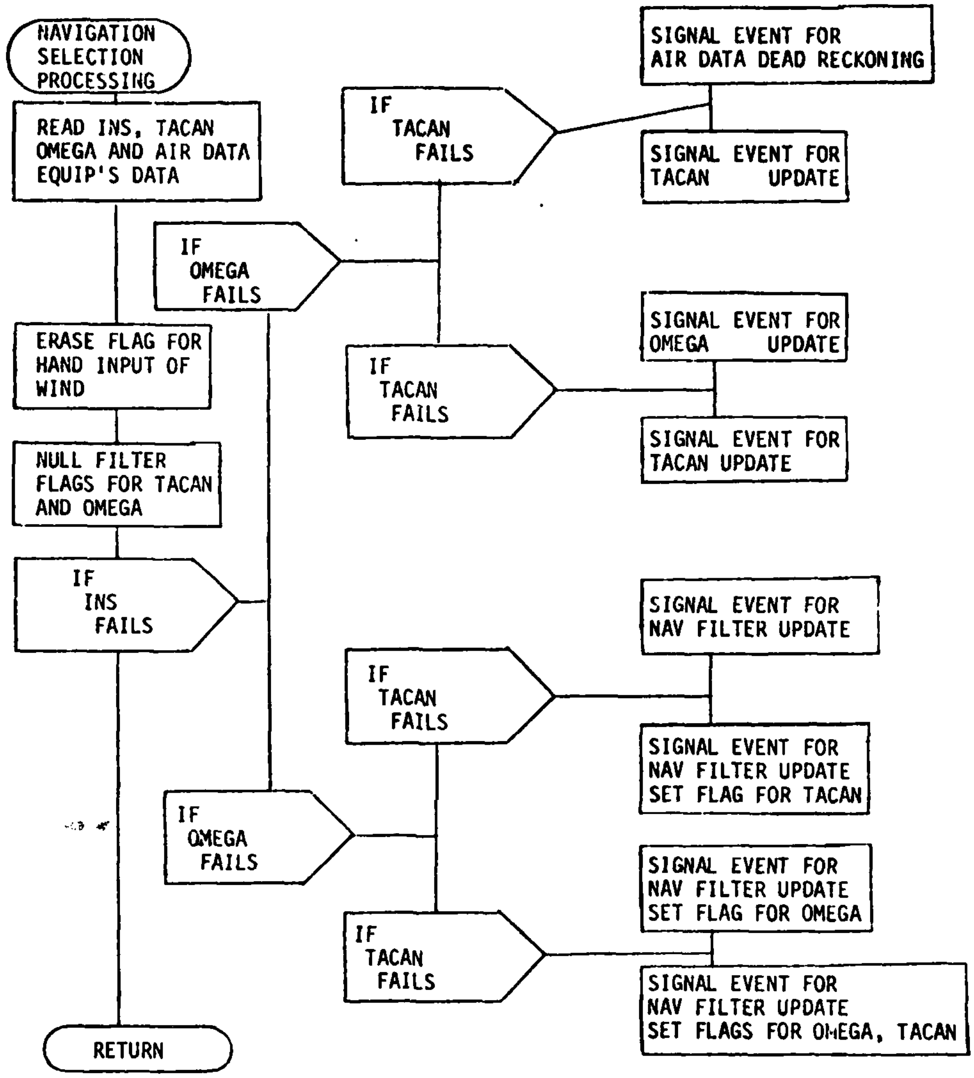


Figure 26 Navigation Selection Processing

sensor measurements. The Navigation Selection SPEC, shall set flags to indicate to the NAV Filter which terms are unreasonable. If the measurements from the INS are unreasonable, the Navigation Selection SPEC shall call for a direct update of the position and velocity. If both the ONE and TACAN are also unreasonable, a flag shall be provided the Wind Computation SPEC to indicate that wind speed cannot be computed and that a pilot input may be desired. The Navigation Selection SPEC shall be scheduled by the Navigation Controller (3.2.4.5) at a rate of once per second.

3.2.4.6.3 <u>Outputs</u>

The outputs from the Navigation Selection SPEC shall be as described in Table LIII.

TABLE LIII OUTPUTS FROM NAVIGATION SELECTION SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Flags for state noise covariance matrix adjustment and filter processing of measurements		1. SPEC: Navigation Filter	3.2.4.7
2. Flag for Hand Input of Wind Computation		2. SPEC: Wind Computation	3.2.4.9

3.2.4.7 Function 4.7 - Navigation Filter Update SPEC

The Navigation Filter Update Specialist Function provides an optimal estimate of the position and velocity. The optimal estimate is based on those sensors which are providing reasonable data. The computer requirements for this module are:

Memory size	2265	16 bit words
Throughput	3.8	ms/sec
Update rate	1	times/sec

3.2.4.7.1 Inputs

The inputs for the NAV Filter Update Specialist Function shall be as specified in Table LIV .

3.2.4.7.2 Processing

The Navigation Filter Update SPEC shall perform the processing specified in Figure 27 . Based on the flags set by the NAV Selection SPEC, the NAV Filter Spec shall read data from the INS, OMEGA and TACAN. For any navigation equipment that is not good, the terms of the state noise covariance matrix corresponding to the bad equipment shall be made arbitrarily large. Also, the corresponding measurements shall not be processed. If the NAV Filter is being executed for the first time or measurements are being resumed after being down for some time, the NAV Filter shall compute appropriate initialization values. The NAV Filter compute the measurement sensitivity matrix using the latest estimates of the state. The NAV Filter Update SPEC shall then compute the minimum variance estimate of the error in the state relative to the INS using the current measurements. The position and velocity provided by the INS shall be adjusted by the error estimates. The resultant values shall be designated as the optimal estimate. The attitude shall be determined directly from the INS but adjusted by the estimate of the computer to platform angle error.

3.2.4.7.3 Outputs

The outputs from the NAV Filter Update SPEC shall be as specified in Table LV .

TABLE LIV INPUTS TO NAV FILTER UPDATE SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Position, Velocity, Attitude from INS		EQUIP: INS	3.2.4.1
2. Bearing and Range from TACAN Stations		EQUIP: TACAN	3.2.4.3
3. Latitude and Longitude from ONE		EQUIP: OMEGA	3.2.4.2
4. Flags indicating Status of Data		SPEC: Navigation Selection	3.2.4.6
5. Air Speed, Barometric Attitude, A/A		EQUIP: Air Frame Sensor	3.2.9.2
6. Initialization Values for Filter		-	-
7. Current Time		-	-

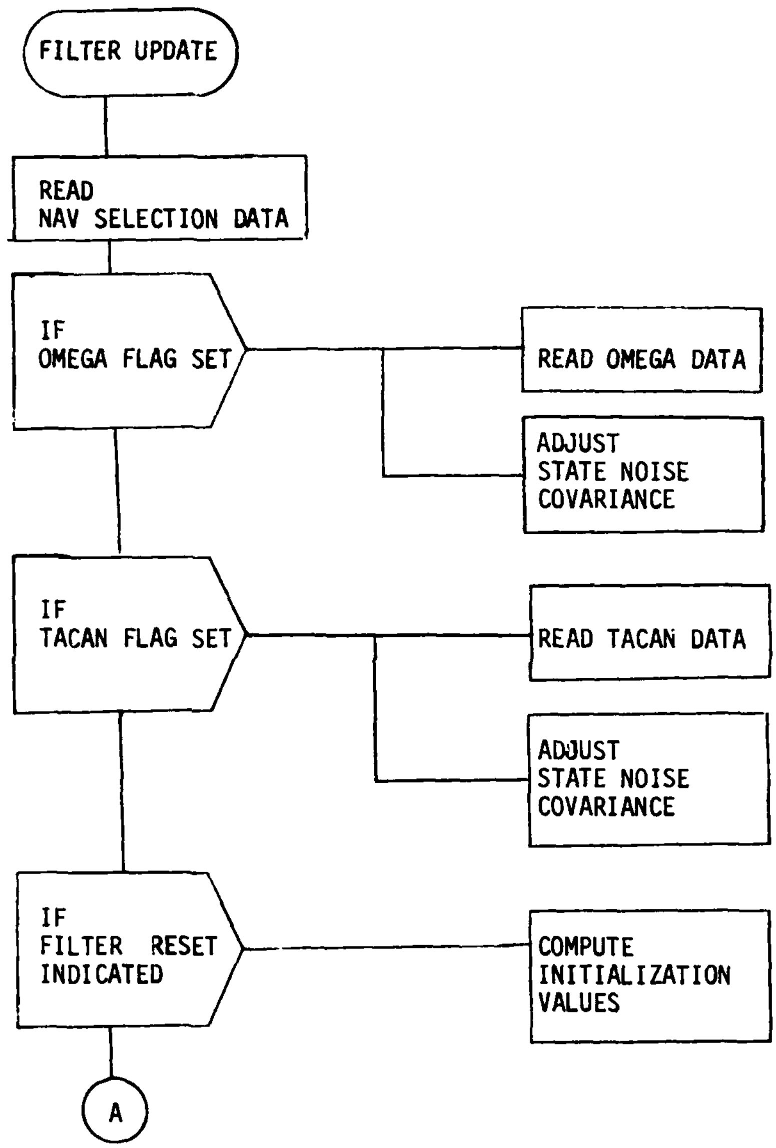


Figure 27 NAV Filter Update SPEC

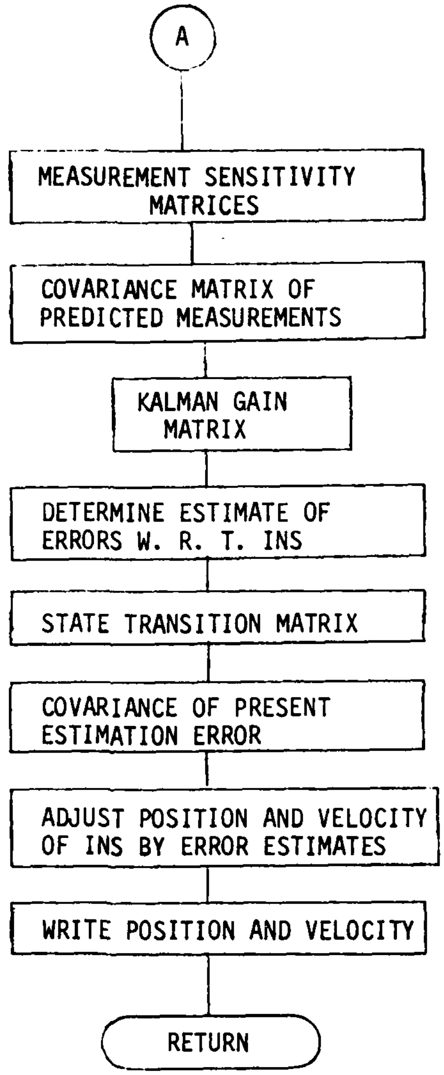


Figure 27 (Cont.) NAV Filter Update SPEC

TABLE LV - OUTPUTS FROM NAV FILTER UPDATE SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Position with Time Tag		SPEC: Wind Computation	3.2.4.9
		DISP: Multi-Purpose Display	3.2.1.2.1
2. Velocity		SPEC: Wind Computation	3.2.4.9
		DISP: Multi-Purpose Display	3.2.12.1
3. Attitude		SPEC: Wind Computation	3.2.4.9
		DISP: Multi-Purpose Display	3.2.12.1

3.2.4.8 Function 4.8 - Air Data Dead Reckoning SPEC

The Air Data Dead Reckoning Specialist Function is used to compute the position when other navigation equipment is not available. The Air Data DR SPEC uses the last best estimates of navigation quantities provided by the other navigation equipment when it was operable. The Air Data Dead Reckoning SPEC is signalled by the Brute Force NAV SPEC (3.2.3.1) and the Navigation Selection SPEC (3.2.4.6). The computer requirements for this module are:

Memory size	67	16 bit words
Throughput	0	ms/sec
Update rate	0	times/sec

3.2.4.8.1 Inputs

The inputs to the Air Data DR SPEC shall be as specified in Table LVI .

3.2.4.8.2 Processing

The Air Data DR SPEC shall compute the position and vertical velocity using measurements provided by the air data equipment. The processing shall be performed as specified in Figure 28 . The current velocity shall be integrated over the time since the last update of position to provide the change in position. The components of the current velocity shall be computed using attitude information from the air data and AHRS. The velocity shall be adjusted for wind velocities. The vertical velocity shall be computed using the barometric attitude change. The Air Data DR SPEC shall be performed asynchronously.

3.2.4.8.3 Outputs

The outputs from the Air Data DR SPEC shall be as specified in Table LVII .

TABLE LVI INPUTS TO AIR DATA DEAD RECKONING

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Magnetic Bearing		EQUIP: AHARS	3.2.4.4
2. Magnetic Variation			
3. Angle of Attack		EQUIP: FCS	
4. Pitch Angle		EQUIP: FCS	
5. Estimate of Winds		SPEC: Wind Computation	3.2.4.9
6. Barometric Attitude		EQUIP: FCS	
7. Best Estimate of Position		SPEC: Nav Filter	3.2.4.7
8. Time When Estimate Computed		SPEC: Nav Filter	3.2.4.7
9. Current Time			

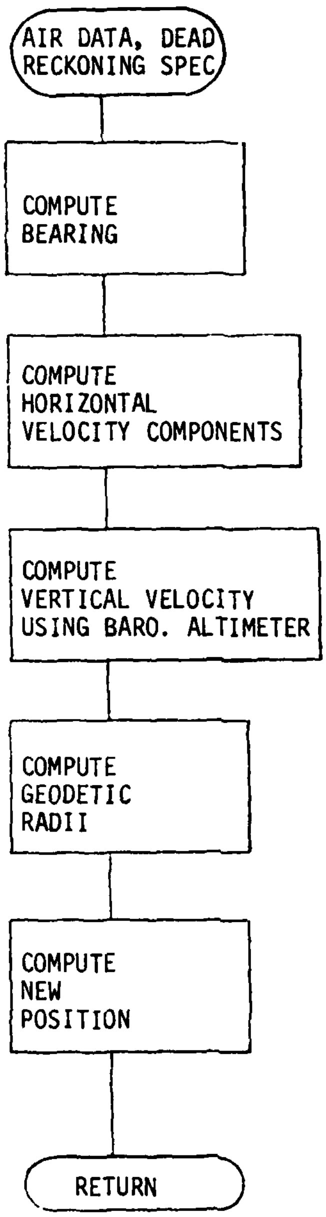


Figure 28 Air Data Dead Reckoning

TABLE LVII OUTPUTS FROM AIR DATA DEAD RECKONING

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Geographic Position and Time of Computation			
2. Vertical Velocity			

3.2.4.9 Function 4.9 - Wind Computation SPEC

The Wind Computation Specialist Function determines the wind velocity based on the True Air Speed (TAS) and the optimal estimate of ground speed. Also, the Wind Comp SPEC asks for pilot aid if the optimal estimate is not available. The optimal estimate of ground speed not being available indicates that TAS is the only source of velocity information. The computer requirements for this module are:

Memory size	18	16 bit words
Throughput	0.1	ms/sec
Update rate	1	times/sec

3.2.4.9.1 Inputs

The inputs to the Wind Comp SPEC shall be as specified in Table LVIII .

3.2.4.9.2 Processing

The Wind Computation Specialist Function shall perform the processing specified in Figure 29 . The Wind Comp SPEC shall read in a hand-input flag which indicates whether there is sufficient NAV Equip data to make a valid estimate of the ground speed. If the hand-input flag is set, a check shall be made to determine if this is first call to Wind Comp SPEC since all key Nav Equip invalid. If this is first pass, a message shall be sent to pilot on MPD describing the situation and providing the value and time of the wind estimate to be used if pilot does not override. If the current pass is occurring after the message has been previously sent to pilot, the DEK shall be interrogated for an estimate of the wind velocity. If pilot has not responded, the last available estimate of wind velocity is used as the current estimate. When the pilot responds, a flag shall be set. The pilot's estimate shall be used as

TABLE LVIII INPUTS TO WIND COMPUTATION SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Hand Input Flag		SPEC: Nav Selection	3.2.4.6
2. Wind Estimate From Pilot		DISP: DEK	3.2.12.5
3. Optimal Estimate of Velocity		SPEC: Nav Filter Update	3.2.4.7
4. True Heading& Attitude		EQUIPS: AHARS, INS	3.2.4.4, 3.2.4.1

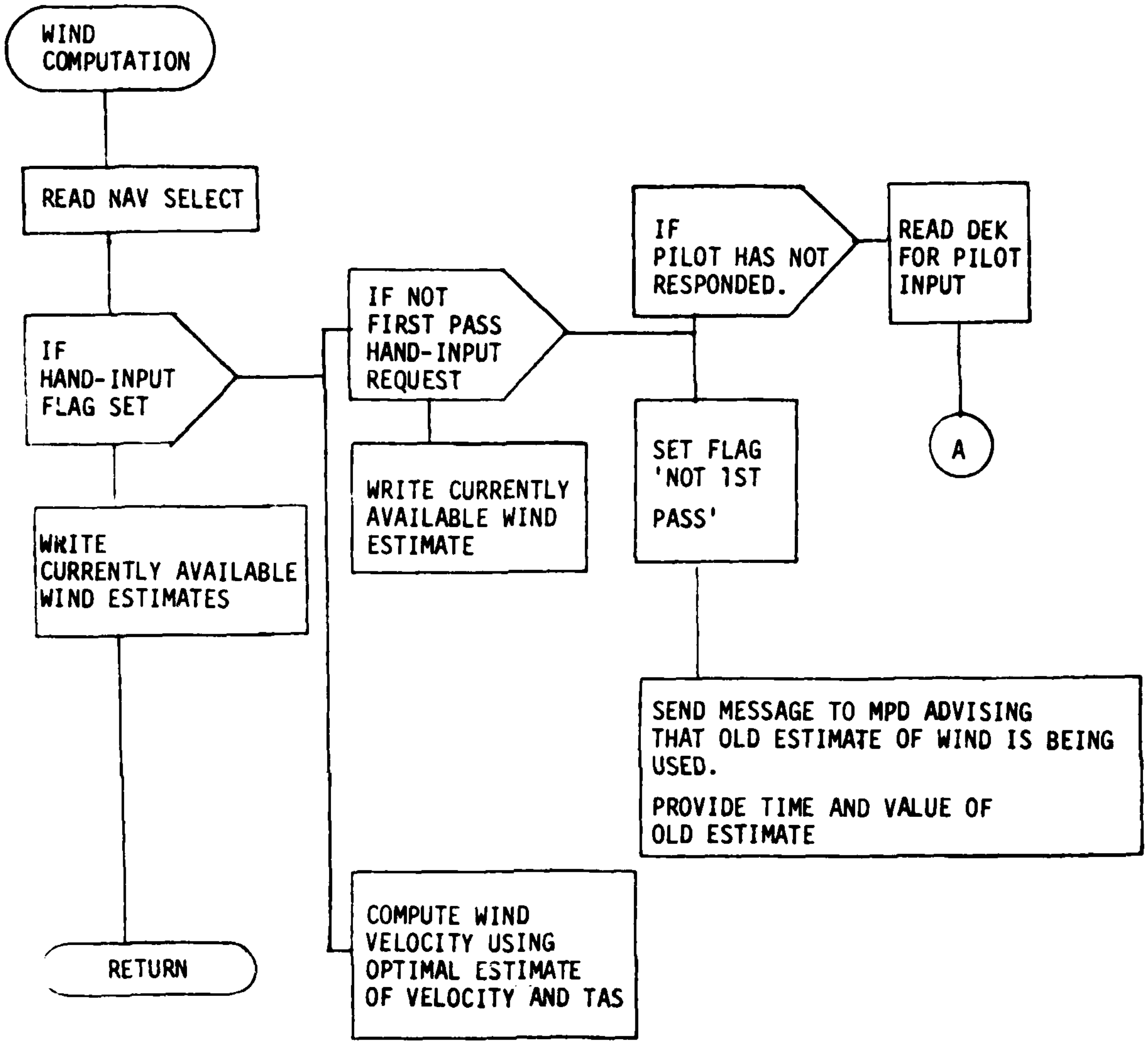


Figure 29 Wind Computation SPEC

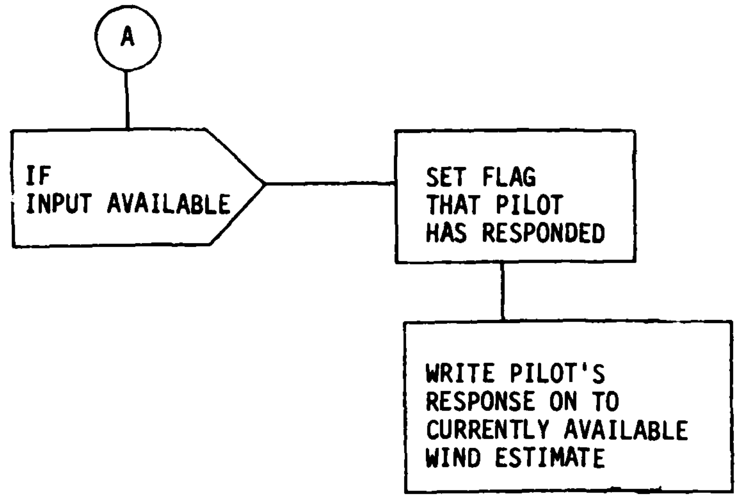


Figure 29 (Cont.) Wind Computation SPEC

the current estimate. If sufficient Nav Equip is available to make a valid estimate of ground speed, the Wind Comp SPEC shall compute the wind velocity using the optimal estimate of the velocity and the true air speed (TAS). This estimate of wind velocity shall become the currently available wind estimate. The Wind Computation SPEC shall be scheduled by the Navigation Controller (3.2.4.5) at the Nav Filter rate.

3.2.4.9.3 Outputs

The outputs from the Wind Computation SPEC shall be as specified in Table LIX .

3.2.4.10 Function 4.10 - TACAN Navigation Update - SPEC

The TACAN Navigation Update Specialist Function computes the velocity and position based on the range, range-rate and bearing generated by the TACAN Equip Function (3.2.4.3). The TACAN NAV SPEC event is signalled by the Brute Force Nav SPEC (3.2.3.1) or the Navigation Selection SPEC (3.2.4.6). The worst case computer requirements for this module are:

Memory size	360	16 bit words
Throughput	0.4	ms/sec.
Update rate	1	times/sec

3.2.4.10.1 Inputs

The inputs required by the TACAN Navigation Update SPEC shall be as specified in Table LX .

FIGURE LIX OUTPUTS FROM WIND COMPUTATION SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Message Indication to Pilot that Manual Estimate of Wind may be desired		DISP: MPD	3.2.12.1
2. Estimate of Wind Velocity		SPEC: Air Data Dead Reckoning	3.2.4.8

TABLE LX INPUTS TO TACAN NAVIGATION UPDATE

DATA NAME	SYMBOL	SOURCE	REFERENCE
Channel Number of Tacan Station		EQUIP: TACAN	3.2.4.3
Latitude, Longitude and Magnetic Bearing of TACAN Station		Read in from Mass Memory per Area	
Range, Range Rate and Bearing		EQUIP: TACAN	3.2.4.3
Mag. Bearing of A/C		EQUIP: AHARS	
Mag. Variation Table			
Barometric Attitude		EQUIP: FCS	
Geodetic Earth Radius			
Meridian Radius			
Ellipticity			

3.2.4.10.2 Processing

The processing performed by the TACAN Navigation Update SPEC shall be as described in Figure 30 . The TACAN NAV function shall determine if a new TACAN channel has been requested. The determination shall be made by keeping track of the channel being used. When the channel is changed, a new station shall be assumed. When a new channel is indicated, a TACAN channel table shall be interrogated to provide the latitude, longitude, altitude and magnetic variation of the requested TACAN channel. When the TACAN station characteristics are determined, the true bearing of the aircraft relative to the station shall be computed. The range to the station and barometric attitude of the aircraft shall be used to compute the ground range. The difference in longitude and latitude between aircraft and TACAN station shall then be computed. The latitude and longitude of the aircraft shall then be calculated. The range rate shall be used to compute the ground speed and the velocity. The resultant velocity and position shall be provided as the best available estimates. The TACAN Nav Update SPEC shall be performed asynchronously.

3.2.4.10.3 Outputs

The outputs provided by the TACAN Navigation Update Specialist Function shall be as specified in Table LXI .

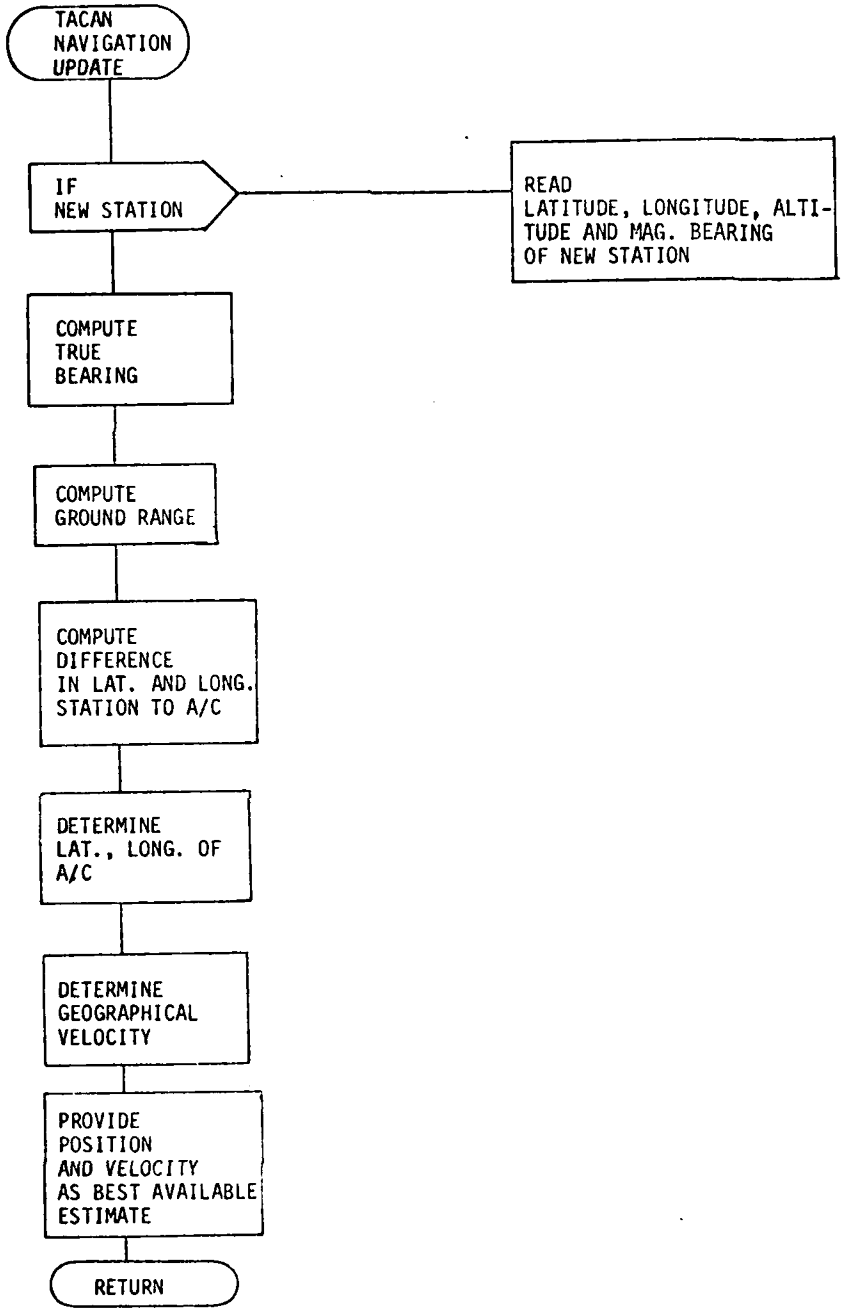


Figure 30 TACAN Navigation Update

TABLE LXI OUTPUTS FROM TACAN NAVIGATION UPDATE

DATA NAME	SYMBOL	DESTINATION	REFERENCE
Position of A/C with Time Tag		DISP: MPD, SPEC: Wind Computation	
Velocity of A/C		DISP: MPD, SPEC: Wind Computation	

3.2.4.11 Function 4.11 - OMEGA Navigation Update - SPEC

Thw OMEGA Navigation Update Specialist Function copies the position and velocity provided by the OMEGA Equip (3.2.4.2) to the best available estimate values. The best available estimate is used for future navigation. The OMEGA NAV SPEC event is signalled by the Brute Force NAV SPEC (3.2.5.2) or the Nav Selection SPEC (3.2.4.6). The worst case computer requirements for this module are:

Memory size	21	16 bit words
.Throughput	0.1	ms/sec
Update rate	1	times/sec

3.2.4.11.1 Inputs

The OMEGA Nav Update SPEC inputs shall be as specified in Table LXII .

3.2.4.11.2 Processing

The OMEGA Nav Update SPEC shall perform the processing specified in Figure 31 . The only function of the OMEGA Nav SPEC shall be to force the estimate of position and velocity to be the best available estimate. The OMEGA NAV Update SPEC shall be performed asynchronously.

3. 2.4.11.3 Outputs

The OMEGA Nav Update SPEC shall be as specified in Table LXIII .

TABLE LXII INPUTS TO OMEGA NAVIGATION UPDATE SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Latitude, Longitude		EQUIP: OMEGA	3.2.4.2
2. Velocity		EQUIP: OMEGA	3.2.4.2
3. Baro. Altitude		SPEC: Flight Control Interface	

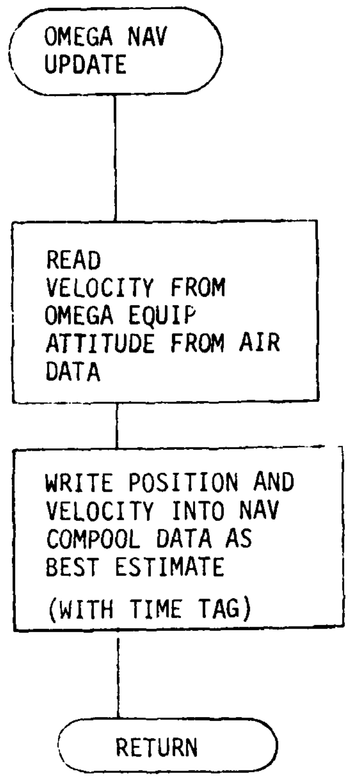


Figure 31 OMEGA Navigation Update SPEC

TABLE LXIII OUTPUTS FROM OMEGA NAVIGATION UPDATE SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Position with Time Tag		COMPOOL Info	
2. Velocity		COMPOOL Info	

3.2.5 Guidance

The Guidance Group of Modules consist of those tasks necessary to steer aircraft. These modules include both SPECs and EQUIPs. The software modules provide steering displays for the pilot to use and heading, altitude, and cross track errors for the autopilot. The steering SPECs provide this information for various modes of steering. These include track steering, destination steering, ILS, ADF, TACAN Beam and inertial heading steering.

3.2.5.1 UHF/ADF Receiver - EQUIP (UHFADF-E)

This program module processes the input of relative bearing from the UHF/ADF Receiver, Collins #DF-301E. This unit must function in conjunction with the UHF Transceiver (See 3.2.7.7) which provides the control and frequency selection functions. By comparison with previously received bearing inputs, this program module will determine the reasonableness of the input data. The computer requirements for this module are:

Memory size	44	16 bit words
Throughput	4376	ms/sec
Update rate	8	times/sec

3.2.5.1.1 Inputs

The inputs to this program module are listed in Table LXIV .

3.2.5.1.2 Processing

The program module shall convert the control and mode inputs to an appropriate format for output to properly control the operation of the UHF/ADF Receiver.

The program module shall issue the "power on" command as an output when so commanded by the "power on" input.

TABLE LXIV INPUTS - UHF/ADF RECEIVER EQUIP (UHFADF-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
POWER SWITCH		8	01	IMK EQUIP	
AUDIO HI/LOW SWITCH		8	01	DEK EQUIP	
REL. BEARING (3 BITS)		8	18	UHF/ADF RCVR	

The current input value of relative bearing shall be compared to the previous value in order to determine the reasonableness of the current input values.

The processing shall be performed as specified in Figure 32 .

This program module is a privileged task and shall be executed synchronously 8 times per second.

3.2.5.1.3 Outputs

The outputs from the program module are listed in Table

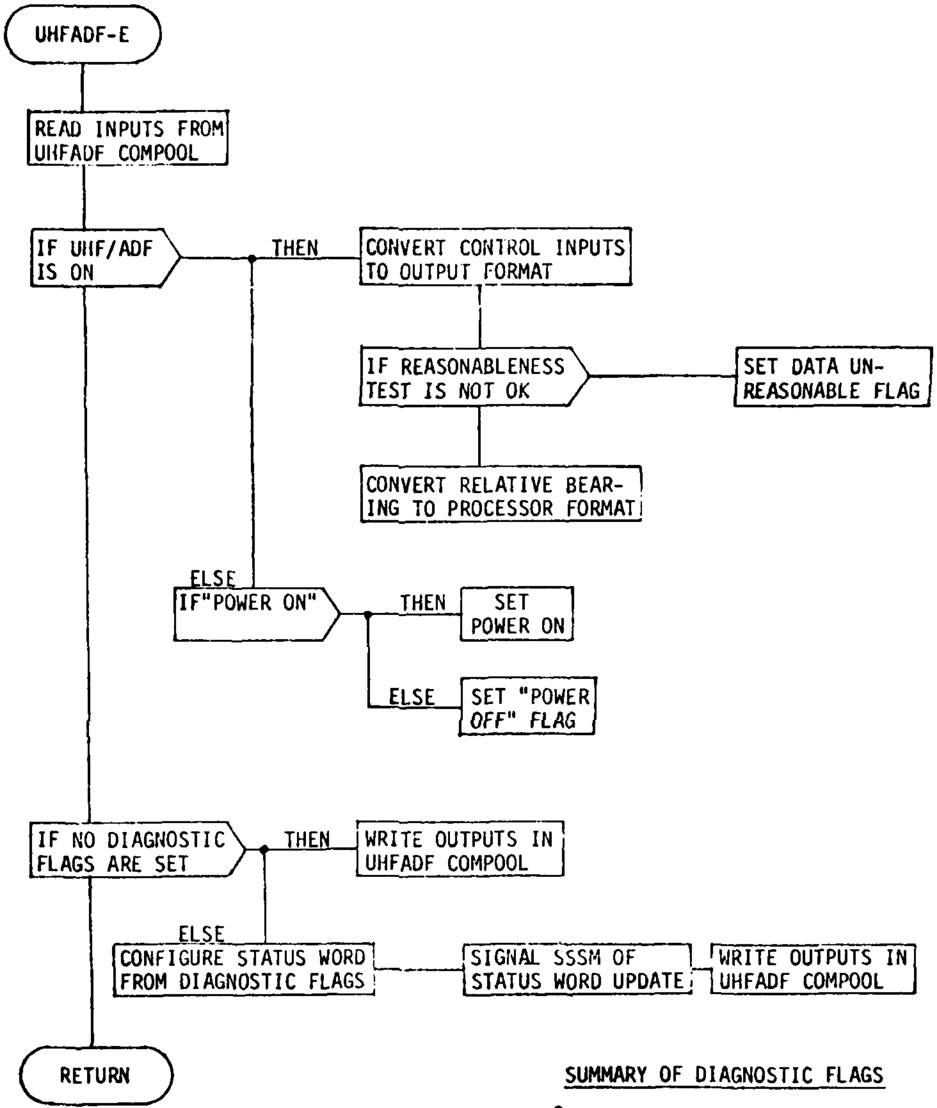
3.2.5.2 LF/ADF RECEIVER EQUIP (LF ADF-E)

This program module processes the input of relative bearing from the LF/ADF Receiver, Collins #DF-201. This module also processes the mode and function commands from the operator by converting them to appropriate formats for output to properly control the operation of the LF/ADF Receiver. This module also activates the Self-Test mode of operation upon command by the operator and will process the results of the self-test for input to the Subsystem Status Monitor. By comparison with previously received bearing inputs, the program module will determine the reasonableness of the input data. The computer requirements for this module are:

Memory size	51	16 bit words
Throughput	4872	ms/sec
Update rate	8	times/sec

3.2.5.2.1 Inputs

The inputs to this program module are listed in Table LXVI .



SUMMARY OF DIAGNOSTIC FLAGS

- "UHF/ADF DATA UNREASONABLE"
- "UHF/ADF POWER OFF"

Figure 32 UHF/ADF EQUIP

TABLE LXV OUTPUTS - UHF/ADF RECEIVER EQUIP (UHFADF-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
POWER SWITCH		8		UHF/ADF RCVR	
AUDIO HI/LOW SWITCH		8		UHF/ADF RCVR	
REL. BEARING		8		GUIDANCE SPEC	
STATUS WORD		8		SSSM	

TABLE LXVI INPUTS - LF/ADF RECEIVER EQUIP (LFADF-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
DIRECTION INDICATION		32	09	LF/ADF RECVR	
MODE SWITCH (2 BITS)		8	01	IMK EQUIP	
TEST ENABLE		8	01	DEK EQUIP	
TEST INDICATION		8	01	LF/ADF RECVR	
TONE ON/OFF		8	01	DEK EQUIP	
FREQUENCY SELECT		8	10	DEK EQUIP	

3.2.5.2.2 Processing

The program module shall convert the control and mode inputs to an appropriate format for output to properly control the operation of the LF/ADF Receiver.

The program module shall issue the "power on" command as an output when so commanded by the "power on" input.

Upon command from the Request Processor, the Self-Test feature shall be activated. The results of this test will be a bearing indication of 45.0 degrees if the LF/ADF Receiver is operating properly. Improper operation shall be announced by the test indicator signal at which time the module shall set the appropriate flags and the appropriate bits on the status word.

The current input value of relative bearing shall be compared with the previous value in order to determine the reasonablness of the current input values.

The processing shall be performed as specified in Figure 33 .

This program module is a privileged task and shall be executed synchronously 32 times per second.

3.2.5.2.3 Outputs

The outputs from the program module are listed in Table LXVII .

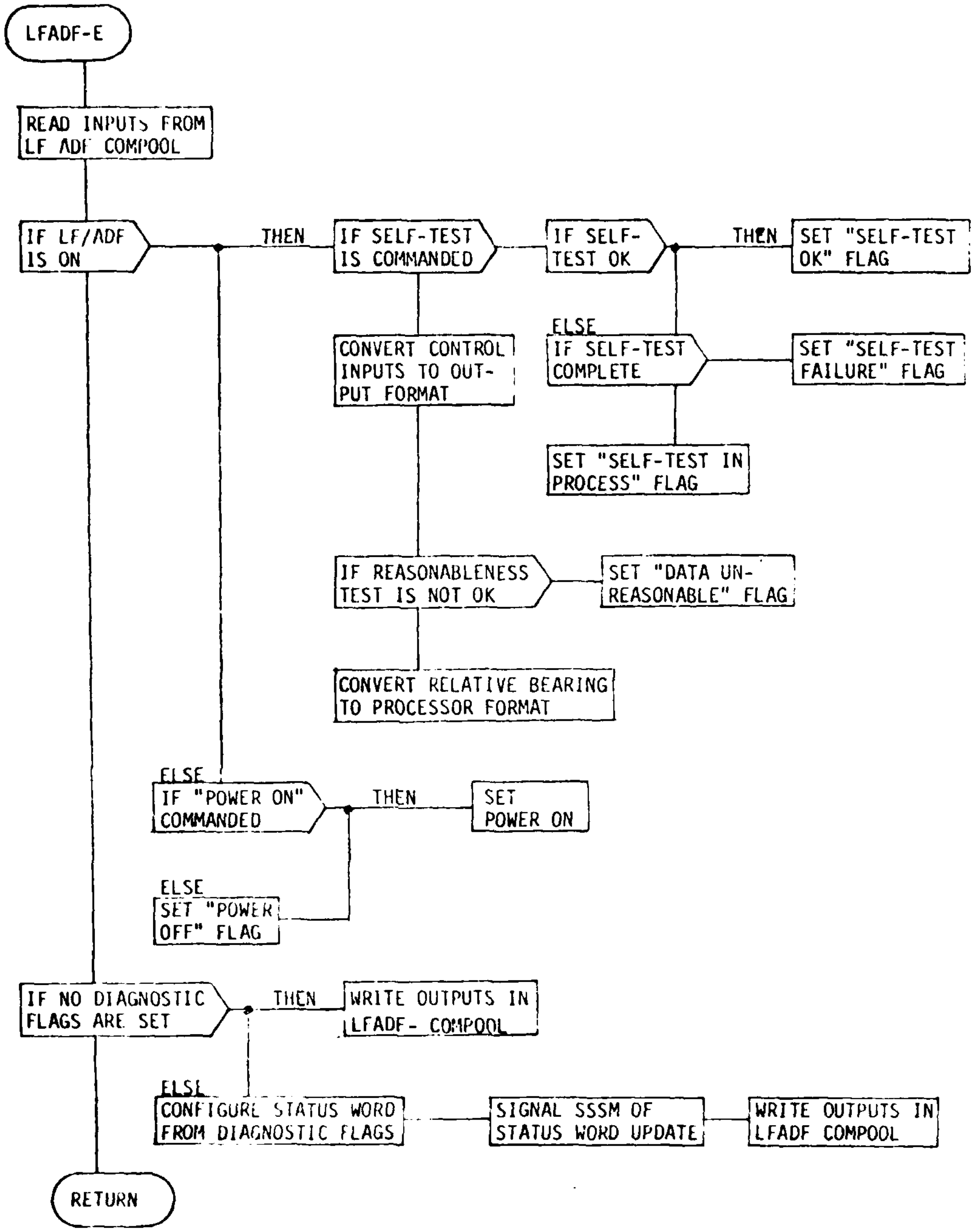


Figure 33 LF/ADF RECEIVER EQUIP

SUMMARY OF DIAGNOSTIC FLAGS

- "LF/ADF SELF-TEST OK"
- "LF/ADF SELF-TEST FAILURE"
- "LF/ADF SELF-TEST IN PROCESS"
- "LF/ADF DATA UNREASONABLE"
- "LF/ADF POWER OFF"

Figure 33 (Cont.) LF/ADF RECEIVER EQUIP

TABLE LXVII OUTPUTS - LF/ADF RECEIVER EQUIP (LFADF-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
DIRECTION INDICATION		32		GUIDANCE SPEC	
MODE SWITCH		8		LF/ADF RECVR	
TEST ENABLE		8		LF/ADF RECVR	
TEST INDICATION		8		MPD EQUIP	
TONE ON/OFF		8		LF/ADF RCVR	
FREQUENCY SELECT		3		LF/ADF RCVR	
STATUS WORD		8		SSSM	

3.2.5.3 Multi-Mode Radar EQUIP (MMRAD-E)

This program module processes the mode and function commands from the operator by converting them to appropriate formats for output to control the operation of the Multi-Mode Radar Set, AN/APQ-122(V) 5.

The results of the Built-In-Test features of the Radar Set are processed for input to the Subsystem Status Monitor.

This program processes sensor positioning commands from the Hand Control Unit (HCU) by converting them to slant range and relative bearing. The computer requirements for this module are:

Memory size	159	16 bit words
Throughput	14736	ms/sec
Update rate	8	times/sec

3.2.5.3.1 Inputs

The inputs to this program module are listed in Table LXVIII .

3.2.5.3.2 Processing

The Antenna Fail and Receiver/Transmitter Fail Signals shall be periodically checked.

The program module shall convert the control and mode inputs to an appropriate format for output to properly control the operation of the Radar Set.

This program module is a privileged task and shall be executed synchronously 8 times per second.

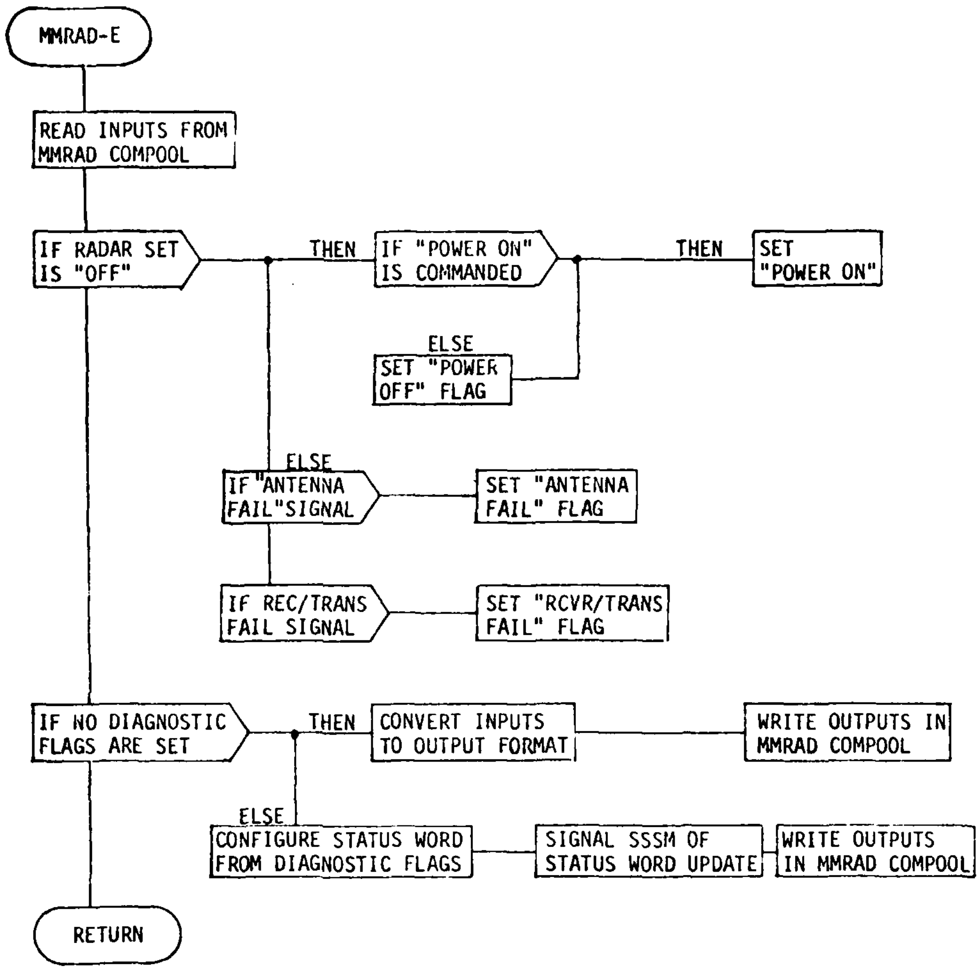
The processing shall be performed as specified in Figure 34 .

TABLE LXVIII INPUTS - MULTI-MODE RADAR EQUIP (MMRAD-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
MODE SWITCH (3 BITS)		8	01	IMK EQUIP	
RANGE SWITCH (3 BITS)		8	01	DEK EQUIP	
FREDQUENCY SWITCH (3 BITS)		8	01	DEK EQUIP	
RF POWER SWITCH		8	01	DEK EQUIP	
AGILE SWITCH		8	01	DEK EQUIP	
BEAM SWITCH		8	01	DEK EQUIP	
RCVR GAIN CONTROL		8	05	ACP EQUIP	
FTC SWITCH		8	01	DEK EQUIP	
STC RANGE		8	05	ACP EQUIP	
STC DEPTH		8	05	ACP EQUIP	
TILT CONTROL		8	05	ACP EQUIP	
SCAN SWITCH (3 BITS)		8	01	DEK EQUIP	
AZIMUTH STAB. SWITCH (2 BITS)		8	01	DEK EQUIP	
MAG VAR CONTROL		8	05	ACP EQUIP	
REL. BRG. CONTROL		8	05	SCP EQUIP	

TABLE LXVIII INPUTS - MULTI-MODE RADAR EQUIP (CONT.) (MMRAD-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
SECTOR WIDTH SEL.		8	05	ACP EQUIP	
VIDEO GAIN CONTROL		8	05	ACP EQUIP	
VARBLE RANGE CONTROL		8	05	ACP EQUIP	
RANGE CURSOR CONTROL		8	05	SCP EQUIP	
RANGE DELAY SWITCH		8	01	DEK EQUIP	
LAMP SWITCH (2 BITS)		8	01	DEK EQUIP	
AZ. STAB. SWITCH		8	01	DEK EQUIP	
ISO-ECHO CONTROL		8	01	DEK EQUIP	
WEST INDICATOR		8	05	RADAR CONTROL UNIT	
EAST INDICATOR		8	05	RADAR CONTROL UNIT	
ANTENNA FAIL		8	01	RADAR CONTROL UNIT	
RCVR/XMTR FAIL		8	01	RADAR CONTROL UNIT	
RADAR RANGE STATUS (4 BITS)		8	01	RADAR CONTROL UNIT	
RADAR SLANT RANGE		8		HCU EQUIP	
RADAR RELATIVE BEARING		8		HCU EQUIP	



SUMMARY OF DIAGNOSTIC FLAGS

- "RADAR SET POWER OFF"
- "RADAR ANTENNA FAIL"
- "RADAR SET FAIL"

Figure 34 MULTI-MODE RADAR EQUIP

The module shall convert the slant range and relative bearing inputs from the HCU to an appropriate format for the processor.

3.2.5.3.3 Outputs

The outputs from this program module are listed in Table LXIX .

3.2.5.4 Radar Beacon EQUIP (RADBCN-E)

This program module processes the "power on" and "pulse mode" commands from the operator or from other program modules by converting them to an appropriate format for output to the Transponder Set (Radar Beacon) AN/UPN-25. The computer requirements for this module are:

Memory size	21	16 bit words
Throughput	1880	ms/sec
Update rate	8	times/sec

3.2.5.4.1 Inputs

The inputs to this program module are listed in Table LXX .

3.2.5.4.2 Processing

The program module shall issue the "power on" command as an output when so commanded by the "power on" input.

The program module shall issue the "pulse mode switch" command as an output when so commanded by the "pulse mode switch" input.

The processing shall be performed as specified in Figure 35 .

This program module is a privileged task and shall be executed synchronously 8 times per second.

3.2.5.4.3 Outputs

The outputs from this program module are listed in Table LXXI .

TABLE LXIX OUTPUTS - MULTI-MODE RADAR EQUIP (MMRAD-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
MODE SWITCH		8		RADAR CONTROL UNIT	
RANGE SWITCH		8		RADAR CONTROL UNIT	
FREQUENCY SWITCH		8		RADAR CONTROL UNIT	
RF POWER SWITCH		8		RADAR CONTROL UNIT	
AGILE SWITCH		8		RADAR CONTROL UNIT	
BEAM SWITCH		8		RADAR CONTROL UNIT	
RCVR GAIN CONTROL		8		RADAR CONTROL UNIT	
FTC SWITCH		8		RADAR CONTROL UNIT	
STC RANGE		8		RADAR CONTROL UNIT	
STC DEPTH		8		RADAR CONTROL UNIT	
TILT CONTROL		8		RADAR CONTROL UNIT	
SCAN SWITCH		8		RADAR CONTROL UNIT	
AZIMUTH STAB. SWITCH		8		RADAR CONTROL UNIT	
MAG. VAR. CONTROL		8		RADAR CONTROL UNIT	
REL. BRG. CONTROL		8		RADAR CONTROL UNIT	

TABLE LXIX OUTPUTS - MULTI-MODE RADAR EQUIP (CONT.) (MMRAD-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
SECTOR WIDTH CONTROL		8		RADAR CONTROL UNIT	
VIDEO GAIN CONTROL		8		RADAR CONTROL UNIT	
VARBLE GAIN CONTROL		8		RADAR CONTROL UNIT	
RANGE CURSOR CONTROL		8		RADAR CONTROL UNIT	
RANGE DELAY SWITCH		8		RADAR CONTROL UNIT	
LAMP SWITCH		8		RADAR CONTROL UNIT	
AZ. STAB. SWITCH		8		RADAR CONTROL UNIT	
ISO-ECHO CONTROL		8		RADAR CONTROL UNIT	
WEST INDICATOR		8		TBD	
EAST INDICATOR		8		TBD	
RADAR RANGE STATUS		8		TBD	
STATUS WORD		8		SSSM	
SLANT RANGE		8		TGT. AQSN. SPEC RADAR SPEC.	
RELATIVE BEARING				TGT. AQSN. SPEC RADAR SPEC	

TABLE I XX INPUTS - RADAR BEACON EQUIP (RADBCN-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
POWER ON		8	01	IMK EQUIP	
PULSE MODE SWITCH		8	01	DEK EQUIP	

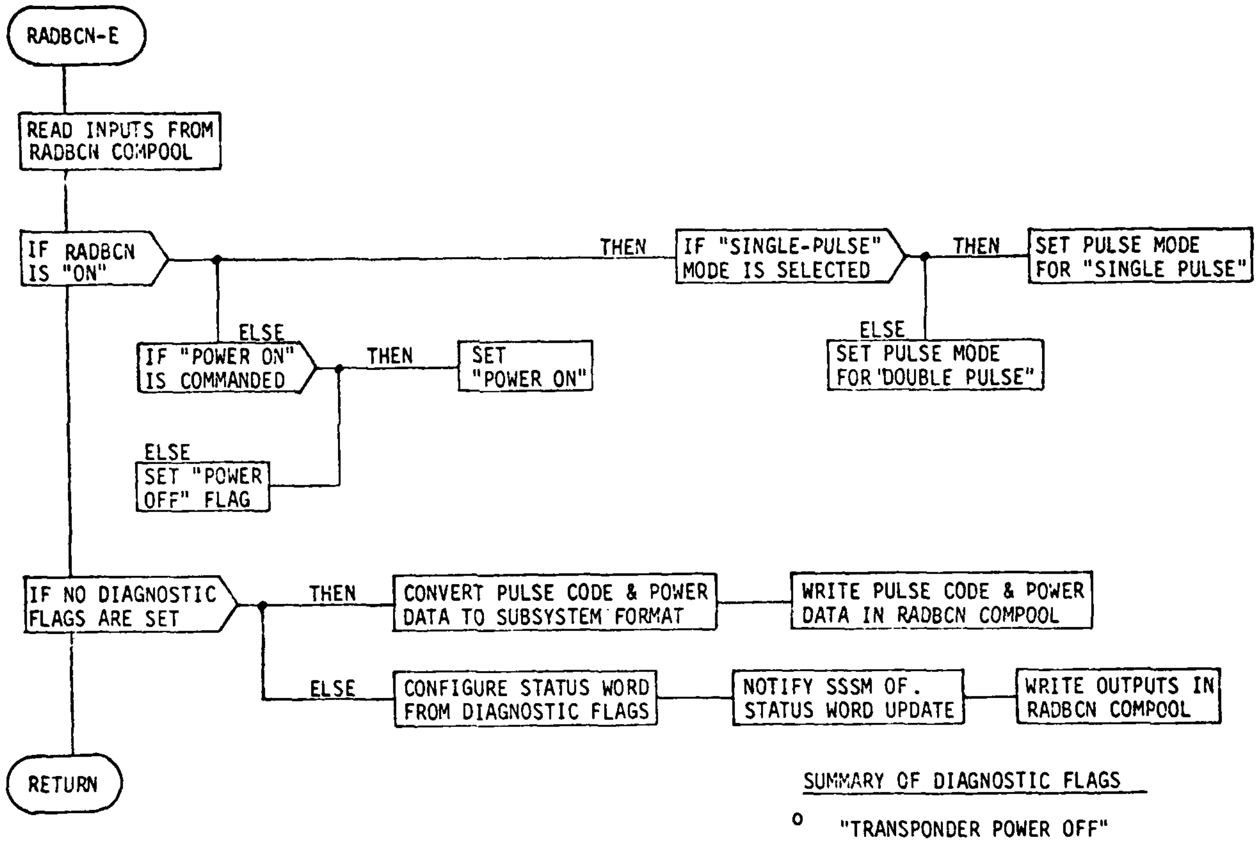


Figure 35 RADAR BEACON EQUIP

TABLE LXXI OUTPUTS-RADAR BEACON EQUIP (RADBCN-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
POWER ON		8		RADAR BEACON	
PULSE MODE SWITCH		8		RADAR BEACON	
STATUS WORD		8		SSSM	

3.2.5.5 Instrument Landing System (ILS) EQUIP (ILS-E)

This program module processes the glide slope, localizer, and marker beacon outputs from the AN/ARN-108 ILS/VOR Receiver. This module also processes the mode and function commands from the operator by converting them to appropriate formats for output to control the operation of the ILS/VOR. This module processes the results of the automatic self-test operation for input to the Subsystem Status Monitor and for display. By comparison with previously received inputs, the program module determines the reasonableness of the inputs. The computer requirements for this module are:

Memory size	56	16 bit words
Throughput	5376	ms/sec
Update rate	8	times/sec

3.2.5.5.1 Inputs

The inputs to this program module are listed in Table LXII .

3.2.5.5.2 Processing

The input value of Glide Slope Deviation and Localizer Deviation, both positive and negative values, shall be converted to the appropriate output scale factor.

The Light Marker Beacon inputs for the Outer Marker and the Middle Marker shall be converted to the appropriate output scale factor.

The loss of a reliable signal from the Glide Slope and/or the Localizer shall result in the issuance of the Glide Slope Flag Signal and the Localizer Flag Signal, respectively. These signals shall be converted to the appropriate format for display output. In addition, the appropriate diagnostic flags and the appropriate bits on the status word shall be set.

TABLE LXXII INPUTS - INSTRUMENT LANDING SYSTEM (ILS) EQUIP (ILS-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
FREQUENCY SELECT (13 BITS)		8	01	DEK EQUIP	
GLIDE SLOPE DEV. (2 BITS)		8	06	ILS	
LOCALIZER DEV. (2 BITS)		8	06	ILS	
LIGHT MARKER BEACON (2 BITS)		8	01	ILS	
GLIDE SLOPE FLAG		8	06	ILS	
LOCALIZER FLAG		8	06	ILS	

The multiple inputs for selecting the proper frequency shall be converted to an appropriate format for output to control the ILS Receiver frequency.

The current input values of Glide Slope Deviation and Localizer Deviation shall be compared with the previous values in order to determine the reasonableness of the current input values.

The processing shall be performed as specified in Figure 36 .

This program module is a privileged task and shall be executed synchronously 8 times per second.

3.2.5.5.3 Outputs

The outputs from this program module are listed in Table LXXIII .

3.2.5.6 Radar Altimeter EQUIP (RADALT-E)

This program module processes the inputs of absolute altitude and rate of change of altitude from the AN/APN-194 Radar Altimeter System. The inputs are checked for validity prior to being converted to the appropriate format for further processing. This program module also processes "power on" commands from the operator or from other program modules and will activate the Built-In Self-Test features of the Radar Altimeter upon operator command. By comparison with previously received inputs, the program module determines the reasonableness of the inputs. The computer requirements for this module are:

Memory size	59	16 bit words
Throughput	11744	ms/sec
Update rate	16	times/sec

SUMMARY OF DIAGNOSTIC FLAGS

- "ILS LOCALIZER OUT"
- "ILS GLIDE SLOPE OUT"
- "ILS DATA UNREASONABLE"

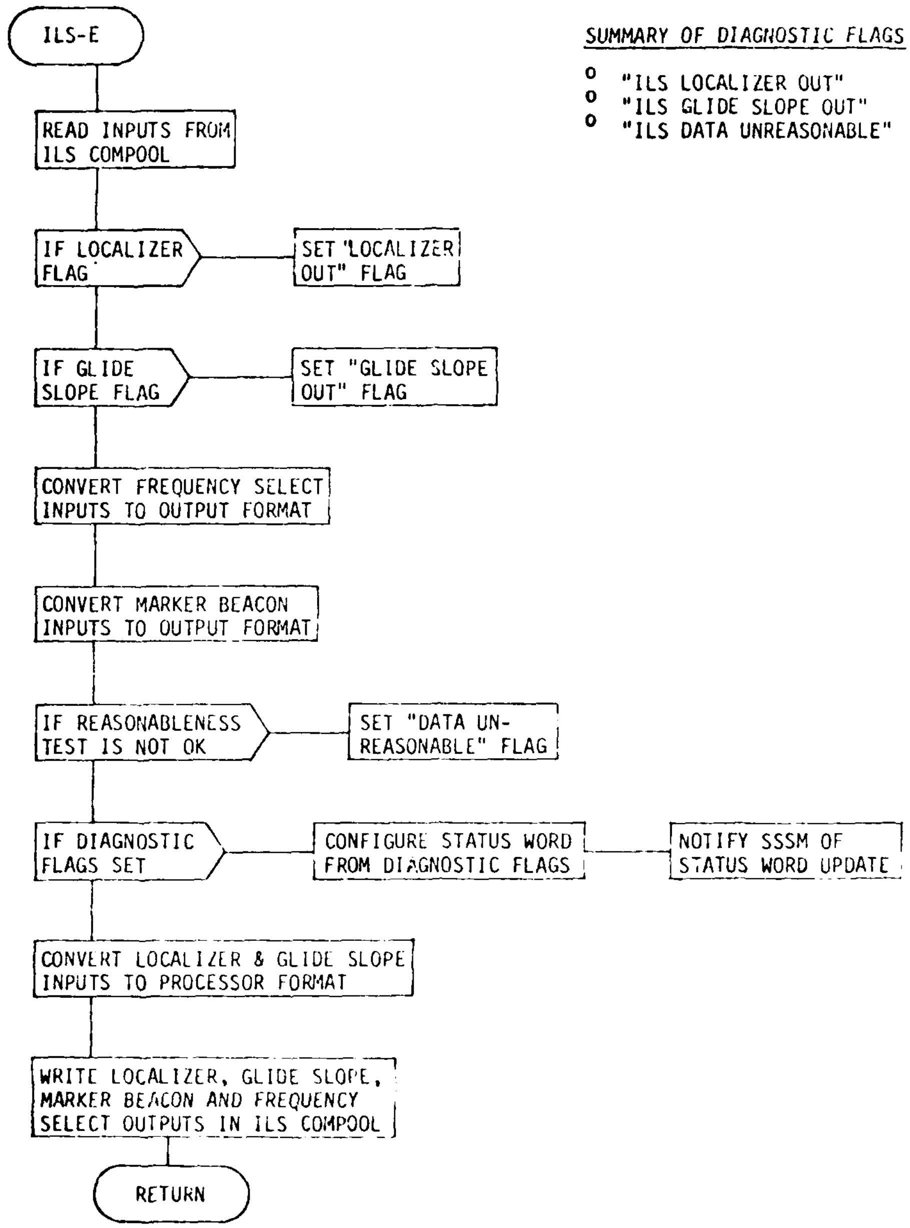


Figure 36 ILS EQUIP

TABLE LXXIII OUTPUTS - INSTRUMENT LANDING SYSTEM (ILS) EQUIP (ILS-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
FREQUENCY SELECT (13 BITS)				ILS	
GLIDE SLOPE DEV. (2 BITS)				GUIDANCE SPEC	
LOCALIZER DEV (2 BITS)				GUIDANCE SPEC	
LIGHT MARKER BEACON (2 BITS)				GUIDANCE SPEC	
GLIDE SLOPE FLAG				GUIDANCE SPEC	
LOCALIZER FLAG				GUIDANCE SPEC	
STATUS WORD				SSSM	

3.2.5.6.1 Inputs

The inputs to this program module are listed in Table LXXIV .

3.2.5.6.2 Processing

The digital altitude signal validity bit on the digital radar altitude input word shall be periodically checked.

The reliability signal, indicating reliable track, shall be periodically checked.

The input data words for radar altitude and for range rate (rate of change of altitude) shall be processed by the elimination of any non-function bits, such as a validity bit, then shall be further processed by the conversion of the data bits to the appropriate output scale factors.

Upon command from the Request Processor, the Built-In Self-Test feature of the Radar Altimeter shall be activated. The results of the test will be an altitude of 100 feet ± 10 feet if the Radar Altimeter is functioning properly.

The processing shall be performed as specified in Figures 37 .

The program module shall issue the "power on" command as an output when so commnded by the "power on" input.

The current input value of absolute altitude shall be compared with the previous value in order to determine the reasonableness of the current input value.

TABLE LXXIV INPUTS - RADAR ALTIMETER EQUIP (RADALT-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
RANGE RATE		16	06	RCVR/XMITTER	
RADAR ALTITUDE (DIGITAL)		16	10	RCVR/XMITTER	
LOW ALTITUDE WARNING		8	01	RCVR/XMITTER	
POWER ON		1		IMK EQUIP	
RELIABILITY SIGNAL		TBD		RCVR/XMITTER	
TEST COMMAND		8		DEK EQUIP	

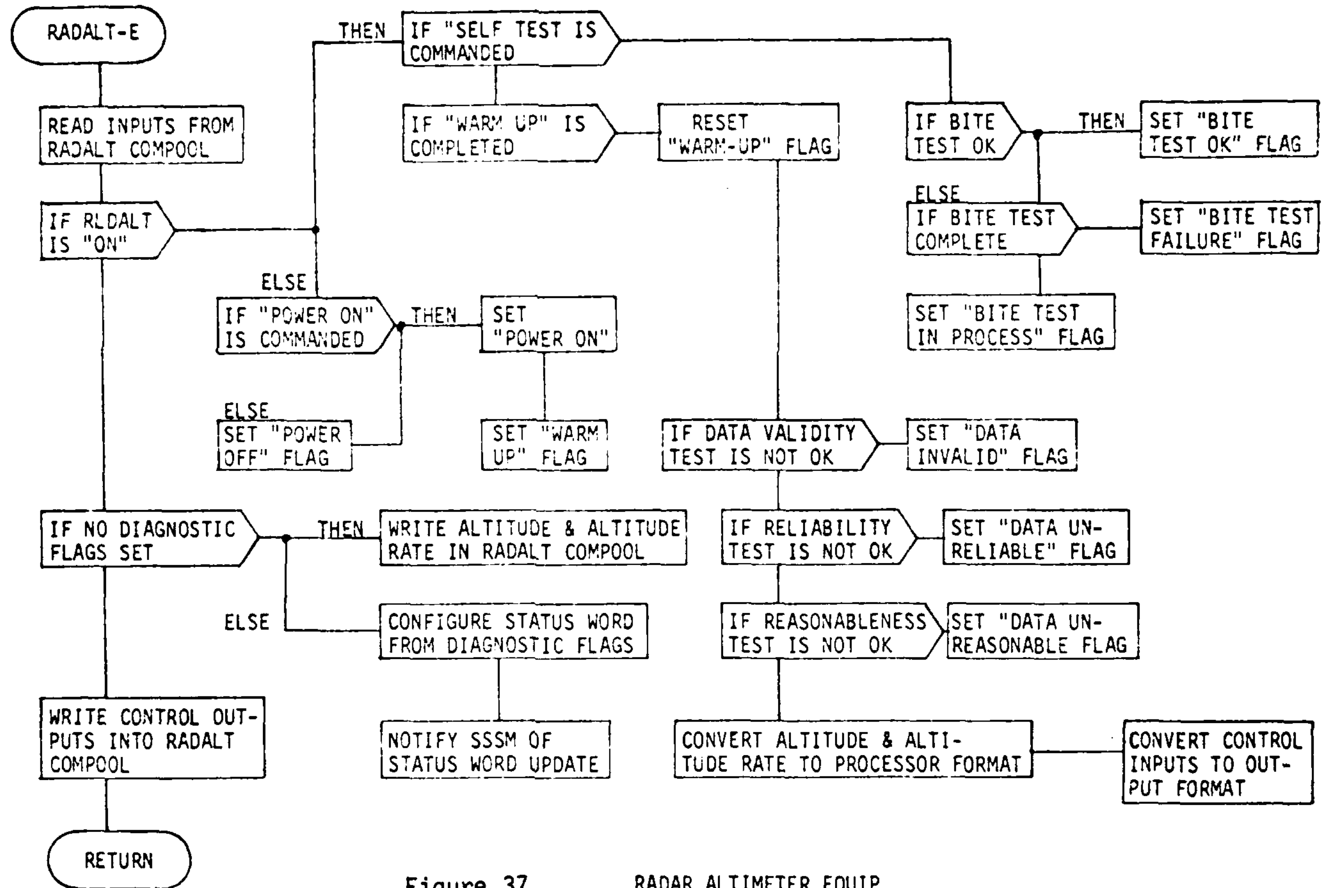


Figure 37 RADAR ALTIMETER EQUIP

SUMMARY OF DIAGNOSTIC FLAGS

- "BITE TEST OK"
- "BITE TEST FAILURE"
- "DATA INVALID"
- "DATA UNRELIABLE"
- "DATA UNREASONABLE"
- "RADAR ALTIMETER IN WARM-UP"
- "RADAR ALTIMETER POWER OFF"
- "BITE TEST IN PROCESS"

Figure 37 (Cont.) RADAR ALTIMETER EQUIP

After receipt of the "power on" command, the program mocule shall set the "warm up" flag, then bypass further data processing until the appropriate warm-up period has transpired.

This program module is a privileged task and shall be executed synchronously 16 times per second.

3.2.5.6.3 Outputs

The outputs from this program module are listed in Table LXXV .

3.2.5.7 Station Keeping Equipment (SKE) EQUIP (SKE-E)

This program module processes the mode and function commands from the operator by converting them to appropriate format for output to control the operation of the Station Keeping Equipment, AN/APN-169B. Upon command by the operator, this module activates the BITE (Built-In Test) mode of operation for input to the Subsystem Status Monitor. This module also processes the inputs of slant range and relative bearing received by the SKE from a cooperative zone marker radar beacon. The computer requirements for this module are;

"emory size	218	16 bit words
Throughput	20984	ms/sec.
Update rate	8	times/sec

3.2.5.7.1 Inputs

The inputs to this program module are listed in Table LXXVI .

3.2.5.7.2 Processing

The BITE Indicator signal, the BITE Test Switch and the Caution Indicator shall be periodically checked.

TABLE LXXV OUTPUTS - RADAR ALTIMETER EQUIP (RADALT-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
READ COMMAND		8	01	RCVR/XMITTER	
TEST COMMAND		8	01	RCVR/XMITTER	
POWER ON		1	01	RCVR/XMITTER	
STATUS WORD		16		SSSM	
RADAR ALTITUDE		16		GUIDANCE SPEC	
RANGE RATE		TBD		GUIDANCE SPEC	

TABLE LXXVI INPUTS - STATION KEEPING EQUIPMENT (SKE) EQUIP (SKE-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
BLANKING SIGNAL		8	05	DEK EQUIP	
RANGE RING CURSOR		8	05	SCP EQUIP	
BITE INDICATOR		8	01	SKE	
MASTER INDICATOR		8	01	SKE	
CAUTION INDICATOR		8	01	SKE	
MASTER LOST INDICATOR		8	01	SKE	
PROXIMITY WARNING		8	01	SKE	
RANGE SELECTOR (3 BITS)		8	01	DEK EQUIP	
UP/DOWN SELECTOR (2 BITS)		8	01	DEK EQUIP	
BITE TEST SWITCH		8	01	DEK EQUIP	
NO GO BITE IND		8	01	SKE	
TWO MASTERS IND		8	01	SKE	
FREQUENCY SELECT		8	01	DEK EQUIP	
MODE SELECT (2 BITS)		8	01	DEK EQUIP	
MASTER/FOLLOWER SELECT		8	01	DEK EQUIP	

TABLE LXXVI INPUTS - STATION KEEPING EQUIPMENT (SKE) EQUIP (CONT.) (SKE-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
TWO-IN-SLOT IND.		8	01	SKE	
TRACK SELECTOR (8 BITS)		8	01	DEK EQUIP	
ALTITUDE SELECTOR (9 BITS)		8	01	DEK EQUIP	
LEADER NO. SELECTOR (8 BITS)		8	01	DEK EQUIP	
CROSS TRACK SELECT (9 BITS)		8	01	DEK EQUIP	
IDENT SWITCH		8	01	DEK EQUIP	
PROXIMITY WARN. TONE SWITCH		8	01	DEK EQUIP	
PROXIMITY WARN. RESET		8	01	DEK EQUIP	
PROX. WARN DISTANCE SEL. (8 BITS)		8	01	DEK EQUIP	
RANGE INDICATION		8	05	SKE	
RANGE WARNING FLAG		8	01	SKE	
FLIGHT COMMAND IND. (7 BITS)		8	01	SKE	
FLIGHT COMMAND BUTTONS (7 BITS)		8	01	DEK EQUIP	
ALTITUDE DATA		8	10	SKE	
SLANT RANGE				SKE	
RELATIVE BEARING				SKE	

The program module shall convert the control and mode inputs to an appropriate format for output to properly control the operation of the SKE.

The program module shall issue the "power on" command as an output when so commanded by the "power on" input.

After receipt of the "power on" command, the program module shall set the "warm-up" flag, then bypass further processing until the appropriate warm-up period has transpired.

The processing shall be performed as specified in Figure 38 .

The input value of slant range and relative bearing shall be converted to an appropriate scale factor for input to the processor.

This program module is a privileged task and shall be executed synchronously 8 times per second.

3.2.5.7.3 Outputs

The outputs from this program module are listed in Table LXXVII .

3.2.5.8 CCA EQUIP

The CCA EQUIP monitors the Control Column Assembly notifying the intercommunications system and the radar sets when they are to be activated. Computer requirements for this module are:

Memory size	60	16 bit words
Throughput		ms/sec
Update rate	8	times/sec

3.2.5.8.1 Inputs

The inputs to the CCA EQUIP shall be as specified in Table LXXVIII .

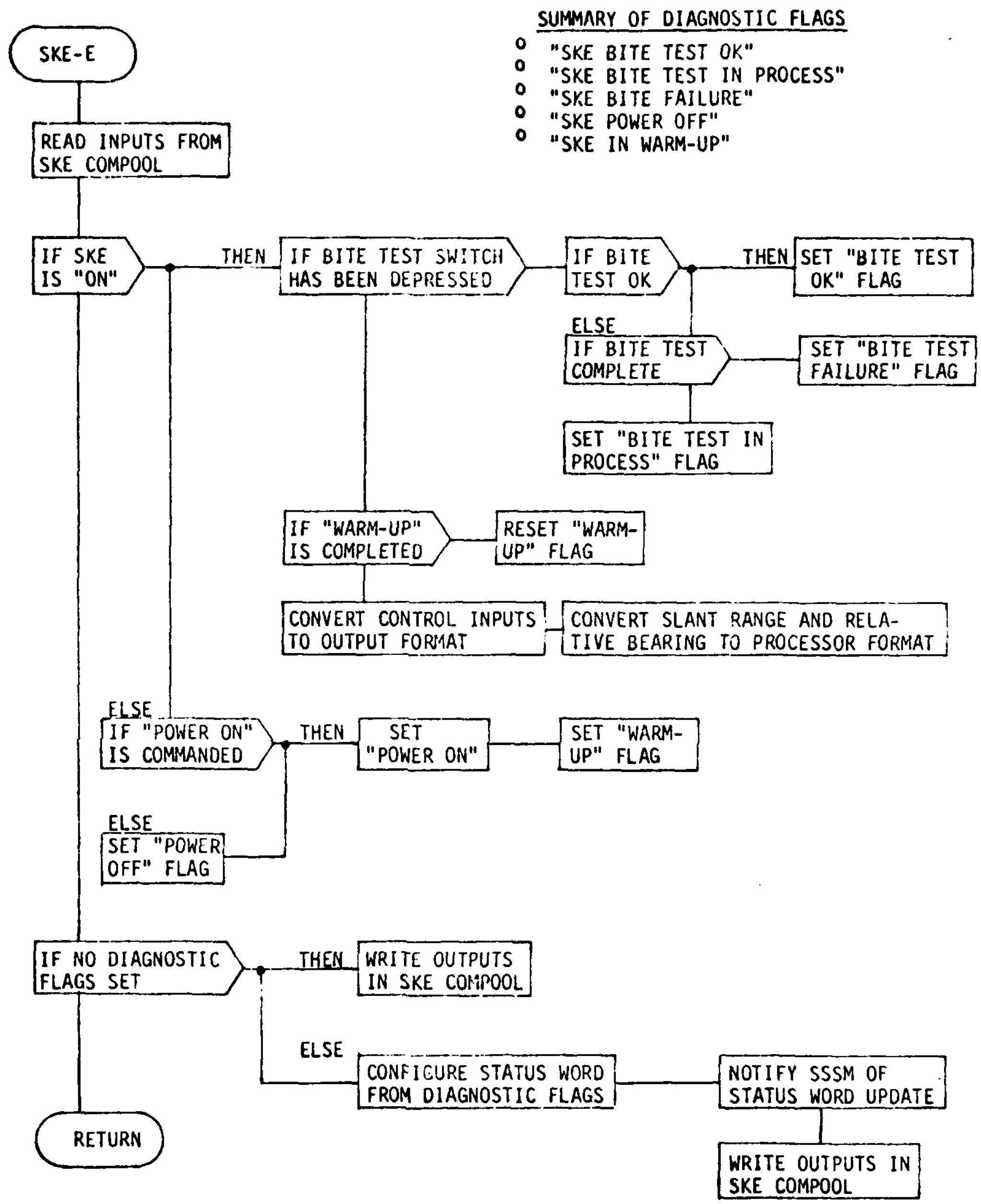


Figure 38 SKE EQUIP

TABLE LXXVII OUTPUTS - STATION KEEPING EQUIPMENT (SKE) (SKE-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
BLANKING SIGNAL		8		SKE	
RANGE RING CURSOR		8		SKE	
BITE INDICATOR		8		GUIDANCE SPEC	
MASTER INDICATOR		8		GUIDANCE SPEC	
CAUTION INDICATOR		8		GUIDANCE SPEC	
MASTER LOST INDICATOR		8		GUIDANCE SPEC	
PROXIMITY WARNING		8		GUIDANCE SPEC	
RAÑGE SELECTOR (3 BITS)		8		SKE	
UP/DOWN SELECTOR (2 BITS)		8		SKE	
BITE TEST SWITCH		8		SKE	
NO GO BITE IND.		8		GUIDANCE SPEC	
TWO MASTERS IND.		8		GUIDANCE SPEC	
FREQUENCY SELECT		8		SKE	
MODE SELECT (2 BITS)		8		SKE	
MASTER/FOLLOWER SELECT		8		SKE	
TWO-IN-SLOT IND.		8		GUIDANCE SPEC	

TABLE LXXVII OUTPUTS - STATION KEEPING EQUIPMENT (SKE) (CONT.) (SKE-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
TRACK SELECTOR (8 BITS)		8		SKE	
ALTITUDE SELECTOR (9 BITS)		8		SKE	
LEADER NO. SELECTOR (8 BITS)		8		SKE	
CROSS TRACK SELECT (9 BITS)		8		SKE	
IDENT SWITCH		8		SKE	
PROXIMITY WARN. TONE SWITCH		8		SKE	
PROXIMITY WARN. RESET		8		SKE	
PROX. WARN. DISTANCE SEL. (8 BITS)		8		SKE	
RANGE INDICATION		8		GUIDANCE SPEC	
RANGE WARNING FLAG		8		GUIDANCE SPEC	
FLIGHT COMMAND IND. (7 BITS)		8		GUIDANCE SPEC	
FLIGHT COMMAND BUTTONS (7 BITS)		8		SKE	
ALTITUDE DATA		8		SKE	
STATUS WORD		8		SSSM	
SLANT RANGE				(TGT. AQSN SPEC (SKE SPEC	

TABLE LXXVII OUTPUTS - STATION KEEPING EQUIPMENT (SKE) (CONT.) (SKE-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
RELATIVE BEARING				(TGT. AQSN. SPEC. (SKE SPEC	

TABLE LXXVIII INPUTS TO CCA EQUIP

DATA NAME	SYMBOL	SOURCE	REFERENCE
SWITCH DATA		CONTROL COLUMN ASSEMBLY	

3.2.5.8.2 Processing

The CCA EQUIP shall perform the processing specified in Figure 39 .

The CCA EQUIP monitors the Control Column Assembly. If the switch for activation of the intercommunications system and/or the radio sets is depressed, the CCA EQUIP shall notify that subsystem.

3.2.5.8.3 Outputs

The outputs from the CCA EQUIP shall be as specified in Table LXXIX .

3.2.5.9 HCU EQUIP

The HCU (Hand Control Unit) EQUIP processor HCU messages to move the cursor on the HSD or the arming reticle on the HUD. Computer requirements for the module are:

Memory size	______	16 bit words
Throughput	______	ms/sec
Update rate	______	times/sec

3.2.5.9.1 Inputs

The inputs to the HCU EQUIP shall be as specified in Table LXXX .

3.2.5.9.2 Processing

The HCU EQUIP shall perform the processing specified in Figure 40 .

The state of the HCU is indicated by a greeen light behind appropriate button. If a transient failure has occurred, the HCU EQUIP determines the status of the HCU and sets it to the correct state by requesting a button be backlighted.

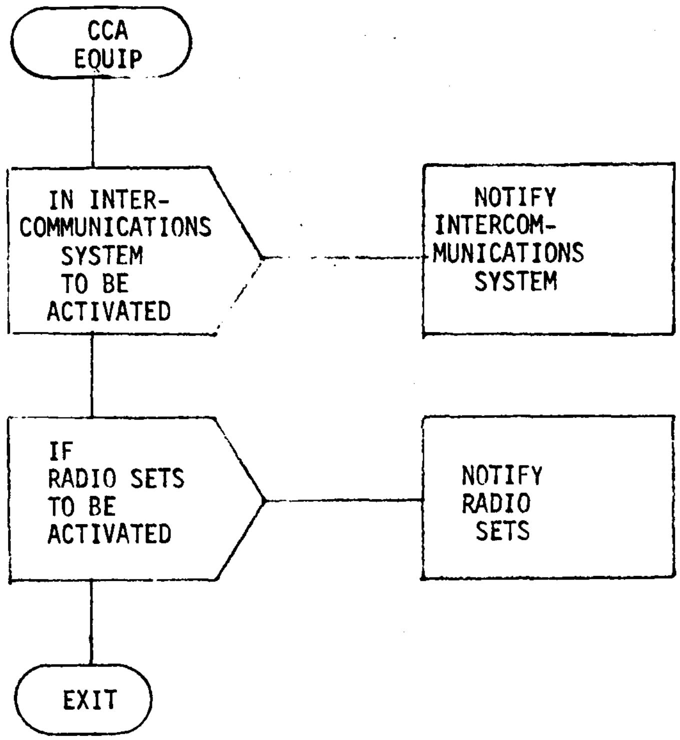


Figure 39 CCA EQUIP

TABLE LXXIX OUTPUTS FROM CCA EQUIP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
ACTIVATION DATA		INTERCOMMUNICATIONS SYSTEM RADIO SETS	

TABLE LXXX INPUTS TO HCU EQUIP

DATA NAME	SYMBOL	SOURCE	REFERENCE
ERROR NOTICE			
HCU STATUS		DATA BASE	
HCU MESSAGE		HCU	
CURSOR POSITION		HCU	
TARGET POSITION		DEK EQUIP	
		IMK EQUIP	

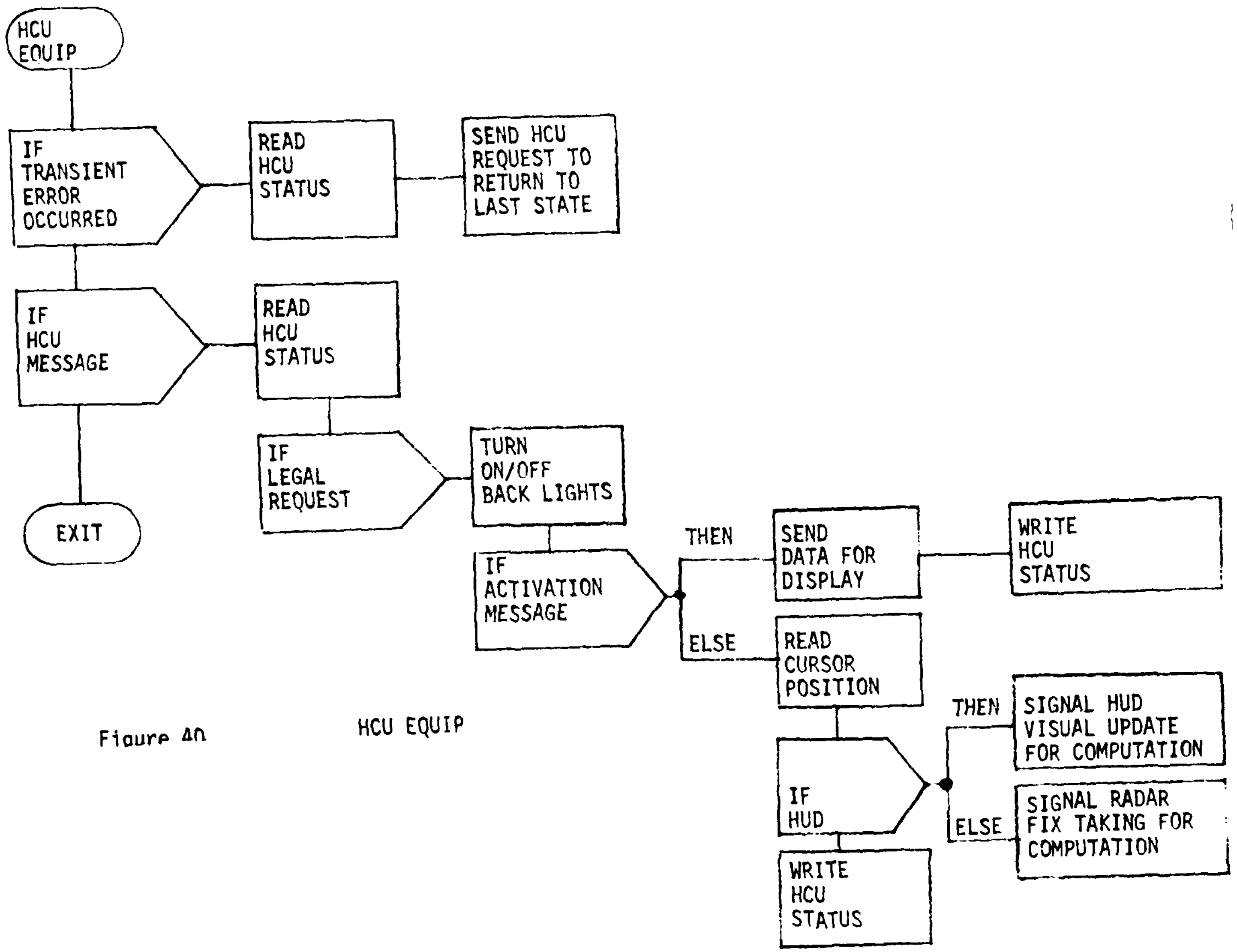


Figure 40 HCU EQUIP

An HCU message indicates a display (HUD or HSD) and whether this is an activation command. An activation command signals that the cursor or reticle is to be moved as controlled by the HCU. A designation signal instructs the computer to read the position of the cursor and compare it to a known target position and compute a new/updated aircraft position and update the navigation system with this new position. Computer requirements for the module are:

Memory size	_____	16 bit words
Throughput	_____	ms/sec
Update rate	_____	times/sec

On receiving a HCU message, the HCU EQUIP reads the HCU status compool to determine if the message is legal. If so, the appropriate backlights are turned off and on. The HCU EQUIP processes the message according to whether it is to activate or to designate.

3.2.5.9.3 Outputs

The outputs from the HCU EQUIP shall be as specified in Table LXXXI .

3.2.5.10 SCP EQUIP

The SCP EQUIP sends data inserted by the pilot using the Sensor Control Panel to adjust items such as brightness, tilt, azimuth, sector width, and scan rate. The SCP EQUIP will select the subsystem when other sensors are added. Computer requirements for the module are:

Memory size	116	16 bit words
Throughput	_____	ms/sec
Update rate	8	times/sec

TABLE LXXXI OUTPUTS FROM HCU EQUIP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
LIGHTS ON/OFF		HCU	
HCU STATUS		DATA BASE	
ACTIVATION SIGNAL		MPDG	
NEW POSITION DATA		OPS	

3.2.5.10.1 Inputs

The inputs to the SCP EQUIP shall be as specified in Table LXXXII .

3.2.5.10.2 Processing

The SCP EQUIP shall perform the processing specified in Figure 41 .

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The SCP EQUIP reads the subsystem controlled on its last execution. The subsystem switches are checked to determine if a different subsystem is to be controlled. If so, the switches are turned on or off and the subsystem is stored for use in the next execution. The variable controls are read and formatted to be sent to the indicated subsystem.

3.2.5.10.3 Outputs

The outputs from the SCP EQUIP shall be as specified in Table LXXXIII .

3.2.5.11 Function 5.11 - Guidance/Autopilot Controller SPEC

The Guidance/Autopilot Controller SPEC interrogates flags for the various methods of steering the aircraft and schedules the appropriate SPEC. The Guidance/Autopilot Controller SPEC scheduled synchronously at a rate of 4 /second and its event signalled by the appropriate OPS (3.2.2.2-7) as needed. The computer requirements for this module are:

Memory size	81	16 bit words
Throughput	2.0	ms/sec
Update rate	4	times/sec

TABLE LXXXII INPUTS TO SCP EQUIO

DATA NAME	SYMBOL	SOURCE	REFERENCE
SENSOR SWITCHES		SCP	
ANALOG POSITIONS		SCP	
SUBSYSTEM CONTROLLED		DATA BASE	

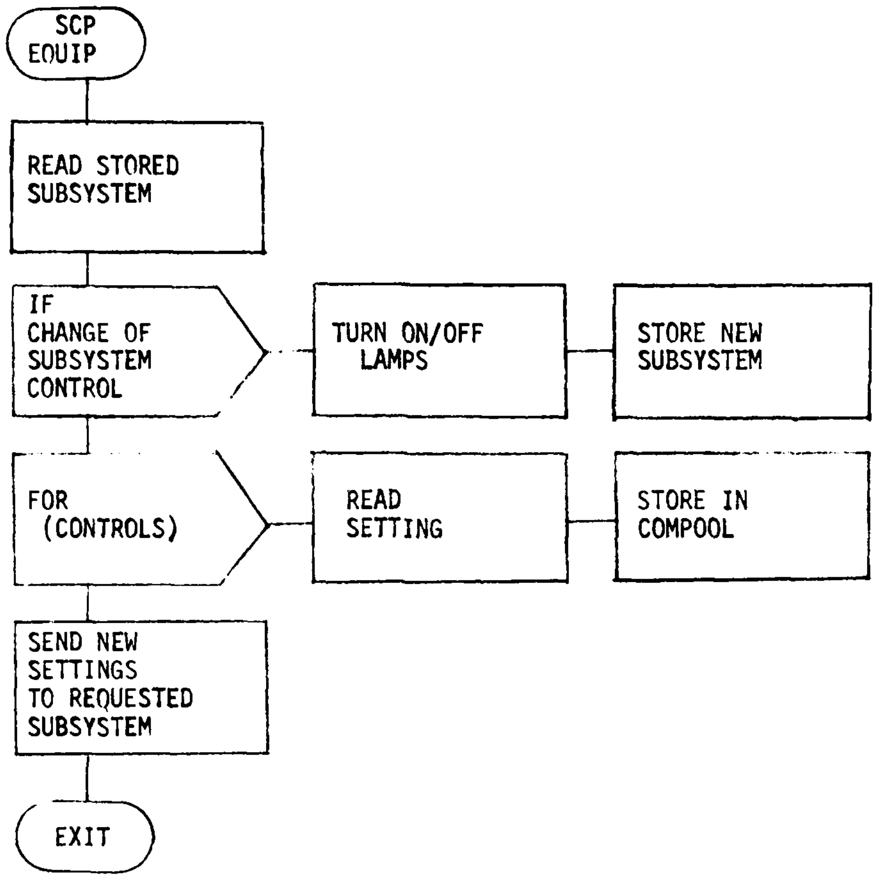

Figure 41 SCP EQUIP

TABLE LXXXIII OUTPUTS FROM SCP EQUIP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
ANALOG SETTINGS		DESIGNATED SUBSYSTEM	
SUBSYSTEM CONTROLLED		DATA BASE	

3.2.5.11.1 Inputs

The inputs to the Guidance/Autopilot Controller SPEC shall be as specified in Table LXXXIV .

3.2.5.11.2 Processing

The Guidance/Autopilot Controller SPEC shall be performed as described in Figure 42 . The SPEC shall check to see if the aircraft is in descent. If the aircraft is in descent, the Descent Profile SPEC (3.2.2.9) shall be scheduled and signalled to determine the descent rates. The type of descent shall be provided for the Descent Profile SPEC. The Waypoint Steering SPEC (3.2.5.13) shall be scheduled synchronously at a rate of 16/second if the following modes of steering are selected:

a. Destination

b. Track

The Steering SPEC (3.2.5.14) shall be scheduled synchronously at a rate of 16/second if the following modes of steering are selected:

a. Inertial Heading

b. Landing

c. TACAN

d. ADF

3.2.5.11.3 Outputs

The outputs from the Guidance/Autopilot Controller SPEC shall be as specified in Table LXXXV .

TABLE LXXXIV INPUTS TO GUIDANCE/AUTOPILOT CONTROLLER SPFC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Descend OPS Indicator		Configurator	3.2.1.4
2. Descend Type		OPS: Descend	3.2.2.6
a. Planned			
b. Normal			
c. STOL			
d. Rapid			
e. Precision			
f. Radar			
3. Waypoint Steering Modes Indicator		All OPS requesting Guidance/ Autopilot Controller	3.2.2.3-7
a. Destination			
b. Track			
4. Steering Modes Indicators		All OPS requesting Guidance/ Autopilot Controller	3.2.2.3-7
a. Inertial Heading			
b. Landing			
c. TACAN			
d. ADF			

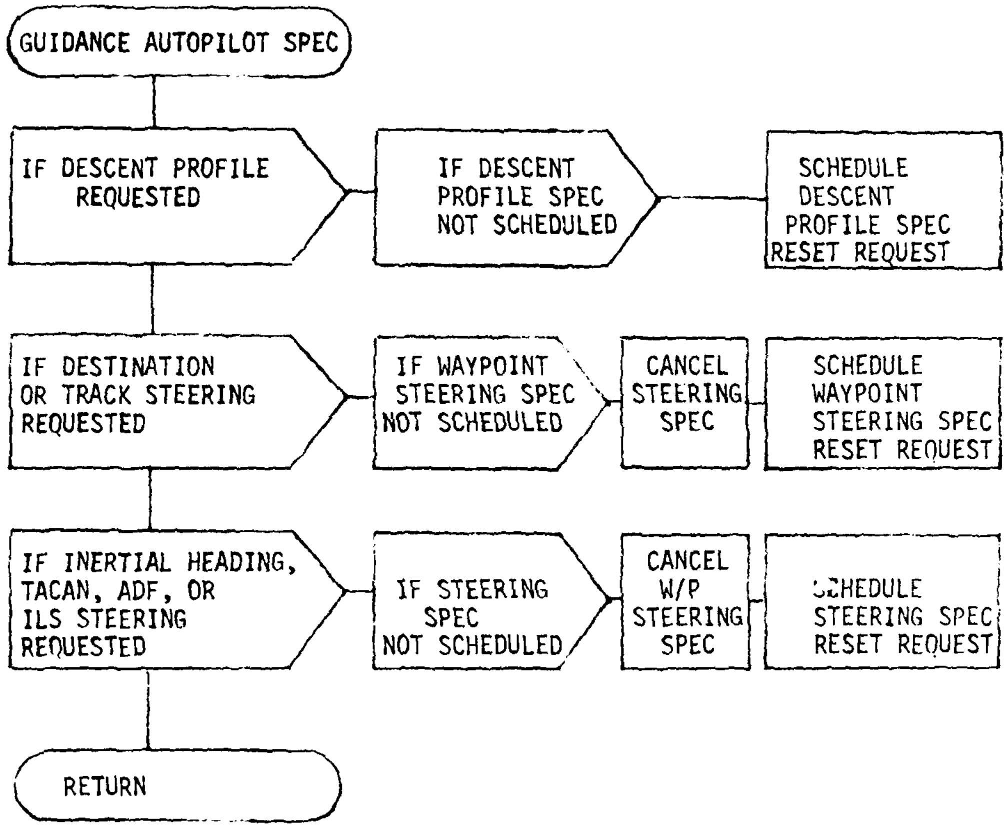

Figure 42 Guidance/Autopilot SPEC

TABLE LXXXV OUTPUTS FROM GUIDANCE/AUTOPILOT CONTROLLR SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Descent Type		SP'C: Descent Profiles	3.2.2.9
a. Planned			
b. Normal			
c. STOL			
d. Rapid			
e. Precision			
f. Radar			

3.2.5.12 Function 5.12 - Waypoint Steering SPEC

The Waypoint Steering SPEC computes deviaitons in the desired course and sends this error information to the HUD DISP (3.2.11.4) for pilot use and to the FCS EQUIP (3.2.9.3) for the autopilot. The desired course is determined based on operator selected waypoints on the current position as provided by the navigation SPEC's (3.2.4). The computer requirements for this module are:

Memory size	113	16 bit words
Throughput	11.8	ms/sec
Update rate	16	times/sec

3.2.5.12.1 Inputs

The inputs to the Waypoint Steering SPEC shall be as specified in Table LXXXVI

3.2.5.12.2 Processing

The processing shall be performed as described in Figure 43 The current optimal estimate of position and ground velocity shall be determined. The optimal estimate of ground velocity shall be provided by the Navigation Group (3.2.4). The optimal estimate of position shall be computed by the navigation SPECS or by the measurements from an SKE/ZONE Marker. The nominal estimate of the position shall be provided by the Navigation Filter Update SPEC (3.2.4.7). The estimate provided by the filter can be changed by use of the of the Navigation Brute Force SPEC (3.2.3.2). The desired course shall depend upon whether the operator has selected track steering or destination steering. The current altitude error shall be computed and displayed on the MPD. If the aircraft is descending the current and desired rate of descent shall also be displayed. In descent the amount of altitude yet to descend shall be displayed.

3.2.5.12.2.1 Tracking Steering Processing

The track steering option shall be selected by the operator in the IMK as provided by the appropriate OPS or implicity by the Cargo Delivery Controller SPEC (3.2.6.1). In the track steering mode it shall be determined if new waypoints are selected. If new waypoints are selected a new course shall be determined. Once a desired course is known, this SPEC shall compute along track deviation, distance to go, and the cross track deviation. These

TABLE LXXXVI INPUTS TO WAYPOINT STEERING SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Current Position: Lat, Lon, AH		SPEC: Nav Filter, other Nav Specs	3.2.4.7,8,10, 11,12;3.2.5.13
2. Current Velocity		SPEC: Nav Filter, Other Nav Specs	3.2.4.7,8,10,11
3. SKE/ZM Flag		OPS: Air Drop	3.2.2.5
4. ZM Position		Drop Zone Warning	3.2.6.4
5. Track Steering Flay		All OPS using Guidance Controller; Cargo Delivery Controller	3.2.8.3-7 3.2.6.1
6. Previous Waypoint-Geodetic Lat, Long, Alt.		All OPS using Guidance Controller; SPEC: Cargo Release Path	3.2.2.3-7 3.2.6.3
7. Next Waypoint - Goedetic Lat, Lon, Alt.		All OPS using Guidance Controller Cargo Release Path SPEC	3.2.2.3-7 3.2.6.3
8. Destination Steering Flay		All OPS using G/A Controller	3.2.2.3-7
9. Bearing tr range arc. vector to next waypoint		SPEC Nav Filter, INS Equip, or AHRS Equip.	3.2.4.1,4,7
10. Computation Heading		New Filter SPEC, INS Equip AHRS Equip.	3.2.4.1,4,8
11. Descent Rate, Time of Start of Descent		SPEC: Descent Profiles	3.2.2.9
12. Desired Altitude		All OPS using Guidance Controller	3.2.2.3-7
13. Descend OPS Ikdicator		Configurator	3.2.1.4

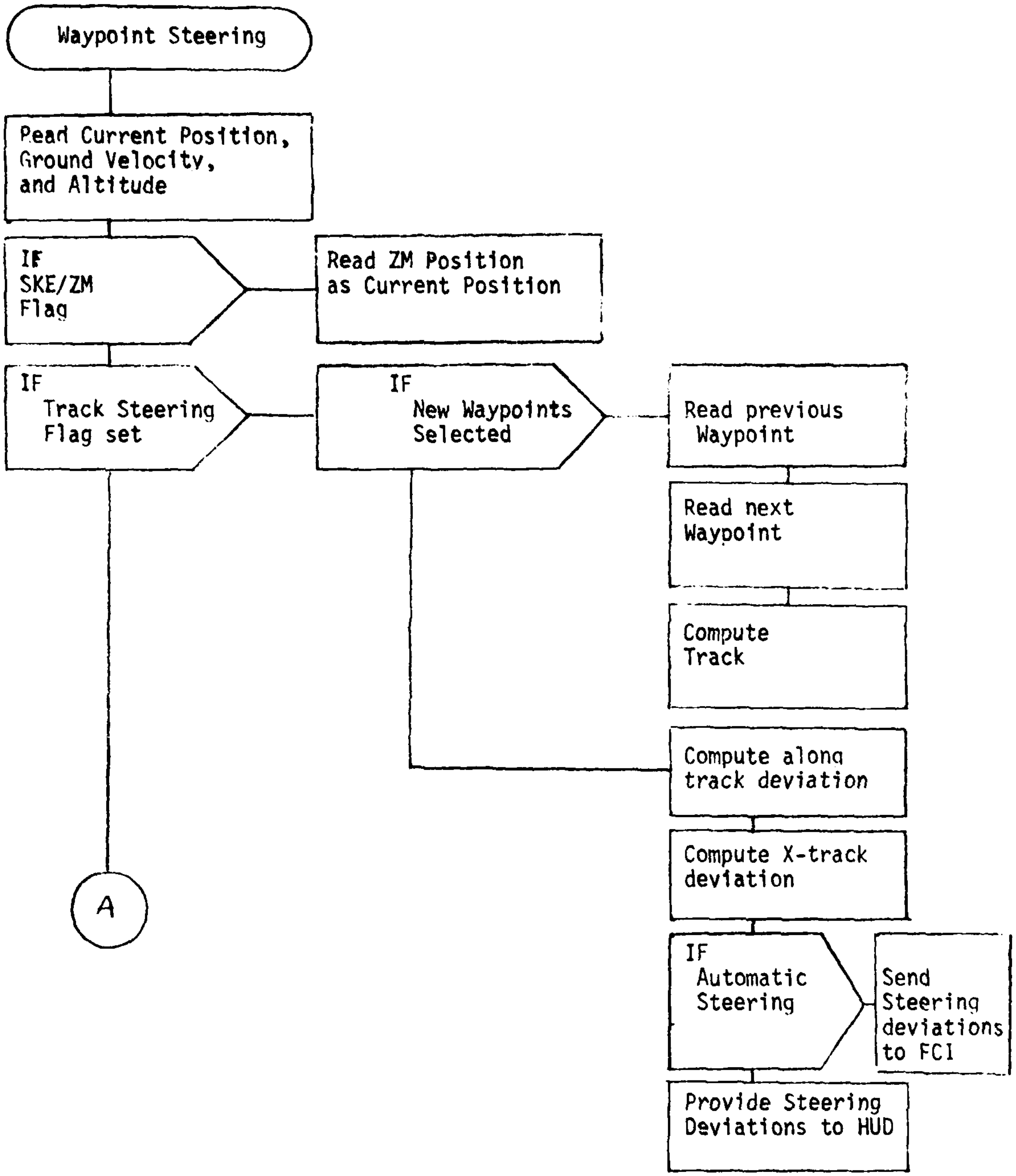

Figure 43 Waypoint Steering SPEC Processing

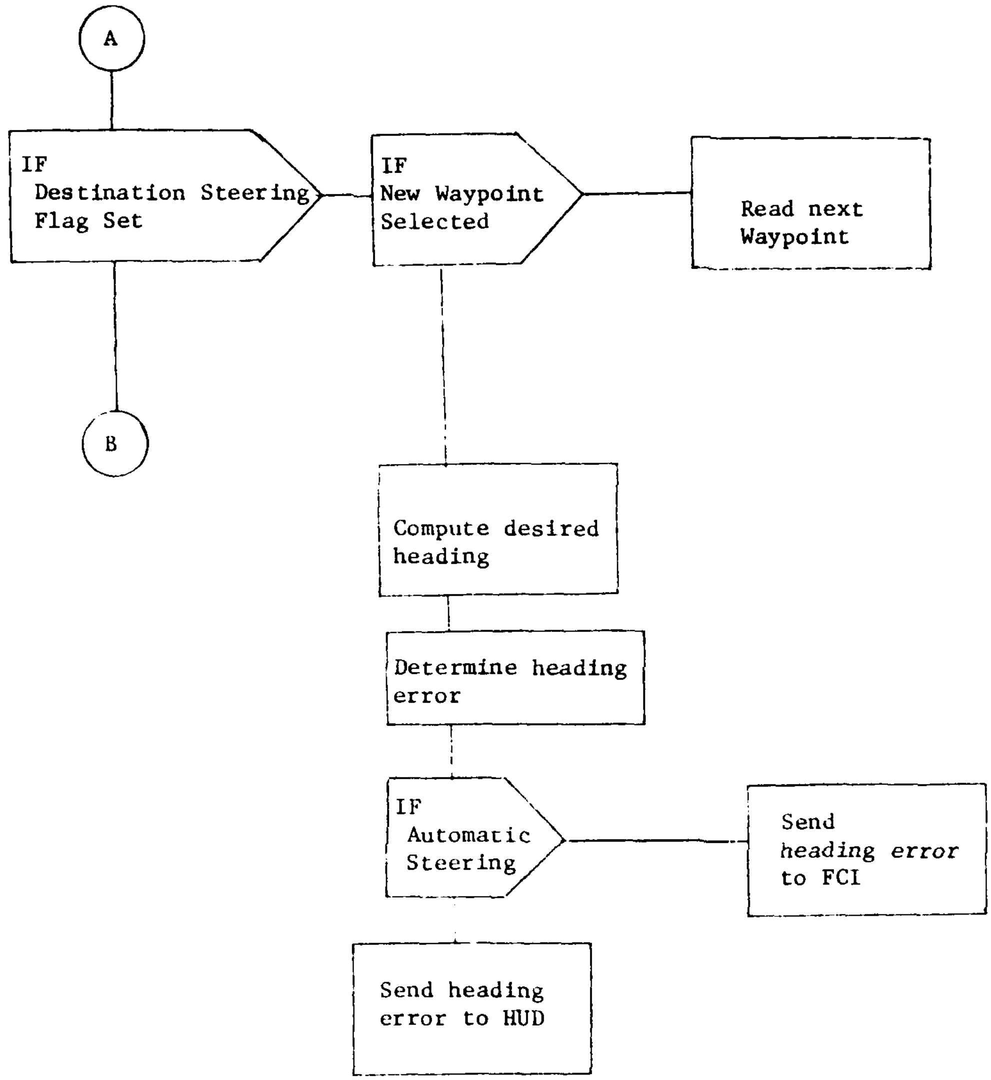

Figure 43 (Cont.) Waypoint Steering SPEC

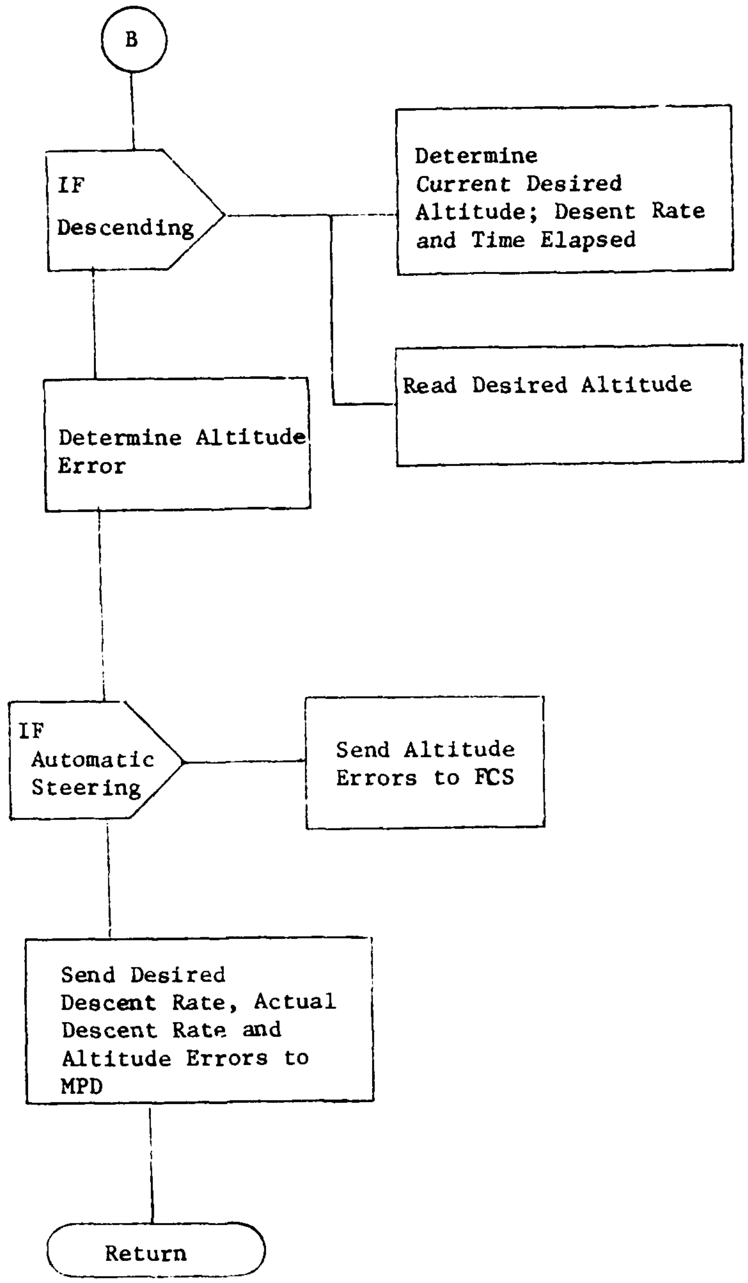

Figure 43 (Cont.) Waypoint Steering SPEC

distances shall be sent to the HUD DISP and if automatic steering has been selected to the FCS EQUIP. When the along track deviation is zero a new waypoint shall be requested through the appropriate OPS.

3.2.5.12.2.2 Destination Steering Processing

The destination steering option shall be selectedby the operator on the IMK as provided by the appropriate OPS. In the destination steering mode, it shall be determined if a new next waypont has been selected. If a new waypoint has been selected the Waypoint Steering SPEC shall compute a desired heading based on current bearing waypoint ground speed and position. The error in the current heading shall be determined. The heading errors shall be sent to the HUD DISP (3.2.11.4) and if automatic steering has been selected to the FCS EQUIP (3.2.11.4). When the waypoint has been reached, a request for a new waypoint shall be requrested through the appropriate OPS.

3.2.5.12.3 Outputs

The outputs from the Waypoint Steering SPEC shall be as specified in Table LXXXVII .

TABLE LXXXVII OUTPUTS FROM WAYPOINT STEERING SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Along track deviation		HUD DISP, FCS EQUIP	3.2.11.4, 3.2.9.3
2. Crosstrack deviation		HUD DISP, FCS EQUIP	3.2.11.4, 3.2.9.3
3. Flay that new Waypoint is needed		All OPS that schedule G/A Controller	3.2.2.3-7
4. Heading Error		HUD DISP, FCS EQUIP	3.2.9.3, 3.2.11.4
5. Altitude Error		DISP: MPD	3.2.11.3
6. Altitude deviation yet to null		DISP: MPD	3.2.11.3
7. Descent Rate: Desired and Actual		DISP: MPD	3.2.11.3

3.2.5.13 Function 5.13 - Steering Computations SPEC

The Steering Computations SPEC provides heading information to aid the pilot in flying the aircraft. The heading information is sent to the HUD DISP (3.2.11.4), the MPD DISP (3.2.11.6) and the FCS EQUIP (3.2.9.3). There are four modes of steering computations depending on the source of the direction information as provided by the various requesting the Guidance/ Autopilot Controller SPFC. The computer requirements for this module are:

Memory size	115	16 bit words
Throughput	16.5	ms/sec
Update rate	16	times/sec

3.2. 5.13.1 Inputs

The inputs to the Steering Computations SPEC shall be as specified in Table LXXXIX .

3.2.5.13.2 Processing

The processing for the Steering Computations SPEC shall be performed as described in Figure 44 . There shall be four modes of processing depending on the navigation aid being used:

a. Inertial Heading

b. Landing with ILS

c. TACAN

d. ADF

For each aid, this SPEC shall determine a desired heading and current actual heading and bearing. Also, the current altitude error shall be computed and displayed on the MPD. If the aircraft is descending the current and desired rates of descent shall also be displayed. In descent, the altitude differential yet to be nulled shall be displayed. The Steering Computations

TABLE LXXXIX INPUTS TO STEERING SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Steering Mode Indicator		All OPS requesting Guidance/Autopilot Controller SPEC	3.2.2.3-7
a. Inertial Heading			
b. Landing - ILS			
c. TACAN			
d. ADF			
2. TACAN station Location, Altitude and Magnetic Variation and Type of bearing (mag; grid, etc.)		Mass memory	
3. TACAN Bearing of A/C from station		EQUIP: TACAN	3.2.4.3
4. TACAN Slant Range		EQUIP: TACAN	3.2.4.3
5. Barometric Altitude		EQUIP: FCS	
6. A/C Heading, True and Mag.		SPEC: Nav Filter, EQUIP: AHRS, INS	3.2.4.7, 3.2. 4.4, 3.2.4.1
7. Magnetic Variation in the Area of Aircraft		- - -	
3. Automatic Wind Compensation Flag (Homing Deselect)		All G/A OPS	3.2.2.3-7
9. Wind Velocity		SPEC: Wind Computation	3.2.4.9
10. Rel. Bearing at A/C from ADF Station		EQUIPS: UHF/ADF, LF/ADF	3.2.5.1-2

TABLE LXXXIX INPUTS TO STEERING SPEC (Cont.)

DATA NAME	SYMBOL	SOURCE	REFERENCE
11. Pilot Provided Desired Heading		All OPS requesting G/A controller	3.2.2.3-7
12. Glide Slope Flag		EQUIP: ILS	3.2.5.5
13. Localizer Flag		EQUIP: ILS	3.2.5.5
14. Localizer Deviation		EQUIP: ILS	3.2.5.5
15. Glide Slope Deviation		EQUIP: ILS	3.2.5.5
16. Light Marker Beacon		EQUIP: ILS	3.2.5.5
17. Radar Altimeter Altitude		EQUIP: Radar Altimeter	3.2.5.6
18. Desired Approach Speed		SPEC: Landing Speed Requirements	3.2.2.12
19. True Airspeed		EQUIP: FCS	3.2.9.3
20. Runway Heading		Initialization Data	
21. Descent Rate, Time of Start of Descent		SPEC: Descent Profiles	3.2.2.9
22. Descend OPS Indicator		Configurator	3.2.1.4
23. Position of Aircraft		SPEC: Nav. Filter	3.2.4.7

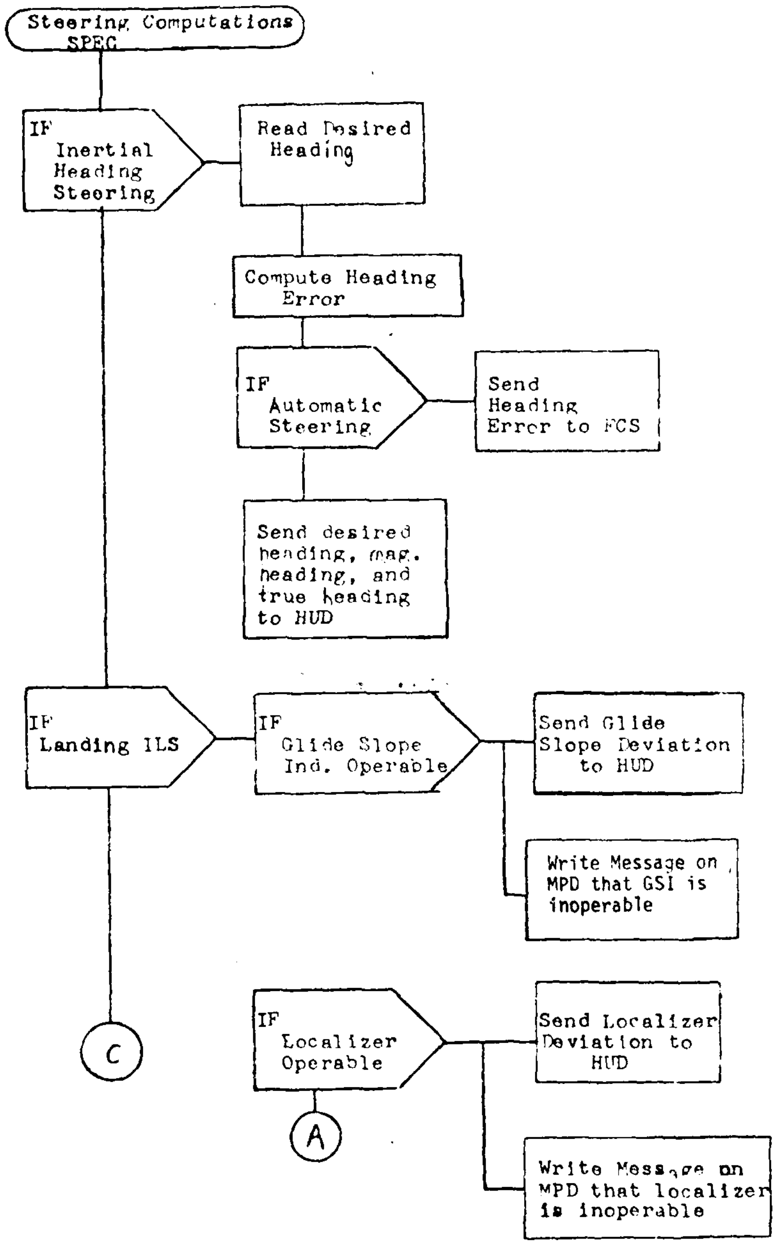

Figure 44 Steering Computations SPEC

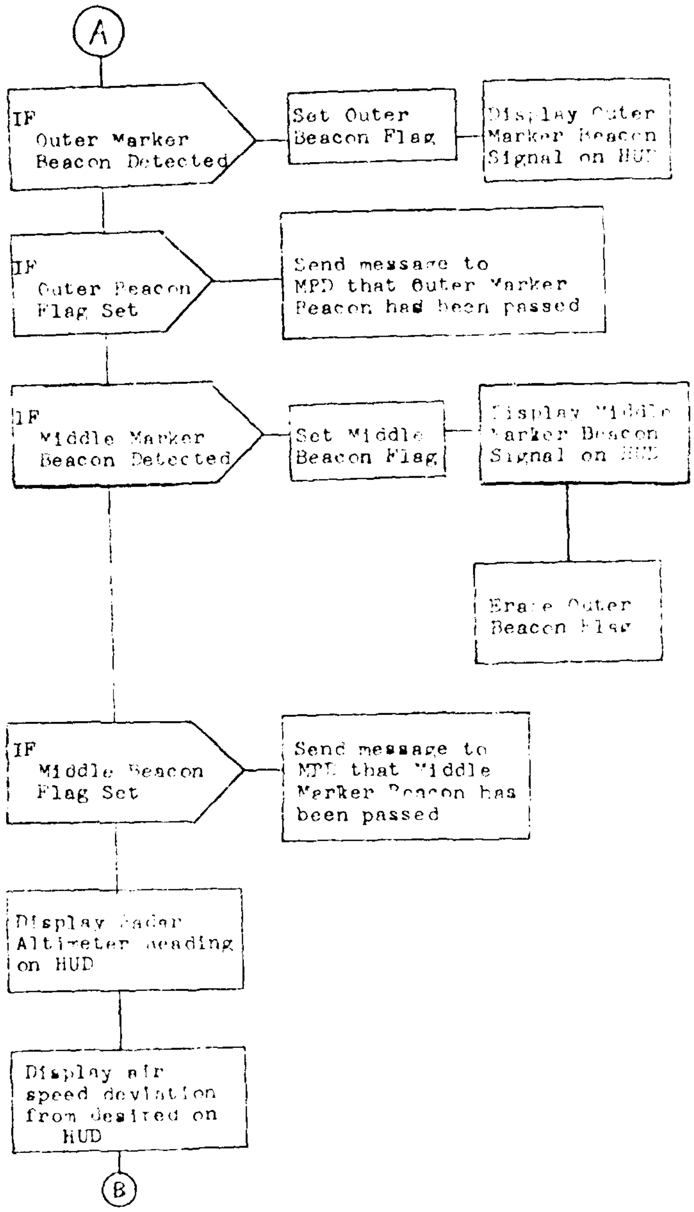

Figure 44 (Cont.) Steering Computations SPEC

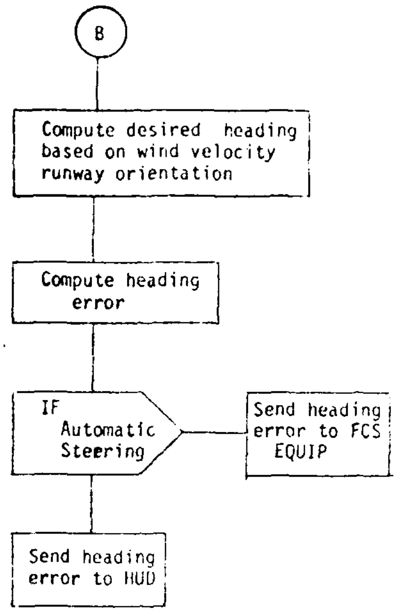

Figure 44 (Cont.) Steering Computations SPEC

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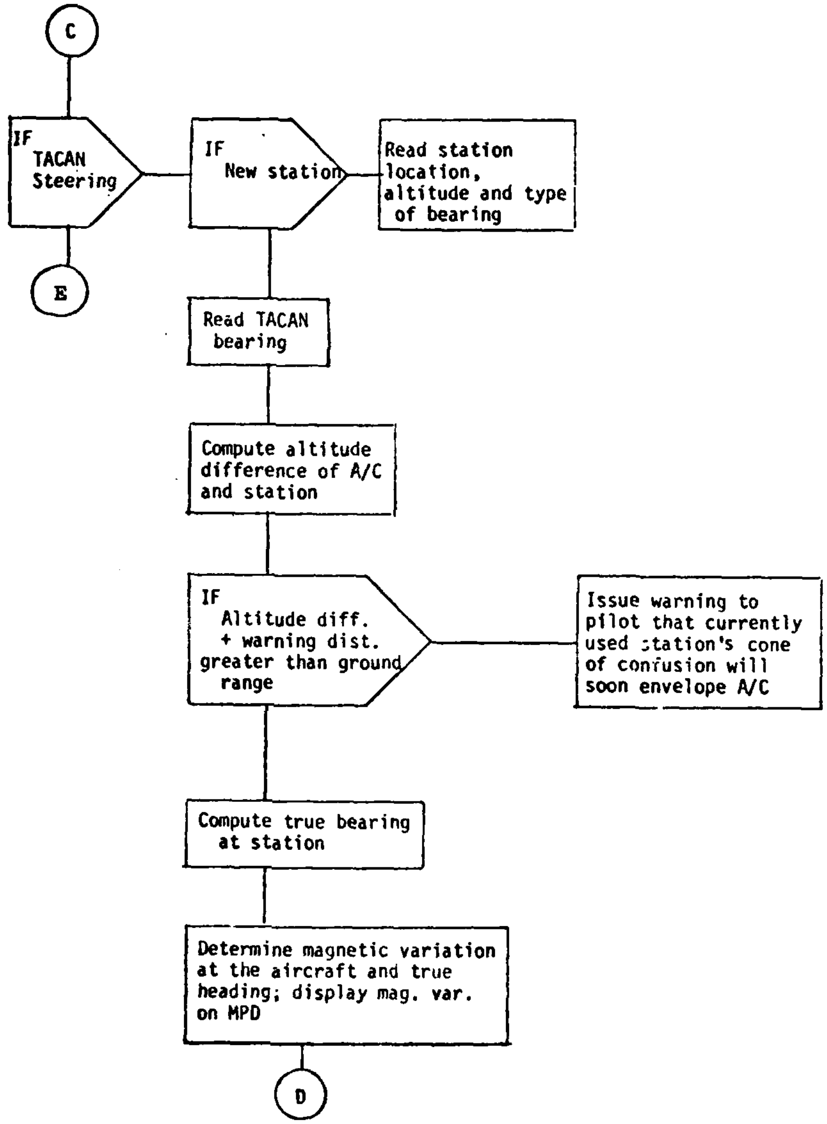


Figure 44 (Cont.) Steering Computations SPEC

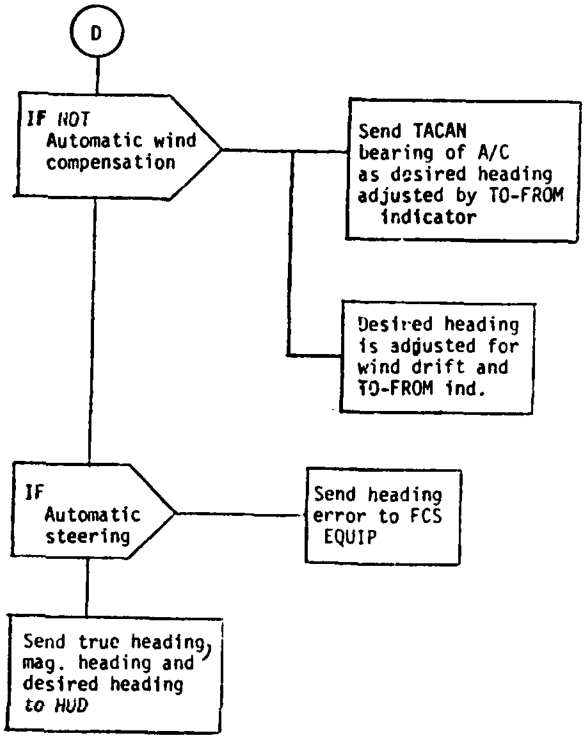


Figure 44 (Cont.) Steering Computations SPEC

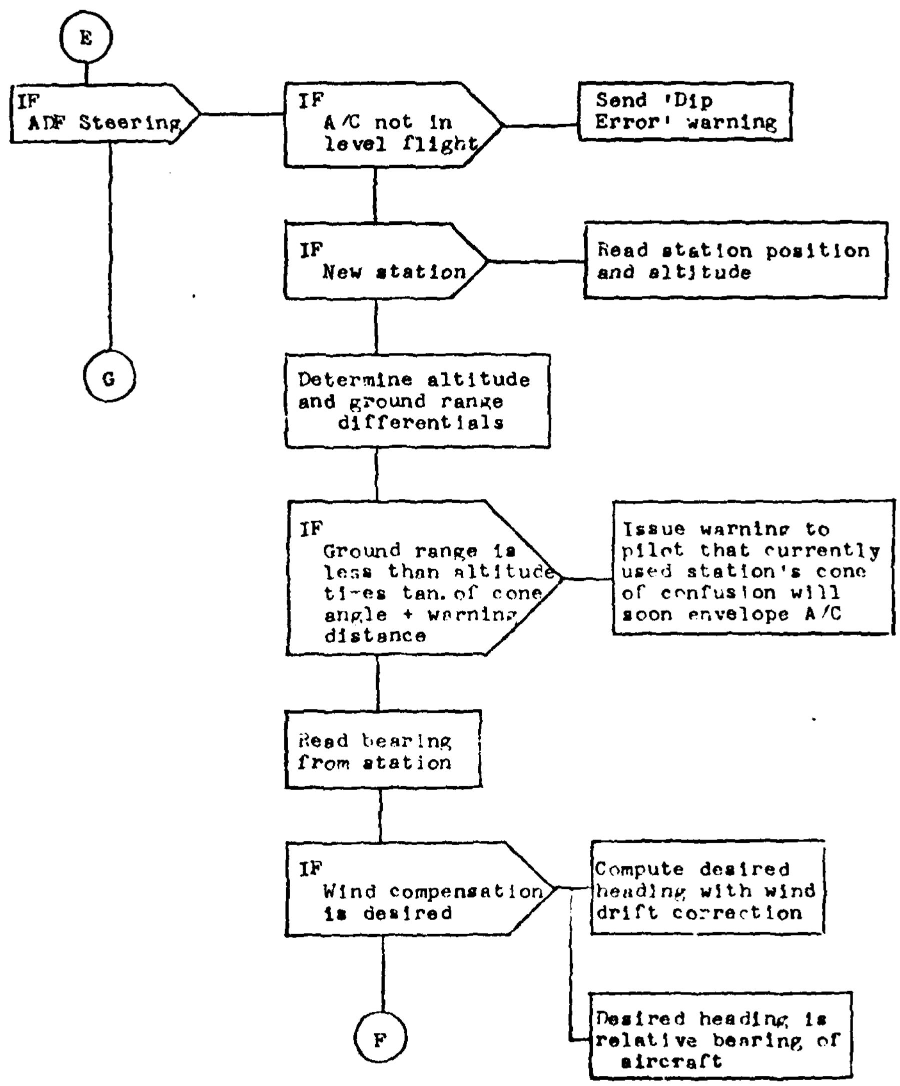


Figure 44 (Cont.) Steering Computations SPEC

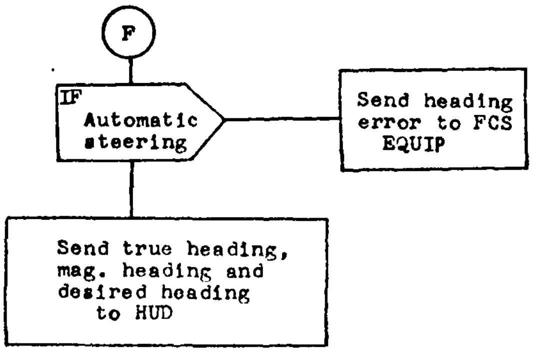


Figure 44 (Cont.) Steering Computations SPEC

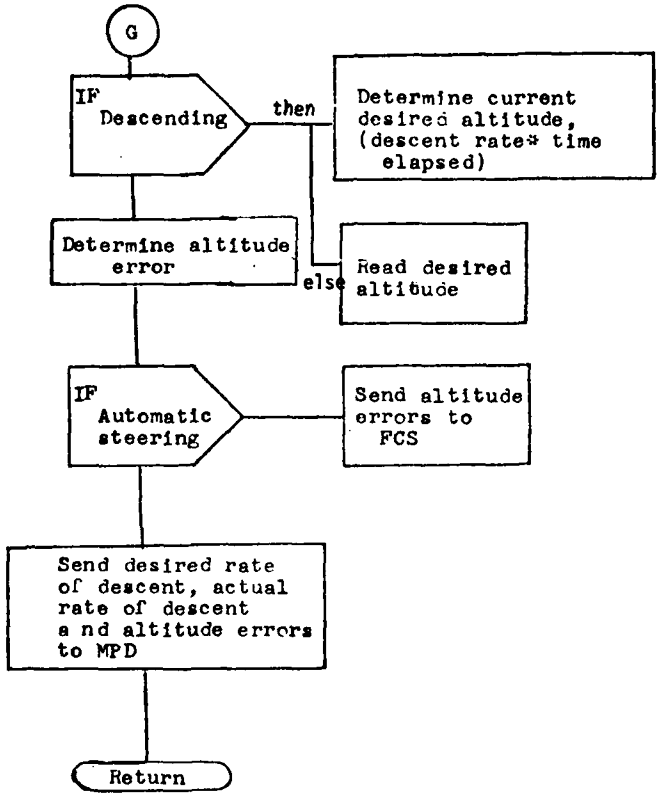


Figure 44 (Cont.) Steering Computations SPEC

SPEC shall be scheduled synchronously by the Guidance/Autopilot Controller (3.2.5.11) whenever any of the navaids a-d are requested for steering.

3.2.5.13.2.1 Inertial Heading Processing

In the Inertial Heading Mode of Steering, the operator simply dictates the INS heading he wants to fly. This SPEC shall read in the desired heading and the actual heading. The heading error shall be computed, and if automatic steering is in effect, the heading error shall be sent to the FCS EQUIP (3.2.9.3). The desired heading, actual heading and magnetic heading shall be displayed on the HUD.

3.2.5.13.2.2 ILS Processing

The processing performed during landing using ILS equipment shall be performed as described in Para. 3.2.5.5 . Through the ILS EQUIP (3.2.5.5), this SPEC shall interrogate the outputs of the following electronicaids, which one part of the ILS:

a. Glide Slope Indicator (GSI)

b. Localizer

c. Outer Marker Beacon

d. Middle Marker Beacon

If the GSI and Localizer are providing reasonable data, the respective deviations shall be displayed on the HUD. If either is inoperable, a warning message shall be displayed on the MPD, and no display shall appear on the HUD. When the marker beacons are being passed, an indication shall be displayed on the HUD. After each beacon is passed, the display shall be removed. Also a message shall be displayed on the MPD to remind the operator that the beacon has been passed. During landing the value of relative altitude from the radar altimeter (3.2.5.6) shall be displayed on the HUD. The deviation of the air speed from the required landing speed (Input 3.2.5.13.1.22) as computed by the Land Speed Requirements SPEC (3.2.2.12) shall be displayed on the HUD. The desired heading shall be computed based on the wind velocity and the direction of the runway. A heading error shall be determined and displayed on the HUD. The roll and pitch displays are to be provided by the FCS. The heading error shall be sent to the FCS EQUIP if automatic steering is indicated.

3.2.5.13.2.3 TACAN Steering Processing

This SPEC shall provide heading information to the pilot to allow him to fly the bearing signal transmitted by a TACAN station. The heading information, at the pilot's option, shall include compensation for magnetic variation and wind. Also, a warning shall be displayed indicating that the aircraft is approaching the cone-of-confusion for the TACAN station being used. The lead time for the warning shall be internal data of this SPEC. Whenever a new TACAN station is selected the position, the altitude, and the nature of the relative bearing of the TACAN station shall be read in. The magnetic variation of the aircraft shall be determined and displayed on the MPD. The true heading of the aircraft shall be computed. The operator shall be given the option to input a different value of magnetic variation. If the pilot deselects automatic wind compensation, (that is, desires to fly a homing course) the desired heading shall be determined as the current true TACAN bearing of aircraft adjusted for TO-FROM indicator. Otherwise, the desired heading shall be computed to maintain the aircraft on the current true TACAN bearing of the aircraft. If automatic steering is selected, a heading error shall be sent to the FCS. The true heading, magnetic heading and desired heading shall be displayed on the HUD.

3.2.5.13.2.3 ADF Steering Processing

The Steering Computations SPEC shall perform the processing presented in Figure . This SPEC shall provide heading information on the HUD to allow the pilot to fly the bearing indicated by the LF/ADF or the UHF/ADF. Also, warnings shall be displayed on the MPD for "Dip Error" and proximity to the cone of confusion. Whenever a new/radio station is selected, the position and altitude of the station shall be read to enable the computation of the cone of confusion. The operator shall be given the option of flying a homing course or of allowing for wind drift. The true heading, desired heading, and the magnetic heading shall be displayed on the HUD. If automatic steering is selected, the heading error shall be sent to the FCS.

3.2.5.13.3 Outputs

The outputs from the Steering SPEC shall be as specified in Table XC .

3.2.6 Cargo Delivery

The Cargo Delivery Group of software modules consist of those tasks necessary to perform an air drop. This group includes a controller SPEC which schedules the three calculator SPECs included in this group. The calculator SPECs compute the CARP, the desired course to intercept the CARP and a series of warning times to aid the pilot. The desired course is sent to the Waypoint Steering SPEC (3.2.5.12). To aid the steering during an air drop the SPECs of the Target Acquisition Group (3.2.8) can be event-signalled

TABLE XC OUTPUTS FROM STEERING SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Mag. Var. of A/C		DISP: MPD	3.2.11.6
2. Current true heading, mag. heading and desired heading of A/C		DISP: HUD, EQUIP: FCS	3.2.11.4, 3.2.9.3
3. Glide Slope Deviation Ind.		DISP: HUD	3.2.11.4
4. Glide Slope Inoperable Message		DISP: MPD	3.2.11.6
5. Localizer Deviation Ind.		DISP: HUD	3.2.11.4
6. Localizer Inoperable Message		DISP: MPD	3.2.11.6
7. Radar Altimeter Altitude		DISP: HUD	3.2.11.4
8. Heading Error		DISP: HUD, EQUIP: FCS	3.2.11.4, 3.2.9.3
9. "Dip Error" Warning		DISP: MPD	3.2.11.6
10. Cone of Confusion Warning		DISP: MPD	3.2.11.6

by the Air Drop OPS or the Navigation BF SPEC. Specifically, the Air Drop OPS can synchronously schedule the SKE computations SPEC in order to use the SKE/Zone Marker Equipment. The Navigation BF SPEC allows the operator to improve his estimate of position through a HUD Visual Update or a radar fix. The Cargo Delivery computations assume a flat earth model.

3.2.6.1 Function 6.1 - Cargo Delivery Controller SPEC

The Cargo Delivery Controller (CDC) SPEC determines through appropriate phasing the order in which the software modules are executed to accomplish accurate delivery of the cargo for an air drop. This SPEC is signalled by the Air Drop OPS. Autonomous cargo delivery is accomplished through using HUD Visual Updates (3.2.4.12) or Radar Fixtaking (3.2.5.12) in combination with optimal navigation processing (3.2.4.5-8). The computer requirements for this module are:

Memory size	30	16 bit words
Throughput	0	ms/sec
Update rate	0	times/sec

3.2.6.1.1 Inputs

The inputs to the Cargo Delivery Controller SPEC shall be as specified in Table XCI .

3.2.6.1.2 Processing

The Cargo Delivery Controller SPEC shall perform the processing as described in Figure 45 . The phasing of the synchronous tasks shall be such that the order of execution shall be as specified in Figure .
The Cargo Release Path (CRP) SPEC (3.2.6.3) shall be scheduled synchronously

TABLE XCI INPUTS TO CARGO DELIVERY CONTROLLER SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. SKE/ZM Flag		GPS: Air Drop	3.2.2.5

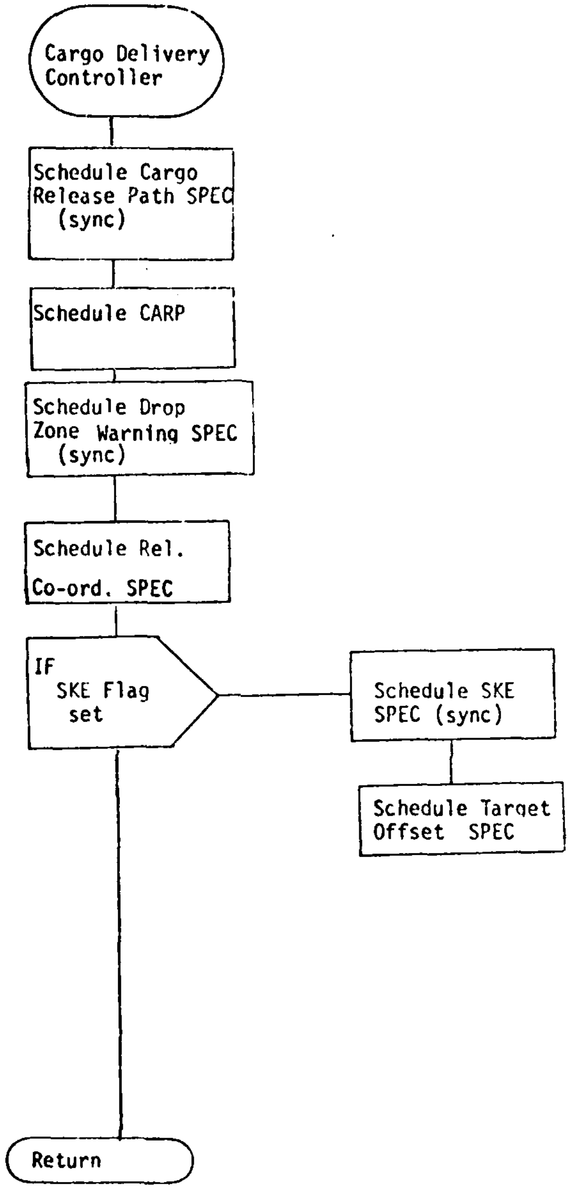


Figure 45 Cargo Delivery Controller Processing

to execute first. The CRP SPEC determines the desired course. In order to determine the desired course, it shall signal the event to compute the CARP (3.2.6.2). The Drop Zone Warning (DZW) SPEC (3.2.6.4) shall be scheduled synchronously to continually determine if warnings should be sent to the pilot and loadmaster. The DZW SPEC shall signal the event for the Relative Coordinates SPEC (3.2.8.1) to execute to provide the time to go before drop. If the SKE/Zone Marker (ZM) is being utilized, the SKE SPEC (3.2.5.15) shall be scheduled synchronously to provide an estimate of the current position for use by the Waypoint Steering SPEC (3.2.5.13).

The Cargo Delivery Controller SPEC shall schedule the Waypoint Steering SPEC synchronously. The CDC SPEC shall select the track steering option for the W/P Steering SPEC. The priority for each of the SPECs scheduled shall be set such that none of them will be executed until the CDC SPEC has been terminated.

3.2.6.1.3 Outputs

The outputs from the Cargo Delivery Controller SPEC shall be as specified in Table XCII .

3.2.6.2 Function 6.2 - Computed Air Release Point (CARP) SPEC

The CARP Specialist Function determines the point in space at which cargo is ejected from the aircraft. The CARP SPEC Function is signalled by the Cargo Delivery Controller SPEC (3.2.6.1). The computer requirements for this module are:

Memory size	63	16 bit words
Throughput	1.3	ms/sec
Update rate	4	times/sec

TABLE XCII OUTPUTS FROM CARGO DELIVERY CONTROLLER SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Track Steering Flag		SPEC: Waypoint Steering	3.2.5.13

3.2.6.2.1 Inputs

The inputs to the CARP SPEC shall be as specified in Table XCIII .

3.2.6.2.2 Processing

The CARP SPEC shall perform the processing specified in Figure 46 .

. The relative displacement between impact point and the release point shall be computed as the combination of two displacements:

a. The position change before full deployment due to aircraft ground velocity.

b. The position change due to wind velocity.

If the wind velocity at the drop zone is known, the effective velocity of the wind shall be computed as the average of the drop zone value and the wind velocity at the aircraft as determined by the Wind Computation SPEC (3.2.4.9). If the wind velocity at the drop zone is not provided, the effective wind velocity shall be the value provided by the Wind Computation SPEC. In order to determine the total time of fall, the difference in altitude between the aircraft and the impact point at the time of the drop shall be computed. The descent rate on a set of polynomials for conversions from altitude differences to time of fall shall be used to provide the time of fall. The polynomials or descent rate shall be a function of the values of pressure, temperature and relative humidity at the drop zone. Also, the descent rate or polynomials shall require information as to the type of parachute being used. The position change during the fall due to ground track velocity of the aircraft, hence the initial velocity of the cargo at release, shall be computed by assuming the cargo travels at the ground velocity during the opening relay time of the parachute. The sum of the displacements shall be used to determine the latitude and longitude of the CARP.

TABLE XCIII Inputs to CARP SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Impact Point - Lat., Long., Altitude		Initialization Data, OPS	
2. Parachute Ballistics Table per Type of Parachute		Initialization Data	
3. Parachute Opening Delay Time per Type of Parachute		Initialization Data	
4. Desired Altitude of Drop		Initialization Data	
5. Wind Velocity at Drop Zone		Initialization Data	
6. Pressure and Temperature and Rel. Humidity at Drop Zone		Initialization Data	
7. Desired Ground Velocity of A/C at Time of Drop.		Spec: NAV Filter, TACAN, ONE Air Data D.R.	3.2.4.7-8 3.2.4.10-11
8. Wind Velocity at A/C		Spec: Wind COMP	3.2.4.9
9. Type of Parachute(s)		Initialization Data	

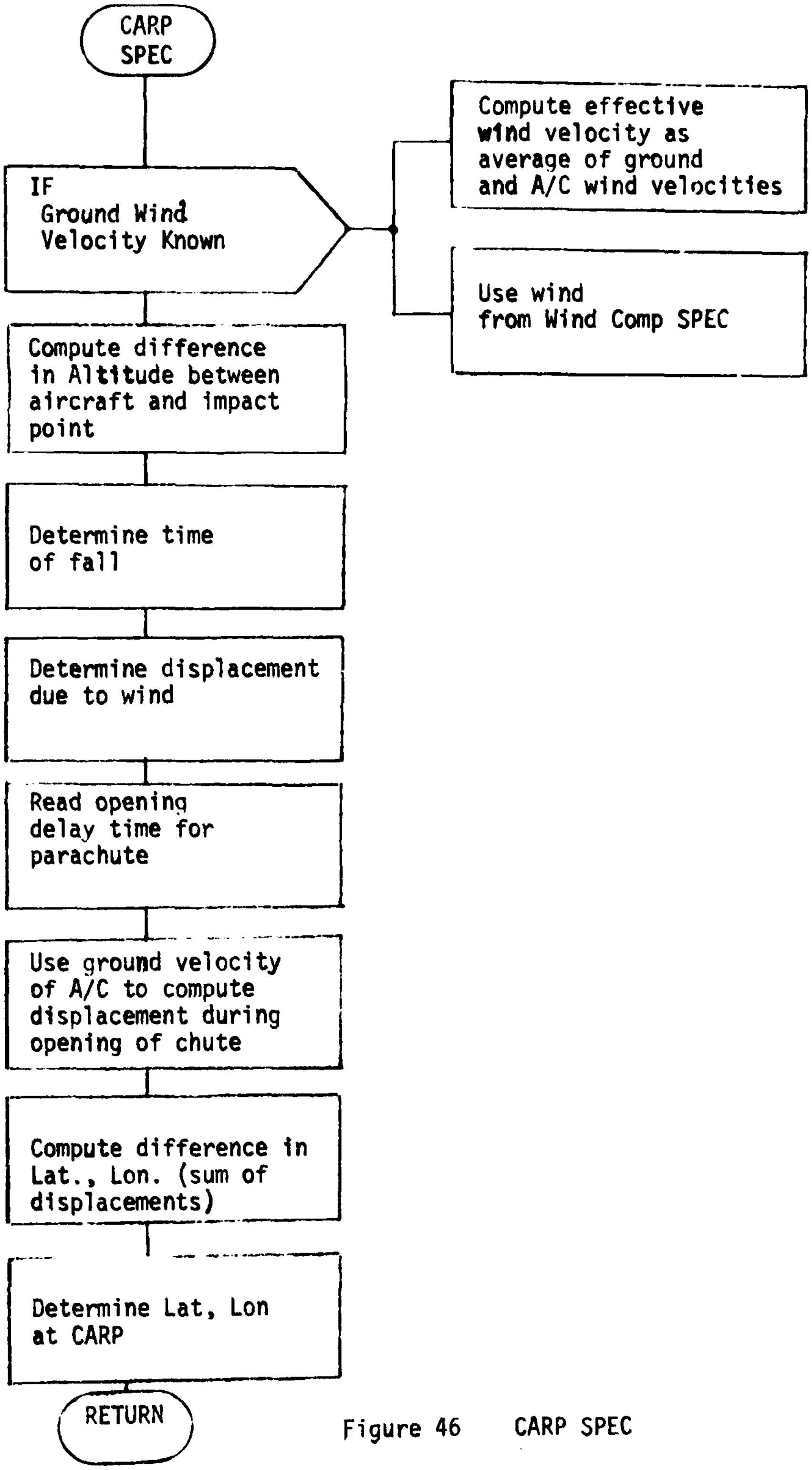


Figure 46 CARP SPEC

3.2.6.2.3 Outputs

The outputs from the CARP SPEC shall be as described in Table SCIV .

3.2.6.3 Function 6.3 - Cargo Release Path SPEC

The Cargo Release Path SPEC determines the course which the aircraft is to follow while ejecting the cargo. This path is defined by providing the coordinates of two waypoints to the track steering option of Waypoint Steering SPEC (3.2.5.). This SPEC is scheduled synchronously by the Cargo Delivery Controller SPEC (3.2.6.1). The computer requirements for this module are:

Memory size	137	16 bit words
Throughput	5.5	ms/sec
Update rate	4	times/sec

3.2.6.3.1 Inputs

The inputs shall be as specified in Table XCV .

3.2.6.3.2 Processing

The processing shall be performed as specified in Figure 47 . If the specification of the drop zone does not provide the trailing edge, the trailing edge shall be computed using the bearing and drop zone length provided. The Cargo Release Path SPEC shall provide for recomputation of the drop zone according to deviations specified by the pilot. The desired deviations in the drop zone as provided by the pilot shall be one of theee forms as follows:

a. The latitude, longitude and bearing of any course passing through the drop zone.

b. An along track deviation from impact point and bearing specified at the new position.

c. Along track and cross track deviations from the impact point.

TABLE XCIV Outputs from CARP SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Latitude, Longitude, Altitude of CARP.		SPEC: Relative Co-ordinates	3.2.8.1

TABLE XCV INPUTS TO CARGO RELEASE PATH SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Lat., Lon. at Impact Point		OPS: Air Drop	3.2.2.5
2. Lat., Lon. Of Trailing Edge Type 1		OPS: Air Drop	3.2.2.5
3. Bearing and Length Drop Type 2		OPS: Air Drop	3.2.2.5
4. Width of Drop Zone		OPS: Air Drop	3.2.2.5
5. Pilot Selected Deviation Type		OPS: Air Drop	3.2.2.5
6. Bearing, Lat., Lon. of any point on Cargo Release Path. (Type 1)		OPS: Air Drop	3.2.2.5
7. Bearing and along track deviation of impact point (Type 2)		OPS: Air Drop	3.2.2.5
8. Along Track and Cross-track Deviation from Impact Point (Type 3)		OPS: Air Drop	3.2.2.5
9. Type of Drop (Normal or LAPES)		C/S: Air Drop	3.2.2.5

TABLE XCV INPUTS TO CARGO RELEASE PATH SPEC (CONT'D)

DATA NAME	SYMBOL	SOURCE	REFERENCE
10. CARP		SPEC: CARP	3.2.6.2
11. Difference in Lat., Lon, Alt CARP to Impact Point		SPEC: CARP	3.2.6.2

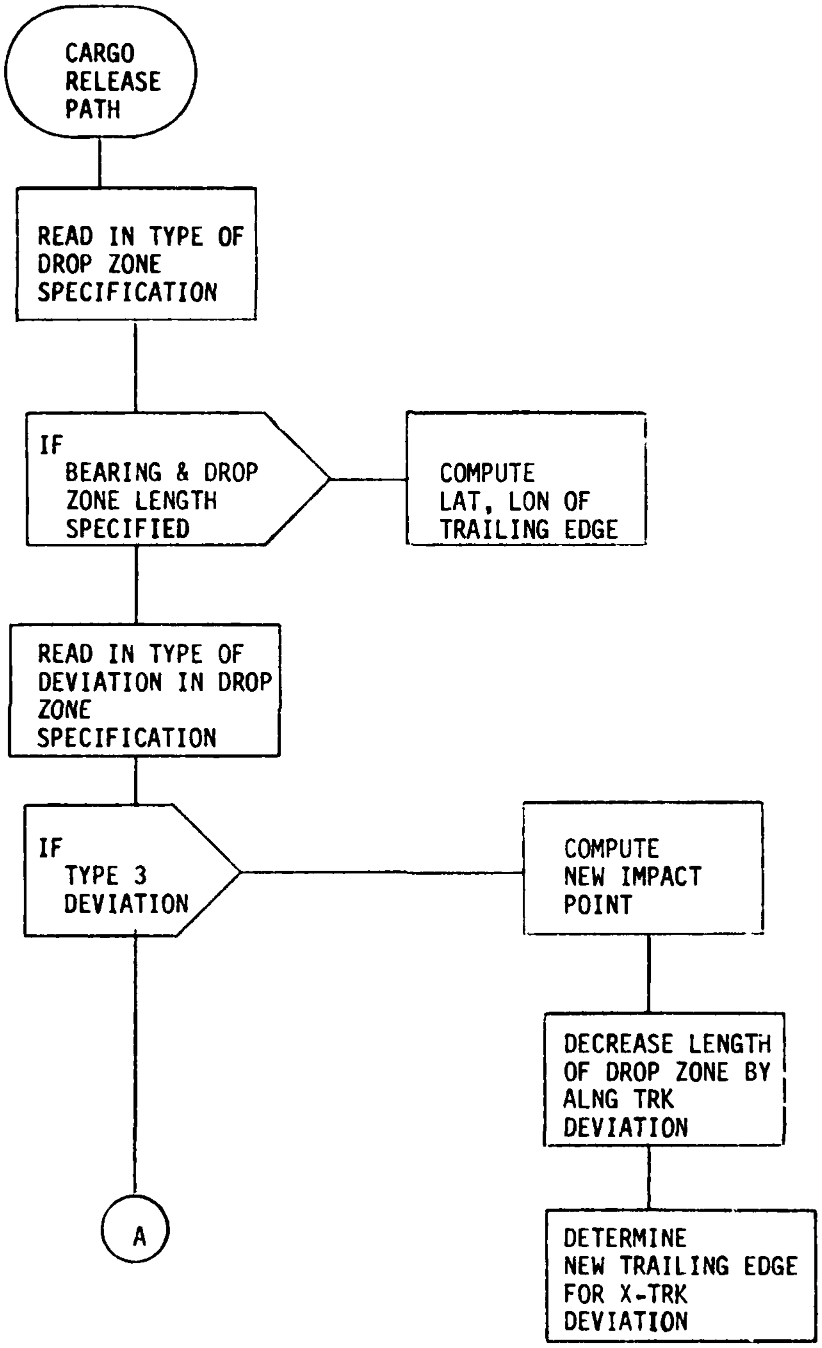


Figure 47 Cargo Release Path SPEC

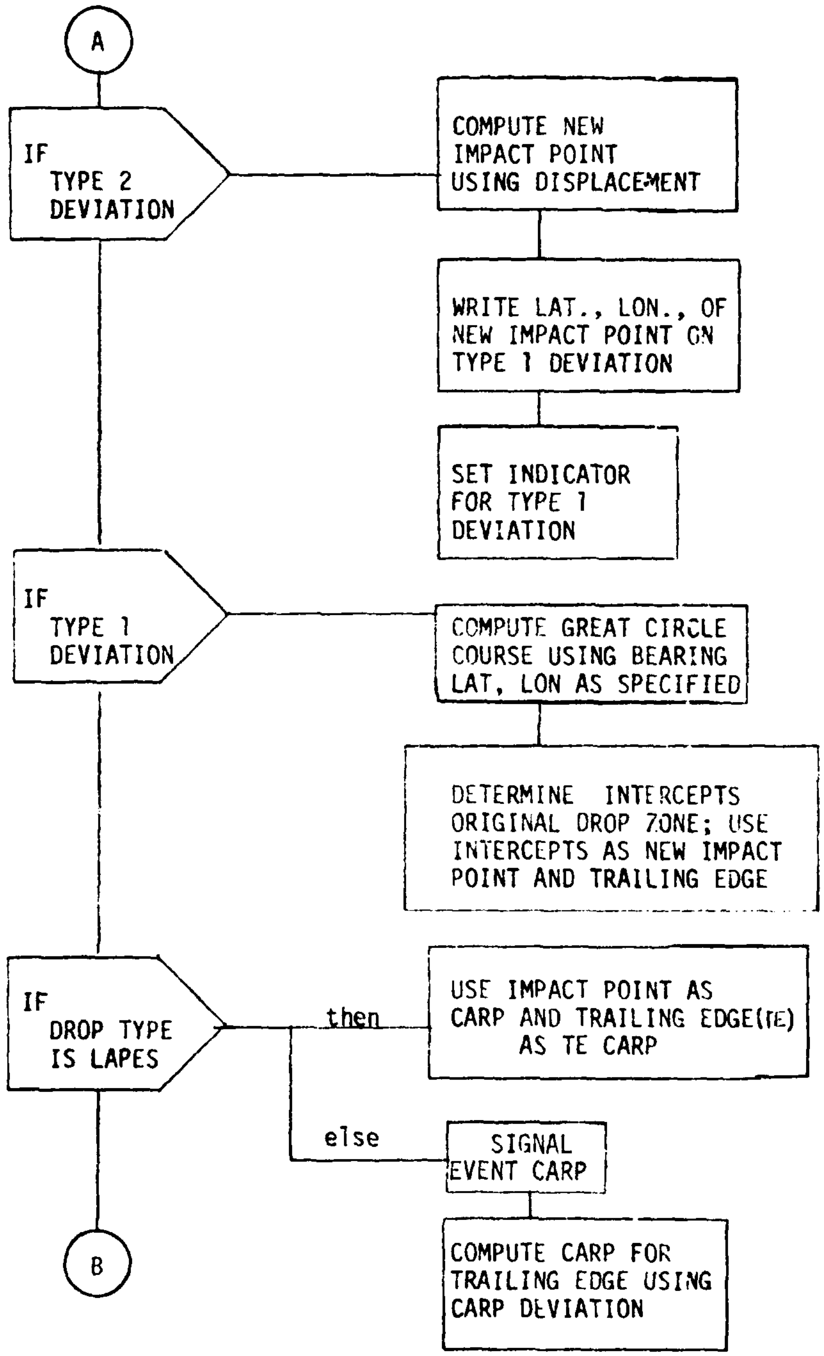


Figure 47 (Cont.) Cargo Release Path SPEC

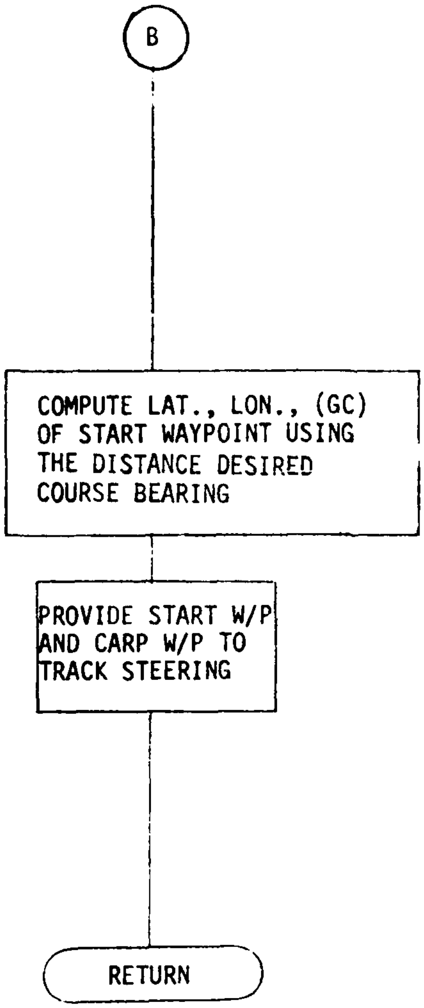


Figure 47 (Cont.) Cargo Release Path SPEC

A new impact point and trailing edge shall be determined by computing the intercepts of the new course, implicitly defined by the specified deviations, with the drop zone. If the type of drop is a LAPES, the CARP shall be the impact point. If the drop is a normal drop, the CARP SPEC (3.2.6.2) shall be signalled to determine the CARP and the displacement from CARP to impact point. A CARP for the trailing edge shall be computed by adding the displacement to the trailing edge. A course shall be defined by the CARP and the trailing edge CARP. The starting waypoint for the cargo release course is an arbitrary distance before the impact point on the course. This distance shall be selected at a distance from the CARP equal to the current range distance of the aircraft. The two waypoints provided to the Waypoint Steering SPEC (3.2.6.   ) shall be the starting waypoint and the CARP.

3.2.6.3.3 Outputs

The outputs from the CARGO Release Path shall be as specified in Table XCVI .

3.2.6.4 Function 6.4 - Drop Zone Warning SPEC

The Drop Zone Warning SPEC provides warning signals and lights to the PD and HUD. These warnings are provided during a cargo delivery before CARP and during the actual dropping. This SPEC is scheduled synchronously by the Cargo Delivery Controller SPEC (3.2.6.1). The computer requirements for this module are:

Memory size	104	16 bit words
Throughput	2.4	ms/sec
Update rate	4	times/sec

TABLE XCVI OUTPUTS FROM CARGO RELEASE PATH SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Current and Previous W/P		SPEC: WAYPOINT STEERING	3.2.5.13
2. Trailing edge Lat., Long. alt.		SPEC: Drop Zone Warning	3.2.6.4

3.2.6.4.1 Inputs

The inputs to the Drop Zone Warning SPEC shall be as specified in Table SCVII .

3.2.6.4.2 Processing

The Drop Zone Warning SPEC shall perform the processing as described in Figure 48 . A timeline shall be provided by the Drop Zone Warning SPEC which it checks against to provide warning messages to the pilot. The timeline shall consist of the following check points.

a. 20 minutes
b. 10 minutes
c. 6 minutes
d. 1 minute
e. 30 seconds
f. 10 seconds
g. CARP time
h. End of Drop time

Before arrival of the CARP, this SPEC shall first check to see if the CARP has been intercepted. The variable T_{go} shall represent the estimated time before CARP. After CARP, T_{go} shall represent the estimated time before the end of the drop. If the current time is before CARP, the time shall be checked and at the appropriate times messages shall be sent to the MPD. The pilot will transmit the messages to the loadmaster (LM) either over the public address or intercome systems. As each timeline point is noted, a flag shall be set to indicate that the message has been set. The flag is set to prohibit the continual transmission of the messages. At the 6 minute point a red light shall be turned on for the pilot. The pilot turns the red light on in the cargo bay after receiving the notification. At the 1 minute point,

TABLE XCVII INPUTS TO DROP ZONE WARNINGS SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. CARP		SPEC: CARP	3.2.6.2
2. Terminal Edge Coordinates		SPEC: Cargo Release Path	3.2.6.3
3. T.E. CARP		SPEC: CARP	3.2.6.2

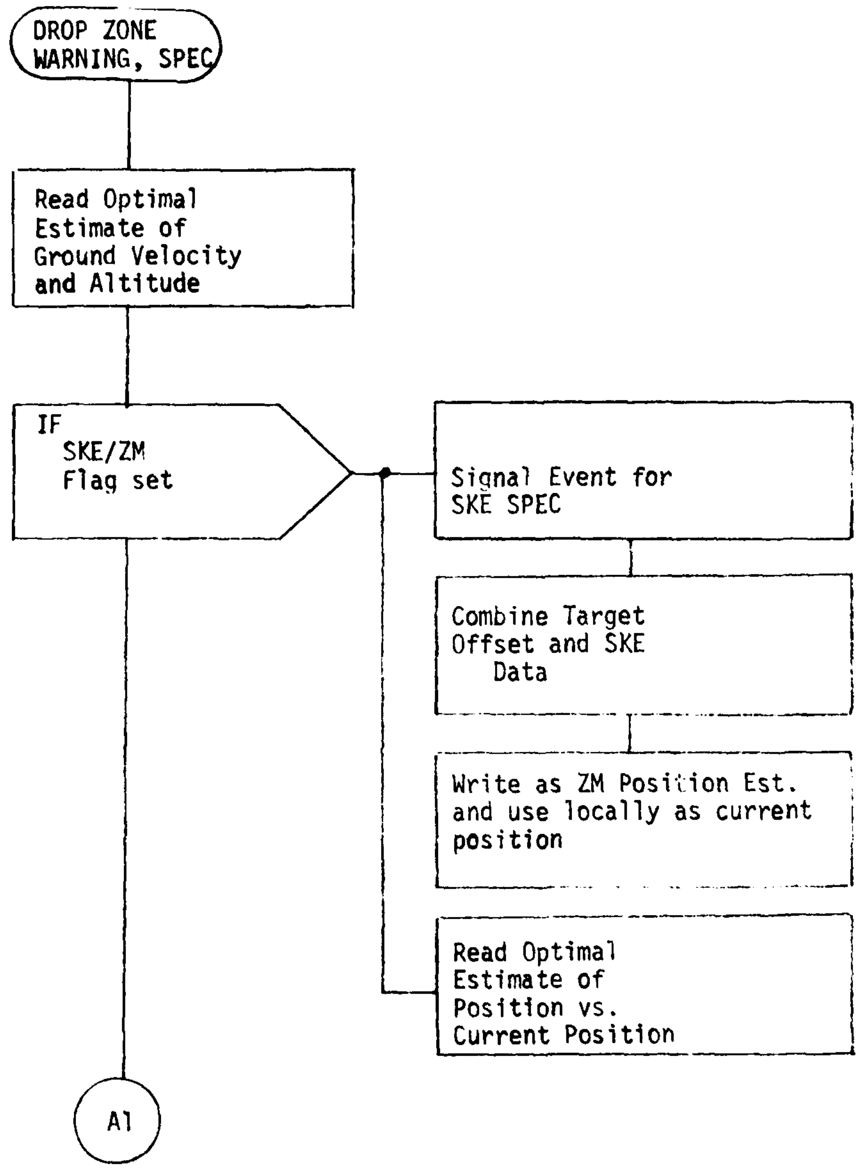


Figure 48 Drop Zone Warning SPEC Processing

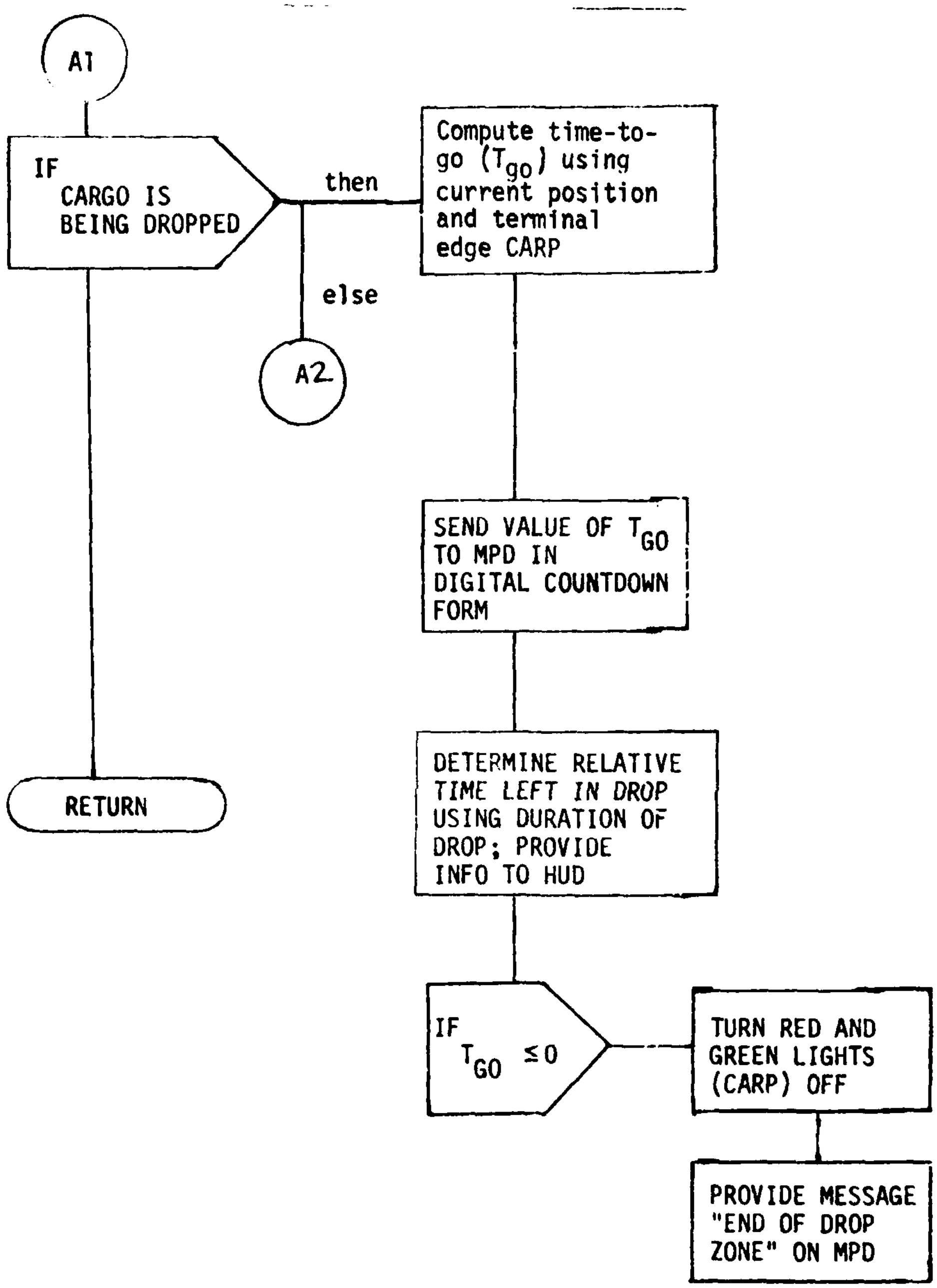


Figure 48 (Cont.) DROP ZONE WARNING SPEC PROCESSING

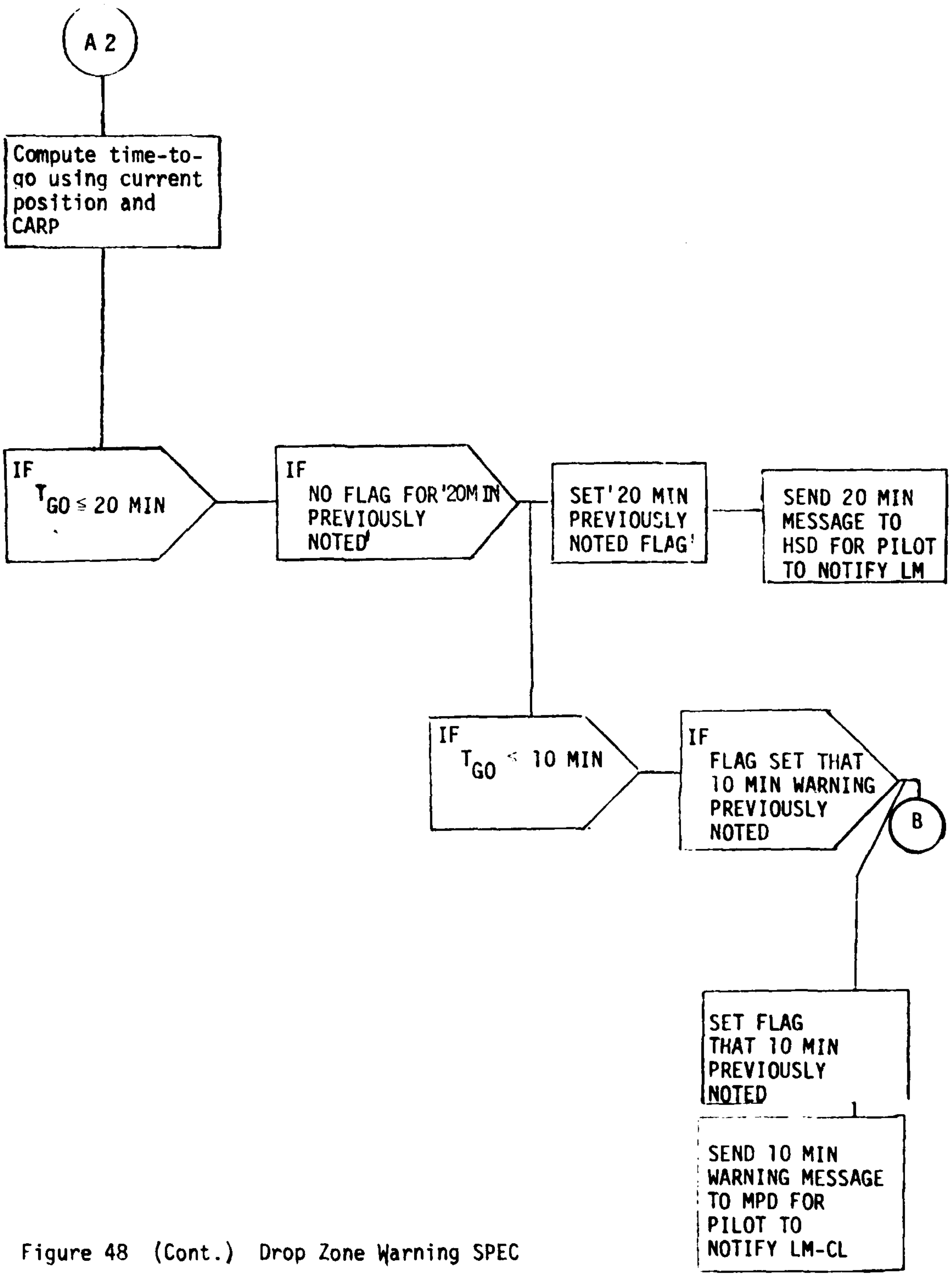


Figure 48 (Cont.) Drop Zone Warning SPEC

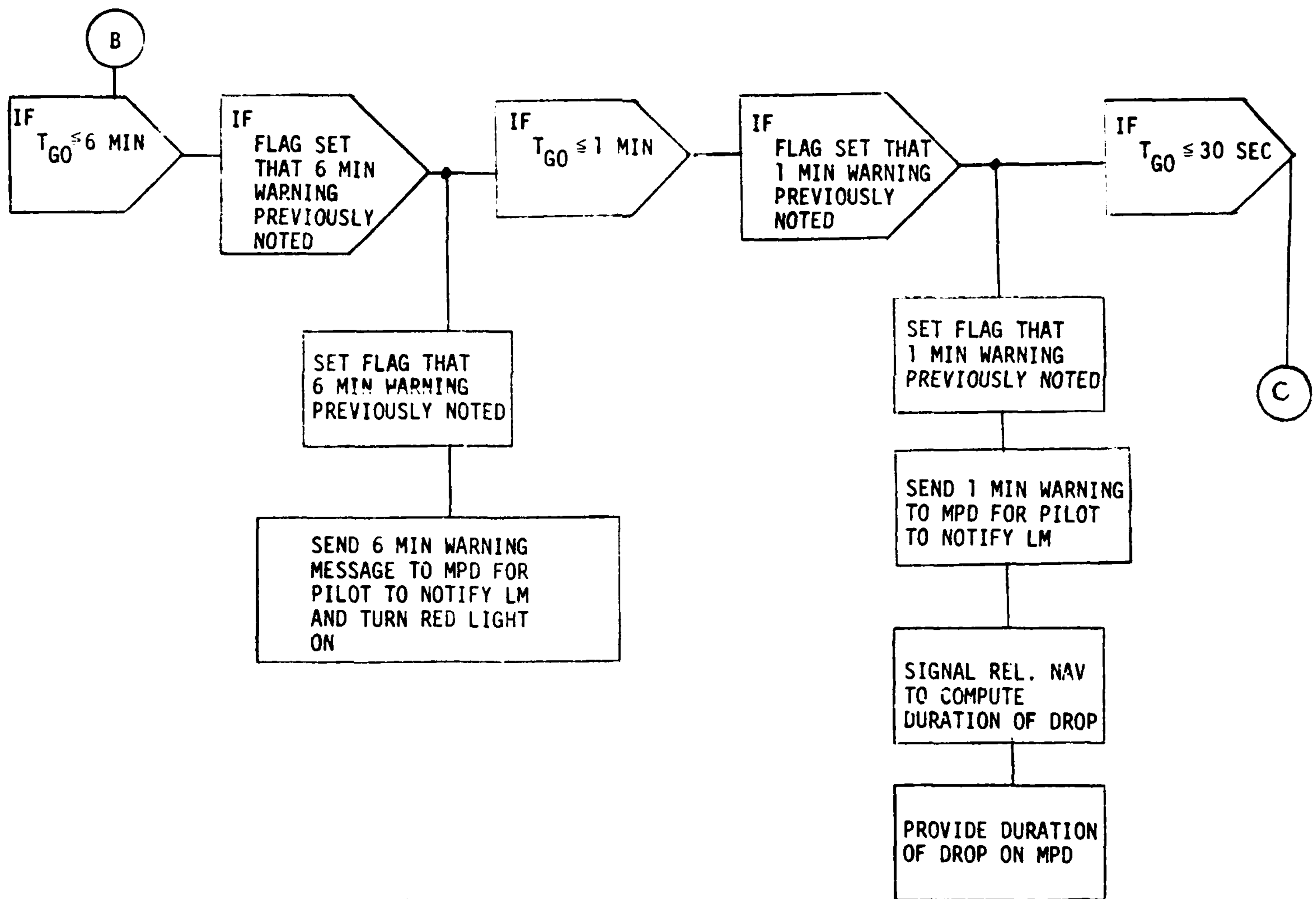


Figure 48 (Cont.) Drop Zone Warning SPEC

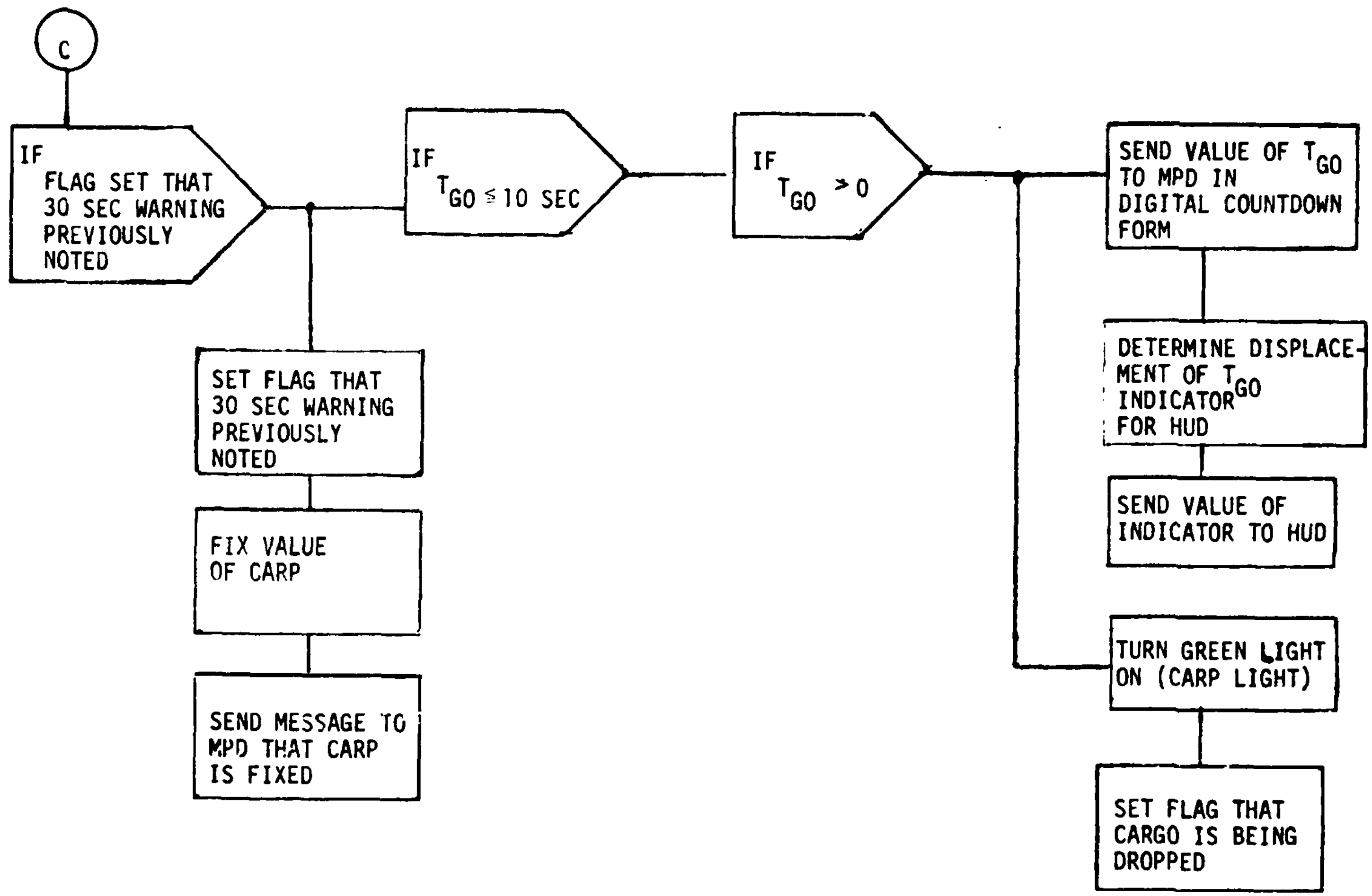


Figure 48 (Cont.) Drop Zone Warning SPEC

C

the duration of the drop shall be computed using the current values of the ground speed, the CARP, and the trailing edge CARP. When the 30 second point is attained, the CARP shall be fixed at its current value. At the 10 second point a T_{go} scale display shall be provided to the HUD, to visually indicate the time remaining before CARP and a T_{go} digital countdown display shall be provided to the MPD. These displays shall be continually updated during the last 10 second before CARP. When CARP is reached, a green light shall be turned on. During the drop a digital countdown shall be sent to the MPD and a T_{go} scale display shall be sent to the HUD. When the terminal edge CARP is attained, the red and green lights shall be turned off, and a message shall be sent to the MPD indicating the end of the drop.

3.2.6.4.3 Outputs

The outputs shall be as specified in Table XCVIII .

3.2.7 Communications

The Communications group consists of interface modules designed to provide the software interface between the modified communications control devices, via the Remote Terminals, and the IDAMST Processors. These interface modules, called EQUIPs, enable the operator to exercise control, i.e. ON/OFF, Frequency Selection, Mode Selection, etc. of the communications equipment by means of the IDAMST controls such as the IMK, DEK and the SCP. There is provided an EQUIP module for each separate type of communication equipment. Additionally, where applicable, the EQUIP modules process BITE data from the communications equipment.

TABLE XCVIII OUTPUTS FROM DROP ZONE WARNING SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Terminal Edge Coordinates		SPEC: CARP	
2. Time Warnings to a. 20 minute b. 10 minute c. 6 minute d. 1 minute e. 10 second countdown		DISP: MPD	
3. 10 Seconds countdown to HUD		DISP: HUD	TBD
4. ZM Position		SPEC: Waypoint Steering	3.2.5.12
5. Duration of Drop		DISP: MPD	

3.2.7.1 Public Address EQUIP (PA-E)

This program module processes the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the Public Address System, AN/AIC-13. The computer requirements for this module are:

Memory size	68	16 bit words
Throughput	3124	ms/sec
Update rate	4	times/sec

3.2.7.1.1 Inputs

The inputs to this program module shall be as specified in Table XCIX .

3.2.7.1.2 Processing

This program shall convert the inputs to an appropriate format to properly energize and control the operation of the Public Address System.

This program module is a privileged task and shall be executed synchronously 4 times per second.

The processing shall be performed as specified in Figure 49 .

3.2.7.1.3 Outputs

The outputs from this program module shall be as specified in Table C .

3.2.7.2 HF Transceiver EQUIP (HF-E)

This program module processes the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the HF Transceiver, AN/ARC-123. The computer

TABLE XCIX INPUTS - PUBLIC ADDRESS EQUIP

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
SPEAKER SELECT (2 BITS)		8	01	DEK EQUIP	
ANNOUNCE CONTROL		8	01	DEK EQUIP	
VOLUME CONTROL		8	01	SCP EQUIP	
POWER CONTROL		8	01	IMK EQUIP	
AUDIO MIX (5 BITS)		8	01	DEK EQUIP	

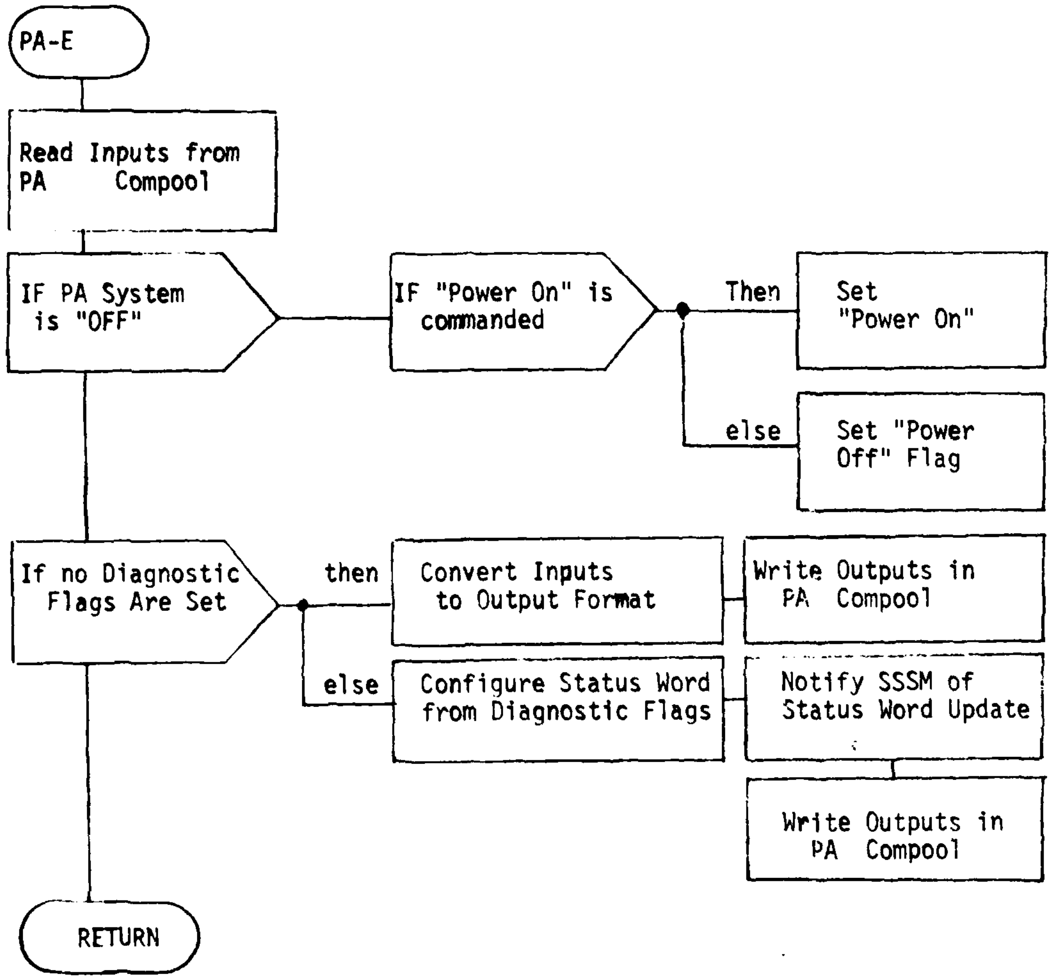


Figure 45 Public Address EQUIP

TABLE C OUTPUTS - PUBLIC ADDRESS EQUIP

DATA NAME	SYMBOL	UPS	TYPE	DESTINATION	REFERENCE
SPEAKER SELECT (2 BITS)		8	01	PA SYSTEM	
ANNOUNCE CONTROL		8	01	PA SYSTEM	
VOLUME CONTROL		8	01	PA SYSTEM	
POWER CONTROL		8	01	PA SYSTEM	
AUDIO MIX (5 BITS)		8	01	PA SYSTEM	
STATUS WORD		8	01	SSSM	

requirements for this module are:

Memory size	64	16 bit words
Throughput	6248	ms/sec
Update rate	8	times/sec

This program shall convert the inputs to an appropriate format to properly energize and control the operation of the HF Transceiver.

This program module is a privileged task and shall be executed synchronously 8 times per second. The HF Transceiver EQUIP processing is shown in Figure 50.

3.2.7.3 VHF-AM Transceiver EQUIP (VHFAM-E)

This program module processes the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the VHF-AM Transmitter-Receiver, AN/ARC-115. The computer requirements for this module are:

Memory size	29	16 bit words
Throughput	2504	ms/sec
Update rate	8	times/sec

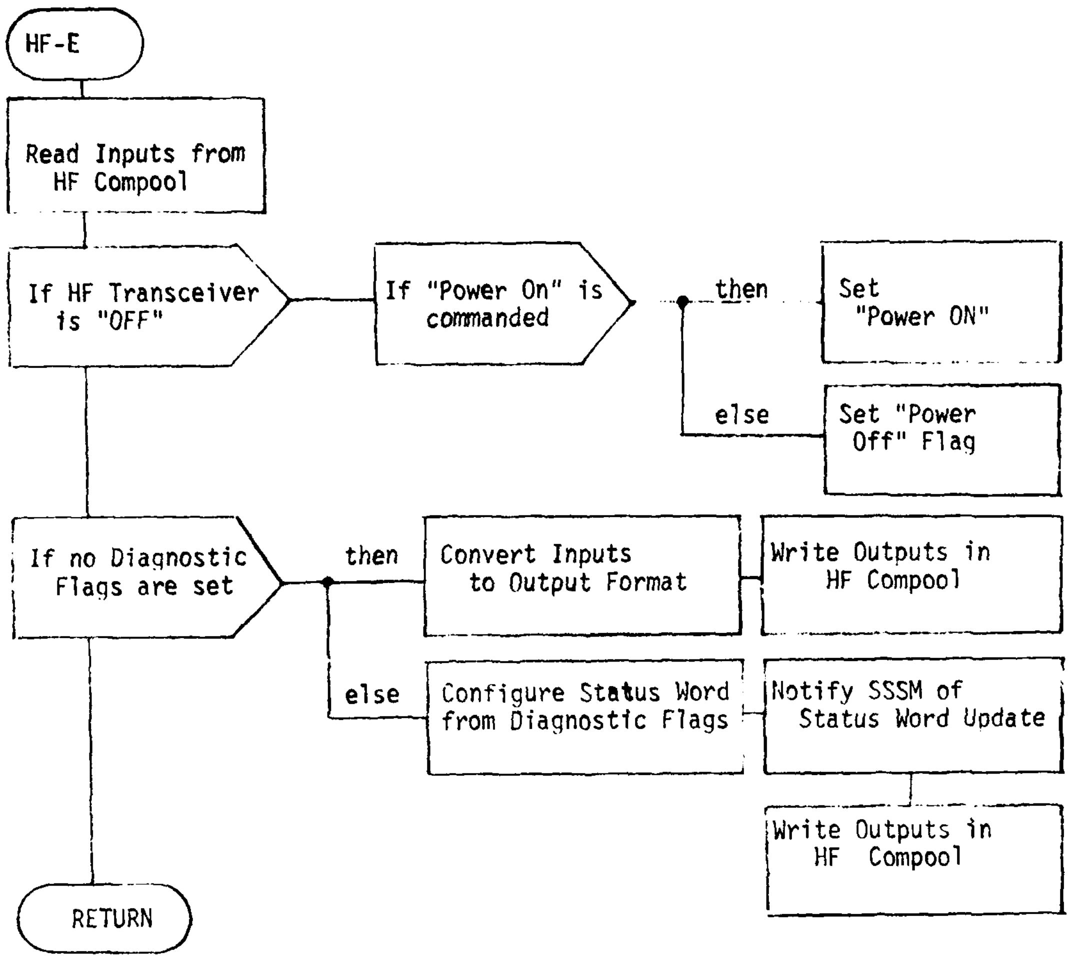


Figure 50 HF Transceiver EQUIP

3.2.7.3.1 Inputs

The inputs to this program module are listed in Table CI .

3.2.7.3.2 Processing

This program shall convert the inputs to an appropriate format for output to properly energize and control the operation of the VHF-AM Transceiver.

The processing shall be performed as specified in Figure 51 .

This program module is a privileged task and shall be executed synchronously 8 times per second.

3.2.7.3.3 Outputs

The outputs from this program module are listed in Table CII .

3.2.7.4 VHF/FM Transceiver EQUIP (VHFFM-E)

This program module processes the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the VHF/FM Transceiver, FM-622A. The computer requirements for this module are:

Memory size	55	16 bit words
Throughput	5000	ms/sec
Update rate	8	times/sec

3.2.7.4.1 Inputs

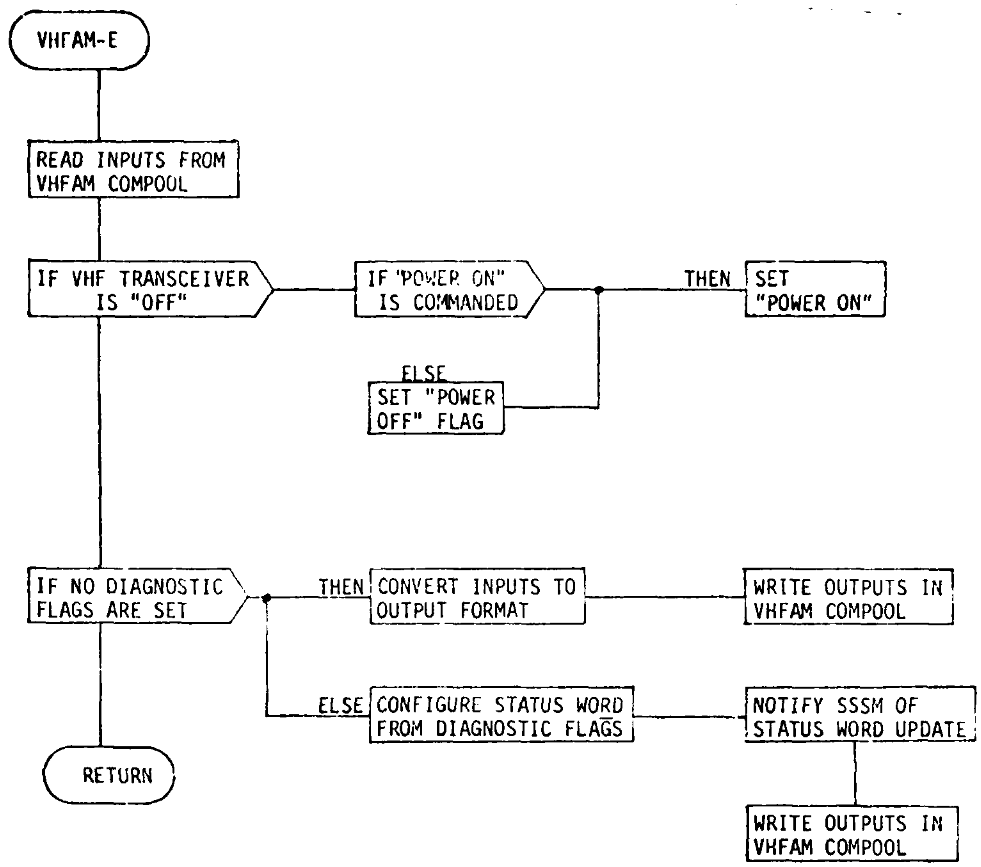
The inputs to this program module shall be as specified in Table TBD .

3.2.7.4.2 Processing

This program shall convert the inputs to an appropriate format to properly energize and control the operation of the VHF/FM Transceiver.

TABLE CI INPUTS - VHF-AM TRANSCEIVER EQUIP AN/ARC-115 (VHFAM-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
FREQUENCY SELECT (12 BITS)		8	01	DEK EQUIP	
AUDIO GAIN CONTROL		8	05	ACP EQUIP	
MODE SWITCH (3 BITS)		8	01	DEK EQUIP	
SQUELCH CONTROL		8	05	ACP EQUIP	



SUMMARY OF DIAGNOSTIC FLAGS

- "VHF-AM TRANSCEIVER POWER OFF"

Figure 51 VHF-AM TRANSCEIVER EQUIP

TABLE CII OUTPUTS - VHF-AM TRANSCEIVER EQUIP (VHFAM-E)
AN/ARC-115

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
FREQUENCY SELECT (12 BITS)		8		VHF CONTROL UNIT	
AUDIO GAIN CONTROL (1 BIT)		8		VHF CONTROL UNIT	
MODE SWITCH (3 BITS)		8		VHF CONTROL UNIT	
SQUELCH CONTROL (1 BIT)		8		VHF CONTROL UNIT	
STATUS WORD		8	TBD	SSSM	

This program module is a privileged task and shall be executed synchronously 8 times per second.

The processing shall be performed as specified in Figure 52.

3.2.7.4.3 Outputs

The outputs to this program module shall be as specified in Table TBD .

3.2.7.5 Intercommunication Set EQUIP (IC-E)

This program module processes the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the Intercommunication Set, AN/AIC-18. The computer requirements for this module are:

Memory size	66	16 bit words
Throughput	6248	ms/sec
Update rate	8	times/sec

3.2.7.5.1 Inputs

The inputs to this program module shall be as specified in Table TBD .

3.2.7.5.2 Processing

This program shall convert the inputs to an appropriate format to properly energize and control the operation of the Intercommunication Set.

This program module is a privileged task and shall be executed synchronously 8 times per second.

The processing shall be performed as specified in Figure 53 .

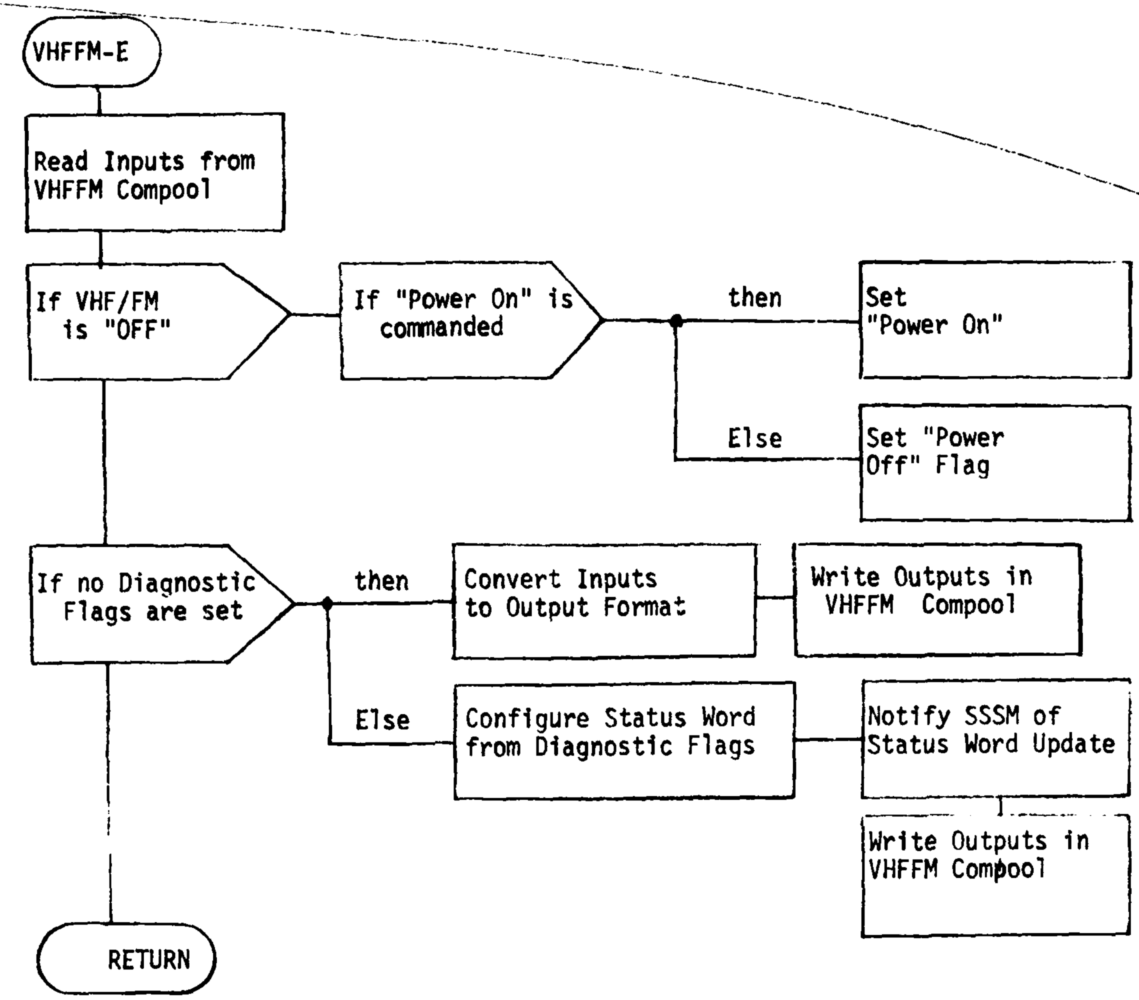


Figure 52 VHF/FM Transceiver EQUIP

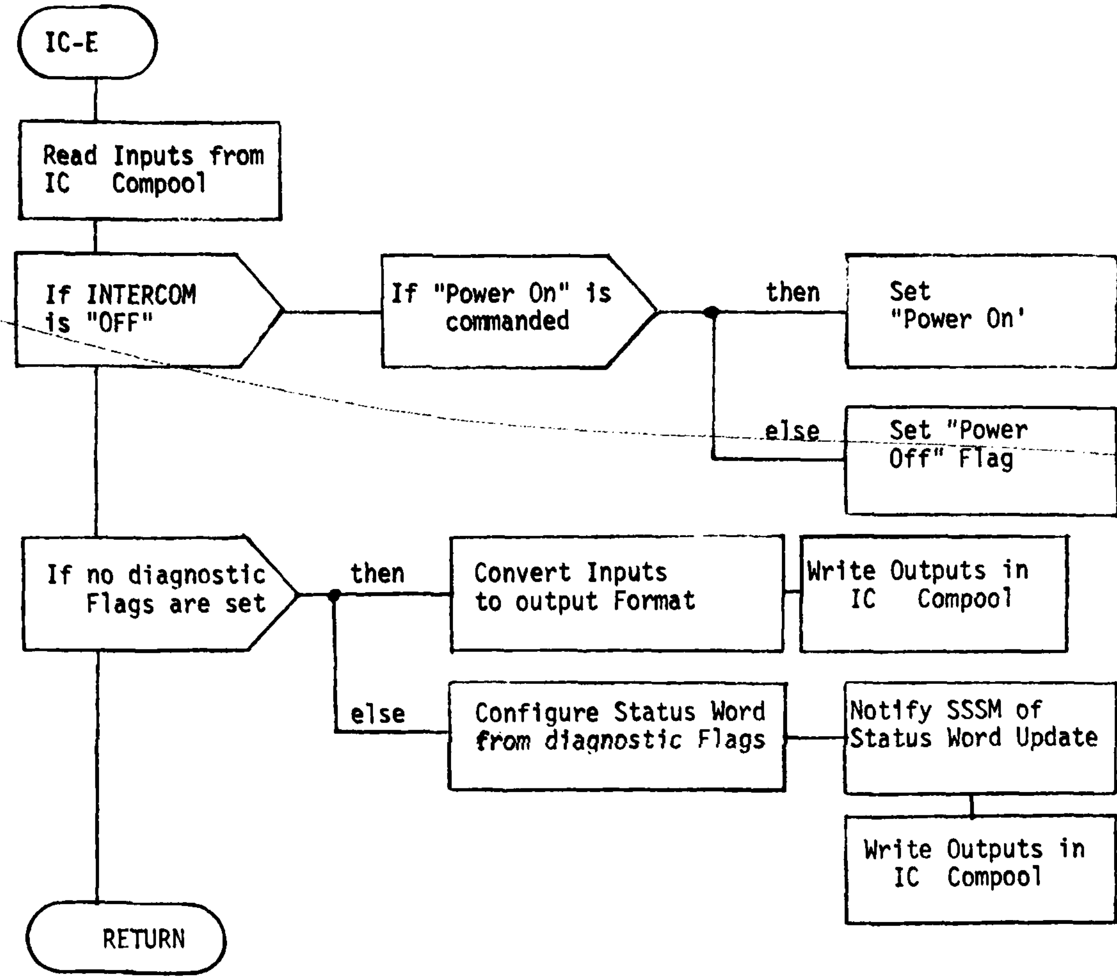


Figure 53 Intercom EQUIP

3.2.7.5.3 Outputs

The outputs from this program module shall be as specified in Table TBD .

3.2.7.6 Speech Security Set EQUIP (SV-E)

This program module processes the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the Speech Security Set, TSEC/KY-58. The computer requirements for this module are:

Memory size	66	16 bit words
Throughput	3124	ms/sec
Update rate	4	times/sec

3.2.7.6.1 Inputs

The inputs to this program module shall be as specified in Table TBD .

3.2.7.6.2 Processing

This program shall convert the inputs to an appropriate format to properly energize and control the operation of the Speech Security Set.

This program is a privileged task and shall be executed synchronously 4 times per second.

The processing shall be performed as specified in Figure 54 .

3.2.7.6.3 Outputs

The outputs from this program module shall be as specified in Table TBD .

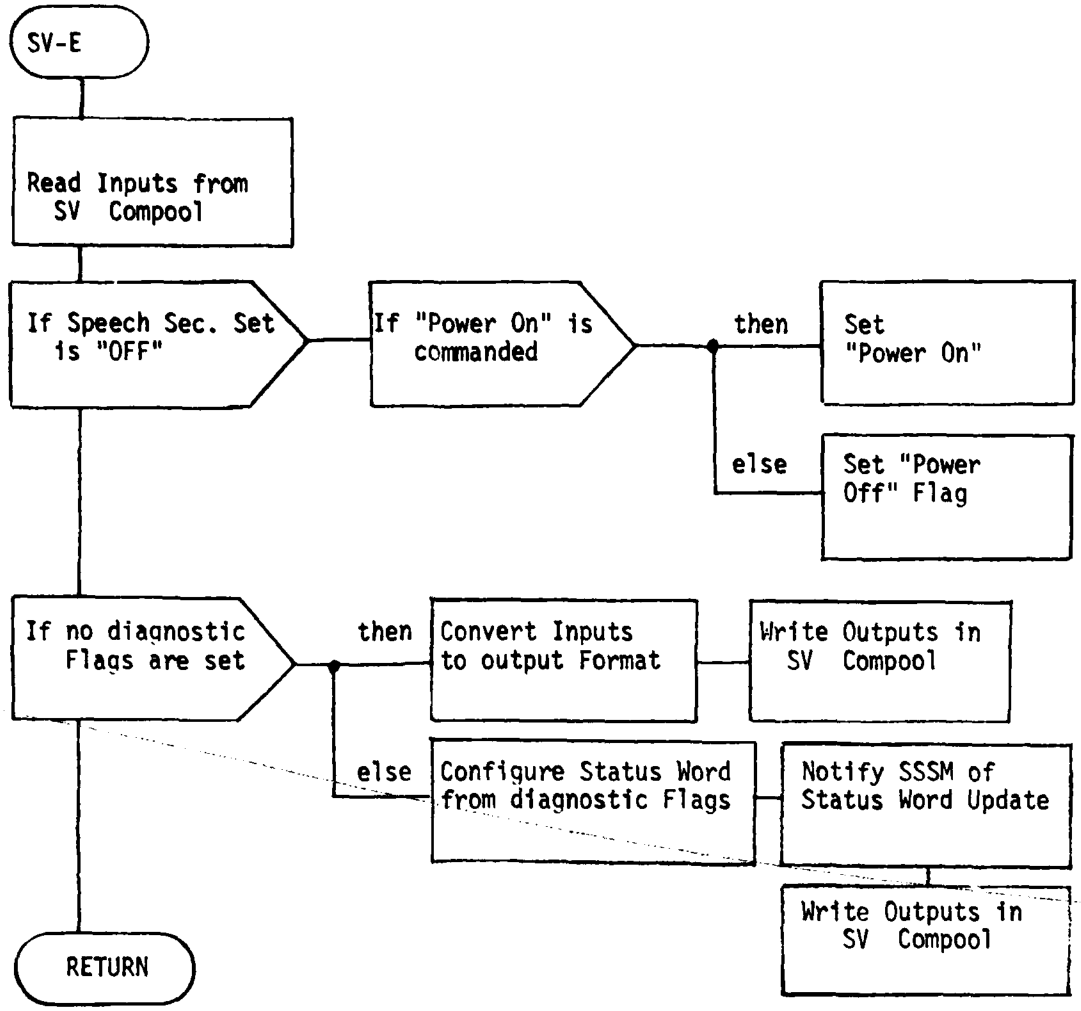


Figure 54 Speech Security Set EQUIP

3.2.7.7 UHF Transceiver EQUIP (UHF-E)

This program module processes the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the UHF Transceiver, AN/ARC-164. The computer requirements for this module are:

Memory size	83	16 bit words
Throughput	7496	ms/sec
Update rate	8	times/sec

3.2.7.7.1 Inputs

The inputs to this program module shall be as specified in Table TBD .

3.2 7.7.2 Processing

This program shall convert the inputs to an appropriate format to properly energize and control the operation of the UHF Transceiver.

This program is a privileged task and shall be executed synchronously 8 times per second.

The processing shall be performed as specified in Figure 55 .

3.2.7.7.3 Outputs

The outputs from this program module shall be as specified in Table TBD .

3.2.8 Target Acquisition

The Target Acquisition Group of software modules consist of those functions necessary to determining the position of aircraft relative to some specified position (target). Great circle computations are used to compute

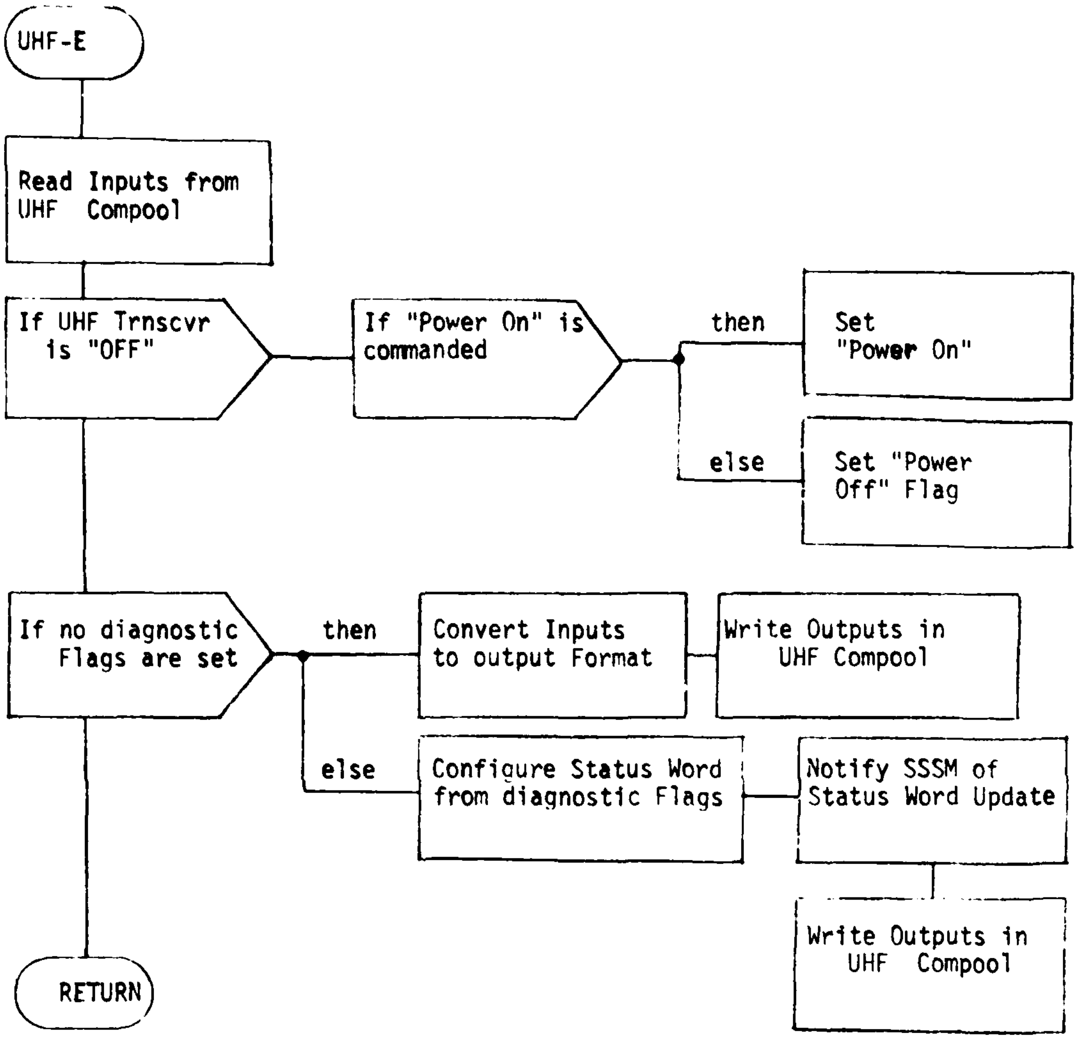


Figure 55 UHF Transceiver EQUIP

relative distance. The SKE/ZM, the HUD and the multi-mode radar can be used to provide fixes.

3.2.8.1 Function 8.1 - Relative Coordinates SPEC

The Relative Coordinates SPEC provides the difference in latitude, longitude, and attitude between two selected positions. Also, the time of travel between the two positions is computed. The Relative Coordinates SPEC is scheduled asychronously by the Cargo Delivery Controller (3.2.6.1). The computer requirements for this module are:

Memory size	62	16 bit words
Throughput	2.5	ms/sec
Update rate	4	times/sec

3.2.8.1.1 Inputs

The inputs in the Relative Coordinates SPEC shall be as specified in Table CIII .

3.2.8.1.2 Processing

The processing for the Relative Coordinates SPFC shall be performed as described in Figure 56 . The destination position shall be read in. Flags for the determining the start position and estimated velocity shall be interrogated. The default value shall be the current position and velocity. If other values are needed for the start point, they shall be read in to the local copy. The arc length distance between the two positions shall be computed. Assuming zero heading error, the ground speed of the aircraft shall be determined. This speed shall be used to compute the time of travel between the selected positions. Also, the difference in altitude, the difference in longitude, and the difference in latitude shall be computed between the two positions.

TABLE CIII Inputs to Relative Co-ordinates SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Destination Position		SPEC: CARP	3.2.6.2
2. Velocity Selection Flag		SPEC: Drop Zone Warning	3.2.6.4
3. Position Selection Flag		SPEC: Drop Zone Warning	3.2.6.4
4. Operator Provided Position and Velocity			
5. Current Position		SPEC: Nav Filter	3.2.4.7
6. Current Velocity		SPEC: Nav Filter	3.2.4.7
7. Earth Radius		Initialization Data	
8. Ellipticity		Initialization Data	

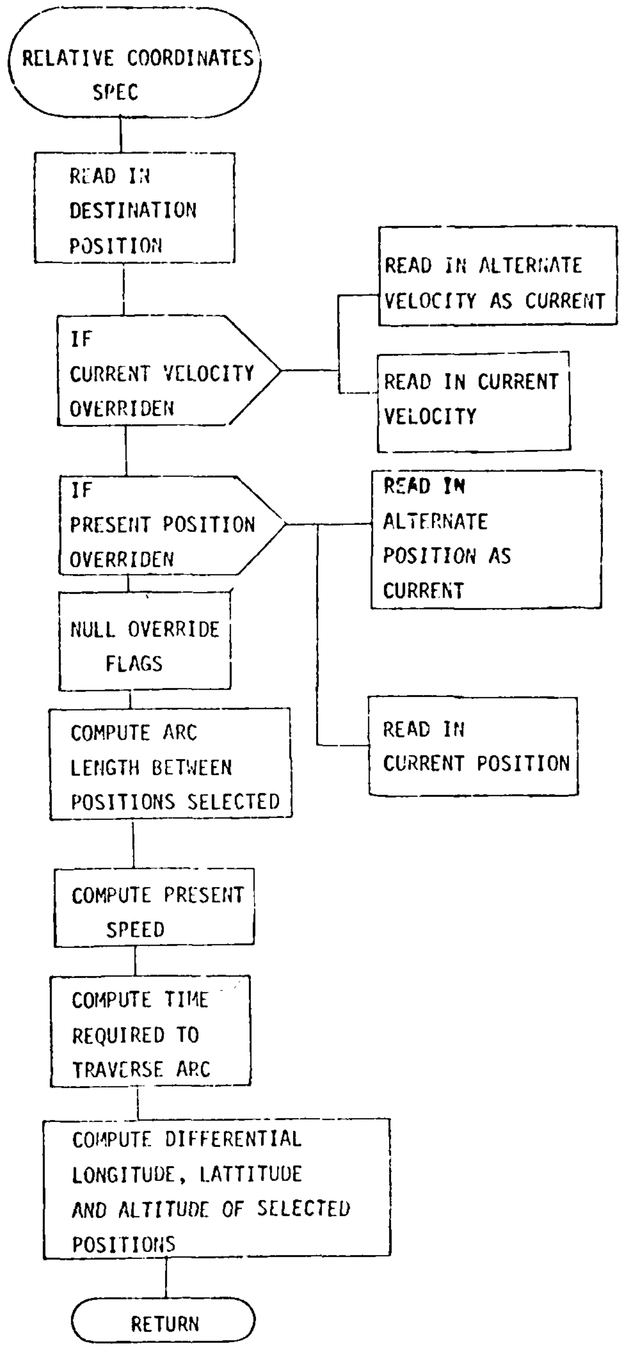


Figure 56 Relative Co-ordinates SPEC Processing

3.2.8.1.3 Outputs

The outputs from the Relative Coordinates SPEC shall be as specified in Table CIV .

3.2.8.2 Function 8.2 - Target Offset Computations SPEC

The Target Offset Computations SPEC determines the difference in longitude and latitude between a target and an indicator such as a SKE zone number system. The Target Offset SPEC is signalled by the Guidance/Autopilot Controller (3.2.5.11). The computer requirements for this module are:

Memory size	44	16 bit words
Throughput	0	ms/sec
Update rate	0	times/sec

3.2.8.2.1 Inputs

The inputs to the Target Offset SPEC shall be as specified in Table CV .

3.2.8.2.2 Processing

The Target Offset SPEC shall perform the processing described in Figure 57 . A flag shall be provided by the Air Drop OPS to indicate the form of the target offset data. The flag shall be interrogated by the Target Offset SPEC to determine the computations required. The Target Offset SPEC shall always provide the difference in position between the indicator and target in latitude and longitude. If the range difference and azimuth of the indicator relative to the target are given, the Target Offset SPEC shall convert these to Cartesian coordinates and shall set the coordinate indicator flag for cartesian coordinates. The Target Offset SPEC shall be scheduled asynchronously by the Guidance/Autopilot Controller (3.2.5.11).

Table CIV Outputs From Relative Coordinates SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Differential Altitude		TBD	
2. Differential Longitude		TBD	
3. Differential Latitude		TBD	
4. Travel Time		OPS: TBD	

Table CV Inputs to Target Offset Computations SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. OFFSET OF INDICATOR (Difference in Lat & Long)		OPS: IMK input, Air Drop	3.2.2.5
2. Target Location - Lat. Long.			
3. Indicator - Lat. Long.		OPS: IMK input Air Drop	
4. Flag for Indication of Type of Data		SPEC: Guidance/Autopilot Controller	3.2.5.11
5. Cartesian Offset		OPS: IMK input, Air Drop	3.2.2.5
6. Range, Azimuth of Indicator		OPS: IMK input, Air Drop	3.2.2.5
7. Equatorial Earth Radius		- - - - - - - -	

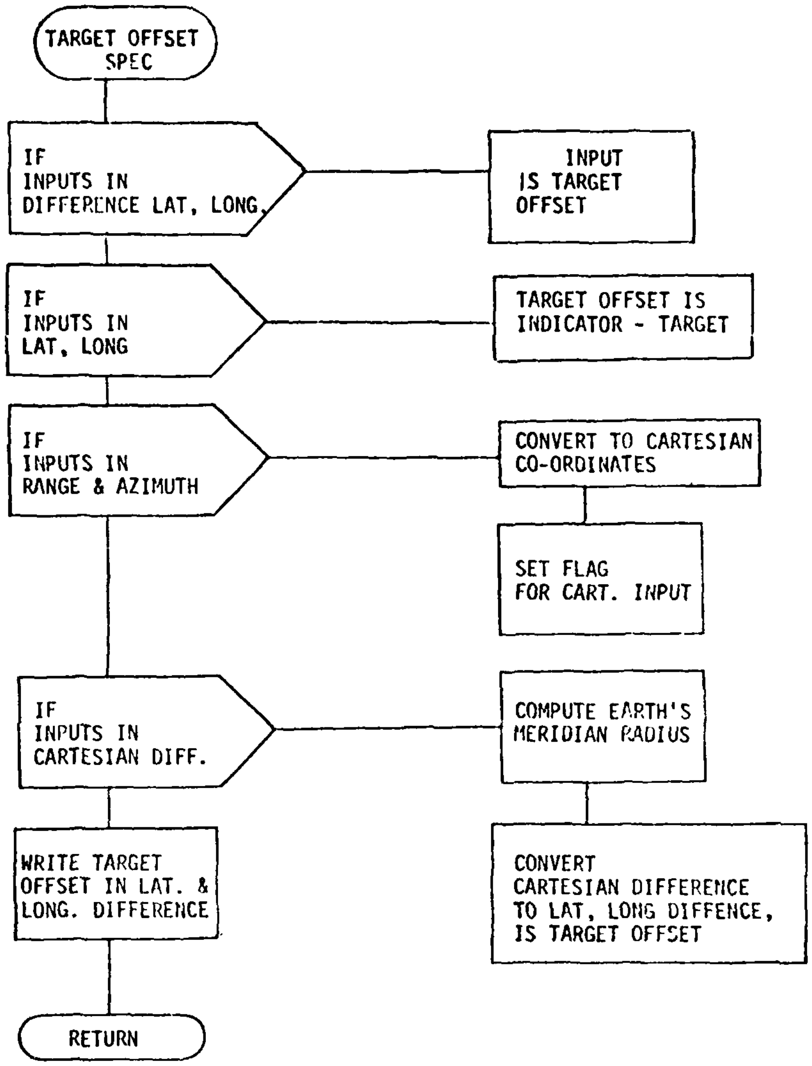


Figure 57 Target Offset Computations SPEC Processing

3.2.8.2.3 Outputs

The outputs from the Target Offset SPEC shall be as specified in Table CVI .

3.2.8.3 Function 8.15 - Station Keeping Equipment (SKE) SPEC

The SKE Computations SPEC uses the range and bearing data (from the zone marker (ZM)) to provide information to the Steering Computational SPEC (3.2.5.14) and the Relative Coordinates SPEC (3.2.8.1). The computer requirements for this module are:

Memory size	29	16 bit words
Throughput	0.6	ms/sec
Update rate	4	times/sec

3.2.8.3.1 Inputs

The inputs to the SKE SPEC shall be as specified in Table CVII .

3.2.8.3.2 Processing

The processing shall be performed as shown in Figure 58 . The relative range and bearing to the ZM shall be converted into the difference in longitude and latitude between the ZM and the aircraft. The SKE computations SPEC shall be scheduled synchronously by the Cargo Delivery Controller (3.2.6.1).

3.2.8.3.3 Outputs

The outputs from the SKE SPEC shall be as specified in Table CVIII .

Table CVI OUTPUTS FROM TARGET OFFSET COMPUTATION SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Target Offset in Lat. Long Difference from Target to Indicator.		SPECS: Steering Computations Relative Co-ordinates	3.2.5.14 3.2.8.1

Table CVII INPUTS TO SKE COMPUTATIONS SPEC

DATA NAME	SYMBOL	SOURCE	REFERENCE
1. Range/ZM		EQUIP: SKE	3.2.5.7
2. Relative Bearing/ZM		EQUIP: SKE	3.2.5.7
3. Baro. Altitude		Air Data	- - -
4. Mag. Bearing of A/C		EQUIP: AHRS	3.2.4.4
5. Mag. Variation Table		Compool Data	
6. Lat, Long. of Aircraft		SPEC: Nav. Filter	3.2.4.7
7. Earth Radius		Compool Data	

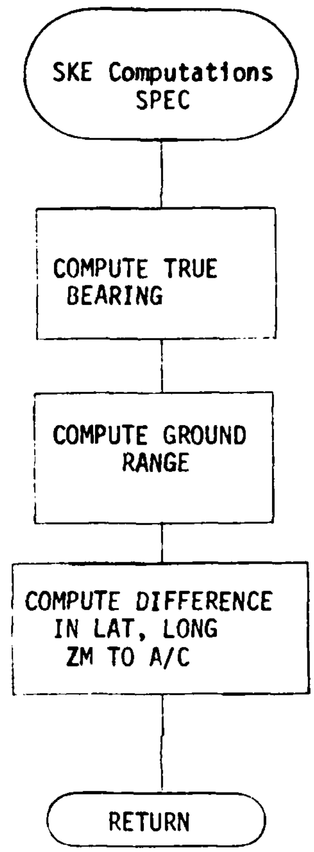


Figure 58 SKE COMPUTATIONS PROCESSING

Table CVIII OUTPUTS FROM SKE COMPUTATIONS SPEC

DATA NAME	SYMBOL	DESTINATION	REFERENCE
1. Latitude and Longitude Difference between Aircraft and ZM.		SPECS: Relative Co-ordinates Steering Computations	3.2.8.1 3.2.5.14

3.2.8.4 Function 8.4 - HUD Visual Update SPEC

The HUD Visual Update SPEC computes the current position through measurements from the HUD. The depression angle is determined by measuring the displacement of the aiming reticle from the aircraft symbol and depends on the aircraft attitude. The relative position of the aircraft and visual target is then determined by use of the altitude. The target offset can be used to determine the location of the visual target if needed. This SPEC is scheduled asynchronously and event-signalled by the Navigation BF SPEC (3.2.3.2), the Cargo BF SPEC (3.2.3.3), or the Air Drop OPS (3.2.2.5) Computer requirements for the module are:

Memory Size	39	16 Bit Words
Throughput	0	MS/Sec
Update Rate	0	Times/Sec

3.2.8.5 Function 8.5 - Radar Fixtaking SPEC

The Radar Fixtaking SPEC computes the current position of the aircraft based on measurements from the multi-mode radar. The Multi-mode Radar EQUIP (3.2.5.3) and the Hand Control Unit EQUIP (3.2.5.9) provide relative bearing and slant range. The true bearing is determined after noting the setting of the azimuth stabilization switch. The true bearing computation depends on the aircraft heading, magnetic variation, and wind velocity. If the radar target position is specified relative to another know position, the actual position of the radar target can be determined by event-signalling the Relative Co-ordinates SPEC (3.2.8.1). The slant range is converted to ground range by this module and depends on the barametric altitude. The relative position of the aircraft with respect to the radar target is then determined from the ground range and true bearing. The Radar Fixtaking SPEC is scheduled asynchronously and event-signalled by the Navigation BF SPEC (3.2.3.2), the Cargo BF SPEC (3.2.3.3.), or the Air Drop OPS (3.2.2.5). Computer Requirements for this module are:

Memory Size	39	16 Bit Words
Throughput	0	MS/Sec
Update Rate	0	Times/Sec

3.2.9 Airframe Monitor

The Airframe Monitor Group of software modules include those functions necessary to communicate with the air data system, the engine sensors, and the automatic flight control system. Also, the center of gravity is computed based on operator inputs. This group uses information from the airframe monitors and engine sensors to provide warnings to the pilot. Also, the steering commands from the IDAMST software pass through this group.

3.2.9.1 Engine Sensor EQUIP (ESD-E)

This program module processes the engine sensor data by converting them to an appropriate format for output to the IDAMST Displays. The computer requirements for this module are:

Memory size	146	16 bit words
Throughput	12488	ms/sec.
Update rate	8	times/sec

3.2.9.1.1 Inputs

The inputs to this program module shall be as specified in Table TBD .

3.2.9.1.2 Processing

This program shall convert the inputs to an appropriate scale factor and format to be displayed on the appropriate IDAMST Display.

This program is a privileged task and shall be executed synchronously 8 times per second.

The processing shall be performed as specified in Figure TBD .

3.2.9.1.3 Outputs

The outputs from this program module shall be as specified in Table TBD .

3.2.9.2 Air Frame Sensor EQUIP (AFS-E)

This program module processes the air frame and Air Data System data by converting them to an appropriate format for further computational use. The computer requirements for this module are:

Memory size	185	16 bit words
Throughput	17488	ms/sec
Update rate	8	times/sec

3.2.9.2.1 Inputs

The inputs to this program module shall be as specified in Table TBD .

3.2.9.2.2 Processing

This program shall convert the inputs to an appropriate scale factor and format for further use in the applicable SPECs.

This program is a privileged task and shall be executed synchronously 8 times per second.

The processing shall be performed as specified in Figure TBD .

3.2.9.2.3 Outputs

The outputs from this program moduel shall be as specified in Table TBD .

3.2.9.3 FCS EQUIP (FCS-E)

This program module processes the pitch and roll steering signals generated by the Flight Control System (FCS). Pitch and roll data are converted to an appropriate format for subsequent output to the IDAMST Displays. This module also outputs autopilot commands to the FCS. The computer requirements for this module are:

Memory size	261	16 bit words
Throughput	49952	ms/sec
Update rate	16	times/sec

3.2.9.3.1 Inputs

The inputs to this program module shall be as specified in Table TBD .

3.2.9.3.2 Processing

This program shall convert theinput values of pitch and roll from the FCS to a scale factor and format appropriate for subsequent output to the HUD ADI.

This program is a privileged task and shall be executed synchronously 16 times per second.

The processing shall be performed as specified in Figure 59 .

3. 2.9.3.3 Outputs

The outputs from this program module shall be as specified in Table TBD .

3.2.9.4 Function 9.4 - Airframe Computations SPEC

The Airframe Computations SPEC compares the values of the outputs of the various airframe sensors to known limits and issues warnings when the limits are exceeded. Also, the nominal values for many of the sensors will be continuously displayed. The airframe sensors that are monitored include those for the engines, electrical power, cargo, hatches, weight-on-gear, and flaps. The Airframe Computation SPEC is scheduled synchronously by each of the OPS (3.2.2.1-8) at a rate of once/second. Computer requirements for this module are:

Memory Size	150	16 Bit Words
Throughput	7.2	MS/Sec
Update Rate	1	Times/Sec

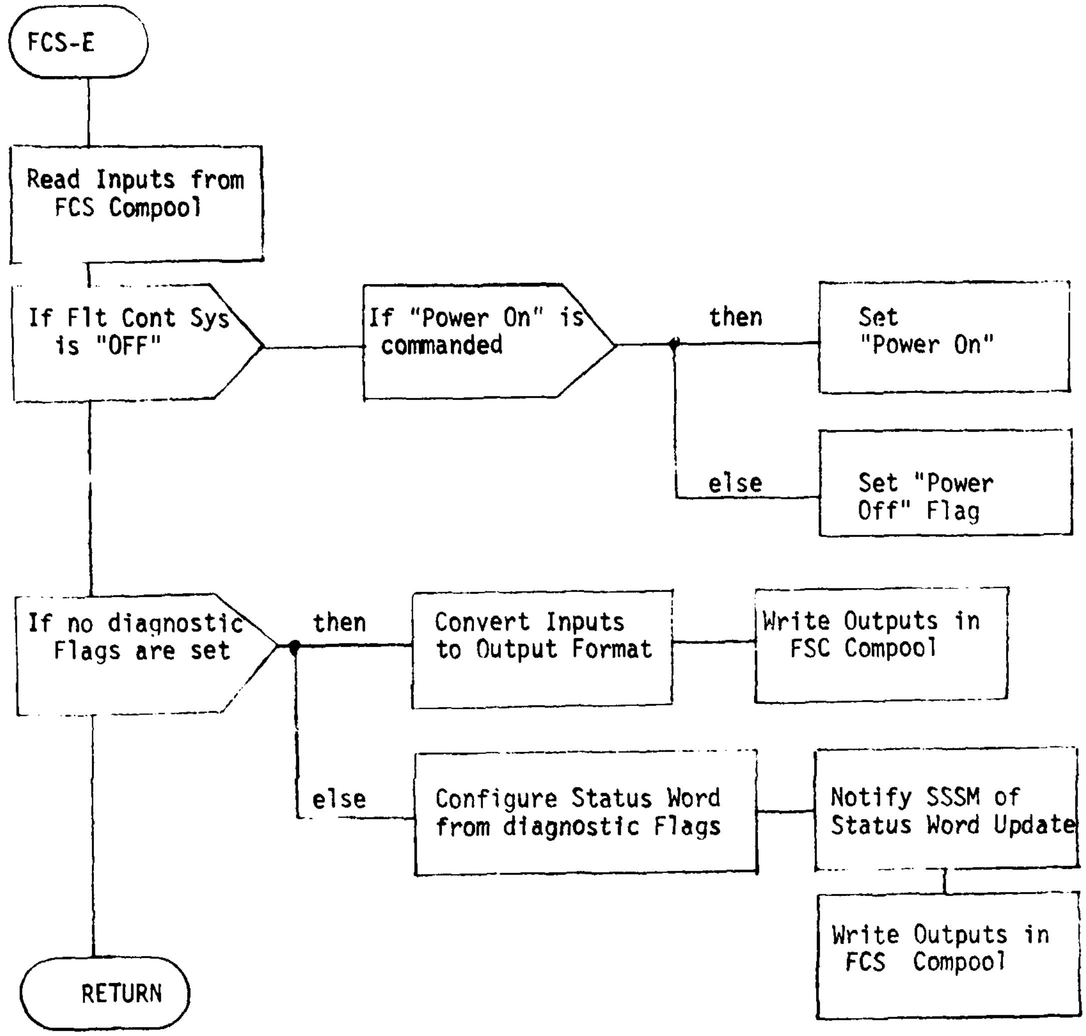


Figure 59 Flight Control System EQUIP

3.2.9.5 Function 9.5 - Center of Gravity SPEC

The Center of Gravity SPEC computes the in one dimension the location of the center of gravity along the longitudinal axis of the aircraft. The value of center of gravity changes with fuel consumption and cargo delivery. A nominal initial configuration is included in the initialization values. The operator can view the initial configuration, or the MPD, and through the OPS's and Brute Force SPEC's, he can alter the configuration during the mission. This SPEC then computes the new center-of-gravity. The Center of Gravity SPEC is scheduled asynchronously by the OPS's and the Brute Force SPEC's. The computer requirements for this module are:

Memory Size	180	16 Bit Words
Throughput	0	MS/Sec
Update Rate	0	Times/Sec

3.2.10 Vehicle Defense/Identification

The Vehicle Defense/Identification Group consists of interface modules designed to provide the software interface between the modified equipment control devices, via the Remote T erminals, and the IDAMST Processors. These interface modules, called EQUIPs, enable the operator to exercise control, i.e., ON/OFF, Mode Selection, Frequency Selection, etc. of the VD/I equipment by means of the DEK, IMK and SCP controls. A separate EQUIP program module is provided for each type of VD/I equipment. Additionally, the EQUIP modules process any BITE data should the particular piece of VD/I equipment be so designed.

3.2.10.1 IR Detection and Warning System EQUIP (IRDW-E)

This program module prcesses the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the Infra-Red Detection and Warning System. The results of the Built-In Test features are processed for input to the Subsystem Status Monitor. The computer requirements for this module are:

Memory size	66	16 bit words
Throughput	5624	ms/sec
Update rate	8	times/sec

3.2.10.1 Inputs

The inputs to this program module shall be as specified in Table TBD.

3.2.10.1.2 Processing

This program module shall convert the inputs to an appropriate format for output to properly control the operation of the IRD&W.

Upon detection of malfunctions by the Built-In Test features, the program shall set the appropriate diagnostic flags and the appropriate bits on the Subsystem Status Word.

This program is a privileged task and shall be executed synchronously 8 times per second.

The processing shall be performed as specified in Figure 60 .

3.2.10.1.3 Outputs

The outputs from this program module shall be as specified in Table TBD .

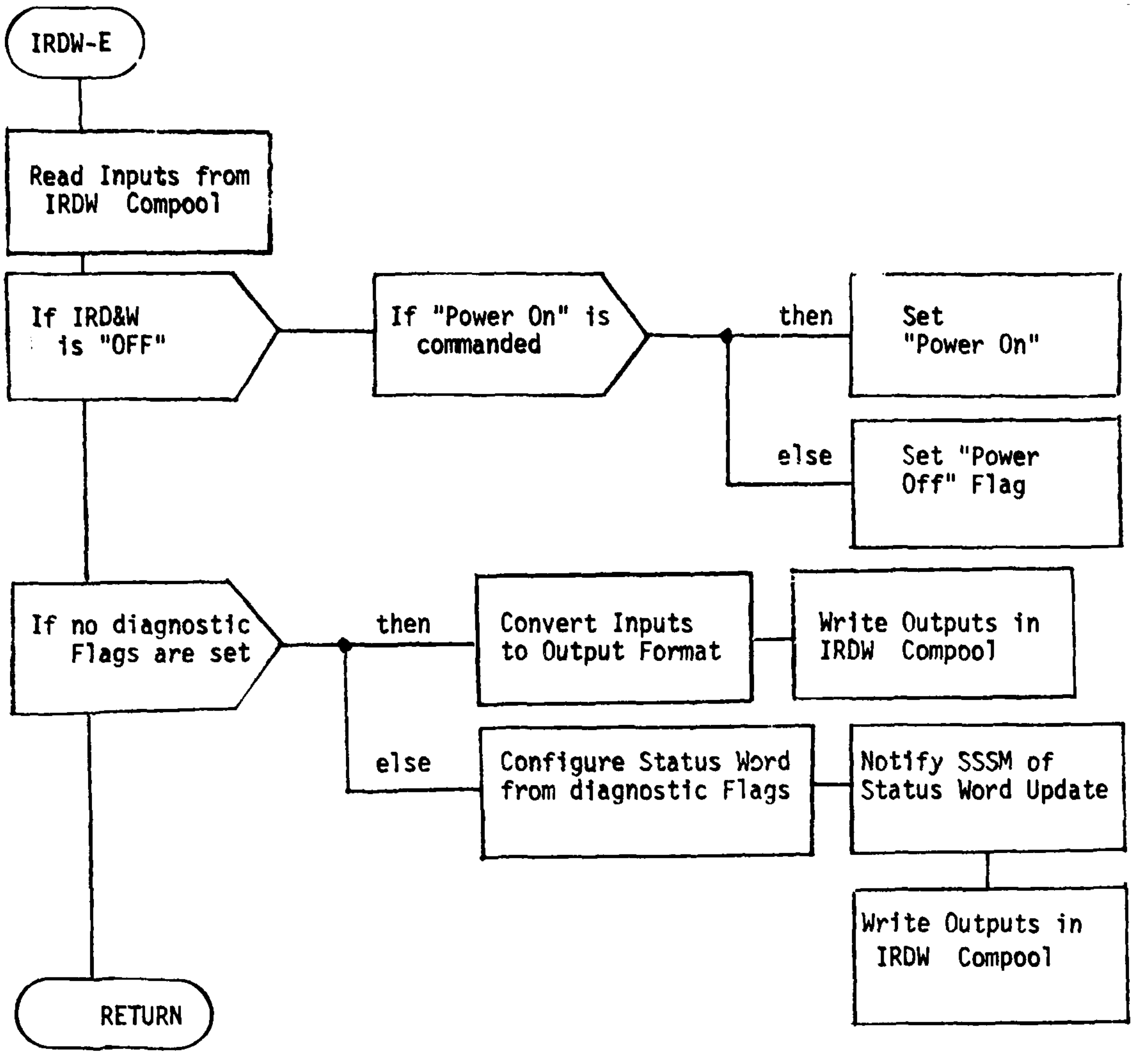


Figure 60 Infra-Red Detection & Warning EQUIP

3.2.10.2 Electronic Support Measures EQUIP (ESM-E)

This program module processes the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the Electronic Support Measures Equipment (ESM). The results of the Built-In Test features are processed for input to the Subsystem Status Monitor. The computer requirements for this module are:

Memory size	55	16 bit words
Throughput	5000	ms/sec
Update rate	8	times/sec

3.2.10.2.1 Inputs

The inputs to this program module shall be as specified in Table TBD .

3.2.10.2.2 Processing

This program module shall convert the inputs to an appropriate format for output to properly control the operation of the ESM Equipment.

Upon detection of malfunctions by the Built-In Test features, the program shall set the appropriate diagnostic flags and the appropriate bits on the Subsystem Status Word.

This program is a privileged task and shall be executed synchronously 8 times per second.

The processing shall be performed as specified in Figure 61 .

3.2.10.2.3 Outputs

The outputs from this program module shall be as specified in Table TBD .

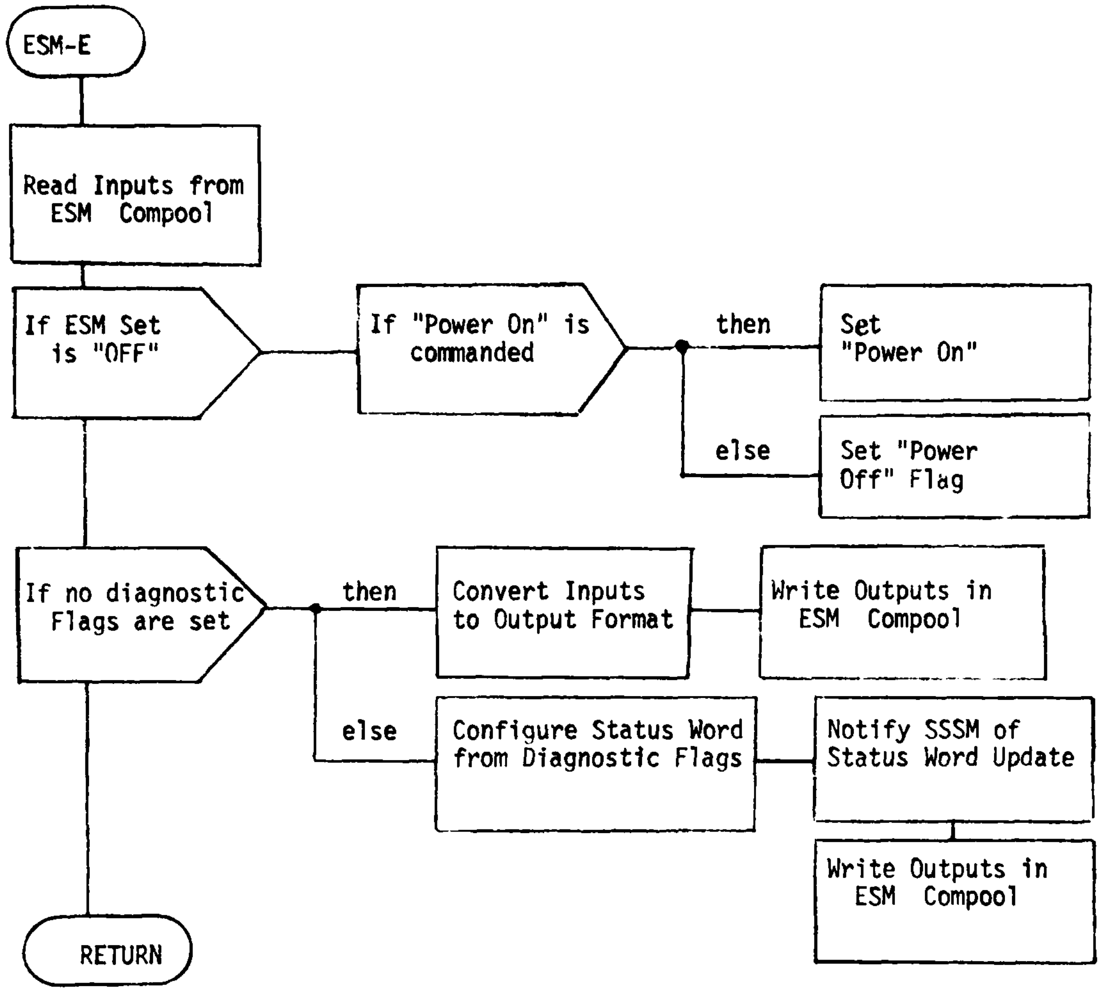


Figure 61 Electronic Support Measures EQUIP

3.2.10.3 IFF Transponder EQUIP (IFF-E)

This program module processes the mode and function commands from the operator by converting them to an appropriate format for output to control the operation of the IFF Transponder, AN/APX-101.

The results of the Built-In Test features are processed for input to the Subsystem Status Monitor. The computer requirements for this module are:

Memory size	78	16 bit words
Throughput	14496	ms/sec
Update rate	16	times/sec

3.2.10.3.1 Inputs

The inputs to this program module are listed in Table CIX .

3.2.10.3.2 Processing

This program module shall convert the inputs to an appropriate format for output to properly control the operation of the IFF Transponder.

Upon the detection of the initiation of the Built-In Test mode, the program shall set the appropriate diagnostic flags and the appropriate bits on the subsystem status word.

The processing shall be performed as specified in Figure 62 .

This program module is a privileged task and shall be executed synchronously 16 times per second.

TABLE CIX INPUTS - IFF TRANSPONDER EQUIP (IFF-E)
AN/APX-101

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
MODE 4 REPLY		16	04	IFF CONTROL UNIT	
TEST INDICATOR		16	04	IFF CONTROL UNIT	
MASTER SWITCH (3 BITS)		8	01	IMK EQUIP	
MODE SELECT (10 BITS)		8	01	DEK EQUIP	
MODE 1 REPLY (8 BITS)		8	01	DEK EQUIP	
MODE 3/A REPLY (16 BITS)		8	01	DEK EQUIP	
IDENT/OUT/MIC CONTROL (2)		8	01	DEK EQUIP	
RAD TEST/OUT/MONITOR CONTRL (2)		8	01	DEK EQUIP	
MODE 4 CODE SWITCH(3 BITS)		8	01	DEK EQUIP	
MODE 4 AUDIO/LIGHT CONTROL (2)		8	01	DEK EQUIP	
ANTENNA SELECT (2 BITS)		8	01	DEK EQUIP	
MODE C ALTITUDE (11 BITS)		8	01	DEK EQUIP	

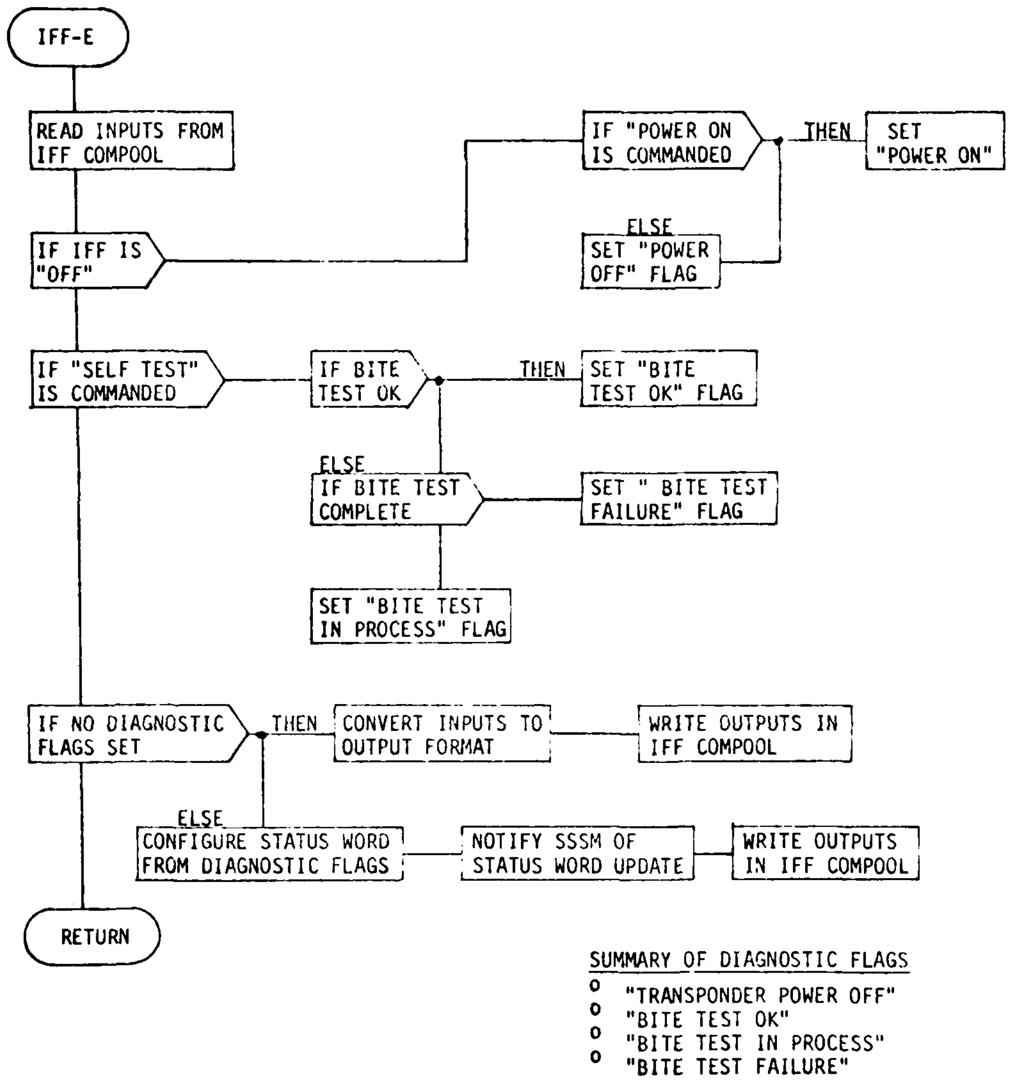


Figure 62 IFF TRANSPONDER EQUIP

3.2.10.3.3 Outputs

The outputs from this program module are listed in Table CX .

3.2.11 Display Modules

The Display Modules provide the software which monitors and processes the display keyboards and provides data and commands to supply to the Display Subsystem.

The keyboard is used by the pilot or co-pilot to call up any particular information display, to communicate with the processor for mode and function selection and to provide control for all on-board avionics.

This software sends commands and data to the MPDGS to use in generating in-raster and stroke symboloty for presentation on the CRT displays. It also sends messages to the A/NSG which cause prestored messages to be generated and displayed.

3.2.11.1 MPDG DISP

MPDG DISP is scheduled by the Configurator such that the MPDG DISP shall be activated eight times a second. The MPDG DISP shall process BIT data from the MPDGS and DSMU. It shall send data for the MPDG to use in updating the displays. The computer requirements for the module are:

Memory size	192	16 bit words
Throughput	3488	ms/sec
Update rate	8	times/sec

3.2.11.1.1 Inputs

The inputs to the MPDG DISP shall be as specified in Table CXI .

TABLE CX OUTPUTS - IFF TRANSPONDER EQUIP AN/APX-101 (IFF-E)

DATA NAME	SYMBOL	UPS	TYPE	SOURCE	REFERENCE
MASTER SWITCH (3 BITS)		8	01	IFF CONTROL UNIT	
MODE SELECT (8 BITS)		8	01	IFF CONTROL UNIT	
MODE 1 REPLY CODE (8 BITS)		8	01	IFF CONTROL UNIT	
MODE 3/A REPLY CODE (16 BITS)		8	01	IFF CONTROL UNIT	
IDENT/OUT/MIC CONTROL (2 BITS)		8	01	IFF CONTROL UNIT	
RAD TEST/OUT/MONITOR CONTROL (2 BITS)		8	01	IFF CONTROL UNIT	
MODE 4 CODE (2 BITS)		8	01	IFF CONTROL UNIT	
MODE 4 AUDIO/LIGHT CONTROL (2 BITS)		8	01	IFF CONTROL UNIT	
ANTENNA SELECT (2 BITS)		8	01	IFF CONTROL UNIT	
MODE C ALTITUDE CODE (11 BITS)		8	01	IFF CONTROL UNIT	
MODE 4 REPLY LIGHT		16		MPD EQUIP	
TEST INDICATOR		16		MPD EQUIP	
STATUS WORD		8		SSSM	

TABLE CXI INPUTS TO MPDG DISP

DATA NAME	SYMBOL	SOURCE	REFERENCE
ACTIVATION FLAG		CONFIGURATOR	
UPDATE FLAGS		CONFIGURATOR, OPS	
MODE DATA		CONFIGURATOR	
DISPLAY DATA		APPLICATION MODULES	
MPDG INITIAL EVENT		TEST CONFIGURATOR	
BIT DATA		MPDGS, DSMU	

3.2.11.1.2 Processing

The MPDG DISP shall perform the processing specified in Figure 63 .

On its first activation the MPDG DISP signals the START-UP DISP to initialize the MPDGS and the DSMU.

If there is a request to change the data or format of the displays or the MPDG or DSMU assignments, the UPDATE DISP is signalled.

The MPDG and DSMU Compools are read to determine the failure status of the MPDGS and DSMU. If no failures have been found, that information is stored for the Subsystem Status Monitor.

If there has been a refresh memory or switch failure, the UPDATE DISP shall be signalled to change assignment so that the faulty part is no longer used.

If one MPDG has failed, the remaining MPDG shall be notified to operate in a degraded mode.

If there is some other DSMU failure, then the remaining channels shall be reassigned such that highest priority displays remain in operation.

The failure shall be stored for Subsystem Status Monitor.

A command message is prepared and sent to the MPDGS. This is a synchronous message consisting of a command word followed by data words. The command word contains the master mode, message number and data word count.

The data contained in these messages is used by the MPDGS to update the displays.

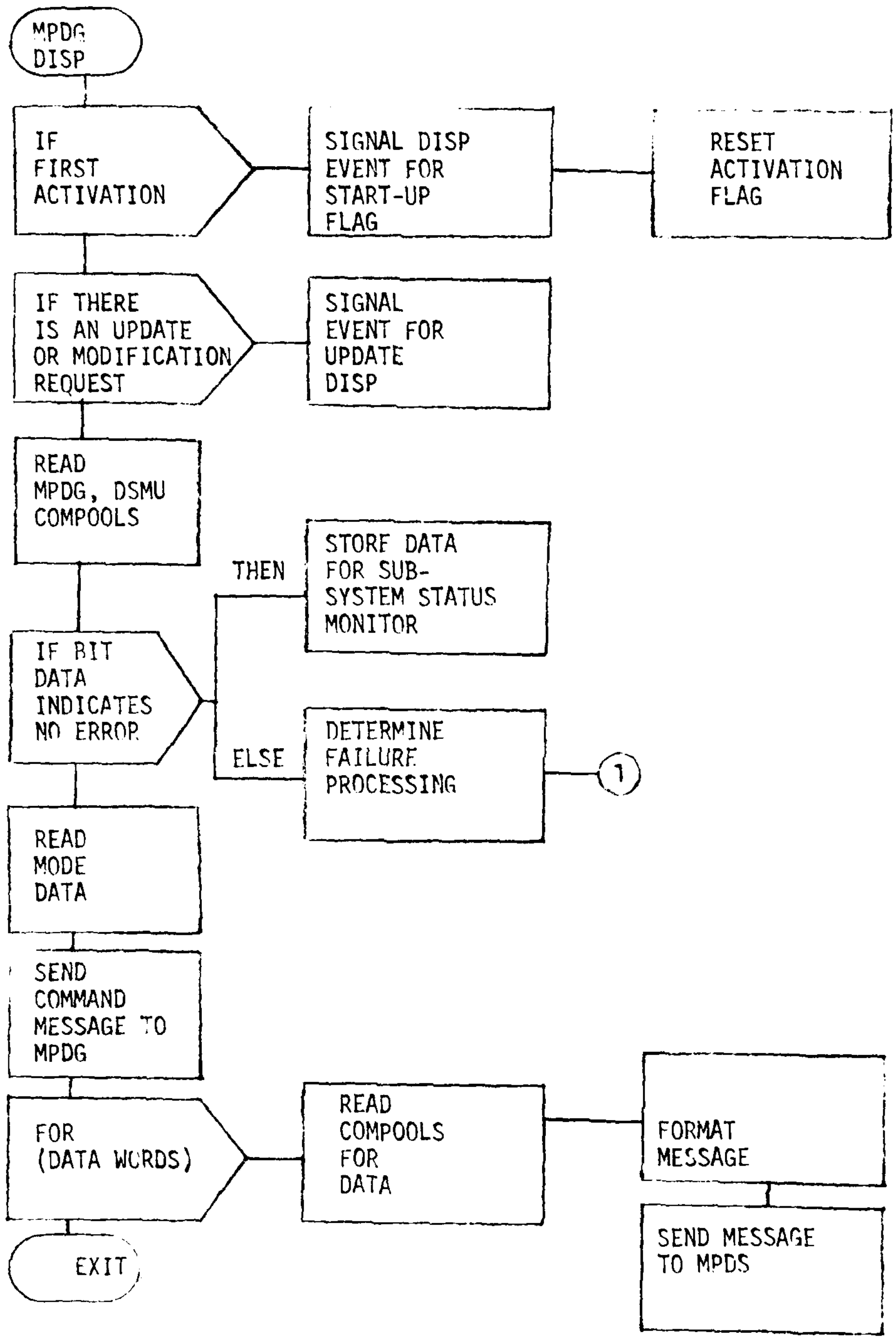


Figure 63 MPDG DISP

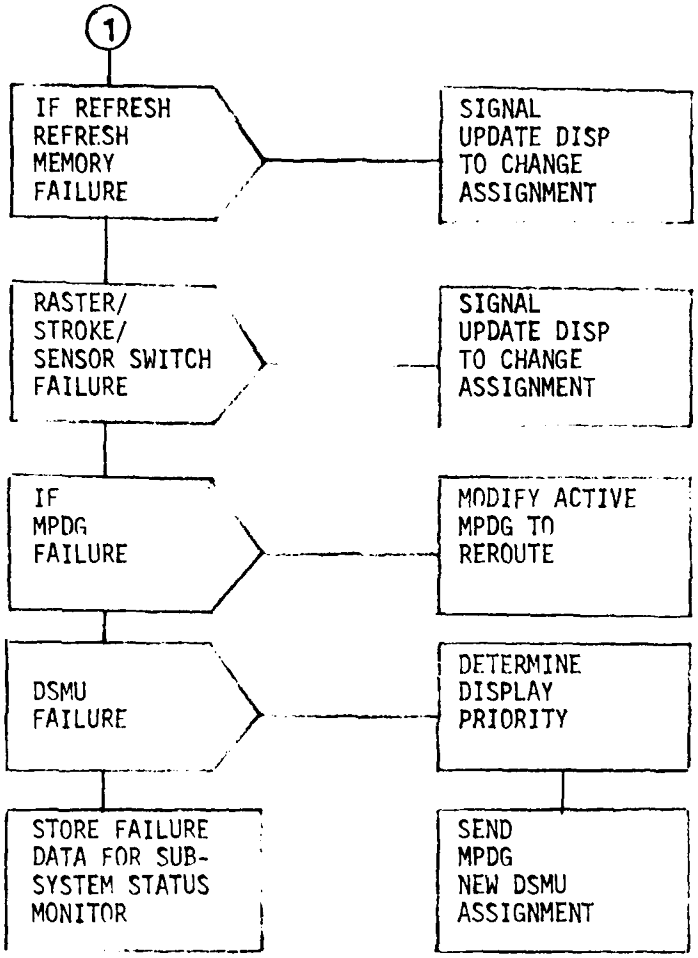


Figure 63 (Cont.) MPDG DISP

3.2.11.1.3 Outputs

The outputs from the MPDG DISP shall be as specified in Table CXII .

3.2.11.2 START-UP DISP

The START-UP DISP is activated only once on the initial processing of MPDG DISP. It initializes MPDG and DSMU assignments. The computer requirements for the module are:

Memory size	42	16 bit words
Throughput	250	ms/sec
Update rate	N/A	times/sec

3.2.11.2.1 Inputs

The inputs to the START-UP DISP shall be as specified in Table CXIII .

3.2.11.2.2 Processing

The START-UP DISP shall perform the processing specified in Figure 64 .

For each display a load command message is sent to MPDG. This message commands the bootstrap loader in the MPDG to load a specific program into the MPDG off of mass memory and commands text page in mass memory to be loaded into a specific text table in the MPDG.

Next assignment commands are sent. Each of these assigns a display to a memory buffer pair and raster output module.

TABLE CXII OUTPUTS FROM MPDG DISP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
DISP EVENT		START-UP DISP	
DISP EVENT		UPDATE DISP	
MASTER MODE MESSAGE		MPDGs	
DATA MESSAGES		MPDGs	
STATUS DATA		SUBSYSTEM STATUS MONITOR	
DISPLAY PRIORITIES		MPDGs	

TABLE CXIII INPUTS TO START-UP DISP

DATA NAME	SYMBOL	SOURCE	REFERENCE
START-UP DISP EVENT		MPDG DISP	
INITIAL LOAD		MASS MEMORY	
INITIAL MPDG ASSIGNMENTS		MASS MEMORY	
INITIAL SWITCH ASSIGNMENTS		MASS MEMORY	
INITIAL REFRESH MEMORY ASSIGNMENT		MASS MEMORY	

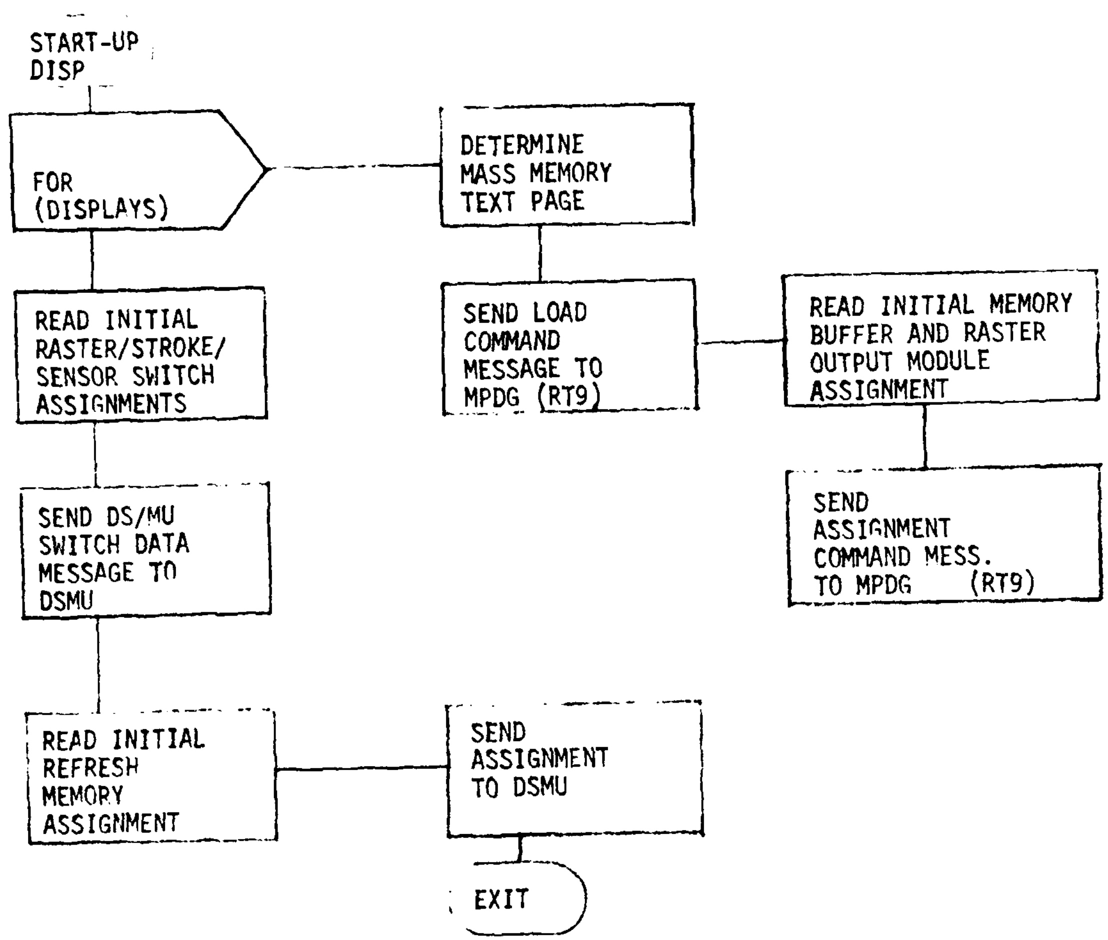


Figure 64 START-UP DISP

The DSMU contains three software controlled switches to control what is put up on the displays. An initial assignment of raster/stroke/ sensor switches is made by sending the DSMU Switch Data Input message.

The five refresh memories can also be controlled by the software. An initial assignment is made by the START-UP DISP.

3.2.11.2.3 Outputs

The outputs from the START-UP DISP shall be as specified in Table CXIV .

3.2.11.3 UPDATE DISP

The UPDATE DISP is activated ehenever there is to be a change in a display or in the controls processing the displays. The computer requirements for the module are:

Memory size	72	16 bit words
Throughput	374	ms/sec
Update rate	N/A	times/sec

3.2.11.3.1 Inputs

The inputs to the UPDATE DISP shall be as specified in Table CXV .

3.2.11.3.2 Processing

The UPDATE DISP shall perform the processing specified in Figure 65 .

The MPDGs can store only eight text tables at a time. Therefore, the stored text tables shall be changed several times during an operation. This is accomplished by sending the Table Update, and Load Command.

TABLE CXIV OUTPUTS FROM START-UP DISP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
LOAD COMMAND		MPDG	
ASSIGNMENT COMMAND		MPDG	
DSMU SWITCH DATA		DSMU	
REFRESH MEMORY ASSIGNMENT		DSMU	

TABLE CXV INPUTS TO UPDATE DISP

DATA NAME	SYMBOL	SOURCE	REFERENCE
NEW TABLES FLAG		CONFIGURATOR	
CHANGE FLAGS		EQUIPs	
		CONFIGURATOR	
ASSIGNMENT CHANGE FLAGS		GTP-1	

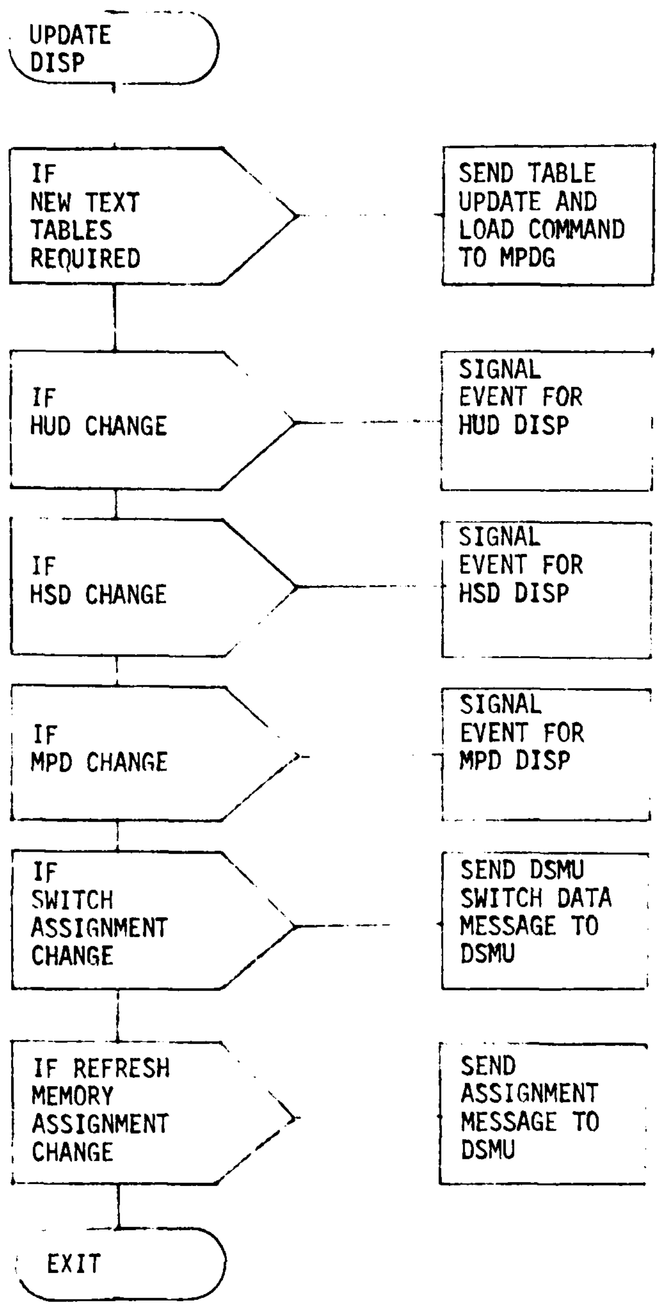


Figure 65 Update DISP

It is assumed that the MPDGs shall determine the display data for any phase from the stored tables. The display is changed only if data not included in the Master Mode Command is required.

If a change in a display is necessary, that display is signalled by an event.

If a change in either the switch or refresh memory assignment is requested the appropriate message will be sent to the DSMU.

3.2.11.3.3 Outputs

The outputs from the UPDATE DISP shall be as specified in Table CXXI .

3.2.11.4 HUD DISP

The HUD DISP is activated by the UPDATE DISP for changes in data displayed not automatically handled by MPDG. The computer requirements for the module are:

Memory size	40	16 bit words
Throughput	241	ms/sec
Update rate	N/A	times/sec

3.2.11.4.1 Inputs

The inputs to the HUD DISP shall be as specified in Table CXVII .

3.2.11.4.2 Processing

The HUD DISP shall perform the processing specified in Figure 66 .

TABLE CXVI OUTPUTS FROM UPDATE DISP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
TABLE UPDATE AND LOAD COMMAND		MPDG	
HUD DISP EVENT		HUD DISP	
HSD DISP EVENT		HSD DISP	
MPD DISP EVENT		MPD DISP	
DSMU SWITCH DATA		DSMU	
REFRESH MEMORY ASSIGNMENT		DSMU	

TABLE CXVII INPUTS TO HUD DISP

DATA NAME	SYMBOL	SOURCE	REFERENCE
HUD FLAGS		PROCESSOR CONTROL PANEL	
		OPS	
MODIFIER FLAG		CONFIGURATOR	
MODIFIER DATA		COMPOOL	
PILOT DISPLAY REQUEST		EQUIP	
DEK/IMK DATA		DEK EQUIP, IMK EQUIP	

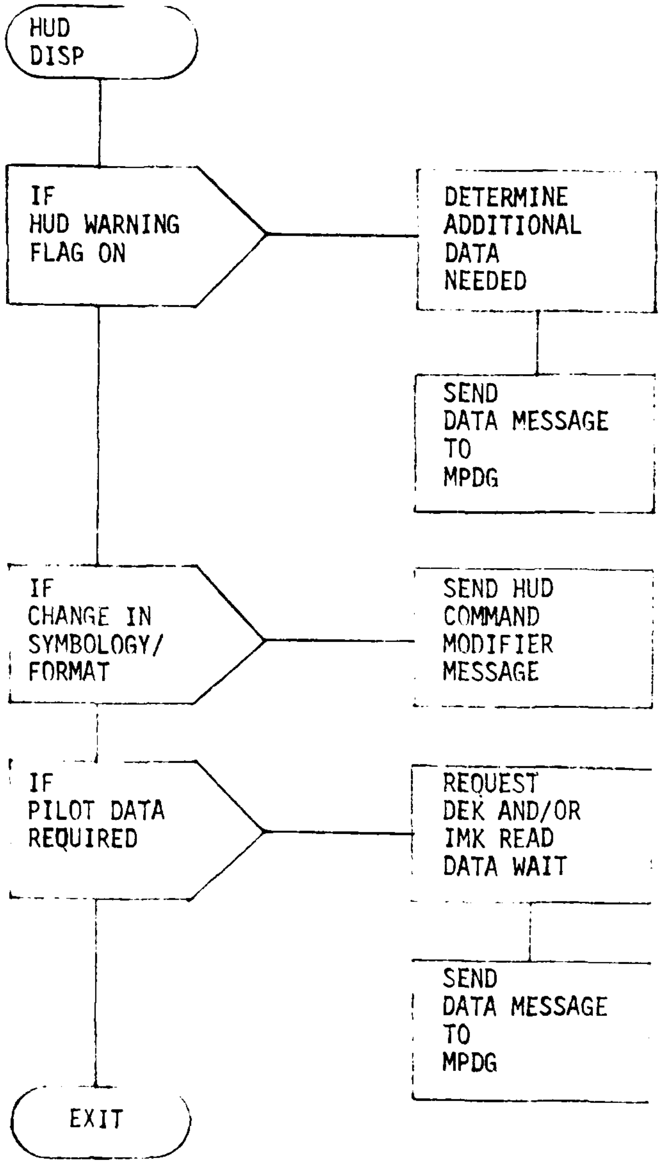


Figure 66 HUD DISP

AD-A083 117 AIR FORCE AVIONICS LAB WRIGHT-PATTERSON AFB OH F/G 9/2
COMPUTER PROGRAM DEVELOPMENT SPECIFICATION FOR IDAMST OPERATION--ETC(U)
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Certain data is displayed only when a HUD warning flag is on. The HUD DISP determines which flag is on, what data is needed and sends a data message to MPDG.

If data other than that contained in the Data Command Message is required, a Command Modifier is sent to MPDG.

The pilot uses IMFK and DEK to input command values for display. The IMFK EQUIP and DEK EQUIP will store the data in a compool for HUD DISP to read and send to MPDG.

3.2.11.4.3 Outputs

The outputs from the HUD DISP shall be as specified in Table CXVIII.

3.2.11.5 HSD DISP

The HSD DISP is activated by the UPDATE DISP for changes in data to be displayed not automatically handled by MPDG. The computer requirements for the module are:

Memory size	35	16 bit words
Throughput	214	ms/sec
Update rate	N/A	times/sec

3.2.11.5.1 Inputs

The inputs to the HSD DISP shall be as specified in Table CXIX.

3.2.11.5.2 Processing

The HSD DISP shall perform the processing specified in Figure 67.

TABLE CXVIII OUTPUTS FROM HUD DISP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
DATA MESSAGES		MPDG	
HUD COMMAND MODIFIER		MPDG	

TABLE CXIX INPUTS TO HSD DISP

DATA NAME	SYMBOL	SOURCE	REFERENCE
WAYPOINT DATA		IMK	
MODIFIER FLAG		CONFIGURATOR	
MODIFIER DATA		COMPOOL	
PILOT DISPLAY REQUEST		EQUIP	
DEK/IMK DATA		DEK EQUIP/IMK EQUIP	

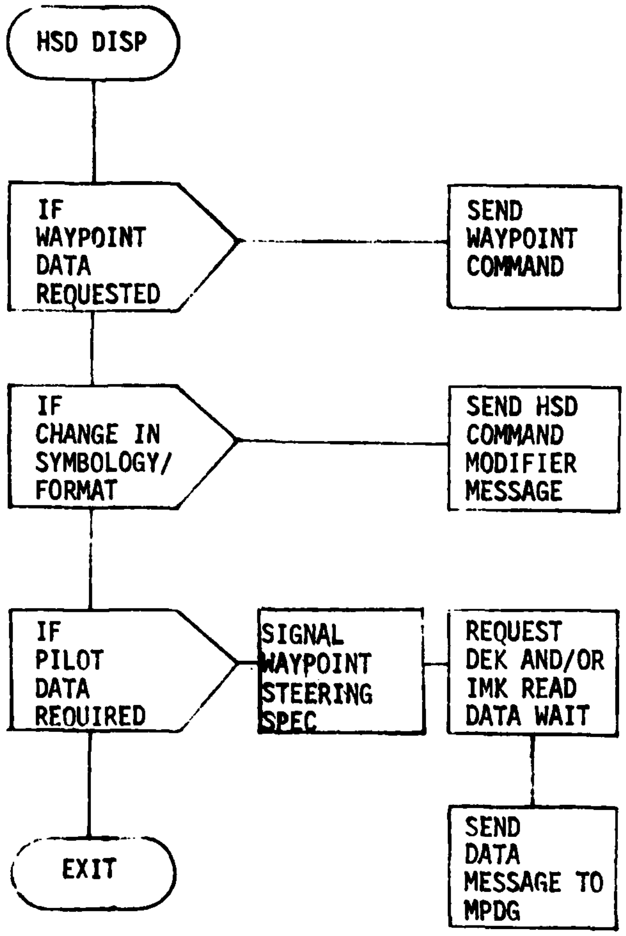

Figure 67 HUD DISP

The pilot may select at any given time, using the IMK, to display the distance and time to go to any waypoint. If so, HSD DISP sends a Waypoint Command to MPDG for display.

If data other than that contained in the Data Command Message is required, a Command Modifier is sent to MPDG.

The pilot uses IMK and DEK to input command values for display. The IMK EQUIP and DEK EQUIP will store the data in a compool for HSD DISP to read and send to MPDG.

3.2.11.5.3 Outputs

The outputs from the HSD DISP shall be as specified in Table CXX .

3.2.11.6 MPD DISP

The MPD DISP is activated when there is a request for a text display. The computer requirements for the module are:

Memory size	70	16 bit words
Throughput	241	ms/sec
Update rate	N/A	times/sec

3.2.11.6.1 Inputs

The inputs to the MPD DISP shall be as specified in Table CXXI .

3.2.11.6.2 Processing

The MPD DISP shall perform the processing specified in Figure 68 .

TABLE CXX OUTPUTS FROM HSD DISP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
WAYPOINT COMMAND		MPDG	
HSD COMMAND MODIFIER		MPDG	
DATA MESSAGES		MPDG	

TABLE CXXI INPUTS TO MPD DISP

DATA NAME	SYMBOL	SOURCE	REFERENCE
REQUEST FOR TEXT DISPLAY		CONFIGURATOR OPS GTP-1 MODULES DEK EQUIP IMK EQUIP	

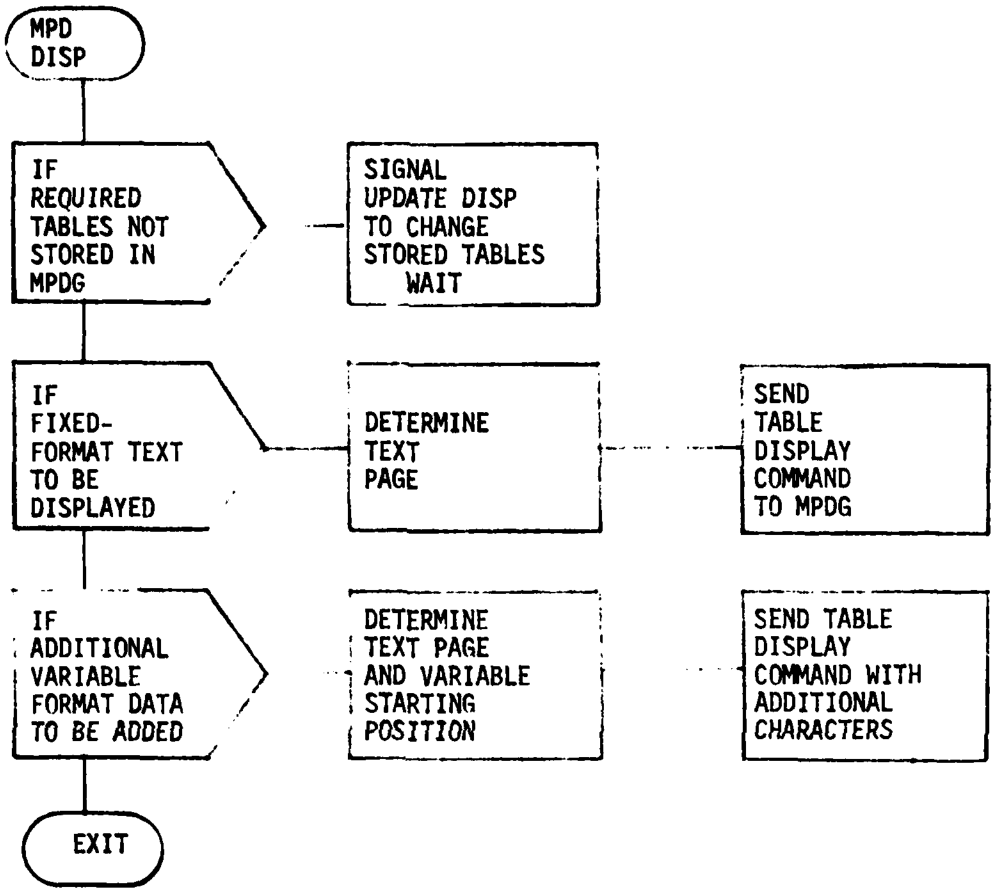

Figure 68 MPD DISP

An MPDG stores eight pages of text at a time. If the request is for a page not stored in MPDG, MPD DISP signals UPDATE DISP to command the MPDG to load the table from mass memory.

If the request is for a stored fixed format text, MPD DISP sends a Table Display Command to MPDG.

A variable parameter may be added to a fixed page by indicating the page identifier and the variable's starting position and passing the characters that represent the variable's value.

3.2.11.6.3 Outputs

The outputs from the MPD DISP shall be as specified in Table CXII .

3.2.11.7 IMK DISP

The IMK DISP receives requests from the application software for new IMK checklists. The IMK DISP notifies A/NSG to display the prestored checklist. The IMK DISP is also activated to process pilot requests. The computer requirements for the module are:

Memory size	7	16 bit words
Throughput	481	ms/sec
Update rate	N/A	times/sec

3.2.11.7.1 Inputs

The inputs to the IMK DISP shall be as specified in Table CXXIII .

3.2.11.7.2 Processing

The IMK DISP shall perform the processing specified in Figure 69 .

TABLE CXII OUTPUTS FROM MPD DISP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
TABLE DISPLAY COMMAND		MPDG	
DISP EVENT		UPDATE DISP	

TABLE CXXIII INPUTS TO IMK DISP

DATA NAME	SYMBOL	SOURCE	REFERENCE
CHECKLIST REQUESTS		APPLICATION MODULES	
BRUTE FORCE SPEC REQUEST		IMK	
BRUTE FORCE SPEC REQUEST LEGAL		REQUEST PROCESSOR	
SIDE KEY REQUEST		IMK	
SIDE KEY LEGAL		OPS	
MODE INDICATOR		DATA BASE	

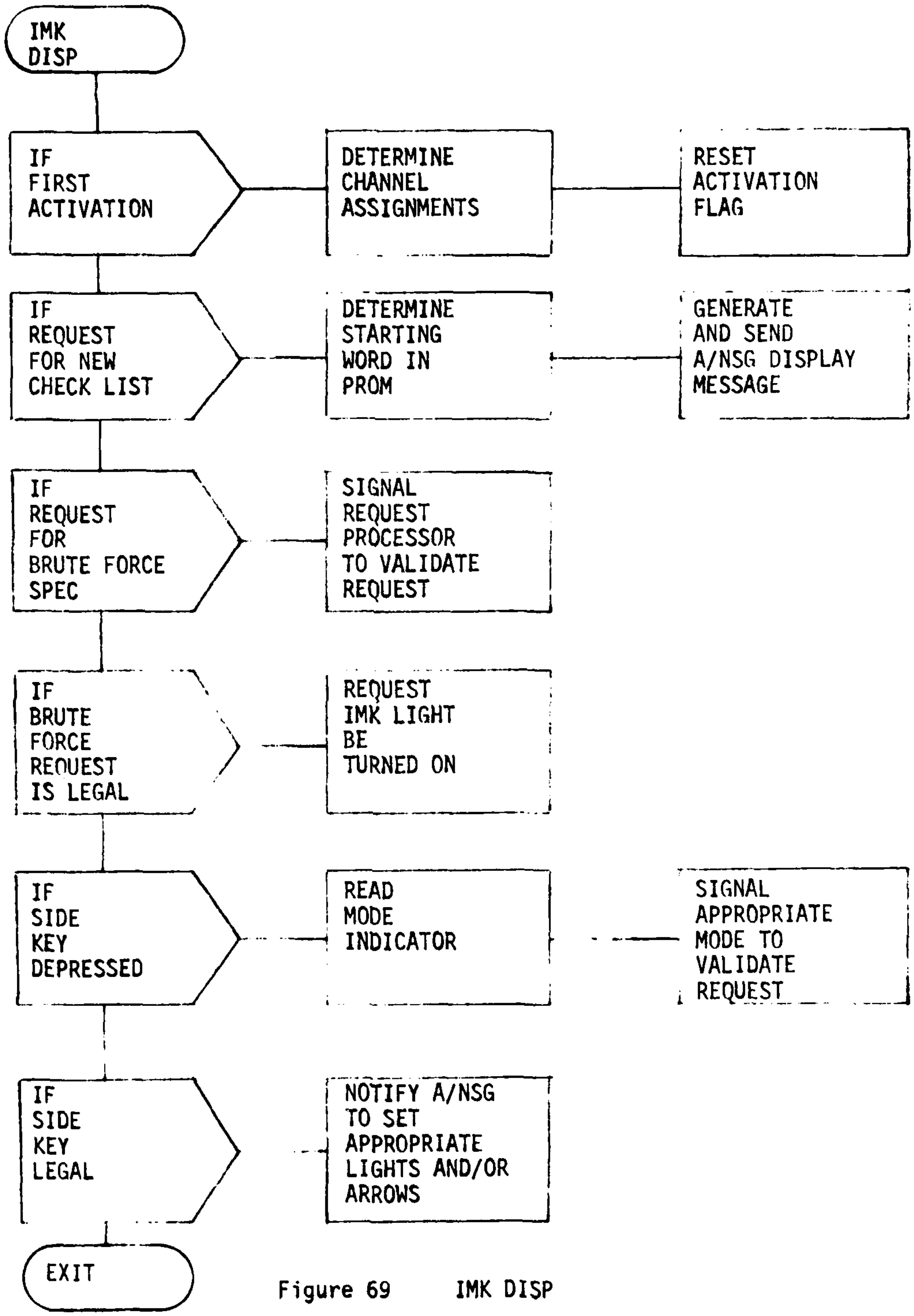

Figure 69 IMK DISP

On the first activation, the Alpha/Numeric Symbol Generator (A/NSG) channel for each IMK shall be assigned. The flag shall be reset to indicate that the assignment has been made.

Commands are sent to the A/NSG. Each command causes prestored messages to be generated and displayed adjacent to the proper control switch. The messages are stored in a Programmable Read Only Memory (PRDM).

If a request for a Brute Force SPEC is received, IMK DISP signals the Request Processor to determine if the request is legal. For a legal request, the IMK DISP shall request that the IMK Brute Force light be turned on.

If a side key on the IMK is depressed the IMK DISP shall read the Mode Indicator to determine which OPS to signal to validate and process the request.

If the OPS signals the IMK DISP that a legal key has been depressed, the IMK DISP shall set appropriate lights and/or arrows.

3.2.11.7.3 Outputs

The outputs from the IMK DISP shall be as specified in Table CXXIV .

3.2.11.8 MMK EQUIP

The MMK (Master Mode Keyboard) EQUIP is activated when a switch on the MMK has been depressed or when the Request Processor has established that a request is legal. The computer requirements for the module are:

TABLE CXXIV OUTPUTS FROM IMK DISP

DATA NAME	SYMBOL	SOURCE	REFERENCE
DISPLAY COMMANDS		A/NSG	
CHANNEL ASSIGNMENT		A/NSG	
VALIDATION REQUEST		REQUEST PROCESSOR	
SWITCH DATA (IMK)		RT	
VALIDATION REQUEST		OPS	

Memory size	31	16 bit words
Throughput	178	ms/sec
Update rate	N/A	times/sec

3.2.11.8.1 Inputs

The inputs to the MMK EQUIP shall be as specified in Table CXXV .

3.2.11.8.2 Processing

The MMK EQUIP shall perform the processing specified in Figure 70 .

If an MMK request to change mode has been made, the Request Processor is signalled to establish the legality of the request.

When the Request Processor has established that a request is legal, it signals the MMK EQUIP. The MMK EQUIP turns appropriate lights on and off and updates the MMK display status compool.

3.2.11.8.3 Outputs

The outputs from the MMK EQUIP shall be as specified in Table CXXVI .

3.2.11.9 DEK EQUIP

The DEK EQUIP is activated when the ENTER Switch is depressed during a DEK activation, when an OPS requests that the DEK be activated or when the OPS signals the DEK EQUIP that the data is complete. The computer requirements for the module are:

Memory size	37	16 bit words
Throughput	214	ms/sec
Update rate	N/A	times/sec

TABLE CXXV INPUTS TO MMK EQUIP

DATA NAME	SYMBOL	SOURCE	REFERENCE
MODE CHANGE REQUESTS		MMK	
PROCESSING REQUESTS		REQUEST PROCESSOR	
DISPLAY STATUS		DATA BASE	

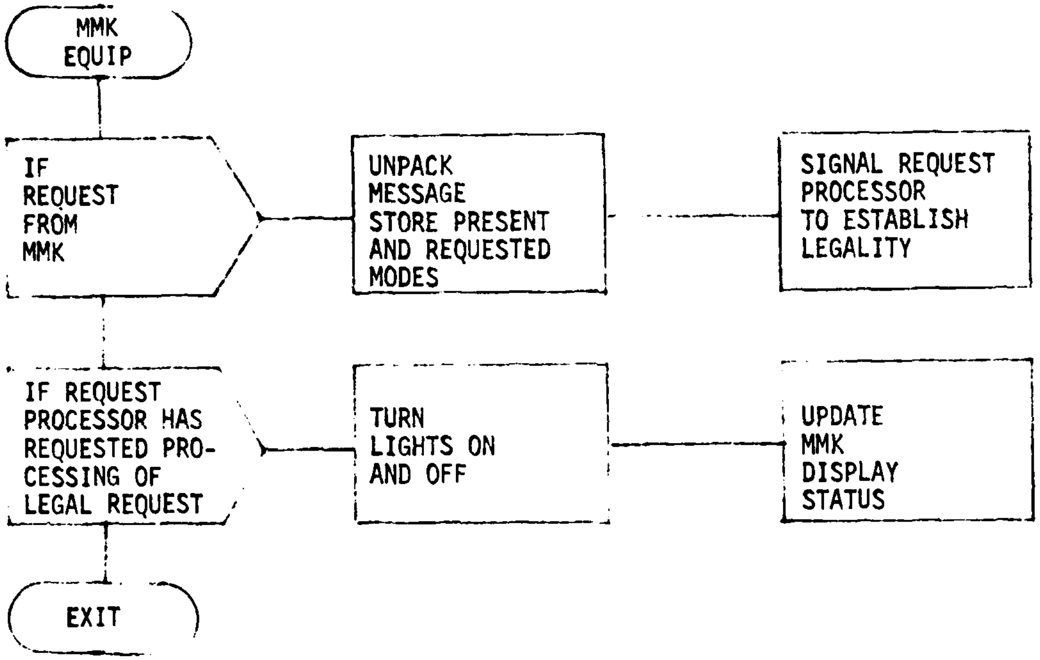

Figure 70 MMK EQUIP

TABLE CXXVI OUTPUTS FROM MMK EQUIP

DATA NAME	SYMBOL	SOURCE	REFERENCE
REQUEST TO ESTABLISH LEGALITY		REQUEST PROCESSOR	
SWITCH DATA		RT	
DISPLAY STATUS		DATA BASE	

3.2.11.9.1 Inputs

The inputs to the DEK EQUIP shall be as specified in Table CXXVII .

3.2.11.9.2 Processing

The DEK EQUIP shall perform the processing specified in Figure 71 .

If an OPS requests that the DEK be activated, the DEK EQUIP shall do so and turn on the DEK backlight.

If a data message is received from the DEK, the Mode Indicator is read to determine to which OPS the data is to be sent. That OPS is signalled to process the data.

When the data from DEK is complete, the DEK EQUIP shall deactivate it.

3.2.11.9.3 Outputs

The outputs from the DEK shall be as specified in Table CXXVIII .

3.2.11.10 MPD EQUIP

The MPD EQUIP is activated when a switch on the MPD has been depressed to request a change in the display. If the request is legal the MPD EQUIP notifies MPDG to make the change. The computer requirements for the module are:

Memory size	35	16 bit words
Throughput	232	ms/sec.
Update rate	N/A	times/sec

TABLE CXXVII INPUTS TO DEK EQUIP

DATA NAME	SYMBOL	SOURCE	REFERENCE
ACTIVATION REQUEST		OPS	
DATA MESSAGE		DEK	
DATA COMPLETE		OPS	
MODE INDICATOR		DATA BASE	

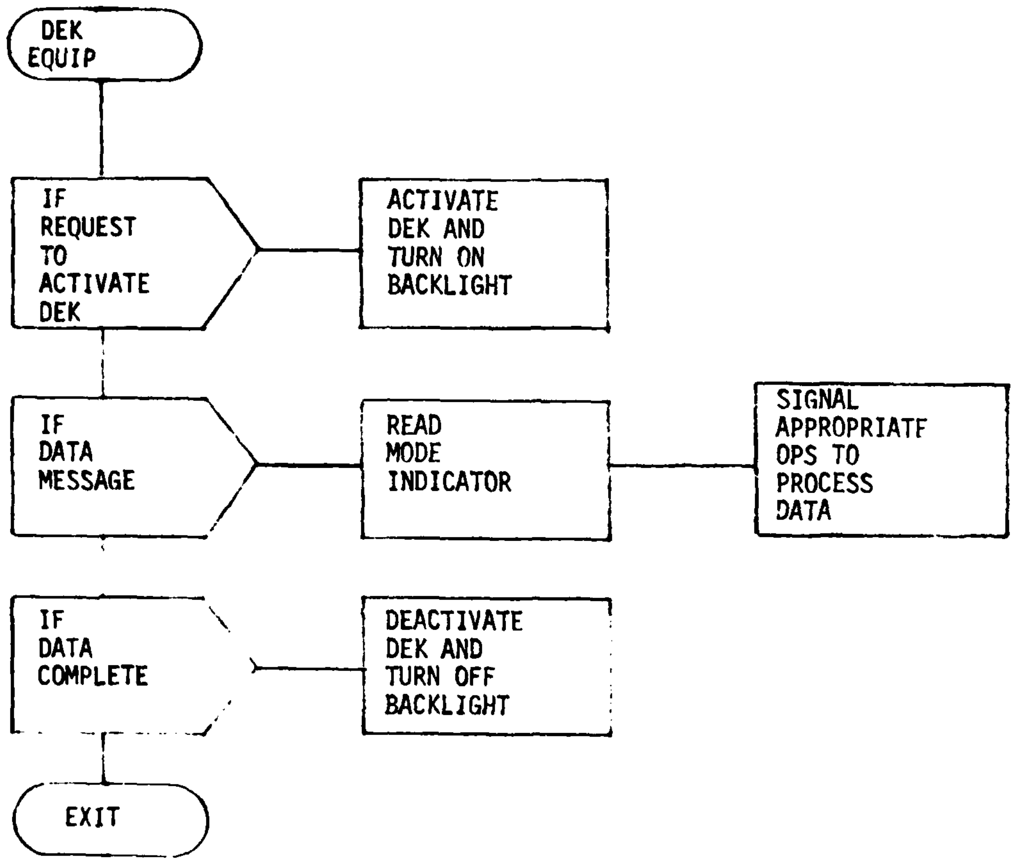

Figure 71 DEK EQUIP

TABLE CXXVIII OUTPUTS FROM DEK EQUIP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
ACTIVATION AND LIGHT DATA		RT OPS	

3.2.11.10.1 Inputs

The inputs to the MPD EQUIP shall be as specified in Table CXXIX .

3.2.11.10.2 Processing

The MPD EQUIP shall perform the processing specified in Figure 72 .

The MPD EQUIP is activated when a switch on the MPD is depressed. The MPD EQUIP compares the request with the present display status to determine if the request is legal. If not, the request is not processed.

For a legal request to return to the nominal (original) display, the MPD EQUIP notifies MPDG to honor the request. The MPD EQUIP turns off the light.

Gor a legal request to change from the nominal display, the MPD EQUIP notifies MPDG to honor the request. The MPD EQUIP turns on the appropriate light.

The display status is updated.

3.2.11.10.3 Outputs

The outputs from the MPD EQUIP shall be as specified in Table CXXX .

3.2.11.1 HSD EQUIP

The HSD EQUIP is activated when a switch on the HSD has been depressed to request a change in the display. The HSD EQUIP processes all legal requests.

TABLE CXXIX INPUTS TO MPD EQUIP

DATA NAME	SYMBOL	SOURCE	REFERENCE
SWITCH DATA		RT	
DISPLAY STATUS		DATA BASE	

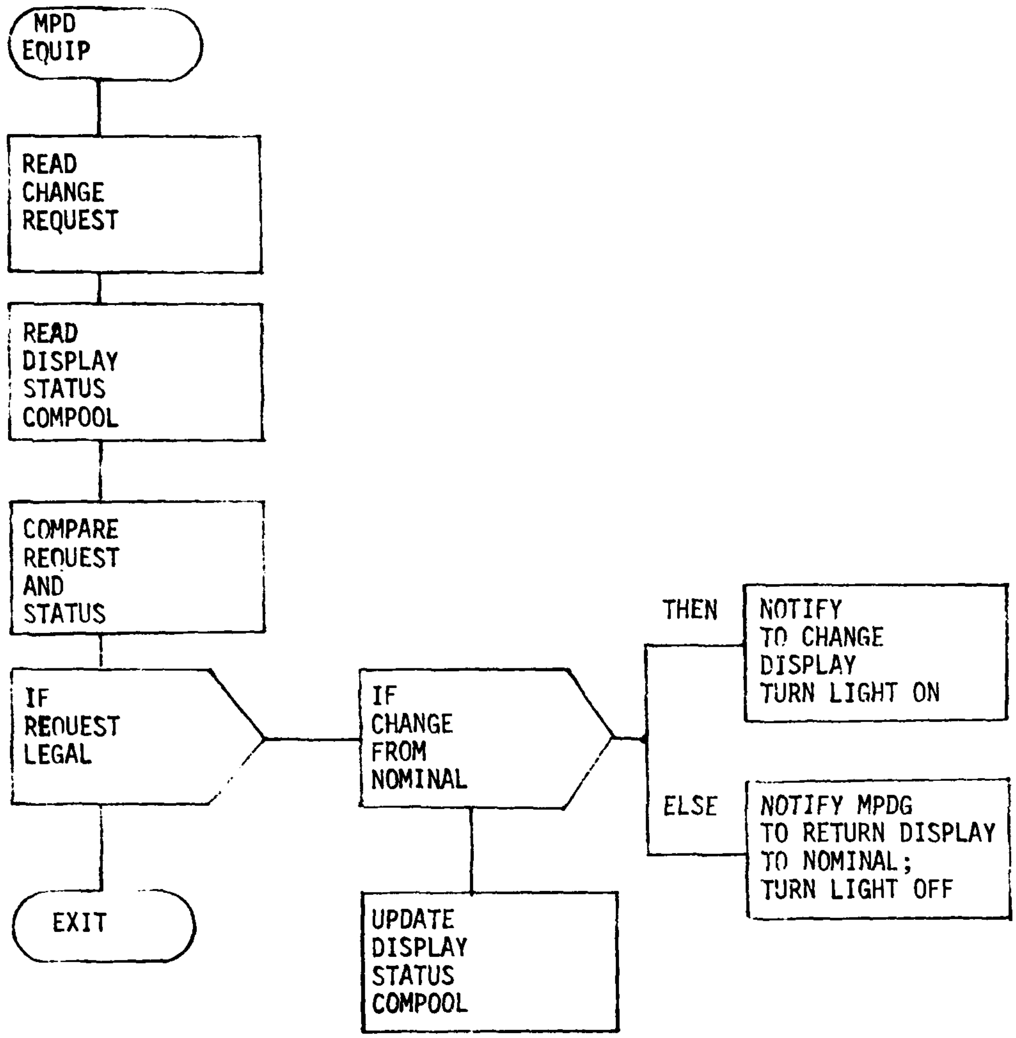

Figure 72 MPD EQUIP

TABLE CXXX OUTPUTS FROM MPD EQUIP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
DISPLAY CHANGES		MPDG	
DISPLAY STATUS		DATA BASE	

The computer requirements for the module are:

Memory size	72	16 bit words
Throughput	481	ms/sec
Update rate	N/A	time/sec

3.2.11.11.1 Inputs

The inputs to the HSD EQUIP shall be as specified in Table CXXXI.

3.2.11.11.2 Processing

The HSD EQUIP shall perform the processing specified in Figure 73.

The HSD EQUIP is activated when a switch on the HSD is depressed.

If the request is for a track/map change, the request shall be processed if the HSD display is in use. This switch shall be used to change between north up and track up maps.

If a range select request has been made, the request shall be honored if the HSD display is in use.

If a legal request to change the display has been made the request shall be processed, and the appropriate lights turned on or off.

If a display change has been made, the display status shall be updated.

3.2.11.11.3 Outputs

The outputs from the HSD EQUIP shall be as specified in Table CXXXII.

TABLE CXXXI INPUTS TO HSD EQUIP

DATA NAME	SYMBOL	SOURCE	REFERENCE
SWITCH DATA		HSP	
DISPLAY STATUS		DATA BASE	

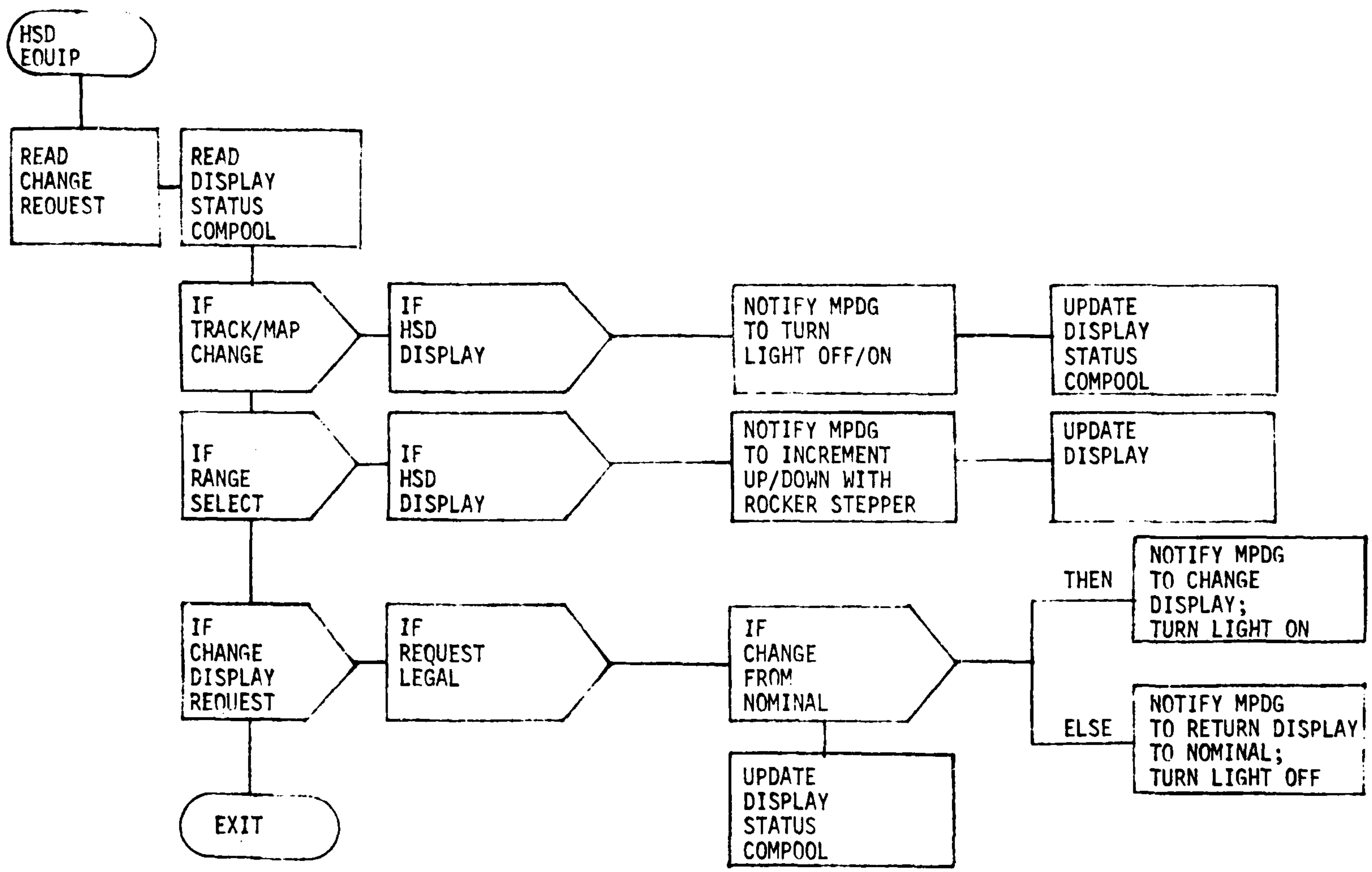

Figure 73 HSD EQUIP

TABLE CXXXII OUTPUTS FROM HSD EQUIP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
DISPLAY CHANGES		MPDG	
DISPLAY STATUS		DATA BASE	

3.2.11.12 HUD EQUIP

The HUD EQUIP is activated when the HUD Switch is depressed. The HUD EQUIP shall process the request. The computer requirements for the module are:

Memory size	22	16 bit words
Throughput	143	ms/sec
Update rate	N/A	times/sec

3.2.11.12.1 Inputs

The inputs to the HUD EQUIP shall be as specified in Table CXXXIII .

3. 2.11.12.2 Processing

The HUD EQUIP shall perform the processing specified in Figure 74 .

The HUD EQUIP is activated when the HUD Switch is depressed. The display status shall be read to determine if the declutter light is on or not. The MPDG is notified to make the appropriate change. The display status is updated.

3.2.11.12.3 Outputs

The outputs from the HUD EQUIP shall be as specified in Table CXXXIV .

TABLE CXXXIII INPUTS TO HUD EQUIP

DATA NAME	SYMBOL	SOURCE	REFERENCE
CHANGE REQUEST		HUD	
DISPLAY STATUS		DATA BASE	

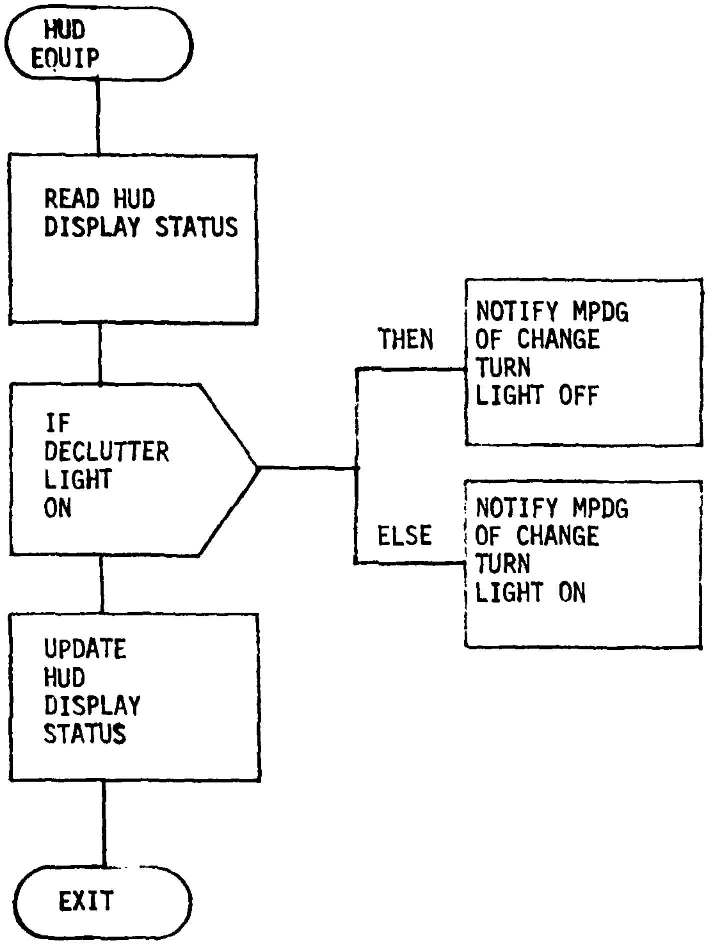

Figure 74 HUD EQUIP

TABLE CXXXIV OUTPUTS FROM HUD EQUIP

DATA NAME	SYMBOL	DESTINATION	REFERENCE
DISPLAY CHANGES		MPDG	
DISPLAY STATUS		DATA BASE	

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Introduction

Tests and evaluations shall be conducted to verify that the performance and design of the OFP-Application shall meet or exceed the requirements specified in Section 3.0. The test category, verification method, and test requirements for performance/design requirements are specified in the Verification Cross-Reference Index (VCRI), Table CXXXV . The requirements delineated shall be the basis for the test plan and test procedure which shall be written. The four methods given in Table of verifying individual requirements are explained as follows:

a. Inspection - Formal verification of a performance of a design requirement by examination of the assembled CPCI at the time and place of qualification testing. Inspection is not often specified as a formal means of verification for a requirement. One set of requirements that might be verified by inspection are the data base requirements, which can be verified by comparing the data base documentation with a system tape listing.

b. Analysis - Formal verification of a performance or design requirement by examination of the constituent elements of a CPCI component. For example, a cargo delivery guidance equation or a coordinate conversion equation might be verified by analysis.

TABLE CXXXV VERIFICATION CROSS REFERENCE INDEX

Method Legend: NA Not Applicable

1 - Inspection
2 - Analysis
3 - Demonstration
4 - Review of Test Data

A - Computer Program Test and Evaluation
B - Preliminary Qualification Test
C - Formal Qualification Test
II - Category II Test

SECTION 3 REQUIREMENT REFERENCE	METHOD					TEST CATEGORY				VERIFICATION REQUIREMENT
	NA	1	2	3	4	A	B	C	II	
3.2.1.1.1*		X				X				
3.2.1.1.2		X			X	X				4.2.2e
3.2.1.2.2		X		X			X			4.2.4, 4.2.2e
3.2.1.3.2		X			X		X			4.2.4, 4.2.2e
3.2.1.4.2		X			X	X	X			4.2.4, 4.2.2e
3.2.1.5.2					X		X			4.2.4
3.2.2.1.2		X		X	X		X	X		4.2.3f,4.2.4,4.2.2e
3.2.2.2.2		X		X	X		X	X		4.2.3f,4.2.4,4.2.2e
3.2.2.3.2		X		X	X		X	X		4.2.3f,4.2.4,4.2.2e
3.2.2.4.2		X		X	X		X	X		4.2.3f,4.2.4,4.2.2e
3.2.2.5.2		X		X	X		X	X		4.2.3f,4.2.4,4.2.2e
3.2.2.6.2		X		X	X		X	X		4.2.3f,4.2.4,4.2.2e
3.2.2.7.2		X		X	X		X	X		4.2.3f,4.2.4,4.2.2e
3.2.2.8.2		X		X	X		X	X		4.2.3f,4.2.4,4.2.2e
3.2.2.9		X	X		X		X			4.2.2c
3.2.2.10				X	X			X		4.2.3f
3.2.2.11			X		X	X	X			4.2.6,4.2.2c
3.2.2.12		X	X		X	X	X			4.2.6

*All inputs and output improvements shall be verified by comparing data base documentation with a system tape listing.

TABLE CXXXVI VERIFICATION CROSS REFERENCE INDEX (Cont.)

Method Legend: NA Not Applicable

1 - Inspection
2 - Analysis
3 - Demonstration
4 - Review of Test Data

A - Computer Program Test and Evaluation
B - Preliminary Qualification Test
C - Formal Qualification Test
II - Category II Test

SECTION 3 REQUIREMENT REFERENCE	METHOD					TEST CATEGORY				VERIFICATION REQUIREMENT
	NA	1	2	3	4	A	B	C	II	
3.2.3.1	X									
3.2.3.1.1		X				X				4.2.3c
3.2.3.1.2					X	X	X	X	X	4.2.2a
										4.2.3f
										4.2.3g
3.2.3.1.3										4.2.3c
3.2.3.2	X									
3.2.3.2.1		X				X				4.2.3c
3.2.3.2.2					X	X	X	X	X	4.2.2a
										4.2.3f
										4.2.3g
3.2.3.2.3		X				X				4.2.3c
3.2.3.3	X									
3.2.3.3.1		X				X				4.2.3c
3.2.3.3.2					X	X	X	X	X	4.2.2a
										4.2.3f
										4.2.3g
3.2.3.3.3		X				X				4.2.3c
3.2.3.4	X									
3.2.3.4.1		X				X				4.2.3c
3.2.3.4.2					X	X	X	X	X	4.2.2a
										4.2.3f
										4.2.3g

TABLE CXXXV VERIFICATION CROSS REFERENCE INDEX (Cont.)

Method Legend: NA Not Applicable

1 - Inspection
2 - Analysis
3 - Demonstration
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SECTION 3 REQUIREMENT REFERENCE	METHOD					TEST CATEGORY				VERIFICATION REQUIREMENT
	NA	1	2	3	4	A	B	C	II	
3.2.3.4.3		X				X				4.2.3c
3.2.3.5	X									
3.2.3.5.1		X				X				4.2.3c
3.2.3.5.2					X	X	X	X	X	4.2.2a
										4.2.3f
										4.2.3g
3.2.3.5.3		X				X				4.2.3c
3.2.3.6	X									
3.2.3.6.1		X				X				4.2.3c
3.2.3.6.2					X	X	X	X	X	4.2.2a
										4.2.3f
										4.2.3g
3.2.3.6.3		X				X				4.2.3c
3.2.3.7	X									
3.2.3.7.1		X				X				4.2.3c
3.2.3.7.2					X	X	X	X	X	4.2.2a
										4.2.3f
										4.2.3g
3.2.3.7.3		X				X				4.2.3c
3.2.3.8	X									
3.2.3.8.1		X				X				4.2.3c
3.2.3.8.2					X	X	X	X	X	4.2.2a
										4.2.3f
										4.2.3g
3.2.3.8.3		X				X				4.2.3c

TABLE CXXV VERIFICATION CROSS REFERENCE INDEX (Cont.)

Method Legend: NA Not Applicable

1 - Inspection	A - Computer Program Test and Evaluation
2 - Analysis	B - Preliminary Qualification Test
3 - Demonstration	C - Formal Qualification Test
4 - Review of Test Data	II - Category II Test

SECTION 3 REQUIREMENT REFERENCE	METHOD					TEST CATEGORY				VERIFICATION REQUIREMENT
	NA	1	2	3	4	A	B	C	II	
3.2.4.1				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.4.2				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.4.3				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.4.4				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.4.5		X				X	X			4.2.2c,e
3.2.4.6					X		X			4.2.6,4.2.5b
3.2.4.7		X	X		X	X	X			4.2.6,4.2.1a,4.2.2c
3.2.4.8		X	X		X	X	X			4.2.6,4.2.1a,4.2.2c
3.2.4.9			X		X	X	X			4.2.6
3.2.4.10		X	X		X	X	X			4.2.6,4.2.1a,4.2.2c
3.2.4.11		X	X		X	X	X			4.2.6,4.2.1a,4.2.2c
3.2.5.1				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.5.2				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.5.3				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.5.4				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.5.5				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.5.6				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.5.7				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.5.8				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.5.9				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.5.10				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.5.11		X			X	X	X			4.2.6,4.2.2c,e
3.2.5.12					X		X			4.2.6
3.2.5.13					X		X			4.2.6

TABLE CXXXVI VERIFICATION CROSS REFERENCE INDEX (Cont.)

Method Legend: NA Not Applicable

- 1 - Inspection
- 2 - Analysis
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SECTION 3 REQUIREMENT REFERENCE	METHOD					TEST CATEGORY				VERIFICATION REQUIREMENT
	NA	1	2	3	4	A	B	C	II	
3.2.6.1		X				X	X			4.2.2e
3.2.6.2			X	X		X	X			4.2.6
3.2.6.3			X	X		X	X			4.2.6
3.2.6.4			X	X		X	X			4.2.6
3.2.7.1				X	X			X		4.2.5a,4.2.3b,c,e
3.2.7.2				X	X			X		4.2.5a,4.2.3b,c,e
3.2.7.3				X	X			X		4.2.5a,4.2.3b,c,e
3.2.7.4				X	X			X		4.2.5a,4.2.3b,c.e
3.2.7.5				X	X			X		4.2.5a,4.2.3b,c,e
3.2.7.6				X	X			X		4.2.5a,4.2.3b,c,e
3.2.7.7				X	X			X		4.2.5a,4.2.3b,c,e
3.2.8.1		X	X		X	X				4.2.2c
3.2.8.2		X	X		X	X				4.2.2c
3.2.8.3			X		X	X	X			4.2.6
3.2.8.4		X	X		X	X	X			4.2.3f,4.2.2c
3.2.8.5		X	X		X	X	X			4.2.3f,4.2.2c
3.2.9.1				X	X			X		4.2.3a,b,c,e
3.2.9.2				X	X			X		4.2.3a,b,c,e
3.2.9.3				X	X			X		4.2.3a,b,c,e
3.2.9.4				X	X			X		4.2.5a
3.2.9.5		X	X			X				4.2.2c
3.2.10.1				X	X			X		4.2.5a,4.2.3a,b,c,e
3.2.10.2				X	X			X		4.2.5a,4.2.3a,b.c.e
3.2.10.3				X	X			X		4.2.5a,4.2.3a,b,c,e

TABLE CXXXVI VERIFICATION CROSS REFERENCE INDEX (Cont.)

Method Legend: NA Not Applicable

1 - Inspection
2 - Analysis
3 - Demonstration
4 - Review of Test Data

A - Computer Program Test and Evaluation
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C - Formal Qualification Test
II - Category II Test

SECTION 3 REQUIREMENT REFERENCE	METHOD					TEST CATEGORY				VERIFICATION REQUIREMENT
	NA	1	2	3	4	A	B	C	II	
3.2.11.1	X									
3.2.11.1.1		X				X				4.2.3c
3.2.11.1.2					X	X	X	X	X	4.2.1a
										4.2.3g
3.2.11.1.3		X				X				4.2.3c
3.2.11.2	X									
3.2.11.2.1		X				X				4.2.3c
3.2.11.2.2					X	X	X	X	X	4.2.3d,4.2.2b
										4.2.3g
3.2.11.2.3		X				X				4.2.3c
3.2.11.3	X									
3.2.11.3.1		X				X				4.2.3c
3.2.11.3.2					X	X	X	X	X	4.2.2e
										4.2.3g
3.2.11.3.3		X				X				4.2.3c
3.2.11.4	X									
3.2.11.4.1		X				X				4.2.3c
3.2.11.4.2					X	X	X	X	X	4.2.3g
3.2.11.4.3		X				X				4.2.3c
3.2.11.5	X									
3.2.11.5.1					X	X	X	X	X	4.2.3c
3.2.11.5.2					X	X	X	X	X	4.2.3g
										4.2.2c
3.2.11.5.3		X				X				4.2.3c

TABLE CXXXV VERIFICATION CROSS REFERENCE INDEX (Cont.)

Method Legend: NA Not Applicable

1 - Inspection
2 - Analysis
3 - Demonstration
4 - Review of Test Data

A - Computer Program Test and Evaluation
B - Preliminary Qualification Test
C - Formal Qualification Test
II - Category II Test

SECTION 3 REQUIREMENT REFERENCE	METHOD					TEST CATEGORY				VERIFICATION REQUIREMENT
	NA	1	2	3	4	A	B	C	II	
3.2.11.6	X									
3.2.11.6.1		X				X				4.2.3c
3.2.11.6.2					X	X	X	X	X	4.2.3g
3.2.11.6.3		X				X				4,2,3c
3.2.11.7	X									
3.2.11.7.1		X				X				4.2.3c
3.2.11.7.2					X	X	X	X	X	4.2.2e 4.2.3g
3.2.11.7.3		X				X				4.2.3c
3.2.11.8	X									
3.2.11.8.1		X				X				4.2.3c
3.2.11.8.2					X	X	X	X	X	4.2.3g
3.2.11.8.3		X				X				4.2.3c
3.2.11.9	X									
3.2.11.9.1		X				X				4.2.3c
3.2.11.9.2					X	X	X	X	X	4.2.3g 4.2.2c
3.2.11.9.3		X				X				4.2.3c
3.2.11.10	X									
3.2.11.10.1		X				X				4.2.3c
3.2.11.10.2					X	X	X	X	X	4.2.3g
3.2.11.10.3		X				X				4.2.3c

TABLE CXXXV VERIFICATION CROSS REFERENCE INDEX (Cont.)

Method Legend: NA Not Applicable

1 - Inspection
2 - Analysis
3 - Demonstration
4 - Review of Test Data

A - Computer Program Test and Evaluation
B - Preliminary Qualification Test
C - Formal Qualification Test
II - Category II Test

SECTION 3 REQUIREMENT REFERENCE	METHOD					TEST CATEGORY				VERIFICATION REQUIREMENT
	NA	1	2	3	4	A	B	C	II	
3.2.11.11	X									
3.2.11.11.1		X				X				4.2.3c
3.2.11.11.2					X	X	X	X	X	4.2.3f 4.2.3g
3.2.11.11.3		X				X				4.2.3c
3.2.11.12	X									
3.2.11.12.1		X				X				4.2.3c
3.2.11.12.2					X	X	X	X	X	4.2.3f 4.2.3g
3.2.11.12.3		X				X				4.2.3c

c. Demonstration - Formal verification of a performance or design requirement by observation of a demonstration test. For example, visual demonstration might be used to verify that the displays generated by the CPCI are in the format necessary to satisfy human performance requirements.

d. Review of Test Data - Formal verification of a performance or design requirement by examining the data output after operation of a CPCI component when selected input data are processed. For example, a review of hardcopy printout test data might be used to verify that the content of a specific told-in message is correctly processed. This method is the one likely to be used for the majority of qualification testing.

Narrative data pertaining to test categories, amplifying the tabular content of the VCRI are specified in subparagraphs below. Test requirements referenced in the VCRI are specified in 4.2 and subparagraphs thereto.

4.1.1 Category I Test

Category I testing is subdivided into the following broad types;

a. Computer program test and evaluation - Tests conducted prior to and in parallel with preliminary or formal qualification tests. These tests are oriented primarily to support the design and development process.

b. Preliminary Qualification Tests - Formal tests oriented primarily towards verifying portions of the CPCI prior to integrated testing/formal qualification tests of the complete CPCI (see paragraph 4.1.3 below). These tests will typically be conducted in the contractor's design and development facilities.

c. Formal Qualification Tests - Formal tests oriented primarily towards testing of the integrated CPCI, normally using operationally configured equipment at the Category II site prior to the beginning of Category II testing. This testing will emphasize those aspects of the CPCI performance which were not verified by preliminary tests. The testing requirements which cannot be verified during Category I test shall be specified in paragraph 4.1.5.

Qualification of this CPCI shall be accomplished during qualification testing to the maximum extent possible, as a result of preliminary qualification tests (POT) and formal qualification test (FQP) conducted by the contractor and witnessed/verified by the procuring activity.

4.1.2 Computer Programming Test and Evaluation

Programming test and evaluation which apply satisfy one or both of the following criteria:

(1) They are intended to be the only source of data to qualify specific requirements in Section 3.

(2) They must be accomplished as part of an integrated test program involving other systems/equipment/ comput er programs.

4.1.3 Preliminary Qualification Tests

These tests will directly support the top-down implementation and verification. Method of verification shall be as specified in Table CXXXV . The following three levels of qualification shall be performed.

a. Unit Design Qualifications shall apply to each module. At this level the characteristics which are of primary interest are the internal workings of the module; logical flow control, numerical results, convergence, scaling, and range.

b. Module Design Qualifications shall apply to each module after it is interfaced with its environment. These tests are basically interface tests; correct internal operations are assumed. The object is to verify that two or more modules work together. To comply with the top-down approach the interfacing tests shall be sequenced from the top to the bottom.

c. System Design Qualifications shall apply to the completely assembled CPCI. THis level requires a totally integrated computer program. Such testing discloses errors due to conflicts introduced by data sharing convention violations, improper range of input values, sequencing requirements and communications and control. The internal working of the CPCI is of primary concern with the interfaces of the CPCI with the external environment deferred to the Formal Qualification Tests.

4.1.4 Formal Qualification Tests (Specified in Part II Specifications)

4.1.5 Category II Tests (Specified in the Part II Specifications)

4.2 Verification Requirements

This paragraph specifies in greater detail the method used to verify the individual requirements given in Table CXXXV . (This table cross-references the subparagraphs of 4.2 which apply).

4.2.1 Performance

The specified function shall be verified with respect to one of the following performance criteria.

a. Accuracy which may be affected by input precision, input frequency, input accuracy, or number of iterations.

b. Response time.

c. Long term degradation.

d. Stability

4.2.2 Priority/Timing

The specified function shall be verified with respect to one of the following priority/timing criteria:

a. Interrupt and return

b. Frequency

c. Consistency in events

d. Order of processing

e. Scheduling/cancelling consistency

f. Job stacking

4.2.3 Interfaces

The specified function shall be verified with response to one of the following interface parameters:

a. Data locks

b. Range

c. Consistency

d. Initialization

e. Data organization

f. Human command/response

g. External procedures

4.2.4 Logic Paths

The specified function shall be verified with respect to the correctness of the logic paths by exercising the computer program in operation.

4.2.5 Off-Nominal Conditions

The specified function shall be verified with respect to off-nominal conditions such as:

a. Error detection

b. Error recovery

c. Limitations

4.2.6 Mathematical Model Validity

The specified function shall be verified by tests conducted on the CPCI with the physical environment simulated to determine the correctness of mathematical models included in the function.

6.0 NOTES

6.1 Traceability of Requirements and Software Functional Modules

This section shows the traceability of the requirements to software functions as derived from the Functional Sequence Diagram (FSD) analysis as provided in the IDAMST Technical Report. This traceability is shown in Tables CXXXVI to CXVIII for the different software functional areas.

6.2 Hierarchical Control Tree

Following the design requirement of the DAIS software architecture standards, the IDAMST application software is structured in a hierarchical control tree. The structure is based on the scheduling of the lower level tasks by higher level tasks. Lower level tasks can influence higher level tasks by setting events which cause tasks to become active.

The hierarchical control tree down to the third level is shown in Figure 75 . A typical lower level structure is shown in Figure 76 .

TABLE CXXXVI TRACEABILITY OF REQUIREMENTS AND SOFTWARE MODULES - COMMUNICATION

FSD REQUIREMENTS	SOFTWARE FUNCTIONAL MODULE
1. Monitor and control HF/SSB Radio	HF Transceiver EQUIP, All OPS, Comm BF Spec
2. Monitor and control VHF/AM Radio	VHF/AM Transceiver EQUIP, All OPS, Comm BF Spec
3. Monitor and control UHF Radio	UHF Transceiver EQUIP, All OPS, Comm BF Spec
4. Monitor and control VHF/FM Radio	VHF/FM Transceiver EQUIP, All OPS, Comm BF Spec
5. Monitor and control secure voice unit	Secure voice EQUIP, All OPS, Comm BF Spec
6. Control Int ercom Unit	Intercom Equip, All OPS, Comm BF Spec
7. Control Public Address Unit	Public Address Equip, All OPS, Comm BF Spec

TABLE CXXXVII TRACEABILITY OF REQUIREMENTS AND SOFTWARE MODULES - MISSION MANAGEMENT

FSD REQUIREMENTS	SOFTWARE FUNCTIONAL MODULE
1. Respond to Master Mode Request	Preflight-OPS, Takeoff/Climb OPS, Cruise OPS, Refuel OPS, Air Drop OPS, Descend OPS, Approach/Land OPS, Post-flight OPS
2. Provide Checklist	Preflight OPS, Takeoff/Climb OPS, Cruise OPS, Refuel OPS, Air Drop OPS, Descend OPS, Approach/Land OPS, Post-flight OPS, Checklist OPS
3. Compute Take-Off Propulsion Requirements	Takeoff Speed Spec
4. Compute Approach Speed Requirements	Approach Speed Spec
5. Take-Off to Climb Master Mode Change	Takeoff/Climb OPS, Airframe Sensor Equip
6. Provide Flight Plan Data	MPD Disp
7. Provide Standard Instrument Departure (SID) and Standard Terminal Arrival Route (STAR)	MPD Disp
8. Notify Pilot of Altimeter Setting Change at 18000 Ft	Altimeter Warning Spec
9. Turn on of Preprogrammed Suite and Conditions	Preflight OPS
10. Provide Descent Profiles	Descent Profile Spec

TABLE CXXXVIII TRACEABILITY OF REQUIREMENTS AND SOFTWARE MODULES - NAVIGATION

FSD REQUIREMENTS	SOFTWARE FUNCTIONAL MODULE
1. Monitor and Control INS	INS Equip, All OPS, NAV Brute Force Spec
2. Monitor and Control OMEGA Set	OMEGA Equip, All OPS, NAV Brute Force Spec
3. Monitor and Control TACAN Set	TACAN Equip, All OPS, NAV Brute Force Spec
4. Provide Wind and Dead Reckoning Ground Speed	Wind Computation Air Data Dead Reckoning
5. Monitor and Control AHRS	AHRS Equip, All OPS, NAV Brute Force Spec

TABLE CXXXIX TRACEABILITY OF REQUIREMENTS AND SOFTWARE MODULES - GUIDANCE

FSD REQUIREMENTS	SOFTWARE FUNCTIONAL MODULE
1. Monitor and Control Radar Set	Multi-Mode Radar Equip, All OPS, Sensor BF Spec
2. Monitor and Control SKE	SKE Equip, All OPS, System BF Spec
3. Monitor and Control ILS	ILS Equip, Approach/Landing OPS SystemBF Spec
4. Monitor and Control UHF ADF	UHF/ADF Receiver Equip, All OPS, SystemBF Spec
5. Monitor and Control LF ADF	LF/ADF Receiver Equip, All OPS, System BF Spec
6. Monitor and Control Radar Altimeter	Radar Altimeter Equip, All OPS, System BF Spec'
7. Monitor and Control Radar Beacon	Radar Beacon Equip, All OPS, System BF Spec
8. Compute Steering Commands	Waypoint Steering Spec, Steering Computation Spec
9. Compute ETA	Waypoint Steering Spec
10. Display Area Chart and Holding Pattern	Approach/Landing OPS, MPDG Equip

TABLE CXV TRACEABILITY OF REQUIREMENTS AND SOFTWARE MODULES - VEHICLE DEFENSE/IDENTIFICATION

FSD REQUIREMENTS	SOFTWARE FUNCTIONAL MODULE
1. Monitor and Control ESM Unit	ESM Equip, All OPS, System BF Spec
2. Monitor and Control IRD&W Unit	IR Detector Equip, All OPS, System BF Spec
3. Monitor and Control IFF Unit	IFF Transponder Equip, All OPS, System BF Spec

TABLE CXVI TRACEABILITY OF REQUIREMENTS AND SOFTWARE MODULES - CARGO DELIVERY

FSD REQUIREMENTS	SOFTWARE FUNCTIONAL MODULE
1. Compute CARP	CARP Spec
2. Relative Coordinates	Relative Coordinate Spec
3. Compute Cargo Release Path	Cargo Release Path Spec
4. Drop Zone Warning	Drop Zone Warning Spec

TABLE CXVII TRACEABILITY OF REQUIREMENTS AND SOFTWARE MODULES - TARGET ACQUISITION

FSD REQUIREMENTS	SOFTWARE FUNCTIONAL MODULE
1. Compute Relative Coordinates	Relative Coordinate Spec
2. Compute Target Offset	Target Offset Computation
3. Compute HUD Update	HUD Visual Update
4. Compute Radar Update	Radar
5. Compute SKE Update	SKE Computation Spec

TABLE CXXVIII TRACEABILITY OF REQUIREMENTS AND SOFTWARE MODULES - AIRFRAME MONITOR

FSD REQUIREMENTS	SOFTWARE FUNCTIONAL MODULE
1. Monitor Engine Parameters	Engine Sensor.Equip, Airframe Computation
2. Monitor Anti-Skid	Airframe Sensor Equip, Airframe Computation
3. Monitor Control Surfaces	Airframe Sensor Equip, Airframe Computation
4. Monitor Aerial Refueling	Airframe Sensor Equip, Airframe Computation
5. Compute Center of Gravity	Center of Gravity Spec

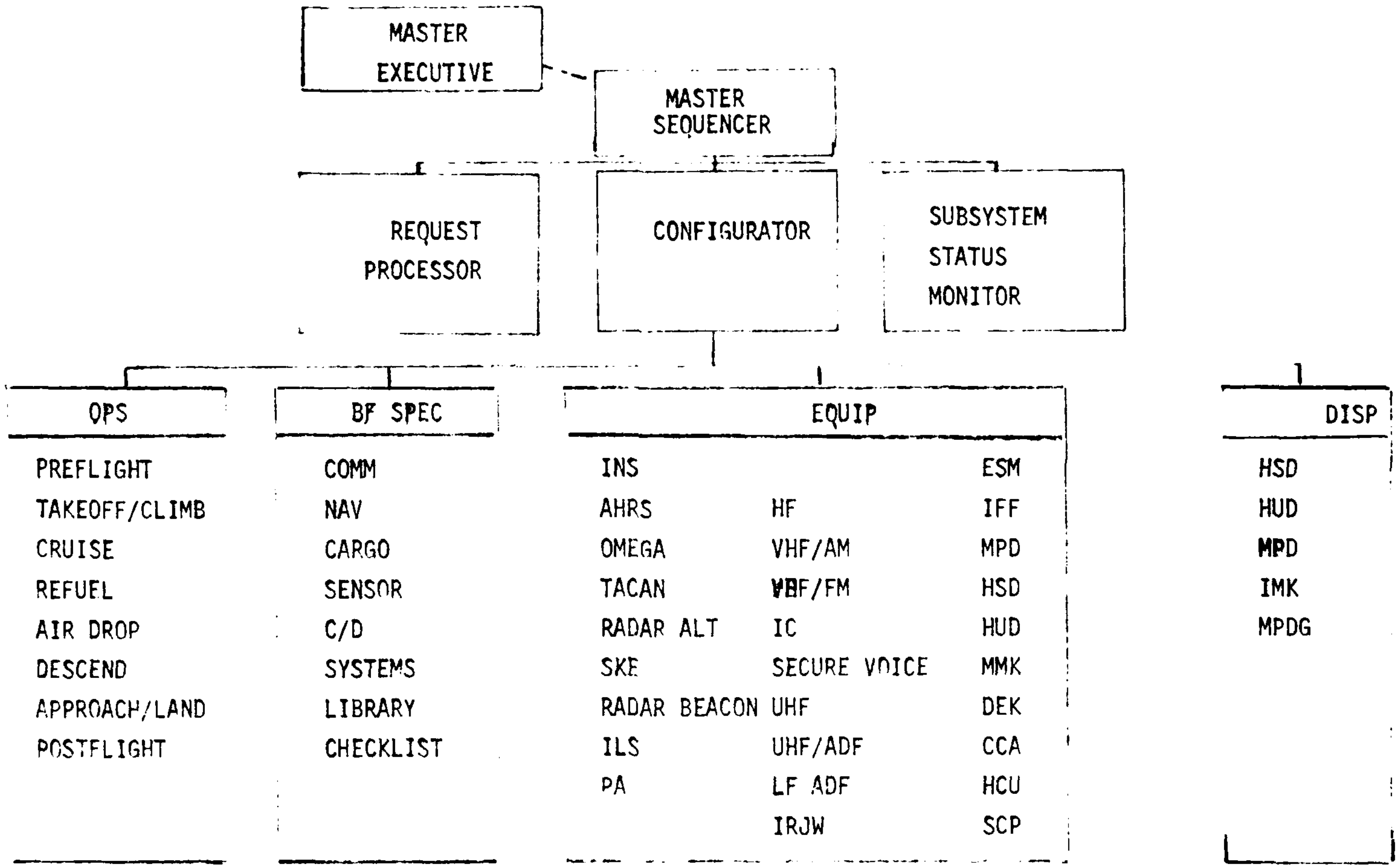

Figure 75 Hierarchical Control Tree For OPF-Applications

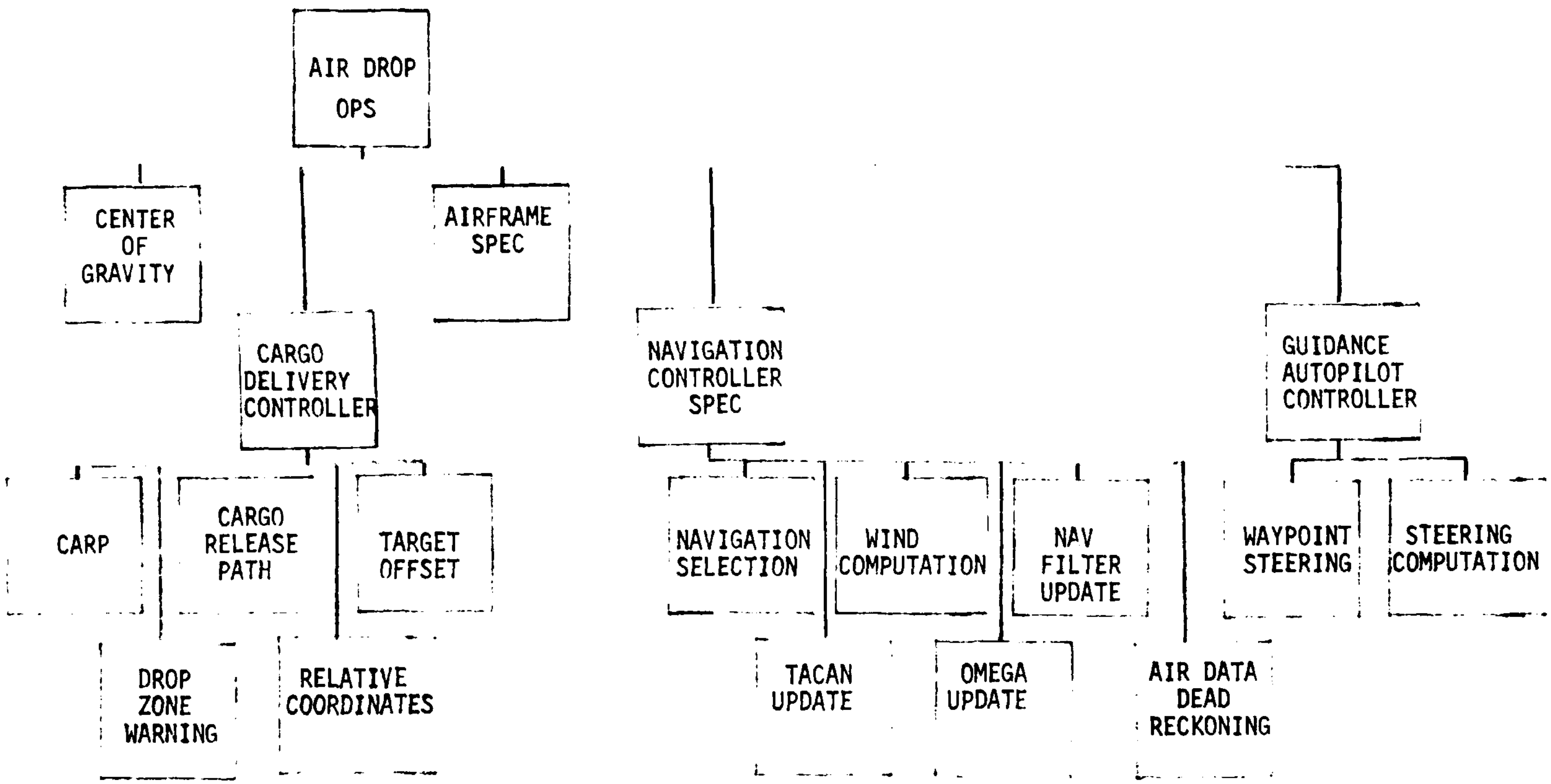

Figure 76 Lower Level Control Structure
Air Drop OPS