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FUNCTION SPECIFICATIONS FOR THE A-7E FUNCTION DRIVER MODULE.(U)

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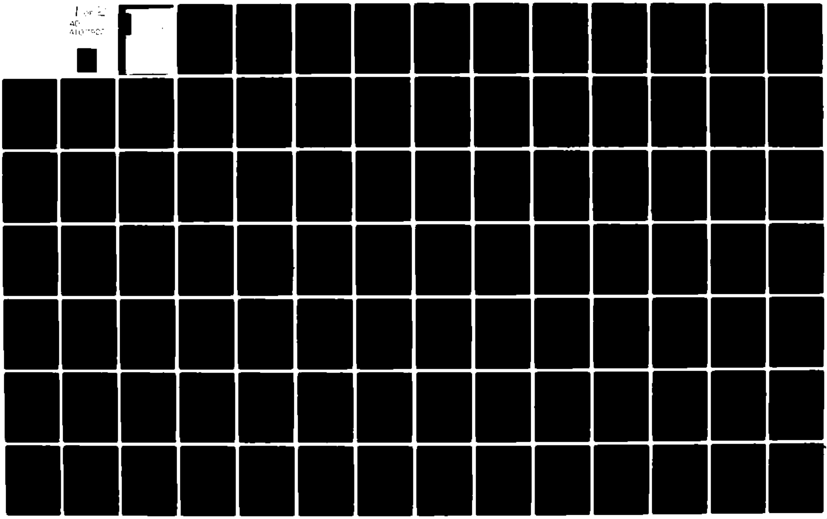

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

As part of the experimental redesign of the flight software for the Navy's A-7E aircraft, software modules were designed to encapsulate the characteristics of the behavioral requirements of the system. The purpose of these Function Driver modules is to allow the remainder of the software to remain unchanged when the required system behavior is modified without associated hardware changes. This document specifies the behavior of the system without regard to specific hardware devices.

(Continues)

20. ABSTRACT (Continued)

This report contains an explanation of the standard organization of each functional description, a description of the review procedures, specifications for all of the functional aspects of the A-7E software, and a set of indices and cross-references to help integrate this module with the rest of the system.

As well as serving as development and maintenance documentation for the A-7E redesign, this document is intended to serve as a model for other people interested in applying our documentation and structuring techniques to other software projects.

Preface

The Operational Flight Program (OFP) for the Navy's A-7E aircraft is considered a successful program: it works reliably. However, it is expensive to maintain because it has problems typical of much DoD software:

* it barely meets its time and space limitations;

* it is not fully understood by the maintenance personnel;

* it is poorly documented; and

* it is difficult to change.

Although various software engineering techniques have been proposed to deal with such problems, there is a widespread reluctance to modify or abandon current techniques which, despite the problems mentioned above, are the basis for many acceptable programs such as the A-7E OFP. Two reasons for this reluctance are:

* No one has proven that the new techniques are useful in the DoD context of complicated requirements and stringent resource limitations.

* There are no fully worked out examples that system developers can use as models in applying the new techniques to DoD systems.

In order to demonstrate feasibility and to provide a useful model, the Naval Research Laboratory (NRL) and the Naval Weapons Center (NWC) have embarked on a joint project in which certain software engineering techniques will be used to redesign and rebuild the A-7E OFP. Among the techniques being used are the following:

* modularity and information hiding

* formal specifications

* abstract interfaces

* cooperating sequential processes

* process synchronization routines

* resource monitors

The first product of the project was /1/. It describes the externally visible behavior required of the A-7 OFP without describing an OFP implementation. The second product of the project was /2/. It describes abstract interfaces for hardware devices connected to the aircraft computer so that changes to those devices do not result in changes to the rest of the software.

The redesigned software is divided into modules according to the information-hiding principle. For each module, we will provide two types of documentation: interface specifications, showing the externally visible characteristics of the module, and abstract programs, showing the internal implementation decisions made for the module.

This report is the third published product of the project. It includes informal specifications for the function driver modules, which are responsible for causing the externally visible behavior of the system by invoking the requirements rules that specify how each system output is a function of the aircraft state.

This report is intended to serve as an example of good module documentation. It describes module interfaces without giving away implementation details. It also demonstrates the design of a systematic procedure for reviewing module interface designs.

Preface References

/1/ Heninger, K., et al.; Software Requirements for the A-7E Aircraft, NRL Memorandum Report 3876; November 1978.

/2/ Parker, A., et al.; Abstract Interface Specifications for the A-7E Device Interface Module, NRL Memorandum Report 4385; November 1980.

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Appendices

Function Driver Module: Standard Organization

References

CLEM81 Clements, Interface Specifications for the A-7 Shared Servfces Module; draft in preparation; dated February, 1981.

HENI78 Heninger, Kallander, Parnas, Shore, Software Requirements for the A-7E Aircraft; NRL Memorandum Report 3876; November, 1978.

HENI81 Heninger, Weiss, Interface Specifications for the A-7 Extended Computer Module; draft in preparation; dated January, 1981.

PARK80 Parker, Heninger, Parnas, Shore, Abstract Interface Specifications for the A-7E Device Interface Module; NRL Memorandum Report 4385; November, 1980.

This introduction defines and explains the format and conventions used for the functional specifications of the Function Driver (FD) modules. In the following, the terms "function", "Function Driver module", and "function driver" are all used interchangeably.

Each Function Driver module specification consists of the following:

1. Title line. This consists of the function number, a note indicating whether the function is demand or periodic, and a brief phrase explaining the function's purpose. The function number is of the form "FD.n.m"; 'n' is an integer from 1 to 14, and corresponds to a virtual device, as defined in Table FD.SO-a; 'm' is a sequence number to differentiate among functions that control the same virtual device.

2. Mnemonic. This is the function identifier, containing an abbreviated form of the device that the function drives. The dictionary of device abbreviations is in Table FD.SO-a. Each mnemonic is suffixed with either a '_D' (for a demand function), or '_P' (for a periodic function).

3. Output produced. Each function is responsible for generating some output value (usually just one). The value is used to direct some user-controllable feature of the Extended Computer (EC), or to drive a virtual device in the Device Interface Module (DIM). This section describes the value(s) generated, the data type(s), and the DIM or EC access program(s) to use.

4. Initiation/termination events (for periodic functions only). This section lists the events that must occur for the function to begin and end its operation, respectively. This information may be presented in the form of an event table. Sometimes, it is necessary to invoke a DIM access program at initiation or termination time. For instance, when a periodic function that updates a HUD symbol position terminates, the symbol might be removed from view. Therefore, invoking the program that removes the symbol is associated with the function's termination event. In such cases, where a program call is required concurrent with initiation or termination, the appropriate program is listed at the bottom of the event table.

5. Function definition. This section defines the output values as a function of conditions, events, and system modes. For periodic functions, this information is almost always in the form of a condition or selector table. For demand functions, this information is almost always in the form of an event table. These kinds of tables are described in Section 0.3 of HENI78; events are defined here as well. The modes in each row of the tables are listed alphabetically by class (e.g., navigation, alignment, weapon delivery, etc.), and modes in different classes are separated by a blank line.

For periodic functions, the specified conditions and input values should be re-evaluated once per execution cycle. For demand functions, which are driven by events, the output values that will be passed to the access programs should be derived or obtained only after the driving event occurs.

6. Local dictionary: If any local terms (denoted by "!!" brackets) have been used in a specification, then a local dictionary will be included to define each such term. Usually, a local term is created when a complex expression appears several times throughout a specification. When practical, the terms are ordered in the local dictionary so that no forward references are used. If a function has no local terms, there is no local dictionary.

7. Design issues: If any non-obvious design decisions were made during the creation of a specification, they are documented in this section. A typical design decision is why a certain function differs in organization or pairing from its Requirements Document counterpart. This section is omitted if no controversial decisions were made.

Overall assumptions:

The following are assumed by all Function Driver modules:

1. The virtual devices and their interfaces are accurately described in the Device Interface Module interface specifications (PARK80). The Extended Computer interfaces are accurately described in the Extended Computer interface specifications (HENI81). The services and values provided by the Shared Services module are accurately described in the Shared Services Module interface specificatons (CLEM81). The values provided by the Data Banker are accurately described by the Data Banker Module interface specifications (to be drafted). The values and services provided by the Physical Models module are accurately described by the Physical Models Module specifications (to be drafted).

2. The values provided by the Data Banker are sufficiently accurate and current to allow the system requirements to be met.

3. An event is signalled soon enough after the event actually occurs to allow the system requirements to be met.

4. Every DIM or EC access program listed in the Output section of a Function Driver module specification is used by exactly one Function Driver module, and by no other module.

5. It is possible to avoid generating undesired events through incorrect use of the DIM or EC access programs. How to do so is conveyed in the DIM and EC specifications, respectively, and does not appear in the Function Driver material.

6. The event @T(!+Init complete+!) causes entry into some navigation or alignment mode.

7. The system cannot simultaneously be in two modes that appear in *different* rows in any condition table. The description of which modes the system may be in at the same time is described in the interface to the mode determination module in (CLEM81).

Note that the Function Driver programs will be considered correct *even if any of the above assumptions are not true.*

Selector Table FD.SO-a: FD References to Virtual Devices

n	Mnemonic Abbreviation	Virtual Device
1	ADC	Air data computer
2	AUDSIG	Audible signal (Bomb tone)
3	COMP_FAIL	Computer fail signal
4	DRS	Doppler radar set
5	ADI, HSI, DME	Flight information displays
6	FLR	Forward-looking radar
7	HUD	Head-up display
8	IMS	Inertial measurement set
9	PNL	Computer panel
10	MAP	Projected map display set
11	SINS	Shipboard inertial navigation system
12	AUTOCAL, IMS_NA	Visual indicators
13	WEAP	Weapon release
14	GRTEST	Extended Computer self-test

Notation Conventions Used in Tables:

1. Factoring of values. "!+Term+! = $Value1$ OR $Value2$" is written instead of "!+Term+! = $Value1$ OR !+Term+! = $Value2$".

2. Omission of boolean values. For boolean-valued terms, "!+Term+!" is written instead of "!+Term+! = true" and "NOT !+Term+!" is written instead of "!+Term+! = false".

3. Equivalent events. Let "B" be a boolean condition. The event @F(A) is equivalent to the event @T(not A), and may be written as such for contextual consistency.

Coordinate System

The airframe coordinate system has axes Xa, Ya, and Za. The Ya axis lies along the aircraft boresight line with the positive direction being forward (toward nose, from tail). The positive Xa axis points out in the direction of the right wing and is defined so that the Xa-Ya plane is horizontal and the positive Za axis points upward when the aircraft wings are level and the aircraft is right side up.

FD.1 ADC functions

FD.1.1 DEMAND FUNCTION DESCRIPTION: Set the ADC sea level pressure.

Mnemonic: +FD_SET_ADC_SLP_D+

Output produced:

Item	Type	Access program
Sea level pressure	pressure	+DI_S_ADC_SLP+

Function definition:

Event Table FD.1.1-a -- Setting the ADC sea level pressure

MODES	EVENTS	
All alignment and navigation modes	@T(!!destnot0!!) OR @T(!+Init complete+!) WHEN(!!destnot0!!) OR @T(!!flyto nonzero!!) OR @T(!+New dest mslp pnl entered+!) WHEN(!+dest entry pnl+! = !+Fly to num+!)	@T(!!mark!! OR !!dest0!!) OR @T(!+Init complete+!) WHEN(!!mark!! OR !!dest0!!)
Output value:	!!dest mslp!!	29.92" Hg

Local dictionary:

Term	Definition
!!dest mslp!!	!+dest mslp pnl+!, indexed by !+Fly to num+!.
!!dest0!!	!+Fly to state+! = $Dest$ AND !+Fly to num+! = 0
!!mark!!	!+Fly to state+! = $Mark$
!!destnot0!!	!+Fly to state+! = $Dest$ AND !+Fly to num+! noteq 0
!!flyto nonzero!!	@T(!+Fly to num changed+!) and the new !+Fly to num+! is not zero.

FD.1.2 DEMAND FUNCTION DESCRIPTION: Set the ADC Reconfiguration value.

Mnemonic: +FD_ADC_RECONFIG_D+

Output produced:

Item	Type	Access program
L-probe switch	boolean	+DI_S_ADC_LPROBE+

Function definition:

Event Table FD.1.2-a -- ADC reconfiguration value update

MODES	EVENTS
All navigation and alignment modes	@T(!+New L-probe pnl entered+!)

Output value: !+L-probe pnl+!

```
*******************************************************************************
*                                                                             *
*                 FD.2          Audible signal functions                   *
*                                                                             *
*******************************************************************************
```

FD.2.1 <u>DEMAND FUNCTION DESCRIPTION:</u> Control the audible signal.

Mnemonic: +FD_AUDSIG_SW_D+

Output produced:

Item	Type	Access program
Audible signal mode	ind_cntrl	+DI_S_AUDIBLE_SIGNAL+

Function definition:

Event Table FD.2.1-a -- Audible signal control

MODES	EVENTS		
NBShrike	@T(!+RE pressed+!) WHEN(!+desig+!)	@F(!+RE pressed+!) OR @T(!+time to prepare+!) WHEN(!+desig+!)	X
NBnot- Shrike	@T(!+RE pressed+!) WHEN(!+desig+!)	@T(!+Rel in Progress+!) OR @F(!+RE pressed+!)	X
A/A Manrip *CCIP* *Manrip*	@T(!+RE pressed+!)	@F(!+RE pressed+!)	X
A/G Guns	@T(!+RE pressed+!) WHEN(!+Weapon Class+! = RK)	@T(!+Rel in Progress+!) OR @F(!+RE pressed+!)	X
Walleye	@T(!+RE pressed+!)	@T(!!time tone on!! gteq 1 sec)	X
LoNuke	@T(!+Rmax+!) OR @T(!+Rmin+!) OR @T(!+RE pressed+!) WHEN(!+desig+!)	@T(!!time since Rmax!! gteq 1 second) OR @T(!+Rmin+6000+!) OR @T(!+pitch IMS+! gt 15° AND NOT !+RE pressed+!) OR @T(!+Rel in Progress+!) OR @T(!!time beeped!! gt 2 sec)	@T(!+R65+!)
HiNuke	@T(!+RE pressed+!) WHEN(!+desig+!)	@T(!+RE pressed+!) OR @T(!+Rel in Progress+!) OR @T(!!time beeped!! gt 2 sec)	
Output value:	On	Off	$Intermittent$

Local dictionary:

Term	Definition
!!time beeped!!	elapsed time since last call to +DI_S_AUDIBLE_SIGNAL+($Intermittent$)
!!time tone on!!	elapsed time since last call to +DI_S_AUDIBLE_SIGNAL+(On)
!!time since Rmax!!	elapsed time since @T(!+Rmax+!) occurred.

Design issues:

1. Whether to set the audible signal's beep rate before turning the signal on intermittently. It was decided not to do so, because under the current requirements, this is the only function to cause the signal to beep; therfore, the signal is only beeped at one rate (the system default rate), which need not be changed.

FD.2.2 FUNCTION DESCRIPTION: Set the audible signal beep rate.

Mnemonic: +FD_AUDSIG_BEEPRATE+

Output produced:

Item	Type	Access program
New beep rate	real	+DI_S_BEEP_RATE+

Function definition:

This function is never performed, because under the current requirements, the beep rate never needs to be changed from its default value. However, should the requirements change and another beep rate be called for, this function would have the responsibility for setting the new value.

FD.3 Computer fail signal functions

FD.3.1 DEMAND FUNCTION DESCRIPTION: Signal tactical computer failure.

Mnemonic: +FD_COMP_FAIL_SIG_D+

Output produced:

Item	Type	Access program
Computer fail signal	boolean	+DI_S_COMPUTER_FAIL_SIGNAL+

Function definition:

Event Table FD.3.1-a -- Signalling computer failure

MODES	EVENTS	
All modes	@T(!+Failed state+!)	@T(!+Init complete+!)
Output value:	true	false

```
****************************************************************************
*                                                                          *
*                  FD.4             Doppler radar functions                *
*                                                                          *
****************************************************************************
```

FD.4.1 DEMAND FUNCTION DESCRIPTION: Start and stop the Doppler radar.

Mnemonic: +FD_DRS_CNTRL_D+

Output produced:

Item	Type	Access program
To start the DRS	--	+DI_START_DRS+
To stop the DRS	--	+DI_STOP_DRS+

Function definition:

Event Table FD.4.1-a -- Turning the Doppler radar on and off

MODES	EVENTS	
All alignment and navigation modes	@T(!+In flight+!)	@F(!+In flight+!)
Function call:	+DI_START_DRS+	+DI_STOP_DRS+

```
*********************************************************************************
*                                                                               *
*                 FD.5             Flight information display functions         *
*                                                                               *
*********************************************************************************
```

FD.5.1.1 PERIODIC FUNCTION DESCRIPTION: Set ADI azimuth indicator display.

Mnemonic: +FD_ADI_AZ_DISPLAY_P+

Output produced:

Item	Type	Access program
ADI azimuth display	angle	+DI_S_ADI_AZIMUTH_INDICATOR+

Initiation/termination events:

None. Always performed.

Function definition:

Condition Table FD.5.1.1-a -- Setting the ADI azimuth display

MODES	CONDITIONS		
Airaln All nav modes; No mode listed below; *Walleye*	NOT !+in_flight+! OR !+fly to num+! = 0	!+in_flight+! AND !+fly to num+! noteq 0	X
HUDdown1 *Nattack* *SHUDdown1* *Snattack*	NOT !+desig+! AND !+fly to num+! = 0	NOT !+desig+! AND !+fly to num+! noteq 0	!+desig+!
HUDdown2 *Noffset* *SHUDdown2* *Snoffset*	X	NOT !+desig+!	!+desig+!
BOC *SBOC*	X	X	Always
BOCFlyto0 *SBOCFlyto0*	NOT !+desig+!	X	!+desig+!
BOCoffset *SBOCoffset*	X	NOT !+desig+!	!+desig+!
OUTPUT VALUE:	0	!!steering error to ftpt!!	!+steering error to tgt+!

Local dictionary:

Term	Definition
!!steering error to ftpt!!	!+brg_grtk_tgt+!, if 0 lseq !+brg_grtk_tgt+! lseq 180 degrees; (!+brg_grtk_tgt+! - 360 degrees) if !+brg_grtk_tgt+! gt 180 degrees.

Design issue:

The Requirements dictate that the output value must be between -2.5 degrees and +2.5 degrees, as these are the limits of the display. This Function Driver does not perform this limiting, because the DIM's virtual ADI does that check and limiting automatically anyway. To perform the calculation here would be to invite duplicate code.

FD.5.1.2 PERIODIC FUNCTION DESCRIPTION: Set the ADI elevation indicator.

Mnemonic: +FD_ADI_ELEV_P+

Output produced:

Item	Type	Access program
ADI elevation indication	angle	+DI_S_ADI_ELEV_INDICATOR+
To display or remove indicator from view	boolean	+DI_S_ADI_ELEV_IN_VIEW+

Initiation/termination events:

Event Table FD.5.1.2-a -- When ADI elevation indicator is updated

MODES	INITIATION EVENTS	TERMINATION EVENTS
IMS fail All alignment modes except *Airaln* **NBShrike**	X	@T(In mode)
HiNuke **NBnotShrike** *Walleye*	@F(ABS(!+LSC elevation+!) gt 4 degrees)	@T(ABS(!+LSC elevation+!) gt 4 degrees)
LoNuke	@F(ABS(!+PUAC elevation+!) gt 4 degrees)	@T(ABS(!+PUAC elevation+!) gt 4 degrees)
Function call:	+DI_S_ADI_ELEV_IN_VIEW+ (true)	+DI_S_ADI_ELEV_IN_VIEW+ (false)

The function also terminates when @F(!+ADI elev avail+!) occurs. No function call is associated with this termination event.

Function definition:

Condition Table FD.5.1.2-b -- Setting the ADI elevation display

MODES	CONDITIONS		
HiNuke **NBnotShrike** *Wa!leye*	Always	X	X
LoNuke	X	NOT !!ac inverted!!	!!ac inverted!!
Output value:	!+LSC elevation+!	!+PUAC elevation+!	- !+PUAC elevation+!

Local dictionary

Term	Definition
!!a/c inverted!!	ABS(!+roll IMS+!) gt 90 degrees

FD.5.2.1 PERIODIC FUNCTION DESCRIPTION: Set HSI pointer 1 and DME display.

Mnemonic: +FD_HSI1_DME_P+

Output produced:

Item	Type	Access program
HSI 1 display	angle	+DI_S_HSI_POINTER_1+
DME display	integer	+DI_S_DME_DISPLAY+
To show/hide the DME flag	boolean	+DI_S_DME_FLAG+

Initiation/termination events:

None. Always performed.

Function definition:

Condition Table FD.5.2.1-a -- Setting HSI pointer 1 and DME displays

MODES	CONDITIONS	
All alignment and navigation modes with no modes listed below; *A/G Guns* *Walleye*	!+fly to num+! = 0	!+fly to num+! noteq 0
HUDdown1 *Nattack* *SHUDdown1* *Snattack*	NOT !+desig+! AND !+fly to num+! = 0	!+desig+! OR !+fly to num+! noteq 0
HUDdown2 *Noffset* *SHUDdown2* *Snoffset*	X	Always
BOC *SBOC*	X	Always
BOCFlyto0 *SBOCFlyto0*	NOT !+desig+!	!+desig+!
BOCoffset *SBOCoffset*	X	Always
HSI pointer 1:	0 degrees	!+brg_grtk_(!!refpt!!)+!
DME setting:	0	!!DME integer display!!

Event Table FD.5.2.1-b -- When to display/remove the DME flag

MODES	EVENTS	
All navigation or alignment modes when not in a mode listed below	@T(!+gr_ac_(!!refpt!!)+! gteq 1000 nmi)	@T(!+gr_ac_(!!refpt!!)+! ls 1000 nmi)
BOC *BOCFlytoO* *BOCoffset* *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SBOC* *SBOCFlytoO* *SBOCoffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	@T(!+desig+! AND !+gr_ac_(!!refpt!!)+! gteq 10 nmi) OR @F(!+desig+!)	@T(!+desig+! AND !+gr_ac_(!!refpt!!)+! ls 10 nmi)
Function call:	+DI_S_DME_FLAG+(true)	+DI_S_DME_FLAG+(false)

Local dictionary:

Term	Definition
!!DME integer display!!	The value of !+gr_ac_(!!refpt!!)+!, converted to an integer. Whether the integer should be the number of feet or nautical miles in the distance is determined by Table FD.5.2.1-c below.

Condition Table FD.5.2.1-c -- Units of measurement for DME display

MODES	CONDITIONS	
All navigation or alignment modes when not in a mode listed below	Always	X
BOC *BOCFlyto0* *BOCoffset* *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SBOC* *SBOCFlyto0* *SBOCoffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	!+desig+! AND !+gr_ac_(!!refpt!!)+! gteq 10 nmi OR NOT !+desig+!	!+desig+! AND !+gr_ac_(!!refpt!!)+! ls 10 nmi)
Units:	nautical miles	thousands of feet

Local dictionary (continued):

Term	Definition
!!refpt!!	Defined by table below. The mnemonic abbreviations are also given in parentheses for each reference point. Thus, for instance, when !!refpt!! is defined to be !target!, the quantity !+brg_grtk_(!!refpt!!)+! actually refers to !+brg_grtk_tgt+!.

Condition Table FD.5.2.1-d -- Definition of !!refpt!! for HSI and DME

MODES	CONDITIONS		
All alignment and navigation modes, with no mode listed below; *A/G Guns* *Walleye*	Always	X	X
HUDdown1 *Nattack* *SHUDdown1* *Snattack*	NOT !+desig+!	X	!+desig+!
HUDdown2 *Noffset* *SHUDdown2* *Snoffset*	NOT !+desig+! AND !+before_slewing+!	NOT !+desig+! AND !+after_slewing+!	!+desig+!
BOC *SBOC*	!+before_slewing+! OR !+gr_ac_ftpt+! gt 30 nmi	X	!+after_slewing+! AND !+gr_ac_ftpt+! lseq 30 nmi
BOCFlyto0 *SBOCFlyto0*	X	X	Always
BOCoffset *SBOCoffset*	!+gr_ac_ftpt+! gt 30 nmi AND NOT !+desig+!	!+gr_ac_ftpt+! lseq 30 nmi AND NOT !+desig+!	!+desig+!
!!refpt!!:	!Fly-to-point!	!OAP!	!target!
abbreviation:	ftpt	oap	tgt

FD.5.2.2 PERIODIC FUNCTION DESCRIPTION: Set HSI pointer 2.

Mnemonic: +FD_HSI2_P+

Output produced:

Item	Type	Access program
HSI indicator 2 setting	angle	+DI_S_HSI_POINTER_2+

Initiation/termination events:

Event Table FD.5.2.2-a -- When HSI indicator 2 is updated

MODES	Initiation events	Termination events
All align and nav modes except *SINSaln*	@T(!+In flight+!)	@F(!+In flight+!)
SINSaln	@T(In mode)	@F(!+align_stage+! = CA)

At termination, 0 degrees should be displayed.

Function definition:

Selector Table FD.5.2.2-b -- Setting HSI indicator 2

MODES	VALUE
SINSaln	Oscillated between 0 and 11.3 degrees each second; displays 11.3 degrees for .6 seconds, and then 0 degrees for .4 seconds.
All alignment and nav modes except *SINSaln*	!+grtk+!

```
********************************************************************************
*                                                                              *
*                 FD.6            Forward-looking radar functions              *
*                                                                              *
********************************************************************************
```

FD.6.1 DEMAND FUNCTION DESCRIPTION: Set the FLR mode.

Mnemonic: +FD_FLR_MODE_D+

Output produced:

Item	Type	Access program
FLR mode	flr_mode	+DI_S_FLR_MODE+

Function definition:

Event Table FD.6.1-a -- Setting the FLR mode

MODES	EVENTS		
RadarUpd	@T(In mode AND !+gr_ac_fxpt+! lseq 22 nmi)	X	X
BOC *BOCoffset* *SBOC* *SBOCoffset*	@T(In mode AND !+gr_ac_ftpt+! lseq 20 nmi)	X	X
BOCFlyto0 *SBOCFlyto0*	@T(In mode)	X	X
!*None*!	X	X	@T(In mode)
HUDUpd *CCIP* *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	X	@T(In mode)	X
A/G Guns	X	@T(!+Gun Enabled+!) OR @T(In mode AND !+Weapon Class+! = RK)	@F(In mode)
Output value:	$CDCE$	$Ranging$	$Idle$

Local dictionary:

Term	Definition
!*None*!	The state when the system is in none of the other modes listed in the Function Definition table.

FD.6.2.1 PERIODIC FUNCTION DESCRIPTION: Position the FLR azimuth and range cursors.

Mnemonic: +FD_FLR_CURSOR_POSN_P+

Output produced:

Item	Type	Access program
FLR az cursor posn	angle	+DI_S_FLR_AZ_CURSOR_POSN+
FLR rng cursor posn	distance	+DI_S_FLR_RANGE_CURSOR+

Initiation/termination events (for placing FLR range cursor):

Initiation: @T(!+FLR mode+! = $CDCE$)
Termination: @F(!+FLR mode+! = $CCDE$)

Initiation/termination events (for placing FLR azimuth cursor):

Initiation: @T(!+FLR az cursor mode+! = $On$)
Termination: @T(!+FLR az cursor mode+! = $Off$)

Function definition:

Condition Table FD.6.2.1-a -- FLR cursor positioning

MODES	CONDITIONS		
BOC *BOCoffset* *SBOC* *SBOCoffset* *RadarUpd*	Always	!+during slewing+!	X
BOCflyto0 *SBOCflyto0*	!+desig+!	!+during slewing+!	NOT !+desig+!
FLR az cursor posn:	!!ltd brg grtk refpt!!	!!Az slew posn!!	0 deg.
FLR rng cursor posn:	!+sr_ac_(!!refpt!!)+!	!!Rng slew posn!!	8 nmi

Local dictionary:

Term Definition

!!Az slew posn!! The new position of the azimuth cursor, computed by adding !+slew FLR delta az+! to the previous position of the azimuth cursor.

!!Rng slew posn!! The new position of the range cursor, computed by adding !+slew FLR delta rng+! to the previous position of the range cursor.

To obtain !+slew FLR delta az+! and !+slew FLR delta rng+!, call +SS_SLEW_FLR+ (!+Slew right-left+!, !+slew FLR delta az+!, !+Slew up-down+!, !+slew FLR delta rng+!).

!!ltd brg grtk refpt!! Under some circumstances, the FLR azimuth cursor is positioned at the left or right screen edge, as defined in the table below.

Selector Table FD.6.2.1-b -- Definition of !!ltd brg grtk refpt!!

!+brg_grtk_(!!refpt!!)+! (in degrees)	!!ltd brg grtk refpt!!
gteq 270 AND lseq 315	!+Az cursor lft max+!
gt 45 AND lseq 90	!+Az cursor rgt max+!
gt 315 OR ls 45	!+brg_grtk_(!!refpt!!)+!

Local dictionary (continued):

Term	Definition
!!refpt!!	Defined by table below. The mnemonic abbreviations are also given in parentheses for each reference point. Thus, for instance, when !!refpt!! is defined to be !target!, the quantity !+sr_ac_(!!refpt!!)+! actually refers to !+sr_ac_tgt+!.

Condition Table FD.6.2.1-c -- Definition of !!refpt!!

MODES	CONDITIONS				
BOC *SBOC*	NOT !+desig+!	!+desig+!	X	X	X
BOCflyto0 *SBOCflyto0*	X	!+desig+!	X	X	X
BOCoffset *SBOCoffset*	NOT !+desig+! AND !+before_ slewing+!	X	!+desig+! OR !+after_ slewing+!	X	X
RadarUpd	X	X	X	!+before_ slewing+!	!+after_ slewing+!
!!refpt!!:	!FLY-TO- POINT! (ftpt)	!target! (tgt)	!OAP! (oap)	!Called- up point! (cup)	!adjusted point! (ap)

FD.6.2.2 DEMAND FUNCTION DESCRIPTION: Set FLR azimuth cursor display mode.

Mnemonic: +FD_FLR_AZ_CURSOR_MODE_D+

Output produced:

Item	Type	Access program
FLR az cursor mode	ind_cntrl	+DI_S_FLR_AZ_CURSOR_MODE+

Function definition:

Event Table FD.6.2.2-a -- Setting the FLR azimuth cursor display mode

MODES		EVENTS	
BOC *BOCoffset* *SBOC* *SBOCoffset* *RadarUpd*	@T(In mode AND NOT !!refpt ahead!!)	@T(!+FLR mode+! = $CDCE$ AND !!refpt ahead!!)	X
BOCflyto0 *SBOCflyto0*	@T(!+desig+! AND NOT !!refpt ahead!!)	@T(!+FLR mode+! = $CDCE$ AND !!refpt ahead!!)	X
Output value:	Off	On	$Intermittent$

Under the current requirements, the FLR azimuth cursor mode is never $Intermittent$.

Local dictionary:

Term	Definition
!!refpt!!	Defined by Table 6.2.1-c.
!!refpt ahead!!	(!+ !!refpt!! ahead+!), where !!refpt!! is one of ap, cup, ftpt, oap, or tgt, as defined by Table 6.2.1-c.

FD.6.3 PERIODIC FUNCTION DESCRIPTION: Set the FLR direction.

Mnemonic: +FD_FLR_DIRECTN_P+

Output produced:

Item	Type	Access program
FLR elevation	angle	+DI_S_FLR_DIRECTION+(elevation, azimuth)
FLR azimuth	angle	

Initiation/termination events:

Initiation: @T(!+FLR mode+! = $Ranging$)
Termination: @F(!+FLR mode+! = $Ranging$)

Function definition:

Selector Table FD.6.3-a -- FLR direction

MODES	FLR elevation	FLR azimuth
HUDUpd		
A/G Guns		
HUDdown1	!+AS elevation+!	!+AS azimuth+!
HUDdown2		
Nattack		
Noffset		
SHUDdown1		
SHUDdown2		
Snattack		
Snoffset		
CCIP	!+LSC elevation+!	!+LSC azimuth+!

FD.6.4 FUNCTION DESCRIPTION: Set the FLR symbol blink rate.

Mnemonic: +FD_FLR_BLINKRATE+

Output produced:

Item	Type	Access program
New beep rate	real	+DI_S_FLR_BLINK_RATE+

Function definition:

This function is never performed, because under the current requirements, the FLR symbol blink rate need never be changed from its default value. However, should the requirements change and another rate be called for, this function would have the responsibility for setting the new value.

```
******************************************************************************
*                                                                            *
*              FD.7              Head-up display functions                   *
*                                                                            *
******************************************************************************
```

FD.7.1 -- HUD Location-indicator Functions

These functions control the display of symbols on the HUD. Most symbols give information concerning the location of the aircraft relative to some external point. One symbol represents the velocity vector of the aircraft. No function controls more than one symbol. The display mode of all symbols is controlled by the software. A symbol's display mode is either on steady, on intermittently, or off. The position of most symbols is controlled by the software. A symbol-positioning function is initiated when the display mode of its symbol becomes On or $Intermittent$; it is terminated when the display mode of its symbol becomes Off.

The input items of the form !+xxx_elev+! and !+xxx_az+! (where 'xxx' represents a reference point, defined in the local dictionary of the function where it is used) define angles from the aircraft boresight to that point on the earth. The HUD is mounted so that displaying a symbol at a particular azimuth and elevation will cause that symbol to overlay a point on the ground at the same azimuth and elevation relative to the a/c Ya axis.

The functions are ordered alphabetically by the name of the symbol they control. For each symbol, there may be up to three possible concerns: the symbol's mode, the symbol's position, and movement of the symbol by slewing. For each symbol, there is a separate function for each applicable concern.

FD.7.1.1 -- Control the HUD Aiming Symbol.

The HUD Aiming Symbol is a symbol used to specify the location of a certain point outside the aircraft. Under certain conditions, the program places the symbol so that is overlays a reference point. Under other conditions, the pilot may move the symbol via the slew control, thus communicating the location of a certain point to the program.

FD.7.1.1.1 DEMAND FUNCTION DESCRIPTION: Set the HUD aiming symbol mode.

Mnemonic: +FD_HUD_AS_MODE_D+

Output produced:

Item	Type	Access program
AS mode	ind_cntrl	+DI_S_HUD_AS_MODE+

Function definition:

Event table FD.7.1.1.1-a -- Setting the HUD aiming symbol mode

MODES	EVENTS		
Hudaln *A/A Guns* *A/A Manrip* *A/G Guns* *BOCFlyto0* *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SBOCFlyto0* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	@T(In mode)	X	X
BOC *BOCoffset*	@T(In mode AND !+gr_ac_HUDrefpt+! lseq 30 nmi)	@T(In mode AND !+gr_ac_HUDrefpt+! gt 30 nmi)	X
SBOC *SBOCoffset*	@T(In mode AND !+gr_ac_HUDrefpt+! lseq 30 nmi)	@T(In mode AND !+gr_ac_HUDrefpt+! gt 42 nmi)	X
RadarUpd	@T(In mode AND !+gr_ac_HUDrefpt+! lseq 20 nmi)	@T(In mode AND !+gr_ac_HUDrefpt+! gt 20 nmi)	X
HUDUpd	@T(In mode AND !+gr_ac_HUDrefpt+! lseq 22 nmi)	@T(In mode AND !+gr_ac_HUDrefpt+! gt 22nmi)	X
Walleye	@T(In mode)	@T(!+RE pressed+!)	X
Grtest	@T(!+test_stage+! = SC)	@T(In mode)	X
No other mode listed above	X	@T(In mode)	X
Output value:	On	Off	$Intermittent$

Under the current requirements, the HUD aiming symbol mode is never $Intermittent$.

FD.7.1.1.2 PERIODIC FUNCTION DESCRIPTION: Set HUD aiming symbol position.

Mnemonic: +FD_HUD_AS_POSN_P+

Output produced:

Item	Type	Access program
AS elevation	angle	+DI_S_HUD_AS_POSITION+(AS elevation, AS azimuth)
AS azimuth	angle	

Function definition:

Condition Table FD.7.1.1.2-a
Where to position the HUD aiming symbol in alignment and test modes

HUDaln	!+after slewing+!	!+before slewing+!	!+during slewing+!
Grtest	X	Always	X
HUD AS elev:	!+HUDrefpt_elev+!	0 deg.	!!Slewed AS elev!!
HUD AS az:	!+HUDrefpt_az+!	0 deg.	!!Slewed AS az!!

Condition Table FD.7.1.1.2-b
Where to position the HUD aiming symbol in weapon and update modes

MODES	CONDITIONS			
Nattack	!!SK!! AND NOT !+desig+! AND (!!desig retent!! OR NOT !+during slewing+!)	NOT !!SK!! AND NOT !+desig+! AND (!!rls imminent!! OR NOT !+during slewing+!)	!+desig+! AND (!!rls imminent!! OR NOT !+during slewing+!)	(NOT !!rls imminent!! AND !+during slewing+! AND NOT !!SK!!) OR (!+during slewing+! AND !!desig retent!! AND !!SK!!)
HUDdown1	!!SK!! AND NOT !+desig+!	NOT !!SK!! AND NOT !+desig+!	!+desig+!	X
SHUDdown1	X	NOT !+desig+!	!+desig+!	X
Snattack	X	NOT !+desig+! AND (NOT !+during slewing+! OR !!rls imminent!!)	!+desig+! AND (NOT !+during slewing+! OR !!rls imminent!!)	NOT !!rls imminent!! AND !+during slewing+!
HUDdown2 *SHUDdown2*	X	NOT !+desig+! AND !+before slewing+!	!+desig+! OR !+after slewing+!	X
HUD AS elev:	!+boresight elevation+!	!+FPM elevation+!	!+HUDrefpt_elev+!	!!Slewed AS elev!!
HUD AS az:	!+boresight azimuth+!	!+FPM azimuth+!	!+HUDrefpt_az+!	!!Slewed AS az!!

Condition Table FD.7.1.1.2-b (continued)
Where to position the HUD aiming symbol in weapon and update modes

MODES	CONDITIONS			
Noffset *Snoffset*	X	NOT !+desig+! AND NOT !+after slewing+! AND (!+before slewing+! OR (!+during slewing+! AND !!rls imminent!!))	(!+desig+! AND !!rls imminent!!) OR (!+desig+! AND NOT!!rls imminent!! AND NOT !+during slewing+!) OR (NOT!+desig+! AND !+after slewing+!)	NOT !!rls imminent!! AND !+during slewing+!
HUDUpd *RadarUpd*	X	X	NOT !+during slewing+!	!+during slewing+!
A/A Guns *A/A Manrip* *A/G Guns*	X	X	Always	X
BOC *BOCFlyto0* *BOCoffset* *SBOC* *SBOCFlyto0* *SBOCoffset*	X	X	!!rls imminent!! OR NOT !+during slewing+! OR !+gr_ac_HUDrefpt+! gt 20 nmi	NOT !!rls imminent!! AND !+during slewing+! AND !+gr_ac_HUDrefpt+! lseq 20 nmi
Walleye	Always	X	X	X
HUD AS elev:	!+boresight elevation+!	!+FPM elevation+!	!+HUDrefpt_elev+!	!!Slewed AS elev!!
HUD AS az:	!+boresight azimuth+!	!+FPM azimuth+!	!+HUDrefpt_az+!	!!Slewed AS az!!

Local dictionary:

Term / Definition

!!Slewed AS elev!! The new elevation position of the aiming symbol, computed by adding !!AS delta elev!! to the previous elevation position of the aiming symbol.

!!Slewed AS az!! The new azimuth position of the aiming symbol, computed by adding !!AS delta az!! to the previous azimuth position of the aiming symbol.

!!AS delta elev!!
!!AS delta az!! Defined by the table below.

Selector Table FD.7.1.1.2-c
!!AS delta elev!! & !!AS delta az!!

MODES	!!AS delta az!!	!!AS delta elev!!
RadarUpd *BOC* *BOCFlyto0* *BOCoffset* *SBOC* *SBOCFlyto0* *SBOCoffset*	!+slew FLR delta az+!	!+slew FLR delta elev+!
HUDaln *HUDUpd* *Nattack* *Noffset* *Snattack* *Snoffset*	!+slew HUD delta az+!	!+slew HUD delta elev+!

To obtain !+slew FLR delta az+! and !+slew FLR delta rng+!, call +SS_SLEW_FLR+ (!+Slew right-left+!, !+slew FLR delta az+!, !+Slew up-down+!, !+slew FLR delta rng+!).

To obtain !+slew HUD delta az+! and !+slew HUD delta elev+!, call +SS_SLEW_HUD+ (!+Slew right-left+!, !+slew HUD delta az+!, !+Slew up-down+!, !+slew HUD delta elev+!).

Local dictionary (continued)

Term	Definition
!!SK!!	!+Weapon Class+! = $SK$
!!desig retent!!	true iff !+desig+!, and the weapon mode was *BOC*, *BOCoffset*, or *BOCFlyto0* when @T(!+desig+!) last occurred.
!!rls imminent!!	Defined by the table below.

Selector Table FD.7.1.1.2-d

MODE	Definition of !!rls imminent!!
BOC *BOCFlyto0* *BOCoffset* *Nattack* *Noffset*	ABS(!+*** elevation+! - !+FPM elevation+!) lseq .59 deg AND !+*** elevation+! gt !+FPM elevation+! where "***" is "LSC" or "USC".
SBOC *SBOCFlyto0* *SBOCoffset* *Snattack* *Snoffset*	0 degrees lseq (!+LSC elevation+! - !+FPM elevation+!) lseq .59 degrees

FD.7.1.2 -- Control the HUD Azimuth Steering Line (ASL)

The ASL usually shows the pilot the direction and sometimes the amount of steering error to his target or release point. Steering error is the angle between the a/c !ground track! and the line from the a/c to the target or release point. In most modes, the ASL center is placed on the line that is (a) parallel to the pitch lines and (b) passes through the flight path marker. Under the current requirements, the ASL mode is never $Intermittent$.

FD.7.1.2.1 DEMAND FUNCTION DESCRIPTION: Set the HUD ASL mode.

Mnemonic: +FD_HUD_ASL_MODE_D+

Output produced:

Item	Type	Access program
ASL mode	ind_cntrl	+DI_S_HUD_ASL_MODE+

Function definition:

Event Table FD.7.1.2.1-a -- Setting the ASL mode

MODES	EVENTS		
BOC *BOCFlyto0* *BOCoffset* *CCIP* *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SBOC* *SBOCflyto0* *SBOCoffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	@T(In mode)	@F(In Mode)	X
Output value:	On	Off	$Intermittent$

FD.7.1.2.2 PERIODIC FUNCTION DESCRIPTION: Set the HUD ASL position.

Mnemonic: +FD_HUD_ASL_POSN_P+

Output produced:

Item	Type	Access program
ASL elevation	angle	+DI_S_HUD_ASL_POSITION+(ASL elevation,
ASL azimuth	angle	ASL azimuth,
ASL rotation	angle	ASL rotation)

Function definition:

Condition Table FD.7.1.2.2-a -- ASL coordinates (1)

MODES	CONDITIONS				
BOCFlyto0 *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SBOCFlyto0* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	X	NOT !+desig+!	!+steering to tgt+!	!+OTS+!	!+GAS+!
BOC *SBOC*	!+gr_ac_HUDrefpt+! gt 30 nmi	X	!+gr_ac_HUDrefpt+! lseq 30 nmi AND !+steering to tgt+!	!+OTS+!	!+GAS+!
BOCoffset *SBOCoffset*	!+gr_ac_HUDrefpt+! gt 30 nmi	NOT !+desig+! AND !+gr_ac_HUDrefpt+! lseq 30 nmi	!+gr_ac_HUDrefpt+! lseq 30 nmi AND !+steering to tgt+!	!+OTS+!	!+GAS+!
ASL azimuth:	!!error weight!! x !+steering error to tgt+!	!!AS intersection!!	!!near steering display!!	-1/2 x !!error weight!! x !+steering error to tgt+!	!!closest edge!!

After the ASL azimuth is computed, ASL elevation is set to !!ASL_elev_placement!! in all cases.

Condition Table FD.7.1.2.2-b -- ASL coordinates (2)

MODES	CONDITIONS	
CCIP	!+ip_elev+! ls -20 degrees	!+ip elev+! gteq -20 degrees
ASL azimuth:	!+FPM azimuth+!	!!ASL_FPM_intersect4_az!!
ASL elevation:	!+FPM elevation+!	4 degrees below !+FPM elevation+!

Condition Table FD.7.1.2.2-c -- ASL rotation

MODES	CONDITIONS		
BOC *BOCFlyto0* *BOCoffset* *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SBOC* *SBOCFlyto0* *SBOCoffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	X	Always	X
CCIP	X	!+ip elev+! ls -20 degrees	!+ip elev+! gteq -20 degrees
ASL rotation:	0	!+roll IMS+! + 90 deg	!+bomb fall line+!

Local dictionary:

Term — Definition

!!closest edge!! — Edge of HUD to the closest return. If !!GAS left!! then -(¢HUD_symbol_az_max¢); if NOT !!GAS left!! then +(¢HUD_symbol_az_max¢).

!!GAS left!! — !+GAS+! AND !+brg_grtk_tgt+! gt 180 degrees

Local Dictionary (continued):

Term	Definition
!!near steering display!!	Condition Table FD.7.1.2.2-d Definition of !!near steering display!!

Condition Table FD.7.1.2.2-d
Definition of !!near steering display!!

MODES	CONDITIONS	
BOC *BOCFlyto0* *BOCoffset* *HUDdown1* *HUDdown2* *Nattack* *Noffset*	!+Weapon Class+! noteq $SK$	!+Weapon Class+! = $SK$
SBOC *SBOCFlyto0* *SBOCoffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	Always	X
!!alternate steering display!!:	(1/2 x !!error weight!! x !!alternate steering error!!)	!+AS azimuth+! + !+drift angle+!

!!error weight!! When a/c pitch gets large, the steering error is multiplied by the weight factor !!error weight!! defined below, to prevent the steering error from becoming too large to display.

!+pitch IMS+! (in degrees)	Weighting Factor
lseq 0	1
gt 0 and lseq 60	$1 - 1.5 \times \frac{\text{!+pitch IMS+!}}{\text{360 degrees}}$
gt 60 and lseq 80	$3 - 13.5 \times \frac{\text{!+pitch IMS+!}}{\text{360 degrees}}$
gt 80 and lseq 90	0

!!alternate steering error!! !+steering error to tgt+!, if !+gr_ac_tgt+! gt 48,000 feet; !+steering error to rls+! otherwise.

Local dictionary (continued):

Term — Definition

!!AS intersection!! — This is the azimuth angle that places the HUD ASL center on the imaginary line that runs through the FPM parallel to the pitch lines such that (given the current ASL rotation) the ASL will intersect the HUD aiming symbol.

!!ASL_FPM_intersect4_az!! — The azimuth position of the ASL such that, given the current rotation angle of the ASL, (1) the ASL center is placed four degrees in elevation lower than the elevation of the Flight Path Marker; and (2) the ASL intersects the Flight Path Marker.

!!ASL elev placement!! — The ASL elevation on the HUD such that, given the current ASL rotation and ASL azimuth, the ASL center is placed on the imaginary line that is both parallel to the pitch lines, and intersects the FPM.

FD.7.1.3 -- Control the HUD Flight Director (FD)

The HUD Flight Director can be positioned in azimuth only. Its displacement from HUD center shows the azimuth steering error; that is, the angle between the projections into the horizontal plane of the a/c heading and the line from the a/c to the !Fly-to-point!. Under the current requirements, the flight director mode is never $Intermittent$.

FD.7.1.3.1 DEMAND FUNCTION DESCRIPTION: Set the HUD flight director mode.

Mnemonic: +FD_HUD_FLTDIR_MODE_D+

Output produced:

Item	Type	Access program
FLTDIR mode	ind_cntrl	+DI_S_HUD_FLTDIR_MODE+

Function definition:

Event Table FD.7.1.3.1-a -- Setting the HUD flight director mode

MODES	EVENTS		
All alignment and navigation modes	@T(!+Init complete+!) OR @T(!+Weapon Mode+! = $None$)	@F(!+Weapon Mode+! = $None$)	X
Output value:	On	Off	$Intermittent$

FD.7.1.3.2 PERIODIC FUNCTION DESCRIPTION: Set HUD flight director position.

Mnemonic: +FD_HUD_FLTDIR_POSN_P+

Output produced:

Item	Type	Access program
Flight director azimuth	angle	+DI_S_HUD_FLTDIR_POSITION+

Function definition:

Condition table FD.7.1.3.2-a -- Positioning the HUD flight director

MODES	CONDITIONS	
All alignment and navigation modes	!+Fly to num+! noteq 0	!+Fly to num+! = 0
Output value:	!!ltd brg_ac_ftpt!!	0 degrees

Local dictionary:

Term	Definition
!!ltd brg_ac_ftpt!!	+SS_LIMIT_FN+(!!steering error to ftpt!!, 1, 5)
!!steering error to ftpt!!	!+brg_ac_ftpt+!, if 0 degrees lseq !+brg_ac_ftpt+! lseq 180 degrees; (!+brg_ac_ftpt+! - 360 degrees) otherwise. This translates between the full-circle measurement of !+brg_ac_ftpt+!, and the plus/minus measurement needed for a steering error.

FD.7.1.4 -- Control the HUD Flight Path Marker (FPM)

The HUD Flight Path Marker shows the direction of the aircraft velocity vector. If the aircraft is in straight and level flight, the FPM is optically centered on the HUD. The azimuth displacement from HUD center shows the lateral velocity component and the elevation displacement from HUD center shows the vertical velocity component.

FD.7.1.4.1 *DEMAND FUNCTION DESCRIPTION:* Set the HUD flight path marker mode.

Mnemonic: +FD_HUD_FPM_MODE_D+

Output produced:

Item	Type	Access program
FPM mode	ind_cntrl	+DI_S_HUD_FPM_MODE+

Function definition:

Event Table FD.7.1.4.1-a -- Setting the HUD FPM mode

MODES	EVENTS		
All alignment and navigation modes with no mode listed below	@T(!+VV mode+! = On)	@F(!+VV mode+! = On)	X
A/A Manrip *BOC* *BOCFlyto0* *BOCoffset* *CCIP* *Manrip* *Nattack* *Noffset* *SBOC* *SBOCFlyto0* *SBOCoffset* *Snattack* *Snoffset* *Walleye*	@T(!+VV mode+!=On AND !!time FPM blinked!! gteq 2.5 seconds)	@F(!+VV mode+! = On)	@T(!+VV mode+! = On AND !+stik empty+!)
Output value:	On	Off	$Intermittent$

Local dictionary:

Term	Definition
!!time FPM blinked!!	elapsed time since last call to +DI_S_HUD_FPM_MODE+($Intermittent$)

FD.7.1.4.2 PERIODIC FUNCTION DESCRIPTION: Set the HUD FPM position.

Mnemonic: +FD_HUD_FPM_POSN_P+

Output produced:

Item	Type	Access program
FPM elevation	angle	+DI_S_HUD_FPM_POSITION+(FPM elevation, FPM azimuth)
FPM azimuth	angle	

Function definition:

Condition Table FD.7.1.4.2-a -- Setting the FPM position

MODES	CONDITIONS		
Airaln	X	!+FM stage complete+! OR !+adc alt up+!	NOT !+FM stage complete+! AND NOT !+adc alt up+!
All alignment modes except *Airaln*	Always	X	X
DI *DIG* *PolarDI* *UDI*	X	Always	X
I *PolarI*	NOT !+in_flight+!	!+in_flight+!	X
Grid *OLB* *Mag sl*	NOT !+in_flight+!	!+adc tas up+! AND !+in_flight+!	NOT !+adc tas up+! AND !+in_flight+!
IMS fail	NOT !+in_flight+!	X	!+in_flight+!
FPM elevation:	0 degrees	!!ltd vert vels!!	!+AOA+!
FPM azimuth:	0 degrees	!!ltd lat vels!!	0 degrees

Local dictionary:

Term — Definition

!!ltd vert vels!!

MIN(!!FPM elev from vels!!, 4.3 degrees)
if !!FPM elev from vels!! gt 0 degrees;

MAX(!!FPM elev from vels!!, -11.7 degrees)
if !!FPM elev from vels!! lseq 0 degrees.

!!ltd lat vels!!

SIGN(!!FPM az from vels!!) x
ABS(MIN(!!FPM az from vels!!, 6 degrees))

!!FPM az from vels!!

The azimuth angle at which the FPM should be placed, assuming it is to depict the direction of the aircraft's velocity vector, derived from !System velocities!.

!!FPM az from vels!! =

$$\frac{\text{System velocity lateral component}}{\text{System velocity forward component}}$$

where the result is interpreted as an angle in radians. The lateral and forward components are derived (via the Physical Models module) from !+Velocity north system+! and !+Velocity east system+!.

!!FPM elev from vels!!

The elevation angle at which the FPM should be placed, assuming it is to depict the direction of the aircraft's velocity vector, derived from !System velocities!.

!!FPM elev from vels!! =

$$\frac{\text{!+Velocity vertical system+!}}{\text{System velocity forward component}}$$

where the result is interpreted as angle in radians. The forward component is derived (via the Physical Model) from !+Velocity north system+! and !+Velocity east system+!.

FD.7.1.5 DEMAND FUNCTION DESCRIPTION: Set the HUD in-range cue mode.

Mnemonic: +FD_HUD_RNGCUE_D+

Output produced:

Item	Type	Access program
RNGCUE mode	ind_cntrl	+DI_S_HUD_RNGCUE_MODE+

Function definition:

Event Table FD.7.1.5-a -- Setting the HUD in-range cue mode

MODES	EVENTS		
A/G Guns	@T(!+target in range+!) OR @T(!+Gun Enable+! AND !+sr reasonable+!) WHEN(!+target in range+!)	@F(!+target in range+!) OR @F(In mode) OR @F(!+Gun Enable+! AND !+sr reasonable+!) WHEN (NOT !+target in range+!)	@F(!+sr reasonable+!) WHEN (!+Gun Enable+! AND !+target in range+!)
Walleye	@T(!+tgt ahead+! AND !+target in range+! AND !+desig+!)	@F(!+target in range+!) OR @F(!+desig+!) OR @F(In mode) OR @F(!+tgt ahead+!)	X
Output value:	On	Off	$Intermittent$

FD.7.1.6 -- Control the HUD Lower Solution Cue (LSC)

The HUD Lower Solution Cue serves as a warning that a release point is approaching, or as an indicator of the impact point.

FD.7.1.6.1 DEMAND FUNCTION DESCRIPTION: Set the HUD lower solution cue mode.

Mnemonic: +FD_HUD_LSC_MODE_D+

Output produced:

Item	Type	Access program
LSC mode	ind_cntrl	+DI_S_HUD_LSC_MODE+

Function definition:

Event table FD.7.1.6.1-a -- Setting the lower solution cue mode (1)

MODES	EVENTS	
NBnotShrike	@T(!+target in range+! AND !+desig+! AND NOT !+GAS+! AND NOT !+during slewing+!) OR @T(1 second before !+target in range+!) WHEN(!+pitch IMS+! = 42 deg)	@F(!+target in range+!) OR @F(!+desig+!) OR @T(!+GAS+!) OR @T(!+during slewing+!)
NBShrike	@T(!+target in range+! AND !+desig+!)	@F(!+target in range+!) OR @F(!+desig+!)
CCIP	@T(!!impact angle proper!!)	@F(!!impact angle proper!!)
SBOC *SBOCflyto0* *SBOCoffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	@T((!+Special in range+! AND !+desig! AND NOT !+GAS+! AND NOT !+during slewing+!) AND (NOT !+low drag release+! OR !+tgt ahead+!))	@T((NOT !+Special in range+! OR NOT In mode OR !+GAS+! OR !+during slewing+!) AND (NOT !+low drag release+! OR !+OTS+! OR !+Rmax+! OR NOT !+tgt ahead+!))
!*None*!	X	@T(In mode)
Output value:	On	Off

Event Table FD.7.1.6.1-b -- Setting the lower solution cue mode (2)

MODES	EVENTS	
HUDdown1 *HUDdown2* *Nattack* *Noffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	@T(!!FLR sampled!! AND NOT !+sr reasonable+!)	@T(!!FLR sampled!! AND !+sr reasonable+!)
None of the eight modes above and not in *Grtest*	X	@T(In mode)
Output value:	$Intermittent$	!!stale LSC mode!!

Local dictionary:

Term	Definition
!!FLR sampled!!	@T(!+desig+!) OR @F(!+Slew displacement non-zero+!) WHEN(!+desig+!)
!!impact angle proper!!	ABS(!+ip elev+!) lseq 16 degrees AND ABS(!+ip az+!) lseq 12 degrees)
!*None*!	The system is in mode !*None*! when it is <u>not</u> in any of the following modes: **NBShrike**, **NBnotShrike**, *CCIP*, *Snattack*, *Snoffset*, *SBOC*, *SBOCFlyto0*, *SBOCoffset*, *SHUDdown1*, OR *SHUDdown2*.
!!stale LSC mode!!	The value of !+LSC mode+! before the call to +DI_S_HUD_LSC_MODE+($Intermittent$)

FD.7.1.6.2 PERIODIC FUNCTION DESCRIPTION: Set the HUD LSC position.

Mnemonic: +FD_HUD_LSC_POSN_P+

Output produced:

Item	Type	Access program
LSC elevation	angle	+DI_S_HUD_LSC_POSITION+(elevation, azimuth)
LSC azimuth	angle	

Function definition:

Condition Table FD.7.1.6.2-a -- Placement of lower solution cue (1)

MODES	CONDITIONS		
BOC *BOCflyto0* *BOCoffset* *HUDdown1* *HUDdown2* *Nattack* *Noffset*	!+OTS+!	!+low drag release+! AND NOT !+OTS+!	NOT !+low drag release+! AND NOT !+OTS+!
LSC elevation:	!+ASL elevation+! - 4 degrees	!+ASL elevation+! - !!ltd dive pullup!!	!+ASL elevation+! - !!ltd sr ac rls!!
LSC azimuth:	!!LSC_az_on_ASL!!	!!LSC_az_on_ASL!!	!!LSC_az_on_ASL!!

Condition Table FD.7.1.6.2-b -- Placement of lower solution cue (2)

MODES	CONDITIONS		
HiNuke	!+TOS+!	NOT !+TOS+! AND !+sr_ac_rls+! gt 0 feet	NOT !+TOS+! AND !+sr_ac_rls+! lseq 0 feet
LSC elevation:	!+FPM elevation+! + 4 degrees	!+FPM elevation+! + !!ltd sr ac rls!!	!+FPM elevation+! + !!wtd sr ac rls!!
LSC azimuth:	!!LSC_az_on_ASL!!	!!LSC_az_on_ASL!!	!!LSC_az_on_ASL!!

Selector Table FD.7.1.6.2-c -- Placement of lower solution cue (3)

MODE	LSC elevation	LSC azimuth
CCIP	!+ip_elev+!	!!LSC_az_on_ASL!!
LoNuke	!+FPM elevation+! + !!wtd gracrmax!!	!!LSC_az_on_ASL!!

Local dictionary:

Term	Definition
!!LSC_az_on_ASL!!	The value returned by +SS_SYMBOL_AS_ON_ASL+ when called with the newly-computed !+LSC elevation+!; this is the azimuth angle at which to place the LSC so that it intersects the ASL.
!!ltd dive pullup!!	+SS_LIMIT_FN+(!+dive_pullup+!, 1/8, 4)
!!ltd sr ac rls!!	+SS_LIMIT_FN+(!+sr_ac_rls+!, 1/1000, 4)
!!wtd gracrmax!!	+SS_WEIGHT_FN+(!+gr_ac_rmax+!, 1/1000, 4)
!!wtd sr ac rls!!	-1 x +SS_WEIGHT_FN+(!+sr ac_rls+!, 1/1000, 3.5)

FD.7.1.7 -- Control the HUD Pullup Anticipation Cue (PUAC)

In most modes, the Pullup Anticipation Cue shows the pilot how far he is from the "pullup point"; that is, the point where the pilot must execute a 4g pullup to avoid either the ground or the blast radius of a released weapon. It is flashed when NOT !+Master Arm+! to remind the pilot that a release is not possible. For the PUAC elevation requirements in *Snattack*, *Snoffset*, *SBOC*, *SBOCFlyto0*, and *SBOCoffset* modes, see the classified Addendum.

FD.7.1.7.1 DEMAND FUNCTION DESCRIPTION: Set the HUD PUAC mode.

Mnemonic: +FD_HUD_PUAC_D+

Output produced:

Item	Type	Access program
PUAC mode	ind_cntrl	+DI_S_HUD_PUAC_MODE+

Function definition:

Event Table FD.7.1.7.1-a -- Setting HUD PUAC mode

MODES		EVENTS	
BOCFlyto0 *CCIP* *Nattack* *Noffset*	@T(In mode AND !+Master Arm+!)	X	@T(In mode AND NOT !+Master Arm+!)
A/G Guns	@T(In mode AND (!+Master Arm+! OR !+Weapon Class+! = GN OR RK)	X	@T(In mode AND NOT !+Master Arm+!) WHEN(!+Weapon Class+! = GN OR RK)
BOC *BOCoffset*	@T(In mode AND !+Master Arm+! AND !+gr_ac_ftpt+! lseq 30 nmi)	@T(!+gr_ac_ftpt+! gt 30 nmi AND !+Master Arm+!)	@T(In mode AND NOT !+Master Arm+!)
*SBOC *SBOCFlyto0* *SBOCoffset* *Snattack* *Snoffset*	@T((!+Master Arm+! OR !+high drag release+! OR !+Rmax+6000+!)	@T(!+Master Arm+! AND !!Off special!!) OR @T(!+high drag release+!)	@T(In mode AND NOT !+Master Arm+!) WHEN(!+low drag release+!)
Walleye	@T(In mode AND !+Master Arm+!)	X	@T(In mode AND NOT !+Master Arm+!)
!*None*!	X	@T(!+Weapon Mode+! = $None$)	X
Output value:	On	Off	$Intermittent$

Local dictionary:

Term	Definition
!!Off special!!	(!+Rmin+6000+! AND !+stik created+!) OR (!+gr_ac_ftpt+! gteq 10 nmi AND !+stik empty) OR (!+pitch IMS+!=-30 degrees AND !+stik empty)
!*None*!	The state when the system is in none of the other modes listed in the Function Definition table.

FD.7.1.7.2 PERIODIC FUNCTION DESCRIPTION: Set the HUD PUAC position.

Mnemonic: +FD_HUD_PUAC_P+

Output produced:

Item	Type	Access program
PUAC elevation	angle	+DI_S_HUD_PUAC_POSITION+(PUAC elevation, PUAC azimuth)
PUAC azimuth	angle	

Function definition:

Condition Table FD.7.1.7.2-a -- Setting HUD PUAC elevation

MODES	CONDITIONS	
BOC *BOCFlyto0* *BOCoffset* *CCIP* *Nattack* *Noffset* *Walleye*	!+sr_ac_gpup+! gt 5000 ft AND !+sr_ac_bpup+! gt 5000 ft	!+sr_ac_gpup+! lseq 5000 ft OR !+sr_ac_bpup+! lseq 5000 ft
A/G Guns	!+sr_ac_gpup+! gt 5000 ft AND (!+sr_ac_bpup+! gt 5000 ft OR (!+Weapon Class+! = $GN$)	!+sr_ac_gpup+! lseq 5000 ft OR (!+Weapon Class+! = $RK$ AND !+sr_ac_bpup+! lseq 5000 ft)
PUAC elevation:	!+FPM elevation+! - 3.5 deg.	!!pullup elev!!

Selector Table FD.7.1.7.2-b -- Setting HUD PUAC azimuth

MODES	PUAC azimuth
BOC *BOCFlyto0* *BOCoffset* *Nattack* *Noffset* *SBOC* *SBOCFlyto0* *SBOCoffset* *Snattack* *Snoffset*	!!PUAC_az_on_ASL!!
A/G Guns *CCIP* *Walleye*	!+FPM azimuth+!

Local dictionary:

Term	Definition
!!pullup elev!!	!+FPM elevation+! - (0.7 degrees x MIN(!+sr_ac_bpup+!, !+sr_ac_gpup+!)/1000 feet)
!!PUAC_az_on_ASL!!	The value returned by +SS_SYMBOL_AS_ON_ASL+ when called with the newly-computed !+PUAC elevation+!; this is the azimuth angle at which to place the PUAC so that it intersects the ASL.

FD.7.1.8 DEMAND FUNCTION DESCRIPTION: Set the HUD pullup cue mode.

Mnemonic: +FD_HUD_PUC_MODE_D+

Output produced:

Item	Type	Access program
Pullup cue mode	ind_cntrl	+DI_S_HUD_PUC_MODE+

Function definition:

Event table FD.7.1.8-a -- When to start/stop the HUD pullup cue

MODES		EVENTS	
All modes except *Grtest*	X	@T(!+blast danger+!) OR @T(!+ground danger+!)	@F(!+blast danger+! OR !+ground danger+!) OR @T(!!time PUC blinked!! gteq 2 secs) WHEN(!+low drag release+! AND !!Speci-l!!)
Output value:	On	$Intermittent$	Off

Note: The HUD pullup cue cannot be turned on steady.

Local dictionary:

Term	Definition
!!Special!!	!+Weapon Class+! = SOD OR SSH
!!time PUC blinked!!	elapsed time since last call to +DI_S_HUD_PUC_MODE+($Intermittent$)

FD.7.1.9 -- Control the HUD Upper Solution Cue (USC)

FD.7.1.9.1 DEMAND FUNCTION DESCRIPTION: Set the HUD upper solution cue mode.

Mnemonic: +FD_HUD_USC_MODE_D+

Output produced:

Item	Type	Access program
USC mode	ind_cntrl	+DI_S_HUD_USC_MODE+

Function definition:

Event table FD.7.1.9.1-a -- Setting upper solution cue mode (1)

MODES	EVENTS	
NBnotShrike *SBOC* *SBOCFlyto0* *SBOCoffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	@T(!+Special in range+! AND !+desig+! AND NOT !+GAS+! AND NOT !+during slewing+!) WHEN(!+low drag release+!)	@F(In mode) OR @F(!+Special in range+! AND NOT !+GAS+! AND NOT !+during slewing+!) OR @F(!+low drag release+!)
No mode listed above	X	@T(In mode)
Output value:	On	Off

Event Table FD.7.1.9.1-b -- Setting the upper solution cue mode (2)

MODES	EVENTS	
HUDdown1 *HUDdown2* *Nattack* *Noffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	@T(!+LSC mode+! = $Intermittent$)	@F(!+LSC mode+! = $Intermittent$)
No mode listed above and not *Grtest*	X	@T(In mode)
Output value:	$Intermittent$	!!stale USC mode!!

Local dictionary:

Term	Definition
!!stale USC mode!!	The value of !+USC mode+! before the call to +DI_S_HUD_USC_MODE+($Intermittent$)

FD.7.1.9.2 PERIODIC FUNCTION DESCRIPTION: Set the HUD USC position.

Mnemonic: +FD_HUD_USC_POSN_P+

Output produced:

Item	Type	Access program
USC elevation	angle	+DI_S_HUD_USC_POSITION+(elevation,
USC azimuth	angle	azimuth)

Function definition:

Condition Table FD.7.1.9.2-a -- Positioning the upper solution cue

MODES	CONDITIONS	
NBnotShrike *SBOC* *SBOCFlyto0* *SBOCoffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	!+OTS+!	NOT !+OTS+!
USC elevation:	!!ltd OTS pullup!!	!!ltd loft pullup!!
USC azimuth:	!!USC_az_on_ASL!!	!!USC_az_on_ASL!!

Local dictionary:

Term	Definition
!!ltd loft pullup!!	+SS_LIMIT_FN+(!+loft pullup+!, 1/8, 4)
!!ltd OTS pullup!!	+SS_LIMIT_FN+(!+OTS pullup+!, 1/8, 4)
!!USC_az_on_ASL!!	The value returned by +SS_SYMBOL_AS_ON_ASL+ when called with the newly-computed !+USC elevation+!; this is the azimuth angle at which to place the USC so that it intersects the ASL.

FD.7.1.10 FUNCTION DLSCRIPTION: Set the HUD symbol blink rate.

Mnemonic: +FD_HUD_BLINKRATE+

Output produced:

Item	Type	Access program
New blink rate	real	+DI_S_HUD_BLINK_RATE+

Function definition:

This function is never performed, because under the current requirements, the blink rate for all HUD symbols is the same, and is equal to the default rate. However, should the requirements change and other blink rates be necessary, this function would have the responsibility to determine the prevailing rate.

FD.7.2 -- HUD Value Indicators

These functions display information on the HUD giving the situation of the aircraft relative to the earth, or numerical indications of the aircraft's velocity. All of these functions control value displays on the HUD, rather than symbol positions.

FD.7.2.1 PERIODIC FUNCTION DESCRIPTION: Set the HUD altitude display.

Mnemonic: +FD_HUD_BARO_ALT_P+

Output produced:

Item	Type	Access program
HUD altitude display	distance	+DI_S_HUD_ALT_DISPLAY+

Initiation/termination events:

None. Always performed.

Function definition:

Condition table FD.7.2.1-a -- Setting the HUD altitude display

MODES	CONDITIONS		
All alignment and navigation modes	!+adc alt up+!	NOT !+adc alt up+!	X
Grtest	X	X	Always
Output value:	!+alt ADC+!	4500 ft	!!last pre-test value!!

Local dictionary:

Term	Definition
!!last pre-test value!!	The value that was being output when @T(*Grtest*) occurred.

FD.7.2.2 PERIODIC FUNCTION DESCRIPTION: Set the HUD heading display.

Mnemonic: +FD_HUD_HEADING_P+

Output produced:

Item	Type	Access program
HUD heading	angle	+DI_S_HUD_HEADING_DISPLAY+

Initiation/termination events:
None. Always performed.

Function definition:

Condition table FD.7.2.2-a -- Setting the HUD heading display

MODES	CONDITIONS	
All alignment and navigation modes, except *IMS fail*	Always	X
IMS fail	!+ims_mode+! noteq Off	!+ims_mode+! = Off
Output value:	!+heading MAG+!	0 degrees (North)

FD.7.2.3 PERIODIC FUNCTION DESCRIPTION: Set the HUD pitch and roll displays.

Mnemonic: +FD_HUD_PITCH_ROLL_P+

Output produced:

Item	Type	Access program
HUD pitch display	angle	+DI_S_HUD_PITCH_DISPLAY+
HUD roll display	angle	+DI_S_HUD_ROLL_DISPLAY+

Initiation/termination events:
None. Always performed.

Function definition:

Selector table FD.7.2.3-a -- Setting HUD pitch and roll displays

MODES	HUD pitch display	HUD roll display
All navigation and alignment modes, except *IMS fail*	!+pitch IMS+!	!+roll IMS+!
IMS fail	!+AOA+!	0 degrees
Grtest	!!pre-test pitch!!	!!pre-test roll!!

Local dictionary:

Term	Definition
!!pre-test pitch!!	The value of !+pitch IMS+! when @T(*Grtest*) occurred.
!!pre-test roll!!	The value of !+roll IMS+! when @T(*Grtest*) occurred.

FD.7.2.4 -- Control the HUD vertical velocity and vertical acceleration displays.

The HUD vertical velocity indicator shows the vertical velocity calculated from the highest-priority reliable sensors. The HUD acceleration display shows vertical (normal) acceleration. These displays differ from other value displays in that they both must be enabled before values may be displayed. Function 7.2.4.1 enables/disables the HUD vertical velocity and acceleration displays.

FD.7.2.4.1 DEMAND FUNCTION DESCRIPTION: Enable the HUD vertical velocity and vertical acceleration displays.

Mnemonic: +FD_HUD_VV_MODE_D+

Output produced:

Item	Type	Access program
vv/accel mode	ind_cntrl	+DI_S_HUD_VV_MODE+

Function definition:

Event Table FD.7.2.4.1-a
Setting the velocity and acceleration displays' mode

MODES	EVENTS		
Airaln	@F(!+align_stage+!=FM) OR @T(!+AOA valid+!)	@F(!+AOA valid+!) WHEN(NOT !+FM stage complete+!)	X
IMS fail *Grid* *Mag sl* *OLB*	@T(!+AOA valid+!) OR @F(!+in_flight+!)	@T(!+in flight+! AND NOT !+AOA valid+!)	X
!*None*!	@T(In mode)	X	X
Output value:	On	Off	$Intermittent$

Local dictionary:

Term	Definition
!*None*!	The state when the system is in none of the other modes listed in the Function Definition table.

FD.7.2.4.2 PERIODIC FUNCTION DESCRIPTION: Set the HUD vertical acceleration display.

Mnemonic: +FD_HUD_ACCEL_P+

Output produced:

Item	Type	Access program
HUD vertical acceleration display	accel	+DI_S_HUD_NACC_DISPLAY+

Initiation/termination events:

Event Table FD.7.2.4.2-a
When the HUD vertical acceleration display is updated

MODES	Initiation events	Termination events
Snattack *Snoffset* *SBOC* *SBOCFlyto0* *SBOCoffset*	@T(!+low drag release+! AND !+VV mode+! = $On$)	@F(!+low drag release+! AND !+VV mode+! = $On$)

Function definition:

Call +DI_S_HUD_NACC_DISPLAY+(!+normal_accel+!).

FD.7.2.4.3 PERIODIC FUNCTION DESCRIPTION: Set the HUD vert. vel. display.

Mnemonic: +FD_HUD_VERTVEL_P+

Output produced:

Item	Type	Access program
HUD vertical velocity display	speed	+DI_S_HUD_VERTVEL_DISPLAY+

Initiation/termination events:

Event Table FD.7.2.4.3-a -- When the HUD vertical velocity is updated

MODES	Initiation events	Termination events
SBOC *SBOCFlyto0* *SBOCoffset* *Snattack* *Snoffset*	@T(NOT !+low drag release+! AND !+VV mode+! = On)	@T(!+low drag release+! OR !+VV mode+! = Off)
None of the above five modes	@T(!+VV mode+! = On)	@F(!+VV mode+! = On)

Function definition:

Condition Table FD.7.2.4.3-b
Updating the HUD vertical velocity display

MODES	CONDITIONS	
All alignment modes *DIG* *DI* *I* *PolarDI* *PolarI* *UDI* *Grid* *IMS fail* *Mag Sl* *OLB*	Always	X
Grtest	X	Always
Output value:	!+Velocity vertical system+!	0

The HUD vertical velocity display is also set to 0 at the moment when any alignment mode except *Airaln* is exited.

```
*****************************************************************************
*                                                                           *
*                 FD.8                      IMS functions                   *
*                                                                           *
*****************************************************************************
```

FD.8.1 DEMAND FUNCTION DESCRIPTION: Switch computer control of the IMS on/off.

Mnemonic: +FD_IMS_COMP_CTRL_D+

Output produced:

Item	Type	Access program
IMS enable	boolean	+DI_S_IMS_ENABLE+

Function definition:

Event Table FD.8.1-a -- IMS computer control setting

MODES	EVENTS	
Airaln	@T(!!roll lrg!! AND !+align_stage+!=FM) OR @T(In mode AND !+align_stage+! noteq FM)	@F(!!roll lrg!!) WHEN (!+align_stage+! = FM) OR @T(!+align_stage+! = FM) WHEN(NOT !!roll lrg!!) OR @T(!+align stage+! noteq CL AND !+IMS reasonable+!) WHEN(!+in flight+!)
Any alignment mode but *Airaln*	@T(In mode)	@T(!+align stage+! noteq CL AND !+IMS reasonable+!) WHEN(!+in flight+!)
DIG *DI* *I* *OLB* *PolarDI* *PolarI* *UDI*	@T(In mode)	X
Grid *IMS fail* *Mag Sl*	X	@T(In mode)
Output value:	true	false

Local dictionary:

Term	Definition
!!roll lrg!!	ABS(!+roll IMS+!) gt 5°

FD.8.2 DEMAND FUNCTION DESCRIPTION: Set the IMS velocity measurement scale.

Mnemonic: +FD_IMS_SCALE_D+

Output produced:

Item	Type	Access program
IMS scale	imsscale	+DI_S_IMS_SCALE+

Function definition:

Event Table FD.8.2-a -- Changing the IMS Velocity Measurement Scale

MODES	EVENTS	
Landaln *Lautocal* *01 Update*	@T(In mode)	X
HUDaln	@T(In mode) WHEN (!+IMS mode+! = $Gndal$)	@T(In mode) WHEN(!+IMS mode+! = ($Norm$ OR $Iner$))
Airaln *Sautocal* *SINSaln* *DI* *DIG* *I* *OLB* *PolarDI* *PolarI* *UDI*	X	@T(In mode)
Output value:	$Fine$	$Coarse$

FD.8.3: Adjust the alignment of the IMS X, Y, and Z axes.

Under certain conditions, the IMS platform axes are assumed to be properly aligned, and the axes are only maintained in alignment; that is, compensations are made for the earth's rotation, a/c movement, etc. The values which are only for maintaining alignment are suffixed with "_m".

Under other conditions, misalignments are corrected, by using certain reference information to discover how much the IMS axes are misaligned from their corresponding earth-reference-frame axes. The values which are for correcting misalignment, as well as for compensating for normal motion (i.e., maintaining, as explained above), are suffixed with "_mc". In addition, the third term of each such value's identifier denotes the source of the reference information; i.e., SINS, Doppler radar, or the knowledge that the aircraft is not moving.

Only small x and y adjustments are made in navigation modes. Whether small or large x and y adjustments are made in an alignment mode is determined completely by the alignment stage. The system is never in a mode or stage where both large and small x/y corrections should be applied at the same time.

Whether large or small z adjustments are made usually depends on the magnitude of the adjustment to be made in each case. Errors above a certain point (!+ims_cutoff+!) are considered to require a large adjustment; errors at or below that cutoff are considered to require a small adjustment.

In the requirements document, there are two functions for adjusting the alignment of the IMS axes: the first applies small adjustments to all three axes, and the second applies large adjustments to all three axes. These functions have been re-shaped so that there is a function to apply small x/y corrections, a function to apply large x/y corrections, and a function to apply all adjustments (i.e., large and small) to the z axis. This was done because the small x/y function is intuitively periodic, while the large x/y function is intuitively demand. The z function was separated because it has very little in common with either of the other two. Further, it is conceivable that deleting z axis alignment from the module would leave a useful functional subset.

FD.8.3.1 PERIODIC FUNCTION DESCRIPTION: Perform small adjustments to the IMS platform X and Y axes.

Mnemonic: +FD_IMS_SMADJ_XY_P+

Output produced:

Item	Type	Access program
IMS small x-axis adjustment	angle	+DI_S_X_FINE_ROTATION+
IMS small y-axis adjustment	angle	+DI_S_Y_FINE_ROTATION+

Initiation/termination events:

None. Always performed.

Function definition:

Condition Table FD.8.3.1-a -- When small x and y adjustments are applied

MODES	CONDITIONS
Lautocal	!+align_stage+! = FG OR ND OR $ND2$ OR ED OR $ED2$
Sautocal	!+align_stage+! = ED OR $ED2$ OR ND OR $ND2$
OlUpdate *HUDaln* *Landaln* *SINSaln*	!+align_stage+! = FG
Airaln	!+align_stage+! = HL OR FG OR HG
DI *DIG* *I* *OLB* *PolarDI* *PolarI* *UDI*	Always

Function calls: +DI_S_X_FINE_ROTATION+(!!IMS adj x error!!)
+DI_S_Y_FINE_ROTATION+(!!IMS adj y error!!)

Local dictionary:

Term	Definition
!!IMS adj x error!! and !!IMS adj y error!!	Defined by Table 8.3.1-b below.

Selector Table FD.8.3.1-b
Values of x and y adjustments:
!!IMS adj x error!! & !!IMS adj y error!!

MODES	!!IMS adj x error!!	!!IMS adj y error!!
Landaln *Lautocal* *HUDaln* *01Update*	!+ims_x_const_error_mc+!	!+ims_y_const_error_mc+!
Sautocal *SINSaln*	!+ims_x_sins_error_mc+!	!+ims_y_sins_error_mc+!
Airaln	!+ims_x_dop_error_mc+!	!+ims_y_dop_error_mc+!
I *UDI* *OLB* *PolarI*	!+ims_x_nav_error_m+!	!+ims_y_nav_error_m+!
DIG *DI* *PolarDI*	!+ims_x_nav_error_mc+!	!+ims_y_nav_error_mc+!

FD.8.3.2 DEMAND FUNCTION DESCRIPTION: Perform large adjustments of the IMS platform X and Y axes.

Mnemonic: +FD_IMS_LGADJ_XY_D+

Output produced:

Item	Type	Access program
IMS large x-axis adjustment	angle	+DI_S_X_COARSE_ROTATION+
IMS large y-axis adjustment	angle	+DI_S_Y_COARSE_ROTATION+

Function definition:

Event Table FD.8.3.2-a -- When large x and y adjustments are applied

MODES	EVENTS
HUDaln *Lautocal* *Landaln* *Sautocal* *SINSaln*	@T(!!IMS adj xy error!! gt !+IMS adj xy tolerance+!) WHEN(!+align_stage+! = $CL2$ OR $CA2$)
Airaln	@T(!!IMS adj xy error!! [illegible] !+IMS adj xy tolerance+!) WHEN(!+align_stage+! = $CL2$)
Function call:	+DI_S_X_COARSE_ROTATION+(!!IMS adj x error!!) +DI_S_Y_COARSE_ROTATION+(!!IMS adj y error!!)

Local dictionary:

Term	Definition
!!IMS adj xy error!!	MAX(!!IMS adj x error!!, !!IMS adj y error!!)
!!IMS adj x error!! and !!IMS adj y error!!	Defined by Table 8.3.1-b.

FD.8.3.3 DEMAND FUNCTION DESCRIPTION: Adjust the alignment of the IMS platform z axis.

Mnemonic: +FD_IMS_ADJ_Z_D+

Output produced:

Item	Type	Access program
IMS small z-axis correction	angle	+DI_S_Z_FINE_ROTATION+
IMS large z-axis correction	angle	+DI_S_Z_COARSE_ROTATION+

Function definition:

Like the x and y axes, the IMS platform z axis may be corrected by either a large or a small adjustment. A large adjustment can be either a "preliminary adjustment" or a "subsequent adjustment". The subsequent adjustment is applied at the concluding portion of an alignment stage, while the preliminary adjustment does not depend on the alignment stage at all. There is a third class of large z-axis adjustments, which we have called "radical" adjustments. These involve temporary ninety-degree rotations about the axis to allow the IMS to align itself in another plane. Values defined by the following table.

Event Table FD.8.3.3-a -- When small z adjustments are applied

MODES	EVENTS
Lautocal	@T(!!IMS small z error!! gt !+IMS z adj tolerance+!) WHEN(!+align_stage+! = $CA2$ OR $ND2$ OR $ED2$ AND !!IMS small z error!! lseq ¢ims_cutoff¢ OR !+align_stage+! = FG)
Sautocal	@T(!!IMS small z error!! gt !+IMS z adj tolerance+!) WHEN(!+align_stage+! = $CA2$ OR $ND2$ OR $ED2$ AND !!IMS small z error!! lseq ¢ims_cutoff¢ OR !+align_stage+!= =FG)
HUDaln *Landaln*	@T(!!IMS small z error!! gt !+IMS z adj tolerance+!) WHEN(!+align_stage+! = $CA2$ AND !!IMS small z error!! lseq ¢ims_cutoff¢ OR !+align_stage+! = FG)
SINSaln	@T(!!IMS small z error!! gt !+IMS z adj tolerance+!) WHEN(!+align_stage+! = $CA2$ AND !!IMS small z error!! lseq ¢ims_cutoff¢ OR !+align_stage+! = FG)
Airaln	@T(!!IMS small z error!! gt !+IMS z adj tolerance+!) WHEN(!+align_stage+! = HL OR FG)
OlUpdate	@T(!!IMS small z error!! gt !+IMS z adj tolerance+!) WHEN(!+align_stage+! = FG)
DI *DIG*	@T(!!IMS small z error!! gt !+IMS z adj tolerance+!)
I *OLB* *UDI*	@T(!!IMS small z error!! gt !+IMS z adj tolerance+!) WHEN(!+latitude+! lseq 80^{o})

Function call: +DI_S_Z_FINE_ROTATION+(!!IMS small z error!!)

Event Table FD.8.3.3-b -- When large z adjustments are applied:
!!IMS preliminary z adj!! and !!IMS subsequent z adj!!

MODES	When to apply !!IMS preliminary z adj!!	When to apply !!IMS subsequent z adj!!
HUDaln	@T(!+TD pressed+! WHEN(NOT !+IMS rotating+!)	@T(!+align_stage+! = $CA2$) WHEN(!!IMS subsequent z adj!! gt ¢ims_cutoff¢)
Lautocal	X	@T(!+align_stage+! = $CA2$ OR $ND2$ OR $ED2$) WHEN(!!IMS subsequent z adj!! gt ¢ims_cutoff¢)
Landaln	X	@T(!+align_stage+! = $CA2$) WHEN(!!IMS subsequent z adj!! gt ¢ims_cutoff¢)
SINSaln	@T(In mode)	@T(!+align_stage+! = $CA2$) WHEN(!!IMS subsequent z adj!! gt ¢ims_cutoff¢)
Function call:	+DI_S_Z_COARSE_ROTATION+ (!!IMS preliminary z adj!!)	+DI_S_Z_COARSE_ROTATION+ (!!IMS subsequent z adj!!)

Event Table FD.8.3.3-c -- Applying radical IMS z-axis adjustments:
Value of adjustments and when to apply them

MODES	EVENTS		
Lautocal	X	@F(!+align_stage+! = ED OR $ED2$)	@T(!+align_stage+! = ED OR $ED2$)
Sautocal	@F(!+align_stage+! = ED OR $ED2$)	X	@T(!+align_stage+! = ED OR $ED2$)
Output value:	90 deg CCW + !+ims_z_const_error_mc+!	90 deg CCW + !+ims_z_sins_error_mc+!	90 deg CW

Local dictionary:

Term Definition

!!az ref error!!

The error (difference in heading) calculated by comparing the IMS heading to the heading calculated from !+az ref hdg pnl+! corrected by the HUD aiming symbol azimuth displacement at the time of the test. The value is updated whenever @T(!+desig+!) WHEN(!+align_mode+! = *HUDaln*) occurs. The value is (!+az ref hdg pnl+! + !+AS azimuth+! - !+heading IMS+!) modulo 360 degrees.

!!IMS small z error!!

The amount of small correction to be applied to the IMS z axis; values defined by table below.

Selector Table FD.8.3.3-d
Values of small IMS z-axis adjustments: !!IMS small z error!!

MODES	!!IMS small z error!!
HUDaln *Landaln* *Lautocal* *OlUpdate*	!+ims_z_const_error_mc+!
Sautocal *SINSaln*	!+ims_z_sins_error_mc+!
Airaln *DIG*	!+ims_z_dop_error_mc+!
DI	!+ims_z_dop_error_m+!
I *OLB* *UDI*	!+ims_z_nav_error_m+!

Local dictionary (continued):

Term — Definition

!!sins error!!
Angular difference measured from !+heading IMS+! to (!+SINS heading+! + !+SINS dhdg pnl+!). Positive if that angle is measured clockwise; negative if counterclockwise.

!!IMS preliminary z adj!!
and
!!IMS subsequent z adj!!
Tne amount of large (coarse) correction to be applied to the IMS z axis during either a preliminary adjustment or a subsequent adjustment, respectively.

Selector Table FD.8.3.3-e -- Values of preliminary and subsequent IMS z-axis adjustments

MODES	!!IMS preliminary z adj!!	!!IMS subsequent z adj!!
HUDaln	!!az_ref_error!!	!+ims_z_const_error_mc+!
SINSaln	!!sins_error!!	!+ims_z_sins_error_mc+!
Landaln	X	!+ims_z_const_error_mc+!

FD.8.4 <u>DEMAND FUNCTION DESCRIPTION:</u> Initialize the IMS velocities.

<u>Mnemonic:</u> +FD_IMS_SET_VELS_D+

<u>Output produced:</u>

Item	Type	Access program
New IMS east velocity	speed	+DI_S_IMS_E_VEOCITY+
New IMS north velocity	speed	+DI_S_IMS_N_VEOCITY+

<u>Function definition:</u>

Event Table FD.8.4-a -- Initializing IMS velocities

MODES	EVENTS	
SINSaln *Sautocal*	@T(!+New align stage+!)	X
Landaln *Lautocal*	X	@T(In mode)
IMS fail	X	@T(In mode)
OUTPUT VALUES:		
New IMS east velocity:	!+SINS east vel+!	0 fps
New IMS north velocity:	!+SINS north vel+!	0 fps

FD.8.5 DEMAND FUNCTION DESCRIPTION: Set the IMS reconfiguration values.

Mnemonic: +FD_IMS_RECONFIG_D+

Output produced:

Item	Type	Access program
New X drift	real	+DI_S_X_GYRC_DRIFTRATE+
New Y drift	real	+DI_S_Y_GYRO_DRIFTRATE+
New Z drift	real	+DI_S_Z_GYRO_DRIFTRATE+
New X corr increm	real	+DI_S_X_GYRO_SCALE+
New Y corr increm	real	+DI_S_Y_GYRO_SCALE+
New Z corr increm	real	+DI_S_Z_GYRO_SCALE+
New N coarse scale factor	real	+DI_S_N_COARSE_VEL_SCALE+
New E coarse scale factor	real	+DI_S_E_COARSE_VEL_SCALE+
New V scale factor	real	+DI_S_V_VEL_SCALE+
New N fine scale factor	real	+DI_S_N_FINE_VEL_SCALE+
New E fine scale factor	real	+DI_S_E_FINE_VEL_SCALE+
New N coarse bias	real	+DI_S_N_COARSE_VEL_BIAS+
New E coarse bias	real	+DI_S_E_COARSE_VEL_BIAS+
New V bias	real	+DI_S_V_VEL_BIAS+
New N fine bias	real	+DI_S_N_FINE_VEL_BIAS+
New E fine bias	real	+DI_S_E_FINE_VEL_BIAS+

Function definition:

Event Table FD.8.5-a -- IMS reconfi~uration updates

MODES	EVENTS
All modes except *Grtest*	@T(!+New !!input item!! entered+!)

Output value: !+ !!input item!! +!

For instance, one of the values of !!input item!! [illegible] drift pnl" (see local dictionary). Therefore, when @T(!+New X dr[illegible] entered+!) occurs, this function should output the new value [illegible] drift pnl+! via the access program +DI_S_X_GYRO_DRIFTRATE+.

Local dictionary:

Term	Definition
!!input item!!	any of the various input items used to update an IMS Reconfiguration value. Enumerated in the list below. X drift pnl Y drift pnl Z drift pnl X corr increm pnl Y corr increm pnl Z corr increm pnl N coarse scale pnl E coarse scale pnl V coarse scale pnl N fine scale pnl E fine scale pnl N coarse bias pnl E coarse bias pnl V coarse bias pnl N fine bias pnl E fine bias pnl

```
************************************************************************
*                                                                      *
*                 FD.9                Panel functions                  *
*                                                                      *
************************************************************************
```

FD.9.1 DEMAND FUNCTION DESCRIPTION: Set the panel's mark window display.

Mnemonic: +FD_PNL_MARK_D+

Output produced:

Item	Type	Access program
To blank out the mark window	--	+DI_CLEAR_MARK+
Display for mark window	char_string(1)	+DI_S_MARK_WINDOW+

Function definition:

Event Table FD.9.1-a -- Clearing the Mark window display

MODES	EVENT
All modes except *Grtest*	@T(!+Init complete+!)
Grtest	@T(In mode)
Functior call:	Call +DI_CLEAR_MARK+

Event Table FD.9.1-b -- Changing the Mark window display

MODES	EVENTS		
All modes except *Grtest*	@T(!+Mark pressed+!) WHEN(NOT !!Nav2 config!!)	@T(!!Nav2 config!! AND NOT !+ADC reasonable+!)	@T(!!Nav2 config!! AND !+ADC reasonable+!)
Output Value:	!+Mark+!, converted to character form	character '0'	character '1'

Local dictionary:

Term — Definition

!!Nav2 config!! — true iff calling +SS_G_PNL_CONFIG+($Nav diags2$, p2) returns p2 with a value of true. This means that the panel is in the $Nav diags2$ configuration.

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FD.9.2 DEMAND FUNCTION DESCRIPTION: Control the panel's enter light.

Mnemonic: +FD_PNL_ENTER_D+

Output produced:

Item	Type	Access program
Enter light mode	boolean	+DI_S_ENTER_LIGHT+

Function definition:

Event Table FD.9.2-a -- Controlling the ENTER light

MODES	EVENTS	
FlyUpd *HUDUpd* *MapUpd* *RadarUpd* *TacUpd*	@T(!+TD pressed+!) WHEN(NOT !+Enter light+!) OR @T(!+data enterable+!)	@T(!!Panel switch changed!! OR !+Input attempted+! OR !+Fly to num changed+! OR !+Fly to state changed+! WHEN(!+Enter light+!) OR @T(!+Init complete+!) OR @F(!+data enterable+!)
OUTPUT VALUE:	true	false

Local dictionary:

Term	Definition
!!Panel switch changed!!	(!+Panel mode changed+! OR !+Update changed+! OR !+Pres pos changed+! OR !+Map hold changed+! OR !+Enter pressed+! OR !+Input requested+!)

FD.9.3 <u>DEMAND FUNCTION DESCRIPTION:</u> Display data in the upper or lower window

<u>Mnemonic:</u> +FD_PNL_DISPLAY_D+

<u>Output produced:</u>

Item	Type	Access program
To control upper and lower window displays	angle	+SS_S_ANGLE_LOWER+
	angle	+SS_S_ANGLE_UPPER+
	charlit	+SS_S_CHARLIT_LOWER+
	charlit	+SS_S_CHARLIT_UPPER+
	latitude	+SS_S_LATITUDE_UPPER+
	longitude	+SS_S_LONGITUDE_LOWER+
	real	+SS_S_REAL_LOWER+
	real	+SS_S_SFRAC_LOWER+
	boolean	+SS_S_SIGN_LOWER+
	integer	+SS_S_SINT_LOWER+
	integer	+SS_S_SINT_UPPER+
	real	+SS_S_UFRAC_LOWER+
	time	+SS_S_TIME_LOWER+
	integer	+SS_S_UINT_UPPER+
	integer	+SS_S_UINT_LOWER+
To clear displays	--	+SS_CLEAR_LOWER+
	--	+SS_CLEAR_UPPER+
To control format lights	boolean	+DI_S_E_LIGHT+
	boolean	+DI_S_N_LIGHT+
	boolean	+DI_S_S_LIGHT+
	boolean	+DI_S_W_LIGHT+

Function definition:

WHAT TO DISPLAY ON THE PANEL WINDOWS: Table FD.9.3-a shows:

(1) all of the various values that can be displayed on the panel. This list is under the "!!item!!" column. The value for each item is either available directly from some other module (if bracketed by "!+ +!" symbols), or is defined in this function's local dictionary (if bracketed by "!! !!" symbols).

(2) the data type for the item to be displayed (called "Input Type" in the table). Some values come directly from other modules, and this is the data type of the provided value. On the other hand, some display values are composed by this function driver from several input values rather than being obtained as a whole from one source. If all components are of the same type, that type is given. Otherwise, the type is given as "various".

(3) the data type that the item must have in order to be displayed (if that data type is different from that item's input data type). If so, a type conversion will be required. In most cases, the value mapping from one type to another is obvious (e.g., from "integer" to "real"), and will not be discussed. In cases where the mapping is not obvious (e.g., from "angle" to "boolean") it will be given in the "Notes" section following the table.

(4) any value constraints placed on the item; if the produced display value exceeds these constraints, this function driver should display the nearest limiting value.

(5) the required display format of the item; each window-display access program is of the form +SS_S_format_window+, where "format" is replaced as appropriate by the entry from this column.

(6) the window in which to display the item: UPPER or LOWER.

WHEN TO DISPLAY AN !!ITEM!!:

A display !!item!! is displayed on the specified window with the specified format each time the following occurs:

@T(!+pnl config+! = !!item!!)

The !!item!! value is re-displayed on the window everytime its value changes by at least !!resolution!! amount, until the event @T(!+pnl config = !!item!!) occurs for some other !!item!!. The term !!resolution!! is defined in the local dictionary for each !!item!!.

WHEN TO DISPLAY NOTHING:

When @T(!+Pnl config changed+!) occurs, this function should blank out both windows by calling +SS_CLEAR_UPPER+ and +SS_CLEAR_LOWER+.

Selector Table 9.3-a -- Definition of panel displays

!!item!!	Input Type	Output type if different and value constraints	Format	Window
		Altitude displays		
!!alt baro AGL!!	distance	integer(0 - 65535 feet)	UINT	UPPER
!!Priority alt display!!	various	char string	CHARLIT	LOWER
		Device reconfiguration values -- ADC, IMS, and PMDS		
!+L-probe+!	boolean	--	SIGN	LOWER
!+E coarse bias+!	real	-.02 - +.02	SFRAC	LOWER
!!Displ E coarse scale!!	real	0, or .026 - .038	UFRAC	LOWER
!+E fine bias+!	real	-.01 - +.01	SFRAC	LOWER
!!Displ E fine scale!!	real	0, or .00026-.00038	UFRAC	LOWER
!+N coarse bias+!	real	-.02 - +.02	SFRAC	LOWER
!!Displ N coarse scale!!	real	0, or .026 - .038	UFRAC	LOWER
!+N fine bias+!	real	-.01 - +.01	SFRAC	LOWER
!!Displ N fine scale!!	real	0, .00026-.00038	UFRAC	LOWER
!+V coarse bias+!	real	-.02 - +.02	SFRAC	LOWER
!!Displ V coarse scale!!	real	0, or .026 - .038	UFRAC	LOWER
!+X corr increm+!	real	.32 - .48	UFRAC	LOWER
!+X drift+!	real	-1 - +1	SFRAC	LOWER
!+Y corr increm+!	real	.32 - .48	UFRAC	LOWER
!+Y drift+!	real	-1 - +1	SFRAC	LOWER
!+Z corr increm+!	real	.32 - .48	UFRAC	LOWER
!+Z drift+!	real	-1 - +1	SFRAC	LOWER
!!central long a!!	longitude	-180°0'0" - +180°0'0"	LONGITUDE	LOWER
!!central long b!!	longitude	-180°0'0" - +180°0'0"	LONGITUDE	LOWER
!!low lat ct a!!	integer	-90 - +90	SINT	LOWER
!!low lat ct b!!	integer	-90 - +90	SINT	LOWER
!!map orient a!!	angle	boolean -- See note 2	SIGN	LOWER
!!map orient b!!	angle	boolean -- See note 2	SIGN	LOWER
		Doppler-related displays		
!!gndspd filtered!!	speed	integer(0 - 1214 knots)	UINT	LOWER
!!drift angle filtered!!	angle	integer(-180 - +180 deg)	SINT	LOWER

Selector Table 9.3-a (continued)

!!item!!	Input Type	Output type if different and value constraints	Format	Window
		Hardware diagnostic displays		
!!IMS diags1!!	boolean	charlit	CHARLIT	UPPER
!!IMS diags2!!	boolean	charlit	CHARLIT	LOWER
!!MFSW diags!!	boolean	charlit	CHARLIT	UPPER
!!Map sw diags!!	boolean	charlit	CHARLIT	LOWER
!!Nav diags1!!	boolean	charlit	CHARLIT	UPPER
!!Nav diags2!!	boolean	charlit	CHARLIT	LOWER
!!SINS valid1!!	boolean	charlit	CHARLIT	UPPER
!!SINS valid2!!	boolean	charlit	CHARLIT	LOWER
!!STARDY diags!!	boolean	charlit	CHARLIT	UPPER
!!Wpn sw diags!!	boolean	charlit	CHARLIT	LOWER
!+ARPINT+!	integer	0 - 990	UINT	LOWER
!+ARPQUANT+!	integer	0 - 99	UINT	UPPER
!+WEAPTYP+!	integer	0 - 99	UINT	LOWER
		Heading displays		
!+az ref hdg pnl+!	angle	0° 0' - 360° 0'	ANGLE	LOWER
!+heading IMS+!	angle	0° 0' - 360° 0'	ANGLE	UPPER
!+heading MAG+!	angle	0° 0' - 360° 0'	ANGLE	LOWER
!!hdg system!!	angle	0° 0' - 360° 0'	ANGLE	UPPER
		IMS-related displays		
!!align stage!!	astage	charlit	CHARLIT	UPPER
!!drftangl IMS!!	angle	integer(-180 - +180 deg)	SINT	UPPER
!!groundspeed IMS!!	speed	integer(0 - 1214 knots)	UINT	UPPER
!!gyro drift delta n!!	real	-.99 - +.99	SFRAC	LOWER
		Position-related displays		
!+Latitude error+!	latitude	N90°0'0" - S90°0'0"	LATITUDE	UPPER
!+Map latitude+!	latitude	N99°59'59 - S99°59'59	LATITUDE	UPPER
!+latitude+!	latitude	N99°59'59 - S99°59'59	LATITUDE	UPPER
!+Longitude error+!	longitude	E180°0'0" - W180°0'0"	LONGITUDE	LOWER
!+Map longitude+!	longitude	E180°0'0" - W180°0'0"	LONGITUDE	LOWER
!+longitude+!	longitude	E180°0'0" - W180°0'0"	LONGITUDE	LOWER

Selector Table 9.3-a (continued)

!!item!!	Input Type	Output type if different and value constraints	Format	Window
		Release-time displays		
!!Alt AGL at rls!!	distance	int(0 - 65535 ft)	UINT	LOWER
!!fpangl at rls!!	angle	real (-180 - +180 deg)	REAL	LOWER
!!norm accel at rls!!	accel	real (0 - 32767 g's)	REAL	LOWER
!!Slant range at rls!!	distance	integer(0 - 262141 feet)	UINT	UPPER
!!az miss dist at rls!!	distance	integer(0 - 65535 feet)	UINT	UPPER
!!TAS ADC at rls!!	speed	integer(0 - 32767 knots)	UINT	UPPER
		SINS-related displays		
!+SINS dhdg pnl+!	angle	0°0'0" - 360°0'0"	ANGLE	LOWER
!+SINS heading+!	angle	0° 0' - 360° 0'	ANGLE	LOWER
!+SINS lat+!	latitude	N90°0'0" - S90°0'0"	LATITUDE	UPPER
!+SINS long+!	longitude	E180°0'0" - W180°0'0"	LONGITUDE	LOWER
!+SINS x offset pnl+!	distance	integer(-2047 - +2047 ft)	SINT	UPPER
!+SINS y offset pnl+!	distance	integer(-2047 - +2047 ft)	SINT	LOWER
!+SINS z offset pnl+!	distance	integer(-2047 - +2047 ft)	SINT	UPPER
!+SINS east vel+!	speed	integer(-2047 - +2047kts)	SINT	LOWER
!+SINS north vel+!	speed	integer(-2047 - +2047kts)	SINT	LOWER
		Software switch displays		
!+data nbr pnl+!	integer	0 - 99	UINT	UPPER
!+Doppler coupled pnl+!	boolean	--	SIGN	LOWER
!+Land based pnl+!	boolean	--	SIGN	LOWER
!+Radalt priority pnl+!	boolean	--	SIGN	LOWER
		Static displays		
!+Compfail config+!	--	See note 3.	--	--
!!OFP version upper!!	charlit	--	CHARLIT	UPPER
!!OFP version lower!!	charlit	--	CHARLIT	LOWER
		Time-related displays		
!+elapsed navaln time+!	time	0:00:00 - 6:45:00	TIME	LOWER
!+time to ftpt+!	time	See note 1.	TIME	LOWER
		Velocity displays		
!!TAS filtered!!	speed	integer(0 - 1214 knots)	UINT	LOWER
!!IMS total vel!!	speed	integer(0 - 1214 knots)	UINT	UPPER
!!vel E!!	speed	integer(-2047 - +2047kts)	SINT	UPPER
!!vel N!!	speed	integer(-2047 - +2047kts)	SINT	UPPER

Selector Table 9.3-a (continued)

!!item!!	Input Type	Output type if different and value constraints	Format	Window
		Wind displays		
!+wind vel+!	integer	0 - 255 knots	UINT	UPPER
!+wind dir+!	angle	0°0'0" - 360°0'0"	ANGLE	LOWER

Items indexed by pilot-chosen number

For all display items in this section, there are several different versions of each that may be displayed. The version that should be displayed is denoted in the specifications by "i", where 1 lseq i lseq ¢num dests¢. The value for "i" is obtained from the data banker item !+dest entry pnl+!.

!+dest altitude pnl+!(i)	distance	integer(-65535 - 65535ft)	SINT	UPPER
!+dest lat+! (i)	latitude	N99°59'59"-S99°59'59"	LATITUDE	UPPER
!+dest long+! (i)	longitude	E180°0'0" - W180°0'0"	LONGITUDE	LOWER
!+dest mslp pnl+! (i)	pressure	real (0 - 40.95 in. Hg)	REAL	LOWER
!+mark lat+! (i)	latitude	N99°59'59"-S99°59'59"	LATITUDE	UPPER
!+mark long+! (i)	longitude	E180°0'0" - W180°0'0"	LONGITUDE	LOWER
!+offset brg pnl+! (i)	angle	0°0'0" - 360°0'0"	ANGLE	LOWER
!+offset dht pnl+! (i)	distance	integer(-65535 - 65535ft)	SINT	UPPER
!+offset rng pnl+! (i)	distance	integer(0 - 131,070 ft)	UINT	UPPER
!+burst ht pnl+! (i)	distance	integer(0 - 65535 ft)	UINT	LOWER
!+Mag variation pnl+!(i)	angle	180°0'0" - W180°0'0"	LONGITUDE	LOWER

Notes:

1. If !+time to dest+! is greater than 6:45:00, then 0:00:00 is displayed.

2. The mapping between types "angle" and "boolean" is as follows: The boolean value is true iff the angular measure is 0 degrees.

3. The display for this item consists of a blank panel, with all the format lights turned on. There is no input item associated with this display.

Local dictionary:

Term Definition

Any term of the form !! item a!!

The value of !+ (item) +!, parameterized by the map value A. For instance, !!map orient a!! is defined as !+map orient+! parameterized by the map value A.

Any term of the form !! item b!!

The value of !+ (item) +! parameterized by the map value B. For instance, !!low lat ct b!! is defined as !+low lat ct+! parameterized by the map value B.

!!align stage!!

If the current !+align_stage+! is FM or HS, this display is blank. Otherwise, the alignment stage is displayed in positions three and four of an otherwise-blank six-character string.

!!Alt AGL at rls!!

An altitude measure taken at the time of the first weapon release in the most recent stik. The value is updated whenever the event @T(!+rls_pts_passed+! = 1) occurs. The value to be used in the update is by the table below.

Definition of !!Alt AGL at rls!!

MODES	CONDITIONS		
CCIP *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	!+sr_ reasonable+!	NOT !+sr_ reasonable+! AND !+Radalt priority pnl+!	NOT !+sr_ reasonable+! AND NOT !+Radalt priority pnl+!
A/A Manrip *BOC* *BOCFlyto0* *BOCoffset* *Manrip* *SBOC* *SBOCFlyto0* *SBOCoffset*	X	!+Radalt priority pnl+!	NOT !+Radalt priority pnl+!
VALUE:	!+alt from sr+!	!+alt RADAR+!	!!altitude baro above tgt!!

!!altitude aro above tgt!!

Defined by the table be w. In the table, !+dest altitude pnl+! and !+offset dht pnl+! are indexed by !+Fly to num+!.

MODES	DEFINITION
BOCoffset *HUDdown2* *Noffset* *SBOCoffset* *SHUDdown2* *Snoffset*	!+alt ADC+! - !+dest altitude pnl+! - !+offset dht pnl+!
Any other weapon mode	!+alt ADC+! - !+dest altitude pnl+!

!!alt baro AGL!!

Definition in table below.

MODES		EVENTS
AflyUpd	X	@T(!+Dest selected+!) OR @T(!+TD pressed+!)
BOCFlyto0 *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SBOCFlyto0* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	@F(!+desig+!) OR @T(In mode)	@T(!+desig+!) OR @F(!+Slew displacement non-zero+!) WHEN(!+rls_pts_passed+! = 0)
BOC *SBOC*	@T(In mode AND !+gr_ac_tgt+! gt 30 nmi)	@T(!+gr_ac_tgt+! lseq 30 nmi) OR @F(!+Slew displacement non-zero+!) WHEN(!+gr_ac_tgt+! lseq 20 nmi AND !+rls_pts_passed+! = 0)
BOCoffset *SBOCoffset*	@T(In mode) OR @F(!+desig+!) OR @T(!+gr_ac_tgt+! gt 30 nmi)	@T(!+desig+!) OR @T(!+gr_ac_oap+! lseq 30 nmi OR @F(!+Slew displacement non-zero+!) WHEN(!+gr_ac_oap+! lseq 20 nmi AND !+rls_pts_passed+! = 0)
CCIP	@T(In mode)	@T(!+ip elev+! lseq 16 deg) WHEN(!+rls_pts_passed+! = 0)
VALUE:	0 feet	!!altitude baro above tgt!!

!!az miss dist at rls!! The value of !+az miss dist+! at the first release of the most recent stik, or zero. Defined by the table below.

Definition of !!az miss dist at rls!!

MODES	EVENTS	
BOC *BOCFlyto0* *BOCoffset* *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SBOC* *SBOCFlyto0* *SBOCoffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	X	@T(!+rls_pts_passed+! = 1)
A/A Manrip *CCIP* *Manrip*	@T(In mode)	X
VALUE:	0 feet	!+az miss dist+!

!!Displ E coarse scale!! !+E coarse scale+! if value is noteq ¢IMSR_init_coarse_vscale¢; 0 otherwise.

!!Displ E fine scale!! !+E fine scale+! if value is noteq ¢IMSR_init_fine_vscale¢; 0 otherwise.

!!Displ N coarse scale!! !+N coarse scale+! if value is noteq ¢IMSR_init_coarse_vscale¢; 0 otherwise.

!!Displ N fine scale!! !+N fine scale+! if value is noteq ¢IMSR_init_fine_vscale¢; 0 otherwise.

!!Displ V coarse scale!! !+V coarse scale+! if value is noteq ¢IMSR_init_coarse_vscale¢; 0 otherwise.

!!drftangl IMS!! 0 degrees if !+nav mode+! = *IMS fail*; !+drift angle IMS+! otherwise.

!!drift angle filtered!! !+drift angle DRS+! averaged over 3 seconds.

!!fpangl at rls!! The value used is !+flt path angle+!. The value is updated when in one of the following weapon modes: *A/A Manrip*, *BOC*, *BOCFlyto0*, *BOCoffset*, *CCIP*, *HUDdown1*, *HUDdown2*, *Manrip*, *Nattack*, *Noffset*, *SBOC*, *SBOCFLyto0*, *SBOCoffset*, *SHUDdown1*, *SHUDdown2*, *Snattack*, or *Snoffset*. The value is updated whenever @T(!+rls_pts_passed+! = 1) occurs.

!!gndspd filtered!! smoothed !+gnd speed DRS+!.

!!groundspeed IMS!! 0 fps if !+nav_mode+! = *IMS fail*; !+IMS horiz velocity+! otherwise.

!!gyro drift delta n!! The difference between the latest value of !+X drift+! and the previous value. The value is updated in *OlUpdate* mode when @F(!+align_stage+! = TS) occurs. Also, the value is set to 0 when @T(*Landaln*) occurs.

!!hdg system!!

Definition of !!hdg system!!

MODES	CONDITIONS	
All modes	!+IMS ready+! AND !+IMS rel+!	NOT !+IMS ready+! OR NOT !+IMS rel+!
VALUE:	!+heading IMS+!	!+heading MAG+! + !+magvar IMS+!

!!item!! Enumerated by Table FD.9.3-a. This tells not only the values to use for display, but also the configuration that the panel must be in for that item to be displayed.

!!IMS diags1!! This is a six-element string of character literals. The conditions for each element are given below. If a condition is true, then the element has the value 1; if false, 0.

Element #	Condition
1	!+IMSREL+!
2	!+ACAIRB+!
3	!+MA+!
4	!+IMSMODE eq Gndal+!
5	!+IMSMODE eq Norm+!
6	!+IMSMODE eq Iner+!

!!IMS diags2!!

This is a seven-element string of character literals. The conditions for each element are given below. If a condition is true, then the element is set to 1; if false it is set to 0.

Element #	Condition
1	!+IMSMODE eq Grid+!
2	!+IMSMODE eq Magsl+!
3	NOT !+IMSREDY+!
4	!+IMSAUTOC+!
5	!+ADCFAIL+!
6	!+ARPPAIRS+!
7	Always set to $blank$

!!IMS total vel!!

0 fps if !+nav mode+! = *IMS fail*; otherwise, !+IMS total velocity+!.

!!Map sw diags!!

This is a seven-element string of character literals. The conditions for each element are given below. If a condition is true, then the element is set to 1; otherwise it is set to 0.

Element #	Condition
1	!+PMSCAL eq 80+!
2	!+PMHOLD+!
3	!+PMDCTR+!
4	!+PMNORUP+!
5	!+PMLAND+!
6	!+HUDREL+!
7	Always set to $blank$

!!MFSW diags!!

This is a six-element string of character literals. The conditions for each element are given below. If a condition is true, then the element is set to 1; otherwise it is set to 0.

Element #	Condition
1	!+BMBDRAG eq High+!
2	!+MFSW eq NATT+! OR !+MFSW eq NATTOFF+!
3	!+MFSW eq NATTOFF+! OR !+MFSW eq BOCOFF+!
4	!+MFSW eq BOC+! OR !+MFSW eq BOCOFF+!
5	!+MFSW eq CCIP+!
6	!+MFSW eq TF+!

!!Nav diags1!!

This is a six-element string of character literals. The conditions for each element are given below. If a condition is true, then the element has the value given after the condition.

Element #	Condition	Value
1	NOT !+ACAIRB+!	1
2	Always	$blank$
3	(!+nav_mode+! = *Magsl* OR *Grid* OR *IMS fail*) OR (!+align_mode+! = *Airaln* AND !+align_stage+! = FM)	1
4	Always	$blank$
5	NOT !+IMSREDY+!	1
6	Always	$blank$

!!Nav diags2!!

This is a seven-element string of character literals. The conditions for each element are given below. If a condition is true, then the element has the value given after the condition.

Element #	Condition	Value
1	NOT !+IMSREDY+! OR NOT !+IMSREL+!	1
2	Always	$blank$
3	NOT !+IMS reasonable+!	1
4	Always	$blank$
5	NOT !+DRSREL+!	1
6	Always	$blank$
7	NOT !+Doppler reasonable+!	1

!!norm accel at rls!!

The value used is !+normal accel+!. The value is updated when in one of the following weapon modes: *A/A Manrip*, *BOC*, *BOCflyto0*, *BOCoffset*, *CCIP*, *HUDdown1*, *HUDdown2*, *Manrip*, *Nattack*, *Noffset*, *SBOC*, *SBOCflyto0*, *SBOCoffset*, *SHUDdown1*, *SHUDdown2*, *Snattack*, or Snoffset*. The value is updated whenever @T(!+rls_pts_passed+! = 1) occurs.

!!OFP version upper!!
!!OFP version lower!!

Two character strings to be displayed in the panel display windows denoting information about this OFP. Defined at system generation time by the sysgen parameters ¢OFP version upper¢ and ¢OFP version lower¢, respectively.

!!Priority alt display!!

The character form of !+alt priority stale+!, prefixed by the character form of !+alt priority source+!.

!!resolution!! The required display resolution for each display item is given in the following table.

Display item:	Display resolution:
!+ADC smoothed TAS+!	1 knot
!!Alt AGL at rls!!	1 foot
!+ARPINT+!	10 feet
!+ARPQUANT+!	1
!!az miss dist at rls!!	.01 feet
!+az ref hdg pnl+!	1 minute
!+alt baro AGL+!	1 foot
!+burst ht pnl+!	2 feet (rounded down value)
!+central long a pnl+!	1 second
!+central long b pnl+!	1 second
!+Data nbr pnl+!	1 (integer)
!+dest altitude pnl+!	2 feet (rounded down value)
!+dest lat+!	1 second
!+dest long+!	1 second
!+dest mslp pnl+!	.01 inches
!+drift angle IMS+!	1 degree
!+DRS treated gndspd+!	1 knot
!+DRS avgd drift angle+!	1 degree
!+E coarse bias pnl+!	.0003 feet/sec/sec
!+E coarse scale pnl+!	.00003 feet/sec/pulse
!+E fine bias pnl+!	.0003 feet/sec/sec
!+E fine scale pnl+!	.000001 feet/sec/pulse
!+E vel IMS+!	1 knot
!+elapsed navaln time+!	1 second
!!fpangl at rls!!	.01 degrees
!+groundspeed IMS+!	1 knot
!!gyro drift delta n!!	.001 deg/hour
!+hdg IMS system+!	1 minute
!+heading IMS+!	1 minute
!+heading MAG+!	1 minute
!+IMS total vel+!	1 knot
!+latitude+!	1 second
!+Latitude error+!	1 second
!+longitude+!	1 second
!+Longitude error+!	1 second
!+low lat ct a pnl+!	10 seconds
!+low lat ct b pnl+!	10 seconds
!+Mag variation pnl+!	1 second
!+Map latitude+!	1 second
!+Map longitude+!	1 second
!+mark lat+!	1 second
!+mark long+!	1 second
!+N coarse bias pnl+!	.0003 feet/sec/sec
!+N coarse scale pnl+!	.00003 feet/sec/pulse
!+N fine bias pnl+!	.0003 feet/sec/sec
!+N fine scale pnl+!	.000001 feet/sec/pulse
!+N vel IMS+!	1 knot

Display item:	Display resolution:
!!norm accel at rls!!	.01 g
!+offset brg pnl+!	1 second
!+offset dht pnl+!	2 feet (rounded down value)
!+offset rng pnl+!	4 feet (rounded down value)
!+SINS dhdg pnl+!	1 second
!+SINS east vel+!	1 knot
!+SINS heading+!	1 minute
!+SINS lat+!	1 second
!+SINS long+!	1 second
!+SINS north vel+!	1 knot
!+SINS x offset pnl+!	1 foot
!+SINS y offset pnl+!	1 foot
!+SINS z offset pnl+!	1 foot
!!Slant range at rls!!	8 feet
!!TAS ADC at rls!!	1 knot
!+time to dest+!	1 second
!+V coarse bias pnl+!	.0003 feet/sec/sec
!+V coarse scale pnl+!	.00003 feet/sec/pulse
!+WEAPTYP+!	1 (integer)
!+wind dir+!	1 second
!+wind vel+!	1 knot
!+X corr increm pnl+!	.0004 sec/pulse
!+X drift pnl+!	.001 deg/hour
!+Y corr increm pnl+!	.0004 sec/pulse
!+Y drift pnl+!	.001 deg/hour
!+Z corr increm pnl+!	.0004 sec/pulse
!+Z drift pnl+!	.001 deg/hour

Term	Definition
!!SINS valid1!!	This is a six-element string of character literals. The conditions for each element are given below. If a condition is true, then the element has the value given after the condition.

Element #	Condition	Value
1	!+SINS heading valid+!	0
2	Always	$Blank$
3	!+SINS north vel valid+!	0
4	Always	$Blank$
5	!+SINS roll valid+!	0
6	Always	$Blank$

!!SINS valid2!!

This is a seven-element string of character literals. The conditions for each element are given below. If a condition is true, then the element has the value given after the condition.

Element #	Condition	Value
1	!+SINS east vel valid+!	$0$
2	Always	$Blank$
3	!+SINS pitch valid+!	$0$
4	Always	$Blank$
5	!+SINS lat valid+!	$0$
6	Always	$Blank$
7	!+SINS long valid+!	$0$

!!Slant range at rls!!

Definition of !!Slant range at rls!!

MODES		EVENTS	
BOC *BOCFlyto0* *BOCoffset* *HUDdown1* *HUDdown2* *Nattack* *Noffset* *SBOC* *SBOCflyto0* *SBOCoffset* *SHUDdown1* *SHUDdown2* *Snattack* *Snoffset*	X	@T(!+rls_pts_passed+! = 1)	X
CCIP	X	X	@T(!+rls_pts_passed+!=1)
A/A Manrip *Manrip*	@T(In mode)	X	X
VALUE:	0 feet	!+sr_ac_tgt+!	!+sr_ac_ip+!

!!STARDY diags!! This is a six-element string of character literals. The conditions for each element are given below. If a condition is true, then the element has the value 1; otherwise, 0.

Element #	Condition
1	!+STA1RDY+!
2	!+STA2RDY+!
3	!+STA3RDY+!
4	!+STA6RDY+!
5	!+STA7RDY+!
6	!+STA8RDY+!

!!TAS ADC at rls!! The value used is !+TAS ADC+!. The value is updated when in one of the following weapon modes: *A/A Manrip*, *BOC*, *BOCflyto0*, *BOCoffset*, *CCIP*, *HUDdown1*, *HUDdown2*, *Manrip*, *Nattack*, *Noffset*, *SBOC*, *SBOCflyto0*, *SBOCoffset*, *SHUDdown1*, *SHUDdown2*, *Snattack*, or Snoffset*. The value is updated whenever @T(!+rls_pts_passed+! = 1) occurs.

!!TAS filtered!! !+TAS ADC+!, after smoothing.

!!vel E!!
!!vel N!!

MODES	EVENTS		
SINSaln *Sautocal*	@T(!+new align stage+!)	@T(!!disp diff!!)	@F(In mode)
Landaln *Lautocal*	X	@T(!!disp diff!!)	@F(In mode)
IMS fail	X	X	@T(In mode)
All other navigation or align. modes	X	@T(!!disp diff!!)	X
!!vel E!!:	!+SINS E vel+!	!+E vel IMS+!	0 fps
!!vel N!!:	!+SINS N vel+!	!+N vel IMS+!	0 fps

!!Wpn sw diags!! This is a seven-element string of character literals. The conditions for each element are given below. If a condition is true, then the element has the value given after the condition.

Element #	Condition	Value
1	!+GUNSSEL+!	1
2	!+RE+!	1
3	!+MULTRACK+!	1
4	!+TD+!	1
5	Always	$blank$
6	Always	$blank$
7	Always	$blank$

Design issues:

1. At one time, this module was responsible for receiving input from the panel as well as displaying data on it. Now, however, the input cperations reside completely in the Shared Services Panel i/o submodule. A parallel may be drawn to the SINS input: a module is responsible for collecting the input and reporting it to the outside world, while hiding the method of input.

2. In a previous version, there was a class of functions which controlled both windows at once. This class included the diagnostic displays, the OFP version display, the error display, and a few more. Most of the other displays had already been divorced from their other-window partners, and the error display has been internalized to the module that handles panel inputs. It was decided to hide the pairing of window displays completely, and so even the limited class of "dual-window" displays was broken up into single-window constituents. It was felt that a future requirements change could easily break up any dual-window display into two unrelated displays. It would be much easier to handle such a change if there were no displays that were considered to use both windows.

```
************************************************************************
*                                                                      *
*               FD.10                    PMDS functions                *
*                                                                      *
************************************************************************
```

FD.10.1 PERIODIC FUNCTION DESCRIPTION: Set the map indicator.

Mnemonic: +FD_MAP_IND_P+

Output produced:

Item	Type	Access program
Map indicator value	angle	+DI_S_MAP_INDICATOR+

Initiation/termination events:

None. Always performed.

Function definition:

This function always outputs the value !+heading MAG+! + !+grtk+! !+heading MAG+!.

FD.10.2 **PERIODIC FUNCTION DESCRIPTION:** Set the map orientation angle.

Mnemonic: +FD_MAP_ORIENT_P+

Output produced:

Item	Type	Access program
Map orientaton angle	angle	+DI_S_MAP_ROTATION+

Initiation/termination events:

None. Always performed.

Function definition:

Condition Table FD.10.2-a -- Map orientation control

MODES	CONDITIONS		
All modes except *Grtest*	!+Map north-up+! AND NOT !+Map hold+!	NOT !+Map north-up+! AND NOT !+Map hold+!	!+Map hold+!
Output value:	0 degrees	!+grtk+!	!!stale orient!!

Local dictionary:

Term	Definition
!!stale orient!!	last value of map orientation angle before @T(!+Map hold+!)

FD.10.3 PERIODIC FUNCTION DESCRIPTION: Set the map pointer.

Mnemonic: +FD_MAP_PTR_P+

Output produced:

Item	Type	Access program
Map pointer angle	angle	+DI_S_MAP_POINTER_ANGLE+

Initiation/termination events:

None. Always performed.

Function definition:

MODES	CONDITIONS	
All modes	!+Fly to num+! = 0	!+Fly to num+! noteq 0
Output value:	0 degrees	!+brg_grtk_flpt+!

FD.10.4 DEMAND FUNCTION DESCRIPTION: Set the map reference point.

Mnemonic: +FD_MAP_REF_PT_D+

Output produced:

Item	Type	Access program
Map reference point	ref_pt	+DI_S_MAP_REFERENCE_PT+

Function definition:

Event Table FD.10.4-a -- Map reference point control

MODES	EVENTS	
All modes except *Grtest*	@T(!+Init complete+!) WHEN(!+Map north-up+! OR NOT !+Map decenter+!) OR @F(NOT !+Map north-up+! AND !+Map decenter+!)	@T(!+Init complete+!) WHEN(NOT !+Map north-up+! AND !+Map decenter+!) OR @T(NOT !+Map north-up+! AND !+Map decenter+!)
Output value:	$center$	$bottom-center$

FD.10.5 **PERIODIC FUNCTION DESCRIPTION:** Position the map.

Mnemonic: +FD_MAP_DISPLAY_P+

Output produced:

Item	Type	Access program
To display the map warning	--	+DI_DISPLAY_MAP_WARNING+
To display a location or remove the map warning	--	+DI_S_MAP_POSITION+

Initiation/termination events: None. Always performed.

Function definition:

Condition Table FD.10.5-b: Setting the map position

MODES	CONDITIONS	
All navigation and alignment modes; *MapUpd*	!!Posn displayable!!	NOT !!Posn displayable!!
FUNCTION RESULT:	Call +DI_S_MAP_POSITION+	Call +DI_DISPLAY_MAP_WARNING+

Note that the Requirements do not specify what to do if a desired display location is not displayable with the current map set. The condition is described in the Requirements as "Error -- undefined". NWC-2 does not perform displayability checks. Since our virtual PMDS does perform this check, we have chosen to have the map display a warning in case a location is not displayable.

Local dictionary:

Term	Definition
!!refpt!!	Defined by the table below.
!!refpt lat!!	Defined by the table below.
!!refpt long!!	Defined by the table below.

Condition Table FD.10.5-c -- Definition of !!refpt!!, !!refpt lat!!, and !!refpt long!!

MODES	CONDITIONS		
All alignment & navigation modes; Not *MapUpd*	NOT !!Dest/Mark!! AND NOT !+Map hold+! AND NOT !+during slewing+!	NOT !+Map hold+! AND NOT !+during slewing+! AND !!Dest/Mark!!	!+Map hold+! OR !+during slewing+!
MapUpd	NOT !+desig+! AND NOT !+during slewing+!	X	!+desig+! OR !+during slewing+!
!!refpt!!:	a/c present posn	!!Recalled pt!!	!!Slewed-to point!!
!!refpt lat!!:	!+latitude+!	See local dict.	!!slewed map lat!!
!!refpt long!!:	!+longitude+!	See local dict.	!!slewed map long!!

Term Definition

!!Dest/Mark!! !!Dest displayed!! OR !!Mark displayed!!.

!!Dest displayed!! true iff calling +SS_G_PNL_CONFIG+($dest lat$,p2) OR calling +SS_G_PNL_CONFIG+($dest long$,p2) returns p2 with a value of true. This means that the panel is in the $dest lat$ or $dest long$ configuration.

!!Mark displayed!! true iff calling +SS_G_PNL_CONFIG+($mark lat$,p2) OR calling +SS_G_PNL_CONFIG+($mark long$,p2) returns p2 with a value of true. This means that the panel is in the $mark lat$ or $mark long$ configuration.

Local dictionary (continued):

Term — Definition

!!Posn displayable!! — true iff the map is capable of displaying the next location required to be displayed. Value is obtained from the DIM by calling +DI_G_MAP_DISPLAYABLE+(!!refpt long!!, !!refpt lat!!, !!Posn displayable!!).

!!Recalled pt!! — Defined by table below.

MODES	CONDITIONS	
All modes	!!Dest displayed!!	!!Mark displayed!!
!!Recalled pt!!:		
	called-up point	mark location
latitude:	!+latitude_cup+!	!+mark lat+!
longitude:	!+longitude_cup+!	!+mark long+!

Notes: If NOT !!Dest displayed!! AND NOT !!Mark displayed!! then !!Recalled pt!! has no meaning.

!+mark lat+! and !+mark long+! are indexed by !+dest entry pnl+!.

!!Slewed-to point!! — The position defined by !!slewed map lat!! and !!slew map long!!, respectively. This is the point that the map has moved to because of inputs from the slew control.

!!slewed map lat!! — The latitude of the new map position, computed by adding !+slew map delta lat+! to the previous latitude of the map display.

!!slewed map long!! — The longitude of the new map position, computed by adding !+slew map delta long+! to the previous longitude of the map display.

To obtain !+slew map delta lat+! and !+slew map delta long+!, call +SS_SLEW_MAP+ (!+Slew right-left+!, !+slew map delta lat+!, !+Slew up-down+!, !+slew map delta long+!).

FD.10.6 DEMAND FUNCTION DESCRIPTION: Set the map scale.

Mnemonic: +FD_MAP_SCALE_D+

Output produced:

Item	Type	Access program
New map scale	map_scale	+DI_S_MAP_SCALE+

Function definition:

Event Table FD.10.6-d -- Setting the map scale

MODES	EVENTS	
All modes	@T(!+Init complete+!) WHEN(NOT !+Map scale sw+!) OR @F(!+Map scale sw+!)	@T(!+Init complete+!) WHEN(!+Map scale sw+!) OR @T(!+Map scale sw+!)
Map scale:	¢Map_scale_array¢(1)	¢Map_scale_array¢(2)

FD.10.7 DEMAND FUNCTION DESCRIPTION: Set the map reconfiguration values.

Mnemonic: +FD_MAP_RECONFIG_D+

Output produced:

Item	Type	Access program
New central long.	longitude	+DI_S_MAP_LONGITUDE+
New lower lat. count	integer	+DI_S_MAP_LATITUDE_CT+
New map orient.	angle	+DI_S_MAP_ORIENTATION+

Function definition:

Event Table FD.10.7-a -- Map reconfiguration updates

MODES	EVENTS
All modes except *Grtest*	@T(!+New !!input item!! entered+!)

Output value: !+ !!input item!! +! and !!mapid!!

For instance, one of the values of !!input item!! is "central long a pnl" (see local dictionary). Therefore, when @T(!+central long a pnl entered+!) occurs, this function should output the new value of !+central long a pnl+!, along with the corresponding !!mapid!! which is A, via the access program +DI_S_MAP_LONGITUDE+.

Local dictionary:

Term	Definition
!!input item!!	any of the various input items used to update an IMS Reconfiguration value. Enumerated in Table FD.10.7-b below.
!!mapid!!	the parameter used in the DIM PMDS Reconfiguration access program to specify which map is being updated. Either A or B. Each !!input item!! has a corresponding !!mapid!!. The correspondence is given in Table FD.10.7-b below.

Table FD.10.7-b -- PMDS Reconfiguration values

!!input item!!	type	corresponding !!mapid!!
!+central long a pnl+!	longitude	(A)
!+central long b pnl+!	longitude	(B)
!+low lat ct a pnl+!	integer	(A)
!+low lat ct b pnl+!	integer	(B)
!+map orient a pnl+!	angle	(A)
!+map orient b pnl+!	angle	(B)

FD.11 SINS functions

FD.11.1 <u>DEMAND FUNCTION DESCRIPTION:</u> Start and stop the SINS.

<u>Mnemonic:</u> +FD_SINS_CNTRL_D+

<u>Output produced:</u>

Item	Type	Access program
To start the SINS	--	+DI_START_SINS+
To stop the SINS	--	+DI_STOP_SINS+

<u>Function definition:</u>

Event Table FD.11.1-a -- Starting/stopping SINS

MODES	EVENTS	
All alignment and navigation modes	@T(!+In flight+!) OR @T(!+Land based+!)	@T(!+Init complete+!) WHEN (NOT !+Land based pnl+! AND NOT !+In flight+!) OR @F(!+Land based+!) WHEN (NOT !+In flight+!) OR @F(!+In flight+!) WHEN (NOT !+Land based pnl+!)
Function call:	+DI_STOP_SINS+	+DI_START_SINS+

FD.12 Visual indicator functions

FD.12.1 DEMAND FUNCTION DESCRIPTION: Control the visual indicator labelled "Auto-cal".

Mnemonic: +FD_AUTOCAL_IND_D+

Output produced:

Item	Type	Access program
AUTOCAL indicator	ind_cntrl	+DI_S_AUTO_CAL_INDICATOR+

Function definition:

Event Table FD.12.1-a -- Auto-cal indicator control

MODES	EVENTS	
Lautocal *Sautocal*	@T(In mode)	@F(In mode)
All other alignment or navigation modes	X	@T(In mode)
Output value:	On	Off

FD.12.2 DEMAND FUNCTION DESCRIPTION: Control the visual indicator labelled "IMS Non-aligned".

Mnemonic: +FD_IMS_NA_IND_D+

Output produced:

Item	Type	Access program
IMS NA indicator signal	ind_cntrl	+DI_S_NON_ALIGN_INDICATOR+

Function definition:

Event Table FD.12.2-a -- IMS non-aligned indicator control

MODES	EVENTS			
Lautocal *Sautocal*	@T(In mode)	@F(In mode)	X	X
Landaln	@T(In mode)	@T(!+Land vel. test passed+!)	X	X
SINSaln	@T(In mode)	@T(!+SINS vel. test passed+!) OR @F(In mode)	@T(In mode AND NOT !!SINS up!!)	@T(!!SINS up!!)
Airaln	@F(!+align_ stage=CL) OR @T(In mode) WHEN(!+CL stage complete+!)	@T(In mode) WHEN (NOT !+CL stage complete+!) OR @T(!+Air vel. test passed+!)	@T(In mode AND NOT !!All IMS cks passed!!)	@T(!!All IMS cks passed!!)
01 Update	@T(!+Land vel. test failed+!) OR @T(!+Drift test failed+!)	@T(!+Land vel. test passed+! AND !+Drift test passed+!)	X	X
HUDaln	@F(!+align_ stage=HS) WHEN (!+IMS mode+! = $Gndal$)	@T(In mode) OR @F(In mode) OR @F(!+align_ stage+! = CL)	X	X
DI *DIG* *PolarDI*	@T(!+Nav vel. test failed+!)	X	@T(In mode AND NOT !!All IMS cks passed!!)	@T(!!All IMS cks passed!!)
Mag sl	X	@T(In mode)	X	X
I *PolarI* *UDI*	X	X	@T(In mode AND NOT !!All IMS cks passed!!)	@T(!!All IMS cks passed!!)
Output value:	On	Off	$Intermittent$	!!stale mode!!

Local dictionary:

Term — Definition

!!All IMS cks passed!!

(!!IMS-Dop Reasonable!! OR NOT !+Doppler up+!)
AND
(!!IMS-ADC Reasonable!! OR NOT !+adc tas up+!)
AND
!+IMS Reasonable+!

!!stale mode!!

The value of !+Non-align+! before the last call to +DI_S_NON_ALIGN_INDICATOR+($Intermittent$)

!!IMS-ADC Reasonable!!

ABS(!+IMS total velocity+! - !+TAS ADC+!) lseq 191 knots.

!!IMS-Dop Reasonable!!

ABS(!+IMS horiz velocity+! - !+gnd speed DRS+!) lseq 62 knots.

!!SINS up!!

At least one validity boolean must be true AND the SINS velocity cannot be invalid for more than one second AND the SINS attitude data cannot be invalid for more than three seconds. If any of these conditions are violated, then the value is false.

FD.12.3 FUNCTION DESCRIPTION: Set the visual indicator blink rates.

Mnemonic: +FD_VISIND_RATE_D+

Output produced:

Item	Type	Access program
New autocal rate	real	+DI_S_AUTOCAL_BLINK_RATE+
New IMS nonalign rate	real	+DI_S_NON_ALIGN_BLINK_RATE+

Function definition:

This function is never performed, because under the current requirements, the visual indicator blink rates never need to be changed from their default values. However, should the requirements change and another blink rate be called for, this function would have the responsibility for setting the new value(s).

FD.13 Weapon release functions

FD.13.1 **DEMAND FUNCTION DESCRIPTION:** Prepare and release a weapon.

Mnemonic: +FD_WEAP_RLS_D+

Output produced:

Item	Type	Access program
To prepare a weapon for release	--	+DI_PREPARE_WEAPON+
To release a weapon	time	+DI_RELEASE_WEAPON+

Function definition:

Event Table FD.13.1-a -- Preparing a weapon for release

MODES	EVENTS
All weapon modes	@T(!+time to prepare+!) WHEN(!+RE pressed+!)
Function call:	Call +DI_PREPARE_WEAPON+

Function definition (continued):

Event Table FD.13.1-b -- Releasing the active weapon

MODES	EVENTS
NBnotShrike **NBShrike** **HiNuke** **LoNuke**	@T(!+Computed rls+!) WHEN(!+RE pressed+!)
A/A Manrip *CCIP* *Manrip* *Walleye*	@T(!!RE delay!!) WHEN(!+wpns rlsd+! = 0) OR @T(!+Computed rls+!) WHEN(!+RE pressed+!)
Output value:	!+release pulse width+!

Local dictionary:

Term	Definition
!!RE delay!!	elapsed time since the last occurrence of @T(!+RE pressed+!) for the current weapon gteq !+preparation time+! for that weapon.

```
*******************************************************************************
*                                                                             *
*             FD.14                         Ground test functions             *
*                                                                             *
*******************************************************************************
```

FD.14.1 DEMAND FUNCTION DESCRIPTION: Conduct the ground test.

Mnemonic: +FD_GRTEST_D+

Output produced:

Item	Type	Access program
Send EC to fail state	--	+EC_S_FAIL_STATE+

Function definition:

This function uses the Extended Computer diagnostic programs to decide whether to set the EC state to "failed". The table below specifies when to call each diagnostic. If any test fails, then +EC_S_FAIL_STATE+ is called, and subsequent tests are not performed.

Event Table FD.14.1-a -- Conducting the ground tests

MODE	EVENT	DIAGNOSTIC PROGRAM(S) CALLED
Grtest	@T(!+test_stage+! = CS)	+EC_START_MEMTEST+ Wait for @F(!+Memtest occurring+!) Call +EC_G_MEMTEST+
	@T(!+test_stage+! = TM)	+EC_TEST_TIMER+ +EC_TEST_INTERRUPTS+
	@T(!+test_stage+! = GA)	+EC_TEST_XACC+ +EC_TEST_YACC+ +EC_TEST_ZACC+
	@T(!+test_stage+! = DIO)	+EC_TEST_DIOW1+ +EC_TEST_DIOW2+ +EC_TEST_DIOW3+
	@T(!+test_stage+! = SC)	+EC_TEST_CSA+ +EC_TEST_CSB+
	@T(!+test_stage+! = DC)	+EC_TEST_DC+
	@T(!+test_stage+! = AC)	+EC_TEST_AC+

Appendix 1

Cross-Reference between functions of the Function Driver module and the Requirements Document

The functions of the Function Driver module are descended from the functions in Section 4 of the A-7 Requirements Document. This appendix names the Requirements function from which each Function Driver module is derived. Not all function drivers are descended from the Requirements functions; some are created in order to correctly use the device abstract interfaces.

FUNCTION DRIVER MODULE		REQUIREMENTS FUNCTION
FD.1	ADC Functions	
FD.1.1	Set ADC sea level pressure	4.3.3
FD.1.2	Set ADC reconfiguration values	None.
FD.2	Audible Signal Functions	
FD.2.1	Control audible signal	4.4.3
FD.2.2	Set audible signal beep rate	None.
FD.3	Computer Fail Signal Functions	
FD.3.1	Signal tactical computer failure	4.1.3
FD.4	Doppler Radar Functions	
FD.4.1	Start and stop Doppler radar	None.

FD.5 Flight Information Display Functions

FD.5.1	ADI functions	
FD.5.1.1	Set ADI azimuth display	4.8.1
FD.5.1.2	Set ADI elevation indicator	4.8.1
FD.5.2	HSI functions	
FD.5.2.1	Set HSI pointer 1 and DME	4.7.1
FD.5.2.2	Set HSI pointer 2	4.7.2

FD.6 Forward-Looking Radar (FLR) Functions

FD.6.1	Set FLR mode	4.2.1, 3
FD.6.2	Control FLR range and azimuth cursors	
FD.6.2.1	Position FLR cursors	4.2.2
FD.6.2.2	Set azimuth cursor display mode	4.2.2
FD.6.3	Set FLR direction	4.2.4 - 5
FD.6.4	Set FLR symbol blink rate	None.

FD.7 Head-Up Display Functions

FD.7.1	HUD Location-indicator Functions	
FD.7.1.1	Control HUD Aiming Symbol (AS)	
FD.7.1.1.1	Set HUD AS mode	4.3.1
FD.7.1.1.2	Set HUD AS position	4.3.1
FD.7.1.2	Control HUD Azimuth Steering Line (ASL)	
FD.7.1.2.1	Set HUD ASL mode	4.3.2
FD.7.1.2.2	Set HUD ASL position	4.3.2
FD.7.1.3	Control HUD Flight Director (FD)	
FD.7.1.3.1	Set HUD FD mode	4.3.4
FD.7.1.3.2	Set HUD FD position	4.3.4
FD.7.1.4	Control HUD Flight Path Marker (FPM)	
FD.7.1.4.1	Set HUD FPM mode	4.3.5
FD.7.1.4.2	Set HUD FPM position	4.3.5

FD.7.1.5	Set HUD in-range cue mode	4.3.11.0 - 3
FD.7.1.6	Control HUD Lower Solution Cue (LSC)	
FD.7.1.6.1	Set HUD LSC mode	4.3.11.0, 3
FD.7.1.6.2	Set HUD LSC position	4.3.11.1
FD.7.1.7	Control HUD Pullup Anticipation Cue (PUAC)	
FD.7.1.7.1	Set HUD PUAC mode	4.3.8
FD.7.1.7.2	Set HUD PUAC position	4.3.8
FD.7.1.8	Set HUD pullup cue mode	4.3.9
FD.7.1.9	Control HUD Upper Solution Cue (USC)	
FD.7.1.9.1	Set HUD USC mode	4.3.11.0, 3
FD.7.1.9.2	Set HUD USC position	4.3.11.2
FD.7.1.10	Set HUD symbol blink rate	None.
FD.7.2	HUD Value Indicators	
FD.7.2.1	Set HUD altitude display	4.3.3
FD.7.2.2	Set HUD heading display	4.3.6
FD.7.2.3	Set HUD pitch & roll displays	4.3.7, 10
FD.7.2.4	-- Control HUD vertical velocity/acceleration displays.	
FD.7.2.4.1	Enable vert. vel. and accel. displays	4.3.12.0
FD.7.2.4.2	Set vert. accel. display	4.3.12.1, 2
FD.7.2.4.3	Set vert. vel. display	4.3.12.1
FD.8	<u>IMS Functions</u>	
FD.8.1	Switch IMS computer control on/off	4.1.2
FD.8.2	Set IMS velocity measurement scale	4.1.5
FD.8.3	Adjust alignment of IMS platform x, y, and z axes	
FD.8.3.1	Perform small X and Y axis adjustments	4.1.4, 4.1.6
FD.8.3.2	Perform large X and Y axis adjustments	4.1.4, 4.1.6
FD.8.3.3	Adjust z axis	4.1.4, 4.1.6
FD.8.4	Initialize IMS velocities	4.6.48
FD.8.5	Set IMS reconfiguration values	None.

FD.9 Panel Functions

FD.9.1	Change panel's mark window display	4.6.3
FD.9.2	Control panel's enter light	4.6.4
FD.9.3	Display data in upper or lower window	4.6.1-54

FD.10 PMDS Functions

FD.10.1	Set map indicator	4.5.1
FD.10.2	Set map orientation angle	4.5.3
FD.10.3	Set map pointer	4.5.2
FD.10.4	Set map reference point	4.5.4
FD.10.5	Set map display	4.5.4
FD.10.6	Set map scale	4.5.4
FD.10.7	Set map reconfiguration values	None.

FD.11 SINS Functions

FD.11.1	Start and stop SINS	None.

FD.12 Visual Indicator Functions

FD.12.1	Control "Auto-cal" indicator	4.1.1
FD.12.2	Control "IMS Non-aligned" indicator	4.1.8
FD.12.3	Set visual indicator blink rates	None.

FD.13 Weapon Release Functions

FD.13.1	Prepare and release a weapon	4.4.1, 4.4.2

FD.14 Ground Test Functions

FD.14.1	Conduct ground test	None.

Appendix 2

Timing Requirements

The numbers and descriptions of the FD functions appear on the left; each function's timing requirement appears on the right. On the far right is a "D" (if the function is demand) or "P" (if the function is periodic). If the function is demand then the timing requirement represents the maximum allowable delay to completion of the function. If the function is periodic then the timing requirement is the maximum length of one period. When a maximum and minimum acceptable times are known, then the frequency requirement is given as a range. In cases where two or more requirements functions have been combined, the more demanding time requirement has been adopted.

FD.1 ADC Functions

FD.1.1	Set ADC sea level pressure	Not specified	D
FD.1.2	Set ADC reconfiguration values	Not specified	D

FD.2 Audible Signal Functions

FD.2.1	Control audible signal	2 ms	D
FD.2.2	Set audible signal beep rate	Not specified	D

FD.3 Computer Fail Signal Functions

FD.3.1	Signal computer failure	Not significant	

FD.4 Doppler Radar Functions

FD.4.1	Start/stop Doppler radar	Not specified	D

FD.5 Flight Information Display Functions

FD.5.1	ADI functions		
FD.5.1.1	Set ADI azimuth display	67 - 80 ms	P
FD.5.1.2	Set ADI elevation indicator	200 ms	P
FD.5.2	HSI functions		
FD.5.2.1	Set HSI pointer 1 and DME	200 ms	P
FD.5.2.2	Set HSI pointer 2	200 ms	P

FD.6 Forward-Looking Radar (FLR) Functions

FD.6.1	Set FLR mode	40 ms	D
FD.6.2	Control FLR range and azimuth cursors		
FD.6.2.1	Position cursors	40 - 80 ms	P
FD.6.2.2	Set azimuth cursor display mode	40 - 80 ms	D
FD.6.3	Set FLR direction	40 ms	P
FD.6.4	Set FLR symbol blink rate	Not specified	D

FD.7 Head-Up Display Functions

FD.7.1	HUD Location-indicator Functions		
FD.7.1.1	Control HUD Aiming Symbol (AS)		
FD.7.1.1.1	Set AS mode	200 ms	D
FD.7.1.1.2	Set AS position	40 ms	P
FD.7.1.2	Control HUD Azimuth Steering Line (ASL)		
FD.7.1.2.1	Set ASL mode	200 ms	D
FD.7.1.2.2	Set ASL position	40 - 80 ms	P

FD.7.1.3	Control HUD Flight Director (FD)		
FD.7.1.3.1	Set FD mode	Not specified	D
FD.7.1.3.2	Set FD position	40 - 80 ms	P
FD.7.1.4	Control HUD Flight Path Marker (FPM)		
FD.7.1.4.1	Set FPM mode	40 ms	D
FD.7.1.4.2	Set FPM position	40 - 80 ms	P
FD.7.1.5	Set HUD in-range cue mode	40 ms	D
FD.7.1.6	Control HUD Lower Solution Cue (LSC)		
FD.7.1.6.1	Set LSC mode	40 ms	D
FD.7.1.6.2	Set LSC position	40 - 200 ms	P
FD.7.1.7	Control HUD Pullup Anticipation Cue (PUAC)		
FD.7.1.7.1	Set PUAC mode	Not specified	D
FD.7.1.7.2	Set PUAC position	40 - 200 ms	P
FD.7.1.8	Set HUD pullup cue mode	40 ms	D
FD.7.1.9	Control HUD Upper Solution Cue (USC)		
FD.7.1.9.1	Set USC mode	40 ms	D
FD.7.1.9.2	Set USC position	40 - 200 ms	P
FD.7.1.10	Set HUD symbol blink rate	Not specified	D
FD.7.2	HUD Value Indicators		
FD.7.2.1	Set Altitude display	Not specified	P
FD.7.2.2	Set Heading display	40 - 200 ms	P
FD.7.2.3	Set Pitch/roll displays	40 ms	P
FD.7.2.4	Control HUD vertical velocity/acceleration displays.		
FD.7.2.4.1	Enable vert. vel./accel. display	1000 ms	D
FD.7.2.4.2	Set HUD vertical accel. display	40 ms	P
FD.7.2.4.3	Set HUD vertical velocity display	40 ms	P

FD.8 IMS Functions

FD.8.1	Switch computer control of IMS on/off	200 ms	D
FD.8.2	Set IMS velocity msrmt. scale	200 ms	D

FD.8.3	Adjust alignment of IMS platform axes		
FD.8.3.1	Perform small X and Y axis adjustments	200 ms	P
FD.8.3.2	Perform large X and Y axis adjustments	200 ms	D
FD.8.3.3	Adjust Z axis	200 ms	D
FD.8.4	Initialize IMS velocities	Not specified	D
FD.8.5	Set IMS reconfiguration values	Not specified	D

FD.9 Panel Functions

FD.9.1	Set Mark window display	200 ms	D
FD.9.2	Panel enter light	40 ms	D
FD.9.3	Display data in upper or lower window	300 ms *	D

*This represents a desired limit only; the current OFP actually takes 1000 ms to change the window displays.

FD.10 PMDS Functions

FD.10.1	Set Map indicator	40 - 200 ms	P
FD.10.2	Set Map orientation angle	40 - 200 ms	P
FD.10.3	Set Map pointer	40 - 200 ms	P
FD.10.4	Set Map reference point	Not specified	D
FD.10.5	Set Map display	40 - 200 ms	P
FD.10.6	Set Map scale	40 - 200 ms	D
FD.10.7	Set Map reconfiguration values	Not specified	D

FD.11 SINS Functions

FD.11.1	Start/stop SINS	Not specified	D

FD.12 Visual Indicator Functions

FD.12.1	Control Auto-cal indicator	200 ms	D
FD.12.2	Control IMS Non-aligned indicator	200 ms	D
FD.12.3	Set visual indicator blink rates	Not specified	D

FD.13 Weapon Release Functions

FD.13.1	Prepare and release a weapon	2 ms	D

FD.14 Ground Test Functions

FD.14.1	Conduct ground test	Not specified	D

Appendix 3

List of Required Events (Ordered Alphabetically)

This appendix lists those events used by the Function Driver module. The events are listed alphabetically by the module that signals them. Following each event is a list of the function drivers that use it.

Events Signalled by the Extended Computer Module

@T(!+Failed state+!)	FD.3.1
@T(!+Init complete+!)	FD.1.1 FD.3.1 FD.7.1.3.1 FD.9.1 FD.9.2 FD.10.4 FD.10.6 FD.11.1

Events Signalled by the Device Interface Module

@F(!+ADI elev avail+!)	FD.5.1.2
@F(!+AOA valid+!)	FD.7.2.4.1
@T(!+AOA valid+!)	FD.7.2.4.1
@T(!+Enter pressed+!)	FD.9.2
@T(!+Fly to num changed+!)	FD.1.1 FD.9.2
@T(!+Fly to state changed+!)	FD.9.2
@T(!+Map hold changed+!)	FD.9.2
@T(!+Mark pressed+!)	FD.9.1
@T(!+Panel mode changed+!)	FD.9.2
@T(!+Pres pos changed+!)	FD.9.2
@T(!+RE pressed+!)	FD.2.1 FD.7.1.1.1 FD.13.1
@F(!+RE pressed+!)	FD.2.1
@F(!+Slew displacement non-zero+!)	FD.9.3
@T(!+TD pressed+!)	FD.8.3.3 FD.9.2 FD.9.3
@T(!+Update changed+!)	FD.9.2

Mode Transition Events signalled by SS.MODE

@T(*OlUpdate*)	FD.8.2 FD.12.1 FD.5.2.1 FD.8.1
@T(*A/A Guns*)	FD.7.1.1.1
@F(*A/A Guns*)	FD.7.1.1.1
@T(*A/A Manrip*)	FD.7.1.1.1 FD.9.3
@F(*A/A Manrip*)	FD.7.1.1.1
@T(*A/G Guns*)	FD.6.1 FD.7.1.1.1 FD.7.1.7.1
@F(*A/G Guns*)	FD.6.1 FD.7.1.1.1 FD.7.1.5 FD.7.1.6.1
@T(*Airaln*)	FD.12.1 FD.12.2 FD.8.2
@F(*Airaln*)	FD.7.2.4.1
@T(*BOC*)	FD.6.1 FD.6.2.2 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.7.1 FD.9.3
@F(*BOC*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1
@T(*BOCFlyto0*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.7.1
@F(*BOCFlyto0*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1
@T(*BOCoffset*)	FD.6.1 FD.6.2.2 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.7.1 FD.9.3
@F(*BOCoffset*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1
@T(*CCIP*)	FD.6.1 FD.7.1.2.1 FD.7.1.7.1 FD.9.3
@F(*CCIP*)	FD.6.1 FD.7.1.2.1 FD.7.1.6.1
@T(*DI*)	FD.12.1 FD.8.1 FD.8.3.3
@F(*DI*)	FD.8.3.1 FD.8.3.3
@T(*DIG*)	FD.12.1 FD.8.1 FD.8.2 FD.8.3.3 FD.12.1
@F(*DIG*)	FD.8.3.3
@T(*Grid*)	FD.8.1
@F(*Grid*)	FD.7.2.4.1
@T(*Grtest*)	FD.7.1.1.1 FD.9.1
@T(*HUDaln*)	FD.12.1 FD.12.2 FD.5.2.1 FD.7.1.1.1 FD.8.1 FD.8.2
@F(*HUDaln*)	FD.12.2 FD.7.1.1.1
@T(*HUDdown1*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1
@F(*HUDdown1*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1 FD.7.1.9.1
@T(*HUDdown2*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1
@F(*HUDdown2*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1 FD.7.1.9.1
@T(*HUDUpd*)	FD.6.1 FD.7.1.1.1
@F(*HUDUpd*)	FD.6.1 FD.7.1.1.1
@T(*I*)	FD.12.1 FD.12.2 FD.8.1 FD.8.2
@T(*IMS fail*)	FD.5.2.1 FD.8.1 FD.9.3 FD.12.1
@F(*IMS fail*)	FD.7.2.4.1
@T(*Landaln*)	FD.9.3
@F(*Landaln*)	FD.12.1 FD.12.2 FD.5.2.1 FD.8.1 FD.8.2
@T(*Lautocal*)	FD.12.1 FD.12.2 FD.5.2.1 FD.8.1 FD.8.2
@F(*Lautocal*)	FD.9.3 FD.12.1 FD.12.2
@T(*Mag sl*)	FD.12.1 FD.12.2 FD.8.1
@F(*Mag Sl*)	FD.7.2.4.1
@T(*Manrip*)	FD.9.3
@T(*Nattack*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.7.1
@F(*Nattack*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1
@F(**NBnotShrike**)	FD.7.1.6.1 FD.7.1.9.1

@T(**NBShrike**)	FD.5.2.1
@F(**NBShrike**)	FD.7.1.6.1
@T(*Noffset*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.7.1
@F(*Noffset*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1
@T(*OLB*)	FD.12.1 FD.8.1 FD.8.2
@F(*OLB*)	FD.7.2.4.1
@T(*PolarDi*)	FD.12.1 FD.8.1 FD.8.2
@T(*PolarI*)	FD.12.1 FD.12.2 FD.8.1 FD.8.2
@T(*RadarJpd*)	FD.6.1 FD.6.2.2 FD.7.1.1.1
@F(*RadarUpd*)	FD.6.1 FD.7.1.1.1
@T(*Sautocal*)	FD.12.1 FD.12.2 FD.5.2.1 FD.8.1 FD.8.2
@F(*Sautocal*)	FD.9.3 FD.12.1 FD.12.2
@T(*SBOC*)	FD.6.1 FD.6.2.2 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.7.1 FD.9.3
@F(*SBOC*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1 FD.7.1.9.1 FD.7.2.4.3
@T(*SBOCFlyto0*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.7.1
@F(*SBOCFlyto0*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1 FD.7.1.9.1 FD.7.2.4.3
@T(*SBOCoffset*)	FD.6.1 FD.6.2.2 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.7.1 FD.9.3
@F(*SBOCoffset*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1 FD.7.1.9.1 FD.7.2.4.3
@T(*SHUDdown1*)	FD.7.1.1.1 FD.7.1.2.1 FD.6.1
@F(*SHUDdown1*)	FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1 FD.7.1.9.1 FD.6.1
@T(*SHUDdown2*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1
@F(*SHUDdown2*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1 FD.7.1.9.1
@T(*SINSaln*)	FD.12.2 FD.5.2.2 FD.8.1 FD.8.2 FD.8.3.3
@F(*SINSaln*)	FD.9.3 FD.12.2
@T(*Snattack*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.7.1
@F(*Snattack*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1 FD.7.1.9.1 FD.7.2.4.3
@T(*Snoffset*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.7.1
@F(*Snoffset*)	FD.6.1 FD.7.1.1.1 FD.7.1.2.1 FD.7.1.6.1 FD.7.1.9.1 FD.7.2.4.3
@T(*UDI*)	FD.12.1 FD.12.2 FD.8.1 FD.8.2
@T(*Walleye*)	FD.7.1.1.1 FD.7.1.7.1
@F(*Walleye*)	FD.7.1.1.1 FD.7.1.5 FD.7.1.6.1

Events Signalled by SS.EVENT

@F(ABS(!+roll IMS+!) gt 5 deg)	FD.8.1
@T(ABS(!+roll IMS+!) gt 5 deg)	FD.8.1
@F(ABS(!+LSC elevation+!) gt 4 deg)	FD.5.1.2
@T(ABS(!+LSC elevation+!) gt 4 deg)	FD.5.1.2
@F(ABS(!+PUAC elevation+!) gt 4 deg)	FD.5.1.2
@T(ABS(!+PUAC elevation+!) gt 4 deg)	FD.5.1.2
@T(!+AS mode+! = Off)	FD.7.1.1.2
@T(!+AS mode+! = On)	FD.7.1.1.2
@T(!+ASL mode+! = $Intermittent$)	FD.7.1.2.2
@T(!+ASL mode+! = Off)	FD.7.1.2.2
@T(!+ASL mode+! = On)	FD.7.1.2.2
@T(!+FLR az cursor mode+! = On)	FD.6.2.1
@T(!+FLR az cursor mode+! = Off)	FD.6.2.1
@T(!+FLR mode+! = $CDCE$)	FD.6.2.1 FD.6.2.2
@F(!+FLR mode+! = $CDCE$)	FD.6.2.1 FD.6.2.2
@F(!+FLR mode+! = $Ranging$)	FD.6.3
@T(!+FLR mode+! = $Ranging$)	FD.6.3
@T(!+FLTDIR mode+! = Off)	FD.7.1.3.2
@T(!+FLTDIR mode+! = On)	FD.7.1.3.2
@F(!+Fly to num+! = 0)	FD.1.1
@T(!+Fly to num+! = 0)	FD.1.1
@T(!+Fly_to_state+! = $Dest$)	FD.1.1
@T(!+Fly_to_state+! = $Mark$)	FD.1.1
@T(!+FPM mode+! = Off)	FD.7.1.4.2
@T(!+FPM mode+! = On)	FD.7.1.4.2
@T(!+Gun Enable+!)	FD.6.1 FD.7.1.5
@F(!+Gun Enable+!)	FD.7.1.5
@T(!+LSC mode+! = $Intermittent$)	FD.7.1.6.2 FD.7.1.9.1
@F(!+LSC mode+! = $Intermittent$)	FD.7.1.9.1
@T(!+LSC mode+! = Off)	FD.7.1.6.2
@T(!+LSC mode+! = On)	FD.7.1.6.2
@F(!+Map decenter+!)	FD.10.4
@T(!+Map decenter+!)	FD.10.4
@T(!+Map hold+!)	FD.10.2
@F(!+Map north-up+!)	FD.10.4
@T(!+Map north-up+!)	FD.10.4
@F(!+Map scale sw+!)	FD.10.6
@T(!+Map scale sw+!)	FD.10.6
@F(!+Master Arm+!)	FD.7.1.7.1
@T(!+Master Arm+!)	FD.7.1.7.1

@T(!+pitch IMS+! = -30 deg)	FD.7.1.7.1		
@T(!+pitch IMS+! gt 15 deg)	FD.2.1		
@T(!+PUAC mode+! = $Intermittent$)	FD.7.1.7.2		
@T(!+PUAC mode+! = Off)	FD.7.1.7.2		
@T(!+PUAC mode+! = On)	FD.7.1.7.2		
@T(!+Rel in Progress+!)	FD.2.1		
@T(!+USC mode+! = $Intermittent$)	FD.7.1.9.2		
@T(!+USC mode+! = Off)	FD.7.1.9.2		
@T(!+USC mode+! = On)	FD.7.1.9.2		
@T(!+VV mode+! = On)	FD.7.1.4.1	FD.7.2.4.2	FD.7.2.4.3
@F(!+VV mode+! = On)	FD.7.2.4.2	FD.7.2.4.3	
@T(!+Weapon Class+! = GN)	FD.7.1.7.1		
@T(!+Weapon Class+! = RK)	FD.6.1		
@T(!+Weapon Mode+! = $None$)	FD.7.1.3.1	FD.7.1.7.1	
@F(!+Weapon Mode+! = $None$)	FD.7.1.3.1	FD.7.1.7.1	

Events Signalled by other Shared Services submodules

@F(ABS(!+ip az+!) lseq 12 deg)	FD.7.1.6.1
@T(ABS(!+ip az+!) lseq 12 deg)	FD.7.1.6.1
@F(ABS(!+ip elev+!) lseq 16 deg)	FD.7.1.6.1
@T(ABS(!+ip elev+!) lseq 16 deg)	FD.7.1.6.1
@T(1 second before !+target in range+!)	FD.7.1.6.1
@F(!+ADC reasonable+!)	FD.9.1
@T(!+ADC reasonable+')	FD.9.1
@T(!+adc tas up+!)	FD.12.2
@F(!+adc tas up+!)	FD.12.2
@T(!+Air velocity test passed+!)	FD.12.2
@F(!+align_stage+! = CA)	FD.5.2.2
@T(!+align_stage+! = $CA2$)	FD.8.3.3
@F(!+align_stage+! = CL)	FD.8.1 FD.12.2
@F(!+align_stage+! = ED)	FD.8.3.3
@T(!+align_stage+! = ED)	FD.8.3.3
@F(!+align_stage+! = $ED2$)	FD.8.3.3
@T(!+align_stage+! = $ED2$)	FD.8.3.3
@F(!+align_stage+! = FM)	FD.7.2.4.1 FD.8.1
@T(!+align_stage+! = FM)	FD.8.1
@F(!+align_stage+! = HS)	FD.12.2
@T(!+align_stage+! = HS)	FD.12.2
@T(!+align_stage+! = $ND2$)	FD.8.3.3
@F(!+align_stage+! = TS)	FD.9.3
@T(!+ap ahead+!)	FD.6.2.2
@F(!+ap ahead+!)	FD.6.2.2
@T(!+blast danger+!)	FD.7.1.8
@F(!+blast danger+!)	FD.7.1.8
@T(!+Computed rls+!)	FD.13.1
@T(!+cup ahead+!)	FD.6.2.2
@F(!+cup ahead+!)	FD.6.2.2
@T(!+data enterable+!)	FD.9.2
@F(!+data enterable+!)	FD.9.2
@T(!+desig+!)	FD.5.2.1 FD.6.2.2 FD.7.1.5 FD.7.1.1.2 FD.7.1.6.1 FD.7.1.9.1 FD.8.3.3 FD.9.3
@F(!+desig+!)	FD.7.1.6.1 FD.7.1.5 FD.5.2.1 FD.7.1.9.1 FD.9.3

@T(!+Dest selected+!)	FD.9.3
@T(!+Doppler up+!)	FD.12.2
@F(!+Doppler up+!)	FD.12.2
@T(!+Drift test failed+!)	FD.12.2
@T(!+Drift test passed+!)	FD.12.2
@T(!+during slewing+!)	FD.7.1.6.1 FD.7.1.9.1
@F(!+during slewing+!)	FD.7.1.6.1 FD.7.1.9.1
@T(!+ftpt ahead+!)	FD.6.2.2
@F(!+ftpt ahead+!)	FD.6.2.2
@T(!+GAS+!)	FD.7.1.6.1 FD.7.1.9.1
@F(!+GAS+!)	FD.7.1.9.1 FD.7.1.6.1
@T(!+gr_ac_ftpt+! lseq 20 nmi)	FD.6.1
@F(!+gr_ac_ftpt+! gteq 10 nmi)	FD.5.2.1 FD.7.1.7.1
@T(!+gr_ac_ftpt+! gteq 10 nmi)	FD.5.2.1
@F(!+gr_ac_ftpt+! gteq 1000 nmi)	FD.5.2.1
@T(!+gr_ac_ftpt+! gteq 1000 nmi)	FD.5.2.1
@F(!+gr_ac_ftpt+! lseq 30 nmi)	FD.7.1.7.1
@T(!+gr_ac_ftpt+! lseq 30 nmi)	FD.7.1.7.1
@T(!+gr_ac_fxpt+! lseq 22 nmi)	FD.6.1
@F(!+gr_ac_HUDrefpt+! lseq 20 nmi)	FD.7.1.1.1
@T(!+gr_ac_HUDrefpt+! lseq 20 nmi)	FD.7.1.1.1
@F(!+gr_ac_HUDrefpt+! lseq 22 nmi)	FD.7.1.1.1
@T(!+gr_ac_HUDrefpt+! lseq 22 nmi)	FD.7.1.1.1
@F(!+gr_ac_HUDrefpt+! lseq 30 nmi)	FD.7.1.1.1
@T(!+gr_ac_HUDrefpt+! lseq 30 nmi)	FD.7.1.1.1
@F(!+gr_ac_HUDrefpt+! lseq 42 nmi)	FD.7.1.1.1
@T(!+gr_ac_HUDrefpt+! lseq 42 nmi)	FD.7.1.1.1
@F(!+gr_ac_oap+! gteq 10 nmi)	FD.5.2.1
@T(!+gr_ac_oap+! gteq 10 nmi)	FD.5.2.1
@F(!+gr_ac_oap+! gteq 1000 nmi)	FD.5.2.1
@T(!+gr_ac_oap+! gteq 1000 nmi)	FD.5.2.1
@T(!+gr_ac_oap+! lseq 30 nmi	FD.9.3
@F(!+gr_ac_tgt+! gteq 10 nmi)	FD.5.2.1
@T(!+gr_ac_tgt+! gteq 10 nmi)	FD.5.2.1
@F(!+gr_ac_tgt+! gteq 1000 nmi)	FD.5.2.1
@T(!+gr_ac_tgt+! gteq 1000 nmi)	FD.5.2.1
@T(!+gr_ac_tgt+! lseq 30 nmi)	FD.9.3
@F(!+gr_ac_tgt+! lseq 30 nmi)	FD.9.3
@T(!+ground danger+!)	FD.7.1.8
@F(!+ground danger+!)	FD.7.1.8
@T(!+high drag release+!)	FD.7.1.7.1
@F(!+IMS Reasonable+!)	FD.12.2
@T(!+IMS Reasonable+!)	FD.8.1 FD.12.2

@T(!+ims_x_const_error_mc+! gt !+IMS adj xy tolerance+!)	FD.8.3.2
@T(!+ims_x_dop_error_mc+! gt !+IMS adj xy tolerance+!)	FD.8.3.2
@T(!+ims_x_sins_error_mc+! gt !+IMS adj xy tolerance+!)	FD.8.3.2
@T(!+ims_y_const_error_mc+! gt !+IMS adj xy tolerance+!)	FD.8.3.2
@T(!+ims_y_dop_error_mc+! gt !+IMS adj xy tolerance+!)	FD.8.3.2
@T(!+ims_y_sins_error_mc+! gt !+IMS adj xy tolerance+!)	FD.8.3.2
@T(!+ims_z_const_error_mc+! gt !+ims z adj tolerance+!)	FD.8.3.3
@T(!+ims_z_dop_error_m+! gt !+ims z adj tolerance+!)	FD.8.3.3
@T(!+ims_z_dop_error_mc+! gt !+ims z adj tolerance+!)	FD.8.3.3
@T(!+ims_z_nav_error_m+! gt !+ims z adj tolerance+!)	FD.8.3.3
@T(!+ims_z_sins_error_mc+! gt !+ims z adj tolerance+!)	FD.8.3.3
@T(!+In flight+!)	FD.11.1 FD.4.1 FD.5.2.2 FD.7.2.4.1
@F(!+In flight+!)	FD.11.1 FD.4.1 FD.5.2.2 FD.7.2.4.1
@T(!+Input attempted+!)	FD.9.2
@T(!+Input requested+!)	FD.9.2
@T(!+ip elev+! lseq 16 deg)	FD.9.3
@T(!+Land based+!)	FD.11.1
@F(!+Land based+!)	FD.11.1
@T(!+Land velocity test failed+!)	FD.12.2
@T(!+Land velocity test passed+!)	FD.12.2
@T(!+low drag release+!)	FD.7.1.6.1 FD.7.2.4.2 FD.7.2.4.3
@F(!+low drag release+!)	FD.7.1.6.1 FD.7.1.9.1 FD.7.2.4.2 FD.7.2.4.3
@T(!+Nav velocity test failed+!)	FD.12.2
@T(!+new align stage+!)	FD.9.3
@T(!+New central long a pnl entered+!)	FD.10.7
@T(!+New central long b pnl entered+!)	FD.10.7
@T(!+New dest mslp pnl entered+!)	FD.1.1
@T(!+New E coarse bias pnl entered+!)	FD.8.5
@T(!+New E coarse scale pnl entered+!)	FD.8.5
@T(!+New E fine bias pnl entered+!)	FD.8.5
@T(!+New E fine scale pnl entered+!)	FD.8.5
@T(!+New L-probe pnl entered+!)	FD.1.2
@T(!+New low lat ct a pnl entered+!)	FD.10.7
@T(!+New low lat ct b pnl entered+!)	FD.10.7
@T(!+New map orient a pnl entered+!)	FD.10.7
@T(!+New map orient b pnl entered+!)	FD.10.7
@T(!+New N coarse bias pnl entered+!)	FD.8.5
@T(!+New N coarse scale pnl entered+!)	FD.8.5
@T(!+New N fine bias pnl entered+!)	FD.8.5
@T(!+New N fine scale pnl entered+!)	FD.8.5
@T(!+New V coarse bias pnl entered+!)	FD.8.5
@T(!+New V coarse scale pnl entered+!)	FD.8.5
@T(!+New X corr increm pnl entered+!)	FD.8.5
@T(!+New X drift pnl entered+!)	FD.8.5

@T(!+New Y corr increm pnl entered+!)	FD.8.5
@T(!+New Y drift pnl entered+!)	FD.8.5
@T(!+New Z corr increm pnl entered+!)	FD.8.5
@T(!+New Z drift pnl entered+!)	FD.8.5
@T(!+oap ahead+!)	FD.6.2.2
@F(!+oap ahead+!)	FD.6.2.2
@T(!+OTS+!)	FD.7.1.6.1
@T(!+pnl config+! = ANY POSSIBLE VALUE)	FD.9.3
@T(!+pnl config+! = $Nav diags2$)	FD.9.1
@T(!+R65+!)	FD.2.1
@T(!+rls_pts_passed+! = 1)	FD.9.3
@T(!+Rmax+!)	FD.2.1 FD.7.1.6.1
@T(!+Rmax+6000+!)	FD.7.1.7.1
@T(!+Rmin+!)	FD.2.1
@T(!+Rmin+6000+!)	FD.2.1 FD.7.1.7.1
@T(!+SINS attitude valid+!)	FD.12.2
@F(!+SINS attitude valid+!)	FD.12.2
@T(!+SINS velocity valid+!)	FD.12.2
@F(!+SINS velocity valid+!)	FD.12.2
@T(!+SINS velocity test passed+!)	FD.12.2
@T(!+Special in range+!)	FD.7.1.6.1 FD.7.1.9.1
@F(!+Special in range+!)	FD.7.1.6.1 FD.7.1.9.1
@T(!+Special solution+!)	FD.13.1
@T(!+sr reasonable+!)	FD.7.1.5 FD.7.1.6.1
@F(!+sr reasonable+!)	FD.7.1.6.1 FD.7.1.5
@T(!+stik created+!)	FD.7.1.7.1
@T(!+stik empty+!)	FD.7.1.4.1 FD.7.1.7.1
@T(!+target in range+!)	FD.7.1.5 FD.7.1.6.1
@F(!+target in range+!)	FD.7.1.5 FD.7.1.6.1
@T(!+test_stage+! = AC)	FD.14.1
@T(!+test_stage+! = CS)	FD.14.1
@T(!+test_stage+! = DC)	FD.14.1
@T(!+test_stage+! = DIO)	FD.14.1
@T(!+test_stage+! = GA)	FD.14.1
@T(!+test_stage+! = SC)	FD.7.1.1.1 FD.14.1
@T(!+test_stage+! = TM)	FD.14.1
@T(!+tgt ahead+!)	FD.6.2.2 FD.7.1.5 FD.7.1.6.1
@F(!+tgt ahead+!)	FD.6.2.2 FD.7.1.5 FD.7.1.6.1
@T(!+time to prepare+!)	FD.2.1 FD.13.1

Appendix 4

Dictionary of Input Items

For each input item required by a function driver module, there is an entry in this dictionary specifying the software submodule that produces that value, and all function driver modules in which it is used.

A '*' means that the specifications for the producing module are not yet complete.

TERM	PRODUCING MODULE	WHERE USED
!+ACAIRB+!	SS.DIAGIO	FD.9.3
!+adc alt up+!	SS.SYSVAL	FD.7.1.4.2 FD.7.2.1
!+adc tas up+!	SS.SYSVAL	FD.7.1.4.2
!+ADCFAIL+!	SS.DIAGIO	FD.9.3
!+after_slewing+!	SS.SYSVAL	FD.5.2.1 FD.6.2.1 FD.7.1.1.2
!+align_mode+!	SS.MODE	FD.1.1 FD.11.1 FD.12.1 FD.12.2 FD.4.1 FD.5.1.1 FD.5.1.2 FD.5.2.1 FD.5.2.2 FD.7.1.1.1 FD.7.1.1.2 FD.7.1.3.1 FD.7.1.3.2 FD.7.1.4.1 FD.7.1.4.2 FD.7.2.1 FD.7.2.2 FD.7.2.3 FD.7.2.4 FD.7.2.4.3 FD.8.1 FD.8.2 FD.8.3.1 FD.8.3.2 FD.8.3.3 FD.9.3
!+align_stage+!	SS.STAGE	FD.9.3 FD.8.1 FD.8.3.1 FD.8.3.2 FD.8.3.3
!+alt ADC+!	DI.ADC	FD.7.2.1 FD.9.3
!+alt from sr+!	PM*	FD.9.3
!+alt priority stale+!	SS.SYSVAL	FD.9.3
!+alt priority source+!	SS.SYSVAL	FD.9.3
!+alt RADAR+!	DI.RADALT	FD.9.3
!+AOA+!	DI.AOA	FD.7.1.4.2 FD.7.2.3
!+ARPPAIRS+!	SS.DIAGIO	FD.9.3
!+ARPINT+!	SS.DIAGIO	FD.9.3
!+ARPQUANT+!	SS.DIAGIO	FD.9.3
!+AS azimuth+!	DI.HUD	FD.6.3 FD.7.1.2.2 FD.8.3.3
!+AS elevation+!	DI.HUD	FD.6.3
!+ASL elevation+!	DI.HUD	7.1.6.2
!+Az cursor lft max+!	DI.FLR	FD.6.2.1
!+Az cursor rgt max+!	DI.FLR	FD.6.2.1
!+az miss dist+!	PM*	FD.9.3

!+az ref hdg pnl+!	SS.SYSVAL	FD.8.3.3 FD.9.3
!+before_slewing+!	SS.SYSVAL	FD.5.2.1 FD.6.2.1 FD.7.1.1.2
!+BMBDRAG eq High+!	SS.DIAGIO	FD.9.3
!+bomb fall line+!	PM*	FD.7.1.2.2
!+boresight azimuth+!	DI.WCM	FD.7.1.1.2
!+boresight elevation+!	DI.WCM	FD.7.1.1.2
!+brg_ac_ftpt+!	SS.SYSVAL	FD.7.1.3.2
!+brg_grtk_ap+!	SS.SYSVAL	FD.6.2.1
!+brg_grtk_cup+!	SS.SYSVAL	FD.6.2.1
!+brg_grtk_ftpt+!	SS.SYSVAL	FD.10.3 FD.5.1.1 FD.5.2.1 FD.6.2.1
!+brg_grtk_oap+!	SS.SYSVAL	FD.5.2.1 FD.6.2.1
!+brg_grtk_tgt+!	SS.SYSVAL	FD.5.2.1 FD.6.2.1 FD.7.1.2.2
!+burst ht pnl+!	SS.PNL.INPUT	FD.9.3
!+central long+!	DI.PMDSR	FD.9.3
!+central long a pnl+!	SS.PNL.INPUT	FD.10.7
!+central long b pnl+!	SS.PNL.INPUT	FD.10.7
!+CL stage complete+!	SS.STAGE	FD.12.2
!+data nbr pnl+!	SS.PNL.INPUT	FD.9.3
!+desig+!	SS.SYSVAL	FD.10.5 FD.2.1 FD.5.1.1 FD.5.2.1 FD.6.2.1 FD.7.1.1.2 FD.7.1.2.2 FD.7.1.6.1
!+dest altitude pnl+!	SS.PNL.INPUT	FD.9.3
!+dest entry pnl+!	SS.PNL.INPUT	FD.1.1 FD.9.3 FD.10.5
!+dest lat+!	SS.SYSVAL	FD.9.3
!+dest long+!	SS.SYSVAL	FD.9.3

!+dest mslp pnl+!	SS.PNL.INPUT	FD.1.1 FD.9.3
!+dive_pullup+!	PM*	FD.7.1.6.2
!+Doppler coupled pnl+!	SS.PNL.INPUT	FD.9.3
!+Doppler reasonable+!	SS.SYSVAL	FD.9.3
!+drift angle+!	SS.SYSVAL	FD.7.1.2.2
!+drift angle DRS+!	DI.DRS	FD.9.3.
!+drift angle IMS+!	*	FD.9.3
!+DRSREL+!	SS.DIAGIO	FD.9.3
!+during slewing+!	SS.SYSVAL	FD.6.2.1 FD.7.1.1.2 FD.10.5
!+E coarse bias+!	DI.IMSR	FD.9.3
!+E coarse bias pnl+!	SS.PNL.INPUT	FD.8.5
!+E coarse scale+!	DI.IMSR	FD.9.3
!+E coarse scale pnl+!	SS.PNL.INPUT	FD.8.5
!+E fine bias+!	DI.IMSR	FD.9.3
!+E fine bias pnl+!	SS.PNL.INPUT	FD.8.5
!+E fine scale+!	DI.IMSR	FD.9.3
!+E fine scale pnl+!	SS.PNL.INPUT	FD.8.5
!+E vel IMS+!	DI.IMS	FD.9.3
!+elapsed navaln time+!	SS.SYSVAL	FD.9.3
!+Enter light+!	DI.PNL	FD.9.2
!+flt path angle+!	PM.ACM	FD.9.3
!+Fly to num+!	DI.SWB	FD.1.1 FD.5.1.1 FD.5.2.1 FD.7.1.3.2 FD.9.3 FD.10.3
!+Fly to state+!	DI.SWB	FD.1.1
!+FM stage complete+!	SS.STAGE	FD.7.1.4.2 FD.7.2.4

!+FPM azimuth+!	DI.HUD	FD.7.1.2.2 FD.7.1.7.2
!+FPM elevation+!	DI.HUD	FD.7.1.1.2 FD.7.1.2.2 FD.7.1.6.2 FD.7.1.7.2
!+GAS+!	SS.SYSVAL	FD.7.1.2.2
!+gnd spd DRS+!	DI.DRS	FD.9.3 FD.12.2
!+gr_ac_ftpt+!	SS.SYSVAL	FD.5.2.1
!+gr_ac_HUDrefpt+!	SS.SYSVAL	FD.7.1.1.2 FD.7.1.2.2
!+gr_ac_oap+!	SS.SYSVAL	FD.5.2.1 FD.9.3
!+gr_ac_rmax+!	*	FD.7.1.6.2
!+gr_ac_tgt+!	SS.SYSVAL	FD.5.2.1 FD.7.1.2.2 FD.7.1.6.2 FD.9.3
!+grtk+!	PM*	FD.10.1 FD.10.2 FD.5.2.2
!+Gun Enable+!	DI.WRM	FD.7.1.9.2 FD.7.1.5
!+GUNSSEL+!	SS.DIAGIO	FD.9.3
!+heading IMS+!	DI.IMS	FD.8.3.3 FD.9.3 FD.10.1
!+heading MAG+!	DI.IMS	FD.7.2.2 FD.9.3 FD.10.1
!+HUDrefpt_az+!	SS.SYSVAL	FD.7.1.1.2
!+HUDrefpt_elev+!	SS.SYSVAL	FD.7.1.1.2
!+HUDREL+!	SS.DIAGIO	FD.9.3
!+IMS horiz velocity+!	*	FD.9.3 FD.12.2
!+IMS mode+!	DI.IMS	FD.7.2.2 FD.8.2 FD.12.2
!+IMS ready+!	DI.IMS	FD.9.3
!+IMS reasonable+!	SS.SYSVAL	FD.9.3
!+IMS rel+!	DI.IMS	FD.9.3

!+IMS rotating+!	DI.IMS	FD.8.3.3
!+IMS total velocity+!	*	FD.9.3 FD.12.2
!+ims_x_const_error_mc+!	*	FD.8.3.1 FD.8.3.2
!+ims_x_dop_error_mc+!	*	FD.8.3.1 FD.8.3.2
!+ims_x_nav_error_m+!	*	FD.8.3.1 FD.8.3.2
!+ims_x_nav_error_mc+!	*	FD.8.3.1 FD.8.3.2
!+ims_x_sins_error_mc+!	*	FD.8.3.1 FD.8.3.2
!+ims_y_const_error_mc+!	*	FD.8.3.1 FD.8.3.2
!+ims_y_dop_error_mc+!	*	FD.8.3.1 FD.8.3.2
!+ims_y_nav_error_mc+!	*	FD.8.3.1 FD.8.3.2
!+ims_y_sins_error_mc+!	*	FD.8.3.1 FD.8.3.2
!+ims_z_const_error_mc+!	*	FD.8.3.3
!+ims_z_dop_error_m+!	*	FD.8.3.3
!+ims_z_dop_error_mc+!	*	FD.8.3.3
!+ims_z_nav_error_m+!	*	FD.8.3.3
!+ims_z_sins_error_mc+!	*	FD.8.3.3
!+IMSAUTOC+!	SS.DIAGIO	FD.9.3
!+IMSMODE eq Gndal+!	SS.DIAGIO	FD.9.3
!+IMSMODE eq Grid+!	SS.DIAGIO	FD.9.3
!+IMSMODE+! eq Iner+!	SS.DIAGIO	FD.9.3
!+IMSMODE eq Magsl+!	SS.DIAGIO	FD.9.3
!+IMSMODE eq Norm+!	SS.DIAGIO	FD.9.3
!+IMSREDY+!	SS.DIAGIO	FD.9.3
!+IMSREL+!	SS.DIAGIO	FD.9.3
!+in_flight+!	SS.SYSVAL	FD.5.1.1 FD.8.1 FD.7.1.4.2 FD.11.1

!+ip_elev+!	*	FD.7.1.2.2 FD.7.1.6.2
!+L-probe+!	DI.ADCR	FD.9.3
!+L-probe pnl+!	SS.PNL.INPUT	FD.1.2
!+Land based pnl+!	SS.PNL.INPUT	FD.9.3 FD.11.1
!+latitude+!	SS.SYSVAL	FD.8.3.3 FD.9.3 FD.10.5
!+latitude_cup+!	SS.SYSVAL	FD.10.5
!+Latitude error+!	SS.SYSVAL	FD.9.3
!+loft pullup+!	*	FD.7.1.9.2
!+longitude+!	SS.SYSVAL	FD.9.3 FD.10.5
!+longitude_cup+!	SS.SYSVAL	FD.10.5
!+Longitude error+!	SS.SYSVAL	FD.9.3
!+low drag release+!	SS.SYSVAL	FD.7.1.6.2 FD.7.1.7.1 FD.7.1.8 FD.7.1.9.1 FD.7.1.9.2
!+low lat ct+!	DI.PMDSR	FD.9.3
!+low lat ct a pnl+!	SS.PNL.INPUT	FD.10.7
!+low lat ct b pnl+!	SS.PNL.INPUT	FD.10.7
!+LSC azimuth+!	DI.HUD	FD.6.3
!+LSC elevation+!	DI.HUD	FD.5.1.2 FD.6.3 FD.7.1.1.2
!+LSC mode+!	DI.HUD	FD.7.1.9.2
!+MA+!	SS.DIAGIO	FD.9.3
!+Mag variation pnl+!	SS.PNL.INPUT	FD.9.3
!+magvar IMS+!	DI.IMS	FD.9.3
!+Map decenter+!	DI.SWB	FD.10.4
!+Map hold+!	DI.SWB	FD.10.2 FD.10.5

!+Map latitude+!	DI.PMDS	FD.9.3 FD.10.5
!+Map longitude+!	DI.PMDS	FD.9.3 FD.10.5
!+Map north-up+!	DI.SWB	FD.10.4
!+map orient+!	DI.PMDSR	FD.9.3
!+map orient a pnl+!	SS.PNL.INPUT	FD.10.7
!+map orient b pnl+!	SS.PNL.INPUT	FD.10.7
!+Map position valid+!	DI.PMDS	FD.10.5
!+Map scale sw+!	DI.SWB	FD.10.7
!+Mark+!	SS.SYSVAL	FD.9.1
!+mark lat+!	SS.SYSVAL	FD.9.3 FD.10.5
!+mark long+!	SS.SYSVAL	FD.9.3 FD.10.5
!+MFSW eq BOC+!	SS.DIAGIO	FD.9.3
!+MFSW eq BOCOFF+!	SS.DIAGIO	FD.9.3
!+MFSW eq CCIP+!	SS.DIAGIO	FD.9.3
!+MFSW eq NATT+!	SS.DIAGIO	FD.9.3
!+MFSW eq NATTOFF+!	SS.DIAGIO	FD.9.3
!+MFSW eq TF+!	SS.DIAGIO	FD.9.3
!+MULTRACK+!	SS.DIAGIO	FD.9.3
!+N coarse bias+!	DI.IMSR	FD.9.3
!+N coarse bias pnl+!	SS.PNL.INPUT	FD.8.5
!+N coarse scale+!	DI.IMSR	FD.9.3
!+N coarse scale pnl+!	SS.PNL.INPUT	FD.8.5
!+N fine bias+!	DI.IMSR	FD.9.3
!+N fine bias pnl+!	SS.PNL.INPUT	FD.8.5
!+N fine scale+!	DI.IMSR	FD.9.3

!+N fine scale pnl+!	SS.PNL.INPUT	FD.8.5
!+N vel IMS+!	DI.IMS	FD.9.3
!+nav_mode+!	SS.MODE	FD.10.5 FD.1.1 FD.11.1 FD.12.1 FD.12.2 FD.4.1 FD.5.1.1 FD.5.1.2 FD.5.2.1 FD.5.2.2 FD.7.1.3.1 FD.7.1.3.2 FD.7.1.4.1 FD.7.1.4.2 FD.7.2.1 FD.7.2.2 FD.7.2.3 FD.7.2.4 FD.7.2.4.3 FD.8.1 FD.8.2 FD.8.3.3 FD.9.3
!+Non-align+!	DI.VISIND	FD.12.2
!+normal_accel+!	PM.ACM	FD.7.2.4.2 FD.9.3
!+offset brg pnl+!	SS.PNL.INPUT	FD.9.3
!+offset dht pnl+!	SS.PNL.INPUT	FD.9.3
!+offset rng pnl+!	SS.PNL.INPUT	FD.9.3
!+OTS+!	SS.SYSVAL	FD.7.1.6.2 FD.7.1.2.2 FD.7.1.9.2
!+OTS pullup+!	PM*	FD.7.1.9.2
!+pitch IMS+!	DI.IMS	FD.7.1.2.2 FD.7.1.6.1 FD.7.1.9.2 FD.7.2.3
!+PMDCTR+!	SS.DIAGIO	FD.9.3
!+PMHOLD+!	SS.DIAGIO	FD.9.3
!+PMLAND+!	SS.DIAGIO	FD.9.3
!+PMNORUP+!	SS.DIAGIO	FD.9.3
!+PMSCAL eq 80+!	SS.DIAGIO	FD.9.3
!+pnl config+!	SS.PNL.CONFIG	FD.9.1 FD.9.3 FD.10.5
!+preparation time+!	DI.WCM	FD.13.1
!+PUAC elevation+!	DI.HUD	FD.5.1.2
!+Radalt priority pnl+!	SS.PNL.INPUT	FD.9.3
!+RE+!	SS.DIAGIO	FD.9.3
!+RE pressed+!	DI.SWB	FD.13.1
!+release pulse width+!	DI.WCM	FD.13.1

!+rls pts passed+!	SS.SYSVAL	FD.9.3
!+roll IMS+!	DI.IMS	FD.5.1.2 FD.7.1.2.2 FD.7.2.3 FD.8.1
!+SINS dhdg pnl+!	SS.PNL.INPUT	FD.8.3.3 FD.9.3
!+SINS east vel+!	DI.SINS	FD.9.3
!+SINS east vel valid+!	DI.SINS	FD.9.3
!+SINS heading+!	DI.SINS	FD.8.3.3 FD.9.3
!+SINS heading valid+!	DI.SINS	FD.9.3
!+SINS lat+!	DI.SINS	FD.9.3
!+SINS lat valid+!	DI.SINS	FD.9.3
!+SINS long+!	DI.SINS	FD.9.3
!+SINS long valid+!	DI.SINS	FD.9.3
!+SINS north vel+!	DI.SINS	FD.9.3
!+SINS north vel valid+!	DI.SINS	FD.9.3
!+SINS pitch valid+!	DI.SINS	FD.9.3
!+SINS roll valid+!	DI.SINS	FD.9.3
!+SINS x offset pnl+!	SS.PNL.INPUT	FD.9.3
!+SINS y offset pnl+!	SS.PNL.INPUT	FD.9.3
!+SINS z offset pnl+!	SS.PNL.INPUT	FD.9.3
!+Slew moving+!	SS.SYSVAL	FD.10.5
!+slew FLR delta az+!	SS.SYSVAL	FD.6.2.1 FD.7.1.1.2
!+slew FLR delta rng+!	SS.SYSVAL	FD.6.2.1 FD.7.1.1.2
!+slew HUD delta az+!	SS.SYSVAL	FD.7.1.1.2
!+slew HUD delta elev+!	SS.SYSVAL	FD.7.1.1.2
!+slew map delta lat+!	SS.SYSVAL	FD.10.5

!+slew map delta long+!	SS.SYSVAL	FD.10.5
!+Slew right-left+!	DI.SLEW	FD.6.2.1 FD.7.1.1.2 FD.10.5
!+Slew up-down+!	DI.SLEW	FD.6.2.1 FD.7.1.1.2 FD.10.5
!+sr_ac_ap+!	SS.SYSVAL	FD.6.2.1
!+sr_ac_bpup+!	SS.SYSVAL	FD.7.1.7.2
!+sr_ac_cup+!	SS.SYSVAL	FD.6.2.1
!+sr_ac_ftpt+!	SS.SYSVAL	FD.6.2.1
!+sr_ac_gpup+!	SS.SYSVAL	FD.7.1.7.2
!+sr_ac_ip+!	SS.SYSVAL	FD.9.3
!+sr_ac_oap+!	SS.SYSVAL	FD.6.2.1
!+sr_ac_rls+!	SS.SYSVAL	FD.7.1.6.2
!+sr_ac_tgt+!	SS.SYSVAL	FD.6.2.1 FD.9.3
!+sr reasonable+!	SS.SYSVAL	FD.9.3
!+STA1RDY+!	SS.DIAGIO	FD.9.3
!+STA2RDY+!	SS.DIAGIO	FD.9.3
!+STA3RDY+!	SS.DIAGIO	FD.9.3
!+STA6RDY+!	SS.DIAGIO	FD.9.3
!+STA7RDY+!	SS.DIAGIO	FD.9.3
!+STA8RDY+!	SS.DIAGIO	FD.9.3
!+steering error to rls+!	PM*	FD.7.1.2.2
!+steering error to tgt+!	SS.SYSVAL	FD.5.1.1 FD.7.1.2.2
!+steering to tgt+!	SS.SYSVAL	FD.7.1.2.2
!+symbol_az_on_ASL+!	SS.SUBRTN	FD.7.1.6.2 FD.7.1.7.2 FD.7.1.9.2
!+target in range+!	SS.SYSVAL	FD.7.1.5
!+TAS ADC+!	DI.ADC	FD.9.3 FD.12.2

!+TD+!	SS.DIAGIO	FD.9.3
!+test_mode+!	SS.MODE	FD.6.1 FD.7.1.1.2 FD.7.2.1 FD.7.2.3 FD.7.2.4.3 FD.14.1
!+test result+!	EC.DIAG	FD.14.1
!+time to ftpt+!	SS.SYSVAL	FD.9.3
!+TOS+!	SS.SYSVAL	FD.7.1.6.2
!+update mode+!	SS.MODE	FD.6.1 FD.6.2.1 FD.6.2.2 FD.6.3 FD.7.1.1.1 FD.7.1.1.2 FD.9.2 FD.9.3 FD.10.5
!+USC elevation+!	DI.HUD	FD.7.1.1.2
!+V coarse bias+!	DI.IMSR	FD.9.3
!+V coarse bias pnl+!	SS.PNL.INPUT	FD.8.5
!+V coarse scale+!	DI.IMSR	FD.9.3
!+V coarse scale pnl+!	SS.PNL.INPUT	FD.8.5
!+Velocity east system+!	SS.SYSVAL	FD.7.1.4.2
!+Velocity north system+!	SS.SYSVAL	FD.7.1.4.2
!+Velocity vertical system+!	SS.SYSVAL	FD.7.1.4.2 FD.7.2.4.3
!+weap_mode+!	SS.MODE	FD.7.1.1.1 FD.13.1 FD.2.1 FD.5.1.1 FD.5.1.2 FD.5.2.1 FD.6.1 FD.6.2.1 FD.6.2.2 FD.6.3 FD.7.1.1.2 FD.7.1.2.1 FD.7.1.2.2 FD.7.1.4.1 FD.7.1.4.2 FD.7.1.5 FD.7.1.6.1 FD.7.1.6.2 FD.7.1.7.1 FD.7.1.7.2 FD.7.1.9.1 FD.7.1.9.2 FD.7.2.4.2 FD.7.2.4.3 FD.9.3
!+Weapon Class+!	DI.WCM	FD.2.1 FD.6.1 FD.7.1.2.2 FD.7.1.1.2 FD.7.1.7.1 FD.7.1.7.2 FD.7.1.8
!+WEAPTYP+!	SS.DIAGIO	FD.9.3
!+wind dir+!	SS.SYSVAL	FD.9.3
!+wind vel+!	SS.SYSVAL	FD.9.3

!+wmode class+!	SS.MODE	FD.13.1 FD.2.1 FD.5.1.2 FD.7.1.6.1 FD.7.1.6.2 FD.7.1.9.1 FD.7.1.9.2
!+wpns rlsd+!	SS.SYSVAL	FD.13.1
!+X corr increm+!	DI.IMSR	FD.9.3
!+X corr increm pnl+!	SS.PNL.INPUT	FD.8.5
!+X drift+!	DI.IMSR	FD.9.3
!+X drift pnl+!	SS.PNL.INPUT	FD.8.5
!+Y corr increm+!	DI.IMSR	FD.9.3
!+Y corr increm pnl+!	SS.PNL.INPUT	FD.8.5
!+Y drift+!	DI.IMSR	FD.9.3
!+Y drift pnl+!	SS.PNL.INPUT	FD.8.5
!+Z corr increm+!	DI.IMSR	FD.9.3
!+Z corr increm pnl+!	SS.PNL.INPUT	FD.8.5
!+Z drift+!	DI.IMSR	FD.9.3
!+Z drift pnl+!	SS.PNL.INPUT	FD.8.5

Appendix 5

Function Driver Review Process

I. REVIEWERS

Each function driver specification should be reviewed from the four different points of view described below. Although four different people will review each specification, no one person will be asked to review every specification. Instead, each reviewer will be asked to review a set of closely-related function driver specifications.

Point of view	Expertise required
NWC-2 EXPERTS	Detailed familiarity with significant parts of NWC-2 program. These people need to understand the behavior of the current software. Programming knowledge is not necessary.
DEVICE EXPERTS	Familiarity with the devices used on the A-7 and with similar devices found on other aircraft. These people should be familiar as well with the architecture of the virtual devices provided by the Device Interface Module. They should know about several devices of a particular type, about the technology used to build them, and about past changes and future trends in devices.
COMPARERS	Good logical minds. A certain familiarity with avionics programs would be helpful but not mandatory. These people will be asked to perform certain checks for consistency and completeness; consequently, a lack of information on the specific application may be advantageous.
AVIONICS PROGRAMMERS	Programming. These people must be able to sketch a pseudo-code program implementing a given functional specification along with interface specifications for support modules.

REVIEW A: Accuracy Review

Each function driver specification should produce output that will result in system behavior that is identical to that of NWC-2 at all times, and it should not specify values in situations in which the values are irrelevant.

Each reviewer should answer the following questions for each function driver specification reviewed. Because the behavior of the function drivers is dependent upon the other modules that it uses, reviewers will be supplied with drafts of interface specifications of the Shared Services and Device Interface modules.

Al: Answer this question for each table that appears in the function driver specification being reviewed: For each box of the table, is the information contained there clear and unambiguous? Explain any "no" answers on the back of the form.

A2: Answer this question for each table that appears in the function driver specification being reviewed: For each box of the table, does the information contained there specify the current behavior of NWC-2? Explain any "no" answers on the back of the form.

A3: For each value designated by the "!+ +!" brackets that appears in the specification, write down the name of the value and answer the following questions:

a. Where did you find its definition? Please give the document name and relevant section number. If you failed to locate its definition, answer with "X".

b. For an item whose definition you located, is the definition of that item such that it will allow the function driver to meet its requirements? Explain any "no" answers on the back of the form.

c. Is the mnemonic suggestive of the proper meaning? Explain any "no" answers on the back of the form.

A4: Are there situations when NWC-2 will produce output, and we have not specified it?

A5: Are there situations in which the value of the output is irrelevant in NWC-2, but we have specified a value?

REVIEW B: DIM appropriateness review

Each function driver module depends on the Device Interface Module in two ways. First, the function driver sends output to a virtual device via that device's access programs. In addition, the DIM produces sensor information that the function driver evaluates and uses to determine its output.

If a hardware device is replaced by a new device with the same capabilities, then the function drivers should not change. In addition, the Device Interface Module must provide capabilities that are consistent with those assumed by the function driver module. Finally, no function driver module should depend on any information that is a secret of a device interface module.

Each reviewer should answer the following questions for each function driver specification reviewed:

B1: List the virtual devices that produce data used by this function driver. For each device listed, answer the following questions:

a. What kind of replacements for these devices, if any, would cause a change in this function driver module?

b. Are there times when the device or the values it produces are not available when needed by this function driver?

B2: Determine the virtual device that this function driver controls by its output. What sort of replacement device, if any, would cause a change in this function driver?

B3: Consider the set of virtual devices used by this function driver, and the undesired events specified in the Device Interface Module as being associated with each device. List the undesired events that this function driver can possibly cause to occur.

B4: For each undesired event you listed above, answer the following question: Can this function driver always avoid causing this undesired event? Or are there times when this function driver depends on the action of some other module to avoid giving rise to the undesired event?

REVIEW C: Programmability review

The function driver specifications must contain enough information to be unambiguously implemented, yet they must contain no software design decisions.

For each function driver specification reviewed, each reviewer should sketch the program (in pseudo-code) that implements it. Then the reviewer should answer each of the following questions:

C1: For each line of your pseudo-code program, note in the left margin what information in the specification was used. Use the following code:

Symbol	Meaning
Rn	Used the entire nth row of a table;
Cm	Used the entire mth column of a table; for instance, C1 means that the entire mode list was utilized by this line of the program;
Rn,Cm	Used information in the box defined by row n and column m of the table;
LD	Used information in the specification's local dictionary;
P	Used information contained in prose paragraph;
O	Used information from some other section of the specification;

C2: What sections of the specification were not used, according to your list of utilized sections created by Question C1?

C3: Is it possible to write another program that is not functionally equivalent to the first one that also meets the specification? If so, describe the ambiguity in the specification that allows this.

C4: Is there any necessary information that was not provided by the specification? What was it?

C5: List all possible failures of services and devices that the function driver assumes are available. For each one, how does the specification determine what to do in that case?

REVIEW D: Comparison review

The function drivers should be relatively independent; that is, a minor change to one should not change any other.

Each review should answer the following questions for each group of function driver specifications reviewed:

D1: Is there a compound condition or event or expression that appears in more than one function driver? If so, what is it, and in which function drivers does it appear?

D2: What small change would cause a change in more than one function driver in the group? Are there things common to more than one function driver that are likely to change together?

D3: Is there more than one function driver in this group that determines the same output to the same virtual device? If so, which function drivers and which device?

REVIEW A: Accuracy Review

Answer Form for Questions A1 and A2

Reviewer: ______________________________

Function Driver table being reviewed: Table FD. ________________

Question being answered (circle one): A1 A2

For each box in the table being reviewed, answer "yes" or "no"; abbreviate "y" or "n" if you like. Explain each "no" answer on the back of this form.

	mode list							
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
Row 1								
Row 2								
Row 3								
Row 4								
Row 5								
Row 6								
Row 7								
Row 8								

REVIEW A: Accuracy Review

Answer Form for Question A3

Reviewer: ______________________________

Function Driver being reviewed: FD. ________________

Explain any "no" answers on the back of this form. Use as many forms as you need for this function driver.

Name of !+ +! value	Where did you find its definition? (Document and section #, or "X")	Is the definition such that it will allow the FD to meet its requirements?	Is the mnemonic proper?
!+ +!			
!+ +!			
!+ +!			
!+ +!			
!+ +!			
!+ +!			
!+ +!			
!+ +!			
!+ +!			
!+ +!			
!+ +!			

REVIEW A: Accuracy Review

Answer Form for Questions A4 and A5

Reviewer: ______________________________

Function Driver being reviewed: FD. ___________________

A4: Are there situations when NWC-2 will produce output, and we have not specified it?

A5: Are there situations in which the value of the output is irrelevant, but we have specified a value?

REVIEW B: DIM appropriateness review

Answer Form for Question B1

Reviewer: ______________________________

Function Driver being reviewed: FD.___________________

B1: List the virtual devices that produce data used by this function driver. For each device listed, answer the following questions:

a. What kind of replacements for these devices, if any, would cause a change in this function driver module?

b. Are there times when the device or the values it produces are not available when needed by this function driver?

REVIEW B: DIM appropriateness review

Answer Form for Questions B2 through B4

Reviewer: ______________________________

Function Driver being reviewed: FD.___________________

B2: Determine the virtual device that this function controls by its output. What sort of replacement device, if any, would cause a change in this function driver?

B3: Consider the set of virtual devices used by this function driver, and the undesired events specified in the Device Interface Module as being associated with each device. List the undesired events that this function driver can possibly cause to occur.

B4: For each undesired event you listed above, answer the following question: Can this function driver always avoid causing this undesired event? Or are there times when this function driver depends on the action of some other module to avoid giving rise to the undesired event?

Use back of form if necessary.

REVIEW C: Programmability review

Answer Form for Psuedo-Code Program Sketch

Reviewer: ________________________________

Function Driver being reviewed: FD.________________

For each function driver specification reviewed, sketch the program (in a pseudo-code) that implements it. Use the back of this form if necessary.

REVIEW C: Programmability review

Answer Form for Questions C1 and C2

Reviewer: ______________________________

Function Driver being reviewed: FD.___________________

C1: For each line of your pseudo-code program, note in the left margin what information in the specification was used. Use the following code:

Symbol	Meaning
Rn	Used the entire n^{th} row of a table;
Cm	Used the entire m^{th} column of a table; for example, C1 means that the entire mode list was utilized by this line of the program;
Rn,Cm	Used information in the box defined by row n and column m of the table;
LD	Used information in the specification's local dictionary;
P	Used information contained in prose paragraph;
O	Us3d information from some other section of the specification;

C2: What sections of the specification were not used, according to your list of utilized sections created by Question C1?

REVIEW C: Programmability review

Answer Form for Questions C3 through C5

Reviewer: ______________________________

Function Driver being reviewed: FD.___________________

C3: Is it possible to write another program that is not functionally equivalent to the first one that also meets the specification? If so, describe the ambiguity in the specification that allows this.

C4: Is there any necessary information that was not provided by the specification? What was it?

C5: List all possible failures of services and devices that the function driver assumes are available. For each one, how does the specification determine what to do in that case?

REVIEW D: Comparison review

Answer Form for Questions D1 through D3

Reviewer: ______________________________

Answer the following questions for each group of function driver specifications reviewed:

D1: Is there a compound condition or event or expressions that appears in more than one function driver? If so, what is it, and in which function drivers does it appear?

D2: What small change would cause a change in more than one function driver in the group? Are there things common to more than one function driver that are likely to change together?

D3: Is there more than one function driver in this group that determines the same output to the same virtual device? If so, which function drivers and which device?

DAT

FILM