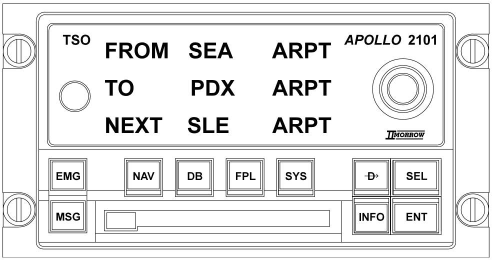
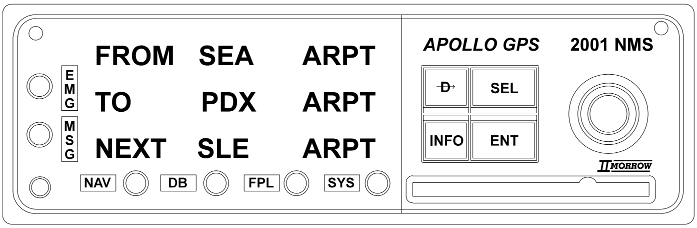
Apollo NMC

Navigation Management Computer
Operating Manual





II MORROW

VISIONARY THINKING TODAY

July 1999

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Caution

The Apollo NMS (Navigation Management System) is a powerful navigation tool, but you should never rely solely on any one piece of navigation equipment. It's important to maintain a constant awareness of the navigation picture by using all appropriate resources.

Your new NMC and peripheral sensors should be installed only by an FAA certified facility. Each installation is unique, and there are several variables and cautions that an installer must deal with for you to get the maximum benefit from your Apollo NMS.

Important Notice

The Global Positioning System (GPS) is operated by the United States Department of Defense which is solely responsible for the accuracy, daily operation, and maintenance of the satellite constellation. System accuracy is affected by the Department of Defense's Selective Availability (SA) and the Dilution of Precision (DOP) attributed to poor satellite geometry.

Due to implementation of Selective Availability by the United States Department of Defense (DoD), all GPS receivers may suffer degradation of position accuracy. The DoD has stated that 95% of the time horizontal accuracy will not be degraded more than 100 m and 99.9% of the time accuracy will not be degraded more than 300 m.

Installations of TSO C-129a authorized GPS Navigation Management Systems (NMS) may be approved for supplemental navigation only. The NMS may be used as the primary navigation data display, however, other means of navigation appropriate to the intended route of flight must be installed and operational. It is not required that these other systems be monitored.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference during residential use. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this equipment not expressly approved by II Morrow Inc. could void the user's authority to operate this equipment.

DOC Notice

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aut appareils numérique de classe B prescrites dans le réglement sur le brouillage radioélectrique édicté par le ministère des communications du canada.

History of Revisions

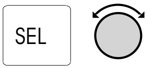
Revision Date	Software Ver.	Manual P/N
April 1996		560-0164-00
December 1996		560-0164-00A
June 1997		560-0164-01
March 1998	6.1	560-0164-01A
July 1999	6.3	560-0164-01B

Preface

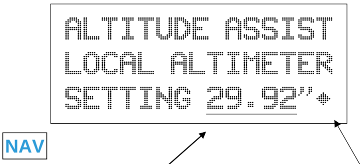
Conventions Used in This Manual

The Action (left) column depicts the steps involved in each procedure. This column can be used by itself as a quick reference for pilots already familiar with the system. The Explanation (right) column contains an explanation of each step along with a sample of the NMS display you will see while performing the procedure.

*In this example the action is “Press the **SEL** button and turn the Small knob”*

Action	Explanation
2. 	Pressing **SEL** activates editing. The altimeter value flashes. Turn the small knob to select the desired value.

Depicts the mode the system is in

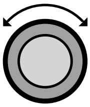
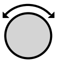


```
ALTITUDE ASSIST
LOCAL ALTIMETER
SETTING 29.92”♦
```

Underlined characters are flashing

Turn the small, inner knob for more pages when values are not flashing

Conventions Used in This Manual (continued)

SEL	Text in all caps and bold indicates the button to press.
NAV	Normal text in all caps indicates an operation mode, such as Navigation mode.
“Airport”	Text in quotes indicates information you will see on the NMS display.
	Large knob refers to turning the large, outer ring of the two concentric knobs.
	Small knob refers to turning the small, inner ring of the two concentric knobs.
SEL	The button graphics refer to the buttons you should press for the given examples.
NAV	Round button graphics refer to the mode buttons to press for the examples.

Audience

This manual has been prepared with the following assumptions:

You are familiar with navigation instruments and displays

The approach and instrument navigation descriptions assume you are familiar with instrument navigation charts and procedures

Welcome ...

Welcome to a new era of navigation. Once again, II Morrow Inc. has set new standards in features and ease of use for the aviation industry. The Apollo NMC is unequaled in providing the features, level of performace, and reliability that aviation users require. The Apollo NMC sets a precedent that will be the standard that all other navigation instruments will be compared to. You can be confident in knowing that you are the owner of the state-of-the-art in navigation. Our products are built to last and to allow for upgrading as your needs change in the future.

It is important to note that only version 5.0, or later version, of the Apollo NMC may be used for IFR GPS approach navigation. You can determine your version by either the part number on the unit or in the System Mode software version display.

Thank you again for choosing II Morrow to supply solutions to your navigation needs.

About This Manual

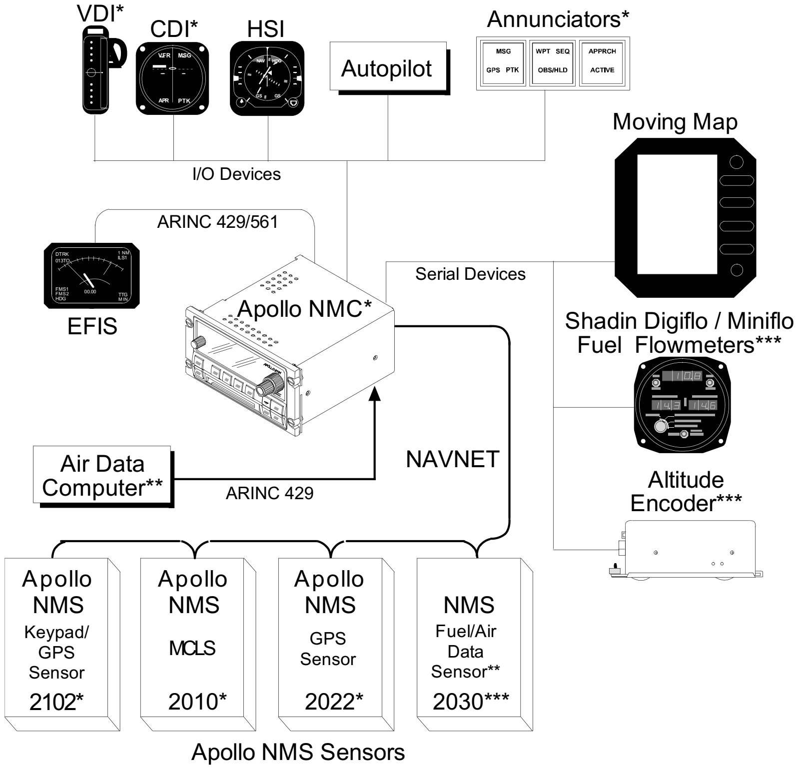
Please take a few moments to review the various sections of this manual. Even if you are an experienced user of GPS navigation, be sure to read the Basic Concepts and First Flight sections. These two sections provide the rules for successful use of the Apollo NMC. The rest of the manual contains important information that you can refer to as you need more detail on specific procedures or features.

Table of Contents

Basic Concepts

The Apollo NMS (Navigation Management System) uses a variety of remote sensors to provide a broad range of information. The “heart” of the system is the NMC (Nav Management Computer). The interface network is called NAVNET™. The NMC interprets data from the sensors to determine position, course, wind, altitude, and fuel information. Some features require specific sensors. For example, Altitude Assist features requires a Fuel/Air Data Sensor, or an altitude encoder. Multiple position sensors and external instruments/annunciators may be used for redundancy. The system approach allows additional components to be added at any time.

Apollo Navigation Management System

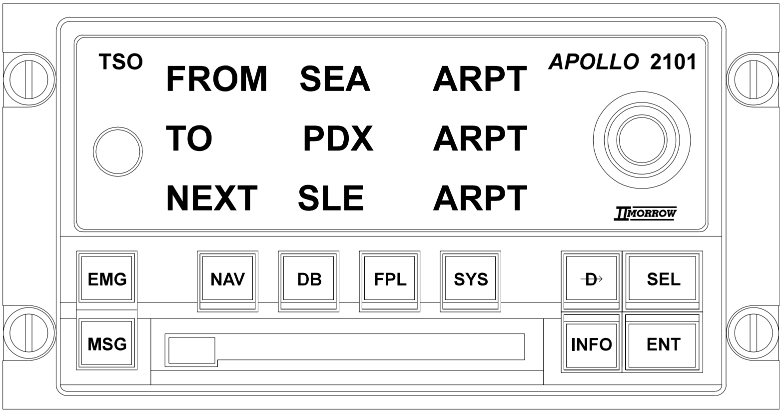


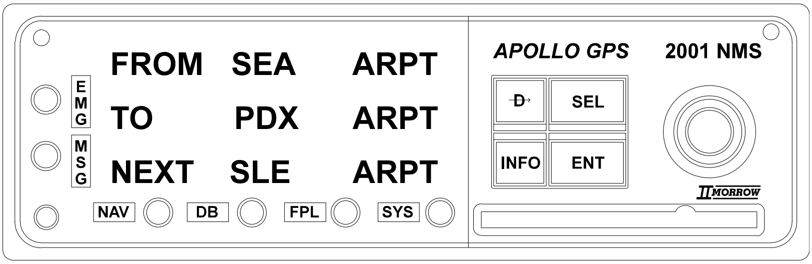
* Available from II Morrow Inc. or an authorized dealer

** Air Data Computer and Fuel/Air Data Sensors are mutually exclusive and are shown together for illustration only.

*** Available from ShadinCo.

Displays, Lights, and Controls





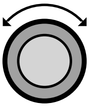
Power Switch

A rotary switch is located on the front panel near the left side of the 2101 NMC. A pull switch is located on the left side of the 2001 NMC.

LED Display

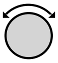
A photocell automatically adjusts the brightness of the LED (Light Emitting Diode) display. The display consists of 3 lines with 16 characters each.

Knobs



The **Large** knob has two functions. First, it is used to scroll through top-level displays in each mode. Second, when part of the display is flashing (i.e., editing is on), the **Large** knob is used to choose which character or characters on the display will flash.

Displays, Lights, and Controls (continued)

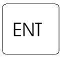


The **Small**, inner knob has two functions. First, it is used to scroll through displays that pertain to the top-level displays; that is, when the diamond ◆ appears in the lower right corner of a display. Second, when editing the display, a character (or series of characters), will flash. The **Small**, inner knob is then used to change the flashing character(s) to the desired character(s).

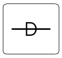
Action Buttons

(Select) The **SEL** button is used to activate editing. Editing is active whenever part of the display is flashing. With some features, editing is automatically activated without pressing **SEL**.

(Information) The **INFO** button accesses supplementary information about the displayed waypoint. It is also used to access flight plan comments that you enter. Pressing this button makes the current mode light flash, indicating you are looking at waypoint or flight plan information. Pressing this button again exits the **INFO** function.



(Enter) The **ENT** button enters and saves the information flashing on the display. If **ENT** is not pressed, any changes made are not saved.



(Direct-To) The **DIRECT-TO** button is used to define a direct course from the present position to any waypoint. The Waypoint Retriever, used to find waypoints in the database, is automatically activated after pressing this button.

Pressing the DIRECT-TO button twice is used to enter a desired course to or from the active waypoint. This action automatically suspends waypoint sequencing.

Mode Buttons

Pressing a Mode button places the NMC (Nav Management Computer) into that mode. Each mode is used to perform certain types of functions. The NMC is always in one of the six modes, signified by the lighted mode annunciator.

EMG (Emergency) Mode

EMG

EMG mode is used to find the nearest waypoints and nearest SUAs (Special Use Airspace areas) to your present position, or to find the closest waypoints to a selected waypoint. Search parameters, such as runway length, may be set so the NMC (Nav Management Computer) only displays airports and User waypoints that are suitable for your aircraft.

MSG (Message) Mode

MSG

MSG mode is used to display messages. The NMC (Nav Management Computer) alerts you to important conditions, such as arrival at a waypoint, or degraded position accuracy. The MSG light flashes when a new message condition occurs, and is lit solid if any messages you have already viewed remain.

NAV (Navigation) Mode

NAV

NAV mode is used to display navigation information, such as the bearing, distance, and ETE (Estimated Time En route) to the *To* waypoint. NAV mode may also provide Altitude Assist features, Parallel Track, Current Position Sensor information, a Countdown Timer, and From, To, Next waypoint access.

DB (Database) Mode

DB

DB mode is used to access waypoints stored on a datacard, and to create, store, and edit up to 200 User waypoints.

Modes (continued)

FPL (Flight Plan) Mode

FPL

FPL mode is used to create, store, view, and edit up to 29 flight plans of up to 20 legs each and to edit the Active flight plan. It can also provide advance information about ETE, ETA, Fuel Usage, and other important flight statistics. An approach is a set of waypoints inserted into the active flight plan.

SYS (System) Mode

SYS

SYS mode is used to make certain settings and adjustments to the system, such as adjusting the Time and Date, Fuel Units, and Barometric Units. (Some settings, including Time and Date, may also be adjusted during the start-up sequence). SYS mode also provides status information for position and other sensors.

Features

Below is a brief explanation of the features available with the Apollo NMS.

Direct-To Flights: The NMS can provide course guidance from your location directly to any waypoint in any database.

Data cards: Data cards contain listings of public use Airports, VORs, NDBs, INTs (intersections), airspaces, non-precision approaches, MSA, MESA, and magnetic variation information in the datacard coverage area. The combined coverage area for all of the data cards is world-wide.

Waypoint Information: Each database contains supplementary information about every waypoint. For example, ATC frequencies and available runways may be displayed for airports. Approaches are also stored on the data cards. In addition, bearing and distance from the present position to any waypoint is also available.

Features (continued)

Nearest Waypoint (Emergency) Search: The NMS finds the 20 nearest waypoints of each type. The pilot can choose any of these waypoints and set a course with the Direct-To feature. The NMC (Nav Management Computer) can be set to display only those Airports and User waypoints which meet your runway length and surface requirements. The NMC can also search for the 20 nearest waypoints around any waypoint, not just your present position.

Messages: The NMC (Nav Management Computer) automatically alerts you of conditions which may require your attention, such as nearing a Special Use airspace. Messages clear automatically, either after they have been viewed, or when the condition clears.

Navigation Information: The NMC (Nav Management Computer) constantly updates a wide variety of navigation information. With the proper sensors installed, this information includes everything from true airspeed to magnetic wind direction. Some information is available only with a specific sensor installed.

Flight Plans: The NMC (Nav Management Computer) allows you to store up to 30 flight plans of up to 20 legs each. These plans may be viewed, activated, reversed, interrupted, edited, and deleted while en route or on the ground. One of these flight plans is the Active flight plan. From the first time a course is entered into the new unit, there is always an Active flight plan. When any of the remaining 29 flight plans is activated, the plan is copied over the current Active flight plan, and the previous Active flight plan is deleted. Any changes to the Active flight plan do *not* affect any of the other stored flight plans. Approaches, when loaded, are placed at the end of the active flight plan, replacing the destination airport.

System Customizing: The NMC (Nav Management Computer) uses factory (default) settings that may be changed. For example, most of the Nav displays may be changed to display the specific navigation information you desire.

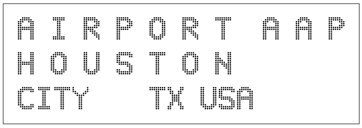
Additional Features: Certain additional features, such as Altitude Assist, True Airspeed, and Outside Air Temperature, may be available depending on what specific components are installed.

Operating Logic

Use of the **Waypoint Retriever** is fundamental to operating the NMS. The Waypoint Retriever is used to display specific waypoints, and is discussed in detail in Operations, *Retrieving a Waypoint.*

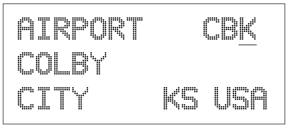
The Waypoint Retriever is activated automatically when you are using a feature that requires you to display a waypoint. For example, when using the Direct-To feature, which allows you to navigate directly to any waypoint in any database from your present position, pressing the **DIRECT-TO** button activates the Waypoint Retriever. In effect, pressing **DIRECT-TO** "tells" the system you want to navigate directly to some specific location.

The system responds to your command by activating the Waypoint Retriever. This is the system's way of asking, "where do you want to navigate to?" A display, similar to the one below, appears. In this manual, black characters, such as the "A" in the display below, indicate the item is flashing, and editing is activated.



AIRPORT AAP
HOUSTON
CITY TX USA

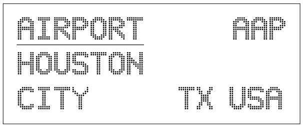
Whenever something on the display is flashing, it may be changed by turning the **Small** knob. To make something else on the display flash, turn the **Large** knob. The display shows the waypoint identifier and the database containing the waypoint. In this example, the waypoint AAP, located in the city Houston, Texas USA, is an Airport— i.e. is contained in the Airport database. If the location you want to fly to is also an airport, it is not necessary for you to change the waypoint type; simply turn the **Small** knob to display first character in the waypoint identifier, then turn the Large knob one increment clockwise to make the next character flash. Use the knobs to choose the remaining characters in the identifier, until the desired waypoint is displayed.



AIRPORT CBK
COLBY
CITY KS USA

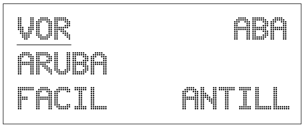
Operating Logic (continued)

If you wanted to fly to a different waypoint type, such as a VOR, you would begin by changing the type. Turn the **Large** knob until the waypoint type flashes.



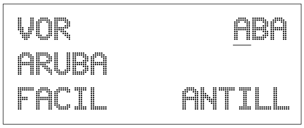
```
AIRPORT     AAP
HOUSTON
CITY     TX USA
```

Select a different waypoint type by turning the **Small** knob.



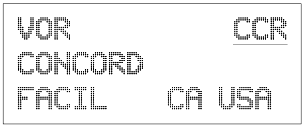
```
VOR         ABA
ARUBA
FACIL    ANTILL
```

Turning the **Large** knob counter-clockwise causes the identifier to again flash.



```
VOR         ABA
ARUBA
FACIL    ANTILL
```

Use the knobs to choose the remaining characters in the identifier, until the desired waypoint is displayed.



```
VOR         CCR
CONCORD
FACIL   CA USA
```

The last step is to press the **ENT** button. As far as the system memory is concerned, nothing has changed until **ENT** is pressed. If you did not want to navigate to the displayed waypoint, you would simply press any mode button. Any time you want to abort a procedure, simply press a mode button.

The Waypoint Retriever can also be used to look up waypoints using the city or facility name. Refer to Database Mode, *Retrieving a Waypoint* for full details.

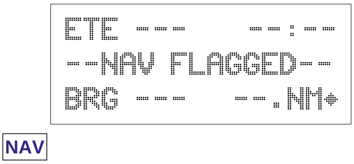
First Flight

WARNING

Before routinely using the Apollo NMS (Nav Management System) in the air, you should be quite familiar with its operation. Federal Aviation Regulations require pilots to practice SEE AND AVOID. It is therefore critical you do NOT study this manual while flying. It is recommended your first flight be made during good weather in a low traffic area. It is important you understand at least the First Flight section before you fly. You may wish to practice at home with the built-in simulator.

Power-Up

After the Nav Management Computer (NMC) is switched on, it initializes its internal circuits. During this approximately 2 second period, the display will remain blank. Following initialization, a power-up sequence begins. After the sequence, the display below appears. If the NMC (Nav Management Computer) has been removed from the panel and used in simulator mode or the unit has moved several hundred mile since the last time it was powered up, your present position must be entered during the power-up sequence. See Operations, *Power-Up Sequence.*



```
ETE ---      --:--
--NAV FLAGGED--
BRG ---     --.NM◆
```

Direct Navigation

This procedure is used to navigate from your present position directly to any waypoint stored in a database. The waypoint you are flying to is called the *To* waypoint. You will use the Waypoint Retriever to display the desired waypoint. The logic used is to:

Press the **DIRECT-TO** button. This activates the Waypoint Retriever.

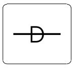
Select the *TO* waypoint using the **SEL** button and the **Large** and **Small** knobs.

Press **ENT**.

Direct Navigation

Action | **Explanation**

1.



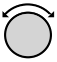
Underlined characters are flashing

The system is in NAV (Navigation) mode

The unit is in NAV mode, and the Waypoint Retriever is activated. The waypoint identifier is flashing.

```
AIRPORT      AAF
APALACHICOLA
CITY      FL USA
```

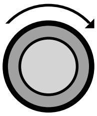
2.



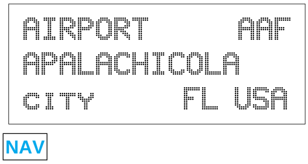
When an item is flashing, turning the **Small** knob displays other available items. Turn the **Small** knob to choose the desired waypoint type. In this example, the VOR type is chosen.

```
VOR          AAF
NABB
FACIL    IN  USA
```

3.



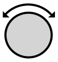
Turning the **Large** knob causes different items on the display to flash. Turn the **Large** knob to make the first character in the waypoint ident flash.



```
AIRPORT      AAF
APALACHICOLA
CITY      FL USA
```

Direct Navigation (continued)

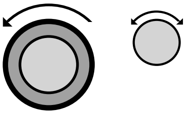
4.



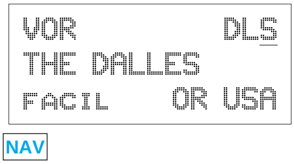
Turn the **Small** knob to choose the desired character. The remaining identifier characters may change as the knob is turned because the NMC (Nav Management Computer) will not display an identifier that doesn't exist.

```
VOR          DAG
DAGGETT
FACIL    CA USA
```

5.



Turn the **Large** and **Small** knobs to choose the remaining characters in the waypoint identifier. The desired waypoint is displayed.



```
VOR           DLS
THE DALLES
FACIL     OR USA
```

Direct Navigation (continued)

7. Press ENT to select the waypoint as the TO waypoint. The MNC will now provice guidance on a course from your present position to the chosen waypoint. Navigation information is only displayed when position sensors have completed acquiring signals.

ENT

```
ETE  DLS   00:00
       ✝    0.00
BRG159  82.7NM⬍
```

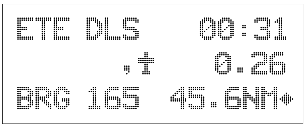
Indicates additional displays (sub-pages) may be viewed by turning the **Small** knob.

Navigation Displays

The **Small** knob is used to scroll through the various navigation displays. The diamond (◆) in the lower-right corner indicates there are sub-pages which may be viewed by turning the **Small** knob. In this example, the sub-pages are additional navigation displays.

A brief explanation of these displays appears below. For more detailed information, see the Operations section, Navigation Sub-Displays.

NAV FLAGGED appears on the middle line, and values for bearing (BRG) and distance (NM) are zero until the system calculates position, which takes from one to four minutes after power-up, and a *To* waypoint is entered.

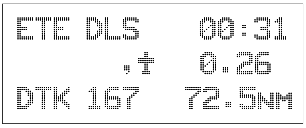


```
ETE DLS     00:31
      ,†     0.26
BRG 165  45.6NM◆
```

TOP LINE: The Estimated Time En route (ETE) to DLS is 31 minutes.

MIDDLE LINE: The CDI indicator (similar to a VOR CDI); The desired course is towards the bar. The selected course is 0.26nm to the left.

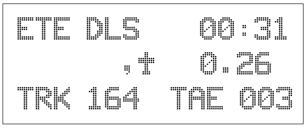
BOTTOM LINE: The bearing to DLS is 165°; the distance is 82.7nm.



```
ETE DLS     00:31
      ,†    0.26
DTK 167   72.5NM
```

ETE
CDI

The Desired Magnetic Track from the From waypoint to DLS is 167°. The distance between the FROM and TO waypoints is 82.7nm.

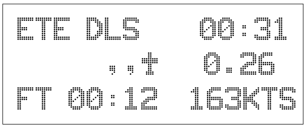


```
ETE DLS     00:31
      ,†    0.26
TRK 164  TAE 003
```

ETE
CDI

The Magnetic Track is 164   the Track Angle Error is 3°.

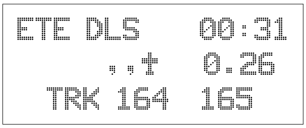
Navigation Displays (continued)



```
ETE DLS    00:31
     ,,✈   0.26
FT 00:12  163KTS
```

ETE
CDI

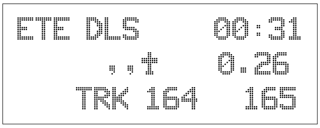
Flight time since departure is 12 minutes; the ground speed is 163 knots.



```
ETE DLS    00:31
     ,,✈   0.26
  TRK 164  165
```

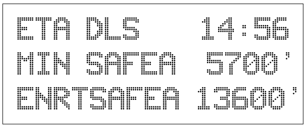
ETE
CDI

The track and bearing indicator. The track is 164°; the current bearing to DLS is 165°. The bearing is displayed to the left or the right side depending on whether the aircraft is to the left or right of the desired course. In this example, the aircraft is to the right of the desired course.



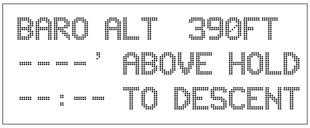
```
ETE DLS     00:31
     ,,✈    0.26
    TRK 164   165
```

ETE
CDI
The current UTC (Coordinated Universal Time) is 14:25 (2:25 pm).



```
ETA DLS    14:56
MIN SAFEA  5700'
ENRTSAFEA 13600'
```

Estimated Time of Arrival (ETA) at DLS is 14:56 UTC.
MSA (Minimum Safe Altitude)
MESA (Minimum En route Safe Altitude)



```
BARO ALT  390FT
----' ABOVE HOLD
--:-- TO DESCENT
```

Barometric (Current) Altitude.
The distance (in feet) above or below Hold altitude.
Time to beginning of Auto descent. When Auto Descent has started, this line displays the distance (in feet) you are above or below the glide path.

If the Fuel/Air Data Sensor is installed on the NMS, three additional pages of navigation information will be available when you turn the Small knob. See *Nav Mode: Navigation Sub-Displays* for more information.

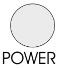
Power-Up Sequence

The power-up sequence is displayed every time the Apollo NMS is turned on. The power-up sequence begins after the NMC completes an approximately 2 second initialization of internal circuits. Following initialization, the sequence will show the owner's name, the database version, the software version, present position, request for altimeter correction factor, and the time/date. It also allows entry of a new time/date and position during the sequence. The NMC will automatically update the time from GPS satellite information at power-up. If a valid datacard is not inserted, you will manually enter the magnetic variation during the power-up sequence for the area you will be flying in. In addition, the NMC displays start-up self-test pages, self-test results, and asks if you want to continue with the last used flight plan.

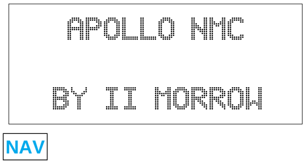
To acquire a position the system must "know" its approximate location and, if using a GPS sensor, the time (UTC Coordinated Universal Time formerly called Greenwich Mean Time).

Hint

The UTC and approximate position should be entered by the installer; in which case, no action is normally required of you during the power-up sequence. As long as the system is functioning when you fly, the NMS will always "know" its position the next time it is powered up; however, if the NMC has been removed from the panel for use in simulator mode, your present position must be entered during power-up after the unit is reinstalled in the aircraft.



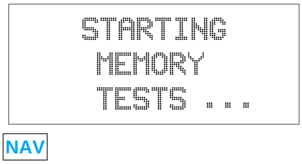
Switching the power on starts the power-up sequence.


APOLLO NMC

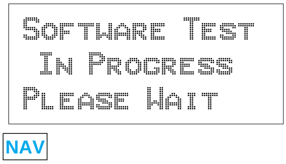
BY II MORROW

Power-Up Sequence (continued)

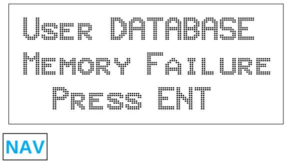
The Self-Test introductory page is displayed for 2 seconds.


STARTING
MEMORY
TESTS ...

The next self-test checks all of the NMC software, and takes about 4 seconds. During this time, the screen shown below is displayed.


SOFTWARE TEST
IN PROGRESS
PLEASE WAIT

The next self-test checks the User Waypoint database. If any errors are found, the affected User Waypoints are cleared from memory, and the display shown below is displayed until the user presses **ENT**. If no errors are found, this page is not shown.

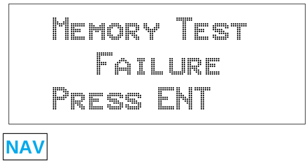

USER DATABASE
MEMORY FAILURE
PRESS ENT

Next, all Flight Plan information is checked. If any errors are found, the affected flight plans are cleared from memory, and the display shown below is displayed until the user presses **ENT**. This page is not shown if no flight plan errors are detected.

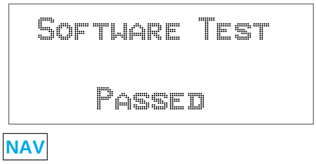

FLIGHT PLAN
MEMORY FAILURE
PRESS ENT

Power-Up Sequence (continued)

Remaining user-set-ups are tested next, resulting in the following message if errors are detected. Again, this message is not shown in the normal case where no errors are detected.

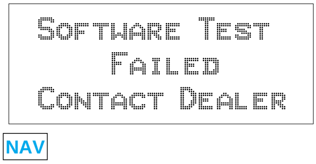

MEMORY TEST
FAILURE
PRESS ENT

When the test is completed successfully, the following screen is displayed for 2 seconds.


SOFTWARE TEST

PASSED

Failure to pass the software test indicates a critical system error may exist. In this case, the following message is displayed and the NMC will not continue to function. If this problem should occur, return the NMC to the dealer for repairs.

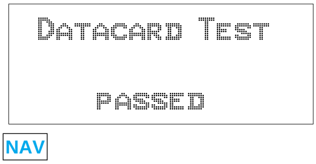

SOFTWARE TEST
FAILED
CONTACT DEALER

If a datacard is in the datacard slot, it is tested next. This test checks all of the datacard memory, taking about 5 seconds to complete. The test is accompanied by the display shown below.

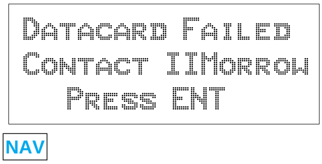

DATACARD TEST
IN PROGRESS
PLEASE WAIT...

When the test is completed successfully, the following screen is displayed for 2 seconds.

Power-Up Sequence (continued)


Datacard Test
Passed

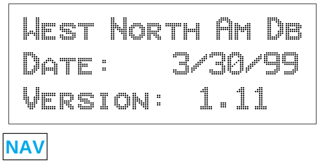
Failure to pass the datacard check causes the display to show the next page. The user must then press **ENT** to continue.


Datacard Failed
Contact IIMorrow
Press ENT

The Owner Name page is displayed for 2 seconds. The procedure for entering owner information is described in Operations, Entering and Editing Owner Information on page 209.

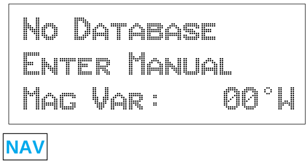

Property Of:
ORVILLE WRIGHT
KITTY HAWK

When a valid datacard is properly inserted in the datacard slot, the database name, expiration date, and version number is displayed for 4 seconds.


West North Am Db
Date: 3/30/99
Version: 1.11

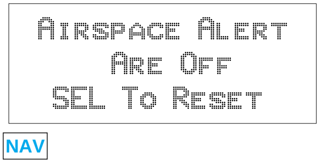
The display below only appears if the datacard is invalid or not inserted properly. The magnetic variation value (in bold) is flashing. Rotate the **Small** and **Large** knobs to update the magnetic variation for your current position, then press **ENT** to save the displayed value.

Power-Up Sequence (continued)



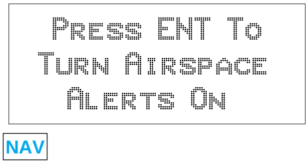
No Database
Enter Manual
Mag Var : 00°W

If the Special Use Airspace (SUA) alerts have been turned off (see System Mode for more information on SUA setups), the next screen is displayed for up to 4 seconds.



Airspace Alert
Are Off
SEL To Reset

To turn the airspace alerts back on, press **SEL** when the screen shown on the previous page is displayed, then press **ENT** when the screen shown below appears, or press **SEL** to cancel.



Press ENT To
Turn Airspace
Alerts On

If the Special Use Airspace (SUA) setups (restricting which SUA alerts are displayed) have been changed from the standard setups, the screen shown below will be displayed for up to 4 seconds.

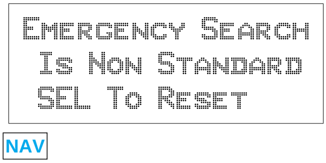
Airspace Setups
Are Non Standard
Setups

To reset the airspace setups, press **SEL** within 4 seconds, then press **ENT**, as shown on the screen below, or press **SEL** again to cancel.

Power-Up Sequence (continued)

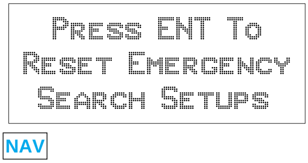
Press ENT To
Reset Airspace
Setups

If Emergency Search settings restricting runway lengths and/or surface types and/or lighting requirements are entered, the display below appears for up to 4 seconds.



Emergency Search
Is Non Standard
SEL To Reset

To reset the Emergency Search settings, press **SEL** within 4 seconds, then press **ENT**, as shown on the screen below, or press **SEL** to cancel.



Press ENT To
Reset Emergency
Search Setups

If the 2030 Fuel/Air Data Sensor is installed, the NMC displays the next screen until **SEL** is pressed.

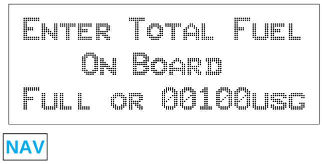
FUEL ON BOARD
Must Be Verified
Press SEL

Enter the total amount of fuel which is in the airplane's tanks including reserve, by rotating the **Small** and **Large** knobs to edit the displayed values, then press **ENT**. If the cursor is flashing on the word "FULL" when **ENT** is pressed, the amount of fuel displayed will become the maximum amount of fuel previously entered, and the cursor will flash on the number. Pressing **ENT** again will enter the number as the current total fuel on board.

Power-Up Sequence (continued)

If the total fuel entered is greater than previous Full tanks amount, the Full tanks amount is updated to the newly entered value.

The total fuel entered is critical for accurate information to be displayed in the Nav items which depend on F/ADS fuel tank information.

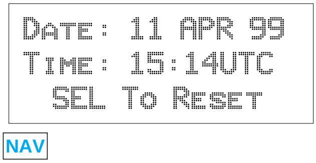


```
Enter Total Fuel
    On Board
Full or 00100usg
```

The Coordinated Universal Time (UTC - formerly called Greenwich Mean Time) and date is displayed for up to 4 seconds.

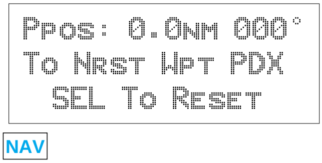
The UTC may be reset here by pressing **SEL** within 4 seconds, rotating the **Large** and **Small** knobs, and pressing **ENT** to save the displayed values. The UTC may also be reset in System Mode.

If using a GPS sensor, the UTC and date *must* be accurate for the sensor to initialize in less than 30 minutes.



```
Date:  11 APR 99
Time:  15:14UTC
  SEL To Reset
```

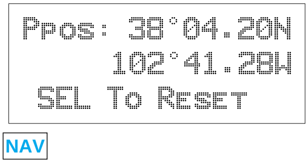
The display below, showing the present position in relation to the nearest airport, appears for up to 10 seconds only if a valid datacard is properly installed and the current position is within 600 nautical miles of an airport in the database. Press **SEL** if the current position needs updating.



```
Ppos:  0.0nm 000°
To Nrst Wpt PDX
  SEL To Reset
```

Power-Up Sequence (continued)

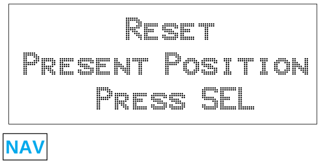
If a valid datacard is not installed or the current position is nowhere near an airport in the database, the display below appears instead for up to 10 seconds. Again, press **SEL** to update the current position.



```
PPOS: 38°04.20N
     102°41.28W
 SEL TO RESET
```

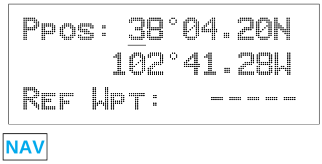
The displayed position is the location of the aircraft when the power was last turned off; therefore, this position will not normally need to be edited; however, **in order for GPS sensors to initialize, and loran sensors to select a GRI, the system *must* "know" its approximate location.**

If the NMC has been removed from the panel for use in Flight Simulator mode, the display below appears after reinstallation in the aircraft, and you must enter a reference position before the power-up sequence will continue. Press **SEL** to update the current position.



```
     RESET
PRESENT POSITION
   PRESS SEL
```

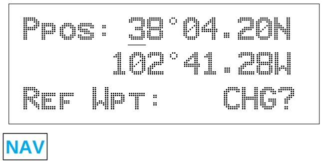
Rotate the **Large** and **Small** knobs to edit the values shown below. Press **ENT** when the desired position is entered. Resetting the Present Position (PPos) may be done by updating the latitude and longitude directly, as shown below, or by choosing a reference waypoint as the current position.



```
PPOS: 38°04.20N
     102°41.28W
REF WPT:   -----
```

Power-Up Sequence (continued)

In most cases, updating the present position may be simplified by selecting a Reference Waypoint's position, if the Reference Waypoint is close to the current position. To do this, press **ENT** when the cursor is flashing on the Reference Waypoint field, as shown below.



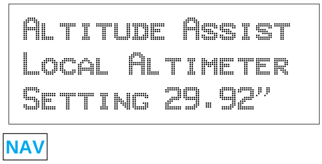
```
Ppos: 38°04.20N
     102°41.28W
Ref Wpt:    CHG?
```

NAV

The Waypoint Retriever will be started if **ENT** is pressed when the cursor is flashing on "CHG?", the Reference Waypoint Change field. Refer to the Operating Logic section of Basic Concepts for detailed information on the Waypoint Retriever.

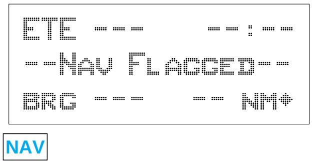
When the desired waypoint has been found using the Waypoint Retriever, press **ENT** to exit the Waypoint Retriever and to display the current position of the retrieved waypoint. If you are satisfied with the present position displayed, press **ENT** again to save it as the NMC's current position.

The final power-up screen, shown below, prompts you to enter a local altimeter setting. This screen is only shown if an Altitude Encoder or a Fuel/Air Data Sensor is installed. Turn the **Small** knob until the setting is correct, then press **ENT.**



```
Altitude Assist
Local Altimeter
Setting 29.92"
```

NAV



```
ETE ---     --:--
--Nav Flagged--
BRG ---     -- NM◆
```

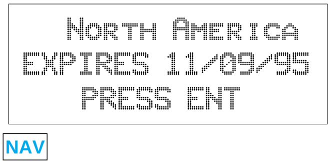
NAV

Power-Up Sequence (continued)

At the end of the power up sequence, you need to decide if you want to clear the last flight plan from memory. Turn the **Small**, inner knob to display “YES” or “NO.” Then, press **ENT**.


CLEAR ACTIVE
FLIGHT PLAN
YES?

At this point, the power-up sequence is complete.


North America
EXPIRES 11/09/95
PRESS ENT

If your unit is installed for IFR GPS approach navigation, a sequence of IFR output tests will be run to verify CDI andVDI annunciators as well as a display test.


STARTING IFR
OUTPUT TESTS

EMG (Emergency) Mode

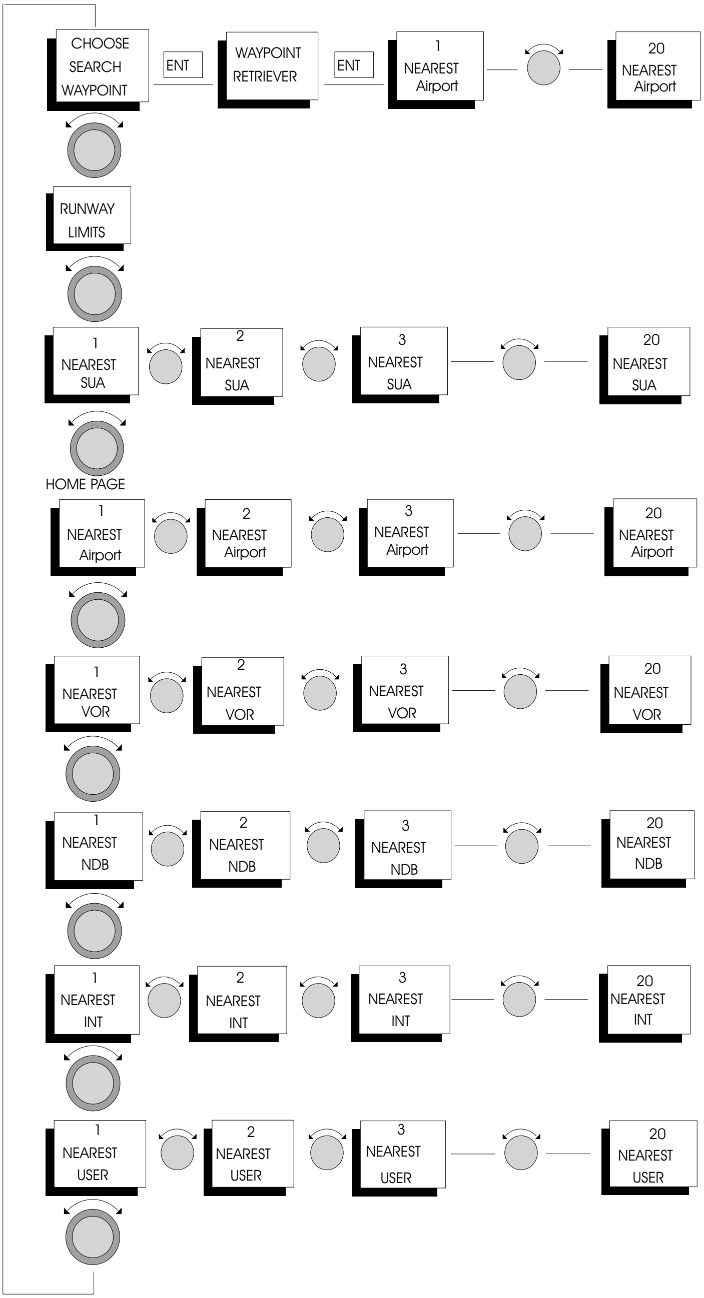
Emergency mode helps you locate nearby waypoints quickly. In addition to being useful in an emergency, this mode provides a quick method of locating nearby waypoints in case of a diversion by ATC. The databases included in the search are Airport, VOR, NDB, INT (Intersection), and User. Emergency Search finds the 20 nearest waypoints in each database. The feature also locates the 20 nearest SUAs (Special Use Airspaces).

The Search Around a Waypoint feature is included in EMG mode, and is very useful in flight planning. It displays the nearest waypoints and SUAs relative to any waypoint in any database.

Runway limits can be used to display only those waypoints with adequate landing facilities. Surface parameters can be Hard, Hard/Soft, or Hard/Soft/Water. Runway length can range from 0 to 9900 feet in 100 foot increments. Lighting can be set to “YES”, or “NO”.

EMG (Emergency) Mode Organization

The figure below illustrates the organization of (EMG) Emergency mode.

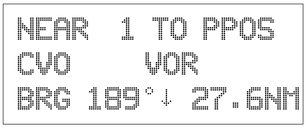


Emergency Mode Displays

The following are examples of Emergency Mode displays. The display below shows the second nearest airport to your present position (PPOS). The waypoint identifier is shown in place of the PPos if you are searching around a waypoint other than your present position. The "2" on the top line indicates this is the second closest airport. The second line shows the waypoint identifier, and the database. The bottom line shows the bearing, relative bearing, and distance. The relative bearing arrow shows the approximate direction relative to the current ground track. In the example, the second closest airport to your present position is SLE. The bearing to SLE is 75^{o}, the relative bearing is straight ahead, and the distance is 7.3 nm.

```
NEAR  2 TO PPOS
SLE    AIRPORT
BRG 075°→ 7.3NM
```

Turning the **Large** knob changes the database type. Below is an example of a display showing the closest waypoint in the VOR database.



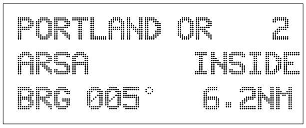
```
NEAR  1 TO PPOS
CVO     VOR
BRG 189°↓ 27.6NM
```

Emergency Mode Displays (continued)

Turning the **Small** knob clockwise displays all the nearest waypoints in the database in sequence. Below is an example of the 5th closest VOR.

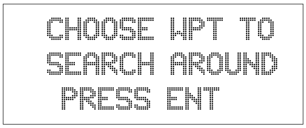
```
NEAR  5 TO PPOS
BTG    VOR
BRG 006°    61NM
```

The display below may be selected with the **Large** knob after entering EMG mode, and is used to display the nearest SUAs (Special Use Airspace areas). The top line shows the name of the SUA. The “2” indicates this is the 2nd closest SUA to your position. The middle line shows the type of SUA. “Inside” means you are inside of the SUA. The bearing and distance to the nearest edge of the airspace is shown on the bottom line. In this example, the second closest SUA to your position is the Portland Oregon ARSA, and the nearest edge of the ARSA is 005°, and 6.2 nm.



```
PORTLAND OR    2
ARSA      INSIDE
BRG 005°   6.2NM
```

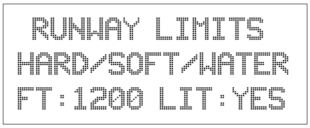
The display below may be selected with the **Large** knob after entering EMG mode, and is used to search around a waypoint. Pressing **ENT** activates the Waypoint Retriever, allowing you to specify which waypoint you want the system to search around.



```
  CHOOSE WPT TO
  SEARCH AROUND
   PRESS ENT
```

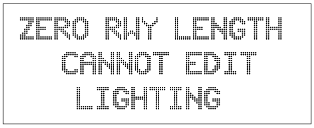
Emergency Mode Displays (continued)

The display below may be selected with the **Large** knob after entering EMG mode, and is used to set the runway search limits. The surface limit may be set for “Hard”, “Hard/Soft”, or “Hard/Soft/Water”. Lighting requirements (“LIT:”) may be set for “YES” or “NO”. The runway requirements may be changed by pressing **SEL**, using the **Large** and **Small** knobs to edit the display, and pressing **ENT**. Those waypoints that do not meet the requirements are not displayed while using the Emergency Search or Search Around a Waypoint features. All nearest waypoints are displayed during Emergency Search if runway limits are set to zero.



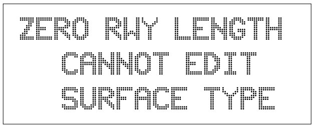
```
 RUNWAY LIMITS
HARD/SOFT/WATER
FT:1200 LIT:YES
```

If you attempt to set the lighting requirement when the runway length is set at 0, the display below appears for approximately 3 seconds.



```
ZERO RWY LENGTH
  CANNOT EDIT
   LIGHTING
```

If you attempt to set the surface type requirement when the runway length is set at 0, the display below appears for approximately 3 seconds.



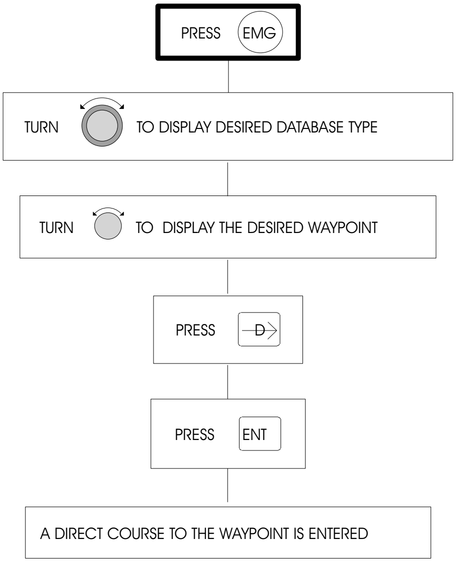
```
ZERO RWY LENGTH
  CANNOT EDIT
  SURFACE TYPE
```

EMG Mode Procedures

Emergency Search/Direct-To Navigation

The following procedure is used to display the nearest waypoints to your position, and navigate directly to any of them.

Flow Chart



Emergency Search/Direct-To Navigation (continued)

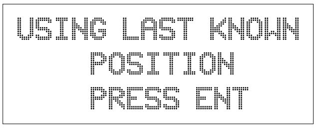
Action **Explanation**

1.

The system is in EMG mode. The nearest airport that meets your runway requirements is displayed. The NMC displays “PPos” for present position, or the waypoint identifier if you are within the arrival radius of a waypoint. (To exit EMG mode, press any other mode button.)

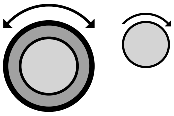
```
NEAR  1  TO PPOS
SLE     AIRPORT
BRG 342°↑  7.3NM
```

If the NMC has not calculated a valid position, the display below, “telling” you the last known position is being used, appears. If you want to continue, press **ENT**.



```
USING LAST KNOWN
    POSITION
    PRESS ENT
```

2.



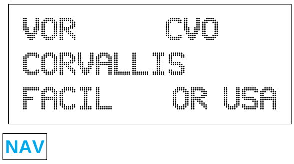
Turn the **Large** knob to display the desired database type. Turn the **Small** knob clockwise to display the remaining nearest waypoints for each database type, beginning with the closest, and ending with the most distant. Only waypoints within 600 nm are displayed.

```
NEAR  2 TO PPOS
CVO    VOR
BRG 189°← 27.6NM
```

Emergency Search/Direct-To Navigation (continued)

3. -D-

Pressing the **DIRECT-TO** button activates the Waypoint Retriever.

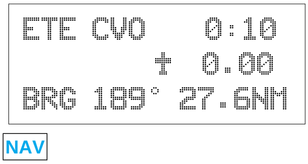


```
VOR       CVO
CORVALLIS
FACIL    OR USA
```

NAV

4. ENT

Pressing **ENT** enters a direct course to the waypoint.



```
ETE CVO    0:10
        +  0.00
BRG 189° 27.6NM
```

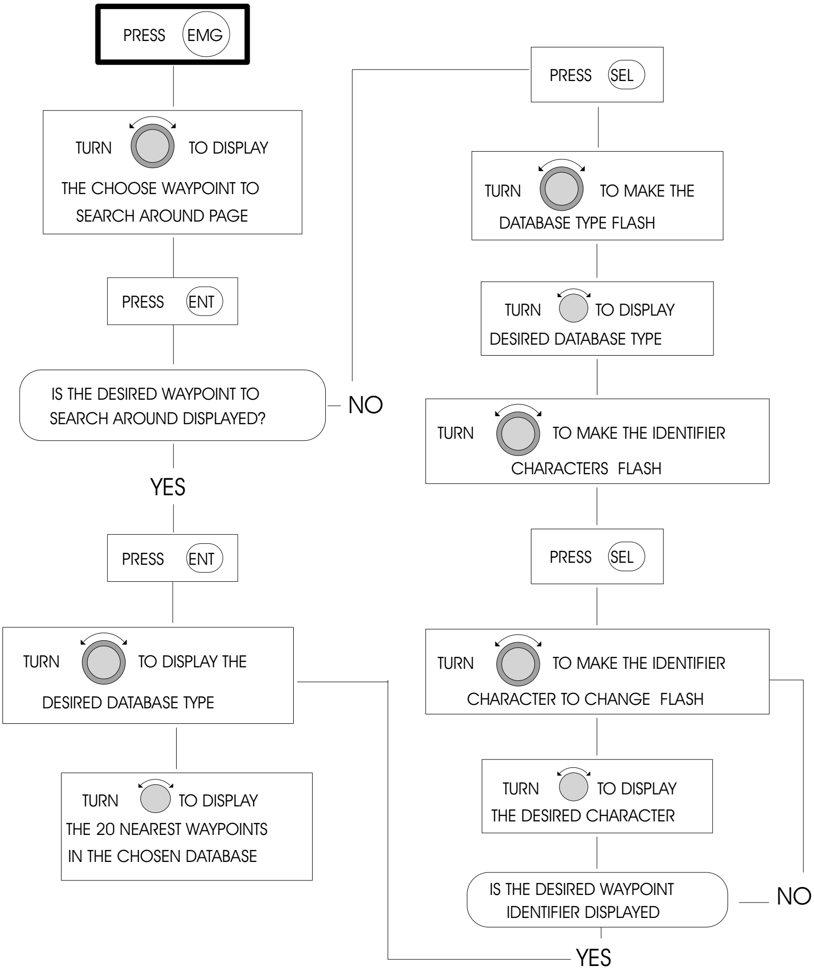
NAV

Searching Around a Waypoint

The following procedure is used to locate waypoints that are nearby a selected waypoint. **You should understand use of the Waypoint Retriever before executing this procedure.** The Waypoint Retriever is described in Operations, *Retrieving a Waypoint*.

Flow Chart

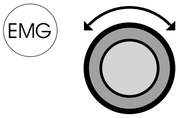
In this flow chart, waypoints are retrieved by identifier. Waypoints may also be retrieved by City/Facility name.



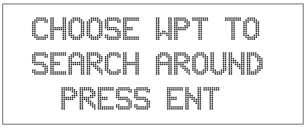
Searching Around a Waypoint (continued)

Action **Explanation**

1.



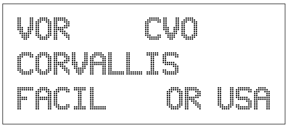
Press EMG and then turn the **Large** knob to display the “Choose Waypoint To Search Around” page.



```
CHOOSE WPT TO
SEARCH AROUND
  PRESS ENT
```

2.

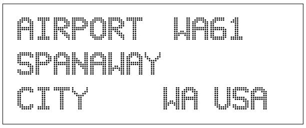
Pressing **ENT** activates the Waypoint Retriever, and the first character in the waypoint identifier flashes.



```
VOR       CVO
CORVALLIS
FACIL     OR USA
```

3. Display the desired waypoint.

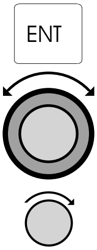
Use the Waypoint Retriever to display the desired waypoint. The Waypoint Retriever is described in Operations, *Retrieving a Waypoint.*



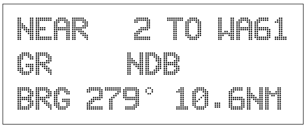
```
AIRPORT  WA61
SPANAWAY
CITY      WA USA
```

Searching Around a Waypoint (continued)

4.



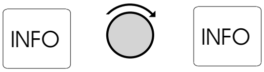
Pressing **ENT** enters the reference waypoint. The NMC displays the nearest airport to the reference waypoint. If necessary, turn the **Large** knob to change the database type. Turn the **Small** knob clockwise to scroll through the waypoints in order, from the nearest to the most distant.



```
NEAR   2 TO WA61
GR     NDB
BRG 279° 10.6NM
```

Note

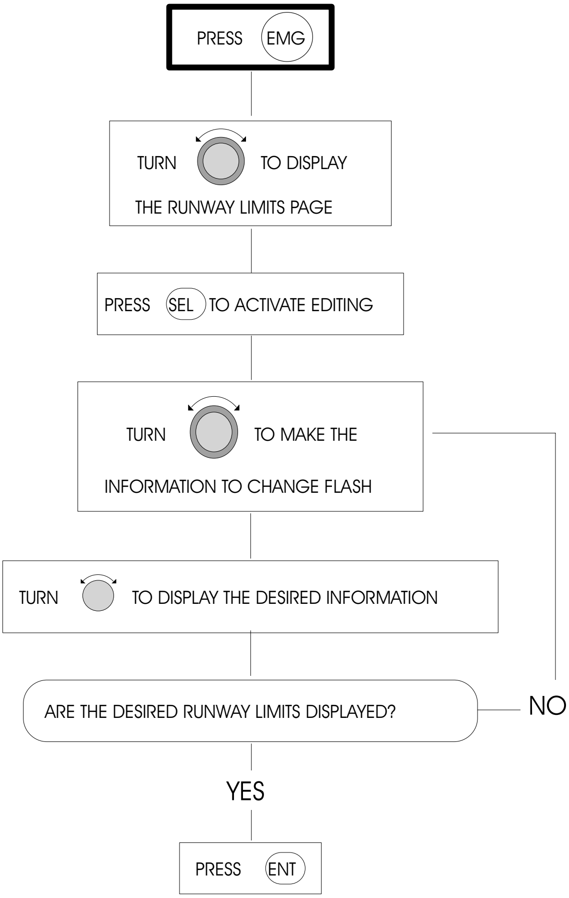
*Press **INFO** and then turn the **Small** knob to examine details about the displayed waypoint. Press **INFO** again to return to the previous screen.*



Setting Runway Limits

The following procedure is used to choose the runway length, surface and lighting you require. When using Emergency Search or Search Around a Waypoint, the NMC will display only those waypoints that meet or exceed the runway requirements you specify. If a runway length of 0 feet is chosen, you cannot set runway surface or lighting limits.

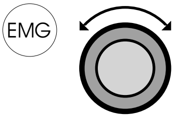
Flow Chart



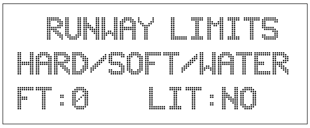
Setting Runway Limits (continued)

Action **Explanation**

1.

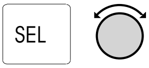


In EMG mode, turn the **Large** knob to display the Runway Limits page.

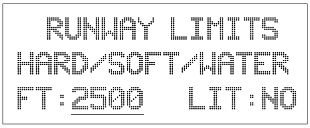


```
  RUNWAY LIMITS
HARD/SOFT/WATER
FT:0    LIT:NO
```

2.

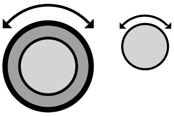


Pressing **SEL** activates editing. Turn the **Small** knob to display the desired runway length. Runway length is selected in increments of 100 feet.

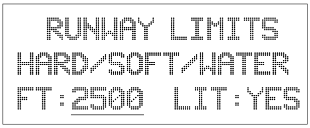


```
  RUNWAY LIMITS
HARD/SOFT/WATER
FT:2500   LIT:NO
```

3.



Turn the **Large** knob to make the surface type or lighting requirement flash. Turn the **Small** knob to choose the setting. Repeat until the desired limits are displayed.



```
  RUNWAY LIMITS
HARD/SOFT/WATER
FT:2500  LIT:YES
```

Setting Runway Limits (continued)

A runway length must be selected before you can enter surface or lighting requirements. If you attempt to edit the lighting or surface type when a runway length of 0 is selected, one of the displays appears for 2 seconds.

```
ZERO RWY LENGTH
  CANNOT EDIT
    LIGHTING
```

```
ZERO RWY LENGTH
  CANNOT EDIT
  SURFACE TYPE
```

4. ENT

Pressing **ENT** enters the displayed runway limits.

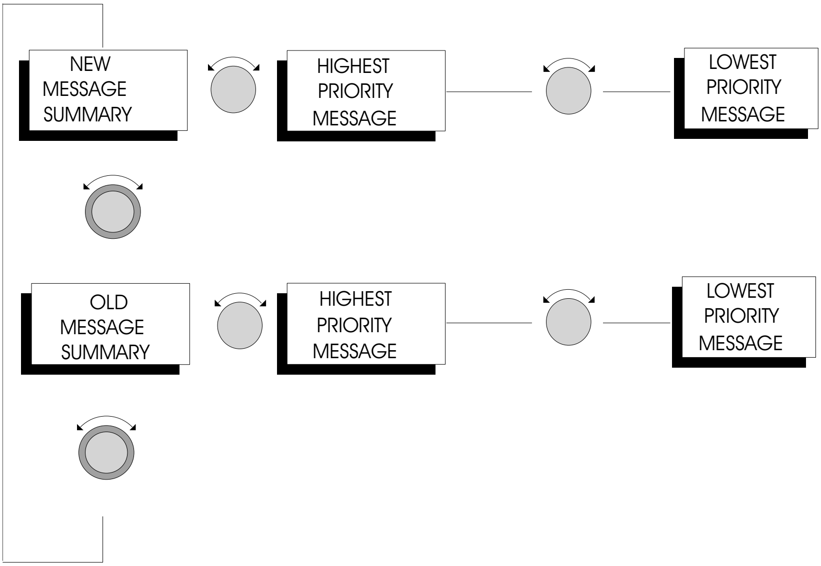
```
  RUNWAY LIMITS
    HARD/SOFT
FT:2500  LIT:YES
```

MSG (Message) Mode

The NMC (Nav Management Computer) alerts you of conditions that may require attention. When a condition prompting a new message occurs, the MSG annunciator flashes. Once the pilot views the message(s), the MSG annunciator stops flashing, but remains lit as long as the message condition exists. If more message conditions occur, the MSG light will begin to flash again.

Messages are displayed in prioritized order, the most important to the least important.

The figure below illustrates the organization of Message Mode.



Message Displays

Messages are displayed in a prioritized order. Messages requiring immediate attention are displayed first. Below is a description of possible messages in prioritized order. Examples of typical messages are shown on the following pages. More information on Special Use Airspace messages can be viewed by pressing the **INFO** button.

NOTE

Altitude Assist and Arc Assist messages will not be displayed if the Altitude Assist and Arc Assist functions are disabled during system setup.

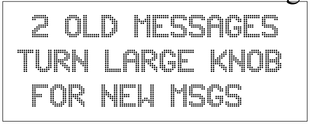
New Message Summary

The display below summarizes the number of new messages. It shows the number of new messages to be viewed. In the example, there are 4 new messages to view. If there are no new messages, the display states there are no new messages.

```
 4 NEW MESSAGES
TURN LARGE KNOB
 FOR OLD MSGS
```

Old Message Summary

The display below shows the number of old messages (messages that have already been viewed). If there are no old messages, then the display states there are no old messages.



```
 2 OLD MESSAGES
TURN LARGE KNOB
 FOR NEW MSGS
```

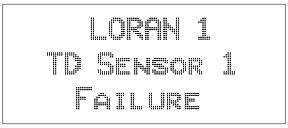
Viewing Messages

The following procedure is used to view messages. New messages are those not yet viewed; old messages have already been viewed.

Action **Explanation**

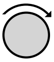
1.

Pressing **MSG** puts the NMC in message mode, and displays the highest priority new message.

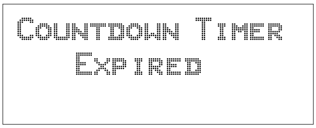


LORAN 1
TD Sensor 1
Failure

2.

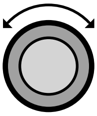


Turn the **Small** knob to view the remaining new messages. Once viewed, new messages become old messages, and the MSG light stops flashing, but remains lighted while there are old messages.



Countdown Timer
Expired

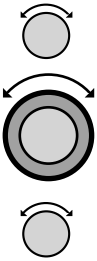
3.



To view old messages, turn the **Large** knob to display the Old Message Summary page.

2 Old Messages
Turn Large Knob
For New Msgs ◆

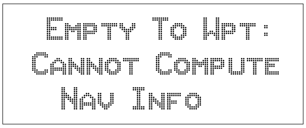
4.



Turn the **Small** knob to scroll through the old messages. If new message conditions occur while in MSG mode, the MSG annunciator begins flashing again. Turn the **Large** knob to display the New Messages page. Turn the **Small** knob to display the new messages.

Empty To Waypoint Message

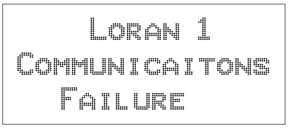
The display below shows there is no *"To"* waypoint in the Active flight plan. Since the Active flight plan does not contain any waypoints when the NMC is new, this message will be displayed before the first *"To"* waypoint is entered.



```
 Empty To Wpt:
Cannot Compute
  Nav Info
```

Position Sensor Communications Failure Message

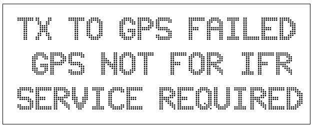
When a position sensor stops communicating (after it has established communications) this message is generated. It becomes an old message after viewing.



```
    Loran 1
Communicaitons
   Failure
```

GPS Sensor Command Failure

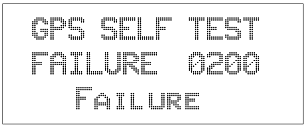
When the NMC is receiving data from the GPS sensor, but is not receiving responses to commands sent to the GPS sensor, this message is generated. This problem indicates that the GPS is not receiving NMC transmissions and cannot be used for IFR flight. You should switch to Loran, if available, for IFR flight. It becomes an old message after viewing and remains an old message even if the condition does not persist. Service is required.



```
TX TO GPS FAILED
 GPS NOT FOR IFR
SERVICE REQUIRED
```

GPS Self-Test Failure

If the GPS has a self-test failure, a message will be displayed indicating the cause of the failure in four hexadecimal digits. Contact the II Morrow service department if this message is displayed. It becomes an old message after viewing. Use another position sensor until service can be performed.



```
GPS SELF TEST
FAILURE  0200
   Failure
```

In Use Position Sensor Lat/Lon Failure Message

When the In Use position sensor cannot compute the Latitude and Longitude, a message is generated for either the Loran or GPS sensor.

```
  GPS POSITION
 SENSOR CANNOT
COMPUTE LAT/LON
```

GPS RAIM Detection Not Available

When RAIM detection is not available for the in-use GPS sensor, a warning is generated. The top line indicates the current flight phase (either Approach, Terminal, or En Route) which directly affects RAIM detection requirements. It becomes an old message after viewing.

```
    ENROUTE
   GPS RAIM
 NOT AVAILABLE
```

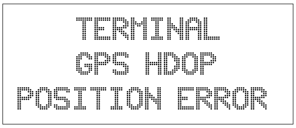
GPS RAIM Alarm Position Error

When RAIM detection is available for the in-use GPS sensor and it detects a RAIM alarm, a warning is generated and NAV data will be flagged as invalid. The top line indicates the current flight phase (either Approach, Terminal, or En Route), which directly affects RAIM alarm requirements. It becomes an old message after viewing. If the “Abort Approach” message is given, you must abort the approach by pressing the OBS/HOLD button and exercise the missed approach procedure.

```
ABORT APPROACH
GPS RAIM ALARM
POSITION ERROR
```

GPS HDOP Accuracy Error

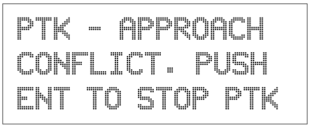
When the HDOP for the in-use GPS sensor exceeds current flight phase HDOP requirements, a warning is generated and NAV data is flagged as invalid. The top line indicates the current flight phase (either Approach, Terminal, or En Route) which directly affects HDOP requirements. It becomes an old message after viewing. If the “Abort Approach” message is given, you must abort the approach by pressing the **OBS/HOLD** button and exercise the missed approach procedure.



TERMINAL
GPS HDOP
POSITION ERROR

Parallel Track - Approach Conflict

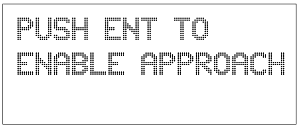
Before an “Enable Approach” alert can occur, parallel track must be “Off.” the following message provides the warning and a fast means to stop parallel track by pressing **ENT**, as indicated. This does not become an old message after viewing.



PTK - APPROACH
CONFLICT. PUSH
ENT TO STOP PTK

Enable Approach

If an approach is loaded in the active plan but not enabled, then at 30 nm to the destination airport and again at 3 nm to the FAF waypoint, the Enable Approach alert will occur. Parallel Track will be disabled when approach operation is enabled. Pressing **ENT** will: enable approach (approach transition operation), turn the APPRCH indicator solid, lock on the GPS sensor, and display a barometric alert.

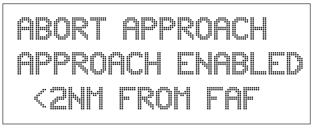


PUSH ENT TO
ENABLE APPROACH

If Loran position inputs are available, the bottom line of the message will also display “and Lock on GPS,” indicating that automatic sensor selection will be disabled when approach in enabled.

Approach Enabled Too Late

When the approach is enabled less than 2 nm inbound to the FAF or after crossing the FAF (inbound to MAP), the Approach Enabled Late alert will occur. This does not become an old message after viewing. You must abort the approach by pressing the OBS/HOLD button and exercise the missed approach procedure.



```
ABORT APPROACH
APPROACH ENABLED
 <2NM FROM FAF
```

Set Barometer

The Set Barometer alert prompts the user to change the altimeter setting after the approach has been enabled. One of three conditions may exist: altitude inputs to the NMC are not baro-corrected; altitude inputs are baro-corrected; altitude inputs are not available.

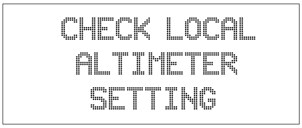
Altitude Inputs without Baro-Correction

If altitude inputs are not already baro-corrected, the following message prompts the user to enter the local altimeter setting. The **Small** knob is used to modify the highlighted field. The user must press **ENT** to continue normal NMC operation. The default value first displayed is the last entered altimeter reading.

```
      ENTER
LOCAL ALTIMETER
 SETTING 29.94”
```

Altitude Inputs with Baro-Correction

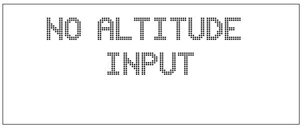
If the altitude inputs are already baro-corrected, the following screen reminds the user to update the remote device altimeter setting.



```
CHECK LOCAL
 ALTIMETER
  SETTING
```

No Altitude Inputs

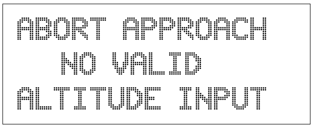
If the NMC is not receiving altitude inputs, the following screen is displayed. You must abort the approach by pressing the OBS/HOLD button and exercise the missed approach procedure.



```
NO ALTITUDE
   INPUT
```

No Valid Altitude Input for Approach

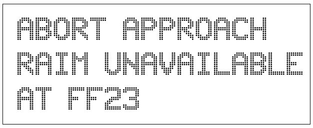
When approach is enabled and you are within 3 nm of the FAF or approach is active, the NMC checks for valid altitude input. If the altitude input is not valid or available, the following warning is given. It becomes an old message after viewing.



```
ABORT APPROACH
   NO VALID
ALTITUDE INPUT
```

Approach RAIM Unavailable

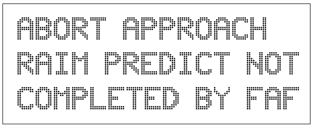
At 2 nm to the FAF, when approach is enabled and when not holding at the FAF, the NMC checks for predicted approach mode RAIM availability at the FAF and at the MAP waypoints. If RAIM will not be available, the following warning is given.



```
ABORT APPROACH
RAIM UNAVAILABLE
AT FF23
```

RAIM Predict Too Late

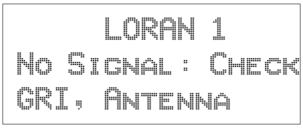
When approach is enabled and you are less than 3 nm from the FAF, the NMC requests a RAIM prediction for the FAF and the MAP. If those predictions are not completed by the FAF, then the following warning is given. This does not become an old message after viewing. You must abort the approach by pressing the OBS/HOLD button and exercise the missed approach procedure.



```
ABORT APPROACH
RAIM PREDICT NOT
COMPLETED BY FAF
```

MCLS Position Sensor Signal Failure

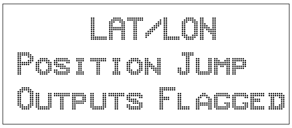
When the in-use MCLS (Multi Chain Loran Sensor) transmits to the NMC that it is unable to receive signals for the current GRI this message is generated. In the example, MCLS 1 is not receiving signals.



```
     LORAN 1
No Signal: Check
GRI, Antenna
```

Lat/Lon Position Jump Message

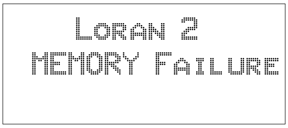
When the In-Use MCLS transmits a Position Jump message to the NMC, or when automatic sensor switching causes a position jump of greater than 0.5 nm, this message is generated for 20 seconds. It becomes an old message after viewing.



```
     LAT/LON
Position Jump
Outputs Flagged
```

MCLS Non-Volatile RAM (Random Access Memory) Failure Message

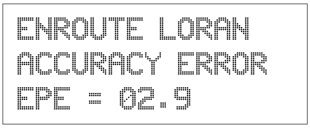
When the In-Use MCLS transmits a non-volatile RAM memory loss message, this message is generated. It becomes an old message after viewing. The top line may be either Loran 1 or Loran 2.



```
    Loran 2
 MEMORY Failure
```

En Route Loran EPE Warning

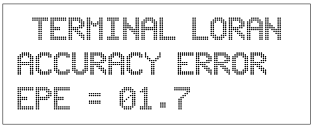
During en route mode, when the estimated position error (EPE) for the in-use Loran position sensor is greater than or equal to 2.8 nm, this message is generated. It becomes an old message after viewing. If the EPE cannot be calculated, this message is still generated, and the EPE value is dashed.



```
ENROUTE LORAN
ACCURACY ERROR
EPE = 02.9
```

Terminal Loran EPE Warning

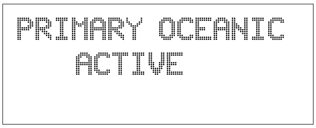
During terminal mode (within 30 nm of departure or destination airport), when the estimated position error (EPE) for the in-use Loran position sensor is greater than or equal to 1.7 nm this message is generated. It becomes an old message after viewing. If the EPE cannot be calculated, this message is still generated, and the EPE value is dashed.



```
 TERMINAL LORAN
ACCURACY ERROR
EPE = 01.7
```

Activating Oceanic Flight Phase

With Primary Oceanic manually armed, the Oceanic flight phase will go active when the aircraft reaches the selected Oceanic Activation Altitude and is outside of terminal airspace.The display shown below will become a new message when the Oceanic flight phase activates and will not become an old message after being read.

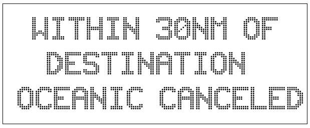


```
PRIMARY OCEANIC
    ACTIVE
```

Canceling Oceanic Flight Phase

The NMC will automatically deactivate the Oceanic/Remote flight phase when the aircraft enters terminal airspace. The Oceanic/Remote function will still be armed.

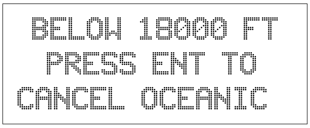
The message below will display when entering terminal airspace. It will not become an old message after being read.



```
 WITHIN 30NM OF
  DESTINATION
OCEANIC CANCELED
```

The message below will display when the aircraft's altitude drops below the Oceanic Activation Altitude. Pressing ENT will cause the NMC to change the flight phase to enroute. Pressing any other button will cause the NMC to continue the Oceanic flight phase. You may then cancel the Oceanic/Remote function as described starting on page 154, or you may:

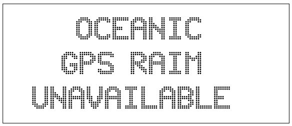
1. Press the **MSG** key.
2. Rotate the **Large** knob to display the "Old Message" page.
3. Rotate the **Small** knob to display the screen below.
4. Press **ENT**.



```
 BELOW 18000 FT
  PRESS ENT TO
CANCEL OCEANIC
```

Loss of RAIM Detection Function

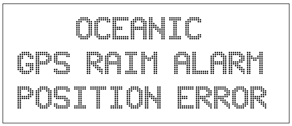
The following status message will be generated if the RAIM status becomes “Unavailable” (meaning there are not enough satellited to perform RAIM calculations) during Oceanic flight phase. This should be a temporary condition. The NMC will continue to provide navigation information while RAIM is unavailable. This message becomes an “Old” message after being acknowledged, and remains until GPS RAIM become available.



OCEANIC
GPS RAIM
UNAVAILABLE

Oceanic RAIM Alarm

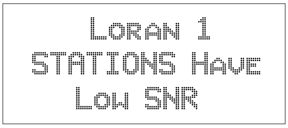
The following message will be generated when a persistent RAIM alarm occurs during the active Oceanic flight phase due to the NMC being unable to exclude an unhealthy satellite or verify that it has excluded the faulty satellite. This message becomes an “Old” message after being acknowledged, and remains until the RAIM alarm condition ends. NAV will be flagged, but the NMC will continue to provide cross-track information.



OCEANIC
GPS RAIM ALARM
POSITION ERROR

MCLS Station Warnings

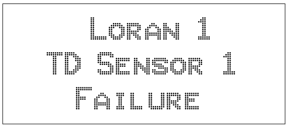
The display below shows the Loran signals are unusable. In this example MCLS 1 has a low SNR (Signal-to-Noise Ratio). The bottom line will display “Signal Blink” or “Cycle Error” instead if either of those conditions occur. It becomes an old message after viewing.



Loran 1
STATIONS Have
Low SNR

MCLS TD Sensor Failure Warning

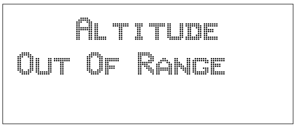
The display below shows a TD sensor for an MCLS has failed. In the example below, the MCLS 1 TD sensor has failed. This message clears only after the Loran sensor is repaired. It becomes an old message after viewing.



Loran 1
TD Sensor 1
Failure

Altitude Out Of Range Warning

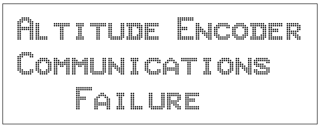
The display below shows that the current altitude is out of range for the in-use altitude sensor. Legal altitude ranges are between -1,500 and 50,000 feet. Check the pressure setting in NAV mode for a possible quick-fix.



Altitude
Out Of Range

Altitude Encoder Communications Failure Warning

A five second transmission delay from the altitude encoder will cause a message to be generated if the altitude encoder is being used for the current altitude. It does not become an old message after viewing.



Altitude Encoder
Communications
Failure

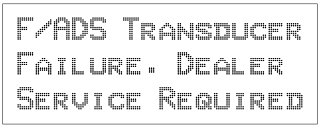
F/ADS Communications Failure Warning

A five second transmission delay from the Fuel/Air Data Sensor causes a communication failure message to be generated. It does not become an old message after viewing.

Fuel/Air Data
Communications
Failure

F/ADS Transducer Failure Warning

The display below shows that the Fuel/Air Data Sensor (F/ADS) has a transducer failure problem, and requires dealer service. This message may not be generated if there is an F/ADS communication failure. All Fuel/Air Data Sensor fields are dashed when this message is on.



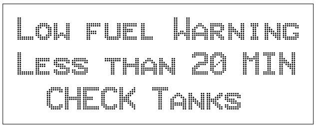
F/ADS Transducer
Failure. Dealer
Service Required

NOTE

II Morrow has been informed by the Model 2030 manufacturer (Shadin) that Model 2030 firmware versions xx.xx.62 and earlier do not support the above message. See Page 169 for a method to view the firmware version. Many transducer failures will be indicated by dashed data fields. Contact Shadin for details.

Low Fuel Warning

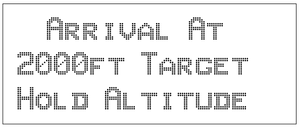
This message is set when the estimated time before fuel runs out is less than a pre-set number of minutes. The number of minutes remaining when the fuel warning is shown may be edited in System Mode. The example below starts the warning when 20 minutes of fuel remains. *The reserve tank fuel is not taken into account for this message.*



```
Low fuel Warning
Less than 20 MIN
  CHECK Tanks
```

Arrival at Hold Buffer Altitude Message

The display below shows arrival at the Target Hold Buffer Altitude. In the example below, the Target Hold Altitude is 2,000 feet. The Target Hold Altitude is the altitude you want to descend/ascend to, and is adjusted in NAV mode. The Target Hold Buffer is the distance above/below the Target Hold Altitude at which you want this message to activate. The Target Hold Buffer Altitude is also adjusted in NAV mode.



```
  Arrival At
2000ft Target
Hold Altitude
```

Outside of Hold Buffer Message

The display below shows you are above/below the Hold Altitude. This message only appears if you have already ascended/descended into the Target Hold Buffer, and have climbed/descended back out of the buffer. In the example below, the aircraft is 400 ft below the Hold Altitude.

```
Altitude Alert
   400' Below
Hold Altitude
```

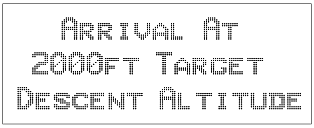
Start Auto Descent Message

The display below shows you should begin your Auto Descent. This message will be generated 20 seconds prior to auto descent. The descent rate and airspeed are set in NAV mode. In the example below, you should begin your descent to SLE at 1,500 ft/min and 250 knots. This message is cleared after viewing; it does not become an old message after viewing.

Begin Descent
To SLE
1500'/min 250kts

Arrival at Auto Descent Target Altitude Message

This message is generated when the aircraft is within 100 feet of the Auto Descent Target Altitude when the feature is turned on. The target altitude is adjusted in NAV mode. In the example below, the Auto Descent Altitude is 2,000 feet. This message is immediately reset after viewing; it does not become an old message after viewing.



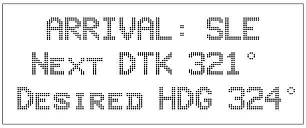
Arrival At
2000ft Target
Descent Altitude

Arrival at Waypoint Messages

The arrival message is generated when you are within 36 seconds of arrival at the current TO waypoint. It is cleared after viewing. The arrival condition will also go away without viewing the message after crossing the angle bisector.

Not Holding At The TO Waypoint

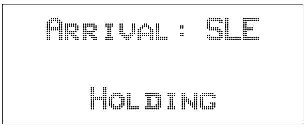
This form of the Arrival Alert is provided when not holding at the current TO waypoint. In addition to the arrival waypoint identifier, the next leg's desired track is shown, when available; otherwise it is dashed. If wind factors (from the Fuel/Air Data Sensor) and a Next waypoint are available, the desired heading is also shown on line three, otherwise line three is blank.



ARRIVAL: SLE
Next DTK 321°
Desired HDG 324°

Holding At The TO Waypoint

This form of the Arrival Alert is provided when holding at the current TO waypoint.

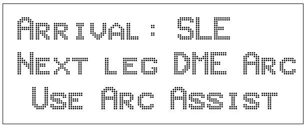


Arrival: SLE

Holding

Next Leg Is DME Arc

This form of the Arrival Alert is provided when the next TO waypoint is the end of a DME arc. Use the DME Arc Assist page in NAV mode. Next Desired Track and Desired Heading are not provided with this alert.



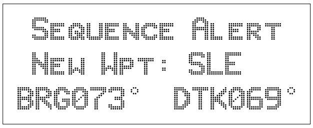
Arrival: SLE
Next leg DME Arc
Use Arc Assist

TO Waypoint Sequence

When a waypoint sequence occurs and you have not viewed the arrival alert, one of the following alerts are provided.

Normal Sequence

The alert is only provided if traveling faster than 5 knots. This reduces the chance of nuisance alerts after power-up. The new waypoint identifier, bearing, and desired track are provided.



Sequence Alert
New Wpt: SLE
BRG073° DTK069°

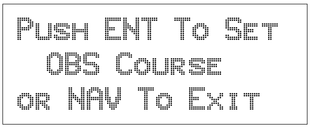
DME Arc Sequence

This form of the Sequence Alert is provided when the next TO waypoint is the end of a DME arc in a nonprecision approach.

Sequence Alert
Next Leg DME Arc
Use Arc Assist

Auto OBS Crossing Holding Waypoint

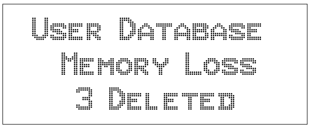
When a waypoint on hold is crossed to the FROM side the first time, the NMC will generate the following message. Note: This message is not generated when crossing the MAP. If you press ENT, the OBS Desired Track screen is displayed. If you press NAV, the NAV page is displayed. This message does not become an old message after viewing.



Push ENT To Set
OBS Course
or NAV To Exit

User Database Memory Corrupted Message

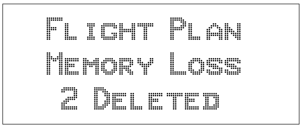
The display below shows the memory storing one or more User waypoints or comments is corrupted, and memory was deleted. The NMC tests all User waypoints each time the unit is turned on. In the example below, 3 User waypoints or comments were deleted. This message clears after it is viewed.



User Database
Memory Loss
3 Deleted

Flight Plan Memory Corrupted Message

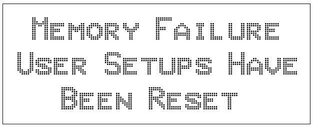
The display below shows the memory storing one or more flight plans is corrupted, and the affected flight plans were deleted. The NMC tests all flight plans each time the unit is turned on. In the example below, 2 flight plans were deleted. This message clears after it is viewed.



Flight Plan
Memory Loss
2 Deleted

User Setups Memory Corrupted Message

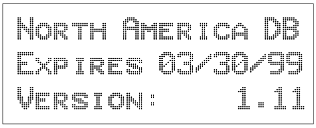
The display below shows the memory storing user configuration settings such as SUA Buffers or the Flight Timer Trigger Speed is corrupted, and settings have been restored to default (factory) values. This message clears after it is viewed.



Memory Failure
User Setups Have
Been Reset

Data card Expired Message

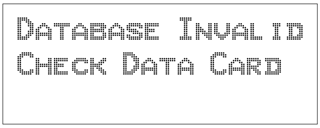
The display below shows the data card expiration date has passed. This message may be set any time a data card is inserted and when the NMC is powered up. The message is cleared after viewing.



```
North America DB
Expires 03/30/99
Version:     1.11
```

Data card Invalid Message

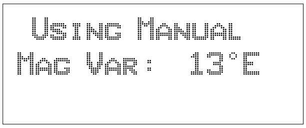
The display below shows the data card is invalid, corrupted, or not properly inserted. This last check is done only once at power-up. It becomes an old message after being viewed.



```
Database Invalid
Check Data Card
```

Using Manual Magnetic Variation Message

The display below shows manual magnetic variation is in use. If a valid data card is not properly inserted, the magnetic variation must be entered manually during the power-up sequence. Manual magnetic variation may also be entered in System mode. It becomes an old message after being viewed.



```
 Using Manual
Mag Var:  13°E
```

Battery Voltage

The NMC checks the battery voltages every 15 seconds.

Low Battery Voltage - NMC

The low battery voltage message is generated when the NMC detects a low battery voltage. User memory for waypoints, flight plans, and configurations is at risk and may be lost. The unit must be serviced within about a month after the first time this warning is seen. It becomes an old message after being viewed.

Low Battery
Voltage: NMC
Needs Service

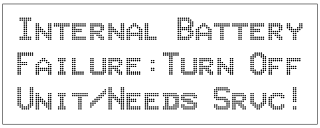
Low Battery Voltage - Keypad

The low battery voltage message is generated when the NMC detects a low battery voltage in the keypad. The unit must be serviced within about a month after the first time this warning is seen. It becomes an old message after being viewed.

Low Battery
Voltage:Keypad
Needs Service

High Battery Voltage

The high battery voltage message is generated when the NMC detects a high battery voltage. The unit must be returned for service. Continued operation is not recommended. It becomes an old message after being viewed.



Internal Battery
Failure:Turn Off
Unit/Needs Srvc!

Countdown Timer Expired Message

The display below shows the active countdown timer has expired. The countdown timer is set in NAV mode. The message is cleared when the user views the message (it does not become an old message) or reactivates the Countdown Timer.

Countdown Timer
Expired

Flight Plan Transmit Failure

This message is generated when an attempted serial Flight Plan transmission fails to be acknowledged affirmatively by the receiving NMC in under two seconds. It does not become an old message after being viewed.

FLIGHT PLAN
TRANSFER TO NMC
FAILED

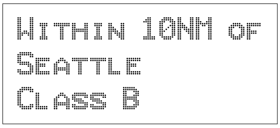
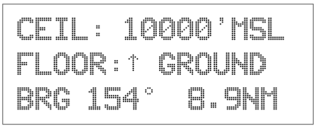
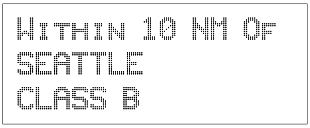
RAM Data card Is Full

This message is generated when an installed RAM data card cannot be written to because the RAM data region is full. It does not become an old message after being viewed. Note: This message is only available for the 2101 NMC with a RAM data card installed.

RAM DATACARD IS
FULL: FLIGHTDATA
STORAGE COMPLETE

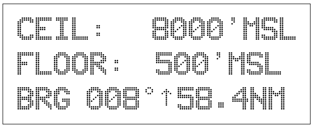
Displaying SUA (Special Use Airspace) Information

The following procedure is used to display information on a SUA after a SUA message has been generated.

Action	Explanation
1. Display the SUA message.	In MSG mode, display the message alerting you to an SUA.  WITHIN 10NM OF SEATTLE CLASS B
2. INFO	Press **INFO** to display information of the SUA. The top line of the display shows the ceiling. The middle line shows the floor, and the bottom line shows the bearing, approximate relative bearing, and the distance to the nearest edge of the SUA. In this example, the ceiling is 10,000 ft, the floor is the surface (ground), the bearing is 154°, the SUA is straight ahead, and the distance is 8.9 nm.  CEIL: 10000'MSL FLOOR:↑ GROUND BRG 154° 8.9NM
3. INFO	Press **INFO** again to exit the Information function.  WITHIN 10 NM OF SEATTLE CLASS B

SUA (Special Use Airspace) Nearest Airspace Info

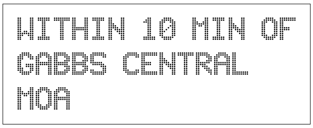
The values for ceiling and floor may be any number of positive feet less than 100,000. Values may also be Unlimited, Ground, Flight Level (FL) followed by a number such as 050, Unknown, or NOTAM (NOtice To Air Men).



```
CEIL:   8000'MSL
FLOOR:  500'MSL
BRG 008°↑58.4NM
```

SUA Soon Message

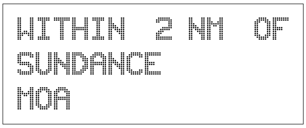
The display below shows you are within 10 minutes of penetrating an SUA (Special Use Airspace), in this example the GABBS CENTRAL MOA. The number of minutes before entering an SUA you want to be alerted may be edited in SYS mode.



```
WITHIN 10 MIN OF
GABBS CENTRAL
MOA
```

SUA Close Message

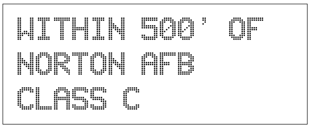
The display below shows you are within 2 nm of an SUA, in this example the SUNDANCE MOA. The number of miles from an SUA you want to be alerted may be edited in SYS mode.



```
WITHIN  2 NM  OF
SUNDANCE
MOA
```

SUA Close Altitude Message

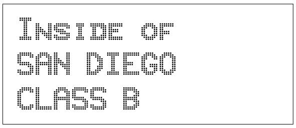
The display below shows you are within 500 ft (either above or below) of an SUA, in this example the NORTON AFB Class C airspace. The number of feet above or below an SUA you want to be alerted may be edited in SYS mode.



```
WITHIN 500' OF
NORTON AFB
CLASS C
```

Inside SUA Message

The display below shows you are inside an SUA, in this example the SAN DIEGO Class B airspace.



INSIDE OF
SAN DIEGO
CLASS B

NAV (Navigation) Mode

NAV mode displays Bearing, Track, Distance, Position, and other navigation information. Up to twelve pages (nine pages without the Fuel/Air Data Sensor) of navigation information may be displayed by turning the **Large** knob, or automatically in sequence (Auto Nav Scroll).

NAV mode also allows you to change, modify, and interrupt the Active flight plan. Waypoints can be inserted, modified, and deleted from the Active flight plan without exiting NAV mode by using the From/To/Next page.

Altitude Assist features included in NAV mode allow the NMC to monitor your altitude while en route, and guide you in descent or ascent. The system must include an altitude encoder or a F/ADS (Fuel /Air Data Sensor) to function.

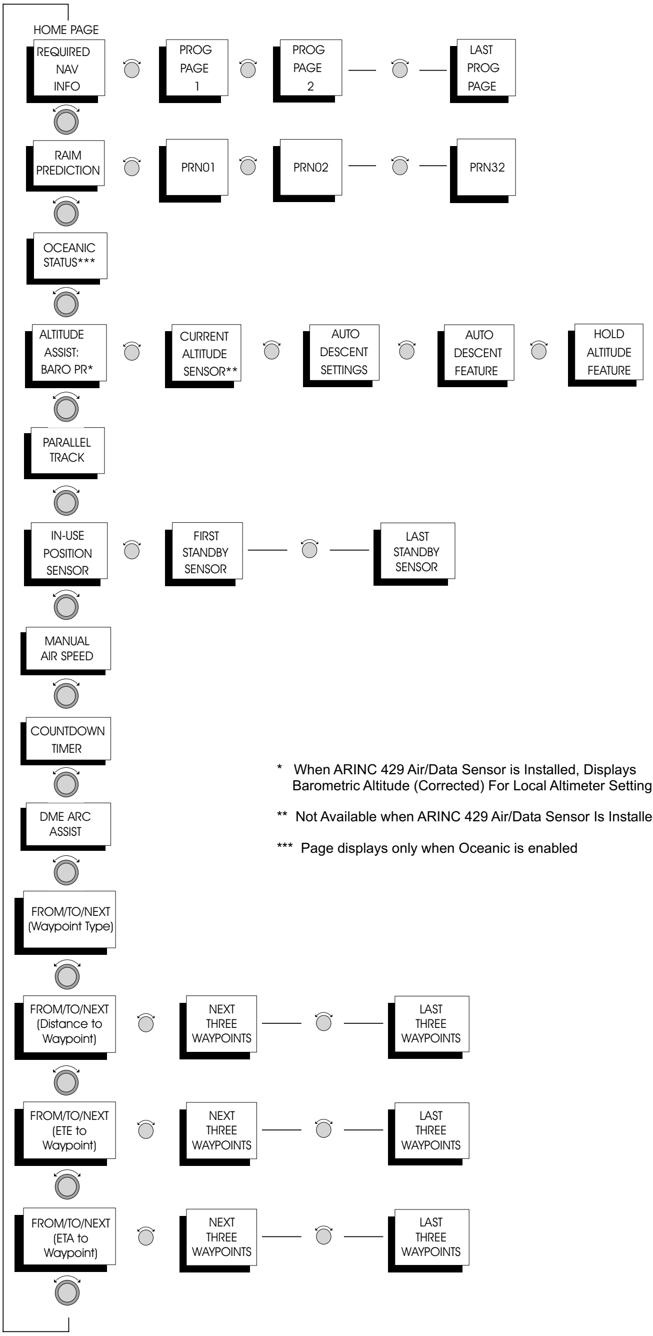
NAV mode also allows you to avoid obstacles or weather by entering a parallel course.

Position sensor selection in NAV mode allows you to select from your available GPS and Loran sensors, while displaying your present position.

A countdown timer is also available and may be set to alert you when it times out.

NAV Mode (continued)

The figure below illustrates the organization of NAV mode.



* When ARINC 429 Air/Data Sensor is Installed, Displays Barometric Altitude (Corrected) For Local Altimeter Setting

** Not Available when ARINC 429 Air/Data Sensor Is Installed

*** Page displays only when Oceanic is enabled

NAV Displays

Top-Level Nav Displays

In NAV mode, turning the **Large** knob displays the pages depicted below, called “Top-Level” displays. In all modes, the **Large** knob is turned to scroll through Top-Level displays.

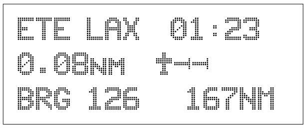
The Required Navigation Information Display is depicted below.

In this example, the top line shows the *TO* waypoint (i.e. the waypoint you are flying to) is LAX (Los Angeles International Airport), and the Estimated Time En route (ETE) is 1 hour, 23 minutes. The ETE values will be displayed in minutes and seconds when the Time To Wpt is less than one hour.

The CDI (Course Deviation Indicator), displayed on the middle line, shows the desired course is in this case 0.08 nm to the right of the aircraft. The single dot bar indicates that CDI sensitivity is set to 0.3 nm full scale per side. The bar always extends towards the desired course (steer in the direction of the bar). The manual sensitivity of the CDI may be set to 0.3, 1.0, or 5.0 nm full scale per side. The table appearing at the top of the next page describes the sensitivity choices for the CDI bar. The airplane symbol is used as a To-From indicator; when the plane symbol is shown below, you are flying in the To condition; when the plane symbol is upside-down, you are flying in the From condition (away from the destination).

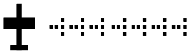
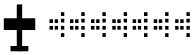
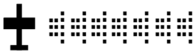
The bottom line shows the bearing to LAX is 126°, and the distance 167 nm. The diamond in the lower right corner indicates there are sub-pages that may be viewed by turning the **Small** knob. These sub-pages are described later in this section.

Required NAV Information Display



```
ETE LAX  01:23
0.08NM  ✈
BRG 126   167NM
```

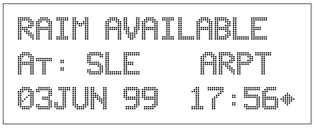
Top-Level Nav Displays (continued)

CDI Sensitivity = 0.3 nm	CDI Sensitivity = 1.0 nm	CDI Sensitivity = 5.0 nm
each ▪ = 0.01 nm	each ⁞ = 0.05 nm	each ⁞ = 0.24 nm
each ⁘ = 0.04 nm	each ⁘ = 0.14 nm	each ⁘ = 0.71 nm
 (full scale) = 0.3 nm	 (full scale) = 1.0 nm	 (full scale) = 5.00 nm

Turning the **Large** knob one increment clockwise after entering NAV mode displays the screen depicted below. Altitude Assist is only available if the system includes a F/ADS or an altitude encoder. The Altitude Assist Altimeter Setting display is used to enter the current local altimeter setting (sea-level barometric pressure). In this example, the setting is 29.92". For procedural information on entering the current altimeter setting, see Operations, *Setting the Altimeter Altitude.*

RAIM Prediction

Look-ahead RAIM is automatically predicted for the destination waypoint and ETA. If the ETA changes by more than 10 minutes, the NMC automatically re-performs the RAIM prediction. The user can perform a RAIM prediction for any waypoint in the data base for any date and time from 1980 to 2079. Manual RAIM prediction provides a RAIM availability indication using approach operation RAIM alarm requirements (0.3 nm alarm limit) within 15 minutes of the provided date and time. Any predicted RAIM availability failure within the ±15 minute range is considered a RAIM availability failure.



```
RAIM AVAILABLE
AT: SLE    ARPT
03JUN 99  17:56◆
```

The top line displays the current RAIM availability status. At power-up it will display “RAIM Unknown.” When manual RAIM prediction is being done by the GPS sensor, the display will read “Predicting

RAIM.” Once RAIM prediction is accomplished the top line will display either “RAIM Available” or “RAIM Unavailable.” If manual RAIM prediction is temporarily locked out due to the automatic RAIM prediction required for approach operation, the top line will read “NMC RAIM Busy...” If GPS sensor inputs are not available, the top line will read “RAIM Off: No GPS.”

Editing Manual RAIM Prediction Fields

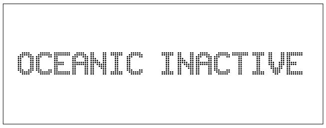
Press **SEL** to begin RAIM prediction editing. Rotate the Large knob to highlight choices on the second line and then press **ENT** to select a waypoint from the database using the **Large** and **Small** knobs.

Primary Oceanic Status Page

When Primary Oceanic is enabled, status will be displayed on the Oceanic status pages. To display the Oceanic status pages

1. Press the **NAV** button

2. Rotate the **Large** knob to display the oceanic status page. The page will display one of the following screens depending on the current NMC oceanic/remote state.



OCEANIC INACTIVE

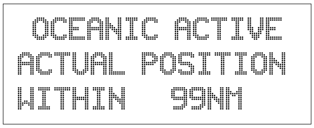
OCEANIC ARMED
FOR 18000 FT

OCEANIC ACTIVE

The following status is displayed when there is a RAIM alarm and the Position Uncertainty is unavailable.

```
 OCEANIC ACTIVE
ACTUAL POSITION
NOT AVAILABLE
```

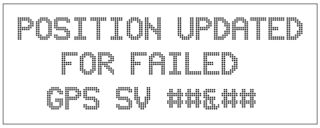
The following status is displayed when there is a RAIM alarm and a value for the Position Uncertainty is available.



```
 OCEANIC ACTIVE
ACTUAL POSITION
WITHIN   99NM
```

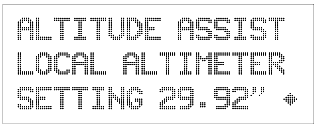
Fault Detection and Exclusion

The NMC will automatically attempt to detect and exclude unhealthy satellite data from calulations during the Oceanic flight phase. When a sucessful exclusion occurs, the NMC will display the following message (## indicates a satellite PRN number).



```
POSITION UPDATED
   FOR FAILED
  GPS SV ##&##
```

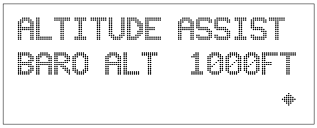
Altitude Assist Altimeter Setting Display



```
ALTITUDE ASSIST
LOCAL ALTIMETER
SETTING 29.92" ◆
```

If an ARINC 429 Air/Data Sensor is installed in the system, the Altitude Assist Altimeter Setting Display shows automatically corrected barometric pressure altitude. No altimeter setting can be made.

Altitude Assist Barometric Altitude Display (ARINC 429 Air/Data Sensor Installations Only)

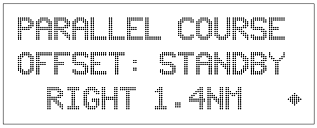


```
ALTITUDE ASSIST
BARO ALT  1000FT
                ◆
```

Top-Level Nav Displays (continued)

The Parallel Course Offset display is depicted below. In this example, the offset is 1.4 nm to the right, and in Standby status. The offset is not in effect until the “In Use” status is entered. For procedural information, see Operations, Parallel Course Offset. Maximum Parallel Course Offset is 20.0 nm. Parallel Course Offset is disabled during an active approach operation.

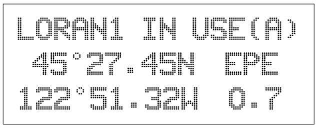
Parallel Course Offset Display



```
PARALLEL COURSE
OFFSET: STANDBY
  RIGHT 1.4NM   ◆
```

The Position Display shows the position sensor in use, the Latitude/Longitude position, and the EPE (Estimated Position Error). GPS Sensors do not display an EPE. In this example, the In Use position sensor is Loran 1, and the present Lat/Lon is 45°27.45’N, 122° 51.32’ W. Position is displayed in degrees, minutes, and hundredths of a minute. Seconds of Lat/Lon are not used. The EPE is 0.7 nm. If position has not been calculated, the top line of the display reads, “Last Valid Position.”

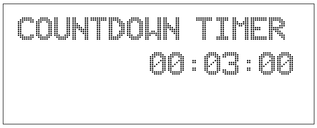
Position Display



```
LORAN1 IN USE(A)
 45°27.45N  EPE
122°51.32W  0.7
```

Countdown Timer Display

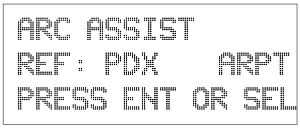
The Countdown Timer display is depicted below. In this example, the timer is set for 3 minutes. For procedural information, see Operations, Setting/Starting the Countdown Timer.



```
COUNTDOWN TIMER
         00:03:00
```

Arc Assist Display

The Arc Assist page helps you to navigate arcs, such as DME arcs in non-precision approaches or for user-defined arcs used to conduct aerial searches via increasingly larger circles. Press **ENT** to get navigation information about the displayed waypoint. Press **SEL** to choose a different waypoint. Choose a Left or Right arc with the **Small** knob.



```
ARC ASSIST
REF: PDX    ARPT
PRESS ENT OR SEL
```

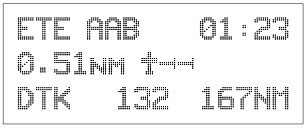
From/To/Next Display

The From/To/Next display is shown below. The top line of the display shows the “FROM” waypoint, i.e. the waypoint you are currently flying from, and the database that stores the waypoint. The middle line shows the “TO” waypoint, i.e. the waypoint you are currently flying to, and the database that stores the waypoint. The bottom line shows the “NEXT” waypoint, i.e. the waypoint you will be flying to after arriving at the “TO” waypoint, and the database that stores the waypoint. After arriving at the To waypoint, the waypoints will sequence, and the “NEXT” waypoint will become the “TO” waypoint. In this example, the “FROM” waypoint is airport (ARPT) SLE; the “TO” waypoint is the PDX VOR, and the “NEXT” waypoint is airport HIO. For procedural information, see NAV Mode Operations, “Using The From/To/Next Page” described on page 102.

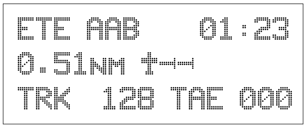
```
FROM SLE    ARPT
TO    PDX    VOR
NEXT HIO    ARPT
```

Navigation Sub-Displays

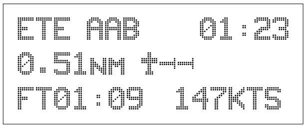
When the Required Nav Information screen, depicted at the beginning of the preceding section, Top Level Nav Displays, is displayed, turning the **Small** knob displays up to 10 navigation sub-pages (up to seven without an F/ADS). These sub-pages may be customized in SYS mode, i.e. you may select the specific navigation items that you want to appear on each display line. The default displays are depicted below.



```
ETE AAB    01:23
0.51NM †⊣⊣
DTK   132  167NM
```



```
ETE AAB    01:23
0.51NM †⊣⊣
TRK  128 TAE 000
```

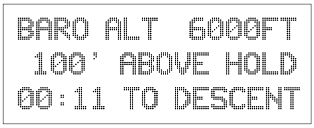


```
ETE AAB    01:23
0.51NM †⊣⊣
FT01:09  147KTS
```

```
ETE AAB    01:23
0.51NM †⊣⊣
 128 TRK132
```

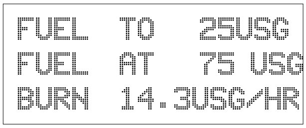
```
ETE AAB    01:23
0.51NM †⊣⊣
     14:07 UTC
```

```
ETA AAB    15:30
MIN SAFEA  5000'
ENRTSAFEA  9000'
```

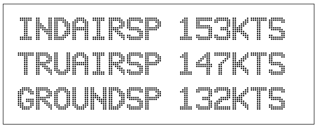


```
BARO ALT  6000FT
 100' ABOVE HOLD
00:11 TO DESCENT
```

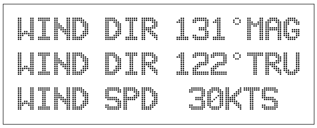
If the Fuel/Air Data Sensor is part of your system, the following default sub-pages are also available.



```
FUEL  TO   25USG
FUEL  AT   75 USG
BURN  14.3USG/HR
```



```
INDAIRSP 153KTS
TRUAIRSP 147KTS
GROUNDSP 132KTS
```

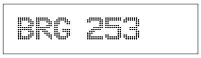


```
WIND DIR 131°MAG
WIND DIR 122°TRU
WIND SPD  30KTS
```

Eight Character Nav Items

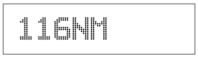
Each navigation item explained below uses half of a display line. All of these items are available when you customize your navigation displays.

The BRG (Bearing) Nav item, depicted below, shows the magnetic bearing to the *To* waypoint from your present location. In this example, the bearing is 253°.



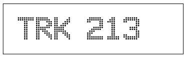
```
BRG 253
```

The distance Nav items, depicted below, show the distance in nautical miles to the *To* waypoint from your present location. In this example, the distance is 116 nautical miles.



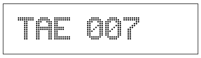
```
116NM
```

The TRK (Track) Nav item, depicted below, shows the current magnetic ground track. In this example, the track is 213°.



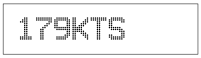
```
TRK 213
```

The TAE (Track Angle Error) Nav item, depicted below, shows the difference between DTK and TRK. In this example, TAE is 007°.



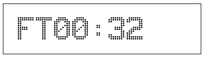
TAE 007

The Ground Speed Nav item is depicted below. In this example, the ground speed is 179 knots.



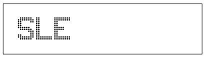
179KTS

The Elapsed Flight Time Nav item is depicted below. The display shows the elapsed flight time since departure. In this example, the elapsed time is 0 hours, 32 minutes. The flight timer starts when ground speed exceeds a selected value. For information on adjusting the flight timer trigger speed, refer to Operations, *Editing the Flight Timer Trigger Speed*.



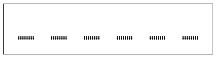
FT00:32

The Current To Waypoint Nav item is depicted below.



SLE

The Blank Field Nav item is depicted below. Selecting this item will result in a blank field display at the highlighted entry location on the Nav page being programmed.

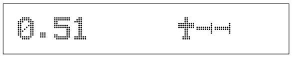


_ _ _ _ _ _

Sixteen Character Nav Items

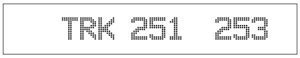
The following navigation display items use a total of sixteen characters, an entire display line.

The CDI (Course Deviation Indicator) Nav item is depicted below. The CDI is used in a similar manner to a VOR CDI. The CDI is always included on the middle line of the Required Navigation Information Display. For a detailed explanation of the CDI, see Operations. Top-Level Nav Displays. In this example, the desired course is 0.51 nm to the right.



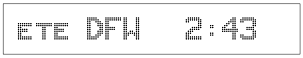
0.51

The Track and Bearing Nav item is depicted below. The display indicates the current magnetic track and the magnetic bearing to the To waypoint. When the track and bearing are the same, you are flying directly toward the waypoint, and only the track is displayed. In this example, the track is 251° and the bearing is 253°. The bearing is displayed on the left or right, depending on whether the bearing to the waypoint is to the left or right of the current track.



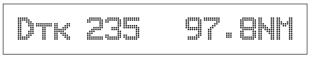
TRK 251 253

The Estimated Time En route (ETE) Nav item is depicted below, and shows the ETE to the *To* waypoint for the current leg. In this example, the ETE to DFW is 2 hours, 43 minutes.



ETE DFW 2:43

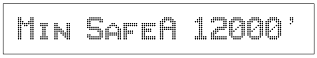
The (DTK) Desired Track and Distance Nav item is depicted below, and shows the desired track and distance between the *From* and *To* waypoints. The desired track is the magnetic bearing to the *To* waypoint from the *From* waypoint. In this example the DTK is 235° and the distance between the *From* and *To* waypoints is 97.8 nm. Distance can also be displayed in kilometers.



DTK 235 97.8NM

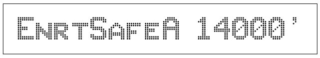
The Minimum Safe Altitude (MSA) Nav item is depicted below. The MSA is the elevation of the highest obstruction near the aircraft, with 1,000 or 2,000 feet added for safety. Near means that the aircraft is within 5 nm of a 1/4° grid that contains the obstacle.

In non-mountainous terrain, (less than 5,000 feet), 1,000 feet is added. In mountainous terrain (more than 5,000 feet), 2,000 feet is added. In the example, the MSA is 12,000 feet.

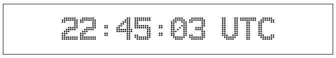


MIN SAFEA 12000'

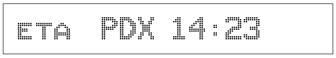
The Minimum En Route Safe Altitude (MESA) Nav item is depicted below. MESA is defined as the highest MSA for every point between the plane's present position and the current "To" waypoint, with a 5 nm buffer around the course.


EnrtSafeA 14000'

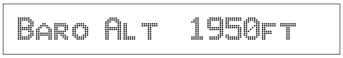
The UTC (Universal Coordinated Time) Nav item is depicted below. For GPS sensors to initialize properly, the UTC time must be correct.


22:45:03 UTC

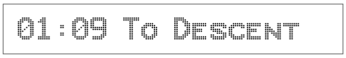
The Estimated Time of Arrival (ETA) Nav item is depicted below. ETA is given in UTC (Universal Time Coordinates) to the current To waypoint. In this example, ETA to Portland International is 14 hours, 23 minutes, and 3 seconds. The Estimated Time of Arrival (Destination Waypoint) Nav item appears the same but displays the destination waypoint identifier and uses the total flight plan distance remaining to calculate ETA.


ETA PDX 14:23

The Barometric Altitude Nav item is displayed below. This item shows pressure altitude corrected for the currently set local altimeter setting. This altitude should match the altitude displayed on your aircraft altimeter, and it should also match the altitude displayed next to the currently in use altitude sensor. In this example, the Barometric Altitude is 1950 feet.


Baro Alt 1950ft

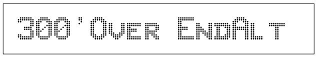
The Time to Descent Nav item is depicted below. This item shows the time before beginning your descent. This item is used only when auto descent monitoring is active. If Auto Descent monitoring is not active, "—:—" is displayed instead of a time. When Auto Descent begins, this item is replaced by the Glide Path Deviation item, or the Feet Over End Altitude item. In this example, the time to descent is 1 hour and 9 minutes.


01:09 To Descent

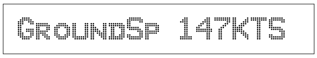
The Glide Path Deviation Nav item is depicted below. This item shows the distance you are above or below your desired glide path. This item is displayed only when Auto descent monitoring is active. If the number of feet above your intended glide path exceeds the number of feet above your intended end altitude, the Feet Over End Altitude item is displayed instead. In this example, the distance above the glide path is 50 feet.


50'Above GlPth

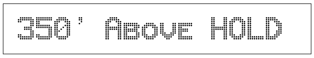
The Feet Over End Altitude Nav item is depicted below. This item shows the distance from your current altitude to your intended auto descent altitude. It is only shown in the case when the number of feet above your intended glide path exceeds the number of feet above your intended end altitude. This scenario may occur when the plane overflies the intended auto descent destination point without reaching the desired end altitude.


300'Over EndAlt

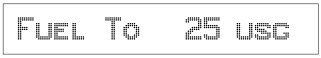
The sixteen character Ground Speed Nav item is depicted below. In this example, the ground speed is 147 knots.


GroundSp 147KTS

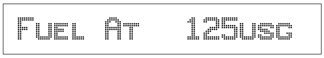
The Hold Altitude Deviation Nav item is depicted below. This item shows the distance you are above or below the chosen Hold altitude. In this example, the distance above the hold altitude is 350 feet.


350' Above HOLD

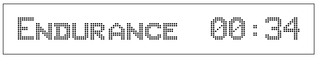
The Fuel To the Current To waypoint item is shown below. This value is calculated using the current burn rates and the distance remaining to the waypoint. The units of fuel may be displayed in USG (United States Gallons), IMG (Imperial Gallons), L (Liters), or LBS (Pounds), Kilos JP4, Kilos Jet Fuel A, or Kilos AvGas depending on the fuel units selected in the System Mode: System Info section. Requires F/ADS.


Fuel To 25 usg

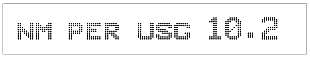
The Fuel Remaining At the Current *To* waypoint Nav item is shown below. This value is calculated using the current burn rates, the amount of fuel in the regular (non-reserve) fuel tanks, and the distance remaining to the waypoint. The units of fuel may be displayed in USG (United States Gallons), IMG (Imperial Gallons), L (Liters), or LBS (Pounds), depending on the fuel units selected in the System Mode: System Info section. Requires F/ADS.


Fuel At 125usg

The Fuel Endurance Nav item is depicted next. It displays the predicted endurance time of the fuel, in hours and minutes, based on the current burn rate and the amount of existing fuel in the non-reserve fuel tanks. Requires F/ADS.

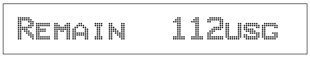

Endurance 00:34

The Miles Per Fuel Unit Nav item is shown below. The units of measurement may be set in System Mode: System Info. Miles per US Gallon, Imperial Gallon, and Liter are displayed in tenths of units. Miles per Pound are displayed in hundredths of units. Requires F/ADS.



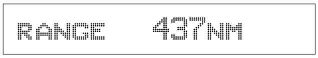
NM PER USG 10.2

The Fuel Remaining Nav item is depicted next. It shows the total fuel on board minus the fuel in the reserve tanks. The units of measurement may be set in System Mode: System Info. Requires F/ADS.



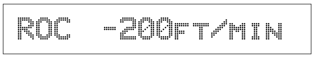
Remain 112usg

The Fuel Range Nav item, shown below, displays the total distance which the plane can be flown given the current burn rate and the amount of remaining non-reserve fuel. Requires F/ADS.



RANGE 437NM

The Rate of Climb (ROC) Nav item is depicted next. The display below indicates the plane is descending at a rate of 200 feet per minute. Requires F/ADS.

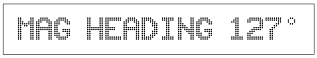


ROC -200ft/min

The Desired Heading Nav item is depicted next. This item takes into account wind factors, magnetic variation, and the desired track to calculate the heading necessary to maintain the desired track. Requires F/ADS or ARINC 429 Air/Data sensor and XYZ heading input.

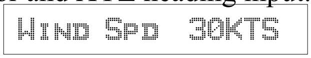
Desired Hdg 153°

The Magnetic Heading Nav item is shown next. Requires F/ADS or ARINC 429 Air/Data sensor and XYZ heading input.



MAG HEADING 127°

The Wind Speed Nav item is shown next. Requires F/ADS or ARINC 429 Air/Data sensor and XYZ heading input.



Wind Spd 30KTS

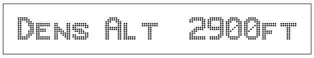
The Magnetic Wind Direction Nav item is shown next. Requires F/ADS or ARINC 429 Air/Data sensor and XYZ heading input.

Wind Dir 131°Mag

The True Wind Direction Nav item is shown next. Requires F/ADS or ARINC 429 Air/Data sensor and XYZ heading input.

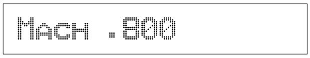
Wind Dir 131°Tru

The Density Altitude Nav item is shown next. Requires F/ADS or ARINC 429 Air/Data sensor and XYZ heading input.



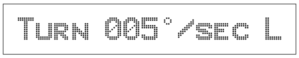
Dens Alt 2900ft

The Mach Number Nav item is depicted below. Requires F/ADS.



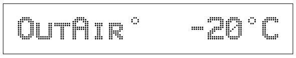
Mach .800

The Turn Rate Nav item, which displays the current rate of turn of the plane, is shown next. It is in degrees of turn per second left (L) or right (R). Requires F/ADS.



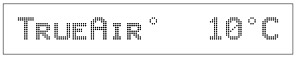
Turn 005°/sec L

The Outside Air Temperature Nav item, which does not take wind factors into account, is depicted below. In this example, the Outside Air Temperature is -20° centigrade. Requires F/ADS.



OutAir° -20°C

The True Air Temperature Nav item, which factors in wind speed relative to a 0 knot ground speed is depicted next. In this example, the True Air Temperature is 10° centigrade. Requires F/ADS.

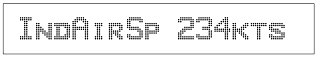


TrueAir° 10°C

The True Air Speed Nav item, which displays the air speed of the plane after correction for altitude and temperature factors, is displayed next. Requires F/ADS or ARINC 429 Air/Data sensor and XYZ heading input.

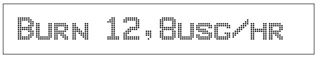
TruAirSp 153kts

The Indicated Air Speed Nav item, which displays the air speed of the plane without correction for altitude and temperature factors, is displayed next. Requires F/ADS.



IndAirSp 234kts

The Burn Rate Nav item, which displays the amount of fuel usage per hour, is shown next. The units of fuel (liters, gallons, pounds, or kilos) may be customized in System Mode. Requires F/ADS.



Burn 12.8usg/hr

RAIM Predict Ignore List Sub-Displays

The RAIM Predict Ignore List (RPIL) pages allow the user to specify satellite outages as presented in NOTAMs (Notice to Airmen) or NANUs (Notice Advisory to NAVSTAR Users). This list is only used for RAIM prediction and is not used in navigation. To Access the RPIL pages in NAV mode, rotate the **Large** knob to the RAIM predict page, then rotate the **Small** knob to display the RPIL page for the satellite (listed by PRN number) that you want to exclude from the RAIM prediction. Press the **SEL** button and use the **Large** and **Small** knobs to select and change fields.

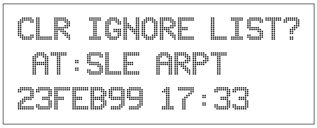
NOTE

The NMC will automatically reinclude satellites whose out-of-service time has elapsed.

```
PRN01
TO IGNORE SAT
  PRESS SEL
```

Clear RAIM Predict Ignore List

The user has the option to clear the RPIL. In the NAV mode, use the **Large** knob to display the main RAIM prediction page. Press **SEL** to display “Select Waypoint?”. Use the **Large** knob to display “Predict RAIM?” on the top line. Use the **Small** knob to display “Clr Ignore List?”. Press **ENT** to clear the RPIL. This will make all satellites available for future RAIM predictions.



```
CLR IGNORE LIST?
 AT:SLE ARPT
23FEB99 17:33
```

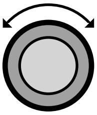
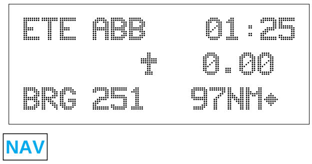
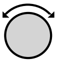
NOTES

NAV Mode Procedures

This section details the procedures used in NAV mode.

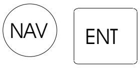
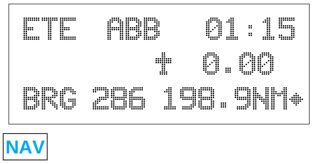
Displaying Nav Information

The following procedure is used to display the various Nav pages.

	Action	Explanation
1.		In NAV mode, if necessary, turn the **Large** knob to display the Required Nav Information page.  ETE ABB 01:25 † 0.00 BRG 251 97NM◆ NAV
2.		Turn the **Small** knob to scroll through the Nav Information displays.

Starting/Stopping Auto Nav Scroll

This feature automatically displays navigation screens sequentially for a specified amount of time, from 1 to 9 seconds per display. To select the amount of time each screen is displayed, refer to Operations, *Setting Auto Nav Scroll Time*.

	Action	Explanation
1	 	In NAV mode while viewing any information page, press ENT to start Auto Nav Scroll. Rotating either knob or pressing any button stops Auto Nav Scroll.  ETE ABB 01:15 † 0.00 BRG 286 198.9NM◆ NAV

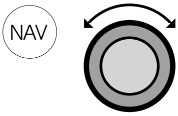
Displaying Present Position

The NMC constantly updates your present position. Loran GRIs, triads, and GPS satellites are automatically chosen by the NMC. If desired, you may enter the GRI/Triad manually in SYS mode.

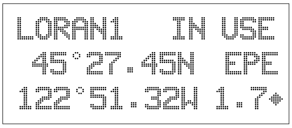
The following procedure is used to display the position calculated by each sensor in the system.

Action **Explanation**

1.



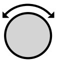
In NAV mode turn the **Large** knob to display the Position Summary page. This page displays the position information from the position sensor in use.



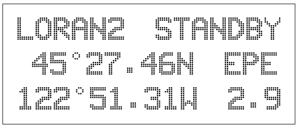
```
LORAN1    IN USE
 45°27.45N  EPE
122°51.32W 1.7◆
```

NAV

2.



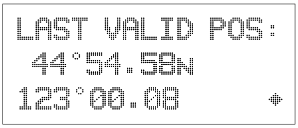
Turn the **Small** knob to display the position provided by each sensor. Only one sensor is In Use, and the rest are on Standby.



```
LORAN2  STANDBY
 45°27.46N  EPE
122°51.31W  2.9
```

NAV

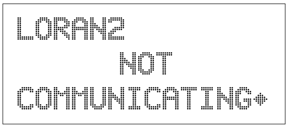
If a position sensor is no longer sending valid information, the Last Valid Position display, depicted below, is displayed, and this position is used for navigation functions.



```
LAST VALID POS:
 44°54.58N
123°00.08      ◆
```

NAV

If a position sensor has not communicated with the NMC since power-up, the Not Communicating display, depicted below, appears.



```
LORAN2
      NOT
COMMUNICATING⬍
```

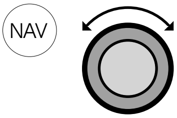
NAV

Selecting a Position Sensor

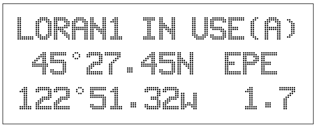
The following procedure is used to choose the In Use position sensor.

Action **Explanation**

1.



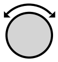
In NAV mode, turn the **Large** knob to display the Position Summary page. This page displays the position (latitude/longitude) determined by the In Use sensor.



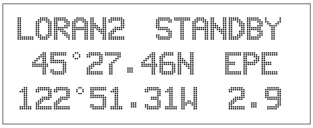
```
LORAN1 IN USE(A)
 45°27.45N  EPE
122°51.32w   1.7
```

NAV

2.



Turn the **Small** knob to display the position sensor you want to use.

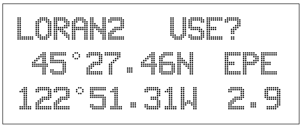


```
LORAN2  STANDBY
 45°27.46N  EPE
122°51.31W  2.9
```

NAV

3. SEL

Pressing **SEL** activates editing. “Standby” automatically changes to “Use?”.



```
LORAN2   USE?
 45°27.46N  EPE
122°51.31W  2.9
```

NAV

4. ENT SEL

Pressing **ENT** enters the displayed sensor as the In Use sensor, and the NMC will use data from this sensor to calculate position. Pressing **SEL** instead exits editing without changing the In Use sensor.

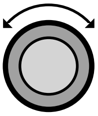
Manually selecting a position sensor will cancel Automatic Position Sensor Selection.

Automatic and Manual Position Sensor Selection

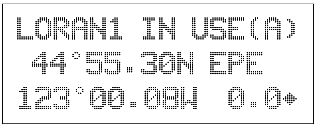
Position Sensor Selection allows you to choose which of the position sensors installed on the Navnet network to use for navigation. Automatic Position Sensor Selection allows the NMC to automatically choose which position sensor is being used for navigation. Manual Position Sensor Selection disables the automatic option and allows you to choose your position sensor. While using Manual Position Sensor Selection, the NMC will not choose a different position sensor for navigation.

Action **Explanation**

1. NAV



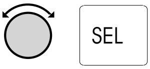
In NAV mode, turn the **Large** knob to display the In Use Position Sensor page. The (A) on the top right of the display indicates that Automatic Position Sensor Selection is in use.



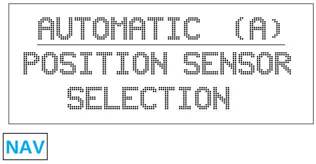
```
LORAN1 IN USE(A)
 44°55.30N EPE
123°00.08W  0.0◆
```

NAV

2.

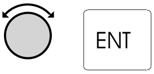


Turn the **Small** knob to display the Automatic/Manual page, and press **SEL** to activate editing.

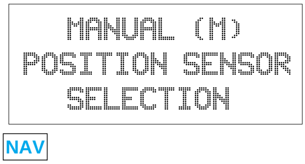


```
 AUTOMATIC   (A)
POSITION SENSOR
   SELECTION
```

3.



Turn the **Small** knob to change the option and press **ENT** to save the change.



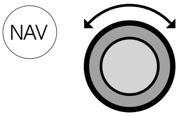
```
   MANUAL  (M)
POSITION SENSOR
   SELECTION
```

While Automatic Position Sensor Selection can be started or canceled using the method described above, it can also be canceled by manually selecting a different position sensor, as follows:

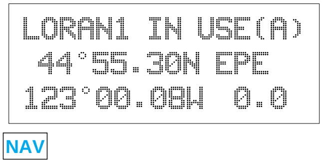
Action

Explanation

1.

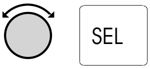


In NAV mode, turn the **Large** knob to display the In Use Position Sensor page. The (A) on the top right of the display indicates that Automatic Position Sensor Selection is in use.

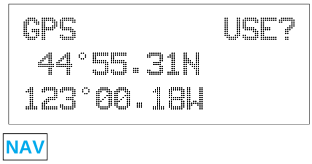


```
LORAN1 IN USE(A)
 44°55.30N EPE
123°00.08W  0.0
```

2.



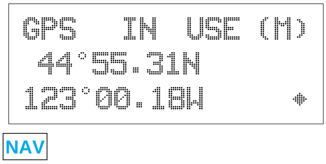
Turn the **Small** knob to display the Position Sensor that you wish to select. Press **SEL** to activate editing.



```
GPS         USE?
 44°55.31N
123°00.18W
```

3.

Pressing **ENT** activates the position sensor and cancels Automatic Position Sensor Selection.

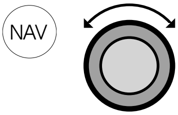


```
GPS   IN  USE (M)
 44°55.31N
123°00.18W      ◆
```

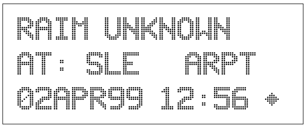
Editing Manual RAIM Prediction Fields

The Apollo NMC allows the user to manually check predicted RAIM availability for any waypoint, date, and time contained by the data base.

1.



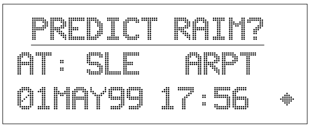
In NAV mode, turn the **Large** knob to the RAIM Prediction page.



```
RAIM UNKNOWN
AT: SLE   ARPT
02APR99 12:56 ◆
```

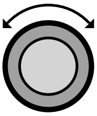
2.

Press **SEL** to begin RAIM prediction editing.

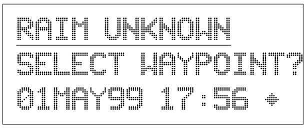


```
 PREDICT RAIM?
AT: SLE   ARPT
01MAY99 17:56  ◆
```

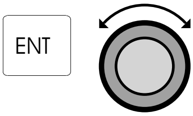
3.



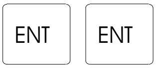
Turn the **Large** knob to highlight the field that you want to change (waypoint, month, day, year, or time).



```
RAIM UNKNOWN
SELECT WAYPOINT?
01MAY99 17:56 ◆
```

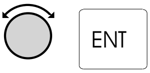
4. 

Press **ENT** to access the database and use the **Large** and **Small** knobs to select a waypoint.

5. 

Press **ENT** twice to begin the prediction process or use the **Large** and **Small** knobs to change the date and time. The prediction process will take approximately 20 seconds.

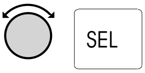
```
RAIM AVAILABLE
AT: SEA    ARPT
012APR99 14:56 ⬍
```

6. 

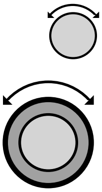
To reselect the destination waypoint, rotate the **Small** knob to USE DEST & ETA ? Press **ENT** to select destination, compute ETA and start RAIM prediction.

Editing RAIM Predict Ignore List

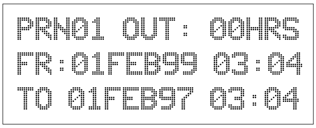
The Apollo NMC allows the user to specify satellite outages for RAIM predictions using information presented in NOTAMs or NANUs.

1. 

From the RAIM prediction page rotate the **Small** knob to the desired satellite page. Press the **SEL** button

2. 

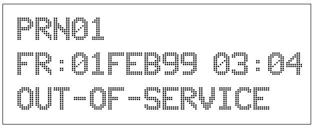
The screen below will initially display with the hours field flashing. Rotate the **Small** knob to select the outage hours (from 0 to 99). Rotate the **Large** knob to select other fields to modify.



```
PRN01 OUT: 00HRS
FR:01FEB99 03:04
TO 01FEB97 03:04
```

3. ENT

To indefinitely remove a satellite from service, including over power ups, rotate the **Small** knob until REMOVE is displayed in the hours location and press **ENT**. The screen below will display and the satellite will be ignored starting from the FR date shown on the screen.



```
PRN01
FR:01FEB99 03:04
OUT-OF-SERVICE
```

Clear RAIM Predict Ignore List

The user has the option to clear the RPIL available from the main RAIM prediction page.

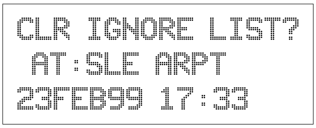
1. SEL

Press **SEL** to display “Select Waypoint?”. Use the Large knob to display “Predict RAIM?” on the top line

```
 PREDICT RAIM?
AT:SLE  ARPT
01MAY99 12:56  ◆
```

2 ENT

Use the **Small** knob to display “Clr Ignore List?”. Press **ENT** to clear the RPIL. This will make all satellites available for future RAIM predictions.



```
CLR IGNORE LIST?
 AT:SLE ARPT
23FEB99 17:33
```

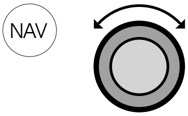
Altitude Sensor Selection

Altitude Assist requires the system include an altitude encoder or Fuel/Air Data Sensor (F/ADS). This procedure is used to select which of these sensors is used for altitude data. In this example, the current sensor is an altitude encoder, and is changed to an F/ADS. The same procedure is used to change back.

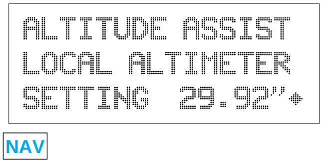
☞ *If an ARINC 429 Air/Data sensor is installed in the system, this sensor is automatically selected as the current sensor for altitude data. No other altitude sensor may be selected.*

Action **Explanation**

1.



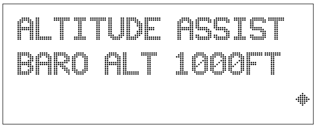
In NAV mode, turn the **Large** knob to display the Altitude Assist page.



```
ALTITUDE ASSIST
LOCAL ALTIMETER
SETTING  29.92”♦
```

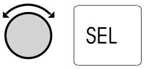
NAV

If an ARINC 429 Air/Data sensor is installed in the system, the Altitude Assist page appears as shown below.

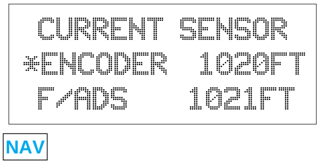


```
ALTITUDE ASSIST
BARO ALT 1000FT
                ♦
```

2.



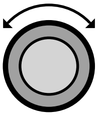
Turn the **Small** knob to display the Current Sensor page, and press **SEL** to activate editing. The “*” is next to the activated sensor.



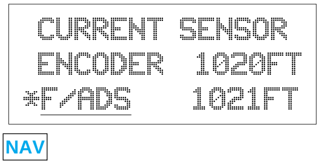
```
 CURRENT SENSOR
*ENCODER  1020FT
 F/ADS    1021FT
```

NAV

3.



Turn the **Large** knob to choose the desired sensor.

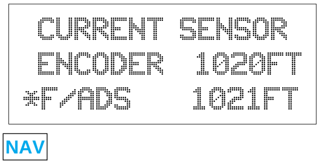


```
 CURRENT SENSOR
 ENCODER  1020FT
*F/ADS    1021FT
```

NAV

4.

Press **ENT** to enter the sensor choice.



```
 CURRENT SENSOR
 ENCODER  1020FT
*F/ADS    1021FT
```

NAV

Setting the Altimeter (Barometric Pressure)

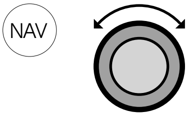
Each time the system is powered up, the barometric pressure is automatically set to standard pressure, 29.92” (or 1013 mb). This procedure is used to enter the current altimeter setting (barometric pressure).

Note

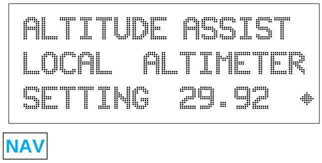
These pages are not available if an ARINC 429 Air/Data sensor is installed in the system.

Action **Explanation**

1.



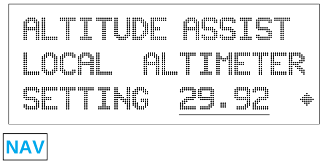
In NAV mode, turn the **Large** knob to display the Altitude Assist page.



```
ALTITUDE ASSIST
LOCAL  ALTIMETER
SETTING  29.92  ◆
```

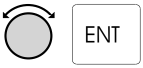
2.

Pressing SEL activates editing, and the current barometric pressure setting flashes.

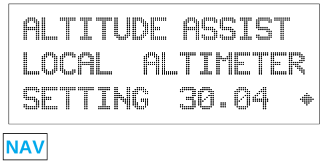


```
ALTITUDE ASSIST
LOCAL  ALTIMETER
SETTING  29.92  ◆
```

3.



Turn the **Small** knob to adjust the barometric pressure. Press **ENT** to enter the setting.

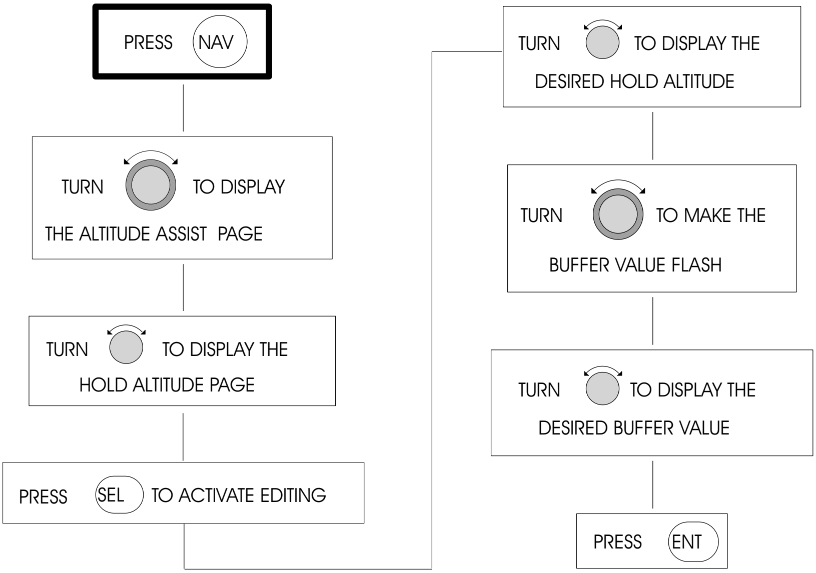


```
ALTITUDE ASSIST
LOCAL  ALTIMETER
SETTING  30.04  ◆
```

Setting/Editing Hold and Buffer Altitudes

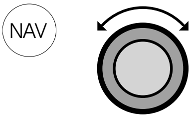
Altitude Assist features require that the system include an altitude input device. The NMC alerts you when you’ve ascended/descended into the Hold Buffer, or have strayed outside of the buffer. The Buffer Altitude is the altitude above and below your Hold altitude at which you want to be alerted with a message. This procedure is used to set the Hold Altitude and the Buffer Altitude.

Flow Chart

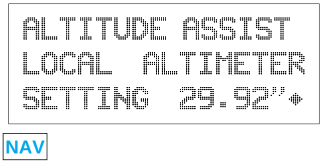


Action **Explanation**

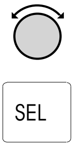
1.



In NAV mode, turn the **Large** knob to display the Altitude Assist page. (If an ARINC 429 Air/Data sensor is installed, this page shows barometric altitude, not the local altimeter setting.)

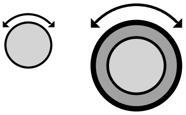

ALTITUDE ASSIST
LOCAL ALTIMETER
SETTING 29.92’’◆
NAV

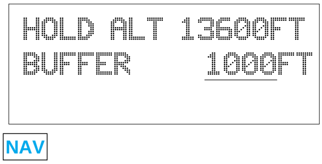
2. Turn the **Small** knob to display the Hold Altitude page. Pressing **SEL** activates editing.



```
HOLD ALT 15000FT
BUFFER     200FT
ENT TO HOLD ALT
```

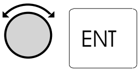
3. Turn the **Small** knob to display the desired Hold Altitude. The altitude is chosen in increments of 50 ft. Turn the **Large** knob to make the Buffer value flash.

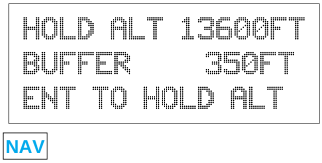




```
HOLD ALT 13600FT
BUFFER    1000FT
```

5. Turn the **Small** knob to display the desired Buffer Altitude value. The Buffer altitude is chosen in increments of 10 ft. Pressing **ENT** enters the displayed values.





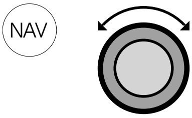
```
HOLD ALT 13600FT
BUFFER     350FT
ENT TO HOLD ALT
```

Starting/Stopping Altitude Hold

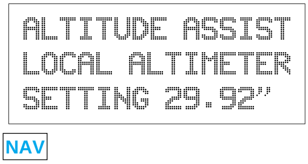
Altitude Assist features require the system include a F/ADS or an altitude encoder sensor. The following procedure is used to start or stop the Altitude Hold feature. When active, Altitude Hold alerts you with a message when you have ascended/descended into the buffer, or when you stray outside the buffer. The Buffer Altitude is the altitude above and below your Hold altitude at which you want to be alerted with a message.

Action **Explanation**

1.

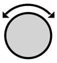


In NAV mode, turn the **Large** knob to display the Altitude Assist page.

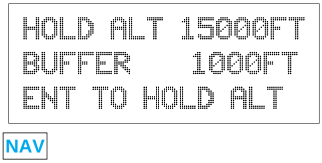


```
ALTITUDE ASSIST
LOCAL ALTIMETER
SETTING 29.92"
```

2.

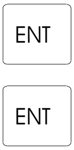


Turn the **Small** knob to display the Hold Altitude page.

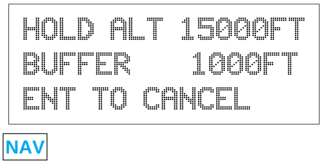


```
HOLD ALT 15000FT
BUFFER    1000FT
ENT TO HOLD ALT
```

3.



Pressing **ENT** activates Altitude Hold. Pressing **ENT** again deactivates the feature.



```
HOLD ALT 15000FT
BUFFER    1000FT
ENT TO CANCEL
```

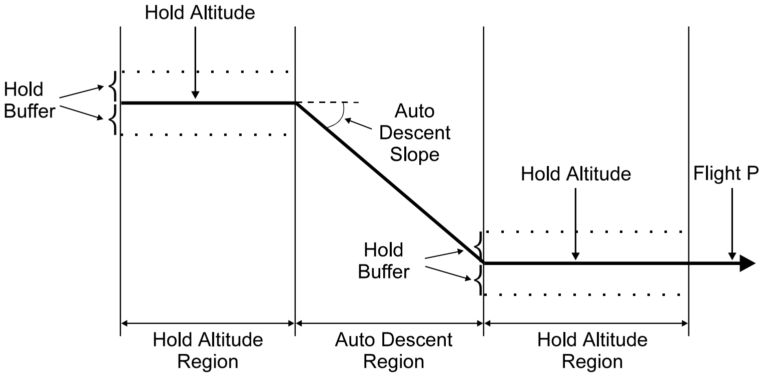
Setting/Editing Auto Descent Values

Altitude Assist features requires the system to include either a F/ADS or an altitude encoder sensor.

The Auto Descent feature allows you to input a desired End Altitude, an Offset Distance from a desired Auto Descent Waypoint from the Active flight plan, a desired Feet per Minute Descent rate, and an expected Ground speed. It then automatically calculates the distance remaining in your Active flight plan to the desired Auto Descent Waypoint and, based on the calculated glide path angle, your present altitude, and the altitude you are descending to, alerts you with a message when you should begin and end your descent. A Nav item field displays information indicating how much time remains before you should begin Auto Descent, and once Auto Descent begins, whether you are above or below your intended Glide Path. Glide Path data may also be output to an optional Vertical Deviation Indicator.

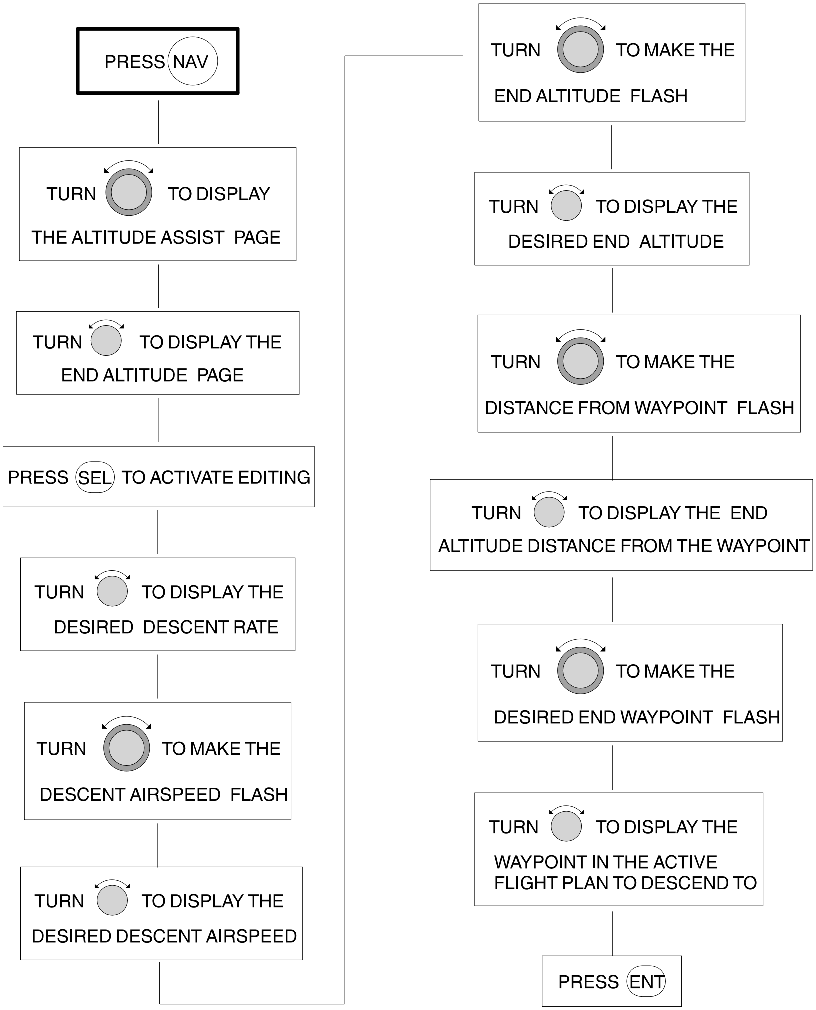
Each time you begin to edit the Auto Descent values, the End Altitude is automatically reset to 1,000 feet over the altitude of the desired Auto Descent Waypoint, if the waypoint is an airport. Otherwise, the End Altitude automatically resets to 1,000 feet. In addition, the default Auto Descent Waypoint is automatically updated, as long as Auto Descent is OFF, to the current To waypoint each time a waypoint sequence occurs. These features will assist you in making Auto Descent quick and easy to edit and use.

The following procedure is used to set/edit the Auto Descent values.



Setting/Editing Auto Descent Values (continued)

Flow Chart



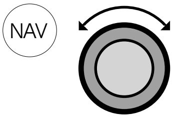
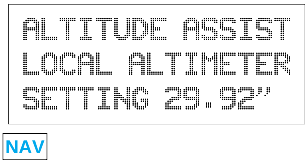
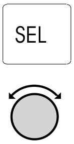
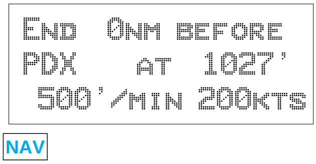
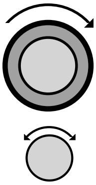
Set up your Auto-Descent by selecting:

Distance from destination waypoint (0 - 99 nm)
or Offset Distance

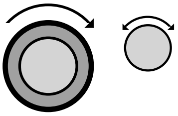
Ending altitude (-1,500 - 50,000’ in 50’ steps)

Descent rate (100 - 5,000’/min in 10’/min steps)

Estimated ground speed (50 - 600 kts)

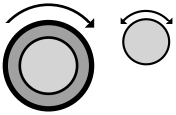
	Action	**Explanation**
1.		In NAV Mode turn the **Large** knob to display the Altitude Assist page. (If an ARINC 429 Air/Data sensor is installed and provides corrected baro-altitude, this page shows barometric altitude, not the local altimeter setting.)  ALTITUDE ASSIST LOCAL ALTIMETER SETTING 29.92”
2.		While viewing either the Auto-Descent or End Alt page in the Altitude Assist function, press **SEL**. The Offset Distance value will flash. Turn the **SMALL** knob to change the Descent Offset Distance value.  END 0NM BEFORE PDX AT 1027’ 500’/MIN 200KTS
3.		Turn the **LARGE** knob to the destination waypoint field. Turn the **SMALL** knob (cw or ccw) to change the field. You can choose from the remaining waypoints in your flight plan.

4.



Turn the **LARGE** knob to the Ending Altitude value. Turn the **SMALL** knob to change the value. The default value is 1000 ft above the airport elevation.

5.



Turn the **SMALL** knob to the Auto Descent page, if necessary. Your recommended glide slope and ending altitude are shown. Press **ENTER** to activate (ready) Auto Descent. Press **ENTER** again to cancel it.

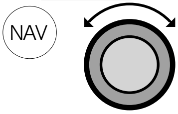
Notes

Starting/Stopping Auto Descent

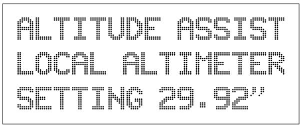
Altitude Assist features require the system to include an altitude input device. The following procedure is used to start or stop Auto Descent. Auto Descent calculates the distance remaining in your Active flight plan, and based on the glide path angle, the altitude you are descending to, and your present altitude, alerts you with a message when you should begin and end your descent. For a complete discussion on Auto Descent, refer to Setting/Editing Auto Descent Values.

Action **Explanation**

1.

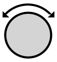


In NAV mode turn the **Large** knob to display the Altitude Assist page. (If an ARINC 429 Air/Data sensor is installed, this page shows barometric altitude, not the local altimeter setting.)

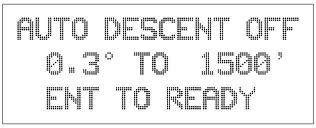

ALTITUDE ASSIST
LOCAL ALTIMETER
SETTING 29.92"

NAV

2.



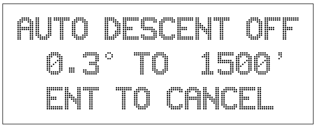
Turn the **Small** knob to display the Auto Descent page. Based on the descent rate defined in the preceding procedure, a descent angle in degrees is calculated and displayed on the middle line.


AUTO DESCENT OFF
0.3° TO 1500'
ENT TO READY

NAV

3.

Pressing **ENT** activates Auto Descent. Pressing **ENT** a second time deactivates the feature.


AUTO DESCENT OFF
0.3° TO 1500'
ENT TO CANCEL

NAV

Parallel Course Offset

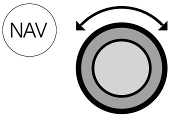
The NMC allows you to fly a course parallel to the course you've defined by entering a parallel course offset. This may be useful in avoiding weather or other obstacles.

Activating/Deactivating/Editing Parallel Course Offset

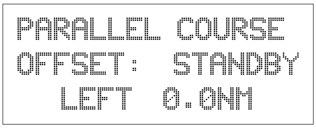
The following procedure is used to activate, deactivate, or edit a parallel course.

Action **Explanation**

1.



In NAV mode, turn the **Large** knob to display the Parallel Course Offset page. The current status is displayed on the right side of the middle line. There are two status options available: In Use and Standby. In this example, the status is Standby, meaning the feature is not in use.

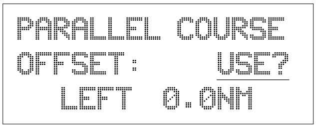


```
PARALLEL COURSE
OFFSET:  STANDBY
   LEFT  0.0NM
```

NAV

2.

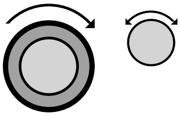
Pressing **SEL** activates editing, and a prompt for the alternate status option, in this example "Use?", flashes. The current offset direction and value is displayed on the bottom line. If the desired offset were already displayed, pressing **ENT** at this point would enter the new status.



```
PARALLEL COURSE
OFFSET:     USE?
   LEFT  0.0NM
```

Activating/Deactivating/Editing Parallel Course Offset (continued)

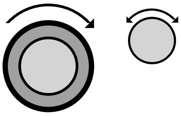
3.



If necessary, turn the **Large** knob to make the direction setting flash, and turn the **Small** knob to change the direction.

```
PARALLEL COURSE
OFFSET:  STANDBY
   RIGHT  2.2NM
```

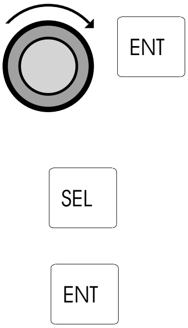
4.



Turn the **Large** knob to make the offset value flash. Turn the **Small** knob to choose the amount of the offset. The offset is chosen in tenths of a mile, up to a maximum of 20.0 nm.

```
PARALLEL COURSE
OFFSET:  STANDBY
   RIGHT  2.2NM
```

5.



Turn the **Large** knob to make the status flash, and press **ENT** to enter the status. Anytime you want to change the status without adjusting the direction or amount of the offset, simply press **SEL** then **ENT**.

```
PARALLEL COURSE
OFFSET:  IN USE
   RIGHT  2.2NM
```

Manual Air Speed

The 2101 can be setup to allow you to manually enter an air speed. The Manual Airspeed selected will be used as the True Air Speed. By entering an air speed, may then view Wind Speed, Magnetic Wind Direction, and True Wind Direction when these Nav items are selected. See the section on Programmable Nav pages on page and page for details on Wind information. This function is only available when a F/ADC or the ARINC 561 board are NOT installed.

1. In NAV mode, turn the **Large** knob to display the Manual Air Speed page.

MANUAL AIRSPEED
SELECTION
0KTS

NAV

2. Turn the **Small** knob to choose the desired values.

Countdown Timer

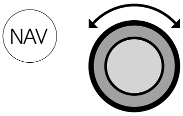
The countdown timer is set in hours, minutes, and seconds. When the timer reaches 00:00:00 a message is generated, and the MSG light flashes. After viewing the message, the message clears. A maximum time of 99:59:59 may be entered. Once the timer is started, you may change modes or displays without disturbing the Countdown Timer.

Setting/Starting the Countdown Timer

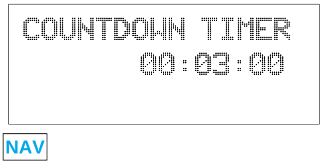
The following procedure is used to set and start the countdown timer.

Action **Explanation**

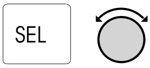
1.



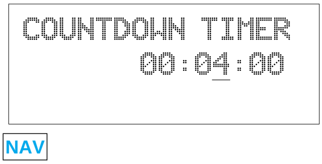
In NAV mode turn the **Large** knob to display the Countdown Timer page.


COUNTDOWN TIMER
00:03:00
NAV

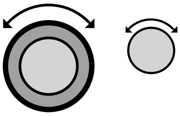
2.



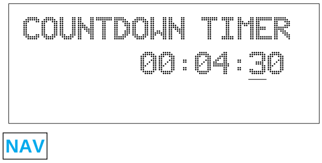
Pressing **SEL** activates editing, and the minutes value flashes. Turn the **Small** knob to adjust the minutes value.


COUNTDOWN TIMER
00:04:00
NAV

3.



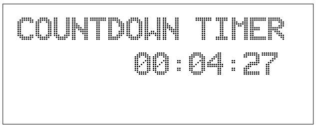
Use the **Large** and **Small** knobs to edit other values on the display.


COUNTDOWN TIMER
00:04:30
NAV

4. ENT

SEL

Press **ENT** to start the timer.
Note: pressing **SEL** while the timer is running resets the timer and activates editing.



```
COUNTDOWN TIMER
      00:04:27
```

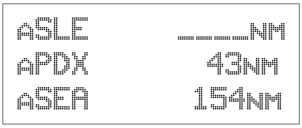
NAV

DME Arc Assist

See the DME-ARCs (Arc Assist) section in the Approach portion of this manual. See page 249.

Waypoint Distance Page

This page shows the cumulative distance from your current position to each waypoint in the active flight plan starting with the active leg. Turn the **Small** knob to view the next set of waypoints in your active flight plan. The waypoint type is shown to the left of the identifier. The allowable waypoint types are: Airport (a), Intersection (i), NDB (n), and VOR (v). The waypoint type symbol will not be shown if one of the following occurs: the waypoint identifier is unknown, it is an approach waypoint that is not one of the four used types, it is a User waypoint, the waypoint is not recognized by the current data card's database, or the data card has been removed.

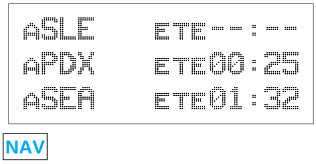


```
aSLE       ___NM
aPDX        43NM
aSEA       154NM
```

NAV

Waypoint ETE Page

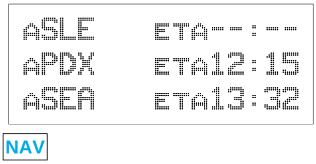
This page displays the cumulative time in hours and minutes from your current position to each waypoint in the active flight plan, starting with the active leg. The ETE values will be displayed in minutes and seconds when the Time To Wpt is less than one hour. Turn the **Small** knob to view the next page of waypoints. The time will not be shown for the same reasons as in the Waypoint Distance page.



```
aSLE    ETE--:--
aPDX    ETE00:25
aSEA    ETE01:32
```

From-To-Next Waypoint ETA Page

This page displays the ETA for each waypoint in your active flight plan from your current position, starting with the active leg. Turn the **Small** knob to view the next page of waypoints. The time will not be shown for the same reasons as in the Waypoint Distance page, if the ground speed is zero, or if 3-D positioning is lost.



```
aSLE    ETA--:--
aPDX    ETA12:15
aSEA    ETA13:32
```

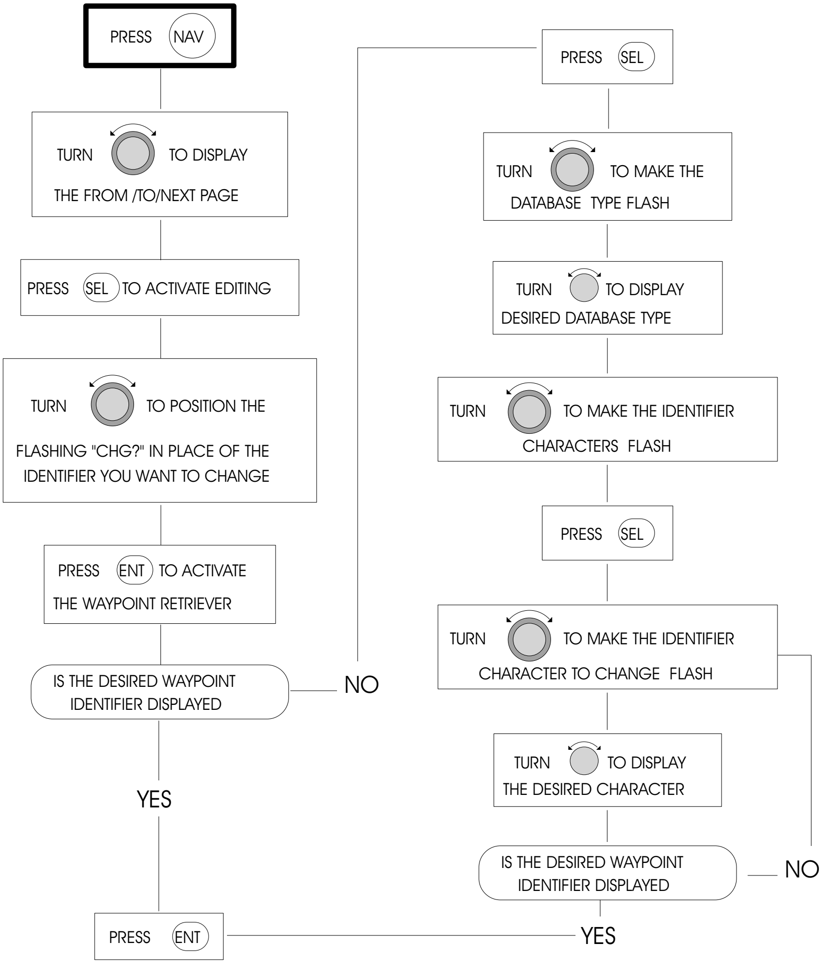
Using the From/To/Next Nav Page

The From/To/Next Nav page shows the *From* waypoint, the waypoint you are currently flying from; the *To* waypoint, the waypoint you are currently flying to; and the *Next* waypoint, the waypoint you will be flying to after arriving at the current *To* waypoint. These waypoints are contained in the Active flight plan. Using the From/To/Next page, these waypoints may be changed or deleted, or a new waypoint may be inserted. These modifications are made to the Active flight plan, and do *not* affect the stored flight plan that was activated. Also, the Active flight plan may be put on "Hold", which stops the flight plan waypoints from sequencing. **You should understand the use of the Waypoint Retriever before executing procedures in this section. The waypoint Retriever is described in DB Mode Procedures, "Retrieving a Waypoint" on page 115.**

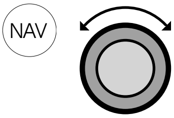
Inserting and Editing a From/To/Next Waypoint

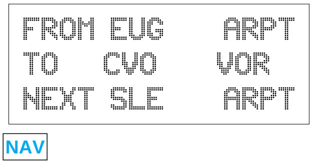
The following procedure is used to insert or edit one of the waypoints on the From/To/Next page with another waypoint. When a waypoint is inserted, the remaining waypoints automatically sequence, i.e. move down.

Flow Chart


PRESS NAV
TURN TO DISPLAY THE FROM /TO/NEXT PAGE
PRESS SEL TO ACTIVATE EDITING
TURN TO POSITION THE FLASHING "CHG?" IN PLACE OF THE IDENTIFIER YOU WANT TO CHANGE
PRESS ENT TO ACTIVATE THE WAYPOINT RETRIEVER
IS THE DESIRED WAYPOINT IDENTIFIER DISPLAYED
NO
YES
PRESS ENT
PRESS SEL
TURN TO MAKE THE DATABASE TYPE FLASH
TURN TO DISPLAY DESIRED DATABASE TYPE
TURN TO MAKE THE IDENTIFIER CHARACTERS FLASH
PRESS SEL
TURN TO MAKE THE IDENTIFIER CHARACTER TO CHANGE FLASH
TURN TO DISPLAY THE DESIRED CHARACTER
IS THE DESIRED WAYPOINT IDENTIFIER DISPLAYED
NO
YES

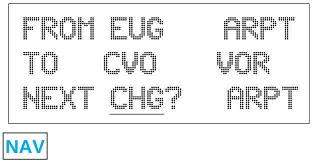
Inserting and Editing a From/To/Next Waypoint (cont’d)

Action	**Explanation**
1. 	In NAV mode, turn the **Large** knob to display the From/To/Next page. The current *From*, *To*, and *Next* identifiers are displayed. Blank lines appear in spaces where there are no waypoints.

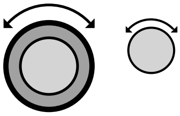


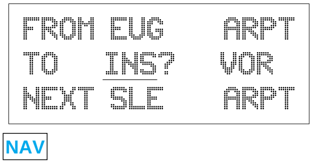
```
FROM EUG    ARPT
TO   CVO    VOR
NEXT SLE    ARPT
```

2. 	Press **SEL** to activate editing. “CHG?” (Change) appears in place of the *Next* waypoint. If no Next waypoint is displayed, “INS?” (Insert) appears instead. “CHG?” is used to replace the waypoint, and “INS?” is used to add a waypoint. “DEL?” (Delete) will remove the waypoint.



```
FROM EUG    ARPT
TO   CVO    VOR
NEXT CHG?   ARPT
```

3. 	Turn the **Large** knob to choose the waypoint to change, or the location where a new waypoint is to be inserted. To insert a waypoint, turn the **Small** knob to display “INS?” “HOLD” may be chosen to replace “TO”. “HOLD” is used to place the Active flight plan on hold, and prevent waypoint sequencing. You may also press the OBS/HLD button when installed.

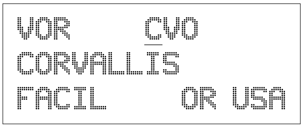


```
FROM EUG    ARPT
TO   INS?   VOR
NEXT SLE    ARPT
```

Inserting and Editing a From/To/Next Waypoint (cont'd)

4. ENT

Pressing **ENT** activates the Waypoint Retriever.

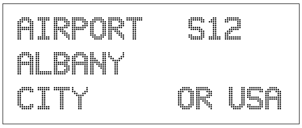


```
VOR      CVO
CORVALLIS
FACIL     OR USA
```

NAV

5. Display the desired waypoint.

Use the Waypoint Retriever to display the desired waypoint. The Waypoint Retriever is described in Operations, *Retrieving a Waypoint.*

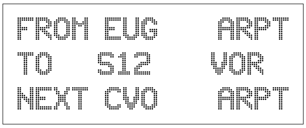


```
AIRPORT   S12
ALBANY
CITY      OR USA
```

NAV

6. ENT

Press **ENT** to enter the displayed waypoint into the Active flight plan.



```
FROM EUG    ARPT
TO   S12    VOR
NEXT CVO    ARPT
```

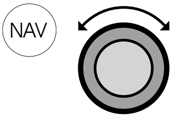
NAV

Hold/Continue the From/To/Next Sequencing

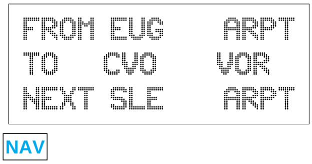
The following procedure is used to change the flight plan status to HOLD, or to resume flight plan sequencing after holding. HOLD prevents the Active flight plan waypoints from sequencing. While the flight plan status is HOLD, the NMC continues to show the bearing to the TO waypoint even after you have passed the waypoint. If you have passed the TO waypoint, the symbolic airplane on the CDI indicator is displayed inverted.

Action **Explanation**

1.



In NAV mode, turn the **Large** knob to display the From/To/Next page. The current *From*, *To*, and *Next* identifiers are displayed. Blank lines appear in spaces where there are no waypoints.



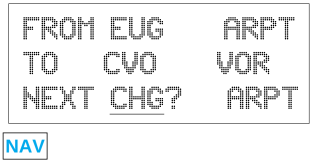
```
FROM EUG     ARPT
TO   CVO    VOR
NEXT SLE     ARPT
```

NAV

2.

SEL

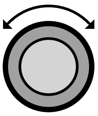
Pressing **SEL** activates editing. "CHG?" (Change) appears in place of the *Next* waypoint. If no Next waypoint is displayed, "INS?" (Insert) appears.



```
FROM EUG     ARPT
TO   CVO    VOR
NEXT CHG?    ARPT
```

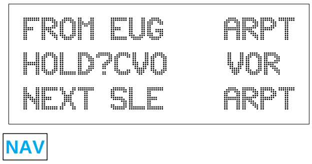
NAV

3.



ENT

Turn the **Large** knob to position "HOLD?" in place of "TO". If "HOLD" is the current status, "TO?" appears instead. Pressing **ENT** enters the status in the Active flight plan.



```
FROM EUG     ARPT
HOLD?CVO     VOR
NEXT SLE     ARPT
```

NAV

DB (Database) Mode

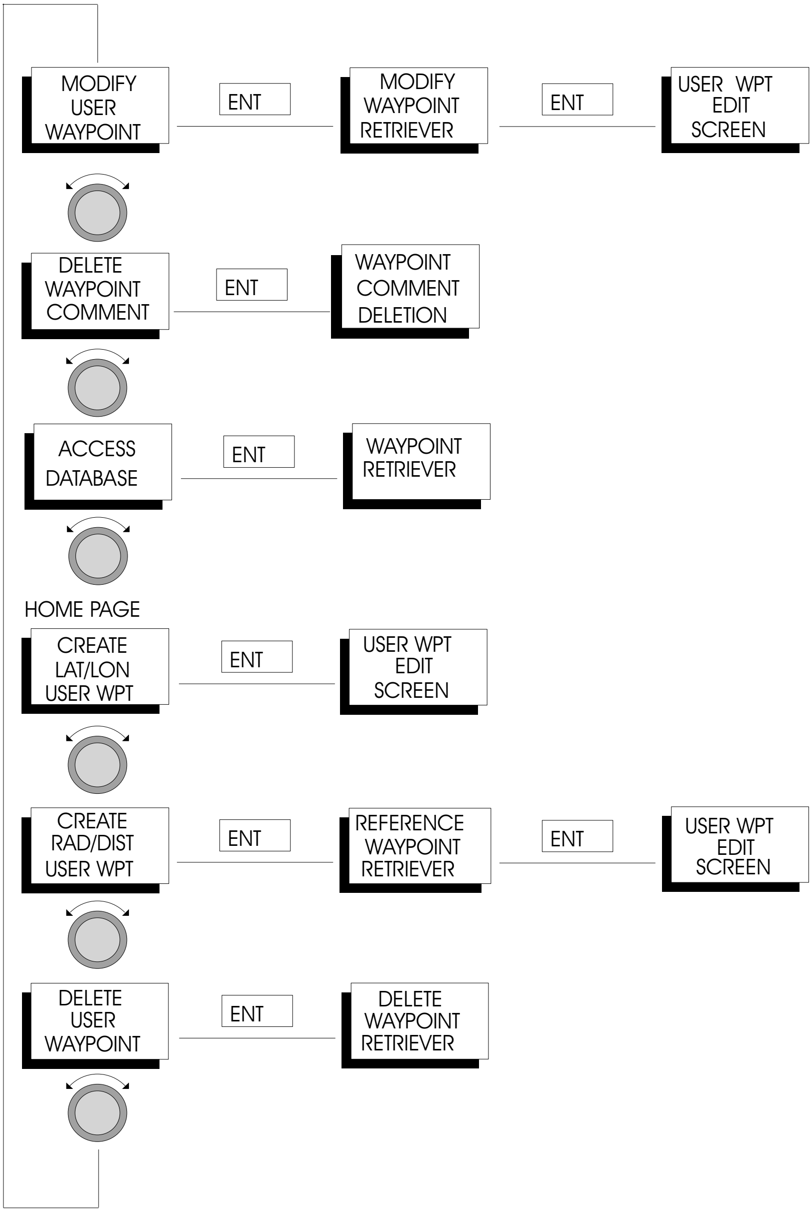
Database mode is used to access, modify, create, and delete waypoints and waypoint information. Airport, VOR, NDB, and Intersection waypoints are stored on the data card, and accessed in DB mode. These waypoints, and information on these waypoints, may not be changed or deleted. User waypoints and information on User waypoints are stored in the Navigation Management Computer (NMC), not on the data card.

The Waypoint Retriever is used to access waypoints. Use of the Waypoint Retriever is consistent in all six modes, and is used whenever you need to display a waypoint.

User waypoints are created in DB mode by directly entering the Latitude/Longitude, creating the waypoint at the location of the waypoint, or by entering the radial and distance from another waypoint.

Database Mode (continued)

The figure below illustrates the organization of Database mode.



Databases

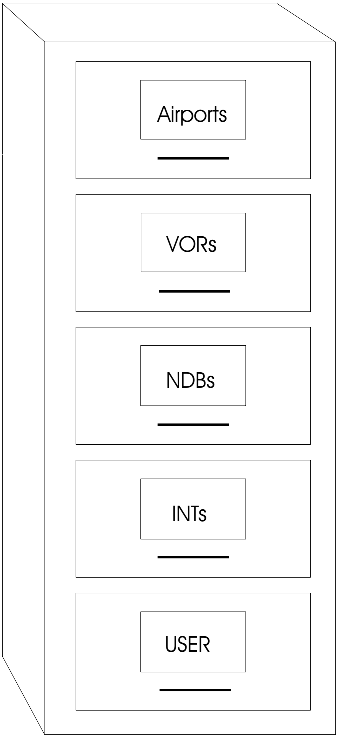
Database mode (DB mode) is used to access and display waypoints stored in databases. The datacard stores four databases—Airports, VORs, NDB's, and Intersections (INT). The NMC (Nav Management Computer) stores User waypoints. It is useful to think of these databases as "drawers" in an electronic "file cabinet." Each drawer contains "folders," and each folder represents a *waypoint*, a specific location on the earth. All databases store waypoints according to identifier in alphanumeric order. You may only edit (change) the contents of the User database.

Airport Database

These databases (drawers) contain Airports. A "folder" is maintained for every public-use airport located in the datacard coverage area. Additional information, such as available runways and frequencies, is included for each waypoint.

VOR/NDB/Intersection Databases

These databases (drawers) contain a "folder" for every VOR, NDB, and Intersection located in the datacard coverage area. Additional information, such as the frequency and facility name of each VOR and NDB, is included.



User Database

When your new NMC leaves the factory, the User database is empty. You may create, delete, and edit (change) waypoints in the User database. You may also enter a runway length for each User waypoint.

Database Information

Datacards are inserted in the slot below the knobs and buttons. A datacard may be inserted while the unit is off, or when powered-up. When a datacard is removed and stored, be sure to keep it free from moisture and dust. With a datacard installed, the Nav Management Computer (NMC) can access information about Airports, VORs, NDBs, and Intersections (INT). Other information used by the NMC includes: Airspace, Magnetic Variation, and non-precision approach data. User waypoints and waypoint comments you enter are stored in the NMC.

Database information may include:

Airport Database

- Identifier
- Facility Name
- Distance from your present position
- Waypoint Elevation
- Available runways
- Available instrument approaches (ILS, LOC, etc.)
- Latitude/Longitude
- City, State, and Country
- Bearing from your present position
- Any special use airspace area, such as a Class B airspace, the waypoint is located in or beneath
- Availability of Avgas/Jet fuel
- Runway Surface
- Runway Lighting
- Frequencies
  - Tower
  - Ground
  - Instrument Approach
  - Clearance Delivery
  - MULTICOM
  - CTAF
  - ATIS
  - Departure/Approach Control
  - UNICOM

VOR/NDB/INT (Intersection) Databases

Identifier

Name

City, State, Country

Frequency of VOR or NDB

Bearing from your
from your present position

Distance from your
present position

Latitude/Longitude

User Database

Identifier

Bearing from your
your present position

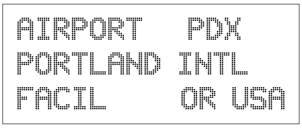
Distance from your
present position

User defined runway length

Waypoint Latitude/Longitude

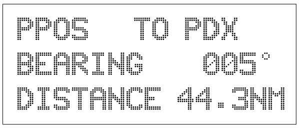
Database Displays

In any mode, information about a displayed waypoint may be shown by pressing the **INFO** button, and turning the **Small** knob. Below are examples of the information pages for the waypoint PDX (Portland International airport).



```
AIRPORT   PDX
PORTLAND INTL
FACIL     OR USA
```

PDX airport facility name is
Portland International,
located in Oregon, USA.

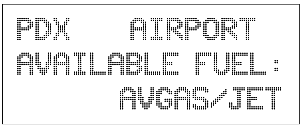


```
PPOS   TO PDX
BEARING    005°
DISTANCE 44.3NM
```

Present position to PDX.
Bearing To PDX is 005°.
Distance to PDX is 44.3 nm.

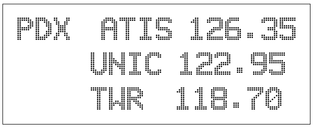
```
PDX   AIRPORT
PUBLIC
    ELEV    27FT
```

Portland
airport is public use.
Elevation is 27 ft above sea level.



```
PDX    AIRPORT
AVAILABLE FUEL:
       AVGAS/JET
```

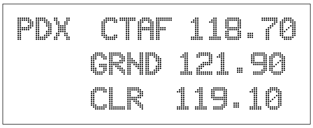
Portland Airport
Fuel available is
Aviation Gas and Jet Fuel.



```
PDX  ATIS 126.35
     UNIC 122.95
     TWR  118.70
```

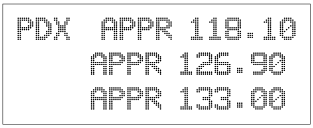
ATIS frequency is 128.35.
Unicom frequency is 122.95.
Tower frequency is 118.70.

Database Displays (continued)



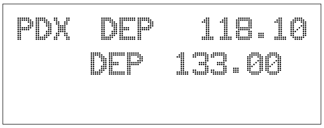
```
PDX  CTAF 118.70
    GRND 121.90
    CLR  119.10
```

CTAF frequency is 118.70.
Ground control frequency is 121.90.
Clearance delivery frequency is 119.10.



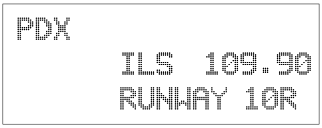
```
PDX  APPR 118.10
    APPR 126.90
    APPR 133.00
```

Approach frequency is 118.10.
Approach frequency is 126.90.
Approach frequency is 133.00.



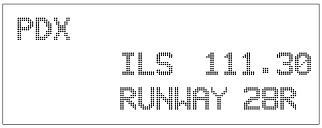
```
PDX  DEP   118.10
    DEP  133.00
```

Departure frequency is 118.10.
Departure frequency is 133.00.



```
PDX
       ILS  109.90
       RUNWAY 10R
```

ILS frequency is 109.90.
Runway 10R



```
PDX
       ILS  111.30
       RUNWAY 28R
```

ILS frequency is 111.30.
Runway 28R

```
PDX
       LOC  109.90
       RUNWAY 28R
```

LOC frequency is 108.90.
Runway 20

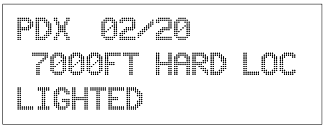
Database Displays (continued)

```
PDX  10R/28L
11000FT HARD  ILS
LIGHTED
```

PDX runway 10R/28L.
11,000 feet long with a hard surface and ILS.
The runway is lighted.

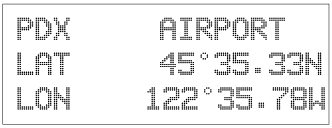
```
PDX  10L/28R
 8000FT HARD ILS
LIGHTED
```

PDX runway 10L/28R
8,000 ft long with a hard surface and ILS.
The runway is lighted.



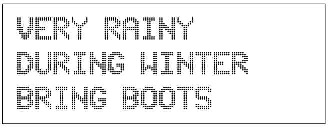
```
PDX  02/20
 7000FT HARD LOC
LIGHTED
```

PDX runway 02/20
7000 feet long with a hard surface and LOC.
The runway is lighted.



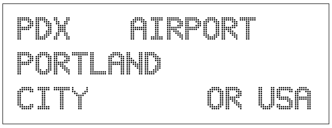
```
PDX      AIRPORT
LAT      45°35.33N
LON     122°35.78W
```

PDX latitude/longitude in degrees, minutes, and hundredths of minutes.
45^{o}35.33 North, 122^{o}35.78 West.



```
VERY RAINY
DURING WINTER
BRING BOOTS
```

Waypoint comment has been entered.



```
PDX    AIRPORT
PORTLAND
CITY        OR USA
```

PDX is an airport,
located in Portland,
Oregon, USA.

DB Mode Procedures

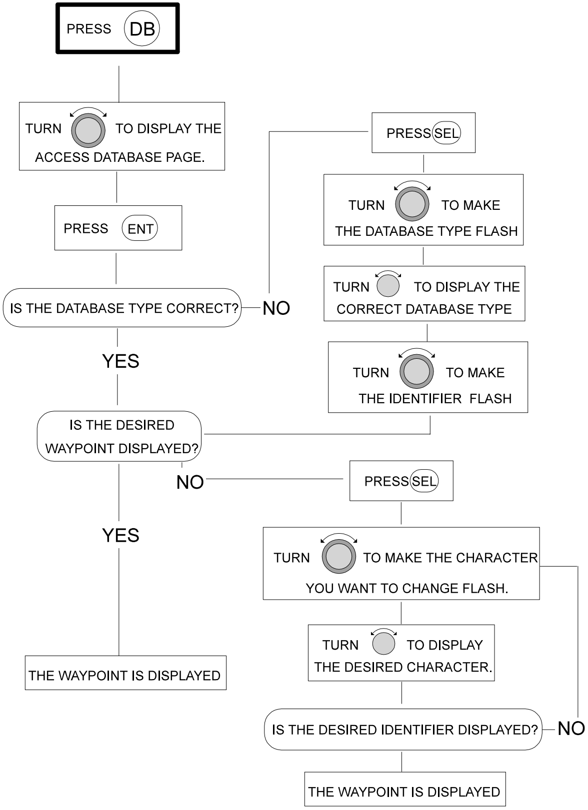
Retrieving a Waypoint

These procedures are used to display a waypoint using the Waypoint Retriever. Waypoints may be retrieved (displayed) by searching according to identifier, city name, or facility name. Before retrieving a waypoint, be sure the data card is inserted in the data card slot.

Once the waypoint is displayed—

> If you want to navigate directly to the waypoint, press **DIRECT-TO**, then **NAV.**
>
> To display information about the waypoint, press **INFO**, and turn the Small knob to view the information displays. To exit the information function, press **INFO** again. The Mode annunciator flashes while the information function is active.
>
> To exit without entering any changes, press any mode button

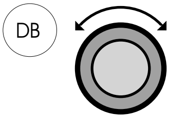
Waypoint Retrieval by Identifier



Waypoint Retrieval by Identifier (continued)

Action **Explanation**

1.



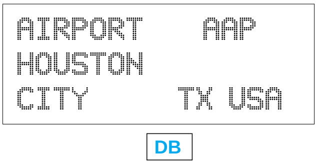
In DB mode, turn the **Large** knob to display the Access Database page.

```
ACCESS DATABASE

   PRESS ENT
```

DB

2.

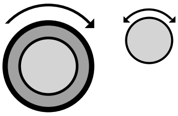
Pressing **ENT** activates the Waypoint Retriever.



```
AIRPORT     AAP
HOUSTON
CITY       TX USA
```

DB

3.



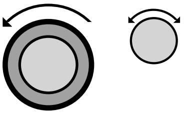
Turn the **Large** knob to make the database type flash. Turn the **Small** knob to display the desired database.

```
VOR       ABA
ARUBA
FACIL      ANTILL
```

DB

Waypoint Retrieval by Identifier (continued)

4.

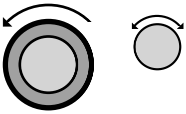


Turn the **Large** knob to make the identifier flash. Turn the **Small** knob to display the desired character. As you turn the **Small** knob, the remaining characters in the identifier also change because the NMC only displays waypoints that exist.

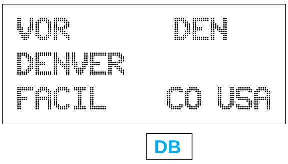
```
VOR        DAG
DAGGET
FACIL      CA USA
```

DB

5.



Turn the **Large** knob to make the next character in the waypoint identifier flash. Turn the **Small** knob to choose the character. Repeat to choose the remaining character(s) in the identifier. The desired waypoint is displayed.



```
VOR         DEN
DENVER
FACIL      CO USA
```

DB

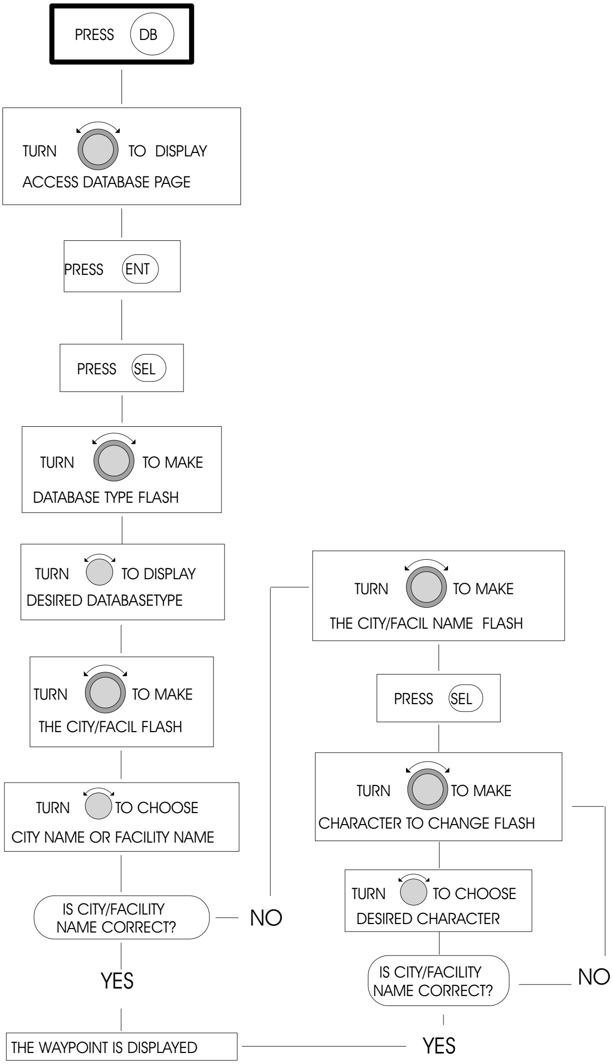
Note

If you see “DUP”on the 3rd line, there are duplicate facilities with the same identifier. Press ***SEL*** *and use the* ***Small*** *knob to view duplicates.*

Retrieving a Waypoint by City/Facility Name

The following procedure is used to retrieve a waypoint by the name of the city in which it is located, or by the name of the waypoint facility. For example, if you did not know the identifier for McNary Field in Salem, Oregon is SLE, you could display the waypoint by searching for the city name, Salem, or by searching for the facility name, McNary Fld. VORs, NDBs, and Intersections do not have city names.

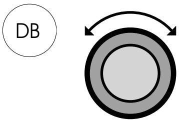
Flow Chart



Retrieving A Waypoint By City\Facility Name (continued)

Action **Explanation**

1.

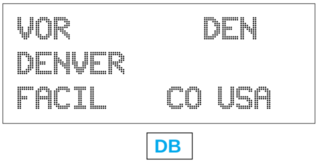


In DB mode, turn the **Large** knob to display the Access Database Page.

```
ACCESS DATABASE

   PRESS ENT
```

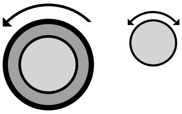
2.

Pressing **ENT** activates the Waypoint Retriever.



```
VOR            DEN
DENVER
FACIL       CO USA
```

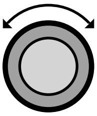
3.



Turn the **Large** knob to make the database type flash. Turn the **Small** knob to display the desired database.

```
AIRPORT        AAP
HOUSTON
CITY         TX USA
```

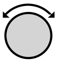
4.



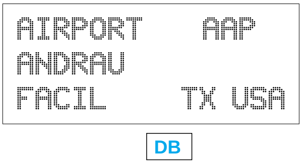
Turn the **Large** knob to make the Facility/City designator flash.

```
AIRPORT        AAP
HOUSTON
CITY         TX USA
```

5.

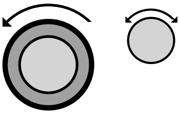


Turn the **Small** knob to display the desired search type — CITY, or FACIL (Facility).



```
AIRPORT    AAP
ANDRAU
FACIL     TX USA
```

6.



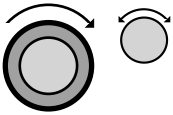
Turn the **Large** knob to make the City/Facility name flash. Turn the **Small** knob to display the desired character.

```
AIRPORT    Q89
MACGILLIVRAY
FACIL     CA USA
```

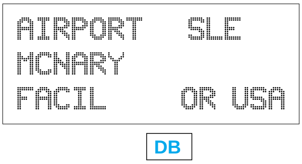
Note

*When you press **SEL** a second time, the selected field will flash. Turn the Small knob to scroll through all items similar to the selected characters. For instance, if you had selected "M" for the first character and "E" as the second character, turning the Small knob will scroll through all names that start with "ME."*

7.



Turn the **Large** knob to make the next character flash. Turn the **Small** knob to choose the character. Repeat to choose the remaining character(s) in the city/facility name. The desired waypoint is displayed.



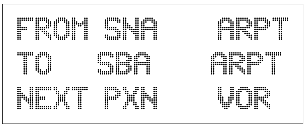
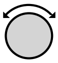
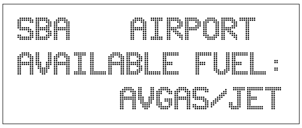
```
AIRPORT   SLE
MCNARY
FACIL     OR USA
```

Waypoint Information and Comments

These procedures are used to display information and personal comments on waypoints. Waypoint information is stored on the data card, and can not be changed. Comments you create are stored in the NMC, and may be edited and deleted. A comment may be entered on any waypoint in any database; however the maximum number of comments that may be stored is 200. To add a new comment once 200 comments have been entered, a previously entered comment must be deleted.

Displaying Waypoint Information

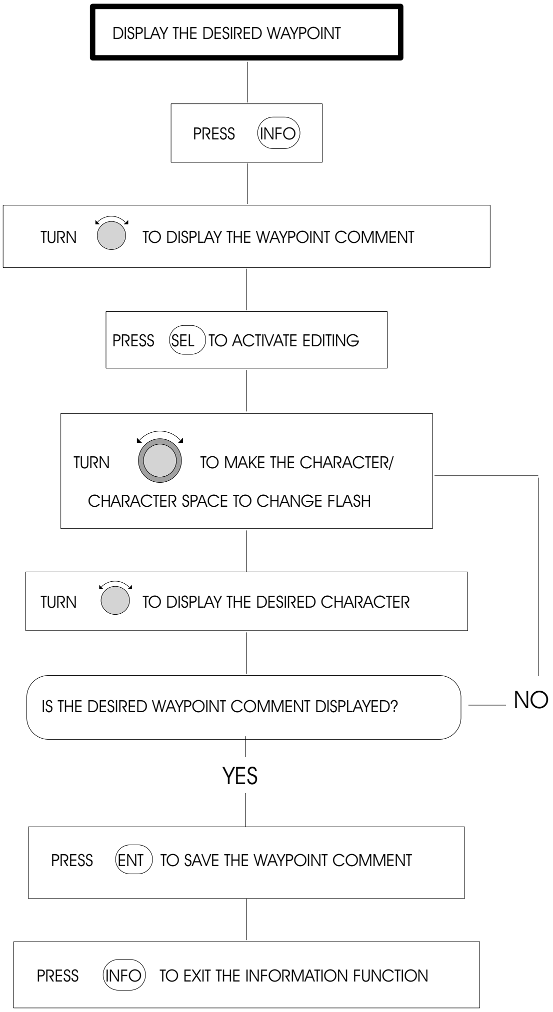
The following procedure is used to display waypoint information stored on a data card. When in NAV mode, pressing **INFO** displays information about the *To* waypoint. In FPL mode, pressing **INFO** displays information about the *To* waypoint for the active leg. In EMRG mode or DB mode, pressing **INFO** displays information about the displayed waypoint. When the INFO function is active, you may scroll through the available information displays on a waypoint by turning the **Small** knob. The mode annunciator flashes when the INFO function is active. In all cases, pressing **INFO** again exits the INFO function.

Action	**Explanation**
1. Display the desired waypoint. NAV INFO	In any mode, display the desired waypoint. NAV mode is used in the following example. Any Nav page may be displayed. Pressing **INFO** in NAV mode displays information on the *To* waypoint.  FROM SNA ARPT TO SBA ARPT NEXT PXN VOR NAV
2.  INFO	Turn the **Small** knob to scroll through the available information displays. Pressing **INFO** again exits the information function.  SBA AIRPORT AVAILABLE FUEL: AVGAS/JET NAV

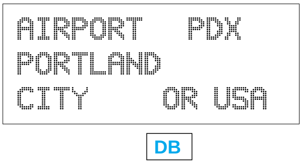
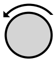
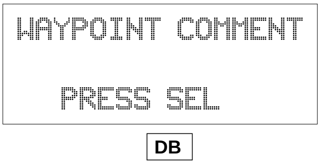
Entering/Editing Waypoint Comments

The following procedure is used to enter or edit a waypoint comment. A waypoint comment is a message you compose. A comment may be entered on any waypoint in any database; however, the NMC stores a maximum of 200 comments.

Flow Chart



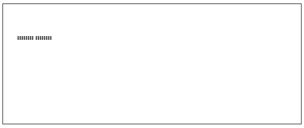
Entering/Editing Waypoint Comments (continued)

Action	Explanation
1. Display the desired waypoint.	In any mode, display the desired waypoint. In this example, PDX (Portland International) is displayed in DB mode.  AIRPORT PDX PORTLAND CITY OR USA DB
2.  	Pressing **INFO** activates the information function.  PDX AIRPORT PORTLAND INTL FACIL OR USA DB
3. 	Turn the **Small** knob to display the waypoint comment page. If a comment on the waypoint has previously been entered, the comment appears instead of the display below.  WAYPOINT COMMENT PRESS SEL DB

Entering/Editing Waypoint Comments (continued)

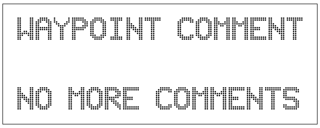
4. SEL

Pressing **SEL** activates comment editing. If a comment on the waypoint has already been entered, the comment appears, and the first character is flashing. If you create a new comment, a flashing cursor appears on an otherwise blank display.



DB

If the NMC is already storing the maximum of 200 comments, the display below appears. You must delete a comment to make room for a new comment.

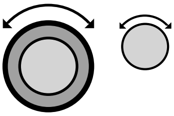


WAYPOINT COMMENT

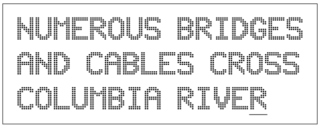
NO MORE COMMENTS

DB

5.



Turn the **Large** knob to move the cursor, and turn the **Small** knob to choose characters.



NUMEROUS BRIDGES
AND CABLES CROSS
COLUMBIA RIVER

DB

6. ENT

INFO

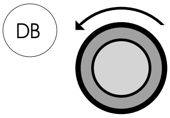
Pressing **ENT** saves the waypoint comment. Press **INFO** to exit the information function.

Deleting a Waypoint Comment

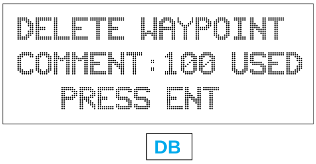
The following procedure is used to delete a waypoint comment. The NMC will store a maximum of 200 comments. Once 200 comments have been entered, you must delete an existing comment to make room for a new comment.

Action **Explanation**

1.



In DB mode, turn the **Large** knob to display the Delete Waypoint Comment page. The display shows the number of waypoint comments currently entered.

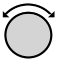

DELETE WAYPOINT
COMMENT:100 USED
PRESS ENT

2.

Pressing **ENT** activates the Delete Waypoint Comment function. The top line shows the identifier and database of the associated waypoint. The middle and bottom lines display the first 2 lines of the waypoint comment.


AVX AIRPORT
GREAT PLACE TO
SCUBA DIVE

3.



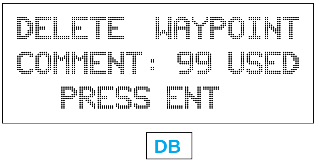
Turn the **Small** knob to scroll to the comment to be deleted. The comments are displayed in alphanumeric order according to identifier.


ONP AIRPORT
FINE SEAFOOD
NORTH END OF BAY

Deleting a Waypoint Comment (continued)

4. ENT

Pressing **ENT** deletes the displayed waypoint comment. Pressing any mode button instead of **ENT** exits the Delete Waypoint Comment function without deleting a comment.



```
DELETE  WAYPOINT
COMMENT: 99 USED
   PRESS ENT
```

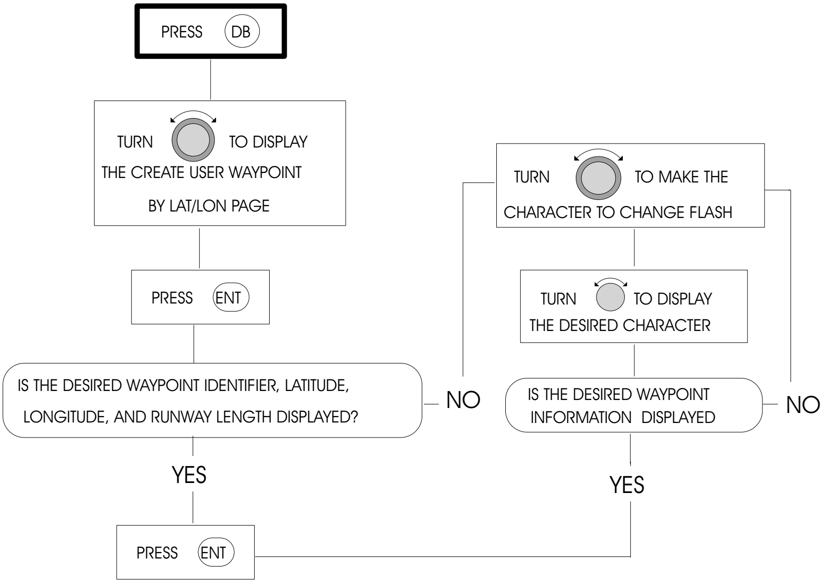
User Waypoints

User waypoints are waypoints entered and named by you. You may create a User waypoint at any location by entering Latitude/Longitude coordinates, or by entering the radial/distance from another waypoint. If you create a User waypoint by entering a radial/distance, the NMC will calculate the Latitude/Longitude of the waypoint. **You should understand the use of the Waypoint Retriever before executing procedures in this section. The waypoint Retriever is described in DB Mode Procedures, "Retrieving a Waypoint" on page 115.**

Creating a User Waypoint by Latitude/Longitude

The following procedure is used to create a User waypoint by entering latitude/longitude coordinates. If there are already 500 User waypoints, you must delete a previously entered User waypoint to make room for a new waypoint. For more information, refer to Operations, *Deleting a User Waypoint.*

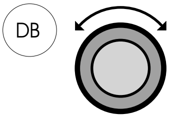
Flow Chart



Creating a User Waypoint by Latitude/Longitude (continued)

Action **Explanation**

1.



In DB mode, turn the **Large** knob to display the Create User Waypoint by Lat/Lon page.

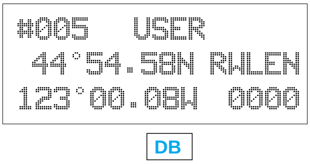
```
CREATE USER WPT
  BY LAT/LON
   PRESS ENT
```

If the maximum of 500 User waypoints already exist, the display below appears, and you must delete a User waypoint before you may create a new waypoint.

```
CREATE USER WPT
  BY LAT/LON
  DATABASE FULL
```

2.

Pressing the **ENT** button displays an open User waypoint page. The waypoint identifier defaults to the next unused numerical identifier (from #000 to #499). The latitude and longitude default to the present position, and the runway length defaults to 0000'.



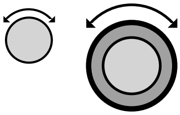
```
#005   USER
 44°54.58N RWLEN
123°00.08W  0000
```

Creating a User Waypoint by Latitude/Longitude (cont'd)

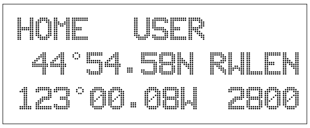
Hint

*If you want to quickly establish a waypoint as you fly over a position, you may choose to accept the automatically assigned numerical identifier instead of naming the waypoint. Pressing **ENT** at this point in the procedure eliminates the need to execute steps 3 and 4.*

3.



Turn the Small knob to display the desired character. Turn the Large knob to make the next character you want to change flash. Repeat to edit the identifier, Latitude, longitude, and the runway length. The identifier may contain up to six characters. When a waypoint is created at the location of the waypoint, it is not necessary to edit the position coordinates (Latitude/Longitude).



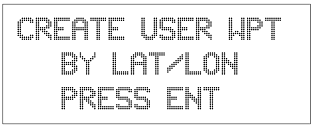
```
HOME    USER
 44°54.58N RWLEN
123°00.08W  2800
```

DB

4.

ENT

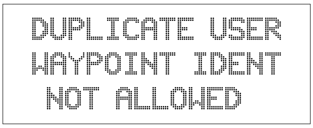
Press **ENT** to store the waypoint in memory.



```
CREATE USER WPT
   BY LAT/LON
   PRESS ENT
```

DB

If a duplicate identifier is entered, the display below appears for approximately 3 seconds. The NMC then displays the waypoint editing page so you can change the identifier.

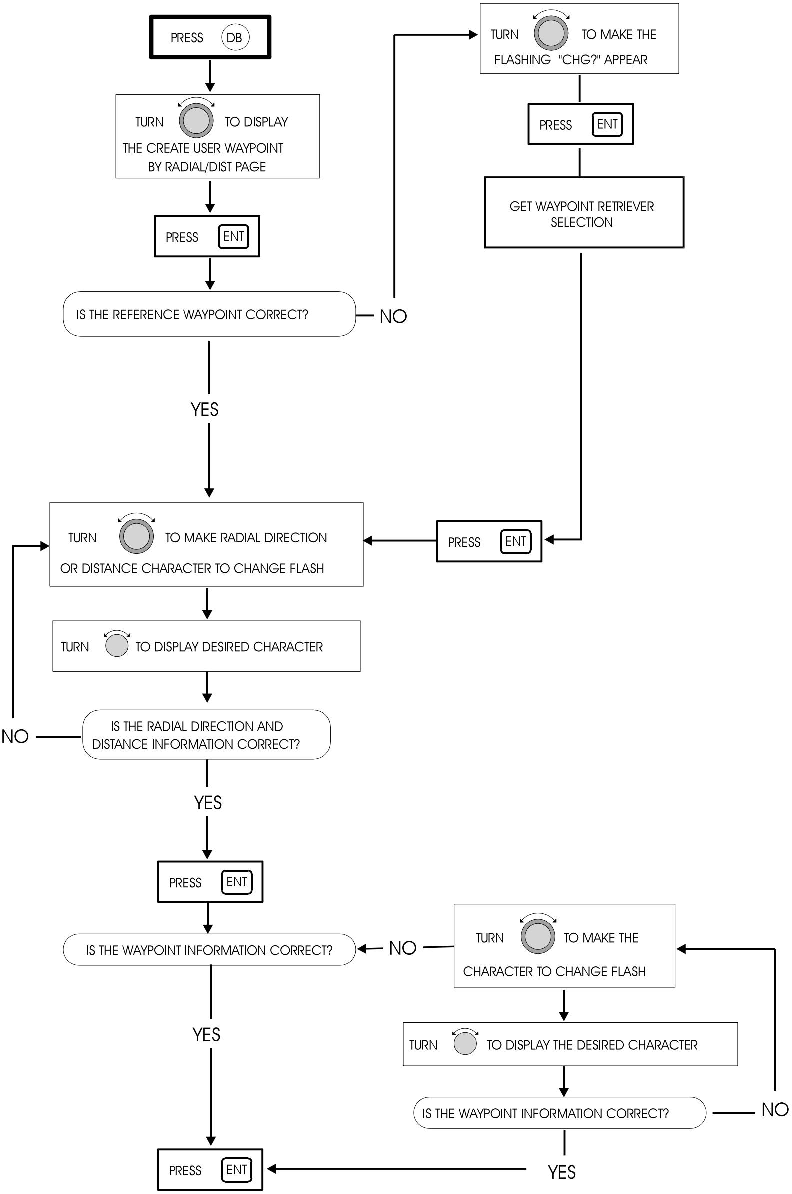


```
 DUPLICATE USER
 WAYPOINT IDENT
  NOT ALLOWED
```

DB

Creating a User Waypoint by Radial/Distance

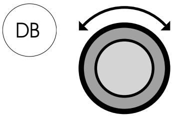
The NMC allows you to create User waypoints by specifying the radial and distance from an existing waypoint. This reference waypoint may be in any database, including the User database. Do not "chain" radial/distance waypoints. If you create a waypoint by radial/distance using another radial/distance waypoint as the reference point, position errors caused by rounding or conversion are cumulative.



Creating a User Waypoint by Radial/Distance (continued)

Action | **Explanation**

1.



In DB mode, turn the **Large** knob to display the Create User Waypoint By Radial/Dist page.

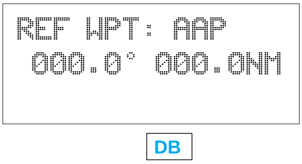

CREATE USER WPT
BY RADIAL/DIST
PRESS ENT

If the maximum of 500 User waypoints already exist, the display below appears, and you must delete a User waypoint before you may create a new waypoint.


CREATE USER WPT
BY RADIAL/DIST
PRESS ENT

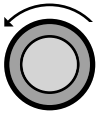
2.

Pressing **ENT** displays the Reference Waypoint Entry page. If the desired reference waypoint identifier is displayed, skip to step 8.

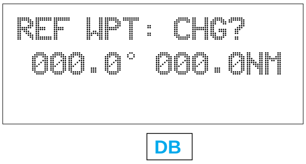

REF WPT: AAP
000.0° 000.0NM

Creating a User Waypoint by Radial/Distance (continued)

3.



Turn the **Large** knob so that “CHG?” flashes in place of the reference waypoint identifier.

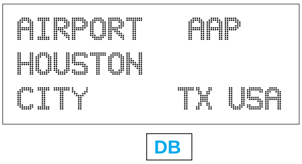


```
REF WPT: CHG?
 000.0° 000.0NM
```

DB

4.

Pressing **ENT** activates the Waypoint Retriever.

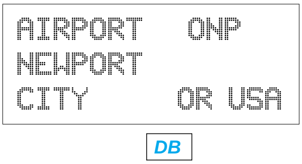


```
AIRPORT   AAP
HOUSTON
CITY     TX USA
```

DB

5. Display the desired waypoint.

Use the Waypoint Retriever to display the desired waypoint. The Waypoint Retriever is described in Operations, *Retrieving a Waypoint.*

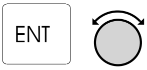


```
AIRPORT   ONP
NEWPORT
CITY     OR USA
```

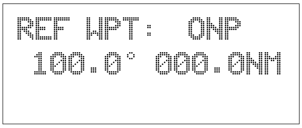
DB

Creating a User Waypoint by Radial/Distance (continued)

8.



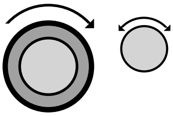
Pressing **ENT** enters the displayed waypoint as the reference waypoint, and displays the Reference Waypoint page. Turn the **Small** knob to choose the first radial value number.



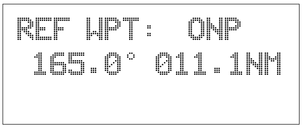
```
REF WPT:  ONP
 100.0° 000.0NM
```

DB

9.



Use the **Large** and **Small** knobs to choose the remaining numbers in the radial and distance values.

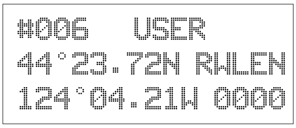


```
REF WPT:  ONP
 165.0° 011.1NM
```

DB

10.

Pressing **ENT** enters the displayed Radial/Distance values. The NMC calculates the latitude/longitude, and displays the User Waypoint Edit page.

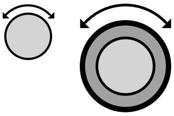


```
#006   USER
44°23.72N RWLEN
124°04.21W 0000
```

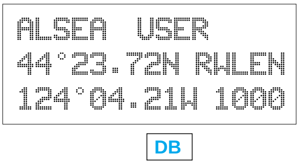
DB

Creating a User Waypoint by Radial/Distance (continued)

11.



Turn the **Small** knob to display the desired character. Turn the **Large** knob to make the next character you want to change flash. Repeat as necessary to edit the identifier, latitude, longitude, and the runway length. The identifier may contain a maximum of six characters.

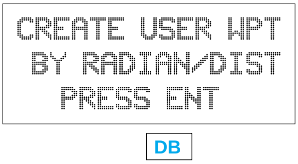


```
ALSEA  USER
44°23.72N RWLEN
124°04.21W 1000
```

DB

12.

Press **ENT** to store the waypoint in memory.



```
CREATE USER WPT
 BY RADIAN/DIST
   PRESS ENT
```

DB

If a duplicate identifier is entered, the display below appears for approximately 3 seconds. The NMC then displays the waypoint editing page so you can change the identifier.

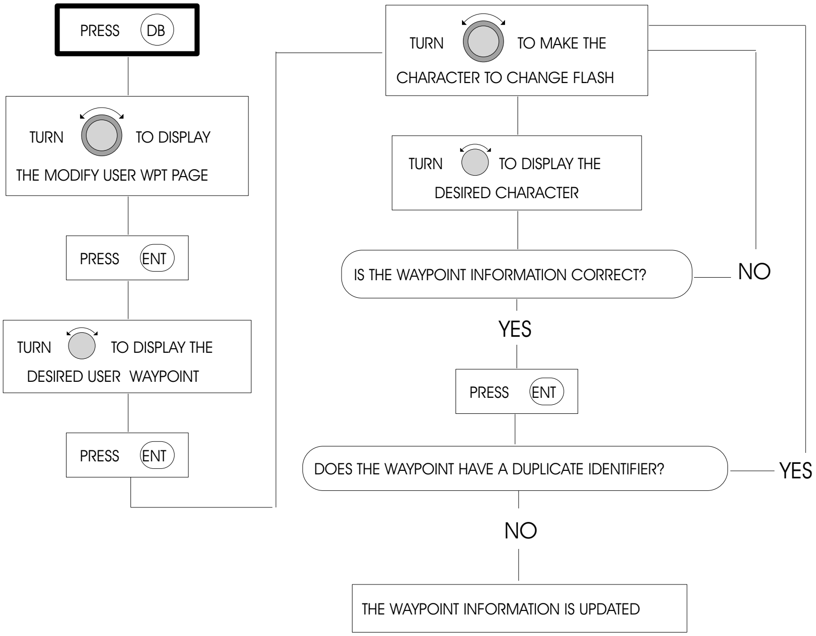
```
DUPLICATE USER
WAYPOINT IDENT
 NOT ALLOWED
```

DB

Editing a User Waypoint

The following procedure is used to change the identifier, latitude/longitude coordinates, or runway length of an existing User waypoint.

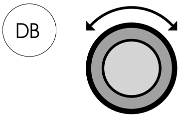
Flow Chart



Editing a User Waypoint (continued)

Action **Explanation**

1.



In DB mode, turn the **Large** knob to display the Modify User Waypoint page.

```
MODIFY USER WPT

   PRESS ENT
```

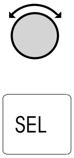
DB

If there are no User waypoints stored, the display below appears.

```
MODIFY USER WPT

 DATABASE EMPTY
```

DB

2.



The NMC displays the Find Waypoint to Modify page. Turn the **Small** knob to display the desired waypoint. If desired, you may press **SEL** to activate character editing to display the waypoint; however, this is generally unnecessary unless there are a large number of User waypoints.

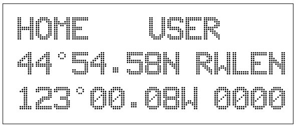
```
FIND WPT TO MOD
HOME     USER
   PRESS ENT
```

DB

Editing a User Waypoint (continued)

3. ENT

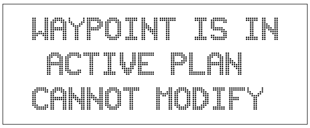
Pressing **ENT** retrieves the waypoint, and activates editing.



```
HOME     USER
44°54.58N RWLEN
123°00.08W 0000
```

DB

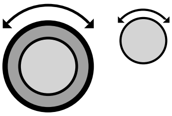
If the waypoint is in the Active flight plan, it cannot be modified, and the display below appears for approximately 3 seconds. The Find Waypoint to Modify page is then displayed.



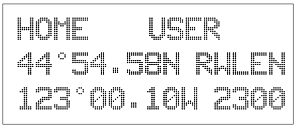
```
WAYPOINT IS IN
 ACTIVE PLAN
CANNOT MODIFY
```

DB

4.



Use the **Large** and **Small** knobs as necessary to edit the identifier, Latitude/Longitude, and runway length.



```
HOME     USER
44°54.58N RWLEN
123°00.10W 2300
```

DB

Editing a User Waypoint (continued)

5. ENT

Press **ENT** to save the changes. If the waypoint is in an inactive flight plan, the display below appears for approximately 3 seconds.


WAYPOINT IS IN
AN INACTIVE PLAN

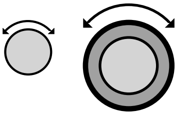
DB

After 3 seconds, or if the waypoint is not in a flight plan, the display below appears.


MODIFY USER WPT

PRESS ENT

DB



If a duplicate identifier is entered, the display below appears for approximately 3 seconds. The NMC then returns to the waypoint editing page so you can change the identifier using the **Small** and **Large** knobs.


DUPLICATE USER
WAYPOINT IDENT
NOT ALLOWED

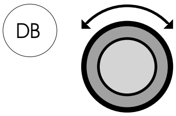
DB

Deleting a User Waypoint

The following procedure is used to delete a User waypoint. This may be necessary to make room for a new User waypoint.

Action **Explanation**

1.



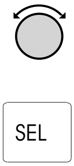
In DB mode, turn the **Large** knob to display the Delete User Waypoint page.

```
DELETE USER WPT

   PRESS ENT
```

If there are no User waypoints stored, the display below appears.

```
DELETE USER WPT

 DATABASE EMPTY
```

2.



The NMC displays the Find Waypoint to Delete page. Turn the **Small** knob to display the desired waypoint. If desired, you may press **SEL** to activate character editing to display the waypoint; however, this is generally unnecessary unless there are a large number of User waypoints.

```
FIND WPT TO MOD
HOME       USER
   PRESS ENT
```

Deleting a User Waypoint (continued)

3. ENT

Pressing **ENT** deletes the waypoint. Pressing any mode button instead of **ENT** exits this function without deleting a waypoint.

DELETE USER WPT

PRESS ENT

The NMC will not delete any User waypoint included in a flight plan. If this is attempted, the following display appears for approximately 3 seconds. The NMC then displays the Find Waypoint to Delete page.

WAYPOINT IS IN A
FLIGHT PLAN
CANNOT DELETE

FPL (Flight Plan) Mode

Flight plans are specific routes between waypoints you may store in the NMC's memory. The NMC uses this information to calculate useful flight statistics.

Flight Plan mode allows you to have up to 30 stored flight plans. Twentynine of these flight plans are Inactive, waiting to be used at any time for navigation. Each flight plan may have up to 20 legs.

The Active flight plan is always used for the current flight. Inactive flight plans may be activated in Flight Plan mode to become the Active flight plan.

Flight Plan Leg pages display *From* and *To* waypoint identifiers on the top line of the display screen. The leg number which is being displayed is shown first on the second line, along with the bearing and distance between the *From* and *To* waypoints. One asterisk (*) next to the leg number means that the displayed leg is in the Active flight plan. Two asterisks (**) means that the displayed leg shows the current *From* and *To* waypoints which are being used for navigation.

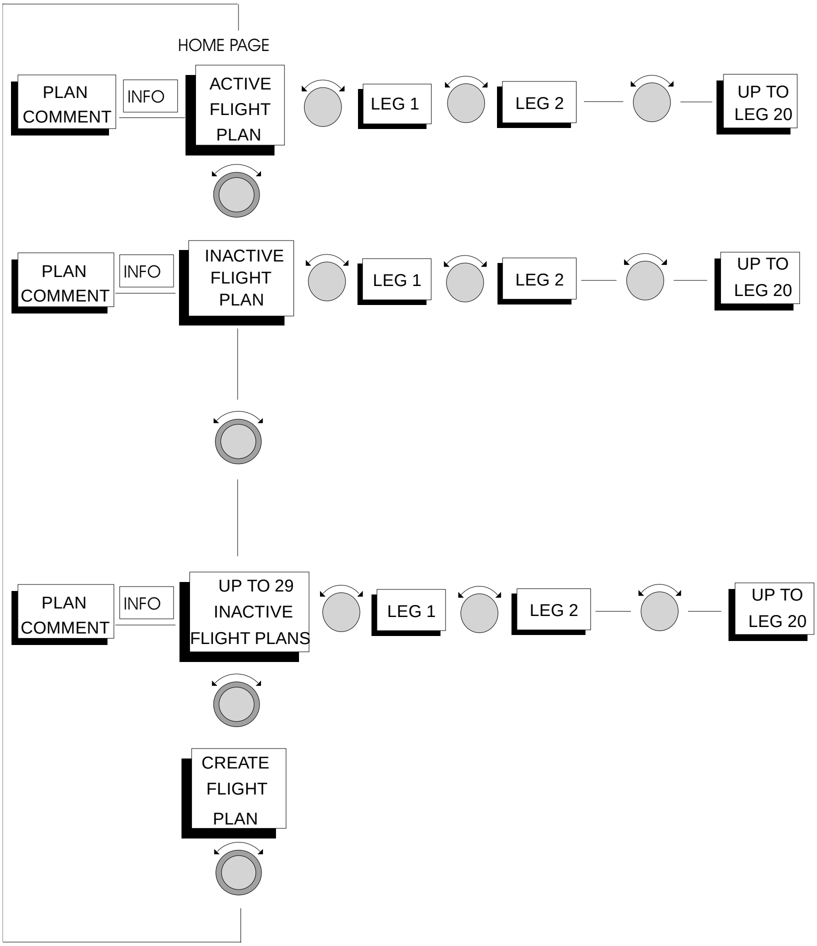
The third line of the Flight Plan Leg pages shows Leg Information. This information may be customized to display one of several types of information related to the displayed flight plan leg (see *Leg Info Options*).

An approach, when loaded, is a sequence of waypoints. The approach waypoints start at an Initial Approach Fix (IAF) and end at a Missed Approach Holding Point (MAHP). The approach is inserted into the active flight plan and replaces the destination airport.

Note

☞ *When an approach is loaded, the destination airport identifier is no longer in the active flight plan. If you want to look up information for the destination airport, such as frequencies, press **FPL** twice and then press **INFO**.*

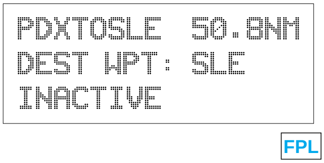
The figure below illustrates the organization of Flight Plan mode.



Flight Plan Summary Pages

The Flight Plan Summary page displays the flight plan's name, total distance, destination waypoint, and its status (Inactive, Active, or Hold). One of the Flight Plan Summary pages is used only to create a new Inactive flight plan. An example of a Flight Plan Summary page is shown below. If an approach is loaded, the destination waypoint (DEST WPT) is replaced with an approach airport (APPR APT).

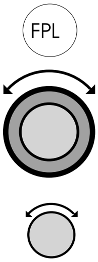
Flight Plan Summary Page



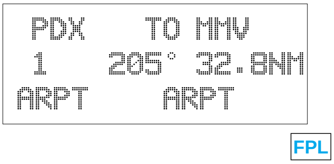
```
PDXTOSLE  50.8NM
DEST WPT: SLE
INACTIVE
```

The flight plan above is named PDXTOSLE, and the total distance of all legs in the flight plan is 50.8 nautical miles. The flight status is Inactive (not currently being used for navigation).

Action	**Explanation**



Press **FPL** to enter FLIGHT PLAN mode, then rotate the **Large** knob to display the desired Flight Plan Summary page. Turn the **Small** knob to view each of the Flight Plan legs.



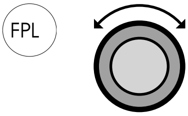
```
  PDX    TO MMV
  1    205° 32.8NM
ARPT      ARPT
```

This Flight Plan leg is from PDX to MMV (line 1). This screen shows the waypoints for Leg 1. The bearing is 205° and the range is 32.8 nm between the two waypoints (line2). The FROM waypoint, PDX, is an airport and the TO waypoint, MMV, is an airport (line 3).

Creating a Flight Plan

Action **Explanation**

1. Press **FPL** to enter FLIGHT PLAN mode, then rotate the **Large** knob to display the flight plan creation page, shown below.

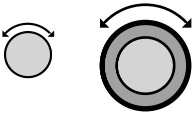


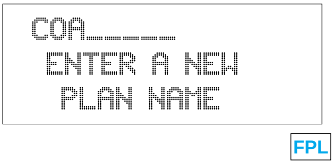

PRESS SEL TO
CREATE A NEW
FLIGHT PLAN
FPL

2. Press **SEL** to start flight plan creation. The first character position will flash.

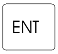

_ _ _ _ _ _ _ _
ENTER A NEW
PLAN NAME
FPL

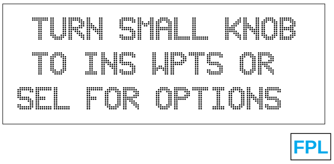
3. Turn the Small knob to choose characters. Turn the **Large** knob to move the cursor. The flight plan name may have up to eight characters.




COA_____
ENTER A NEW
PLAN NAME
FPL

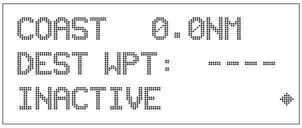
4. Press **ENT** to save the name and create a flight plan.




TURN SMALL KNOB
TO INS WPTS OR
SEL FOR OPTIONS
FPL

After about 2 seconds, the Flight Plan Summary page (shown below) will be displayed, indicating that the new Inactive flight plan has been created.

FPL



```
COAST    0.0NM
DEST WPT:  ----
INACTIVE        ◆
```

FPL

The new Inactive flight plan above is named "COAST." Since it was just created, the firs and last waypoints are blank, and the toatl flight plan distance is 0.0 nautical miles.

Inserting and Editing Flight Plan Legs

Waypoints in a flight plan may be inserted, deleted, or changed to another waypoint at any time in Flight Plan mode. In addition, the third line of the Flight Plan Leg pages may be customized to display one of several types of information.

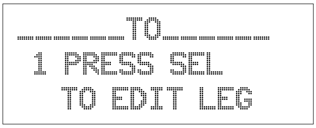
INS? allows you to insert a waypoint into the flight plan.

CHG? allows you to change an existing waypoint in the flight plan.

DEL? allows you to delete a waypoint in the flight plan.

Use the short description given previously to view the desired Flight Plan Leg page, then follow the directions below for editing the leg.

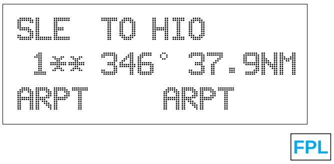
Action	Explanation
1.	The first time a waypoint is entered into a flight plan, the Flight Plan Leg page will look like this.



```
_______TO_______
 1 PRESS SEL
   TO EDIT LEG
```

FPL

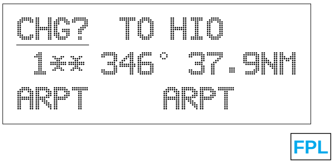
If waypoints have already been entered, the Flight Plan Leg page may be similar to this.



```
SLE   TO HIO
 1** 346° 37.9NM
ARPT     ARPT
```

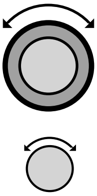
2.

Pressing **SEL** will start the cursor flashing, indicating that Flight Plan Leg page editing has begun.

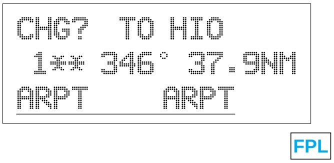


```
CHG?  TO HIO
 1** 346° 37.9NM
ARPT     ARPT
```

3.

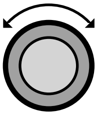


Rotate the **Large** knob to move the cursor Turn the **Small** knob to view available fields.

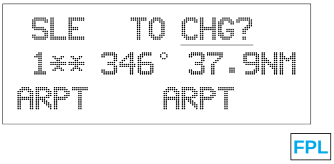


```
CHG?  TO HIO
 1** 346° 37.9NM
ARPT     ARPT
```

4.

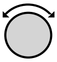


Rotate the **Large** knob to move the cursor, in this case to the *To* waypoint of the displayed leg.

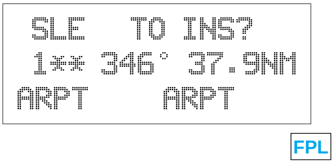


```
 SLE   TO CHG?
 1** 346° 37.9NM
ARPT     ARPT
```

5.



Rotate the **Small** knob to view the desired option where the cursor is flashing.



```
 SLE   TO INS?
 1** 346° 37.9NM
ARPT     ARPT
```

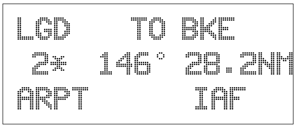
Pressing **ENT** when the correct option is flashing enters the flashing option. The meaning and handling of the flashing options are described next. Press **SEL** to stop editing.

Manually Selecting a Flight plan Leg

Approach operations often result in the need to manually select a leg of the active flight plan. Manual leg selection will often be required when operating with Radar vectors and there is the need to intercept an approach course. It may also occur when flying a DME-ARC to intercept an approach course.

1.

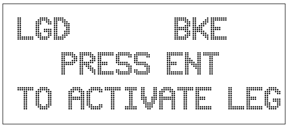
Press **FPL** twice to reach your active flight plan. Then turn the **Small** knob to display the desired leg.



```
LGD    TO BKE
 2*  146° 28.2NM
ARPT      IAF
```

2.

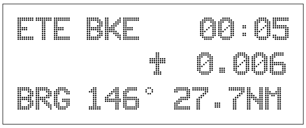
Press **ENT**.



```
LGD       BKE
   PRESS ENT
TO ACTIVATE LEG
```

3.

Press **ENT** to accept the displayed destination waypoint. The unit will then go to NAV mode.

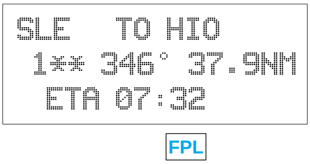


```
ETE BKE   00:05
         ↑ 0.006
BRG 146° 27.7NM
```

Updating Leg Information

The bottom line of Flight Plan Leg pages is used to display the customizable Leg Information. Several types of Leg Information may be selected for viewing, and are described next in *Leg Information Options*.

With the cursor flashing on the third line of the display screen, rotate the **Small** knob to display each of the Leg Information fields.



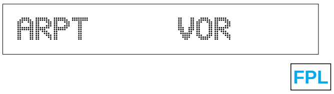
```
SLE   TO HIO
 1** 346° 37.9NM
  ETA 07:32
```

Press **ENT** when the field of your choice is flashing to make the displayed Leg Information available on each of the flight plan legs in the current flight plan.

Leg Information Options

A list of each Leg Information option, along with explanations of their meanings, is given next. The Leg Information is viewed on the third line of the displayed Flight Plan Leg page.

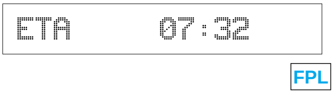
Waypoint Type



```
ARPT      VOR
```

The Waypoint Type field displays which type of waypoint each waypoint in the flight plan is. The example above shows that the From waypoint of the displayed leg is an Airport, and the To waypoint of the displayed leg is a VOR. The waypoint type option is "locked" for loaded approach waypoints so they can easily identified as "IAF, FAF, MAP, and MAHP."

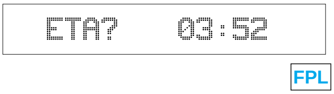
ETA



```
ETA      07:32
```

The ETA field shows the Estimated Time of Arrival at the To waypoint of the currently displayed leg of the Active flight plan only. The Active flight plan ETA uses the plane's actual ground speed, and is the ETA from the latest known position. If actual ground speed is 5 knots or less, the time is dashed (—:—).

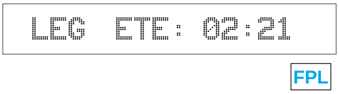
ETA?


ETA?   03:52

The ETA? field shows the Estimated Time of Arrival at the To waypoint of the currently displayed leg of the flight plan. ETA? uses the Estimated Ground Speed value (described in *Using Flight Plan Summary Options*) to figure the ETA.

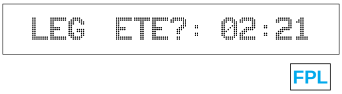
In the Active flight plan, ETA? uses the latest available position as the starting reference point. In inactive flight plans, the beginning of the flight plan is used as the starting point reference position. If the Estimated Ground Speed is 5 knots or less, the time is dashed (—:—).

LEG ETE


LEG ETE: 02:21

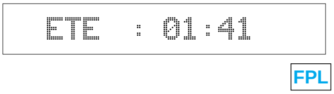
Leg ETE shows the Estimated Time En route to travel from the displayed leg’s *From* waypoint to the displayed leg’s *To* waypoint. It uses the actual ground speed for calculations, and is only available in the Active flight plan. The time is dashed (—:—) if the actual ground speed is 5 knots or less.

LEG ETE?


LEG ETE?: 02:21

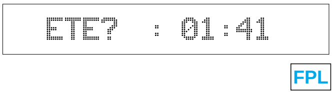
Leg ETE? shows the Estimated Time En route to travel from the displayed leg’s *From* waypoint to the displayed leg’s *To* waypoint using the Estimated Ground Speed value (described previously in Using Flight Plan Summary Options). If the Estimated Ground Speed is 5 knots or less, the time is dashed (—:—).

ETE


ETE   : 01:41

ETE shows the Estimated Time En route to the currently displayed *To* waypoint of the Active flight plan. ETE is calculated from the latest available position, and uses the actual ground speed of the aircraft. If the actual ground speed is 5 knots or less, the time is dashed (—:—).

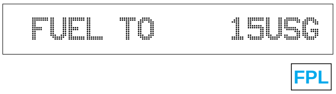
ETE?


ETE? : 01:41

The ETE? field shows the Estimated Time En route to the *To* waypoint of the currently displayed leg of the flight plan, using the Estimated Ground Speed value (described previously in *Using the Flight Plan Summary Options*) to figure the ETE.

In the Active flight plan, ETE? uses the latest available position as the starting reference point. In Inactive flight plans, the beginning of the flight plan is used as the starting point reference position. The time is dashed (—:—) if the Estimated Ground Speed is 5 knots or less.

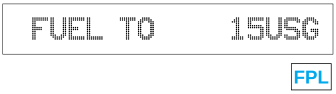
FUEL TO


FUEL TO 15USG

Fuel To is the amount of fuel which will be expended to travel from the current position to the displayed leg's *To* waypoint. Fuel To calculations require a Fuel/Air Data Sensor on NAVNET, and a ground speed greater than 20 knots in order to be valid. If not valid, the number is dashed.

The units of fuel displayed may be edited in System Mode to display in US Gallons, Imperial Gallons, Liters, Pounds of Jet Fuel A, Pounds of AvGas, Pounds of JP4, Kilos of JP4, Kilos of Jet Fuel A, or Kilos of AvGas.

FUEL TO?

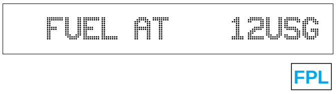

FUEL TO 15USG

Fuel To? works the same as the previous Fuel To description, except the Estimated Fuel Flow (described previously in *Using Flight Plan Summary Options*) is used as an input to the calculation.

The Active flight plan also uses the actual ground speed to calculate the Fuel To?; the Inactive flight plans use the Estimated Ground Speed value (described previously in *Using Flight Plan Summary Options*). If these inputs are not available, the number is dashed.

The units of fuel displayed may be edited in System Mode to US Gallons, Imperial Gallons, Liters, Pounds of Jet Fuel A, Pounds of AvGas, Pounds of JP4, Kilos of JP4, Kilos of Jet Fuel A, or Kilos of AvGas .

FUEL AT


FUEL AT 12USG

Fuel At is the fuel remaining at the displayed leg's *To* waypoint. Fuel At information is only available for the Active flight plan with a Fuel/Air Data Sensor installed on NAVNET, and a ground speed of greater than 20 knots. If these inputs are not available, the number is dashed.

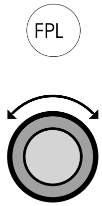
The units of fuel displayed may be edited in System Mode to US Gallons, Imperial Gallons, Liters, Pounds of Jet Fuel A, Pounds of AvGas, Pounds of JP4, Kilos of JP4, Kilos of Jet Fuel A, or Kilos of AvGas.

Using Flight Plan Comments

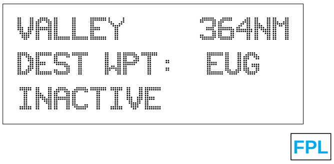
You may edit and save one screen of user-input information for each flight plan. This information is called the Flight Plan Comment, and is accessed from a Flight Plan Summary page.

Action **Explanation**

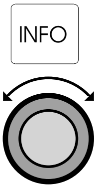
1.



Press **FPL** to enter FLIGHT PLAN mode, then rotate the **Large** knob to display the desired Flight Plan Summary page. All Flight Plan Summary pages are accessed by rotating the **Large** knob in Flight Plan mode.


VALLEY 364NM
DEST WPT: EUG
INACTIVE

2.



Press **INFO** and turn the **Large** knob CCW one position to access the user-input information for the displayed flight plan. The FPL light will begin flashing to remind you that you are accessing INFO. If the Flight Plan Comment has been entered, it will now be displayed.

If the Flight Plan Comment has not been entered for the flight plan, the following page is displayed to prompt you to press **SEL** to begin entering a Flight Plan comment.

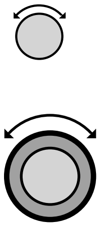

NO PLAN COMMENT

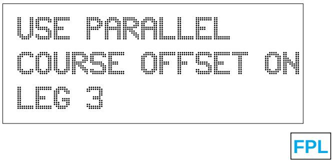
PRESS SEL

3. Press **SEL** to edit the Flight Plan Comment.

The first time the comment is edited, the screen will be cleared, as shown below, and the cursor will be flashing on the first character of the screen. Each time afterwards, pressing **SEL** will allow you to edit the previously entered Flight Plan Comment.

4. Rotate the **Small** and **Large** knobs to input characters and move the flashing cursor.

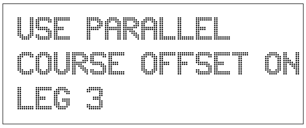



USE PARALLEL
COURSE OFFSET ON
LEG 3

5. ENT

INFO

Press **ENT** to save the Flight Plan Comment. The flashing cursor will stop, and you will be viewing the entered Flight Plan Comment. The Flight Plan light will still be flashing, indicating that you are still viewing INFO. Press **INFO** to end the Flight Plan Comment access, and to redisplay the Flight Plan Summary page.



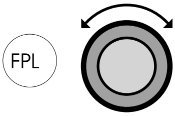
```
USE PARALLEL
COURSE OFFSET ON
LEG 3
```

FPL

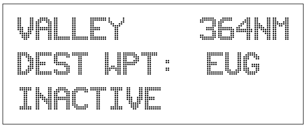
Accessing Flight Plan Summary Options

Several Flight Plan Summary Options are available to assist you in maintaining your flight plans when the Flight Plan Summary page is displayed. Shown below is a simple explanation for accessing these Flight Plan Summary Options. A more detailed explanation of the purpose of each of these options is given later.

Action **Explanation**

1. 

Press **FPL** to enter FLIGHT PLAN mode, then rotate the **Large** knob to display the desired Flight Plan Summary page.

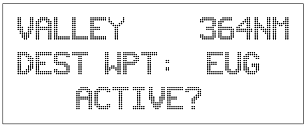


```
VALLEY      364NM
DEST WPT:   EUG
INACTIVE
```

FPL

2. SEL

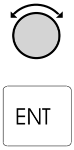
When the correct Flight Plan Summary page is displayed, press **SEL** to start the flashing cursor. The first Flight Plan Summary Option will be flashing on the bottom line of the display screen.



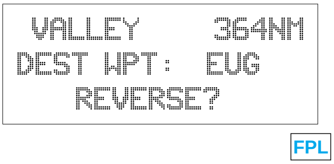
```
VALLEY      364NM
DEST WPT:   EUG
    ACTIVE?
```

FPL

3.



Rotate the **Small** knob to view all available Flight Plan Summary Options. Which options are available depend on the number of waypoints in a flight plan and the flight plan's status (Inactive, Active, or Hold). Press **ENT** to save your choice.

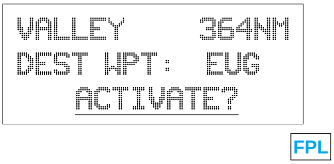


```
 VALLEY      364NM
DEST WPT:   EUG
    REVERSE?
```

Using Flight Plan Summary Options

A list of each Flight Plan Summary Option, along with explanations of their meanings, is given below.

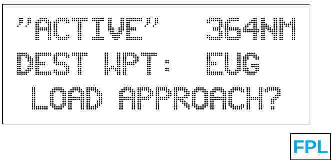
Activate?



```
VALLEY      364NM
DEST WPT:   EUG
    ACTIVATE?
```

Pressing **ENT** when "Activate?" is displayed copies the Inactive flight plan into the Active plan. The new Active flight plan is activated with the new waypoint information. Waypoint sequencing then starts from leg #1. Navigation information, such as Desired Track and CDI, uses the newly activated flight plan's waypoints. The original copy of the Inactive flight plan is not affected.

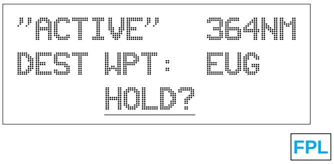
Load Approach



```
"ACTIVE"    364NM
DEST WPT:   EUG
 LOAD APPROACH?
```

Press **ENT** to select an approach for the destination airport. Select the desired approach with the **Small** knob and then press **ENT**. See the Approach Procedures section for more detailed information.

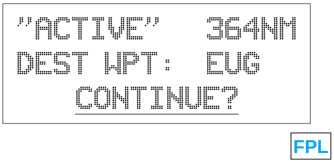
Hold?



```
"ACTIVE"   364NM
DEST WPT:  EUG
     HOLD?
```

Pressing **ENT** when “Hold?” is displayed prevents the sequencing of legs in the Active flight plan, effectively putting the Active flight plan on Hold at the current *To* waypoint. “HOLD” may also be activated in the FROM/TO/NEXT page in NAV mode or by pressing the external **OBS/HLD** button when installed.

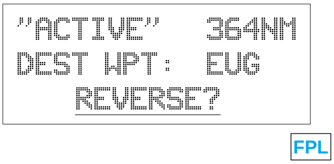
Continue?



```
"ACTIVE"   364NM
DEST WPT:  EUG
   CONTINUE?
```

Pressing **ENT** when “Continue?” is displayed releases the Active flight plan from *Hold*, allowing leg sequencing to continue beyond the current *To* waypoint.

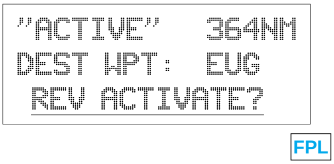
Reverse?



```
"ACTIVE"   364NM
DEST WPT:  EUG
   REVERSE?
```

Pressing **ENT** when “Reverse?” is displayed reverses the order of all waypoints in the Inactive flight plan.

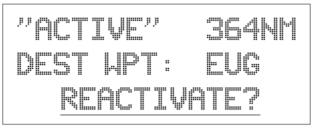
Rev Activate?



```
"ACTIVE"   364NM
DEST WPT:  EUG
 REV ACTIVATE?
```

Pressing **ENT** when “Rev Activate?” is displayed activates the Inactive or Active flight plan in reverse waypoint order. Using this option on an Inactive flight plan does not affect the original copy of the Inactive plan.

Reactivate?

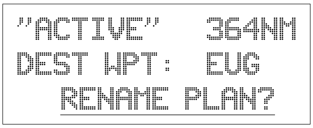


```
"ACTIVE"   364NM
DEST WPT:  EUG
  REACTIVATE?
```

FPL

Pressing **ENT** when "Reactivate?" is displayed restarts the Active flight plan, starting sequencing from leg #1.

Rename Plan?



```
"ACTIVE"   364NM
DEST WPT:  EUG
  RENAME PLAN?
```

FPL

Pressing **ENT** when "Rename Plan?" is displayed allows you to rename an Inactive flight plan. After pressing **ENT**, rotate the **Large** and **Small** knobs to rename the flight plan, then press **ENT** to save the new flight plan name.

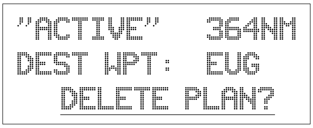
Copy Plan?

```
"ACTIVE"   364NM
DEST WPT:  EUG
  COPY PLAN?
```

FPL

Pressing **ENT** when the "Copy Plan?" option is flashing allows you to copy a flight plan's waypoints from an existing plan into the current flight plan. You can also copy a flight plan's waypoints between another NMC (when installed) and the current plan. After pressing **ENT**, rotate the **Small** knob to select the name of the flight plan containing the waypoints you wish to copy. Then, press **ENT** to copy that flight plan's waypoints into the current flight plan. The Copy Plan function is a way to save an active flight plan that has been modified under a new name.

Delete Plan?

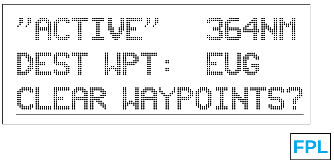


```
"ACTIVE"   364NM
DEST WPT:  EUG
  DELETE PLAN?
```

FPL

Pressing **ENT** when "Delete Plan?" is displayed deletes all of the displayed Inactive flight plan, including the flight plan's summary page. (Also see *Creating Inactive Flight Plans*).

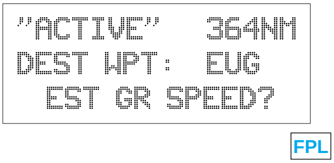
Clear Waypoints?



```
"ACTIVE"   364NM
DEST WPT:  EUG
CLEAR WAYPOINTS?
```

Pressing ENT when “Clear Waypoints?” is displayed removes all of the leg waypoints from the flight plan, active or inactive. If this option is used on the Active flight plan, all of the leg waypoints are removed. This will remove the destination waypoint and all Nav data will be flagged as invalid until a new destination is selected.

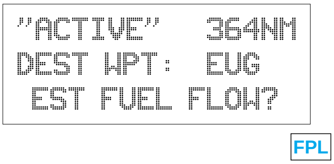
Est Gr Speed?



```
"ACTIVE"   364NM
DEST WPT:  EUG
  EST GR SPEED?
```

Estimated Ground Speed assists in calculating ETE? and ETA? for each of the legs of the displayed flight plan when actual ground speed is not available. The plane’s actual ground speed is used by the Active flight plan whenever traveling faster than 20 knots. On the other hand, Inactive flight plans always use the Estimated Ground Speed value for ETA and ETE leg estimations. This option is especially useful for pre-flight planning. After pressing ENT, rotate the Small and Large knobs until the desired Estimated Ground Speed is displayed, then press ENT again to store it.

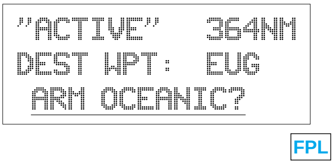
Est Fuel Flow?



```
"ACTIVE"   364NM
DEST WPT:  EUG
 EST FUEL FLOW?
```

Estimated Fuel Flow assists in calculating Fuel To? information for each leg of the displayed flight plan. This option is useful for both pre-flight and in-flight estimations of fuel requirements. The “?” indicates an estimate. If the Fuel Flow/Air Data Sensor is installed, the *actual* fuel flow is used by the Active flight plan whenever possible.

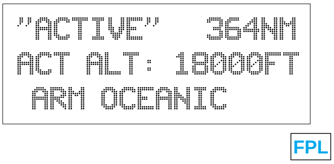
Arm Oceanic



```
"ACTIVE"   364NM
DEST WPT:  EUG
 ARM OCEANIC?
```

Pressing **ENT** when the “Arm Oceanic” option is flashing, arms the Oceanic flight phase when the phase is inactive and the Oceanic function is enabled.

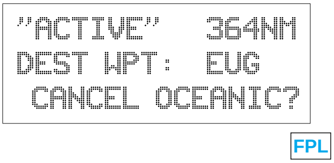
Activation Altitude



```
"ACTIVE"   364NM
ACT ALT: 18000FT
 ARM OCEANIC
```

After pressing the **ENT** button, the second line of the display changes to show the Oceanic Activation Altitude flashing. Press the **ENT** button to accept the altitude. Rotate the **Small** knob **CW** to increase the altitude in 100 ft increments, or **CCW** to decrease the altitude in 100 ft increments. Press ENT when the desired altitude is displayed.

Cancel Oceanic



```
"ACTIVE"   364NM
DEST WPT:  EUG
 CANCEL OCEANIC?
```

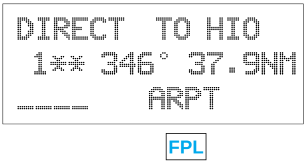
Pressing **ENT** when the “Cancel Oceanic” option is flashing, deactivates the Oceanic flight phase when the phase is armed or active independent of the current altitude.

Direct-To and the Active Flight Plan

When a Direct-To waypoint is entered following the use of the **DIRECT-TO** button, the Active flight plan is updated to reflect the change. The currently active *From* waypoint of the Active flight plan is changed to DIRECT, to reflect that you are now flying directly to the *To* waypoint.

The example below shows the Active flight plan's active leg display after entering a "Direct-To" course to HIO.

Flight Plan Leg Page



```
DIRECT  TO HIO
 1** 346° 37.9NM
____    ARPT
```

Direct-To may be canceled at any time by deleting the DIRECT signifier from the Flight Plan Leg page. This is done exactly as if you were deleting a waypoint. The old waypoint which was previously entered as the leg's From waypoint will then be redisplayed.

In some cases, you may wish to fly Direct-To a waypoint in the Active flight plan which is not the current To waypoint. You may easily do this by viewing the Flight Plan Leg page which displays the desired waypoint as the "To" waypoint identifier. Then, press **DIRECT-TO** and **ENT**. The flight plan is updated to go Direct-To the selected waypoint from your present position. Once you get there, leg sequencing will continue past the Direct-To waypoint in the usual way.

NOTES

System (SYS) Mode

SYS (System) mode is used to display information and enter settings and adjustments into the Apollo NMS (Navigation Management System).

SYS mode is divided into four "sub-states." After entering SYS mode, turning the **Large** knob scrolls through the sub-states. The four sub-states are:

Navigation Info - Functions pertaining to navigation information, such as Airspace Setup, NAV Mode Display Programming, and Autonav time.

System Info - Functions pertaining to the Apollo NMS, such as displaying the Software Version, and entering the Owner's name.

Position Sensors - Functions pertaining to the position sensors, such as displaying Loran or GPS sensor data.

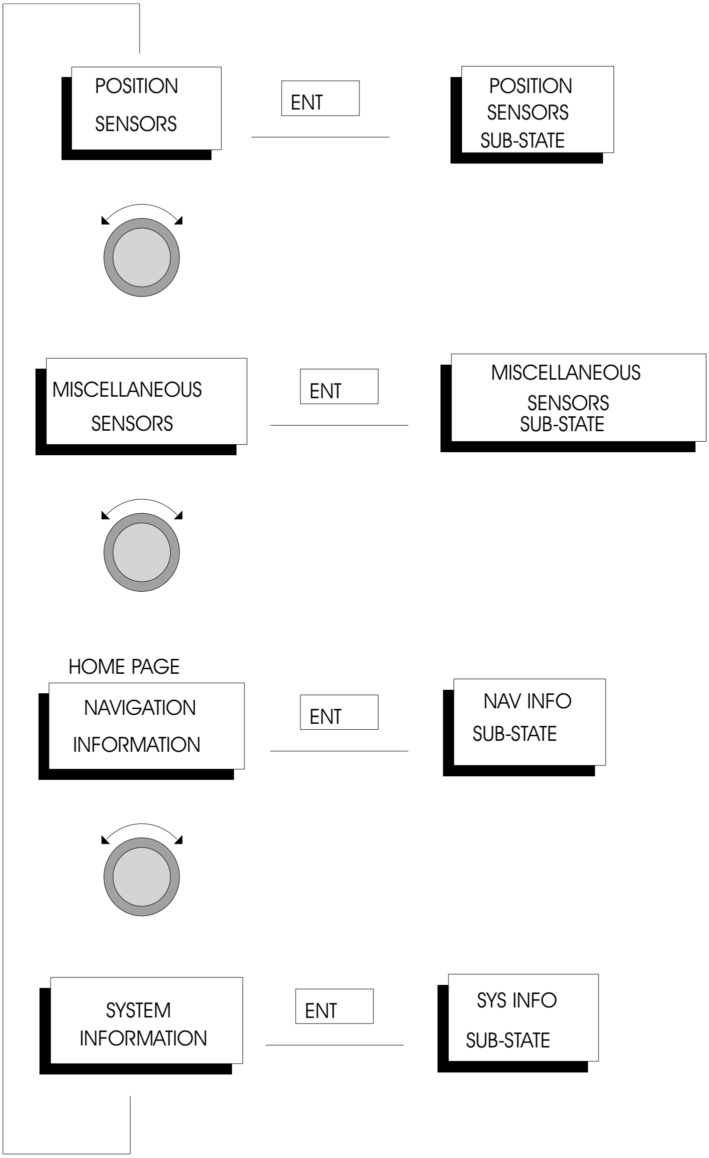
Miscellaneous Sensors - Functions pertaining to the F/ADS (Fuel/Air Data Sensor) and the altitude encoder.

Important

When you enter SYS mode, the page displayed is the page that was displayed the last time you were working in SYS mode. To display the Home (beginning) page in SYS mode, press the ***SYS*** *mode button again.*

System Mode

The figure below illustrates the organization of SYS Mode.



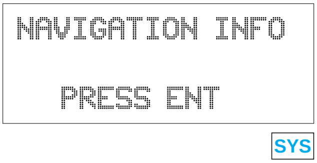
SYS Mode Displays

Top-Level Displays

Top-Level functions are accessed by entering SYS Mode and turning the **Large** knob. These functions are: Navigation Info, System Info, Position Sensors, and Miscellaneous Sensors. Pressing **ENT** places the system in the sub-state described on the top line. For example, pressing **ENT** when the top-level page reading "NAVIGATION INFO" (top line) and "PRESS ENT" (bottom line) is displayed, places the system in the Navigation Info sub-state, and the knobs are then used to access displays pertaining to navigation data and settings.

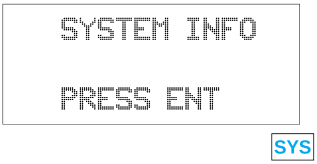
Navigation Information

Pressing **ENT** when the screen below is displayed provides access to Airspace Setup, Autonav Time, NAV Mode Display Programming, Mag Variation (Magnetic Variation), the Flight Timer Trigger, and Direct-To Entry option.


NAVIGATION INFO
PRESS ENT
SYS

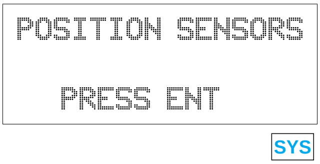
System Information

Pressing **ENT** when the screen below is displayed provides access to Time and Date settings, Fuel Measure Units, Barometric Measure Units, Software Version information, Display Testing, and Owner Information.


SYSTEM INFO
PRESS ENT
SYS

Position Sensors

Pressing **ENT** when the screen below is displayed provides access to Loran/GPS sensor settings and data.

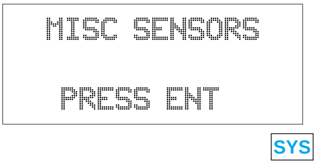


POSITION SENSORS

PRESS ENT

Miscellaneous Sensors

Pressing **ENT** when the screen below is displayed provides access to Air Data Info, Fuel Info data, and pressure altitude.



MISC SENSORS

PRESS ENT

Navigation Info Sub-State Displays

Airspace Setup

The navigation information sub-state screens are used to display and edit various navigation settings. The display below is used to turn Airspace Alerts ON/OFF.

AIRSPACE SETUP

ALERTS: ON ◆

Airspace Buffers

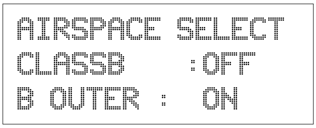
Airspace Alert provides alert messages based on distance, altitude, and time. The page below is used to set the airspace buffers. In this example, you will be alerted when the aircraft is 2 nm from a SUA (Special Use Airspace), within 500 feet of the floor/ceiling of a SUA, and are 10 minutes from penetrating a SUA. These settings are the default (factory) settings.

```
AIRSPACE BUFFERS
DIST  ALT  TIME
 2NM  500'10MIN
```

SYS

Airspace Select

The display below is used to select the type of SUAs that will generate alert messages. A similar page is displayed for each type of SUA. SUA alert options include: Class B and C airspaces, MOAs, Training Areas, Unknown SUAs, Alert Areas, Caution Areas, Danger Areas, Restricted Areas, Prohibited Areas, and Warning Areas. When Class B OUTER or Class C OUTER is chosen, only one alert message is generated when multiple Class B or Class C airspaces overlap; i.e. the system considers the overlapping airspaces to be a single SUA.

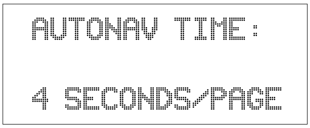


```
AIRSPACE SELECT
CLASSB     :OFF
B OUTER :   ON
```

SYS

Autonav Time

The display below is used to set the Autonav Scroll time. In this example, Autonav Scroll will display each Nav information page sequentially at 4 second intervals. When viewing the NAV mode home page, press **ENT** to activate Autonav Scroll. Press **ENT** again to stop scrolling.



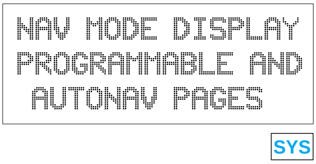
```
 AUTONAV TIME:

 4 SECONDS/PAGE
```

SYS

Navigation Info Sub-State Displays (continued)

Nav Mode Display Programming

The display below is used to customize Nav pages. This feature allows you to choose the specific navigation items displayed in NAV mode.



```
NAV MODE DISPLAY
PROGRAMMABLE AND
 AUTONAV PAGES
```

Magnetic Variation

The display below shows the magnetic variation is set on automatic, and is currently 09°W (West). Magnetic variation information is drawn from the data card. The magnetic variation may also be entered manually, and *must* be entered manually if a valid data card is not inserted.

```
 MAG VARIATION
AUTO        09°W
  SEL TO EDIT
```

Changing Oceanic Activation Altitude

The display below shows the Oceanic Activation Altitude currently set to 16000 feet. Activation altitude is adjustable in 100 foot increments over the range of 0 to 18000 feet.

```
OCEANIC ALTITUDE
    16000 FT
  SEL TO EDIT
```

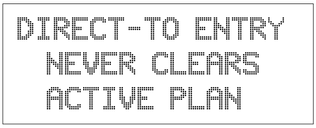
Flight Timer Trigger

The display below is used to adjust the Flight Timer Trigger speed. Flight Trigger choices are: OFF, At Power On, and selectable for speeds from 10 to 500 knots. In this example, the Flight Timer is activated when the ground speed exceeds 30 knots.

```
 FLIGHT TIMER
   TRIGGER
   AT  30 KTS
```

Direct-To Entry

The display below is used to choose the Direct-To Entry Option, which affects how entering a Direct-To waypoint is handled by the Active flight plan.



DIRECT-TO ENTRY
NEVER CLEARS
ACTIVE PLAN

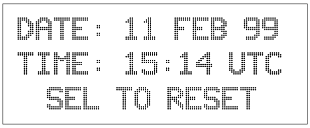
SYS

System Info Sub-State Displays

The system information Sub-State displays show information and settings pertaining to the NMS (Navigation Management System).

Date/Time (UTC)

The screen below is used to display and edit the current time/date. The NMC uses a 24 hour real-time clock to calculate ETA (Estimated Time of Arrival). Also, GPS sensors require the current UTC (Universal Coordinated Time—formally called Greenwich Mean Time) to locate satellites and determine position. In this example the current UTC is 15:14, and the date is February 11, 1999.



DATE: 11 FEB 99
TIME: 15:14 UTC
SEL TO RESET

SYS

Fuel Measure Units

The screen below is used to choose the measurement units used in fuel data displays. The system must be interfaced with a F/ADS (Fuel/Air Data Sensor) or a fuel flow sensor to measure actual fuel flow. Estimated fuel data, which does not require an F/ADS or fuel flow sensor, may be displayed for inactive flight plans in FPL mode. Measurement units available include: US gallons, Imperial gallons, Liters, Pounds, and Kilos. In this example, fuel is measured in US Gallons.

FUEL MEASURE
USG
US GALLONS

SYS

System Info Sub-State Displays (continued)

Baro Measure Units

The screen below is used to choose the measurement units used in barometric pressure adjustment displays in inches or millibars.

```
BARO MEASURE

   INCHES
```

SYS

NMC Software Version

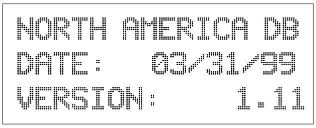
The display below shows the NMC software version and part number. The software version information may be important when servicing/troubleshooting the NMC. In this example, the NMC software version is 6.30 and part number is 139-0197-063. Turn the Small knob to display data base, Gateway/Keypad, GPS Sensor, Loran Sensor, and AirData Computer information.

```
  APOLLO NMC
139-0197-063
```

SYS

Data card Version

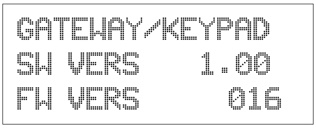
The display below shows the installed data card is North America, version 1.10. The expiration date for this version is March 31, 1999.



```
NORTH AMERICA DB
DATE:   03/31/99
VERSION:    1.11
```

SYS

Gateway/Keypad Version



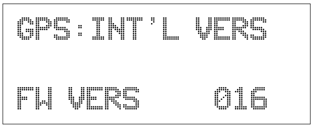
```
GATEWAY/KEYPAD
SW VERS   1.00
FW VERS    016
```

SYS

System Info Sub-State Displays (continued)

GPS Firmware Version

The display below shows the internal GPS Firmware (FW). The version shown is 016.

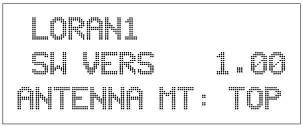


```
GPS:INT'L VERS

FW VERS     016
```

SYS

Loran Software Version

The display below shows the Loran 1 software version is 1.00, and the antenna is top mounted.



```
 LORAN1
 SW VERS    1.00
ANTENNA MT: TOP
```

SYS

AirData Computer Version

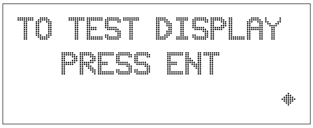
This display shows the version of the AirData Computer.

```
AIRDATA COMPUTER
SW VERS  1.00.02
FW VERS 90.01.01
```

SYS

Display Test

The screen below is used to test the NMC display.

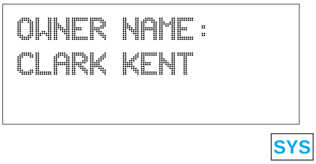


```
TO TEST DISPLAY
   PRESS ENT
```

SYS

Owner Name

The display below shows the owner's name is Clark Kent. The NMC allows you to enter your name, address, phone number, and aircraft number into the NMC memory. This information is protected by an owner entered password.



```
OWNER NAME:
CLARK KENT
```

Position Sensors Sub-State Displays

The position sensor screens display information about each Loran and GPS sensor included in the system.

Loran Information

The display below shows data for Loran 1, and a similar screen is displayed for each Loran sensor. Also, each Loran sensor tracks two GRIs, and turning the Large knob displays data for the other GRI. The top line in this example shows the position sensor is Loran number 1, and GRI number 1 is 9940. The middle line shows the GRI coverage name and the bottom line shows the grade and GRI selection process. “Auto” means the GRI selection process is automatic. “93” describes the grade (relative usefulness) of the signals (from 0 to 99). The higher the grade, the more useful the data.

```
LORAN1 GRI1 9940
US WEST COAST
GRADE 93 AUTO
```

No Data Available

If the NMC is not receiving data from Loran 1, the display below appears.

```
LORAN1 GRI1 ____
    NO DATA
  AVAILABLE
```

Master Station Information

The display below shows Master station signal information. A similar display appears for each GRI tracked by each Loran sensor. The top line displays the Loran sensor number, GRI number, and GRI identifier. The middle line shows the station and tracking status. In this example, the Master station tracking status is “cycle.” Tracking status may be either :

“srch” - the station is in search.

“cycle” - the station is in cycle selection, or has a cycle error.

“track” - the station has acquired the signal, has successfully cycle selected, and is tracking the signal.

The bottom line shows the SNR (Signal to Noise Ratio, from 0 to 99), the cycle data 1 (0 to 99), and the cycle data 2 (0 to 99). These numbers are a measure of the signal strength and accuracy. Cycle 1 data should be less than 50, and Cycle 2 data should be greater than 50. The greater the difference between the Cycle 1 value and the Cycle 2 value, the more accurate the position. The bottom line also shows the station secondary status. Secondary status is displayed as “Bnk” (blink), and/or “SNR” (Signal to Noise Ratio). Secondary station status is used to determine if the signal is useful. The station may not be used if it is in a blink (BNK) condition, or the SNR is too low. In this example, Loran 1 GRI1 is 9940. The Master station is in cycle, the SNR is 8, and the Cycle 1/2 data is 48/51. The Station shows a low SNR condition.

```
LORAN1 GRI1 9940
MASTER     CYCLE
08 48/51     SNR
```

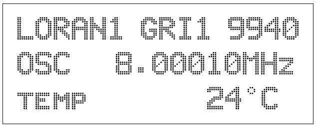
Secondary Station Information

The display below shows the signal information for secondary station W (Whisky). A similar display appears for each secondary station tracked by each Loran sensor. The top line displays the Loran sensor number, GRI number, and GRI identifier. The middle line shows the station, TD (time difference), and tracking status. The bottom line shows the SNR, Cycle Data 1 and 2, and the secondary status. If the station is in search , the coding delay will be displayed in place of the TD. In the example below, the display shows Station W in GRI 9940 is being tracked, and has a TD of 12660.90. The SNR is 99, and the Cycle1/2 data is 14/86.

```
LORAN1 GRI1 9940
W 12660.90 TRACK
99 14/86
```

Oscillator Information

The display below shows the OSC (Reference Oscillator) frequency and temperature. The OSC is used in timing the station TDs. In this example, the OSC frequency is 8.000101 MHz and is at 24°C.



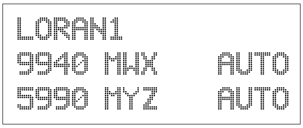
```
LORAN1 GRI1 9940
OSC   8.00010MHz
TEMP        24°C
```

SYS

Each Loran sensor tracks two GRI's simultaneously, and can use stations from both GRIs to calculate a Latitude/Longitude position.

Stations In Use

The display below shows multi-chain information, and whether manual or automatic triad selection is in use. The display also shows the stations used to calculate position, and whether the stations are selected manually or automatically.

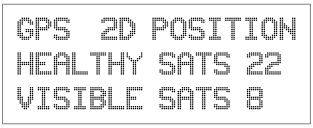


```
LORAN1
9940 MWX    AUTO
5990 MYZ    AUTO
```

SYS

GPS Status

The screen below displays information concerning a GPS (Global Positioning System) Sensor. The top line shows the GPS number and whether the position is 2D or 3D (2-Dimensional or 3-Dimensional). If the position is 2D, altitude is not calculated; if the position is 3D, the sensor is calculating both position and altitude. If "NO" is displayed, the system has not calculated a position. The middle line shows the number of healthy satellites in the GPS system. The bottom line shows the number of visible satellites. In this example, the GPS sensor has calculated a 2D position , with 22 healthy satellites and 8 satellites visible.

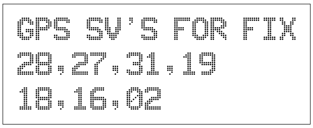


```
GPS  2D POSITION
HEALTHY SATS 22
VISIBLE SATS 8
```

SYS

Satellites In Use

The next sub-page indicates the satellites that are presently being used to calculate your position. The selection of these satellites is a complex process that minimizes the error in calculating your position. The GPS satellites are always moving across the sky, so the ideal selection of satellites is constantly changing. The NMS GPS tracks up to 8 satellites simultaneously to insure fast and accurate transitions as these satellites move.


```
GPS SV'S FOR FIX
28,27,31,19
18,16,02
```

SYS

Satellite Status

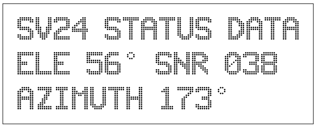
The display below shows the status, elevation, SNR, and Azimuth for each satellite. A similar display appears for each satellite a GPS sensor is tracking. In this example, satellite SV24 is in search status, with an elevation of 56°, an SNR of 38, and an azimuth of 173°. Elevation describes the position (in degrees) above the horizon. Azimuth refers to the horizontal position of the satellite in degrees, measured from true north.

The SNR measurement is a relative value between 0 and 128. Status is a three step mnemonic, SRCH, TRCK or DATA defined by:

SRCH: the receiver is searching for the satellite.

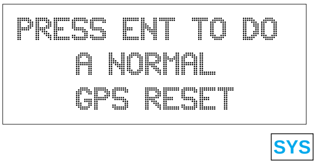
TRCK: the receiver has locked to the satellite's data sequence.

DATA: the receiver is locked and downloading data from the satellite.


```
SV24 STATUS DATA
ELE 56° SNR 038
AZIMUTH 173°
```

SYS

GPS time can also be obtained in UTC hours along with the date. Finally, the user can perform a normal reset. A normal reset sends the time, date and position to the GPS receiver. This will interrupt present navigation and restart satellite acquisition. This is the same sequence that is performed when the NMC is powered ON. This reset is provided but is NOT required for normal use.



```
PRESS ENT TO DO
   A NORMAL
   GPS RESET
```

SYS

Miscellaneous Sensors Sub-State Displays

These displays pertain to systems that include miscellaneous sensors. The miscellaneous sensors are the F/ADS (Fuel/Air Data Sensor), Fuel Sensor, and/or encoding altimeter.

Air Data Sensor Information

If the system does not include a F/ADS, the next display is the only page shown for the Air Data Sensor information.

```
AIR DATA INFO
   NO DATA
  AVAILABLE
```

SYS

If the Air Data Sensor information is available, the next screens are available for information on the Air Data Sensor.

The first Air Data Sensor display shows:

True Air Speed, which is the speed the plane is traveling relative to the surrounding air speed

Indicated Air Speed, which is the speed of the plane as shown on the airspeed indicator

```
Air Data Info
TruAirSp 385kts
IndAirSp 423kts◆
```

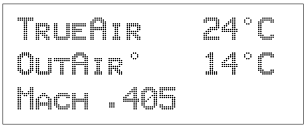
SYS

The next display page shows:

True Air Temperature, which compensates for wind chill factors

Outside Air Temperature, which does not compensate for wind chill

Mach (in this case 0.405 mach)



```
TrueAir    24°C
OutAir°    14°C
Mach .405
```

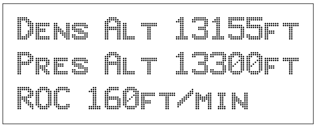
SYS

The next display shows:

Density Altitude

Pressure Altitude

Rate of Climb



```
Dens Alt 13155ft
Pres Alt 13300ft
ROC 160ft/min
```

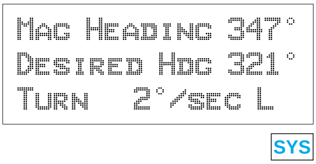
SYS

The next Air Data Sensor display shows:

Magnetic Heading

Desired Heading

Turn Rate

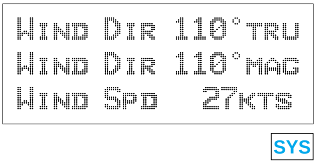

Mag Heading 347°
Desired Hdg 321°
Turn 2°/sec L

The last Air Data Sensor display shows:

True Wind Direction

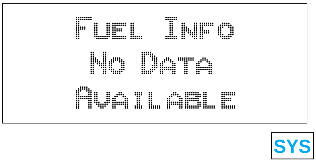
Magnetic Wind Direction

Wind Speed


Wind Dir 110°tru
Wind Dir 110°mag
Wind Spd 27kts

Fuel Data Sensor Information

If the system does not include an F/ADS, the next display is the only page shown for the Fuel Data Sensor Information.


Fuel Info
No Data
Available

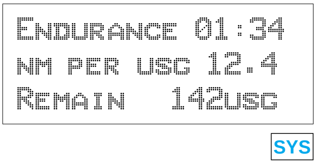
If the Fuel Data Sensor information is available, the next screens are available for information on the Fuel Data Sensor.

The first Fuel Data Sensor display shows:

Estimated Fuel Endurance, based on the current amount of fuel in the regular (non-reserve) tanks and the current burn rates

Nautical Miles per Fuel Unit

Remaining fuel, not including reserve tanks

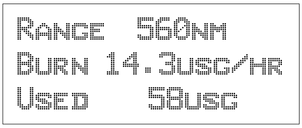

Endurance 01:34
nm per usg 12.4
Remain 142usg

The next display shows:

estimated Fuel Range, based on the current amount of fuel in the regular (non-reserve) tanks,

current Burn Rate per hour

total Fuel Used since power-up



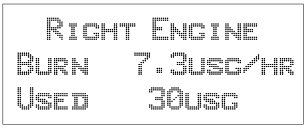
```
RANGE  560NM
BURN 14.3USG/HR
USED    58USG
```

SYS

The next Fuel Data Sensor display shows:

Burn Rate for the right engine

Amount of Fuel Used by the right engine



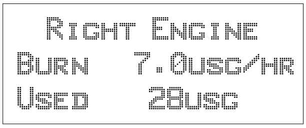
```
  RIGHT ENGINE
BURN   7.3USG/HR
USED    30USG
```

SYS

The next Fuel Data Sensor display shows:

Burn Rate for the left engine

Amount of Fuel Used by the left engine



```
  RIGHT ENGINE
BURN   7.0USG/HR
USED    28USG
```

SYS

The next display shows:

grand total of fuel which all tanks may hold

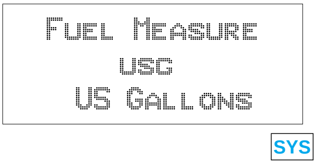
amount of fuel which the reserve tanks may hold

Fuel Warning Message time period before regular fuel tanks are empty

Each of these values may be edited by pressing **SEL**, rotating the **Large** and **Small** knobs, and pressing **ENT** to save any changes.

```
Full       300usg
Reserv      30usg
Message At 30min
```

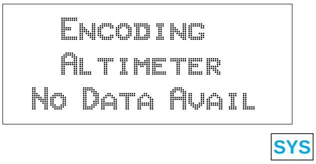
The last Fuel Data Sensor display shows the current Fuel Measure Units which are displayed for fuel information. This information may be edited by pressing **SEL**, rotating the **Large** and **Small** knobs, and pressing **ENT** to save the changed value. The display page is also available in the System Info sub-state.



```
  Fuel Measure
      usg
   US Gallons
```

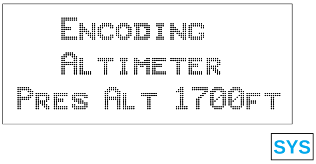
Altitude Encoder Information

If the system does not include an altitude encoder, the next display is shown for the encoding altimeter information.



```
   Encoding
   Altimeter
 No Data Avail
```

If the encoding altimeter information is available, it will be shown as displayed below. This screen displays the pressure altitude being sent by the encoding altimeter, which is the current altitude without barometric pressure adjustment.



```
   Encoding
   Altimeter
Pres Alt 1700ft
```

Navigation Information Sub-State

The Navigation Information sub-state is used to modify the navigation information displays and settings. These settings include:

Airspace Alert

Used to adjust the Altitude Buffers, the types of SUA (Special Use Airspace) areas you want to be alerted to, and the time/distance from SUAs at which you want alerts generated.

Auto Nav Scroll Time

Used to choose the time each Nav information page is displayed during Auto Nav scroll.

Programmable Nav Information Displays

Used to choose the specific navigation items displayed on the Nav information pages.

Magnetic Variation

Used to choose auto or manual variation.

Oceanic Altitude

Used to set the altitude where the NMC starts and stops the Oceanic flight phase.

Flight Timer Trigger Speed

Used to adjust the ground speed at which the flight timer starts measuring elapsed time.

Direct-To Entry Option

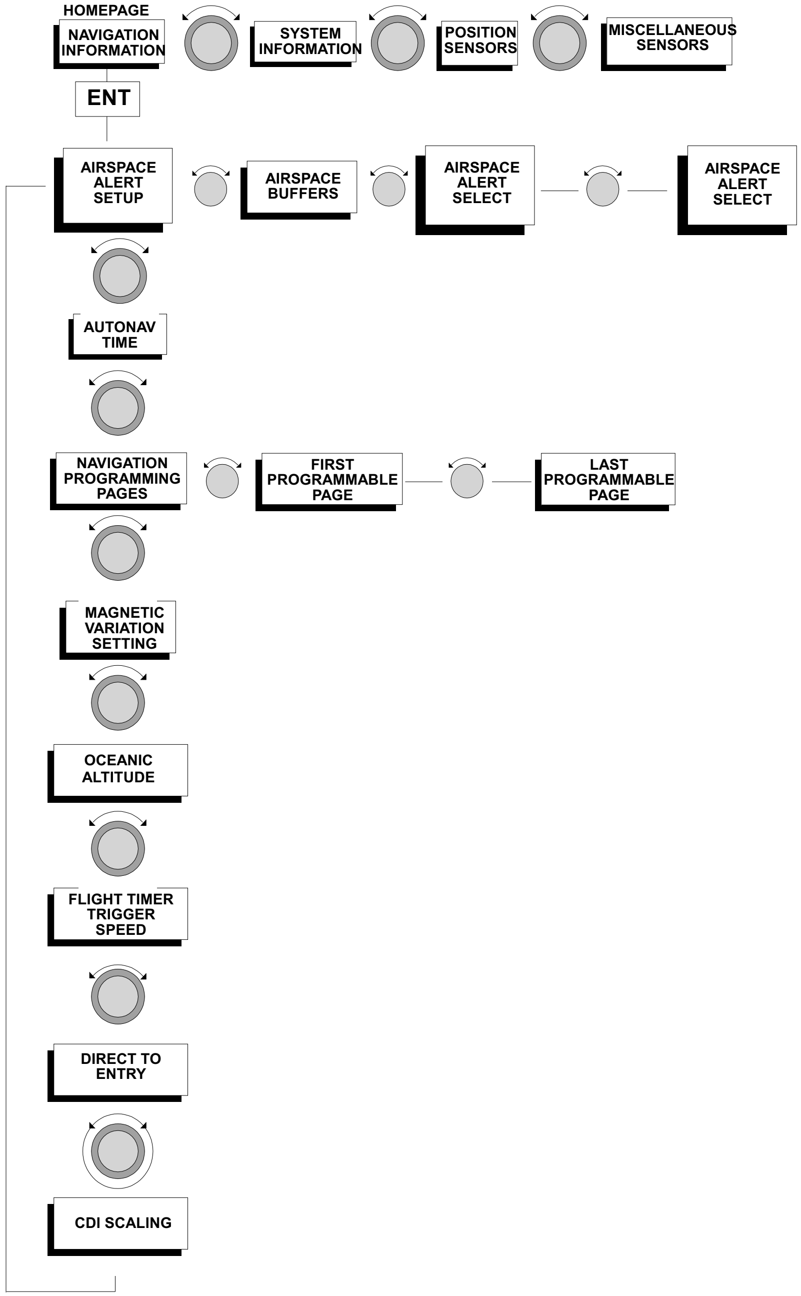
Used to choose how using Direct-To will affect the Active flight plan.

CDI Scaling

Choose Automatic or Manual

Navigation Information Sub-State (continued)

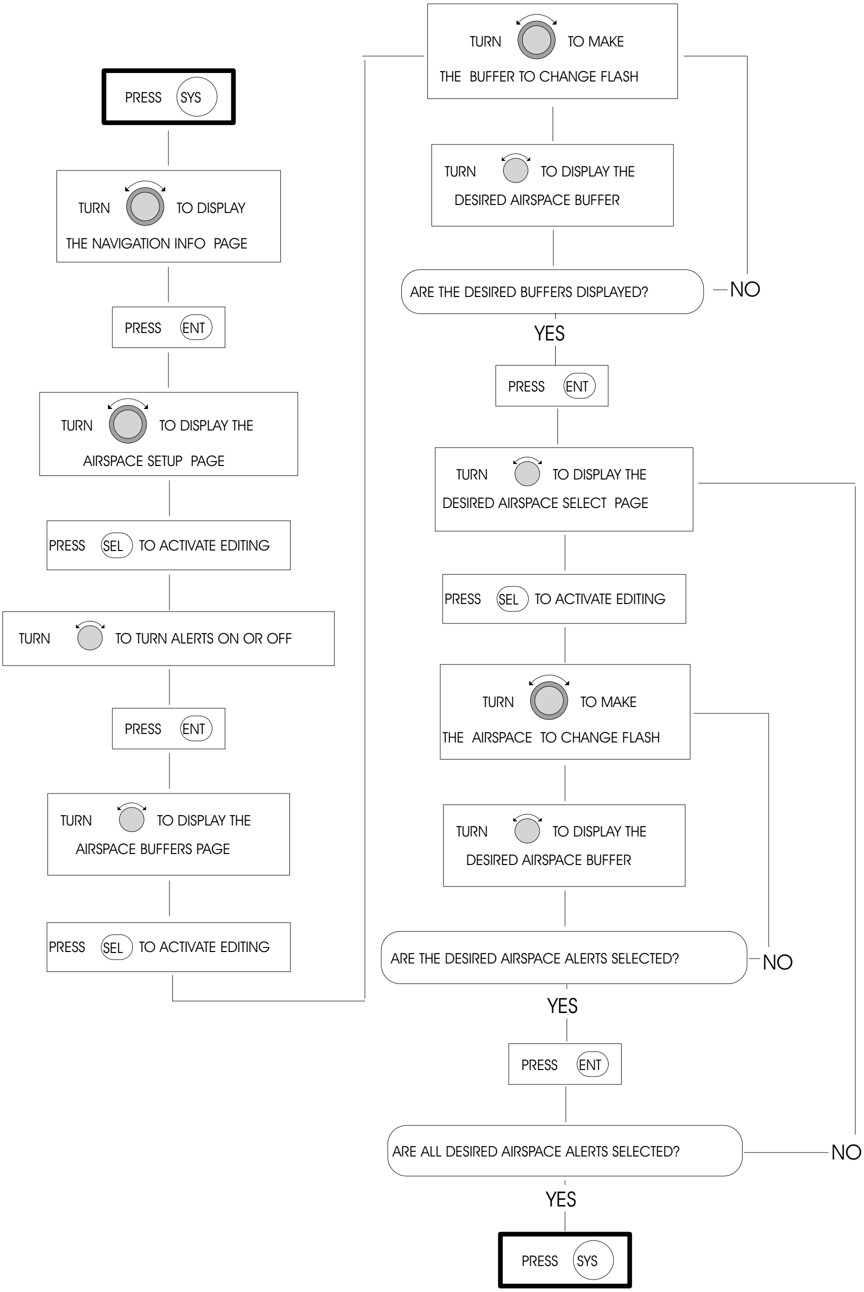
The figure below illustrates the organization of the Navigation Information sub-state.



Airspace Alert Settings

The following procedure is used to edit Airspace Alert settings.

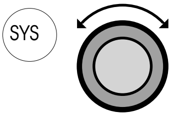
Flow Chart



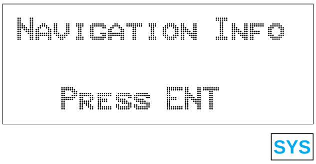
Airspace Alert Settings (continued)

Action **Explanation**

1.



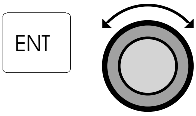
In SYS mode, turn the **Large** knob to display the Navigation Info page.


NAVIGATION INFO

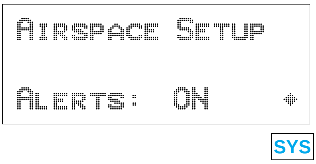
PRESS ENT

SYS

2.



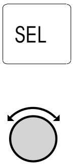
Pressing **ENT** activates the Navigation Info Sub-State functions. Turn the **Large** knob to display the Airspace Setup page.


AIRSPACE SETUP

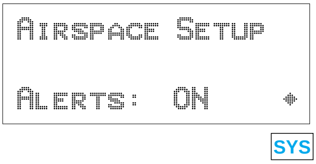
ALERTS: ON ◆

SYS

3.



Pressing **SEL** activates editing. Turn the **Small** knob to display “ON” or “OFF.” Choosing “OFF” turns all airspace alert messages off. Press **ENT** to save the displayed setting.

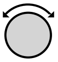

AIRSPACE SETUP

ALERTS: ON ◆

SYS

Airspace Alert Settings (continued)

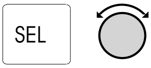
4.



Turn the **Small** knob to display the Airspace Buffer page. DIST refers to the distance from SUAs. ALT refers to the Altitude Buffer. TIME refers to the time before penetrating SUAs.


AIRSPACE BUFFERS
DIST ALT TIME
2NM 500' 10MIN

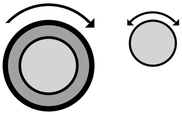
5.



Pressing **SEL** activates editing. Turn the Small knob to display the desired distance setting.


AIRSPACE BUFFERS
DIST ALT TIME
5NM 500' 10MIN

6.

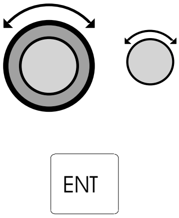


Turn the **Large** knob to make the altitude setting flash. Turn the **Small** knob to display the desired altitude.


AIRSPACE BUFFERS
DIST ALT TIME
5NM 400' 10MIN

Airspace Alert Settings (continued)

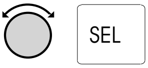
7. Repeat step 6.



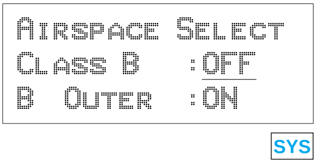
Use the **Large** and **Small** knobs to edit the time setting. Pressing **ENT** save the changes.

```
AIRSPACE BUFFERS
DIST  ALT  TIME
5NM 400' 15MIN
```

8.

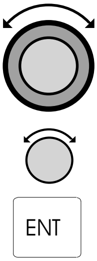


Turn the **Small** knob to display the desired Airspace Select page. Pressing **SEL** activates editing.

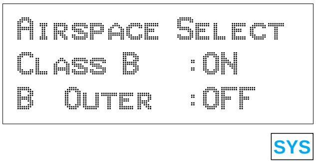


```
AIRSPACE SELECT
CLASS B     :OFF
B  OUTER    :ON
```

9.

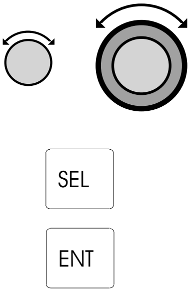


Turn the **Large** knob to make the setting you want to change flash. Turn the **Small** knob to display the desired setting. Press **ENT** to save the changes.



```
AIRSPACE SELECT
CLASS B     :ON
B  OUTER    :OFF
```

10. Repeat steps 8 and 9 as required.

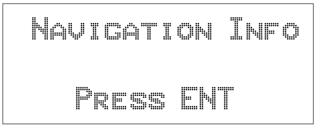
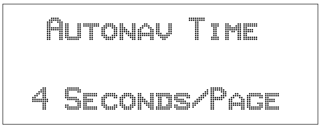
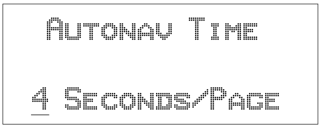
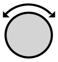
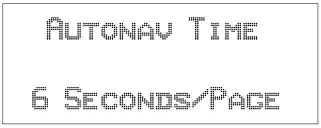


Use the **Small** and **Large** knobs and the **SEL** and **ENT** buttons to edit the remaining Airspace Select pages.

```
AIRSPACE SELECT
RESTRICT:    ON
PROHIBIT:    ON
```

Setting the Auto Nav Scroll Time

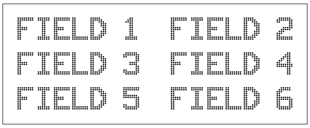
The following procedure is used to set the amount of time each NAV information page is displayed during Auto Nav Scroll. Each NAV information page may be displayed for up to 9 seconds.

	Action	Explanation
1.	SYS	In SYS mode, turn the **Large** knob to display the Navigation Info page.  Navigation Info Press ENT SYS
2.	ENT	Pressing **ENT** activates the Navigation Info sub-state functions. Turn the **Large** knob to display the Autonav Time page.  Autonav Time 4 Seconds/Page SYS
3.	SEL	Pressing **SEL** activates editing.  Autonav Time 4 Seconds/Page SYS
4.	 ENT	Turn the **Small** knob to display the desired time. Press **ENT** to save the setting.  Autonav Time 6 Seconds/Page SYS

Programmable and Autonav Nav Pages

The NMC allows you to customize the Nav Information pages to display your personal choice of Nav Items on each of the programmable pages (see *Eight Character Nav Items* and *Sixteen Character Nav Items* in the *Nav* section starting on page 70). The programmable Nav Information pages include each of the Navigation Sub-Displays except the first one, which displays ETE, CDI, Bearing, and Remaining Distance to the current “To” waypoint. You may also decide which of the Nav Information pages will be displayed when the Autonav feature is being used.

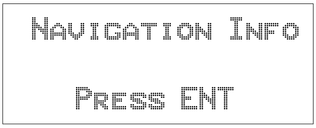
The Navigation Info display is divided into six fields of eight characters each.



```
FIELD 1  FIELD 2
FIELD 3  FIELD 4
FIELD 5  FIELD 6
```

The Eight Character Nav Items will fit into any of fields 1 through 6. The Sixteen Character Nav Items span two fields, and must start in fields 1, 3, or 5.

Action	Explanation
1.	In SYS mode, turn the **Large** knob to display the Navigation Info page.

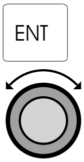


```
 Navigation Info

    Press ENT
```

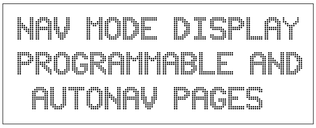
SYS

Programmable and Autonav Nav Pages (continued)

2.



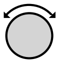
Pressing **ENT** activates the Navigation Info sub-state functions. Turn the **Large** knob to display the Nav Mode Display Programming page.



```
NAV MODE DISPLAY
PROGRAMMABLE AND
 AUTONAV PAGES
```

SYS

3.

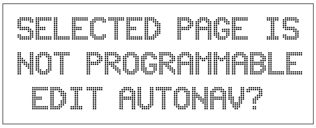


Turning the **Small** knob displays the Navigation Info pages, and pressing **SEL** activates editing.

SEL

SEL

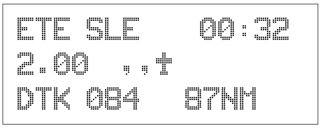
The first Navigation Info page is not programmable. Pressing **SEL** when the first Navigation Info page is displayed causes the next screen to be displayed. If this page is displayed, skip to step 5, or press **SEL** again to cancel.



```
SELECTED PAGE IS
NOT PROGRAMMABLE
 EDIT AUTONAV?
```

SEL

Pressing **SEL** when any of the other Navigation Info pages are displayed starts the editor for updating the Nav Items.

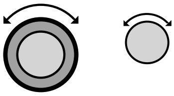


```
ETE SLE    00:32
2.00   ,,†
DTK 084   87NM
```

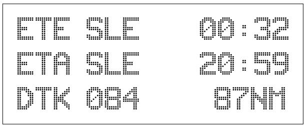
SYS

Programmable and Autonav Nav Pages (continued)

4.



Rotating the **Large** and **Small** knobs moves the cursor and updates the displayed fields.

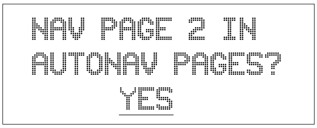


```
ETE SLE     00:32
ETA SLE     20:59
DTK 084      87NM
```

SYS

5. ENT

Pressing **ENT** saves any updates, and displays the Autonav Pages prompt.

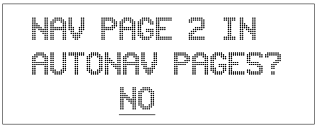


```
 NAV PAGE 2 IN
 AUTONAV PAGES?
      YES
```

SYS

6. ENT

Turning the **Small** knob displays the available choices you have for keeping this page in the Autonav sequence.

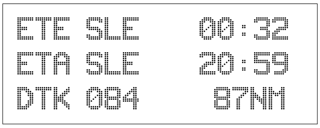


```
 NAV PAGE 2 IN
 AUTONAV PAGES?
      NO
```

SYS

7. ENT

Pressing **ENT** saves the Autonav choice and displays the Navigation Info page with the updated fields.



```
ETE SLE     00:32
ETA SLE     20:59
DTK 084      87NM
```

SYS

Programmable and Autonav Nav Pages (continued)

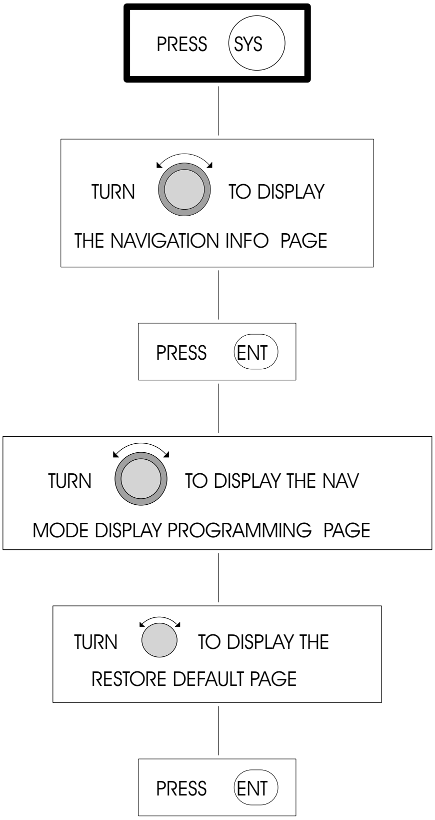
One of the optional fields which may be programmed into the customizable Navigation Info pages is the Empty field. This is an eight character field, and is denoted by six flashing underscore characters ("______") when the cursor is on the field. Moving the cursor off of the Empty field causes the underscores to disappear, leaving the eight characters blank. By programming a Navigation Info page to be completely blank, the page will not appear in the Navigation Info pages of NAV mode, nor will the page appear in the Autonav sequence.

You now have maximum control over the Navigation Info pages for satisfying your individual requirements. You now have the capability of customizing the Navigation Info pages to:

display only desired fields (see pages 70 through 76)

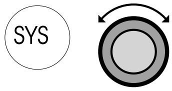
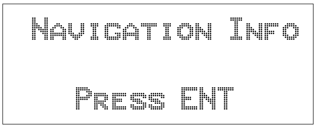
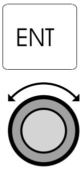
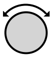
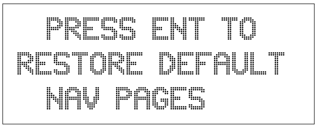
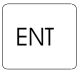
remove pages

customize which pages are displayed in the Autonav sequence



Restoring Default Nav Displays

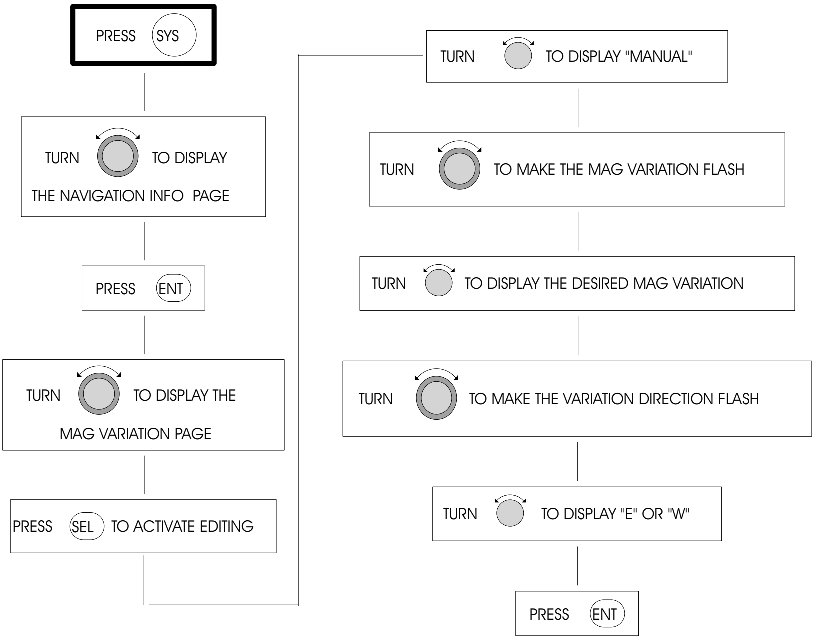
The following procedure is used to restore the default (factory) Nav displays.

Action		**Explanation**
1.		**In SYS mode, turn the Large** knob to display the Navigation Info page. NAVIGATION INFO PRESS ENT SYS
2.		Pressing **ENT** activates the Navigation Info Sub-state functions. Turn the **Large** knob to display the NAV Mode Display Programmable and Autonav page. NAV MODE DISPLAY PROGRAMMABLE AND AUTONAV PAGES SYS
3.		Turn the **Small** knob to display the Restore Default Nav Pages screen. PRESS ENT TO RESTORE DEFAULT NAV PAGES SYS
4.		Pressing **ENT** restores the default Nav displays, and displays the next page. NAV MODE DISPLAY PROGRAMMABLE AND AUTONAV PAGES SYS

Manually Entering Magnetic Variation

The following procedure is used to edit the magnetic variation anytime after the power-up sequence is complete. With a datacard installed, and magnetic variation set to AUTO, the NMC automatically accounts for magnetic variation. If the datacard is not inserted, you *must* enter the magnetic variation during power-up. For the procedure used to enter magnetic variation during power-up, see Operations, *Power-Up Sequence*.

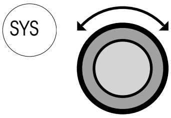
Flow chart



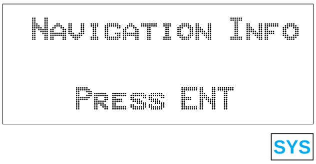
Manually Entering Magnetic Variation (continued)

Action	Explanation

1.



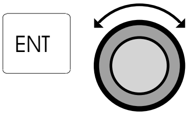
In SYS mode, turn the **Large** knob to display the Navigation Info page.



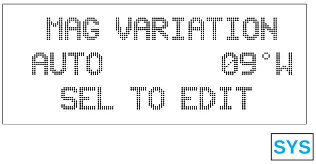
```
 NAVIGATION INFO

   PRESS ENT
```

SYS

2.



Pressing **ENT** activates the Navigation Info sub-state functions. Turn the **Large** knob to display the Mag Variation page.

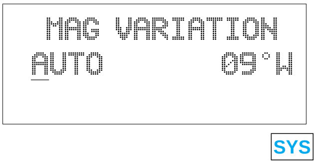


```
 MAG VARIATION
AUTO        09°W
  SEL TO EDIT
```

SYS

3.

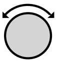
Pressing **SEL** activates editing.



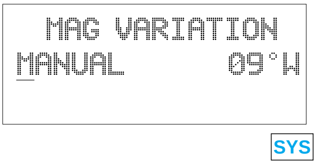
```
 MAG VARIATION
AUTO        09°W
```

SYS

4.



Turn the **Small** knob to display "Manual."

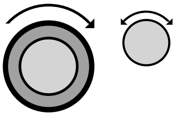


```
  MAG VARIATION
MANUAL       09°W
```

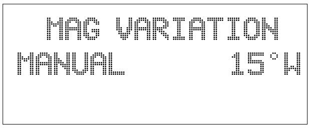
SYS

Manually Entering Magnetic Variation (continued)

5.



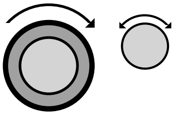
Turn the **Large** knob to make the Mag Variation value flash. Turn the **Small** knob to display the desired Mag Variation.



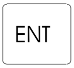
```
 MAG VARIATION
MANUAL      15°W
```

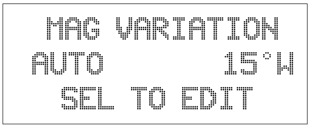
SYS

6.



Turn the **Large** knob to make the direction character flash. Turn the **Small** knob to display “E” (East) or “W” (West). Pressing **ENT** enters the displayed Mag Variation.



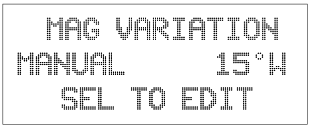


```
 MAG VARIATION
 AUTO       15°W
  SEL TO EDIT
```

SYS

7.

Pressing **ENT** saves the magnetic variation setting.



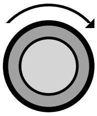
```
 MAG VARIATION
MANUAL     15°W
  SEL TO EDIT
```

SYS

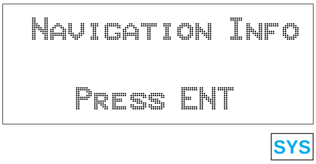
Changing the Oceanic Activation Altitude

The following procedure is used to set the altitude at which the NMC will start and stop the Oceanic/Remote Flight Phase. The default (factory) setting is 18000 feet. Acceptable settings are from 0 to 18000 feet in 100 foot increments.

1.



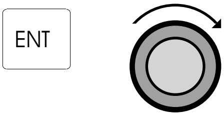
In SYS mode, turn the **Large** knob to display the Navigation Info page.



NAVIGATION INFO

PRESS ENT

2.



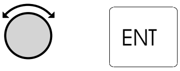
Press **ENT** to activate the Navigation Info sub-state functions. Turn the **Large** knob to display the Oceanic Altitude page.

OCEANIC ALTITUDE
16000FT
SEL TO EDIT

3.

Press **SEL** to activate editing.

4.

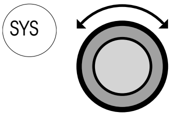


Turn the **Small** knob to display the desired activation altitude. The altitude is changed in 100 foot increments. Press **ENT** to save the setting.

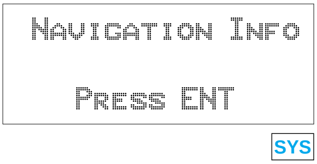
Editing the Flight Timer Trigger Speed

The following procedure is used to edit the flight timer trigger speed. The flight timer may be set to start at power-up, or when the ground speed exceeds from 10 to 500 knots. The default (factory) setting is 60 knots. The feature may also be turned off.

1.

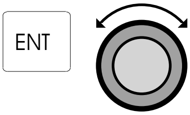


In SYS mode, turn the **Large** knob to display the Navigation Info page.


NAVIGATION INFO

PRESS ENT

2.



Pressing **ENT** activates the Navigation Info sub-state functions. Turn the **Large** knob to display the Flight Timer Trigger page.

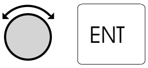

FLIGHT TIMER
TRIGGER
AT 60 KTS

3.

Pressing **SEL** activates editing.


FLIGHT TIMER
TRIGGER
AT 60 KTS

4.



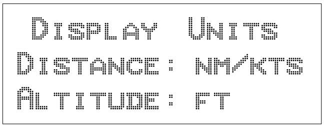
Turn the **Small** knob to display the desired trigger speed. The trigger speed is chosen in increments of 10 kts. OFF or AT POWER-ON may also be chosen. Press **ENT** to save the setting.


FLIGHT TIMER
TRIGGER
AT 40 KTS

Display Units

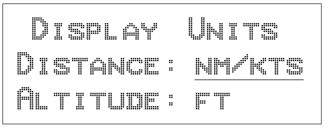
Nav displays that show distance may be selected to show either nautical miles, statute miles, or kilometers. Altitude displays may show either meters (m) or feet (ft). These selections are made in the Nav Info section of the System mode.

1. In the Navigation Info section of the System function, turn the **Large** knob to the Display Units Page.



```
 DISPLAY  UNITS
DISTANCE: NM/KTS
ALTITUDE: FT
```

2. Press **SEL** to activate selection. The Distance value will flash. Turn the **Small** knob to change the value.



```
 DISPLAY  UNITS
DISTANCE: NM/KTS
ALTITUDE: FT
```

3. Turn the **Large** knob to move to the Altitude selection. Turn the **Small** knob to change the value.

```
 DISPLAY  UNITS
DISTANCE: SM/MPH
ALTITUDE: FT
```

4. After completing your selections, press **ENT** to save the values.

Description of the Direct-To Entry Option

When you use Direct-To, the Active flight plan (and the From, To, Next information) is automatically updated.

If you use Direct-To to center the CDI needle for the current “To” waypoint, or skip past the To waypoint to another waypoint already in the Active flight plan, the current leg number of the Active flight plan will be updated, if needed, so that the Direct-To waypoint matches the current “To” waypoint. In these cases, the Direct-To Entry Option is not a factor.

The Direct-To Entry Option becomes a factor if you go Direct-To a waypoint which is *not* in the Active flight plan.

With the **May Clear** Direct-To Entry Option, the Direct-To waypoint will be inserted in the Active flight plan, *and all of the other waypoints will be deleted from the Active flight plan.*

With the **Never Clears** Direct-To option, the Direct-To waypoint is *inserted before the current To waypoint.*

The **May Clear** option is useful for the pilot who uses the Direct-To function for the majority of flight planning, and doesn’t want to be bothered with a steadily increasing number of waypoints in the Active flight plan. The **Never Clears** option is useful when you need to vector off from the Active flight plan’s path temporarily, resuming the previously entered flight plan at a later time.

When you first buy the NMC, the **Never Clears** Direct-To Entry option is set. The NMC retains the last Direct-To Entry Option setting when it is powered up.

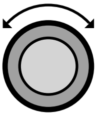
You may select which option to use in System Mode, as described next.

Editing the Direct-To Entry Option

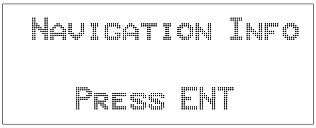
The following procedure is used to edit the Direct-To Entry Option.

Action **Explanation**

1.



In SYS mode, turn the **Large** knob to display the Navigation Info page.



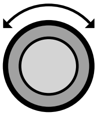
Navigation Info

Press ENT

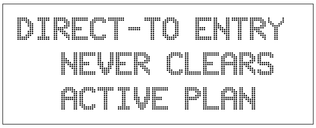
SYS

2.

ENT



Pressing **ENT** activates the Navigation Info sub-state functions. Turn the **Large** knob to display the Direct-To Entry Option page.



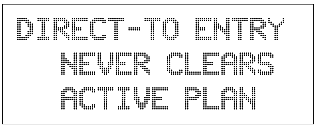
DIRECT-TO ENTRY
NEVER CLEARS
ACTIVE PLAN

SYS

3.

SEL

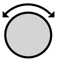
Pressing **SEL** activates editing.



DIRECT-TO ENTRY
NEVER CLEARS
ACTIVE PLAN

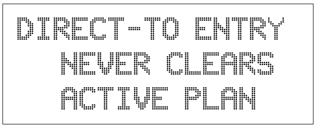
SYS

4.



ENT

Turn the **Small** knob to display the desired Direct-To Entry Option. Press **ENT** to save the option.



DIRECT-TO ENTRY
NEVER CLEARS
ACTIVE PLAN

SYS

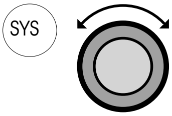
CDI Scaling

The CDI Scaling option allows you to choose between Automatic and Manual Scaling. If Auto CDI Scaling is on, CDI scaling will be 5.00 nm full scale per side. The manual CDI scaling may be set to 0.3, 1.0, or 5.0 nm full scale per side. In an active approach operation, CDI scaling is locked in automatic and will change according to your distance to the destination waypoint for the approach operation flight phase.

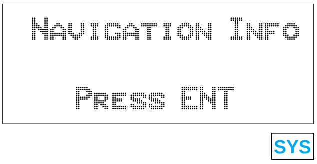
The following procedure is used to edit the Auto CDI Scaling Option.

Action **Explanation**

1.



In SYS mode, turn the **Large** knob to display the Navigation Info page.

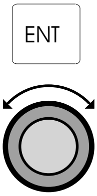


NAVIGATION INFO

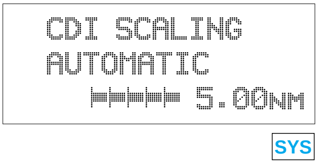
PRESS ENT

SYS

2.



Pressing **ENT** activates the Navigation Info Sub-State functions. Turn the **Large** knob to display the CDI Scaling Option page.



CDI SCALING
AUTOMATIC
5.00NM

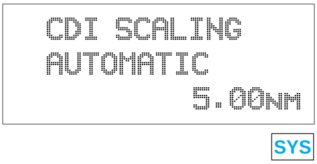
SYS

Editing the Auto CDI Scaling Option (continued)

Action **Explanation**

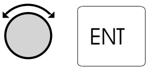
3.

Pressing **SEL** activates editing. The active selection will flash.

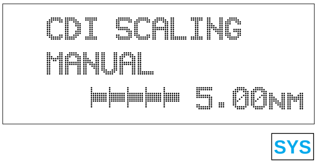


```
CDI SCALING
AUTOMATIC
          5.00NM
```

4.

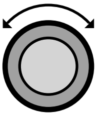


Turn the **Small** knob to Automatic or Manual scaling. Press **ENT** to save your choice.

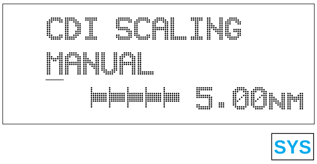


```
CDI SCALING
MANUAL
          5.00NM
```

5.

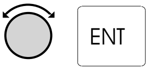


Change the manual resolution while “MANUAL” is flashing. Turn the **Large**, outer knob. The sensitivity value will flash.

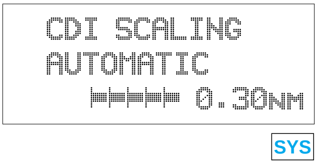


```
CDI SCALING
MANUAL
          5.00NM
```

6.



Turn the **Small**, inner knob to select 0.30, 1.00, or 5.00 nm full scale deflection per side. Press **ENT** to save your choice.



```
CDI SCALING
AUTOMATIC
          0.30NM
```

System Information Sub-State

The System Information sub-state is used to display and modify information pertaining to the Apollo NMS. This information includes:

Time and Date

Used to display/edit the UTC (Universal Coordinated Time-formerly called Greenwich Mean Time) time and date. The current time is based on a 24 hour clock.

Fuel Measure Units

Used to choose the units used to display fuel information.

Baro Measure Units

Used to choose inches or millibars for air pressure display.

Software Versions

Used to display the software version and database for the NMC, and each sensor.

Display Testing

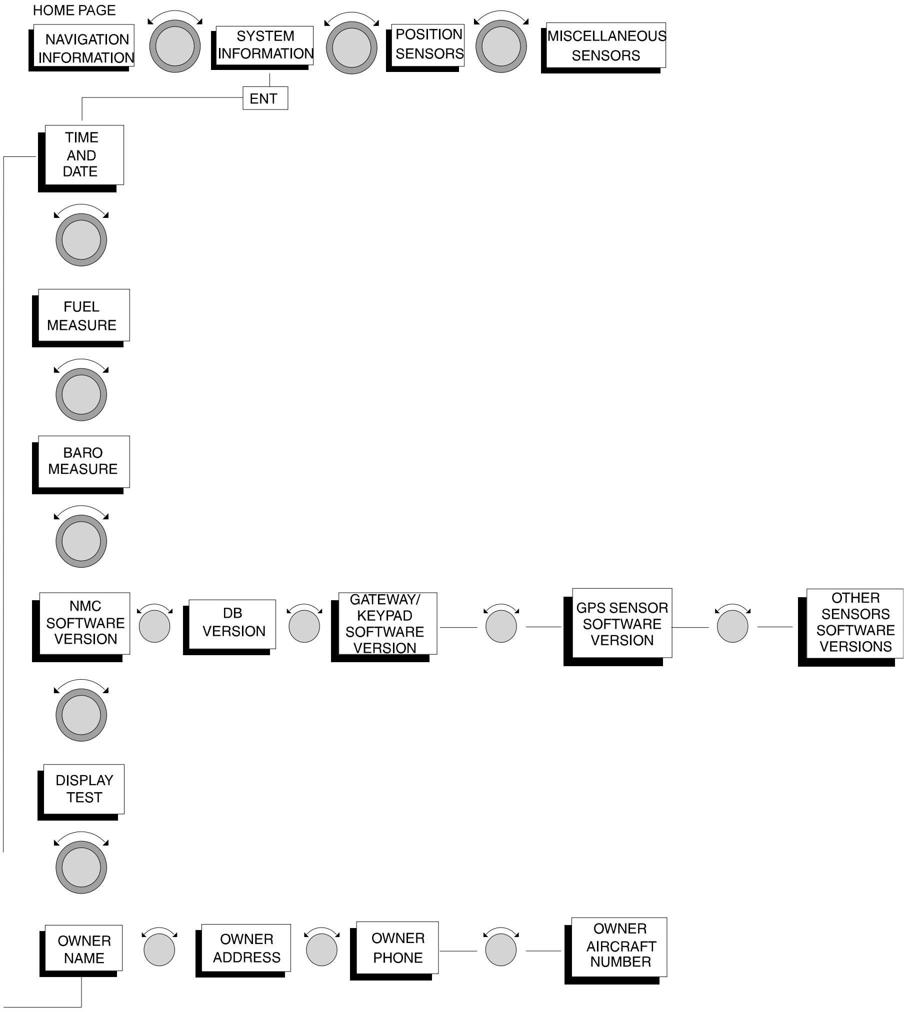
Used to test each LED in the display.

Owner Information

Used to enter/edit the owner's name, address, phone number, and aircraft number. This information is protected by a owner entered password.

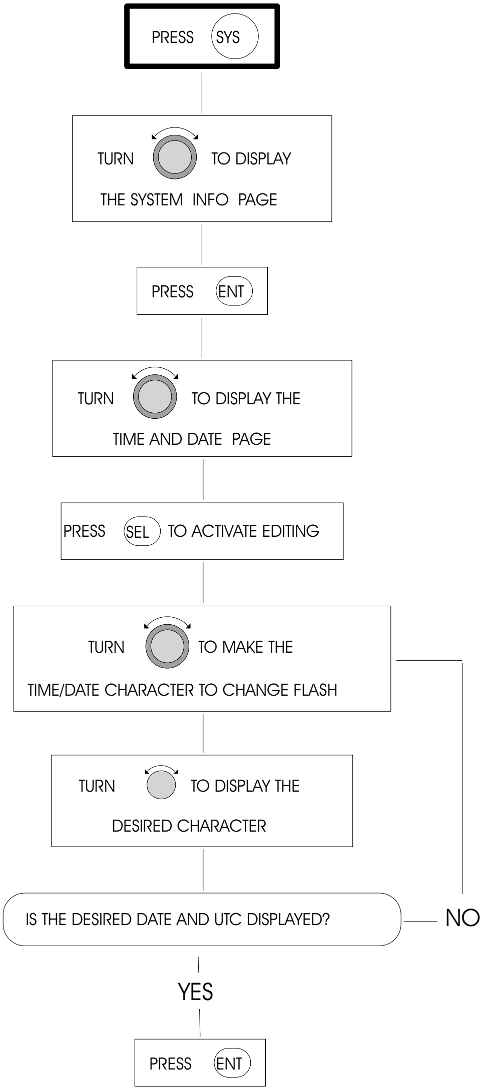
System Information Sub-State (continued)

The figure below illustrates the organization of the Sys Info sub-state.

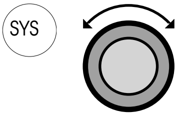


Setting the Time and Date

The following procedure is used to enter the time and date. The NMC uses a real time clock set to Universal Coordinated Time (UTC—formerly called Greenwich Mean Time). The correct UTC must be entered for GPS sensors to initialize. During the power-up sequence, the NMC briefly displays the current time and date. The time and date may also be adjusted during the power-up sequence. The NMC will update itself from GPS satellite data during power-up after it gets a 3-D fix. For the procedure used to adjust the time and date during power-up, see Operations, *Power-Up Sequence.*

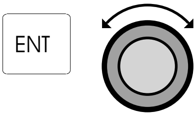


1\.

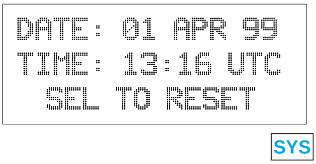


In SYS mode, turn the **Large** knob to display the System Info page.

2



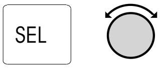
Pressing **ENT** activates the System Info sub-state functions. Turn the **Large** knob to display the Time/Date page.



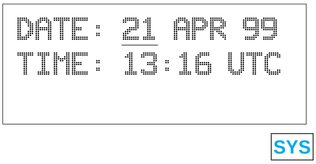
```
DATE: 01 APR 99
TIME: 13:16 UTC
  SEL TO RESET
```

SYS

3\.



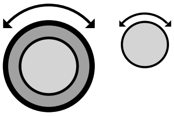
Pressing **SEL** activates editing. Turn the **Small** knob to display the desired date.



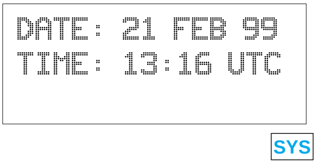
```
DATE: 21 APR 99
TIME: 13:16 UTC
```

SYS

4\.



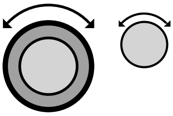
Turn the **Large** knob to make the next item you want to change flash. Turn the **Small** knob to display the desired item.



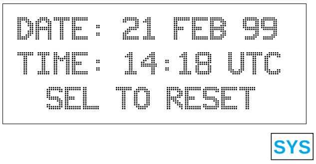
```
DATE: 21 FEB 99
TIME: 13:16 UTC
```

SYS

5\. Repeat step 4.



Use the **Large** and **Small** knob to edit the items. Pressing **ENT** saves the changes. Pressing **SEL** exits editing without saving any changes.



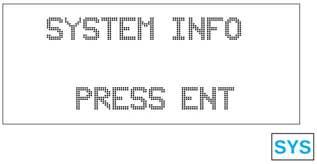
```
DATE: 21 FEB 99
TIME: 14:18 UTC
  SEL TO RESET
```

SYS

Choosing the Fuel Measure Units

The following procedure is used to choose the fuel measure units that appear in fuel displays. Fuel may be measured in US Gallons (USG), Imperial Gallons (IMG), Liters (L), Pounds (LBS), or Kilos (KGS).

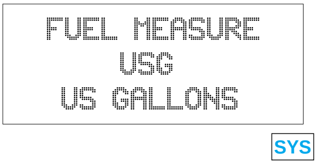
1. In SYS mode, turn the **Large** knob to display the System Info page.


SYSTEM INFO

PRESS ENT

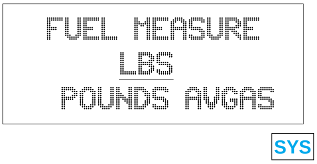
SYS

2. Pressing **ENT** activates the Navigation Info sub-state functions. Turn the **Large** knob to display the Fuel Measure page.


FUEL MEASURE
USG
US GALLONS

SYS

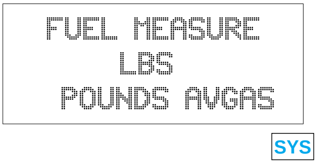
3. **Pressing SEL** activates editing. Turn the **Small** knob to choose the desired fuel measure units.


FUEL MEASURE
LBS
POUNDS AVGAS

SYS

4. Press **ENT** to save the selection.

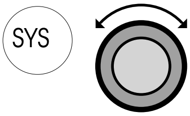
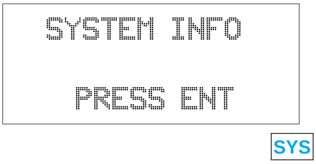
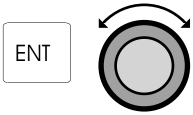
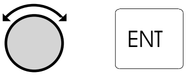
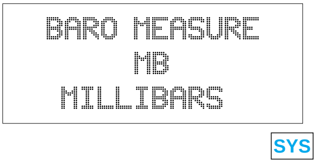
ENT


FUEL MEASURE
LBS
POUNDS AVGAS

SYS

Choosing the Barometric Pressure Units

The following procedure is used to choose the barometric pressure units that appear in the Local Altimeter Setting page in Nav mode.

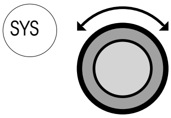
	Action	Explanation
1.	 	In SYS mode, turn the **Large** knob to display the Navigation Info page.  SYSTEM INFO PRESS ENT SYS
2.	 	Pressing **ENT** activates the Navigation Info sub-state functions. Turn the **Large** knob to display the Barometric Pressure Units page.  BARO MEASURE " INCHES SYS
3.	 	Pressing **SEL** activates editing.  BARO MEASURE " INCHES SYS
4.	 	Turn the **Small** knob to display the desired Direct-To Entry Option. Press **ENT** to save the option.  BARO MEASURE MB MILLIBARS SYS

Activating the Display Test

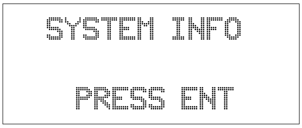
The following procedure is used to test the NMC display. The test illuminates every LED (Light Emitting Diode) in the display. If any LED does not light in response to this test, have the NMC serviced.

Action **Explanation**

1.



In SYS mode, turn the **Large** knob to display the System Info page.



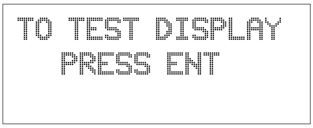
```
  SYSTEM INFO

   PRESS ENT
```

SYS

2.

ENT

Pressing **ENT** activates the System Info sub-state functions. Turn the **Large** knob to display the Test Display page.



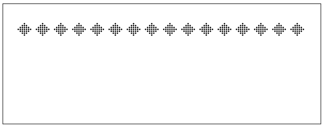
```
TO TEST DISPLAY
  PRESS ENT
```

SYS

3.

ENT

Pressing **ENT** activates display testing.



```
◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
```

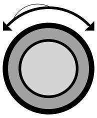
SYS

Displaying Software and Database Versions

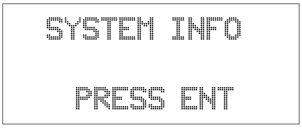
The following procedure is used to display the software and database version numbers. If you call your dealer or the factory concerning a problem, it may be helpful if you have these numbers available.

Action **Explanation**

1.



In SYS mode, turn the **Large** knob to display the System Info page.

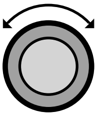


```
   SYSTEM INFO

    PRESS ENT
```

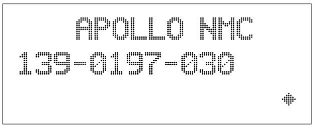
SYS

2.

ENT



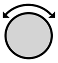
Pressing **ENT** activates the Navigation Info sub-state functions. Turn the **Large** knob to display the Apollo NMC Software Version page.



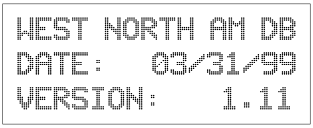
```
    APOLLO NMC
139-0197-030
```

SYS

3.



Turn the **Small** knob to scroll through the displays showing version information for the various system components.



```
WEST NORTH AM DB
DATE:   03/31/99
VERSION:    1.11
```

SYS

Entering and Editing Owner Information

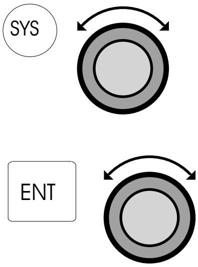
The NMC allows you to input your name, address, phone number, and aircraft ID number. The owner name is displayed each time the NMC is powered up. This is designed to discourage theft. The information entered may not be changed without the proper six letter password, also entered by the owner. Entry of this information is optional, but highly recommended. The password may not be changed once it is entered.

Caution

To change the owner information, you must remember your password. The password can only be cleared by II Morrow technicians.

Action | **Explanation**

1.

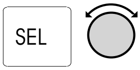


In SYS mode, turn the **Large** knob to display the System Info page and press **ENT** to activate the System Info functions. Turn the **Large** knob to display the Owner Name page.

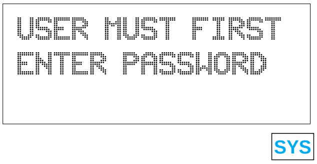

OWNER NAME:

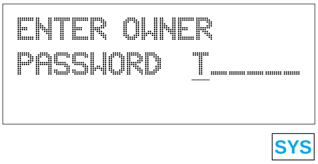
SEL TO EDIT

2.

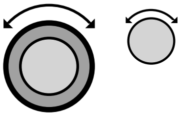


Pressing **SEL** activates editing. The display below appears for approximately 3 seconds. Turn the **Small** knob to display the first character in the password.

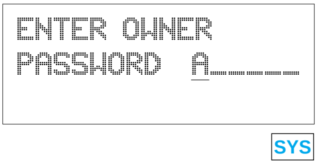

USER MUST FIRST
ENTER PASSWORD


ENTER OWNER
PASSWORD T_____

4.

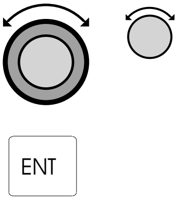


Turn the **Large** knob to make the next character space flash. Turn the **Small** knob to display the desired character.

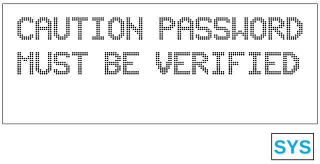


```
ENTER OWNER
PASSWORD  A_____
```

5. Repeat step 4.

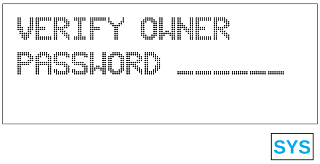


Use the **Large** and **Small** knobs to choose the remaining characters in the password. Characters chosen are not displayed when another character space is flashing. To review the characters, turn the **Large** knob. Press **ENT** to enter the password. The display below appears for approximately 3 seconds.



```
CAUTION PASSWORD
MUST BE VERIFIED
```

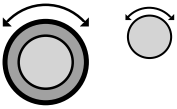
After 3 seconds the display below appears.



```
VERIFY OWNER
PASSWORD ______
```

Entering and Editing Owner Information (continued)

6.



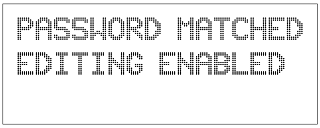
Use **Large** and **Small** knobs to confirm (re-enter) your password, as shown the step 4.

```
VERIFY OWNER
PASSWORD _____N
```

SYS

7.

Pressing **ENT** saves the password. If a mistake is made, the NMC “asks” you to try again. The following display appears for approximately 3 seconds.



```
PASSWORD MATCHED
EDITING ENABLED
```

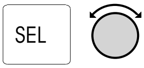
SYS

After 3 seconds, the display below appears.

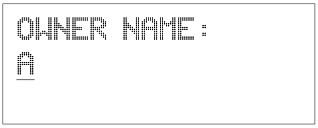
```
OWNER NAME:

  SEL TO EDIT   ⇕
```

SYS

8.



Pressing **SEL** enables editing. Turn the **Small** knob to display the first character in the owner name.

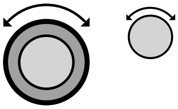


```
OWNER NAME:
A
```

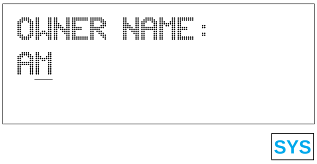
SYS

Entering and Editing Owner Information (continued)

9.



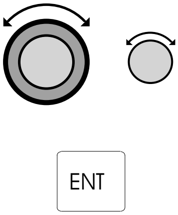
Turn the **Large** knob to make the next character space flash. Turn the **Small** knob to display the desired characters.



OWNER NAME:
AM

SYS

10. Repeat step 9.

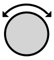


Use the **Large** and **Small** knobs to display the remaining characters in the owner name. Press **ENT** to save the name.

OWNER NAME:
AMELIA JEAN
EARHART

SYS

11.



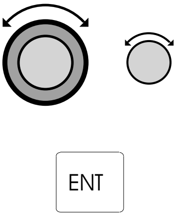
Turn the **Small** knob to display the next Owner Information page.

OWNER ADDRESS:

SEL TO EDIT

SYS

12. Repeat steps 8 through 11.



Use the **Large** and **Small** knobs and the **ENT** button to edit the remaining Owner Info pages. Once the password has been verified, Owner Info displays may be edited without entering the password until the NMC is powered off.

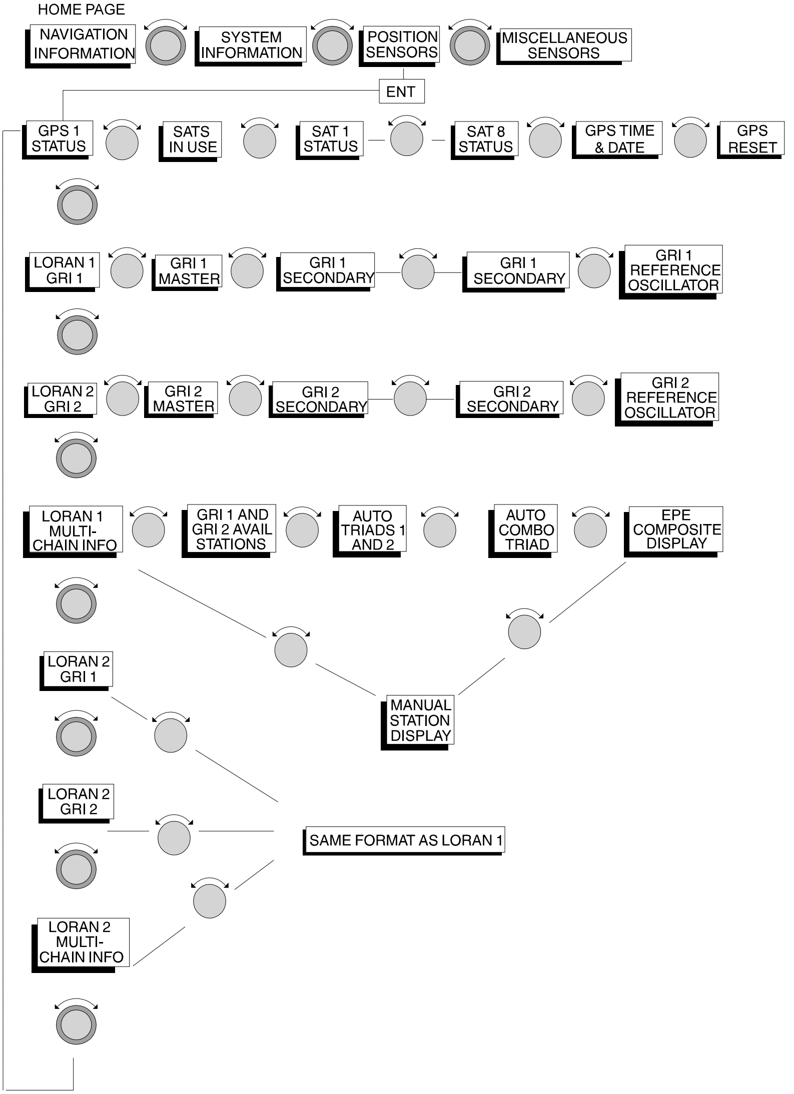
AIRCRAFT:
N1234J

SYS

Position Sensor Sub-State

The Position Sensor sub-state is used to display and modify position sensor settings. If Loran sensor(s) are installed, this information includes: TDs (Time Differences), OSC (Reference Oscillator) frequency and temperature, GRI's, and Triads.

If GPS sensor(s) are installed, this information includes: the number of healthy satellites, the number of visible satellites, present altitude, track, ground speed, identifiers of the satellites used, the UTC (Coordinated Universal Time), satellite status, satellite elevation, SNR (Signal to Noise Ratio), and Azimuth.



Loran Sensor Sub-State

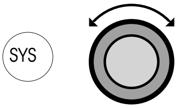
The Position Sensor sub-state is used to display and modify position sensor settings. If Loran sensor(s) are installed, this information includes: TDs (Time Differences), OSC (Reference Oscillator) frequency and temperature, GRI's, and Triads.

If GPS sensor(s) are installed, this information includes: the number of healthy satellites, the number of visible satellites, present altitude, track, ground speed, identifiers of the satellites used, the UTC (Coordinated Universal Time), satellite status, satellite elevation, SNR (Signal to Noise Ratio), and Azimuth.

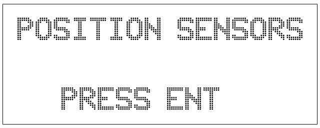
Displaying Position Sensor Information

The following procedure is used to display position sensor data.

1.



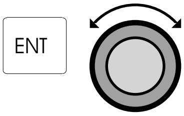
In SYS mode, turn the **Large** knob to display the Position Sensors page.



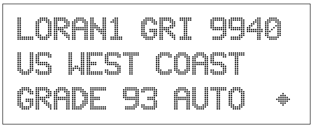
```
POSITION SENSORS

   PRESS ENT
```

SYS

2.



Pressing **ENT** activates the Position Sensor sub-state functions. Turn the **Large** knob to display the desired Loran GRI page.

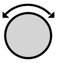


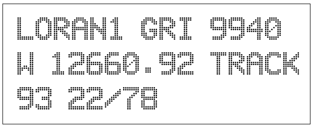
```
LORAN1 GRI 9940
US WEST COAST
GRADE 93 AUTO  ◆
```

SYS

3.

Turn the **Small** knob to display station data.





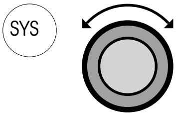
```
LORAN1 GRI 9940
W 12660.92 TRACK
93 22/78
```

SYS

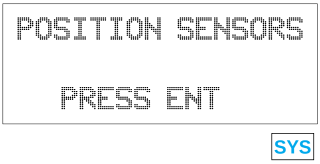
Manual GRI Selection

The following procedure is used to manually choose GRI’s. Triads may still be automatically selected with manually selected GRIs.

1.



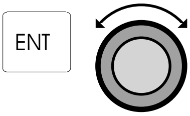
In SYS mode, turn the **Large** knob to display the Position Sensors page.



```
POSITION SENSORS

   PRESS ENT
```

SYS

2.



Pressing **ENT** activates the Position Sensor sub-state functions. Turn the **Large** knob to display the desired Loran GRI page.

```
LORAN1 GRI 9940
US WEST COAST
GRADE 93 AUTO  ◆
```

SYS

3.

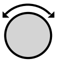
Pressing **SEL** activates editing.

```
LORAN1 GRI 9940
US WEST COAST
GRADE 93 AUTO
```

SYS

4.

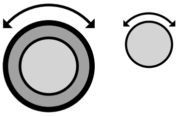
Turn the **Small** knob to choose MANUAL.



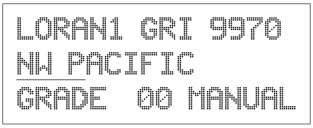
```
LORAN1 GRI 9940
US WEST COAST
GRADE 93 MANUAL
```

SYS

5.



Turn the **Large** knob to make the GRI name flash. Turn the **Small** knob to display the desired GRI.

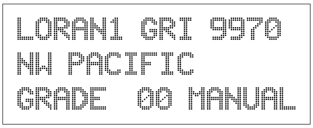


```
LORAN1 GRI 9970
NW PACIFIC
GRADE  00 MANUAL
```

SYS

6.

Pressing **ENT** enters the displayed GRI. Pressing any mode button exits this function without entering any changes.



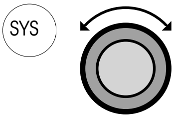
```
LORAN1 GRI 9970
NW PACIFIC
GRADE  00 MANUAL
```

SYS

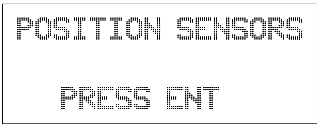
Manual Triad Selection

The following procedure is used to manually select the Loran triad. Prior to using this procedure, you *must* manually select the GRI(s). Only one triad may be manually selected for each Loran sensor.

1.



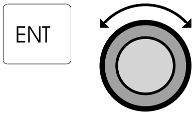
In SYS mode, turn the **Large** knob to display the Position Sensor page.



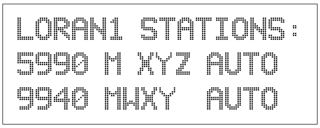
```
POSITION SENSORS

    PRESS ENT
```

SYS

2.



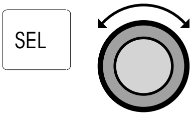
Pressing **ENT** activates the Position Sensor sub-state functions. Turn the **Large** knob to display the Loran Stations page.



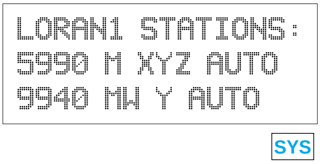
```
LORAN1 STATIONS:
5990 M XYZ AUTO
9940 MWXY  AUTO
```

SYS

3.



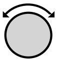
Pressing **SEL** activates editing. Turn the **Large** knob to make AUTO flash by the desired GRI.



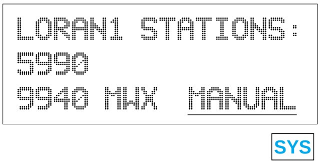
```
LORAN1 STATIONS:
5990 M XYZ AUTO
9940 MW Y AUTO
```

SYS

4.



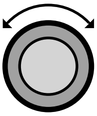
Turn the **Small** knob to choose MANUAL. The Stations for the other GRI are no longer displayed.

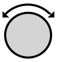


```
LORAN1 STATIONS:
5990
9940 MWX  MANUAL
```

SYS

5.



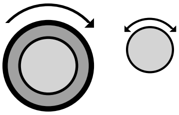


Turn the **Large** knob to make the first station designator flash. Turn the **Small** knob to display the desired station.

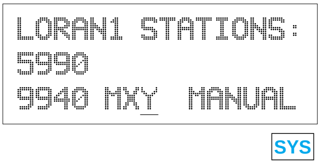
```
LORAN1 STATIONS:
5990
9940 M     MANUAL
```

SYS

6.



Turn the Large knob to make the next station designator flash. Turn the **Small** knob to display the desired station. Repeat to choose the remaining station.



```
LORAN1 STATIONS:
5990
9940 MXY  MANUAL
```

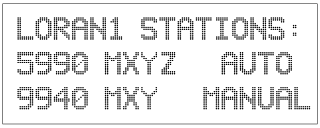
SYS

7.

ENT

SEL

Press ENT to enter the triad. Pressing any Mode button or the **SEL** button instead exits editing without saving the changes.



```
LORAN1 STATIONS:
5990 MXYZ   AUTO
9940 MXY  MANUAL
```

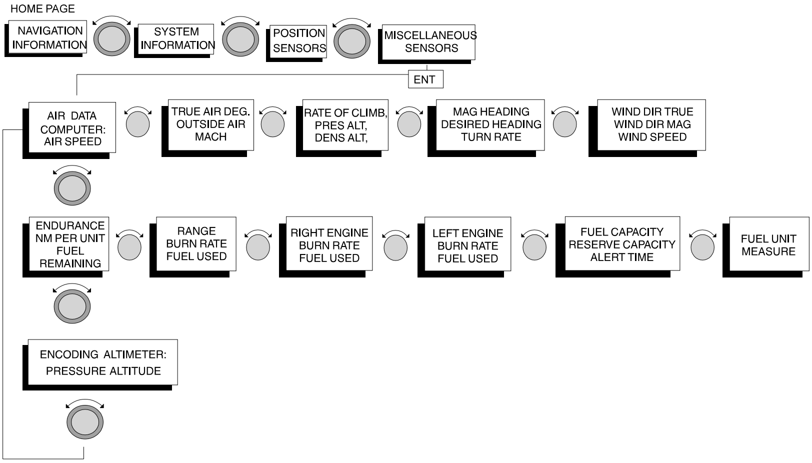
SYS

Miscellaneous Sensor Sub-State

The Miscellaneous Sensor Sub-State is used to display information concerning the F/ADS (Fuel/Air Data Sensor), fuel sensor, and altitude encoder. The F/ADS, which includes a fuel sensor and altitude encoder, monitors fuel flow, air speed, outside air temperature/pressure, and magnetic heading. The F/ADS data is used to compute TAS, pressure altitude, density altitude, heading, wind direction/velocity, rate of climb, and fuel usage.

Miscellaneous Sensor Sub-State

The figure below illustrates the organization of the SYS Mode Miscellaneous Sensors Sub-State.

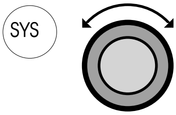


Displaying Miscellaneous Sensor Information

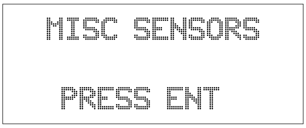
The following procedure is used to display miscellaneous sensor information.

Action	**Explanation**

1\.



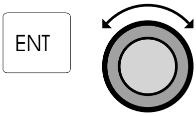
In SYS mode, turn the **Large** knob to display the Misc Sensors page.



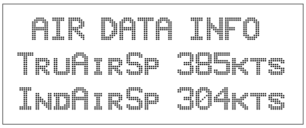
```
 MISC SENSORS

  PRESS ENT
```

SYS

2\.



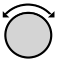
Pressing **ENT** activates the Miscellaneous Sensor sub-state functions. Turn the **Large** knob to display the Air Data Sensor top page, the Fuel Data Sensor top page, or the altitude encoder page.



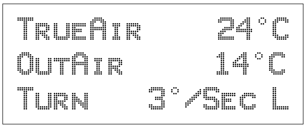
```
 AIR DATA INFO
TruAirSp 385kts
IndAirSp 304kts
```

SYS

3\.



If the diamond character is displayed on the lower right hand corner of the display page, rotate the **Small** knob to view sub-pages of the current page.



```
TrueAir      24°C
OutAir       14°C
Turn     3°/Sec L
```

SYS

General Approach Overview

Apollo NMS Approaches

The Apollo NMS may be used to navigate GPS non-precision approaches. These consist of overlay approaches, GPS approaches which overlay an existing non-precision approach procedure such as a VOR, an RNAV, or an NDB approach, and GPS only approaches. GPS approaches may overlay any type of non-precision approach procedure except for localizer, LDA, and SDF approaches. GPS approaches may be either Phase II or Phase III overlay or named GPS only approaches. The major difference in the overlay approaches is that for a Phase II approach, the underlying approach NavAid(s) must be operating and the aircraft must be equipped for the underlying approach. It is not necessary to monitor the underlying NavAid(s). A Phase III GPS approach may be conducted even if the underlying NavAid(s) are not operating.

Phase II GPS Approaches

GPS equipment may be used as the primary IFR flight guidance during a non-precision approach without actively monitoring the applicable navaid(s) which define the approach being used. However, the traditional ground-based navaid(s) required for the published approach and alternate should be operational and the associated avionics should be installed and operational. The approach should be requested and approved by its published name, such as "NDB Runway 24." Modification of the published instrument approach name is not required. Note: Jeppesen Approach Procedure Charts identify Phase-2 overlay approaches by printing GPS contained in parenthesis, (GPS) along with the procedure name.

Phase III GPS Approaches

Phase III GPS approaches must contain GPS in the title of the GPS procedure such as VOR or GPS RWY 24. Neither the ground station navaid(s) nor the traditional aircraft avionics is required. If the approach is to be flown using the Apollo NMS, it should be requested and approved by the GPS name, such as GPS RWY 24. If it is to be flown with the traditional avionics, it should be requested and approved by that name, such as VOR RWY 24.

You should always plan the route and approach to any required alternate airport such that a supplementary navigation system, such as GPS or Loran-C may not be available. The traditional en route and approach Navaids must be operating and the aircraft must have the required avionics to use for required alternates. You may use a supplementary system, such as GPS to navigate to an alternate airport. You may execute a GPS approach to a required alternate, but you must plan for the possibility that GPS navigation will not be available.

FAA guidelines on IFR use of GPS and GPS approaches are contained in an FAA Advisory Circular (AC), AC 90-94. You should be familiar with the information in this AC before attempting GPS approaches.

In order to use the Apollo NMS for an approach, the approach must be selected from the NMS database and loaded into the active flight plan. Only approaches found in the Apollo NMS database may be flown with the Apollo NMS.

Approach Waypoints

General

The database waypoints which describe the TSO C129a GPS approaches correspond with the waypoints which appear on the approach procedure charts whenever possible. VORs, NDBs, and named Intersections will appear in the approach sequence as they are on the charts. The Rifle, Colorado VOR will be identified RIL, the Turno Locator/Outer-Marker (LOM) at Salem, Oregon will be identified SL, the Forsyth NDB, at Forsyth Montana will be identified FOR, and the HIKOX intersection, used as an Initial Approach Fix (IAF) for VOR/DME or GPS RWY 3 approach at Casper Wyoming, will be identified as HIKOX.

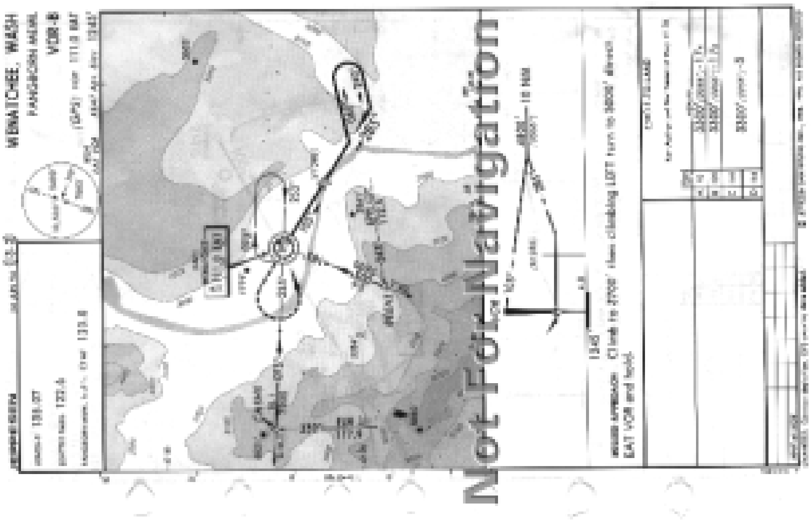
Many waypoints that are specific to TSO C129a GPS approaches require that a name be assigned to them, such as an Initial Approach Fix (IAF) which is shown on the approach procedure chart as a radial and distance from a VOR. These waypoints may or may not appear on the approach procedure charts. Jeppesen includes the names of many of these waypoints on their approach procedure charts; however, these names are usually not included on National Ocean Service (NOS) charts.

TSO C129 Overlay specific.

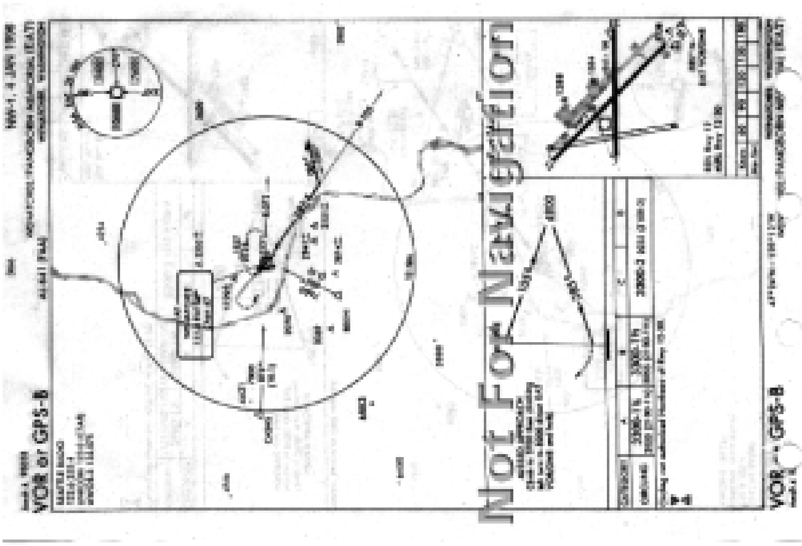
TSO C129 requires the equipment to prompt the pilot to enter the local altimeter setting, if not already entered, at 3 nm inbound to Final Approach Fix, FAF. It also requires that the equipment change RAIM alarm limits from 1 nm to 0.3 nm and to begin changing CDI sensitivity from 1 nm full-scale deflection to 0.3 nm full-scale deflection when 2 nm inbound to the FAF. The TSO also requires that the final leg of the approach be defined as a path between the FAF and the MAP waypoints (bearings to or from waypoints are not allowed for the final segment). For these reasons, a GPS TSO C129a approach must always have an FAF lying on the inbound course to the MAP, even when there is no such waypoint in the underlying approach. There are many GPS overlay approaches, such as the VOR or GPS-B approach to Wenatchee Washington, where there is no FAF inbound. The EAT VOR is the Initial Approach Fix (IAF), Final Approach Fix (FAF), Missed Approach Point (MAP), and Missed Approach Holding Point (MAHP). When there is no FAF inbound waypoint for a GPS approach, it is necessary to add one so that the equipment can do these TSO required tasks. This equipment-required FAF is called a sensor FAF and it is always located on the final approach course prior to the MAP. If there is already a named waypoint which can be used, it becomes the sensor FAF. If not, a sensor FAF waypoint is created. In the Wenatchee approach example, this waypoint is named FF285. FF285 is the sensor FAF and the inbound course for the approach is 285°. FF285 appears on the Jeppesen approach procedure chart, but not on the National Ocean Service (NOS) approach procedure chart for this approach.

This is especially important to understand when a procedure turn or course reversal is required. If you are inbound from the CASHS intersection, a procedure turn is required. You must execute this procedure turn on your Apollo NMS relative to FF285, the TSO C129a FAF, not relative to the EAT VOR as depicted on the NOS chart as it is necessary to cross this sensor FAF waypoint inbound in order for the Apollo NMS to go approach active (approach active annunciator lit) and allow you to complete the approach. This is clearly depicted on the Jeppesen approach procedure chart.

Charts have been reduced for illustrative purposes.



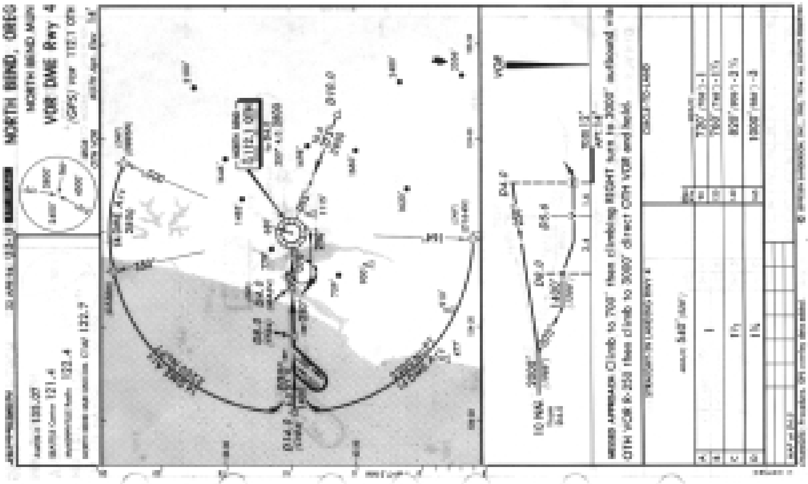
Reproduced with permission of Jeppesen Sanderson, Inc.



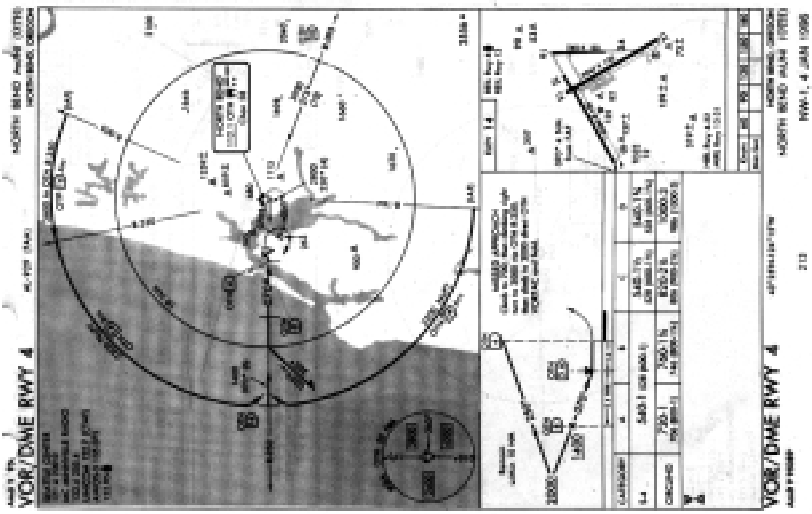
NOS Chart

Another type of waypoint which will have a name in your Apollo NMS database, but may or may not appear on your approach procedure chart is an IAF waypoint defined as a radial and distance from a VOR. An example would be the VOR DME RWY 4 approach to North Bend, Oregon. The IAF at the OTH 164 radial at 14 nm is contained in the Apollo NMS database as D164N (“D” for DME, 164 for 164 radial, and “N,” the 14th letter of the alphabet, for 14 nm.). It is also depicted on Jeppesen approach procedure charts with this name; however, this name is not found on NOS charts.

Charts have been reduced for illustrative purposes.



Reproduced with permission of Jeppesen Sanderson, Inc.



NOS Chart

There are several other types of waypoints which may appear in your Apollo NMS loaded approach and which may or may not appear on your approach procedure charts.

Following is a brief description of these types of waypoints and the naming convention followed.

Identification

Each waypoint in an Apollo NMS flight plan has an identifying type and a name. When you view the flight plan legs, by turning the **Small** knob while viewing a flight plan in FLIGHT PLAN mode, the display will show a “FROM” waypoint and a “TO” waypoint for each leg. Under the names for the waypoint, the waypoint type is usually displayed although this field may be changed by pressing sel and turning the small knob to show other information such as leg ETE. The from-to-next page, located one click to the left of the ‘home’ navigation page, always shows the waypoint names and types for this two-leg “window” view of your active flight plan.

Most of the waypoint types for en route waypoints are quite familiar. They include ARPT for Airport, VOR, NDB, INT for intersection and USER for a user defined waypoint.

The approach waypoint types will usually also have familiar types, but there may be a few types which are new. The approach waypoint types include:

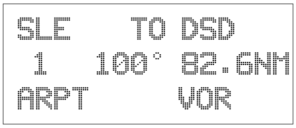
IAF	Initial Approach Fix
FAF	Final Approach Fix. (Note that there must always be a Final Approach Fix inbound for TSO C129a approaches. When an underlying approach, such as a VOR or NDB approach does not have an inbound FAF, one is created or added.)
IFAF	Combined Initial and Final Approach Fix with no intermediate waypoints. (Sometimes a procedure turn or course reversal is required - this usually depends on the direction of flight)

MAP	Missed Approach Point
MAHP	Missed Approach Holding Point
ARC	A DME arc terminator (The preceding flight plan leg is described as an arc to this waypoint. An ARC waypoint may follow another ARC waypoint.)
APPR	An intermediate approach waypoint. These are sometimes used as step-down fixes or to define a course to the next approach waypoint.

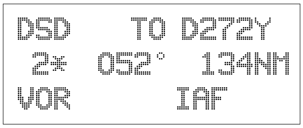
An Apollo NMS TSO C129a approach will always begin at an IAF. It will always contain at a minimum an IAF, FAF, MAP, and MAHP sequence. The IAF and FAF may be combined. Waypoints may be used more than once; the same waypoint could be the IAF, the MAP, and the MAHP; however, TSO C129a non-precision approaches require that there always be a distinct FAF to MAP leg. Intermediate waypoints, of type APPR or ARC, may be anywhere in the sequence except between the FAF and the MAP.

The following example uses the VOR DME RWY 12 GPS-overlay approach to Baker City Oregon.

The Apollo NMS has a flight plan loaded from the Salem, Oregon airport to the Deschutes VOR, DSD, to the Baker City airport, BKE. An approach, the VOR DME RWY 12 approach with the D272Y (waypoint on the BKE VOR 272 radial at 25 nm.) IAF is selected and loaded. When viewing the flight plan legs, the following legs may be viewed.

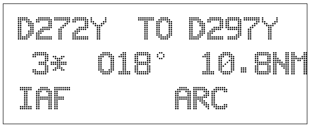


```
SLE     TO DSD
 1   100° 82.6NM
ARPT      VOR
```

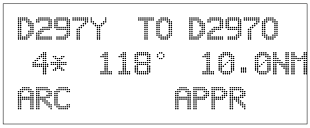


```
DSD     TO D272Y
 2*  052°  134NM
VOR       IAF
```

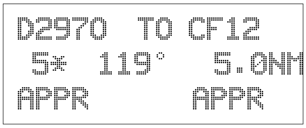
The following legs replace the BKE airport in the flight plan and describe the approach sequence.



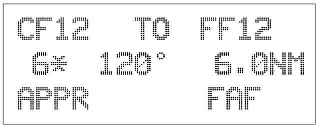
```
D272Y  TO D297Y
 3*  018°  10.8NM
IAF       ARC
```



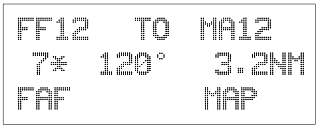
```
D297Y  TO D297O
 4*  118°  10.0NM
ARC       APPR
```



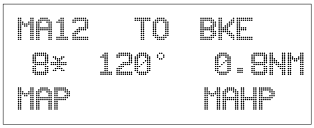
```
D297O  TO CF12
 5*  119°   5.0NM
APPR       APPR
```



```
CF12   TO  FF12
 6*  120°   6.0NM
APPR        FAF
```



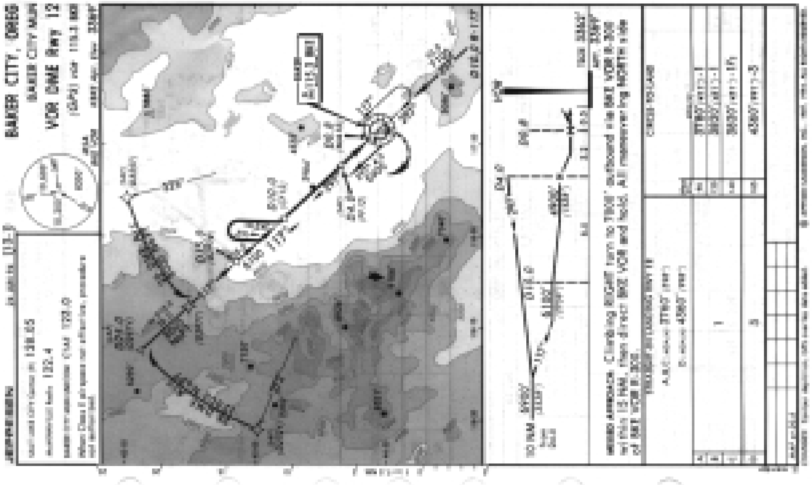
```
FF12   TO  MA12
 7*  120°   3.2NM
FAF         MAP
```



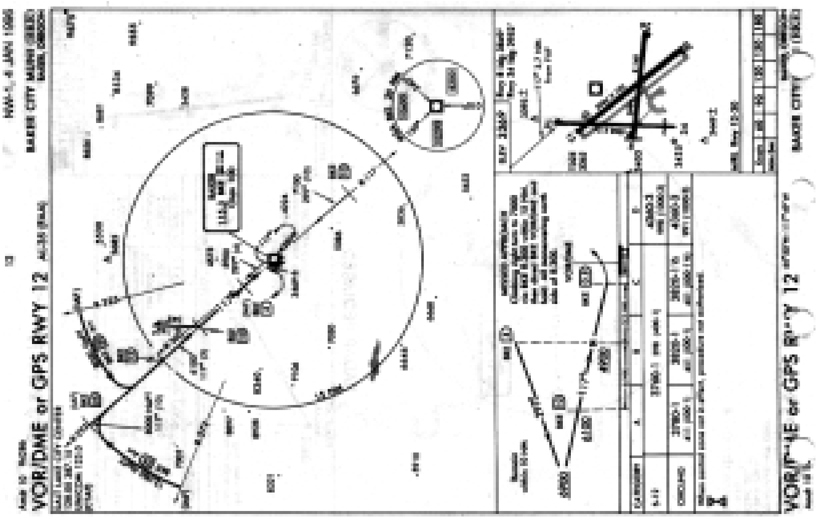
```
MA12   TO  BKE
 8*  120°   0.8NM
MAP         MAHP
```

Notice that these waypoints are all depicted on the example Jeppesen Approach plate; however, only BKE is depicted as such on the NOS plate (shown on the following page).

Charts have been reduced for illustrative purposes.



Reproduced with permission of Jeppesen Sanderson, Inc.



NOS Chart

Naming Conventions

When a name must be provided for an otherwise unnamed waypoint, the naming will use the ARINC-424, chapter 7 specified convention whenever possible. There are a few types of waypoints, DME arc waypoints greater than 26 nm from the reference and single character NDB idents, which are not adequately addressed by the ARINC-424 specification. Most of these names are intuitive after you understand a few of the rules. The entire ARINC naming conventions are not included here, but the following guidelines will probably explain the names you see assigned to these waypoints.

First, the exceptions:

DME arc or DME-distance/bearing waypoints that are greater than 26 miles from their reference point. The standard ARINC convention for DME arc or DME-distance/bearing (sometimes called Rho-Theta) waypoints is to use ‘D’ followed by the bearing from the waypoint, followed by an Alpha character from A to Z corresponding to the number of miles, from 1 to 26, rounded to the nearest whole mile. A waypoint on the BKE VOR 272 radial at 25 nm would then be named D272Y as is the IAF in the Baker, Oregon approach example above. When the distance is greater than 26 miles, such as for the Topeka, KS VOR DME RWY 3 approach, the waypoint is named by using the first two characters of the reference navaid ID, followed by the bearing from the navaid. The IAF at the Topeka VOR, TOP, located on the 231 radial at 31 nm is then named TO231. The IAF on the TOP 176 radial at 31 nm is named TO176.

Canada and some South American countries have multiple NDBs with the same ident. When these are in the same ICAO region, they can’t both be in the data. When this happens, one airport which uses a Golf NDB, “G,” would have the waypoint named “G.” The next airport that uses a “G” NDB in the approach waypoints would have a waypoint named with the 1 letter ident and ‘NB’ for NDB appended to it; therefore, it would appear in the database as “GNB” at the second airport.

Standard Naming Conventions

In general, the following codes are used to correspond to a waypoint type. When they are associated with an approach to a specific runway, the runway is appended. When the approach is not to a specific runway, the approach bearing is appended. These codes are:

FF	Final Approach Fix
CF	Final Approach Course Fix (used when necessary to define a course to the FAF—all VOR DME approaches require a course fix waypoint).
MA	Missed Approach Point
RW	Runway Fix

Following the characters will either be a runway number, when associated with a particular runway, or a bearing corresponding to the course at that waypoint. A missed approach point that corresponds to a RWY 12 approach, would then be called MA12 if it is not the runway threshold. If the MAP were the runway threshold, it would be named RW12. A missed approach point associated with a VOR-A approach, where there are no published straight-in minimums to any runway, and where the final approach course is 120 would be named MA120.

Bearing and Distance Waypoints: Distance/bearing waypoints (sometimes called Rho - Theta waypoints), that are defined as a bearing and distance from a VHF navaid, are named with the character "D," followed by the radial on which they are positioned, followed by a single alpha character from "A" to "Z" that corresponds to a distance from 1 to 26 nm. Thus a waypoint that is on a 350° radial at 10 nm will be named D350J and a waypoint that is on the 250 radial at 15 nm would be named D250O.

Unnamed turn points, intersections, and bearing/distance waypoints: Idents for unnamed turn points, intersections, or bearing/distance waypoints (other than VHF navaid distance/bearing), that are not coincidental with named waypoints, are constructed by using the ident of the nearest navaid together with the distance (rounded to whole miles). If the distance is less than 100 nm, the distance follows the navaid ident. If the distance is 100 nm or more, the last two digits of the miles are placed in front of the navaid ident. For example:

NAVAID	DISTANCE	IDENT
INW	18	INW18
CSN	106	06CSN
TCS	89	TCS89

These are most often used for identifying bends in airways that occur at unnamed positions and other enroute uses. It is unlikely that you will often see this convention used to name any approach waypoints, but you will occasionally.

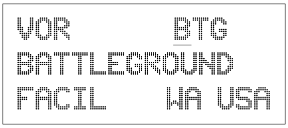
Approach Topics

Direct-To

The Direct-To function is used for several purposes. Especially during approach operations, you should be very comfortable with how this feature works. Review the Direct-To section of the manual if you need a refresher before proceeding with approaches.

In general:

Pressing **DIRECT-TO** once allows you to select a waypoint that you will navigate “Direct-To.” The first character will flash as the NMS is ready for you to select a waypoint to fly “Direct-To.”



```
VOR       BTG
BATTLEGROUND
FACIL    WA USA
```

Pressing **DIRECT-TO** a second time allows entry of a desired inbound course to the current active waypoint. Entering a desired inbound course to a waypoint automatically suspends leg-sequencing at that waypoint and lights the **OBS/HLD** annunciator.

```
OBS DTK: 001
TO BTG
BRG 002  DTK 001
```

Subsequent pressing of **DIRECT-TO** toggles between the two first uses.

The Direct-To feature defaults to the current active waypoint, the current displayed waypoint, or in FLIGHT PLAN mode, the waypoint displayed on the “TO” side of any displayed flight plan leg.

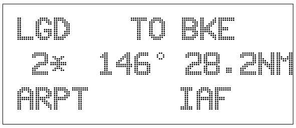
If the Direct-To is used during approach operations, and you select a waypoint that is not one of the waypoints already in the active flight plan, use of Direct-To will automatically unload any active approach. Use of Direct-To cancels parallel-track operations, if they are in use.

Manually Selecting a Flight plan Leg

Approach operations often result in the need to manually select a leg of the active flight plan. Manual leg selection will often be required when operating with Radar vectors and there is the need to intercept an approach course. It may also occur when flying a DME-ARC to intercept an approach course.

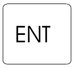
1.

Press **FPL** twice to reach your active flight plan. Then turn the **Small** knob to display the desired leg.

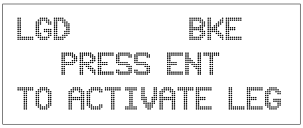


```
LGD    TO BKE
 2✱  146° 28.2NM
ARPT      IAF
```

2.



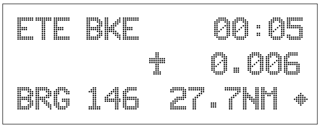
Press **ENT**.



```
LGD        BKE
   PRESS ENT
TO ACTIVATE LEG
```

3.

Press **ENT** to accept the displayed destination waypoint. The unit will then go to NAV mode.

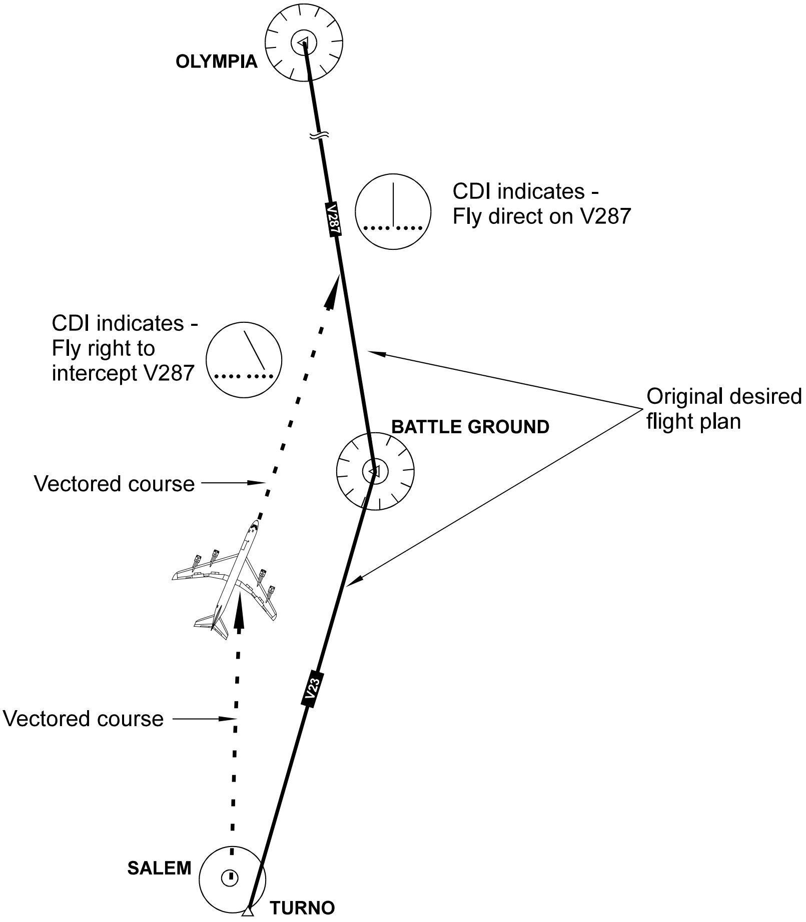


```
ETE BKE     00:05
        †   0.006
BRG 146  27.7NM ◆
```

Example

You are flying a section of an active flight plan from SLE to BTG to OLM. As you approach the Portland area, you are given Radar vectors to the West of your course. ATC then tells you: “Fly heading 360, resume own navigation, intercept V287 to OLM, then as filed...”

Manually select the leg from BTG to OLM (which is V287). Even though you have not yet reached BTG, you will know when you have intercepted this course.



FPL

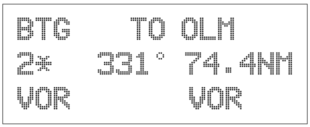
FPL

Press **FPL** twice to reach the active plan in FLIGHT PLAN Mode. This example uses a flight plan from the Salem (SLE) airport to the Battle Ground (BTG) VOR and then to the Olympia (OLM) VOR. Turn the Small knob clockwise one click to view the first leg of your flight plan.

Note that on the second line of each leg page, a number appears to indicate the leg number. An Asterisk is used after the number of each leg to indicate the active flight plan.

```
SLE    TO BTG
1**  001° 53.2NM
ARPT      VOR
```

Two asterisks after the leg number indicate the active leg of the active flight plan (SLE to BTG).



```
BTG    TO OLM
2*   331° 74.4NM
VOR       VOR
```

Turn the **Small** knob until the leg you wish to activate is shown and then press **ENT** twice.

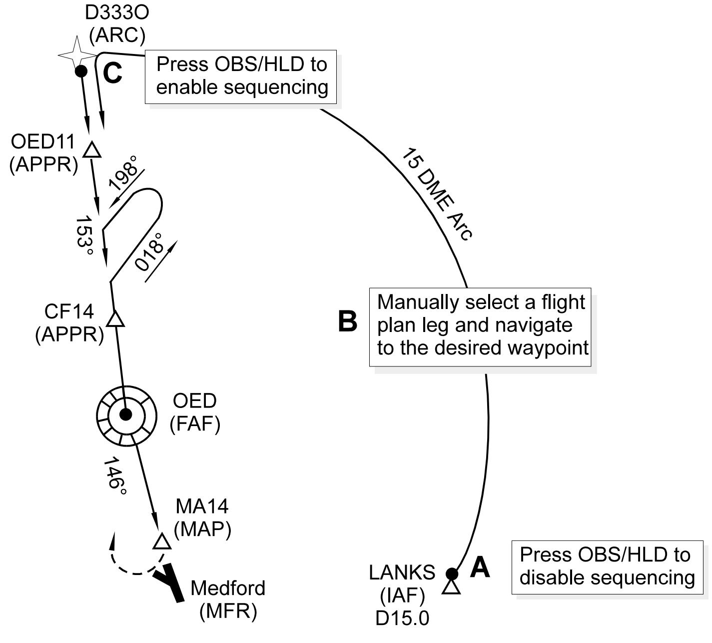
ENT

ENT

Now fly the ATC assigned heading of 360 until the CDI centers to indicate that we have intercepted V287.

Sequencing Details

When manually selecting a flight plan leg, you must be aware of the rules for sequencing. A flight plan will sequence to the next leg of the flight plan if the aircraft is on the "FROM" side of a line drawn through the "TO" waypoint perpendicular to the desired inbound course to that waypoint. If you manually select a leg that you have already passed, the NMS will immediately sequence to the next leg. There are times, such as when flying a DME-ARC to intercept a leg, that you will want to select a leg that according to the rule for sequencing you are already past. In order to keep the NMS from immediately sequencing when such a leg is selected, place your flight plan on hold by pressing the **OBS/HLD** button prior to selecting the leg. It is then necessary to re-enable sequencing, by pressing the **OBS/HLD** button again, when established inbound on the desired leg.



When approaching LANKS intersection, we will want to select the flight plan leg of D333O to OED11. This is the inbound course that we want to intercept. We will use the DME-Arc page to navigate the arc. See *DME-Arc Procedure* section.

Since our current position, near the LANKS intersection (Point A), is already beyond our next “TO” waypoint (OED11), on the inbound course from D333O to OED11, our flight plan would sequence past our selected leg as soon as the leg is selected. To prevent sequencing, press **OBS/HLD** before manually selecting the leg. The OBS/HLD annunciator will turn on. Manually select the desired flight plan leg and navigate to the waypoint (Point B). When the leg is intercepted, press **OBS/HLD** again to enable sequencing (Point C). The OBS/HLD annunciator will then turn off.

Procedure Turns

A procedure turn is a way of crossing the same waypoint more than once in order to accomplish a course reversal. First, make sure that flight plan leg sequencing is suspended. Second, after crossing the waypoint, set the correct inbound course to intercept. Finally, enable sequencing when you are established inbound.

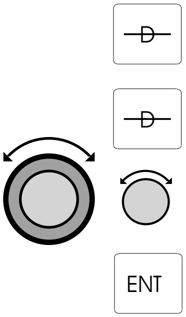
In some cases, the NMS will know when a course reversal is required and will automatically suspend sequencing. This is the case when during an approach, the FAF is the active waypoint and there is more than a 70 degree difference between your bearing to the FAF and the final approach course (FAF to MAP course). In this case the NMS will automatically suspend sequencing and the **OBS/HLD** annunciator will light.

Note

☞ *The only other time the NMS will automatically suspend sequencing for you is when the active waypoint is either the Missed Approach Point (MAP) or the Missed Approach Holding Point (MAHP).*

When you know that a procedure turn or course reversal is required, check the **OBS/HLD** annunciator and press the **OBS/HLD** button if necessary to suspend sequencing and to light the annunciator.

When you cross the waypoint, the TO/FROM flag will change to "FROM."



Next, set the desired inbound course by pressing **DIRECT-TO** twice. Set the desired inbound course with the **Large** and **Small** knobs. Then, press **ENT**.

Note

Selecting the inbound course is a very important step. Sequencing is performed relative to the inbound course you have selected. Once you are established on the selected inbound course, press ***OBS/HLD*** *again to enable sequencing. The* ***OBS/HLD*** *light will turn off.*

Fly the procedure-turn or course reversal and intercept the selected inbound course to the waypoint.

WPT SEQ
OBS/HLD

When established inbound, press **OBS/HLD** to enable the flight plan to sequence upon the next arrival at the waypoint.

If you do not enable flight plan sequencing when established, the TO/FROM flag will go to “FROM” as you cross the waypoint.

WPT SEQ
OBS/HLD

Press the **OBS/HLD** button. Sequencing will occur immediately, if you are past the waypoint (on the “From” side).

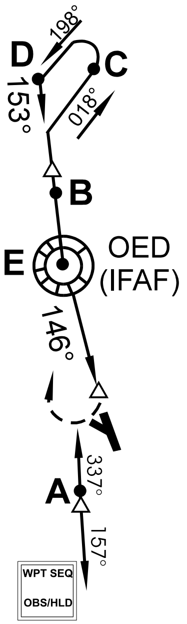
Procedure Turn at an FAF

A special condition occurs when a procedure turn is made at an IAF which is also the FAF. In this case, the Apollo NMS will treat the waypoint as the IAF until sequencing is enabled when established inbound. When you enable sequencing by pressing the **OBS/HLD** button thereby extinguishing the **OBS/HLD** annunciator light, the IAF/FAF waypoint becomes the FAF. If you are less than 2 nm from the FAF when you enable sequencing, then transition to Approach Active, i.e., the CDI sensitivity will begin changing to 0.3 nm full-scale deflection immediately. The approach annunciator will begin flashing immediately if all the conditions exist to allow the approach to go to the active condition (RAIM available, etc.). It is important for you to enable sequencing as soon after becoming established inbound as practical when you want the waypoint to become the FAF.

Note

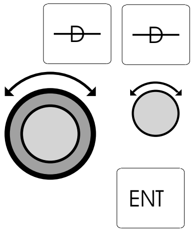
Combined IAF/FAF waypoints are identified by the Apollo NMS as IFAF waypoint types.

Procedure Turn Example 1



This example uses MFR VOR DME or GPS Rwy 14 procedure with IAF OED VOR using the OED 157/10 transition (see point A).

1. At point A, press **OBS/HLD** to suspend sequencing.



2. At point B, press **DIRECT-TO** twice. Use the **Small** and **Large** knobs to select 153° and then press **ENT** to establish an inbound course. Note that your CDI will “reverse-sense” while outbound, just like a VOR with 153°-TO selected on the OBS.

3. At point C, make your procedure turn.

4.

At point D, press **OBS/HLD** to enable sequencing. Once sequencing is enabled, OED becomes the FAF and the NMS will transition to Approach Active at OED.

5. At point E, the NMS will be in Approach Active operation.

Procedure Turn Example 2

For this example, use the VOR or GPS-B approach for Wenatchee, Washington. You will start the approach using the CASHS transition.

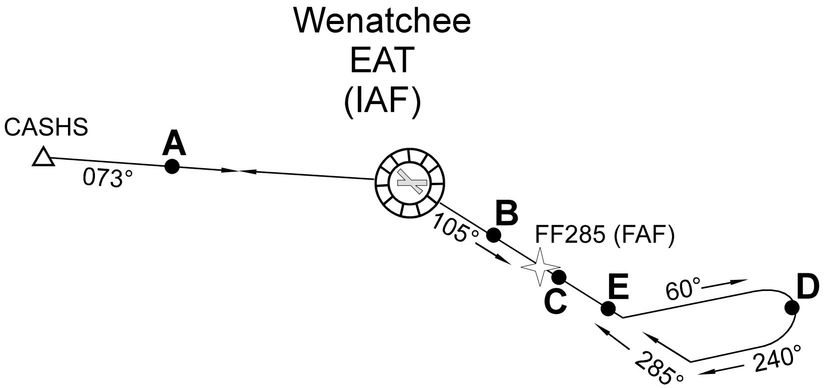


Illustration Points

Point A - Between CASHS and EAT.

Point B - A heading of 105° between EAT and FF285.

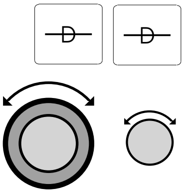
Point C - Continue on a heading of 105° between FF285 and the procedure turn until beyond FF285.

Point D - Make the procedure turn.

Point E - Intercept the 285° inbound to FF285.

1. WPT SEQ OBS/HLD Point A - A heading of 073° inbound to EAT.

2.



Between EAT and FF285 (Point B) with a heading of 105°, press **OBS/HLD** to suspend sequencing.

3. Press **DIRECT-TO** twice. Select an OBS setting of 285° with the **Large** and **Small** knobs and then press **ENT** to select an inbound course. Note that the CDI will be “reverse-sensing” just as it would when outbound from a VOR with the OBS set to the inbound course. (Point C)

9. At point D, make the procedure turn.

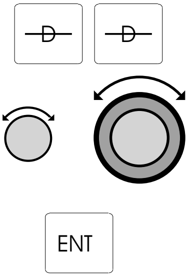
10. At the intercept of the inbound course to the FAF, press **OBS/HLD** to allow sequencing at the FAF. Waypoint FF285 now becomes the FAF. (Point E)

Holding Patterns

A holding pattern is operationally the same as a procedure turn except that you usually intend to make repeated crossings of the waypoint on a specific inbound course. For a holding pattern, like for the procedure turn, the steps will always be to:

1. 

First, verify that sequencing is suspended, the OBS/HLD annunciator is lit, or suspend sequencing by pressing the **OBS/HLD** button.

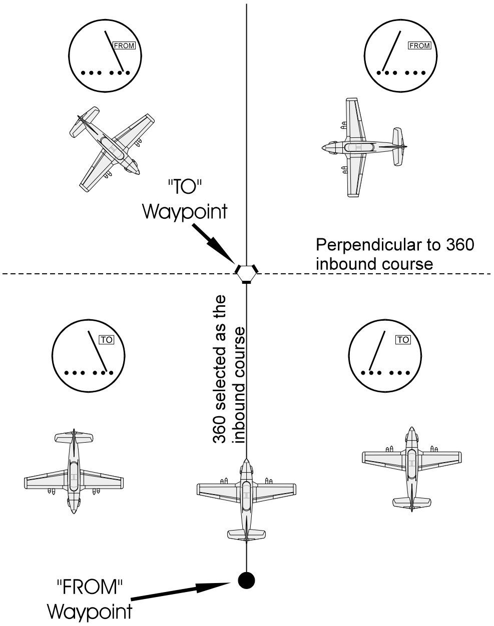
2. 

Second, after crossing the waypoint, establish the desired inbound course to the waypoint by pressing **DIRECT-TO** twice or pressing **ENT** for the "Set OBS Course" message. Select the inbound course with the **Small** and **Large** knobs, then press **ENT**.

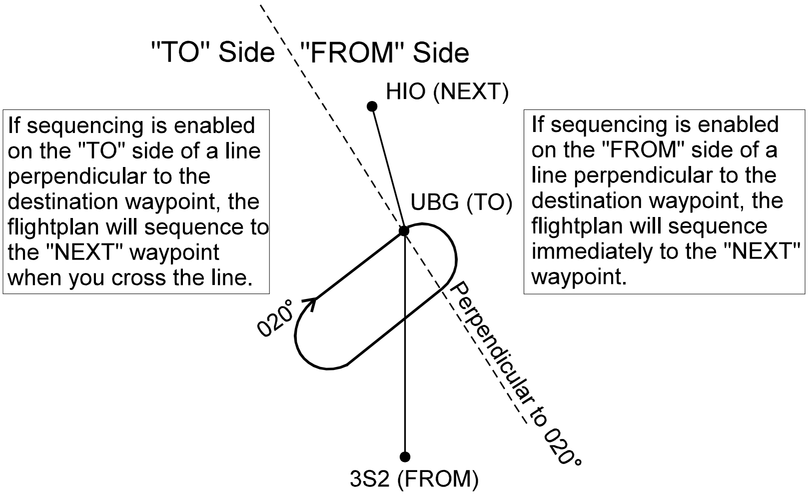
3. 

Enter the holding pattern by the most appropriate entry method. For example, Direct, Teardrop, or Parallel, just as you would enter that holding pattern at a VOR. Finally, when you are ready to exit the holding pattern, press **OBS/HLD** while still on the "To" side of the waypoint to enable sequencing the next time you cross the waypoint.

While you are in a holding pattern, the CDI/HSI cross-track deviation display and the TO/FROM flag will behave almost exactly the way they would if you were holding at a VOR. The TO/FROM flag will display "TO" prior to reaching the waypoint. The TO/FROM flag will display "FROM" after crossing the waypoint. TO and FROM is determined by position relative to a line drawn perpendicular to the selected inbound course and through the waypoint. The CDI will indicate "fly-left" if the aircraft is to the right of the desired track with reference to the selected inbound course. The CDI will indicate "fly-right" if the aircraft is to the left of the desired track with reference to the selected inbound course. As with traditional VOR navigation, these indications are always related to the aircraft position and not to the heading or direction of flight.



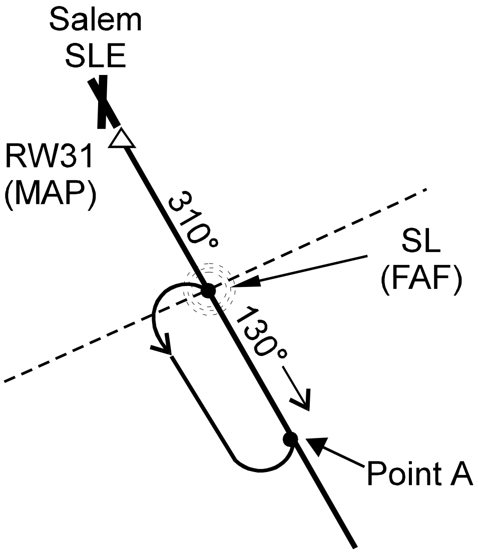
When you are ready to depart the hold, you enable sequencing with the **OBS/HLD** button. If you are on the “TO” side of the waypoint, the flight plan will sequence the next time you cross the waypoint. If you are on the “FROM” side of the waypoint, the flight plan will sequence immediately. The following example shows holding at the Newburg VOR (VBG) with 020° inbound selected as the “OBS” course to UBG.



If sequencing is enabled on the "TO" side of a line perpendicular to the destination waypoint, the flightplan will sequence to the "NEXT" waypoint when you cross the line.

If sequencing is enabled on the "FROM" side of a line perpendicular to the destination waypoint, the flightplan will sequence immediately to the "NEXT" waypoint.

A special case exists when holding at the FAF. The waypoint will not be treated as the FAF until sequencing is resumed inbound to the waypoint. When the Hold waypoint is the FAF, be sure you are on the “TO” side of the waypoint and established inbound before you press **OBS/HLD** to resume sequencing. Also, if you are less than 2 nm from the waypoint when you resume flight plan sequencing, the NMS will immediately begin the transition to Approach Active.



WPT SEQ
OBS/HLD

Press the **OBS/HLD** button as soon as you are established inbound when you want the waypoint to become the FAF in order to allow as much time for this transition as possible.

This example shows holding at the FAF, SL (TURNO) for the NDB or GPS Runway 31 Salem (McNary) Airport (SLE)

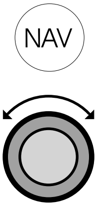
WPT SEQ
OBS/HLD

Press **OBS/HLD** to release the hold as soon as you intercept the inbound course (point A). This will allow you as much time as possible for transition to Approach Active operation. The waypoint SL (TURNO) becomes the FAF as soon as the hold is released.

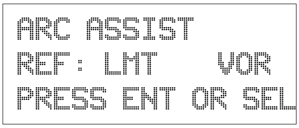
DME-ARCs (Arc Assist)

The Apollo NMS provides navigation pages customized for flying DME arcs. The Arc Assist page shows the identifier and type of waypoint being used as a reference. The Arc Assist page allows you to select and change the reference waypoint just as you would any other waypoint: the distance from that reference waypoint, the radial from that waypoint, and the desired track at that point on the arc. Actually there are two Arc Assist pages: one is labeled “Left” and the other “Right.” The only difference is that one shows the desired track for a left-arc and the other shows the 180 degree opposite desired track for a right-arc.

1.

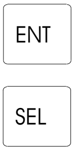


The Arc Assist page is selected in navigation mode with the **Large** knob. The nearest VOR will display as the default reference point.



```
ARC ASSIST
REF: LMT    VOR
PRESS ENT OR SEL
```

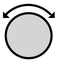
2.



Before you reach the starting waypoint of a DME Arc, press **ENT** to accept the displayed VOR or press **SEL** and select the desired waypoint. The selected waypoint is now used as the center of the arc.

```
LEFT ARC DTK 031
REF: ILR   VOR
RAD 121°  131NM
```

3.



Turn the **Small** knob to view the left-arc or right-arc pages.

The desired track shown on a Arc Assist page is relative to the arc, not to the flight plan legs. The DME-Arc is always perpendicular to the present radial and it shows the desired track at the current radial if the aircraft was on the arc. It is the desired no-wind heading if established on the arc. If your distance from the reference waypoint is greater or less than the distance should be for the published arc, then you will need to increase or decrease your heading to intercept the arc.

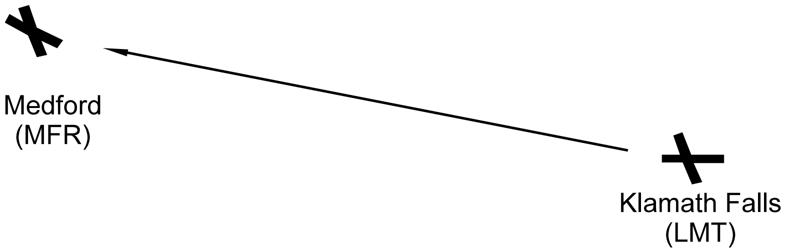
DME-Arcs are usually used as a method for pilots to intercept a flight plan leg, or a course to a fix. They are sometimes used as a method of reaching a subsequent fix such as a missed approach holding waypoint.

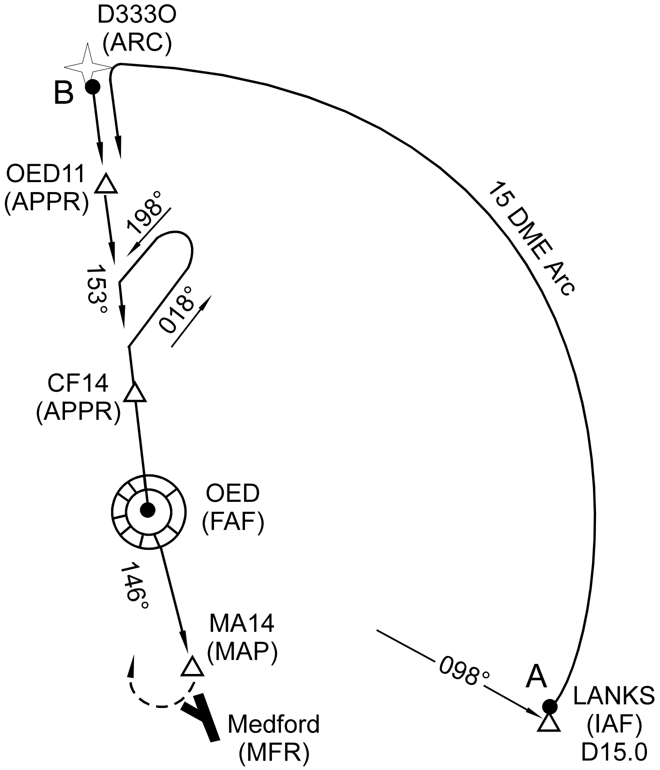
Flying a DME-Arc is a procedure. The Apollo NMS provides you with more information than traditional DME equipment including a Desired-Track (DTK) relevant to the arc at your current radial. The information provided and the method of navigating the arc and intercepting a new course is very similar to the information and techniques used to fly a DME-Arc with traditional equipment, except easier.

DME-Arcs are flown using an Apollo NMS Arc Assist page and the aircraft heading for primary guidance. This makes them nearly identical to flying a DME-Arc with traditional DME equipment. The NMS and your CDI should provide guidance on the course or leg that you intend to intercept so that the CDI gives intercept information exactly as if you were intercepting a familiar VOR inbound course.

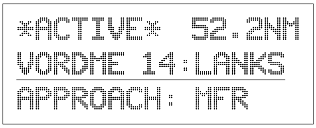
DME Arc Example

The following example describes the process for intercepting and flying a DME-Arc. This example uses a flight plan from Klamath Falls (LMT) to Medford (MFR) and will navigate along the VOR DME Runway 14 approach.





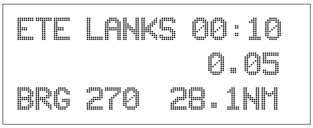
1. Create a flight plan from Klamath Falls, Oregon to Medford, Oregon. Activate the flight plan and then load an approach. Select the VOR DME 14 LANKS approach.



```
*ACTIVE*  52.2NM
VORDME 14:LANKS
APPROACH: MFR
```

2. In NAV Mode view the home NAV page and watch your progress to the first waypoint (LANKS).

NAV

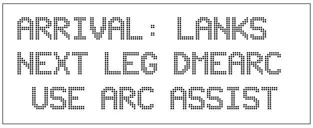


```
ETE LANKS 00:10
            0.05
BRG 270  28.1NM
```

3.

When you reach LANKS, the **MSG** button will flash. Press **MSG** to view the message. You will be advised to use the Arc Assist page in NAV mode.

```
SEQUENCE ALERT
NEXT LEG DMEARC
 USE ARC ASSIST
```



```
ARRIVAL: LANKS
NEXT LEG DMEARC
 USE ARC ASSIST
```

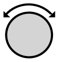
4.

Press the **OBS/HLD** button to suspend flight plan leg sequencing.

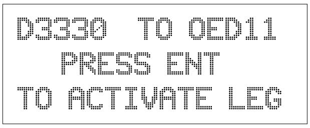
Note

We are on the FROM side of the leg from D333O to OED11. We are going to manually activate this leg and we don't want to sequence immediately.

5.



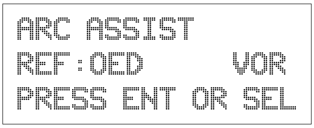
Now, manually select the flight plan leg from D333O to OED. This is the inbound course this Arc will intercept. Press **FPL**. Turn the **Small** knob to display the leg from D333O to OED. Press **ENT**. Press **ENT** a second time to activate the leg



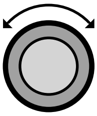
```
D3330  TO OED11
   PRESS ENT
TO ACTIVATE LEG
```

6.

Press **NAV**. Turn the **Large** knob to the DME Arc page.



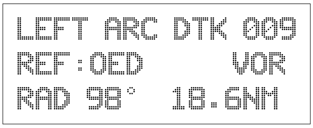
```
ARC ASSIST
REF:OED      VOR
PRESS ENT OR SEL
```



7. Press **ENT** to choose the displayed default reference point. In this case, the OED VOR.

Note

☞ *If the displayed default reference is not the desired one for the DME Arc, press **SEL** and use the **Large** and **Small** knobs to select the correct reference waypoint. Use this page and your aircraft heading to fly the arc.*



```
LEFT ARC DTK 009
REF:OED      VOR
RAD 98°  18.6NM
```

8. NAV WPT SEQ OBS/HLD After you intercept your inbound leg, i.e. your CDI begins to center. Press **NAV** to return to NAV Mode. Reactivate flight plan leg sequencing by pressing the **OBS/HLD** button.

Note

☞ *When intercepting and flying DME-ARCs, autopilots may be used only in the heading mode. Autopilots may be used to capture the course you select to intercept.*

Other Uses for the Arc Assist Function

You can select the reference waypoint for the Arc Assist feature and it can be used at any time, not just during approach or terminal operations. This allows the Arc Assist feature to be used for a variety of uses other than flying DME arcs to intercept an approach course. It can of course be used to navigate DME arcs that are part of a published missed approach procedure. It can also be used for difficult operations such as conducting an over water search. By establishing a user waypoint at the center of such a search area and selecting that waypoint as a DME Arc reference point, you can fly circles about that waypoint at known distances. By gradually increasing the arc distance each time you pass a specific radial, you can expand the search area. Looking for something on the water or over featureless terrain is usually quite a challenge, especially when the winds are variable. The Arc Assist feature of the Apollo NMS can make this much easier.

Missed Approaches

When you have reached the Missed Approach Point, you must either decide to land or not land. The Apollo NMS will continue to provide guidance on an extension of your inbound course to the MAP. The MAP will remain the active waypoint, the TO/FROM flag will indicate from, and the Apollo NMS will continue to display navigation data such as bearing and distance relative to the MAP.

If you have decided not to land, you will then follow either the published or alternate missed approach instructions. Missed approach instructions can be very complex. However, the Apollo NMS can be used to provide guidance for virtually any missed approach.

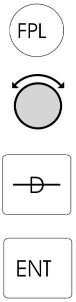
The steps for a missed approach are as follows:

1. Begin your missed approach. This usually includes a procedural clearance such as: “Fly runway heading to altitude,” or “climbing left turn to a heading of xxx.”

2. 

Cancel the approach on your Apollo NMS. Press **OBS/HLD** to enable sequencing and to cancel the approach.

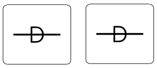
As soon as you enable sequencing, the Apollo NMS will sequence to the next waypoint in the flight plan. This is the next waypoint in the published missed approach procedure. Note that if the next waypoint is the MAHP, it is an automatic holding point and sequencing will again be automatically suspended. The OBS/HLD light will come back on. Operation will change from Approach Active to Approach Transition. The Approach Active light will go out and the CDI will gradually go back to Approach Transition CDI sensitivity (from 0.3 nm to 1.0 nm full-scale).



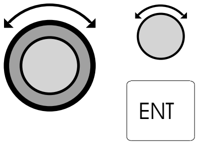
3. Verify or select the next waypoint in your flight plan. If the active waypoint is not the one you wish to navigate to, select a new active waypoint. If the active waypoint you want is already in your active flight plan, the easiest way to select it is to press **FPL**, to enter flight plan mode. Turn the **Small** knob until the waypoint you want is shown as the "TO" side of a flight plan leg (illustration). Then press **DIRECT-TO** and **ENT** to select the waypoint.

Note

☞ *If the same waypoint appears in the approach sequence more than once, be sure to turn to the occurrence you wish to select.*



4. Verify or select the course to the waypoint. If a specific inbound course to the active waypoint is to be intercepted or flown, press **DIRECT-TO** twice.



5. Enter the desired the inbound course with the **Large** and **Small** knobs. Then, press **ENT**. Selecting an inbound course in this manner will suspend flight plan sequencing and the **OBS/HLD** annunciator will light.

6. If you do not wish to hold or execute a procedure turn at the next waypoint, press **OBS/HLD** to enable sequencing at the active waypoint. You may also want to manually select a flight plan leg to intercept. In this case, press **FPL**, turn the **Small** knob to the desired leg and press **ENT**. Press **ENT** again to activate it.

7. After you have executed the missed approach, you may want to proceed to another destination or you may want to execute the same approach or another approach to the same airport.

Select a New Destination Airport Using Direct-To

(Method 1)

Most often, the easiest way will be to edit and modify the current active flight plan. Remember that if you want to select an approach for the new destination, it must be the last waypoint in your active flight plan. If you use DIRECT-TO to select a new destination, edit the active flight plan and delete any subsequent waypoints before attempting to load an approach for the new destination. If you do use DIRECT-TO and you select a waypoint not currently in the active plan, any currently loaded approach will automatically be unloaded if you are within one of the approach legs of the flight plan.

Some people may choose the “Clear Waypoints” option on the main flight plan page prior to selecting a new Direct-to waypoint. While this guarantees that the new selected destination is the last waypoint in the flight plan, it will also result in a Nav-Flagged condition immediately after “delete waypoints” is selected. This is because the Apollo NMS has no waypoint to navigate to. Therefore, all navigation data is invalid until you select a new “TO” waypoint.

Select a New Destination by Activating Another Flight plan

(Method 2)

You may also select another stored flight plan to your new destination and activate it. Activating a stored flight plan copies it into the active plan.

Repeat the Same Approach or Select Another Approach at the Same Airport

(Method 3)

1. FPL FPL

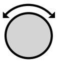
   Change the approach if necessary. Press **FPL** (twice - to make certain you are on the top, or home, page of the active flight plan).

2. SEL

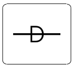
   Press **SEL**, and turn the **Small** knob until “Change Approach?” appears.

3. ENT ENT

   Press **ENT.** Select the new approach with the **Small** knob and then press **ENT**.



4. When cleared, you will want to proceed to the IAF or to intercept an approach leg prior to the FAF via radar vectors. If you are to proceed direct to the IAF, press **FPL** to enter FLIGHT PLAN mode. Then, turn the **Small** knob until the leg with the IAF at the "TO" end is shown.



5. Press **DIRECT-TO** and **ENT** to select the IAF as a direct to waypoint. If you are to intercept an inbound course to the IAF, select the inbound course and then remember to enable sequencing when established inbound on that course.

6. If you are being vectored to intercept an approach leg, manually select the leg you are intercepting.

Press **FPL** twice. Turn the **Small** knob to display the desired leg.

Press **ENT**. The message displayed is "Press **ENT** to activate leg."

Press **ENT**.

Note

*If you are on the FROM side of the leg you are manually activating, be sure to press **OBS/HLD** to keep it from sequencing as soon as it is selected.*

Notes

GPS Approach Operations

The information in this section covers GPS Approach Procedures for use with the Navigation Management System. The first part provides an overview of approach operations. The second part is a check list that gives an overview of the process for setting up and performing an approach to a suitable airport. The third part gives more detailed directions that cover many of the situations you will encounter including example approaches. A fourth gives a background about what RAIM is and what it means to your approach navigation.

Operations

There are three general areas of operation (see the diagram on the next page): En Route, Approach Transition, and Approach Active.

En route operations describe what you do to set up your approach information before you are within 30 nm of destination airport and prior to enabling your approach. Load your approach to the active flight plan. At 30 nm your NMC will ask if you want to enable approach, press the ENT button. Then, enter the local altimeter setting. If you are less than 30 nm from your destination when you load an approach, you will be prompted immediately to enable it.

Approach Transition operations occur after you enable approach operation. The APPRCH annunciator will turn on. The CDI sensitivity will gradually scale from 5.0 to 1.0 nm full scale per side automatically. The IAF is in the Approach Transition operation area. The ACTIVE annunciator will start flashing when you are within 3 nm inbound to the FAF and not on hold. When you are 2 nm from the FAF, CDI sensitivity will gradually scale from 1.0 to 0.3 nm full scale per side automatically.

Approach Active operation begins when you cross the FAF and ends when you cross the MAP. The CDI is at 0.3 nm full scale per side. The OBS/HOLD Annunciator is on steady. The ACTIVE annunciator is on steady. If the ACTIVE annunciator is not on steady, do NOT continue the approach.

Approach Transition operation begins again when you cross the MAP. Decide whether you are going to land or perform a missed approach. If you are performing a missed approach procedure, press the OBS/HOLD annunciator to enable waypoint sequencing. The CDI will scale back to 1.0 nm.

Waypoint Arrival Alert

A standard Waypoint Arrival Alert message is generated when you reach each approach waypoint. Press the **MSG** button to view and acknowledge the message. Information for navigating to the next waypoin. Generally you will then press the **NAV** button to return to the navigation displays. The Waypoint Alert indicates that you are close (approximately 1 nm for every 100 nm/h or about 36 seconds) to the next destination waypoint.

Approach Annunciator Summary

Device or Annunciator	En route	Approach Transition	Approach Active	Appr. Trans. (Missed Appr)
CDI Sens.	5 nm*	1 nm	0.3 nm	1 nm
Approach	Off	On	On	On
Active	Off	Flashes 3 nm from FAF	On	Off
OBS/HOLD	Off*	Off*	Auto-On	
for MAP*	Auto-On for MAHP*			

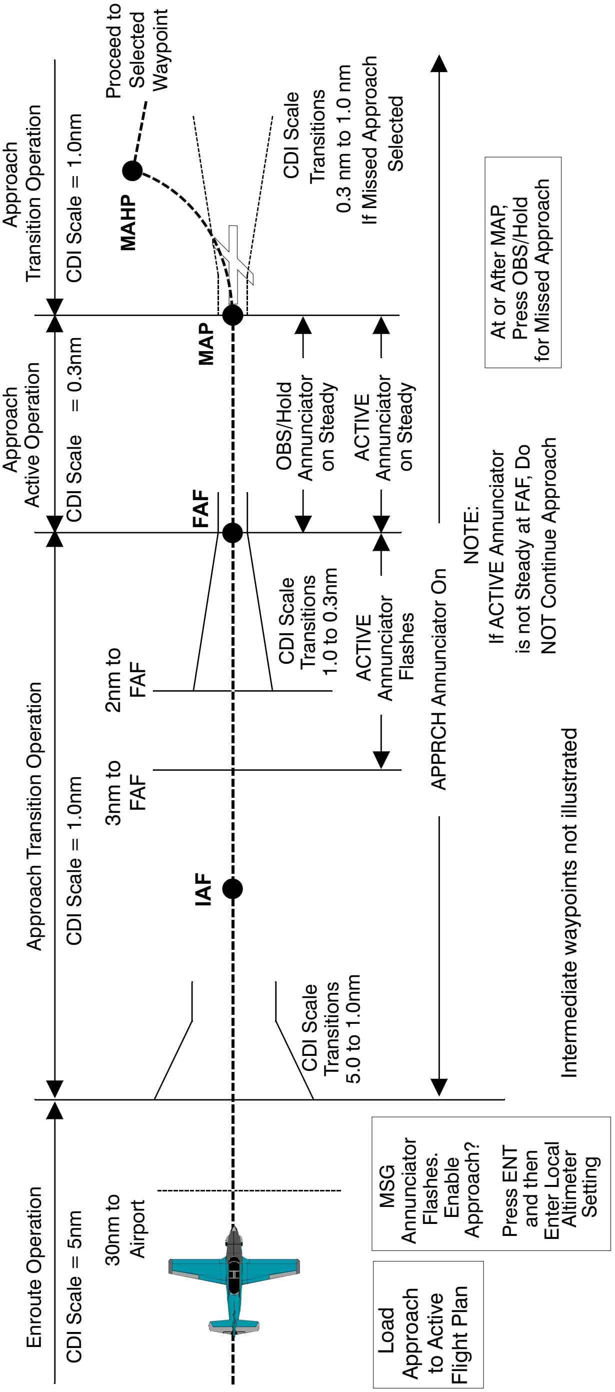
* Default is shown, but the value is user-selectable

CAUTION

The Apollo NMS and the U.S. GPS Satellites use the World Geodetic System 1984 (WGS-84) horizontal datum for latitudes and longitudes. Approach plate or approach procedure data must be referenced to the WGS-84 or North American Datum 1983 (NAD-83) in order to use the approach. NAD-83 is for all practical purposes identical to the WGS-84 datum. All published U.S. and Canadian approach charts meet this criterion. Prior to using the Apollo NMS for any GPS approach other than a published U.S. or Canadian approach, you must first verify that the approach charts and approach waypoints use the WGS-84 or NAD-83 reference system. If the approach data is referenced to any other coordinate system, it can result in an unsafe position error.

The Apollo NMS database contains approach information. It is very important that the pilot verify that approach data is current prior to use. The approach data contained in the Apollo NMS does not replace or eliminate the need for Approach Plates or published Approach Procedures.

Some approach procedures may not be suitable for the Apollo NMS operational characteristics and may be omitted from the Apollo NMS database. Since an approach must be in the database in order to be selected and flown using the Apollo NMS, it is good pre-flight practice to make sure that the database contains anticipated approaches.


Enroute Operation
CDI Scale = 5nm
30nm to Airport
Load Approach to Active Flight Plan
MSG Annunciator Flashes. Enable Approach?
Press ENT and then Enter Local Altimeter Setting
Approach Transition Operation
CDI Scale = 1.0nm
CDI Scale Transitions 5.0 to 1.0nm
IAF
3nm to FAF
2nm to FAF
CDI Scale Transitions 1.0 to 0.3nm
ACTIVE Annunciator Flashes
APPRCH Annunciator On
Intermediate waypoints not illustrated
Approach Active Operation
CDI Scale = 0.3nm
FAF
OBS/Hold Annunciator on Steady
ACTIVE Annunciator on Steady
NOTE:
If ACTIVE Annunciator is not Steady at FAF, Do NOT Continue Approach
MAP
Approach Transition Operation
CDI Scale = 1.0nm
MAHP
Proceed to Selected Waypoint
CDI Scale Transitions 0.3 nm to 1.0 nm If Missed Approach Selected
At or After MAP, Press OBS/Hold for Missed Approach

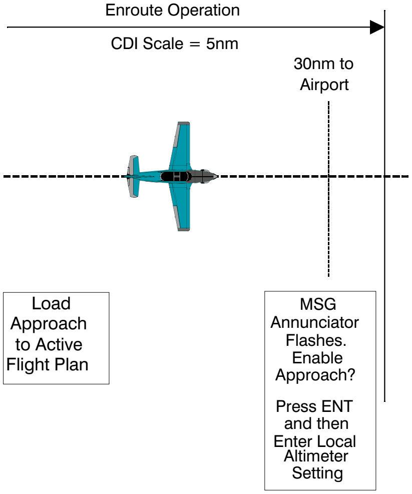
NMS Approach Procedure

There are three general types of NMS operation (see diagram on the next page): En route, Approach Transition (or Approach Enabled) and Approach Active. When conducting an approach, your Apollo NMS will progress from En Route to Approach Transition when the pilot enables the approach, then to Approach Active, and possibly back to Approach Transition in the event of a missed approach.

Action	Explanation
	Turn on your NMC system and all related equipment.

En route Operations

En route Operations describe all operations prior to 30 nm from your destination airport. Your Apollo NMS is providing En route operation whenever the Approach annunciator light is not on. The default CDI sensitivity for en route is 5.0 nm; however, you may manually select other CDI sensitivities. Generally, you will select your destination airport prior to departure or while en route, and you will usually select and load an anticipated approach from the database into your active flight plan while en route.



Note

An approach can only be selected for an airport when it is the last waypoint in your active flight plan.

Load a Destination Airport

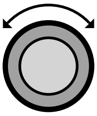
The destination must be an airport.

1.

FPL

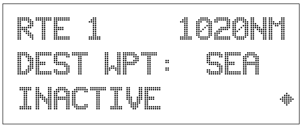
Load your flight plan. You may activate or edit an existing flight plan. Press the FPL button to reach FLIGHT PLAN mode.

If the desired flight plan is active, go to the next section “Load Approach Information.”



2.

If the desired flight plan is not displayed, turn the **Large**, outer knob to display the desired flight plan.



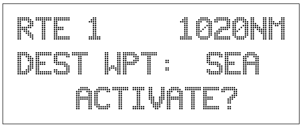
```
RTE 1      1020NM
DEST WPT:   SEA
INACTIVE         ◆
```

3.

SEL

ENT

Press **SEL**. “Activate” will flash. Press **ENT** to activate the selected flight plan.



```
RTE 1      1020NM
DEST WPT:   SEA
    ACTIVATE?
```

Load Approach Information

1.

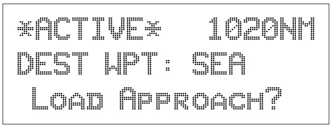
Press **FPL**.

2.

FPL

SEL

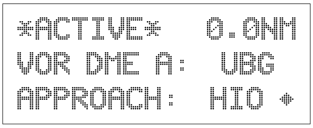
Press **SEL** to reach the “Load Approach?” selection.



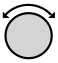
```
*ACTIVE*   1020NM
DEST WPT:  SEA
 Load Approach?
```

3. ENT

Press **ENT**. The approach selections will now flash. The approach name is in the middle row on the left; the IAF name is shown on the right. Press **INFO** to view the waypoints for a flashing approach name.



```
*ACTIVE*   0.0NM
VOR DME A:  UBG
APPROACH:  HIO ◆
```

4.  ENT

Turn the **Small**, inner knob to display the approach choices. When the desired approach and IAF is displayed, press **ENT**.

```
*ACTIVE*  33.1NM
APPR ARPT:  UBG
APPROACH:  HIO ◆
```

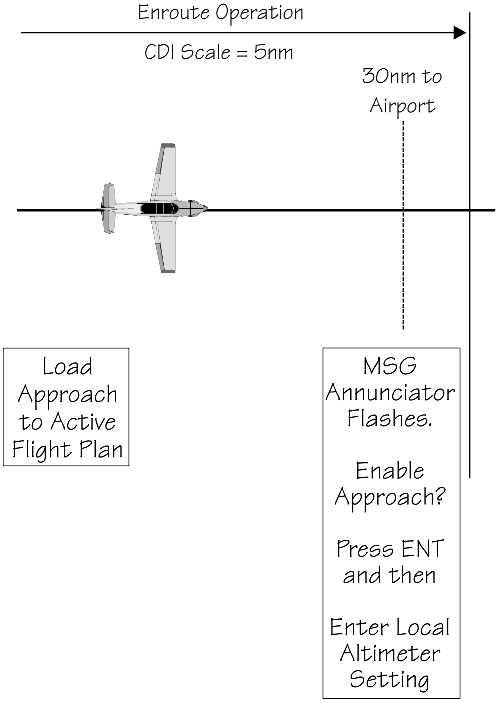
5. NAV

Press **NAV** to return to Navigation mode.

Approach Transition Operation (Enabling Approach)

Approach Transition Operation begins when you enable an approach which has already been selected from the database and loaded into the active flight plan. The Approach annunciator will be on (and the Approach Active annunciator will be off) to indicate that your NMS is operating in Approach Transition. The CDI sensitivity is locked at 1.0 nm for Approach Transition. After an approach has been loaded into the active flight plan, you will be prompted with a message to enable the approach. This prompt occurs when you are 30 nm from your destination assuming the approach was loaded prior to that. The enable approach message occurs immediately after loading an approach if you are already closer than 30 nm. As soon as you enable the approach by pressing **ENT** when the “Enable Approach?” prompt-message is displayed, the Approach annunciator will come on, the CDI will begin a smooth change to a 1 nm full-scale deflection sensitivity, and you will get a prompt-message to enter the local altimeter setting. Approach Transition Operation will usually be preceded by En route Operations. Approach Transition will be preceded by Approach Active in the event of a missed approach or a canceled approach.

An approach is enabled by pressing **ENT** when the "Enable Approach?" prompt is displayed. Note that there are two methods to enable an approach:



Method 1

Press **ENT** when the "Enable Approach?" prompt is displayed as a message. The message will occur when an approach is loaded from the database and the aircraft is 30 nm or less from the destination airport. This message-prompt is repeated at 3 nm inbound to the FAF if the approach has not yet been enabled.

Method 2

When an approach has been loaded, the aircraft is less than 30 nm from the destination airport, and the approach has not yet been enabled, pressing **FPL** will result in displaying the "Enable Approach?" prompt. Press **ENT** when this prompt is displayed to enable the approach.

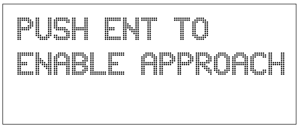
At 30 nm from Destination Airport

1. At 30 nm from the destination airport, the MSG annunciator will flash.

MSG

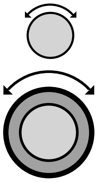
ENT

Press **MSG**. The display will ask if you want to "Enable approach." Press **ENT** to enable the Approach operation. The Approach annunciator will light and the CDI sensitivity will automatically scale gradually from 5 nm to 1 nm full scale per side.

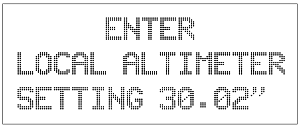


```
PUSH ENT TO
ENABLE APPROACH
```

2. The display will verify that you have enabled the selected approach. You will now be prompted to enter the local altimeter setting. Turn the **Small** knob to change the barometric pressure values and turn the **Large** knob to move the cursor. Press **ENT**.



ENT



```
     ENTER
LOCAL ALTIMETER
SETTING 30.02"
```

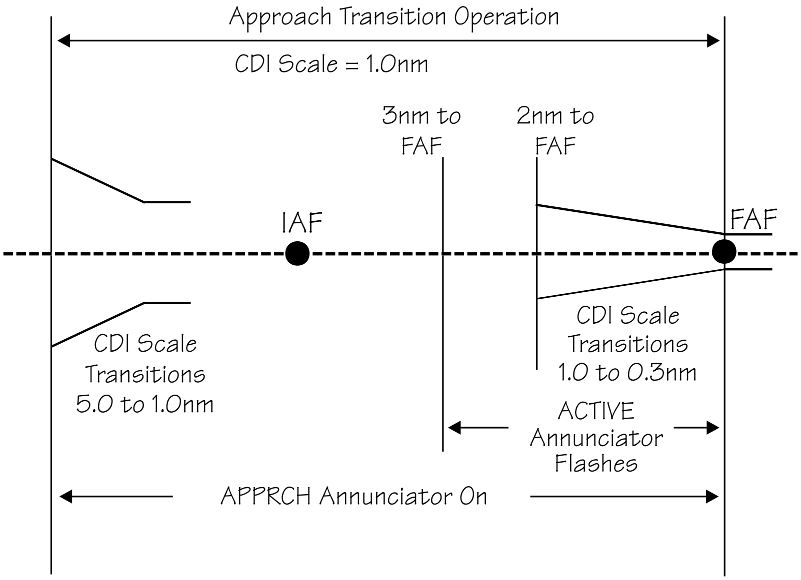
3. NAV Press **NAV** to return to the Navigation Mode.

Initial Approach Fix (IAF)

1. Prior to the Initial Approach Fix (IAF), the MSG indicator will light to announce a Waypoint Arrival Alert.

MSG

Press **MSG** to acknowledge the message and view the instructions to the next approach point.



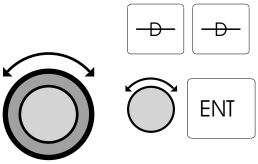
2.

Press **NAV** to return to the Navigation Mode.

3.

Prior to reaching the IAF, determine if sequencing is desired. Press **OBS/HLD** and execute a procedure turn or holding pattern entry if a course reversal procedure is required.

4.



If hold is selected after first crossing the IAF, press **DIRECT-TO** twice. Select your new inbound course to the IAF with the **Large** and **Small** knobs. When finished, press **ENT**.

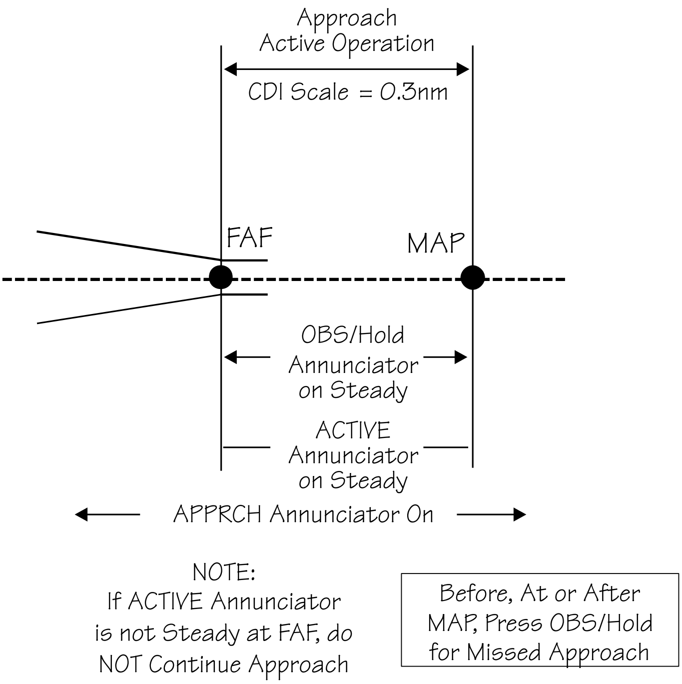
5.

Press **OBS/HLD** again to resume sequencing and to continue your approach when you have established an inbound heading.

Final Approach Fix (FAF)

1. When you are 3 nm inbound to the Final Approach Fix (FAF) and not on Hold, the Active light will flash to

indicate that you are about to transition to Approach Active. At 2 nm from the FAF, the CDI sensitivity will start to gradually scale from 1.0 to 0.3 nm full scale. At the FAF, CDI sensitivity will be at 0.3 nm full scale.

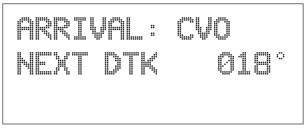


2.

MSG

NAV

When you are near the Final Approach Fix, the MSG annunciator will flash and a standard Waypoint Arrival Alert will turn on. Press **MSG** to acknowledge the message and then press **NAV** to return to Navigation Mode.



```
ARRIVAL: CVO
NEXT DTK    018°
```

Approach Active Operation

Approach Active Operation begins when you cross the Final Approach Fix (FAF) inbound if an approach has been loaded and enabled, the FAF is the active waypoint, and there are no system-detected reasons not to continue the approach (see Message Mode starting on page 39). The Approach Active annunciator is illuminated for Approach Active. The CDI sensitivity is 0.3 nm for approach active. Approach active is always preceded by Approach Transition. At 3 nm inbound to the FAF, the Approach Active annunciator will begin to flash. This is to alert you to the impending automatic CDI sensitivity change. At 2 nm inbound to the FAF, the CDI will begin a smooth change to Approach Active sensitivity which will be reached at the FAF. At the FAF, the Approach Active annunciator will come on solid indicating that the Apollo NMS is providing approach guidance. As soon as you cross the FAF, the active flight plan sequences and the Missed Approach Point (MAP) becomes the active waypoint. Sequencing is now automatically suspended and the OBS/HLD annunciator will be on. Anytime the Apollo NMS is in Approach Active Operations, the approach may be canceled by pressing the OBS/HLD button. Canceling the Approach will result in returning to Approach Transition operation. The Approach Active light will go out and the CDI will smoothly scale back to 1.0 nm sensitivity. Once Approach Active has been canceled by the pilot, it can not be made active again except by again crossing the FAF inbound.

Important

☞ *Verify that the Approach Active annunciator illuminates at the FAF. If for any reason it is not on, do NOT continue the approach.*

Crossing the Final Approach Fix

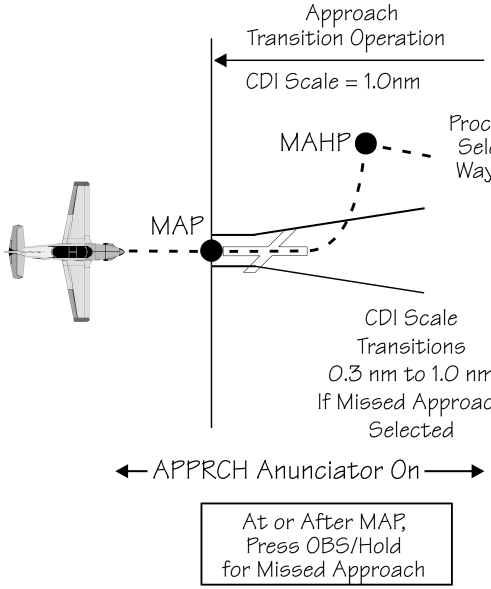
1. You are now in Approach Active operation. The Approach Active annunciator will light continuously. If the Approach Active annunciator is not lighted continuously, do NOT continue the approach.

2. The OBS/HOLD annunciator will light. Flight Plan leg sequencing to the MAP is suspended.

Missed Approach Point (MAP)

1. MSG NAV

The MSG annunciator will indicate a standard Waypoint Alert as you approach the MAP. Press the **MSG** key to acknowledge the message. Press the **NAV** key.



2. The OBS/HOLD annunciator will remain lighted solid. CDI resolution is maintained at 0.3 nm. The To/From flag will switch from “TO” to “FROM” as you cross the MAP.

3. If desired, and conditions allow, land the aircraft.

4. WPT SEQ OBS/HLD

If you do not choose to land, cancel the approach. Follow the published missed approach instructions or clearance as appropriate. Press the **OBS/HOLD** annunciator to deselect HOLD and cancel the approach. The CDI resolution will gradually increase to 1.0 nm full scale deflection.

5. Your NMS will sequence to the next waypoint in the missed approach procedure.

Canceling An Approach

Whenever the Approach Active annunciator is lit, an approach may be terminated by a single action of the pilot. You may want to cancel an active approach to try the approach again, choose another approach, to proceed to another airport, or in response to an “Abort Approach” message. In any case, you must follow the appropriate missed approach instructions.

1.

Press the **OBS/HLD** button.

Canceling an approach does the following:

Sequencing is enabled

The unit returns to Approach Transition operations

Approach Active annunciator turns off

Approach annunciator remains turned on

CDI scales to 1 nm full-scale deflection

RAIM alarm limit goes from 0.3 nm to 1.0 nm

Though you have canceled the active approach, it is still loaded and enabled. You may activate a previous leg or waypoint and navigate to try the approach again. Your flight plan remains unchanged.

Note

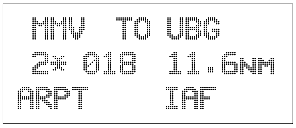
After an active approach has been canceled, you cannot immediately reactivate it. The approach can only be reactivated by crossing the FAF inbound, when the FAF is the active waypoint.

Repeating an Approach

You must cross the FAF inbound with the FAF selected as the active waypoint to allow reactivation of an approach. So, set up a course to return to the IAF and then back to the FAF.

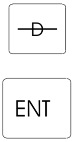
1.

Press **FPL**. Turn the small, inner knob to display the IAF as the TO waypoint.

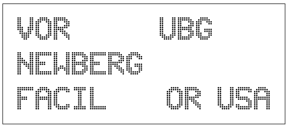


```
 MMV  TO UBG
 2* 018  11.6NM
ARPT     IAF
```

2.



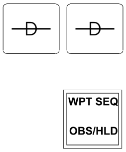
Press **DIRECT-TO** and then **ENT** to establish a direct course back to the IAF.



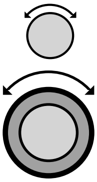
```
VOR      UBG
NEWBERG
FACIL    OR USA
```

or

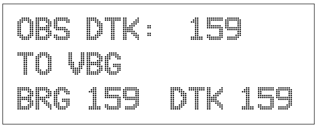
3.



Press the **DIRECT-TO** button twice to set a new Desired Track (DTK) to the selected waypoint. This also activates the OBS/HLD annunciator, so remember to press the **OBS/HLD** annunciator to enable waypoint sequencing when you have established your inbound course.



Turn the Small knob to change the flashing value. Turn the Large knob to move the cursor. Press ENT when finished. Press one of the mode buttons (i.e. NAV, DB, FPL, or SYS) to quit without changing anything.



```
OBS DTK:  159
TO VBG
BRG 159  DTK 159
```

Note

☞ *If you wish to intercept an approach leg, manually activate that leg. This is useful when receiving radar vectors back to intercept an approach leg. See "Manually Selecting a Flight Plan Leg" in the Approach Overview section.*

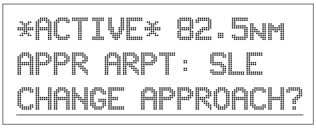
Selecting a Different Approach

After a missed approach, you may want to select one of the other approach choices for your intended destination airport.

1. Press **FPL** and then the **SEL** button. Turn the **Small** knob to display a flashing "Change Approach."

FPL

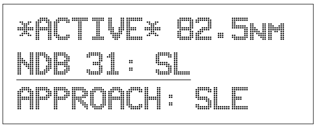
SEL



```
*ACTIVE* 82.5NM
APPR ARPT: SLE
CHANGE APPROACH?
```

2. Press **ENT** to change the approach. The center row showing the approach choices will flash.

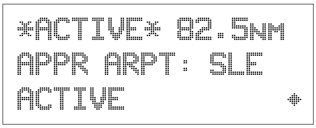
ENT



```
*ACTIVE* 82.5NM
NDB 31: SL
APPROACH: SLE
```

3. Turn the **Small** knob to display the approach choices. If desired, press **INFO** to display a list of the approach waypoints. Press **ENT** to choose the displayed approach.

ENT



```
*ACTIVE* 82.5NM
APPR ARPT: SLE
ACTIVE          ✦
```

Notes

Approach Examples

A variety of the situations that you may encounter while using approaches is included in this section. This section expands on the previous Approach Basics section. Use this section to familiarize yourself with the procedures that you expect to use in normal flight operations.

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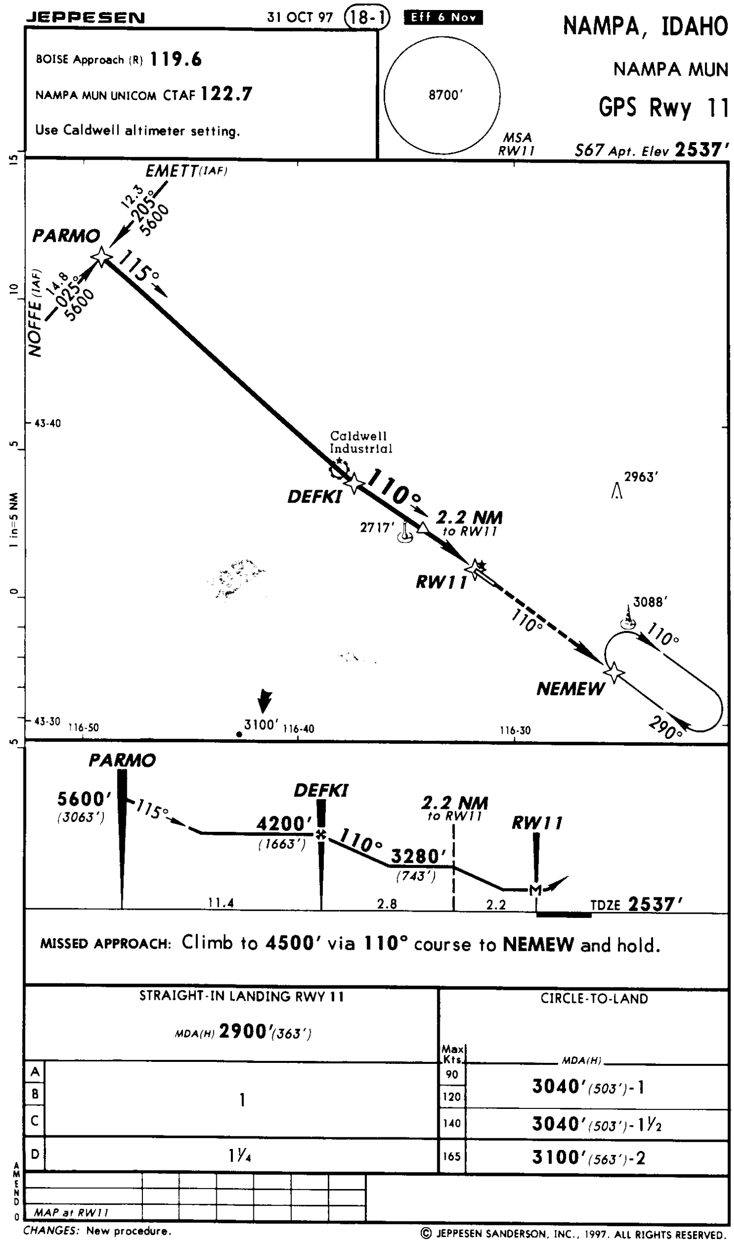
Reduced for illustrative purposes.



JEPPESEN 31 OCT 97 (18-1) Eff 6 Nov

NAMPA, IDAHO
NAMPA MUN
GPS Rwy 11
S67 Apt. Elev **2537'**

BOISE Approach (R) **119.6**
NAMPA MUN UNICOM CTAF **122.7**
Use Caldwell altimeter setting.

MISSED APPROACH: Climb to **4500'** via **110°** course to **NEMEW** and hold.

STRAIGHT-IN LANDING RWY 11		Max Kts	CIRCLE-TO-LAND
MDA(H) **2900'**(363')			MDA(H)
A	1	90	**3040'**(503')-1
B		120	
C		140	**3040'**(503')-1½
D	1¼	165	**3100'**(563')-2

MAP at RW11

CHANGES: New procedure.

Example 1

This example illustrates the approach to Nampa, Idaho. This example was selected because it is a new approach designed especially for TSO C-129 GPS equipment. It is probably as simple an approach to fly with the Apollo NMS as there is.

Note

It is good planning to always consider what you would do in the event of any equipment failures that may occur during flight operation, including your navigation system. Always make yourself aware of other available navaids should you need to select an alternate method of navigation.

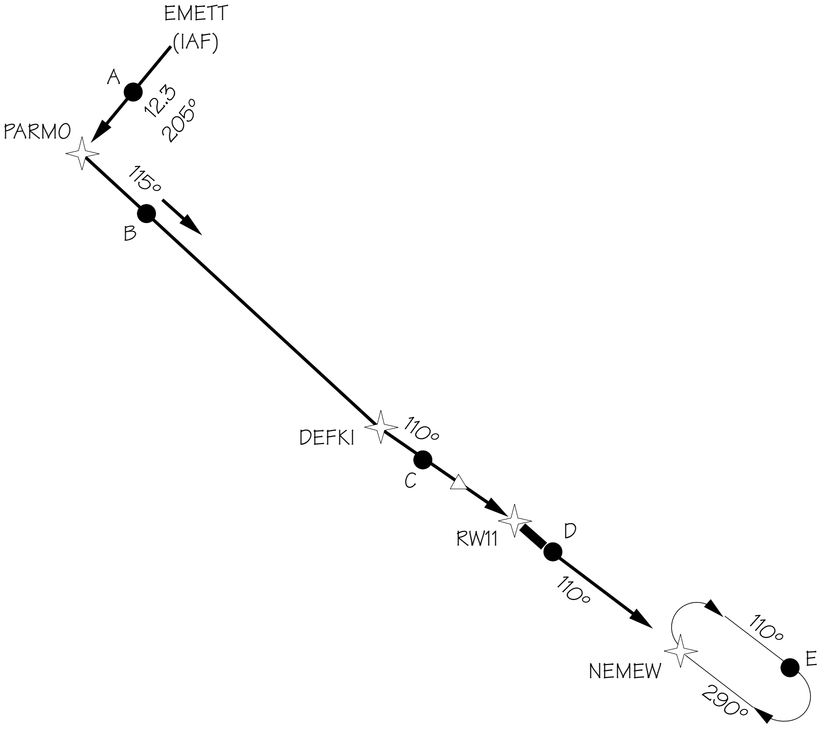


Illustration Points

A - Between EMETT (IAF) and PARMO (APPR)
B - Between PARMO (APPR) and DEFKI (FAF)
C - Between DEFKI (FAF) and RW11 (MAP)
D - Between RW11 (MAP) and NEMEW (MAHP)
E - In Holding Pattern

En Route

Load and activate your flight plan, then load the approach. Select the Nampa Municipal GPS Rwy 11 approach.

30 nm From Nampa Municipal Airport

1. The message annunciator will flash. Press **MSG** and then **ENTER** to enable the approach.

2. Select the local Altimeter Setting with the **SMALL** knob and then press **ENTER**. Press **NAV** to return to NAV mode.

Point A (Between EMETT and PARMO)

1. Fly the segment.

2. Verify that the Approach annunciator is on.

Point B (Between PARMO and DEFKI)

1. Fly the segment.

2. The Approach Active annunciator will begin flashing 3 nm from DEFKI (FAF) indicating that approach RAIM prediction is beginning. The transition to approach active is starting.

3. At 2 nm from DEFKI the CDI scale will begin changing from 1 nm to 0.3 nm full scale deflection.

Point C (Between DEFKI and RW 11)

As you cross DEFKI, verify that the Approach Active and OBS/HLD annunciators are on steady.

Point D (Missed Approach)

1. If you choose a Missed Approach at RW11, cancel the Approach Active operation by pressing the **OBS/HLD** button. The CDI sensitivity will now gradually scale back to Approach Transition sensitivity (1.0 nm full scale).

2. NEMEW will become the TO waypoint. The inbound course to NEMEW is already the same as the approach inbound, so you do not need to enter it.

3. NEMEW is the MAHP and will automatically become a holding waypoint. Verify that the OBS/HLD annunciator is lighted.

Point E (Holding Pattern)

1. After crossing NEMEW, you will be prompted to set the OBS course. Turn the **LARGE** and **SMALL** knobs to select 290° and press **ENTER**.

2. Fly the holding pattern. A parallel entry should work well.

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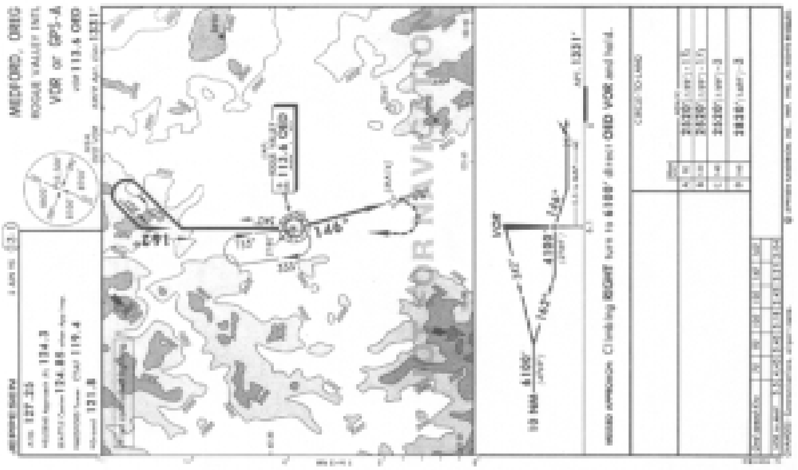
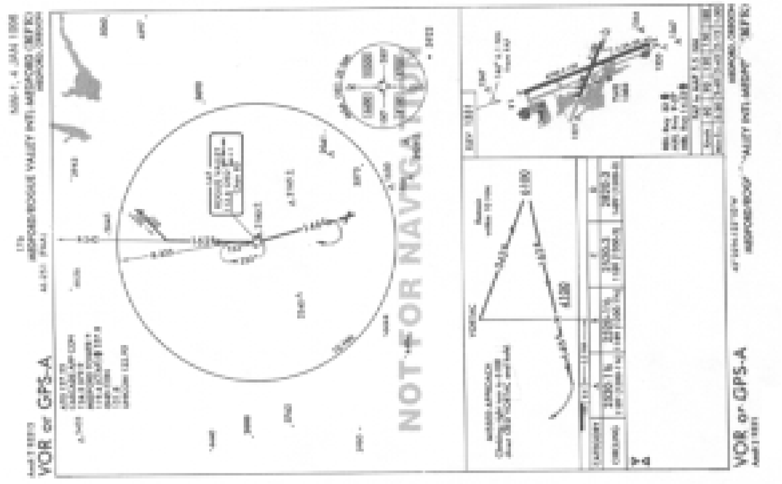


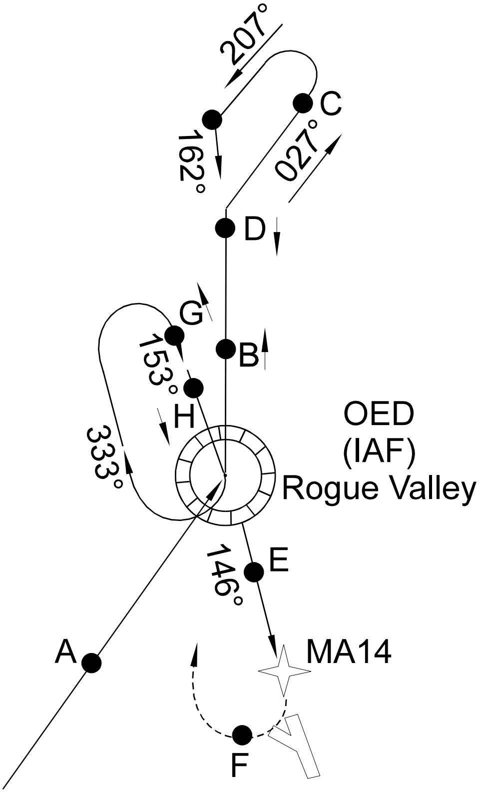


Approach Example 2

This example uses an active flight plan ending at the Medford, Oregon airport (MFR). The last two waypoints in this example are the Klamath Falls, Oregon VOR (LMT) and the Medford airport.

Illustration Points

A - Inbound to OED from the south
B - Outbound on the procedure turn
C - On the procedure turn
D - Inbound to OED
E - Between OED and MA14
F - Turning right and climbing to 6100 feet
G - Outbound from OED to enter the holding pattern
H - Inbound to OED in the holding pattern

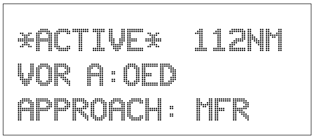


En Route to Medford (MFR)

1. Create a flight plan named “Example 2” with the last two waypoints as the Klamath Falls VOR (LMT) and the Medford airport (MFR).

2. Activate the flight plan. Press **FPL**. Turn the **Large** knob to display the “Example 2” flight plan. Press **SEL** and then **ENT**.

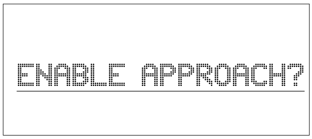
3. Load the VOR or GPS-A approach to MFR. In flight plan mode, press **SEL**. The display will flash “Load Approach?” Press **ENT**. Select “VOR A:OED” with the **Small** knob, if necessary, and press **ENT**. Turn the **Small** knob to view the waypoint legs. Press **NAV** to view NAV info.



```
*ACTIVE*  112NM
VOR A:OED
APPROACH: MFR
```

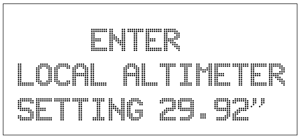
30 nm from Medford (MFR)

1. At 30 nm from your destination (MFR), the MSG annunciator will light. Press **MSG**. At the “Enable Approach” prompt, press **ENT**.



```
ENABLE APPROACH?
```

2. The Altimeter Setting will flash. Turn the **Small** knob to display the local barometric pressure and press **ENT**. Press **NAV** to return to NAV mode.



```
    ENTER
LOCAL ALTIMETER
SETTING 29.92”
```

Point A (Inbound to OED from the south)

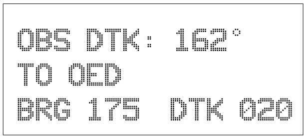
1. Suspend flight plan sequencing at OED to prepare for a procedure turn. The combined IAF/FAF waypoint is noted on your Apollo NMS as IFAF. Press the **OBS/HLD** button.

2. Verify that the Hold annunciator is ON.

Point B (Outbound on the procedure turn)

1. After crossing OED, the To/From flag will indicate FROM. OED will remain the active waypoint.

2. Select the desired inbound course to OED. Press **DIRECT-TO** twice. Turn the **Large** and **Small** knobs to display 162°. Press **ENT**.



```
OBS DTK: 162°
TO OED
BRG 175  DTK 020
```

Point C (On the procedure turn)

1. Fly outbound via the 342 radial of OED to execute a procedure turn. A distance of 2 to 3 nm outbound is recommended in order to allow adequate distance for the Apollo NMS to transition to Approach Active as you pass the FAF inbound.

2. Fly as you would with a VOR with “162° TO” selected on the OBS.

Point D (Inbound to OED)

1. As you intercept the 162 inbound re-enable flight plan sequencing. Press **OBS/HLD** as soon as you enable sequencing, OED becomes the FAF. At 3 nm inbound to OED, the Approach Active annunciator will begin flashing to indicate an impending CDI sensitivity change.

2. At 2 nm inbound to OED, the CDI sensitivity will begin changing from 1 nm to 0.3 nm full-scale deflection.

3. As you cross OED, the Approach Active annunciator will come on solid to indicate that approach operation is active and you may continue the approach to the FAF.

Point E (Between OED and MA14)

1. Continue to the missed approach point. Verify that the OBS/HLD and Approach Active annunciators are lighted steady.

2. If you wish to cancel Approach Active, press **OBS/HLD**. Your Apollo NMS will then revert to Approach Transition with 1 nm CDI deflection and a 1 nm RAIM alarm limit.

Point F (Choosing not to land at the MAP)

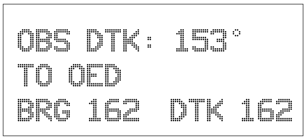
1. At the Missed Approach Point, if you are not going to land, follow your missed approach clearance. The MAP will remain active and your Apollo NMS will continue to provide guidance on the final approach course until you press the **OBS/HLD** button. If you choose to not land, the published missed approach instructions say “climbing right turn to 6100’ direct OED VOR and hold.” You will then press the **OBS/HLD** button as soon as you decide to miss the approach.

2. The CDI will scale out to 1 nm and OED will become the active waypoint. As you reach 6100’, press **DIRECT-TO** and then press **ENT** to establish a direct route to the active waypoint (OED).

3. Because OED is the MAHP, it is automatically a Hold waypoint and flight plan sequencing is suspended. Verify that the OBS/HLD annunciator is lighted.

Point G (At the MAHP)

1. Upon crossing OED, select the inbound holding course (153°). Press **DIRECT-TO** twice. Use the **Large** and **Small** knobs to select 153°. Then, press **ENT**.



```
OBS DTK: 153°
TO OED
BRG 162  DTK 162
```

2. After selecting 153° inbound, enter the Hold waypoint as you would for a VOR with 153° selected on the OBS.

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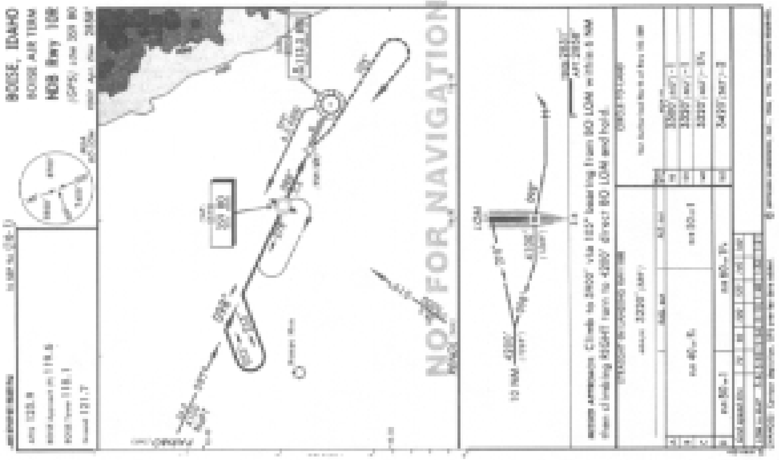
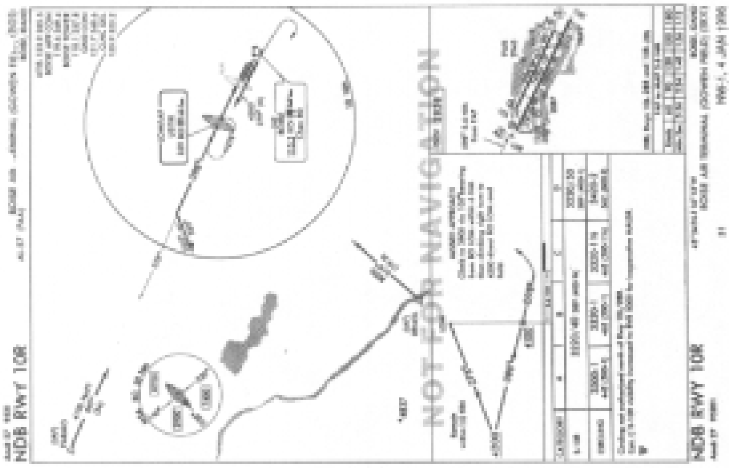




Example 3

This approach example describes an NDB approach from PARMO (IAF) to the Boise, Idaho airport (BOI). This example was chosen primarily because of the unusual published missed approach instructions and to illustrate how to navigate this missed approach with the Apollo NMS.

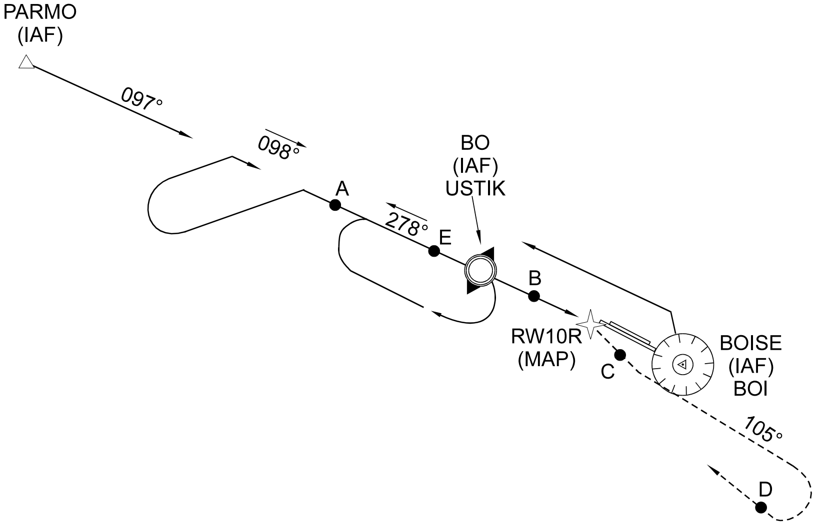


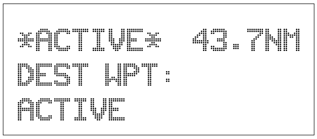
Illustration Points

A - Between Parmo (IAF) and BO (FAF)
B - Between BO (FAF) and RW10R (MAP)
C - Just past RW10R (MAP)
D - Turn inbound to BO (MAHP)
E - Just past BO (MAHP)

En Route to BOI

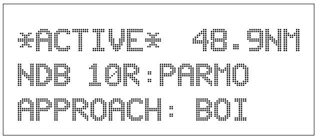
1. Create a flight plan named “Example3” with the last two waypoints as the Ontario, Oregon airport (ONO) and the Boise, Idaho airport (BOI).

2. Activate the flight plan. Press **FPL**. Turn the **Large** knob to display the “Example3” flight plan. Press **SEL** and the **ENT**.



```
*ACTIVE*  43.7NM
DEST WPT:
ACTIVE
```

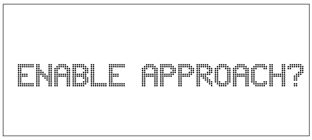
3. Load the NDB approach to BOI. In flight plan mode, press **SEL**. The display will flash “Load Approach?” Press **ENT**. Select “NDB 10R:PARMO” with the **Small** knob and press **ENT**.



```
*ACTIVE*  48.9NM
NDB 10R:PARMO
APPROACH: BOI
```

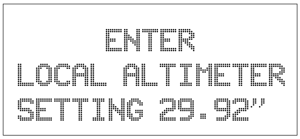
30 nm from Boise (BOI)

1. At 30 nm from your destination the MSG annunciator will light. Press **MSG**. At the “Enable Approach” prompt, press **ENT**.



```
ENABLE APPROACH?
```

2. Select the barometric pressure for the local altimeter setting with the **Small** knob and press **ENT**.



ENTER
LOCAL ALTIMETER
SETTING 29.92"

Point A (Between PARMO *IAF* and BO *FAF*)

1. The Approach Active annunciator will flash at 3 nm inbound. The CDI sensitivity begins to scale at 2 nm inbound.

2. Verify that the Approach Active annunciator lights at BO. Verify that the OBS/HLD annunciator is lighted at BO.

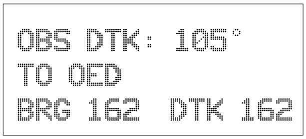
Point B (Nearing MAP)

Fly the final approach and descend to MDA.

Point C (Missed Approach)

1. When the decision has been made to execute the published missed approach, press **OBS/HLD**. The active waypoint will become BO (Missed Approach Point). The CDI will gradually scale out to 1.0 nm full-scale deflection. The OBS/HLD annunciator, after turning off briefly, will turn back on as BO (now the Missed Approach Hold Point), is an automatic holding waypoint.

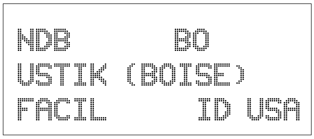
2. Now press **DIRECT-TO** twice. Select 105’ with the **Small** knob as the desired inbound course and press **ENT**. The CDI will indicate FROM and will provide guidance on the 105° outbound radial as per missed approach instructions.



```
OBS DTK: 105°
TO OED
BRG 162  DTK 162
```

3. When you reach 3900’, begin the climbing right turn.

4. When you reach 4200’ or when your bearing to BO matches your current heading, press **DIRECT-TO** and then **ENT**. This will establish a new inbound course direct to BO.



```
NDB         BO
USTIK (BOISE)
FACIL       ID USA
```

Point D (Inbound to BO)

Fly inbound on the new direct course to BO. The OBS/HLD annunciator will remain lighted.

Point E (Missed Approach Hold Point)

As you pass BO, establish the new inbound holding course and enter the hold. Press **DIRECT-TO** twice. Select an OBS DTK of 098° with the **Large** and **Small** knobs. Press **ENT**.

Note

If you want to reshoot the approach following your missed approach hold, reactivate the flight plan leg from PARMO (IAF) to BO (FAF) or select DIRECT-TO PARMO (IAF) as appropriate.

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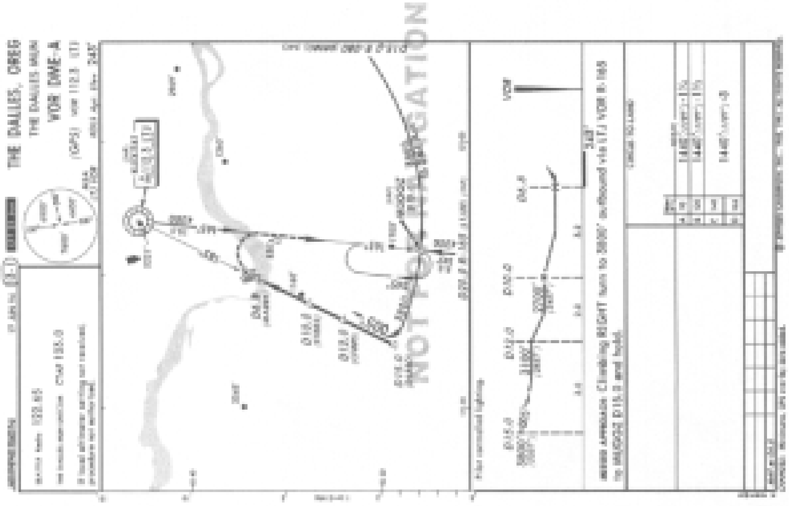
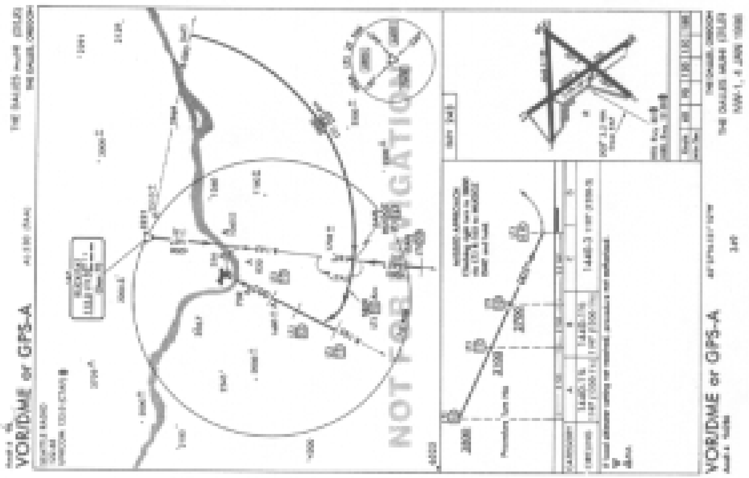
Reduced for illustrative purposes.



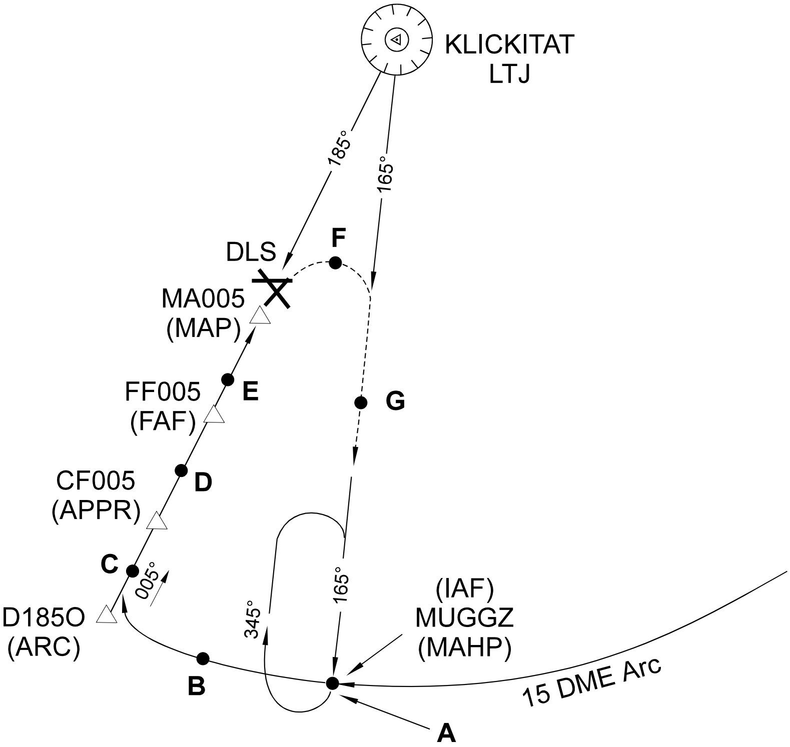


Example 4

This example for the VORDME A:MUGGZ approach uses a flight plan with the last two waypoints as VOR IMB (Kimberly, Oregon) to The Dalles, Oregon (DLS). This example is used because the step down fixes are referenced to a VOR that is not co-located with the MAP and because of the published missed approach instructions.

Illustration Points

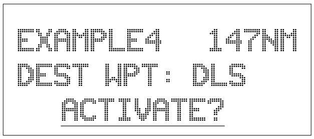
A - Approaching MUGGZ (IAF)
B - On the DME Arc between MUGGZ and D185O (ARC)
C - Inbound between D185O and CF005 (APPR)
D - Between CF005 and FF005 (FAF)
E - Between FF005 and MA005 (MAP)
F - Turning to intercept 165° to MUGGZ
G - Inbound to MUGGZ (MAHP)
H - In the holding pattern at MUGGZ



En Route

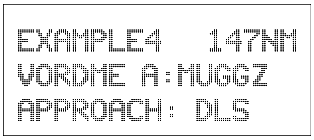
1. Create a flight plan named “Example4” with The Dalles, Oregon (DLS) as the destination airport.

2. Activate the flight plan. Press **FPL**. Turn the **Large** knob to display the “Example4” flight plan. Press **SEL** and then **ENT**.



```
EXAMPLE4   147NM
DEST WPT: DLS
   ACTIVATE?
```

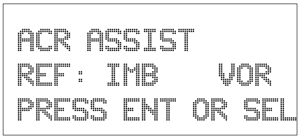
3. Load the VOR DME A approach to DLS. In flight plan mode, press **SEL**. The display will flash “Load Approach?” Press **ENT**. Select “VORDME A:MUGGZ” with the **Small** knob and press **ENT**.



```
EXAMPLE4   147NM
VORDME A:MUGGZ
APPROACH: DLS
```

Point A (Near MUGGZ)

1. As you approach MUGGZ (the IAF), verify that your DME-Arc reference is the Klickitat VOR (LTJ). Press **NAV** and then turn the **Large** knob to reach the Arc Assist page.



```
ACR ASSIST
REF: IMB    VOR
PRESS ENT OR SEL
```

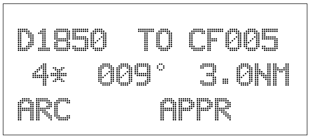
2. If the reference VOR is LTJ, press **ENT**. If the reference is not LTJ, press **SEL** and select the LTJ VOR and then press **ENT**.

```
LEFT ARC DTK 031
REF: LTJ    VOR
RAD 121° 84.1NM
```

Note

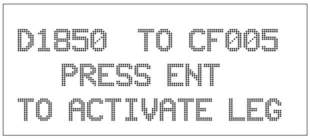
Always suspend sequencing before manually activating an inbound leg to intercept with a DME Arc if you are already on the FROM side of that leg. This ensures that the flight plan will not sequence if you are currently at a point on the arc that is past the TO waypoint on the leg that you are manually selecting. Re-enable sequencing when you are established on the inbound path. Although this is only necessary if you have a present position on the FROM side of the leg, it doesn't hurt to always do this step, and may help you to remember it when required.

3. Use the Arc Assist page as the primary guidance for flying the DME Arc and manually activate the inbound leg. Press **FPL** to reach Flight plan. Turn the **Large** knob if necessary to reach the active flight plan. Turn the **Small** knob to display the “D185O to CF005” display.



```
D1850  TO CF005
 4*  009°  3.0NM
ARC      APPR
```

4. Press **ENT** to start manual leg selection. Press **ENT** to accept the displayed leg.



```
D1850  TO CF005
   PRESS ENT
TO ACTIVATE LEG
```

5. Turn the **Large** knob to the Arc Assist page.

Point B (On the arc between MUGGZ and D1850.

1. Make sure that you are viewing the “Right” Arc Assist page. Turn the **Small** knob, if necessary.

```
RGHT ARC DTK 270
REF: LTJ    VOR
RAD 180° 16.1NM
```

2. Use the Arc Assist page and your aircraft heading display to navigate to the selected inbound leg. The Desired Track (DTK) is your tangent to the arc on your present radial. For the right turn arc in this example, there are no other Arc waypoints to identify. If there were more waypoints, the Arc Assist page will continuously show the radial and distance from the Arc Reference making them easy to identify from your approach chart.

3. As you approach your selected inbound course, your CDI will begin to center to indicate when you intercept the selected inbound leg. As you intercept your inbound course, transition to the CDI as your primary navigation display.

Point C (Inbound between D1850 and CF005)

1. As you become established inbound, return the Apollo NMS display to the primary navigation page and reenable flight plan sequencing. Press **NAV** twice or turn the **Large** knob until you display your primary NAV page.

2. Press **OBS/HLD** to reenable flight plan sequencing, if you suspended it prior to activating the inbound leg.

Point D (Between CF005 to FF005)

1. Note that the flight plan waypoints used as step-down fixes are depicted on the Jeppesen Approach Plate, but not on the NOS charts.

2. If you are using an NOS chart, you must identify the waypoints on the chart by looking at the distances between them on the vertical profile. You may want to view the Arc Assist page to show your distance relative to LJT.

3. As soon as FF005, the FAF becomes the active waypoint. The Approach Active light will begin flashing and the CDI will begin scaling to approach sensitivity, as you will be within 2 nm of the FAF when it becomes active.

4. As you cross FF005, verify that the Approach Active annunciator is lighted indicating that you may continue the approach.

Point E (Between FF005 and MA005)

1. Continue to the Missed Approach Point (MA005).

2. Verify that the OBS/HLD and Approach Active annunciators are lighted.

Point F (Turning to intercept 165° to MUGGZ)

1. When you reach the Missed Approach Point and you wish to fly the published Missed Approach procedure, press **OBS/HLD** as you start your climbing right turn.

2. The CDI will scale back to Approach Transition CDI sensitivity. The MAP (MUGGZ) will become the active waypoint.

3. Select a 165° inbound course to MUGGZ. Press **DIRECT-TO** twice. Turn the **Large** and **Small** knobs to select 165° and then press **ENT**.

Note

☞ *We are selecting an inbound course to MUGGZ rather than an outbound course from the LTJ VOR. With RNAV-type equipment, such as GPS, there could be several degrees difference in the course between LTJ and MUGGZ than the one published on the chart. The 165° inbound to MUGGZ will get us to MUGGZ more precisely than the 165° outbound from LTJ.*

4. MUGGZ should automatically be noted as a holding waypoint as it is a Missed Approach Hold Point (MAHP). Verify that the OBS/HLD annunciator is lighted.

Point G (Inbound to MUGGZ)

1. As we already have selected 165° as the inbound to MUGGZ and sequencing is suspended, we are set up for the hold.

2. Enter and fly the published holding pattern just as you would if MUGGZ was a VOR and you had selected 165° on your OBS.

Point H (Holding Pattern)

Fly the holding pattern.

Note

☞ *If you are going to reshoot the approach, select MUGGZ as the IAF in your approach sequence again. While holding at MUGGZ (MAHP), press **FPL**, turn to the leg IMB (VOR)-to-MUGGZ (IAF). Press **DIRECT-TO** and then **ENT**. MUGGZ will remain the active waypoint and sequencing is still suspended, but now you are holding at MUGGZ (IAF). If your course to MUGGZ is not exactly 165° TO, reset it. Press **DIRECT-TO** twice, set the OBS to 165°, and press **ENT**.*

Notes

Introduction to Primary Oceanic/Remote Airspaces

What is Primary Oceanic?

Primary Oceanic/Remote airspace operations refers to the equipment's ability to provide navigation and integrity monitoring functions described in FAA Notice N8110.60. This means that the NMC and its GPS sensor are continuously monitoring GPS satellite integrity and automatically remove a satellite from position calculations if it is determined to be faulty. Under TSO-C129a, the sensor also monitors satellite signals more closely than before.

The TSO-C129a requirements for satellite health monitoring are generally similar to those of N8110.60 with the additional capability included of allowing you to exclude satellites from the RAIM Prediction function based on information provided in NOTAMs (NOtice To AirMen) and NANUs (Notice Advisory to NAVSTAR Users).

This section describes the operating modifications to the Apollo 2001/2101 NMC to implement Primary Oceanic/Remote Airspace operation requirements. The Oceanic/Remote flight phase is in addition to the currently provided En Route, Terminal, and Approach flight phases and is used for primary navigation in oceanic and/or remote airspaces.

Definitions

The following paragraphs define various terms that relate to the NMC's primary oceanic/remote airspace operation.

Arm(ing)(ed): The manual entry sequence you use to instruct the NMC to change to the oceanic/remote flight phase when the aircraft is outside terminal airspace (30 nm from the departure or destination waypoint) and above the Oceanic Activation Altitude. You may arm the oceanic/remote function at any time and any altitude, provided there are at least two waypoints in the active flight plan. You may adjust the activation altitude. When armed, the NMC is not providing navigation in the oceanic/remote flight phase, but is monitoring the distance from departure (and destination) waypoint and altitude.

Active: The NMC is in an active state when it is navigating in the oceanic/remote flight phase. This occurs when the aircraft is outside terminal airspace and above the Oceanic Activation Altitude. The oceanic/remote function must be armed before it can become active.

NOTE

☞ *If the oceanic/remote function is armed outside of terminal airspace and above the Oceanic Activation Altitude, the NMC will immediately transition to the active state.*

Activate: Refers to the NMC action that changes the state from armed to active and changes the flight phase to the oceanic/remote flight phase.

Cancel(ing): The manual entry sequence you use to instruct the NMC to do the following depending on which state it is in:

1. If the NMC is in the armed state, canceling changes the state to disarmed. In other words, you instruct the NMC never change to the oceanic/remote flight phase. The NMC will continue with the current flight phase (terminal or enroute).
2. If the NMC is in the active state, canceling changes the state to disarmed. This causes the NMC to stop flying the oceanic/remote flight phase and change to the enroute flight phase (the NMC automatically changes to the terminal flight phase when entering terminal airspace).

Deactivate: The NMC's action that changes the state from active to armed and stops flying in the oceanic/remote flight phase.

NOTE

☞ *The NMC changes states from active to armed automatically if the aircraft enters terminal airspace. In this case, the NMC will change to the terminal flight phase.*

NOTE

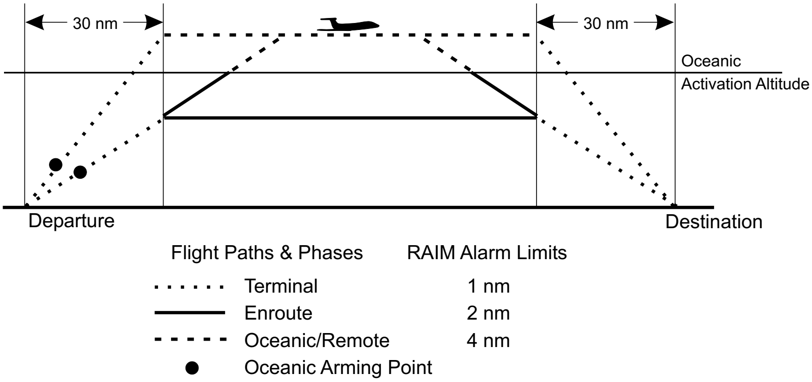
☞ *The NMC changes states from active to armed if you press ENT when the message indicating you have descended below the activation altitude is displayed. The NMC will contiue to provide navigation in the Oceanic flight phase if you press any other button. For example, you are flying above the Oceanic Activation Altitude and outside your destination's terminal airspace. You then begin your descent and your altitude drops below the Oceanic Activation Altitude before entering terminal airspace. In this case the NMC will display a message indicating that you have decended below the Oceanic Activation Altitude. You then press the* ***ENT*** *key. The NMC changes to the enroute flight phase. Because you* *haven't canceled oceanic/remote operation, the NMC will change to the armed state. If you then climb above the Oceanic Activation Altitude while still outside terminal airspace, the NMC will change back to the active state and the oceanic/remote flight phase.*

Disarm(ed): The NMC's state when it is not monitoring distance and altitude (for the purposes of oceanic/remote flight) and will not transition to the oceanic/remote flight phase.

Position Uncertainty: The distance from the reported position to your actual position. This distance is reported on the Oceanic Status page when in the oceanic/remote flight phase, there is a RAIM alarm, and there are enough satellites to calculate it. You are assured that your actual position is within the displayed distance from your reported position. If there are not enough satellites to compute the distance, the position uncertainty will be reported as "Not Available".

As the operator of the NMC, you can only arm or cancel the oceanic/remote mode of operation. The NMC does the rest.

The diagram below illustrates the different NMC flight phases (except approach) and their relationship for flight through terminal, en route, and oceanic/remote airspace. The diagram shows the NMC was armed before leaving terminal airspace and below the Oceanic Activation Altitude.



Other terminology related to TSO-C129a are:

PRN: GPS satellite Pseudo-Random Numbers used to uniquely identify satellites. This is different than the SVN (Space Vehicle Number, or the satellites serial number). The RAIM Prediction Ignore List (RPIL) pages display the PRN number for each satellite. When excluding satellites from the RAIM Prediction, use the PRN number found on the NOTAMs and NANUs, not the SVN.

Also on the RPIL pages are the field titles FR: and TO:. FR: refers to the time when the satellite is expected to go out of service. TO: refers to the time when the satellite is expected to be back in service. NOTAMs and NANUs will indicate satellite outages in the following formats:

1.PRNxx will be out of service FROM a date and time TO a date and time.

2.PRNxx will be out of service FROM a date and time for hh hours.

3.PRNxx will be out of service indefinitely FROM a date and time.

The RPIL pages permit you to specify satellite outages in any of these formats.

RAIM

What Is Raim?

RAIM stands for Receiver Autonomous Integrity Monitor. It is a way a GPS receiver can detect when the signals it is receiving from one or more of the satellites are wrong. It does this by using more satellites than are required for a position solution. In essence, the receiver compares the pseudo-ranges, or calculated distance measurements, from the satellites against what it expects. If this comparison yields too big a value, based on the current RAIM alarm limit, an Alarm is generated and you get a message telling you that a RAIM alarm has occurred.

It is important to understand that RAIM provides integrity, not accuracy. Accuracy is the ability of the GPS to determine a correct position with good satellite signals, enough satellites in view, and an acceptable geometric position of the available satellites. Integrity is the ability of the GPS system to detect when its position may not be accurate due to bad or false satellite information.

GPS systems limited to VFR use must meet the exact same accuracy requirements as those authorized for IFR use. Systems authorized for IFR use must also have an integrity monitor such as RAIM.

How Is Raim Used?

TSO C129a calls for three different levels of RAIM protection: En route, Terminal, and Approach. Plus, the receiver has the ability to predict RAIM availability at any given location and time.

Why predict availability?

Because RAIM requires that more satellites be used than are required for a position solution, RAIM may not always be available. The TSO requires that RAIM be available with a 0.3 nm. alarm limit, from a distance of 2 nm inbound to the Final Approach Fix (FAF) until the Missed Approach Point (MAP) is reached. A means must be provided to allow the pilot to predict whether RAIM will be available at the estimated time of arrival at the destination. Your Apollo NMS provides you with a RAIM prediction page. This page allows you to determine if RAIM should be available at any location and time. If it says RAIM will be available, it actually means that it will be available at your predicted time of arrival and plus and minus 15 minutes from your arrival time calculated at 5 minute intervals.

RAIM prediction is required to be done automatically by the equipment for the estimated time of arrival at the FAF and the MAP when you are 3 nm inbound to the FAF. On your Apollo NMS, the system will not go to the approach active state at the FAF and the Approach Active annunciator will not come on if approach RAIM is not available or if it has been predicted to become unavailable while you are between the FAF and the MAP.

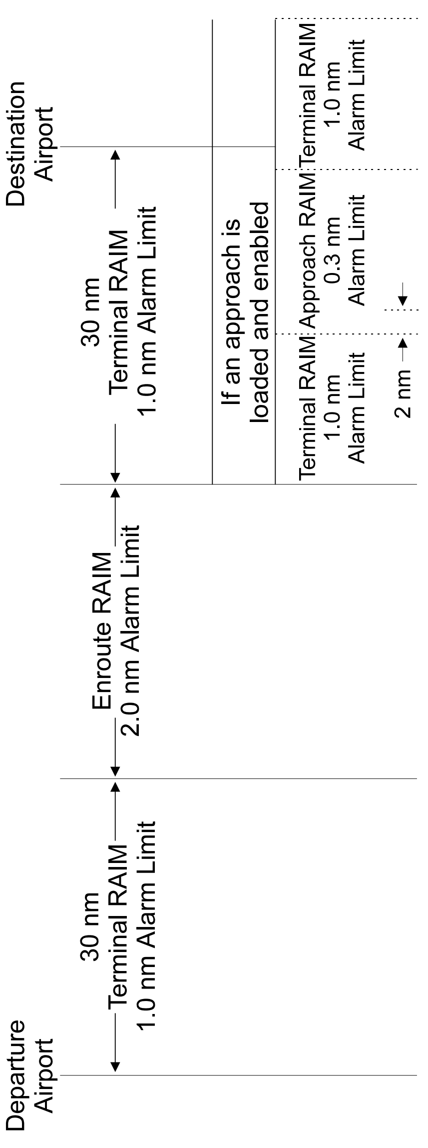
TSO C129a requires the RAIM alarm limit to be at least 2.0 nm for en route operations, 1.0 nm for Terminal operations, and 0.3 nm for Approach operations.

What are En Route, Terminal, and Approach Operations?

Approach RAIM, or 0.3 nm alarm limit, is provided from 2.0 nm inbound to the FAF until you cancel the Approach Active operation (usually at the MAP). Approach RAIM is provided only if an approach is loaded into your active flight plan and it is enabled.

Terminal RAIM, or 1.0 nm alarm limit is provided within 30 nm of your departure and your destination airport (except when Approach RAIM is provided). This is automatic and requires no pilot action. For those of you who are familiar with the traditional definition of Terminal, which was the ability to operate on SIDs and STARs that are only 4 nm wide, the term Terminal has been “redefined” in TSO C129a to mean within 30 nm of your departure or destination.

En route RAIM, or a 2.0 nm alarm limit is provided at all other times.



Note that the three different equipment operation states: En route, Approach-Transition, and Approach-Active are somewhat but not directly related to the three RAIM alarm limits of En route, Terminal, and Approach. The equipment states are defined by the CDI sensitivity and operational requirements. When you depart an airport, the equipment is operating En route, but it is providing Terminal RAIM integrity. When you reach a point 30 nm from your destination airport, the Apollo NMS will automatically switch to Terminal RAIM integrity, but you will be prompted to enable your approach and thus transition to the Approach-Transition CDI scale only if you have an approach loaded into your active flight plan. If you have an approach loaded and enabled, the Apollo NMS will provide Approach RAIM integrity starting 2 nm from the FAF. Approach-Active operation, which requires both that Approach RAIM and Approach CDI sensitivity be provided, begins at the FAF and is indicated by the Approach Active annunciator on solid.

This may seem very confusing, but operationally, the Apollo NMS makes it very simple. If the Approach Active annunciator comes on solid at the FAF, then it is OK to continue the approach. If it does not come on solid at the FAF, discontinue the approach. You will get a message telling you what operational or integrity requirement was not OK.

How often will RAIM be unavailable?

RAIM availability depends on many factors, including the number of operational satellites in the sky, the time of day, the location, the receiver design, the antenna mask angle and location, and on the method of baro-aiding. The Apollo NMS has been designed such that with an optimal 21 satellites in operation, Approach RAIM availability should exceed 95%. There are currently, at the time this manual was published, at least 24 satellites in operation; however, the Federal Navigation Radio Plan only guarantees that there is at least a 95% probability that 21 will be operational at any given time.

What is baro-aiding?

Baro-aiding is required by TSO C129a to enhance RAIM availability. It is a method where pressure altitude data can be used to provide RAIM availability during some times when RAIM would not be available using the satellites alone. This is the reason that TSO C129a GPS installations are required to have pressure altitude inputs.

What does it mean when I get a “RAIM not available” message?

If RAIM is not available, your Apollo NMS may be capable of continuing to provide good accurate IFR navigation. What you have lost is the ability to tell if a satellite is sending bad data. For all operations except Approach, the FAA has determined that it is acceptable for you to continue to use GPS for IFR navigation as long as you verify the accuracy of your position by other means at least every 15 minutes until RAIM becomes available again. This can be accomplished by cross-checking your GPS position against that of other navigation instruments. Even during times of no RAIM, if your Apollo GPS determines that it can not provide an accurate position due to poor satellite availability or geometry, it will flag the navigation display as invalid. If the Apollo NMS is providing valid navigation data, then it is still capable of providing good IFR navigation as long as the satellite data is good.

During Approach operations, if you lose RAIM availability, your Apollo NMS will continue to provide navigation data; however, your navigation display will be flagged as invalid. You should discontinue the approach and revert to other means of navigation. It should be noted that even if this were to occur, canceling Approach-Active, by pressing the OBS/HLD button, will result in an immediate transition to Terminal RAIM from Approach RAIM. Terminal RAIM integrity may still be available even when Approach RAIM integrity is not. If so, your navigation display will again become valid, and you may continue to use the Apollo GPS for missed approach navigation.

What does a RAIM alarm mean?

A RAIM alarm means that the navigation data can not be trusted to be within the alarm limit. A RAIM alarm means that the Apollo NMS has determined that there is something wrong with the data it is receiving from one or more satellites. The data may be corrupted by a satellite failure, such as a clock failure, or it may have been corrupted by some form of signal interference. A RAIM alarm will also be accompanied by flagging all navigational displays as invalid. If you should ever see a RAIM alarm, do not trust the GPS position, and revert to other means of navigation as appropriate.

How often do satellite failures occur?

There is not enough data to provide a good answer; however, it is known that they can and do happen. Satellite clock failures, one of the more probable failures, is more likely to occur on the older Block-I satellites, but this does not mean that it can't happen on the newer ones. When a satellite failure does happen, it can result in undetected error of miles in the position if a receiver is using the failed satellite in its navigation solution.

When a satellite fails, even if that failure is detected by an earth-based monitoring station, it can be some time before an uplink to that satellite can occur. During that time, there is no way for a GPS receiver to know that the information from that satellite is bad directly from that satellite's transmissions. An integrity monitor, such as RAIM when it is available, protects you from false or misleading navigation displays resulting from bad satellite information.

Approach Questions and Answers

How do I check to see what I entered for an inbound course (OBS/HLD)?	There are two ways to check this. One way is to press **FPL** to enter flight plan mode. Turn the **Small** knob until the active leg is displayed (denoted by two asterisks on the leg). The displayed desired-track is what was entered as the "OBS" course when leg sequencing is suspended. The second way is to press **DIRECT-TO** twice as if you are going to enter the inbound course again. The displayed value will be whatever you last selected.
What do I do if on a procedure turn or holding pattern entry I forgot to set a new OBS/HLD inbound course after first crossing the waypoint and the flight plan sequences to the next waypoint as soon as I re-enable sequencing?	1. Press **OBS/HLD** to disable sequencing. 2. Press **FPL**. Then, turn the **Small** knob to show the waypoint you want active on the TO side. 3. Press **ENT** twice to select the desired leg. 4. Remember to press **OBS/HLD** to re-enable sequencing when established inbound.
Why do I sometimes see several degrees difference in what the Apollo NMS shows as the course for a leg and what is on the published approach chart.	There are two main reasons: station declination and airway definition. The VOR station magnetic declination setting may not be current and will provide slightly differing readings compared to your actual magnetic course. Airways are defined by constant bearing To or From VOR stations while GPS navigation is based on the great circle route between the

	stations. In great circle navigation, your bearing will change as you move along the course. This is more evident over longer distances. To illustrate this, stretch a string or rubber band over a globe between Seattle and Tokyo. This string represents the great circle route. Note that as you leave Seattle you must travel northwest and as you approach Tokyo you must travel southwest. The effect of these small discrepancies is generally negligable over the relatively short distances used for most flight legs that you will navigate.
What if I manually activate a leg and it immediately sequences to a new leg?	This will happen if you were on the FROM side of the leg when you activated it if you did not press OBS/HLD first to disable sequencing. Press OBS/HLD and activate the leg again. Re-enable sequencing when you intercept the leg.

Troubleshooting

To Ensure Trouble Free Operation

Avoid high cockpit temperatures when the aircraft is not in use. Extreme heat shortens the life of any electronic equipment. Periodically check all antenna, power, and ground connections.

Caution

DO NOT clean the face plate with chemical cleaning agents, solvents, or harsh detergents. A soft cloth may be used to clean the face plate. DO NOT wax or paint the antenna.

Battery Replacement

The NMC memory is maintained by a lithium battery. The expected service life of this type of battery is from 5 to 10 years. This is not a user replaceable item. The lithium battery must be replaced by the factory, an authorized dealer, or service center.

If You Have A Problem

Please read the instructions again for the desired function.

If You Are Unable To Correct The Problem

Record as much information as possible, such as where and when the problem occured, symptoms, and your actions. Record the position sensor data (displayed in SYS mode) for ALL satellites (GPS) or stations in the chain (Loran) used, and call your II Morrow dealer, Service Center, or the factory. The technician **MUST** have this information to help you solve the problem.

In-Flight

Indication

MSG light is on.
Displayed message is:
LORAN1 [or 2]
STATIONS HAVE
LOW SNR

Problem

If flying through clouds, rain, snow, etc., the likely problem is precipitation static (P-STAT).

Action

After landing inspect (or install) static wicks per aircraft manufacturers specifications. Also, check the static bonding straps on all control surfaces. If the problem continues, skin mapping may be necessary.

Indication

(Same as above).

Problem

The aircraft is flying out of the coverage area for the selected chain.

Action

Use Auto GRI, or manually select a new GRI.

Indication

(Same as above).

Problem

If the MSG light comes on and stays on after takeoff, or run-up, noise from the aircraft alternator or magneto may be responsible.

Action

Contact the dealer or factory.

In-Flight (continued)

Indication	Problem	Action
MSG light is on. Displayed message is: LORAN1 [or 2] STATIONS HAVE SIGNAL BLINK	If the Loran sensor is selected as the in-use position sensor, a blink condition is occurring. This is a signal generated by the operator of the transmitter indicating a temporary technical problem with the transmitted signal.	Signal information appears normal. The MSG clears when the problem clears.
MSG light is on. Displayed message is: LORAN1 [or 2] TD SENSOR 1 [or 2] FAILURE	The Loran TD sensor has failed.	Return MCLS for service.
Bearing and distance displays appear to be wrong.	A mistake was made in entering the Latitude/Longitude coordinates of a User waypoint, or the wrong waypoint is selected.	Verify that coordinates of the User waypoint are accurate. Check the hemispheric identifier. Check the “From” and “To” waypoints. Verify that “ManualMagVar” has not been selected and set to an incorrect value.

In-Flight (continued)

Hint

Verify your position by activating the Emergency Search Listing. The correct bearing/distance to the nearest airports should be displayed.

On The Ground

Indication	Problem	Action
MSG light stays on after power-up. Displayed message is: LORAN1 STATIONS HAVE LOW SNR	The wrong Loran GRI is manually selected.	Use Auto GRI, or manually select an appropriate GRI.
(Same as above).	Required secondary is shut down.	Check Loran signals in SYS mode to see if unit is receiving signals from each station.
(Same as above).	Signal is weak due to distance from transmitters.	You may not obtain lock-on until after takeoff.

On The Ground (continued)

Indication	Problem	Action
MSG light stays on after power-up. Displayed message is: LORAN1 STATIONS HAVE LOW SNR (continued)	Aircraft may be parked near something interfering with the signal (APU, hanger, high-voltage lines).	Move the aircraft. The system usually does not work inside a hanger.
MSG light stays on after power-up. Displayed message is: IN USE POSITION SENSOR CANNOT COMPUTE LAT/LON	The In-Use position sensor is not able to calculate a position	Select a different position sensor.
MSG light is on after run-up. Displayed Message is: LORAN1[or 2] EST POS ERROR (EPE) IS 1.8NM	Noise generated from the aircraft alternator or magneto.	Contact II Morrow dealer or factory.

Contacting the Factory for Assistance

If the unit fails to operate correctly despite troubleshooting efforts, contact the II Morrow factory for assistance. The factory address and phone number are:

II Morrow Inc.
2345 Turner Road S.E.
Salem, OR 97302
U.S.A.
Phone (503) 581-8101, or 1-800-525-6726

Be prepared to offer the following information about the installation:

- system configuration, including number of NMCs, sensor, antennas, etc.
- model numbers, part numbers with mod level, and serial numbers
- software (SW) version numbers
- firmware (FW) version numbers
- description of problem
- efforts made to isolate the problem
- mounting location of each system component
- computed lat/long position shown on the NMC
- UTC time and date
- local time
- antenna location

Glossary

A

Activation Altitude: The selectable altitude at which (if oceanic operation is armed) the NMC will automatically enter the active state and begin navigating in the Oceanic/Remote flight phase.

Almanac: Data transmitted by a GPS satellite including orbit information on all satellites, clock correction, and atmospheric delays.

Altitude (GPS ALT): Altitude based upon a mathematical model of the earth's surface curvature. A substantial difference between this altitude value and altitude referenced to sea level may exist.

Approach: A predefined sequence of waypoints used during approach procedures.

Approach Active, Approach Active Mode: The phase of flight used for GPS nonprecision approaches that is concurrent with approach RAIM integrity and full scale deflection at 0.3 nm. During approach active mode, approach is enabled, the MAP is the current TO waypoint, and waypoint sequencing is on HOLD.

Approach Enabled: A state that allows automatic transition to approach active mode. When approach is first enabled, the flight mode transitions from terminal to approach transition. Approach can only be enabled when within 30 nm of the destination airport.

Approach RAIM Integrity: 0.3 nm RAIM alarm limit.

Approach Transition, Approach Transition Mode: Phase of flight concurrent with terminal RAIM integrity and full scale deflection at or transitioning to 1.0 nm. During approach transition mode, approach is enable.

Approach Waypoint: A waypoint that is part of a published approach (all waypoints from IAF to the MAHP).

Automatic Terminal Information Service (ATIS): Recorded information about weather and other conditions at an airport, periodically updated when conditions change.

Azimuth: The horizontal bearing, as measured clockwise from true or magnetic north.

B

Bearing (BRG): The direction to any point, usually measured in degrees relative to true or magnetic north.

C

Constellation: A group of stars or objects, such as GPS satellites, in the heavens.

Coordinates: Values for latitude and longitude that describe a geographical point on the surface of the earth.

Course: The planned direction of travel in a horizontal plane.

Course Deviation: A measurement of distance left or right from the desired course of travel.

Course Deviation Indicator (CDI): A graphic indicator of course deviation typically shown as a graduated horizontal bar with an icon indicating the deviation distance left or right of course.

Common Traffic Advisory Frequency (CTAF)

D

Database: A collection of data structured in such a way as to allow quick and convenient access to any particular record or records. The NMC contains a built-in database of waypoints and waypoint information. Users may add waypoints to this database.

Degree: 1/360th of a circle.

Departure: The first waypoint in the active route.

Desired Track (DTK): The desired course of navigation between a point of origin and a destination waypoint.

Destination: The last waypoint in the active route.

Dilution of Precision (DOP): A merit value for the calculated position based on the geometrical configuration of the satellites used; 3 is considered good, greater than 7 is considered poor. Also called Position Dilution of Precision or PDOP.

Distance: A measure of interval in space. Also referred to as range.

DME: Distance Measuring Equipment

Drift: Displacement from the intended course of travel.

E

Elevation: The angle of a GPS satellite above the horizon. Height above mean sea level.

En Route EPE: Loran EPE limit of 2.8 nm.

Enroute Mode: The phase of flight when more than 30 nm from departure or destination airport. During en route mode, full scale deflection is at or transitioning to 5.0 nm.

Enroute RAIM Integrity: 2.0 nm RAIM alarm limit.

EPE: Estimated Precision Error.

Ephemeris: A list of accurate positions or locations of a celestial object as a function of time.

Estimated Time of Arrival (ETA)

Estimated Time Enroute (ETE)

F

FAF: Final Approach Fix.

Fix: A geographical location determined by either visual reference or by electronic navigation aids.

G

GDOP: Geometric Dilution of Precision. The relationship between errors in receiver position and time and in satellite range.

Global Positioning System (GPS): Also known as NAVSTAR. A constellation of satellites launched by the U.S. Department of Defense into six orbit lanes (four satellites per plane) at an altitude of 10,898 nm above the earth.

Greenwich Mean Time (GMT): See Universal Time Coordinate (UTC).

Ground (GRND): Ground communication frequency

Ground Speed (GS): Speed of travel across the ground. In aviation, the relation between ground speed and air speed is affected by the prevailing winds.

H

HDOP: Horizontal Dilution of Precision.

I

IAF: Initial Approach Fix.

IFAF: A point that exists as a combined IAF and FAF.

Identifier: A name, typically abbreviated, assigned to a waypoint. The identifier may consist of numbers and alpha characters, up to six in length. For example, the airport identifier for Los Angeles International Airport is LAX.

Instrument Flight Rules (IFR)

Intersection (INT): A point defined by any combination of courses, radials, or bearings of two or more navigational aids.

K

Knot (kt): A unit of speed equal to one nautical mile per hour.

L

Latitude (Lat): Any line circling the earth parallel to the equator, measured in degrees, minutes, and seconds north and south of the equator.

Longitude (Lon): Any line from the north to the south pole, measured in degrees, minutes, and seconds of a circle, east or west of the Prime Meridian (Greenwich, England).

M

Magnetic North: The region, some distance from the geographic north pole where the earth's magnetic lines concentrate. A magnetic compass points to the magnetic north.

Magnetic Variation (Mag Var): The angle between the magnetic and true north. At various points on the earth it is different due to local magnetic disturbances. It is shown on charts as isogonic lines marked with degrees of variation, either east or west. These degrees must be added to or subtracted from the true course to get the magnetic course. (Easterly variations are deducted, and westerly variations are added.)

Map Datum: A mathematical model of the earth used for the purpose of creating navigation charts and maps.

Meter (m): A metric distance measurement equal to 39.37 inches.

Minute: 1/60th of a degree.

MAHP: Missed Approach Hold Point.

MAP: Missed Approach Point.

MCLS: Multi-Chain Loran Sensor

MESA: Minimum Enroute Safe Altitude is the highest MSA for every point between the aircraft present position and the "TO" waypoint with a 5 nm buffer around the course.

MSA: Minimum Safe Altitude is the elevation of the highest obstruction near the aircraft plus a 1,000 or 2,000 foot buffer added for safety. In non-mountainous terrain, a 1,000 foot buffer is added. In mountainous terrain, a 2,000 foot buffer is added. The result is rounded to the nearest 100 feet.

N

NANU: Notice Advisory to NAVSTAR Users.

Nautical Mile (nm): A distance measurement equal to 6,076 feet, or 1.15 statute mile. One nautical mile is also equal to one minute of latitude.

NAVSTAR: The name given to GPS satellites formed from the acronym for **NAV**igation **S**ystem with **T**ime **A**nd **R**anging.

Non-Directional Beacon (NDB): A low frequency/medium frequency navigation aid sending non-directional signals that can be used for navigation.

Non-Sequenced Waypoint: Any waypoint that is not part of a predefined sequence of waypoints belonging to an approach.

NOTAM: Notice to Airmen.

P

PDOP: Position Dilution of Precision. A description of the merit of position quality expressing the relationship between the error in user position and the error in satellite position. Values considered good for positioning are small, such as 3. Values greater than 7 are considered poor.

Position Uncertainty: The maximum distance from the reported position to your actual position. This is reported on the Oceanic Status page when in the oceanic/remote flight phase, there is a RAIM alarm, and there are enough satellites to calculate it. You are assured that your actual position is within the displayed distance from your reported position.

Primary Oceanic/Remote Airspace Operations: The NMC and it's GPS sensor continuously monitor GPS satellite integrity and automatically remove a satellite from position calculations if it is determined to be faulty in accordance with FAA Notice N8110.60

PRN: Pseudo-Random Numbers used to uniquely identify satellites. This is different than the SVN (Space Vehicle Number) or the satellite serial number.

R

Radial: Any of the 360 magnetic courses from a VOR or similar navigational aid, beginning at the navigational aid and proceeding outward in a straight line.

RAIM: Receiver Autonomous Integrity Monitoring. A method of predicting possible system accuracy errors that may be caused by bad satellite data. The RAIM algorithm requires that more satellites are available and usable than required for a normal GPS position fix.

RAIM Alarm: A signal that, with RAIM available, RAIM integrity for the current flight mode is exceeded.

RAIM Alarm Limit: The maximum RAIM integrity value for the current phase of flight. The accuracy tolerance used by the RAIM algorithm. The limit is set at 2 nm for Enroute and Oceanic operations, 1 nm for Terminal operations, and 0.3 nm for Approach operations.

RAIM Availability, RAIM Detection: Availability of five groups of four satellites, with adequate geometry, to provide RAIM.

RAIM Integrity: A measurement based on RAIM calculations of the probability of error in the position solution.

Range (RNG): The distance from the present position to a destination waypoint.

RPIL: RAIM Predict Ignore List. List of expected satellite outages.

S

Second: 1/60th of a minute of a degree.

Seed Position: A latitude and longitude position fix approximately equal to the current position that the NMC uses to determine the location of available satellites from which signals may be received.

Selective Availability (SA): The degradation of accuracy of GPS position fix data by the United States Department of Defense for civilian use.

SID: Standard Instrument Departure: A predefined sequence of waypoints used during departure procedures.

Space Vehicle (SV): A GPS satellite.

STAR: Standard Terminal Arrival Route. A predefined sequence of waypoints used before arrival procedures.

Statute Mile: A distance measurement equal to 5,280 feet or 0.87 of a nautical mile.

T

Terminal EPE: Loran EPE limit of 1.7 nm.

Terminal Operations: The phase of flight within 30 nm of the departure airport or the destination airport when approach is not enabled. During terminal operations, terminal RAIM integrity is used. For Loran, terminal EPE applies.

Terminal RAIM Integrity: 1.0 nm RAIM alarm limit.

Three-dimensional (3D) Position Fix: A position fix defined by latitude, longitude, and altitude.

Track (TRK): The imaginary line that the flight path of an airplane makes over the earth.

Track Angle Error (TAE): the absolute value of the DTK minus the TRK.

TRU: True outside air temperature.

True North: Geographic north, at the earth’s north pole.

Tower (TWR): Airport tower communication frequency

U

UNICOM: The radio frequencies assigned to aeronautical advisory stations for communication with aircraft. Unicoms may provide such airport information as active runway, wind direction and velocity and other conditions of importance to pilots.

Universal Coordinated Time (UTC): Greenwich Mean Time, or the time at the Prime Meridian in Greenwich, England. Also referred to as Zulu time.

UTC Differential: The difference in time between that at the present position and UTC.

Universal Transverse Mercator Map Projection System (UTM): Also known as Military Grid Coordinates, the UTM grid consists of 60 north-south/east-west zones, each six degrees wide in longitude.

V

Very High Frequency Omnirange (VOR): A navigational aid that transmits signals such that a receiver can indicate its current radial or bearing from the transmitter.

W

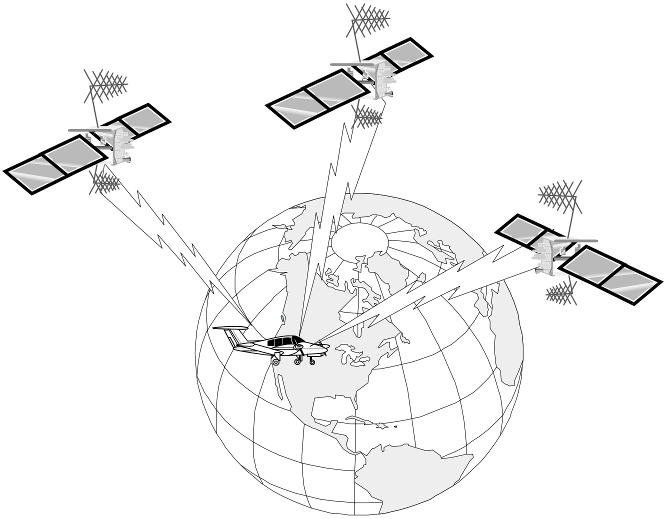
Waypoint: A navigation fix used in area navigation and defined by latitude and longitude coordinates.

GPS Reference

This section provides an overview of the Global Positioning System (GPS), its limitations, advantages, and special features.

General Information

GPS, is a constellation of 24 satellites in six lanes with four satellites per plane in 10,898 nm orbits. The orbit period is 12 hours, or two orbits per day. Each satellite transmits a signal with special coding unique to each satellite called a pseudorandom code and allows any GPS receiver to identify each satellite. A precise time mark is provided in the code that is used to determine the range from the satellite to the receiver. Each satellite transmits at the same frequency (1575.42 MHz). The GPS equipment in the Apollo Navigation Management System (NMS) only receives signals. The receiver looks for the satellites by searching for the codes transmitted by each satellite. Each satellite found is used to determine a position solution. An additional satellite is used to determine the time differences between the time of signal transmission and its reception. Each satellite transmits its signal at precisely the same time. Each satellite has two cesium beam clocks on board as a time reference to ensure accurate timing. Knowing the length of time it takes for the signal to reach the GPS receiver allows it to determine the distance to the satellite. This distance is referred to as the range from the satellite.



Using the range from the satellite to the GPS receiver, the location of the receiver is a point somewhere on the surface of a sphere. Adding a third satellite to the equation creates two overlapping spheres placing the location of the GPS receiver on a circle. A fourth satellite narrows the location of the GPS receiver to two points. One location is on or near the surface of the earth. The other position is in the opposite direction in space and is discarded as a solution. The position determined by four satellites provides latitude, longitude, altitude, and time for a three-dimensional (3-D) location or fix.

The exact location of each satellite must be known at any given time. Traveling in a high speed orbit, some satellites will “rise” and some will “set” in relation to the location of the GPS receiver. A general almanac is continuously transmitted from each satellite giving the approximate location of each satellite. It takes about 12-1/2 minutes to acquire all of the almanac data for the entire system. A given set of almanac data is valid for about six months. So, it is possible for a GPS receiver that is new or stored for a long time to take from 12 to 45 minutes to acquire all of the required almanac information the first time it is turned on. If you use your GPS receiver regularly, it should always have a current almanac and you won’t have to wait very long. The almanac only provides an approximate location for each satellite so the receiver knows where to begin to look. Information that pinpoints the exact location of the satellite is also transmitted about every 30 seconds. This data is called “ephemeris” data. The ephemeris data is used in the calculation that determines the exact location the satellite.

Because four satellites are needed for a position fix and the satellites are constantly moving, setting, and rising, the ideal receiver would track at least five satellites with channels.

Accuracy, Error, and Limitations

GPS can be very accurate in defining a position fix. Accuracy can however mean many things and depends upon how it is defined. If you only want to know how accurate a system is in two dimensions, you could use the Circular Error Probability (CEP) method. The CEP method gives the diameter of a circle that the receiver will be located in 50% of the time. The Radial Normal Error (1 DRMS) method gives a circle that is large enough that the receiver will be in it 63% to 68% of the time. The 1 DRMS method is more restrictive than the CEP method. A more common method of error measurement is the 2

DRMS method. The 2 DRMS method describes a circle that the receiver must be located in for 95% to 98% of the time and is the most restrictive measurement method.

There are several inherent sources of error in GPS. Some factors are intentional, some are a result of geometry, while others are caused by equipment or natural conditions. One factor in accuracy and error in GPS is the process of "Selective Availability." Two levels of service exist for GPS: Precise Positioning Service (PPS) and Standard Positioning Service (SPS). PPS has the best possible accuracy and is reserved for military use only. SPS was designed for civilian use and, while less accurate than PPS, still has enough accuracy to be of strategic concern to the military. Selective Availability (S/A) is a deliberate introduction of errors. The DoD has stated that these induced errors will be within 100 meters 95% of the time and within 300 meters 99.9% of the time.

Other errors that can degrade the accuracy of GPS are satellite clock error, ephemeris error, ionospheric error, or Geometric Dilution of Precision (GDOP). The atomic clocks used in the satellites are extremely accurate, but because of the large distances involved even a very small error will have an effect on overall accuracy. Clock error can contribute a real distance error of about two feet. Ephemeris information is a prediction of a satellite position in space. The actual position of the satellite might differ slightly and can contribute to an error of about two feet at the GPS receiver. The calculation of distance used to fix a position of a GPS receiver depends on knowing the time it takes for the signal to travel from the satellite to the receiver and the speed of light. The density of the atmosphere affects the speed of light. Ionospheric error is caused by changes in the density and thickness of the ionosphere at different times of the day and year resulting in a possible error of two feet to two hundred feet.

Geometric Dilution of Precision (GDOP) refers to the effect of the geometry of the satellites used to arrive at a position fix. The best possible arrangement of satellites would place one directly overhead with three more spaced 120 degrees apart and very low over the horizon. The perfect arrangement creates the smallest possible area of error. As the actual geometry of the satellites is never ideal, the area of possible error always exists and varies. GDOP is a multiplier of other errors. For example, if the total error due to other causes was five meters and the GDOP was six, the actual error would be 30 meters using the 2

DRMS method. Typically, the accuracy of most good GPS receivers under normal conditions will be within 15 to 30 meters.

Position Fix

A 2D position fix is possible with only three satellites visible. Four satellites are required for a 3D fix and at least five satellites (with good geometry) are required to provide RAIM. Pressure altitude data can sometimes be substituted for the fifth required satellite in order to provide RAIM. Your Apollo NMC allows use of an altitude input to replace one of the required satellites for a position solution. This will yield a 2D, or horizontal, position with only three satellites, but is not as accurate as when four satellites are used. A three-dimensional fix (3D) includes altitude information. GPS altitude is calculated according to an ideal model (WGS-84 spheroid). The GPS altitude is determined by the distance calculated to be the height above an ideal ellipsoid model of the earth designed to closely approximate the surface of the earth. The translation applied to GPS altitude to convert to MSL altitude changes from area to area due to the uneven shape of the earth. The designed accuracy of GPS for civilian-use can have a typical accuracy of 500 feet depending on the cumulative error sources. So, don’t depend on your GPS altitude for navigating.

Apollo NMC Flight Simulator

Your Apollo Navigation Management Computer (NMC) is provided with a Flight Simulation program that allows you to “fly” your unit when it is removed from the aircraft. Using the power supply provided with the unit, you can practice using your Apollo NMC at home, in the office, or anywhere you have an AC outlet. This section describes the procedures used to remove your NMC from the aircraft, run the Flight Simulator, and re-install the NMC.

About the Flight Simulator

The Flight Simulator is programmed into your NMC at the factory and is activated when the NMC is powered-up using the external power supply (P/N 148-1033).

The NMC “asks” you to input a ground speed and altitude each time it is powered-up using the external power supply. This speed and altitude information will remain constant throughout the simulation. The NMC uses a simulated GPS sensor to provide position, altitude, speed, and course information. As no external sensors are connected while the simulation is running, no information is displayed about external sensors. The simulated altitude does not change while the Flight Simulator is running, so the Altitude Assist functions will show that you are maintaining the entered altitude.

The NMC uses the position of the first FROM waypoint in the Active flight plan as the initial position and simulates flight along the desired track to each successive TO waypoint. While “en route,” the NMC generates updated navigation information and alert messages consistent with the simulated flight path. When the NMC “arrives” at the final waypoint of your flight plan, it stops waypoint sequencing. The NMC continues to simulate flight past the waypoint and provides bearing and distance information to the last TO waypoint.

NMC Removal (Panel Mount)

The following procedure is used to remove the panel mounted NMC from the aircraft panel. Reverse this procedure to re-install the NMC.

1. Unscrew the two mounting rods under the NMC front panel with the flat blade screwdriver provided (P/N 555-0500). Insert the screwdriver blade into the face plate holes, as shown in Figure 1, to reach the mounting rod screw heads.

2. Pull the unit straight out of the mounting tube.

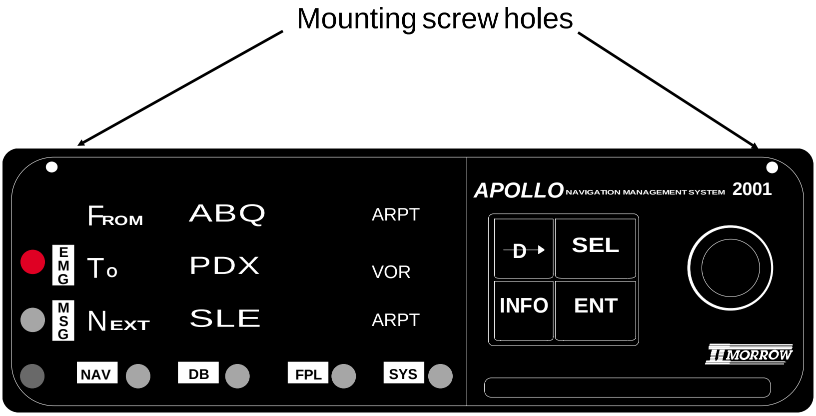

Mounting screw holes

Figure 1 - Apollo NMS Panel Mount

NMC Removal (Dzus Mount)

The following procedure is used to remove the Dzus mounted NMC from the aircraft panel. Reverse this procedure to re-install the NMC.

1. Unscrew the four Dzus mount screws on the NMC front panel by turning them 1/4 turn counterclockwise with a flat blade screwdriver.

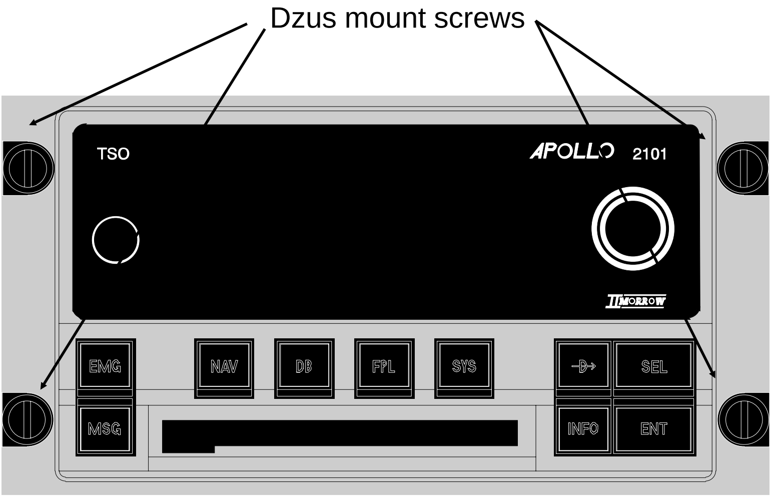


Figure 2 - Apollo NMS Dzus Mount Front Panel

2. Pull the unit out of the panel. Disconnect the avionics connector, ground wires, and air flow tube from the back of the unit.

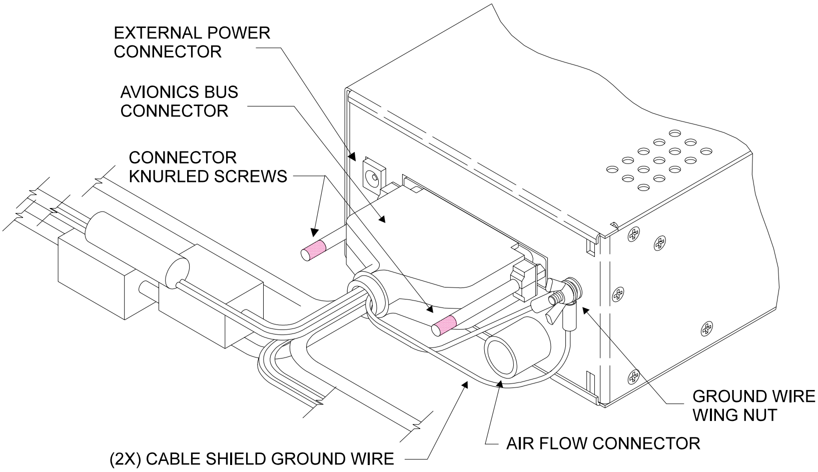


Figure 4 - Apollo NMC Dzus Mount Rear Connections

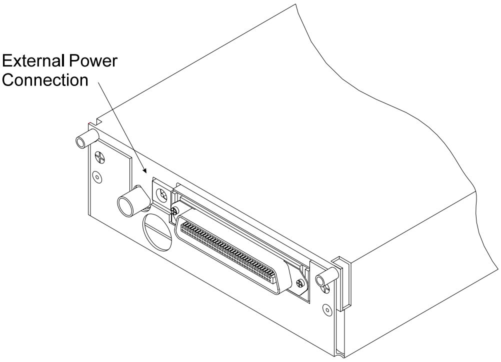


Figure 3 - Panel Mount Apollo NMC Rear Connections

Connecting the Power Supply

The following procedure is used to connect the NMC to the external power supply. The NMC must be removed from your aircraft to use the Flight Simulator.

1. Remove the NMC from the aircraft.

2. Plug the external power supply into a 120 VAC socket.

3. Insert the power cord into the power connector shown in Figure 3 or 4.

Starting the Flight Simulation

The following procedure is used to start the flight simulation. It is recommended that you have a data card properly inserted into the data card slot so you can use the appropriate functions.

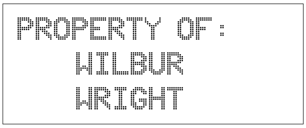
Action	Explanation
1.	Push in or turn the power switch.

```
   APOLLO NMC

 BY II MORROW
```

NAV

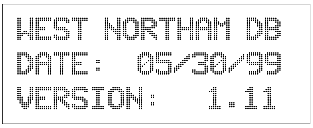
The owner name is displayed for approximately 2 seconds. If you have not entered your name, the display will read "Property of: No Name Entered"



```
PROPERTY OF:
    WILBUR
    WRIGHT
```

NAV

The data card information is displayed for approximately 3 seconds.

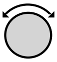


```
WEST NORTHAM DB
DATE:  05/30/99
VERSION:   1.11
```

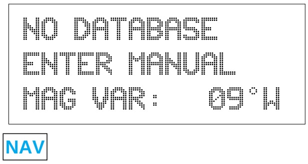
NAV

Starting the Flight Simulation (continued)

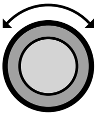
2. (Only if a data card is not installed)

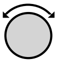


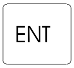
If no data card is installed, the magnetic variation must be entered manually. Turn the **Small** knob to display the desired magnetic variation.



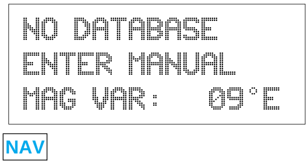
NO DATABASE
ENTER MANUAL
MAG VAR: 09°W





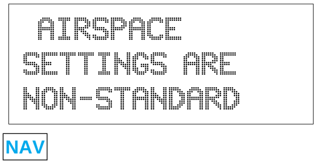


Turn the **Large** knob to make the variation direction flash. Turn the **Small** knob to display “E” or “W.” Pressing **ENT** enters the displayed magnetic variation.



NO DATABASE
ENTER MANUAL
MAG VAR: 09°E

If you have changed the default (factory) airspace alert settings, the following display appears for approximately 3 seconds.



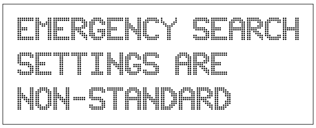
AIRSPACE
SETTINGS ARE
NON-STANDARD

Starting the Flight Simulation (continued)

If you have turned the airspace alerts off, the following display appears for approximately 3 seconds.

```
 AIRSPACE
SETTINGS ARE OFF
```

If you have changed the Emergency Search (runway limits) settings, the following display appears for approximately 3 seconds.



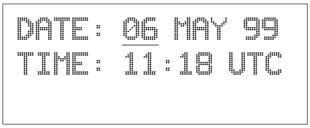
```
EMERGENCY SEARCH
SETTINGS ARE
NON-STANDARD
```

NAV

3. (Only if adjusting the Date/Time)

SEL

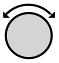
The date and time are displayed for confirmation. The time setting is displayed as UTC (Universal Coordinated Time - formerly Greenwich Mean Time). If the date and time are incorrect, press the **SEL** button to activate editing.



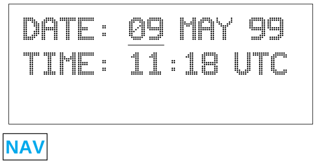
```
DATE: 06 MAY 99
TIME: 11:18 UTC
```

NAV

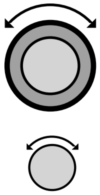
Starting the Flight Simulation (continued)



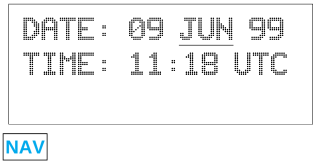
Turn the **Small** knob to display the desired date.



```
DATE: 09 MAY 99
TIME: 11:18 UTC
```



Turn the **Large** knob to make the next information to change flash. Turn the **Small** knob to display the desired information. Repeat as necessary to edit the Time and Date.



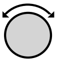
```
DATE: 09 JUN 99
TIME: 11:18 UTC
```

Pressing **ENT** enters the displayed time and date. The power-up sequence will continue.

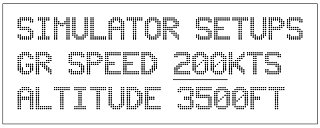
```
FLIGHT SIMULATOR
NOT FOR FLIGHT
PRESS SEL
```

Starting the Flight Simulation (continued)

4.

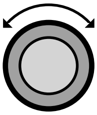


Pressing **SEL** activates editing. This display is used to enter a ground speed and altitude to be used during the flight simulation. Turn the **Small** knob to display the desired ground speed.

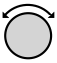


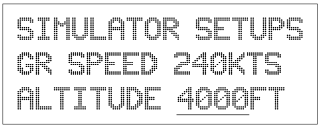
SIMULATOR SETUPS
GR SPEED 200KTS
ALTITUDE 3500FT

NAV



Turn the **Large** knob to make the altitude value flash. Turn the **Small** knob to display the desired altitude.

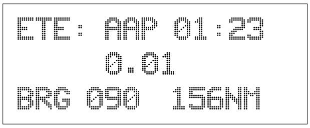




SIMULATOR SETUPS
GR SPEED 240KTS
ALTITUDE 4000FT

NAV

Pressing **ENT** enters the displayed ground speed and altitude values and starts the flight simulation. The NMC is placed in NAV mode, and a simulated GPS sensor begins tracking your position from the first FROM waypoint in the Active flight plan.



ETE: AAP 01:23
0.01
BRG 090 156NM

NAV

Flight Simulator Operations

Once you've started the flight simulator, you may practice the various operating procedures, such as activating flight plans, entering Direct-To courses, and inserting/deleting/changing waypoints in the Active flight plan. The simulator is also useful for planning purposes; you may create and edit flight plans in the comfort of your office or home. Changes made to flight plans and waypoints while the simulator is running are retained when the NMC is reinstalled in the aircraft.

After the NMC is Re-Installed in the Aircraft

To acquire a position, the system must "know" is approximate location and, if using GPS sensor(s), the UTC time. After using the Flight Simulator, the NMC "remembers" the last simulated location it was at when the power was turned off. At power-up, the NMC will use this location in trying to acquire signals. **When the Apollo NMC has been re-installed into the aircraft, you may be required to enter the location and time.** Refer to the *Power-Up Sequence* section for details.

Operating Manual Supplement
for the
Apollo 2002/2102 Keypad

These pages supplement your Apollo NMC Operating Manual and includes information for use with the Apollo 2002/2102 Keypads.

Place these pages in the rear portion of your NMC Operating Manual behind the tab labeled “Supplements, Other.”

P/N 560-0168-00

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History of Revisions

January 1996	Original Release

Ordering Information

To receive additional copies of this document, order part #560-0168-00, *NMC Operating Manual Supplement for the Apollo 2002 Keypad*. The Apollo NMC Operating Manual is part # 560-0164.

Warranty Information

The Apollo 2002/2102 Keypads carrie the same II Morrow limited warranty as your Navigation Management Computer. Refer to the terms and conditions on your warranty card for specific information.

Operating Manual Supplement for the Apollo 2002/2102 Keypads

The Apollo 2002/2102 keypad is a small, Dzus rail-mounted unit designed for use with Apollo Dzus-mount Navigation Management Computers (NMC). The keypad provides a fast, easy method for entering data into your NMC. The keypad allows a convenient way to enter or edit single characters, such as in waypoint names.

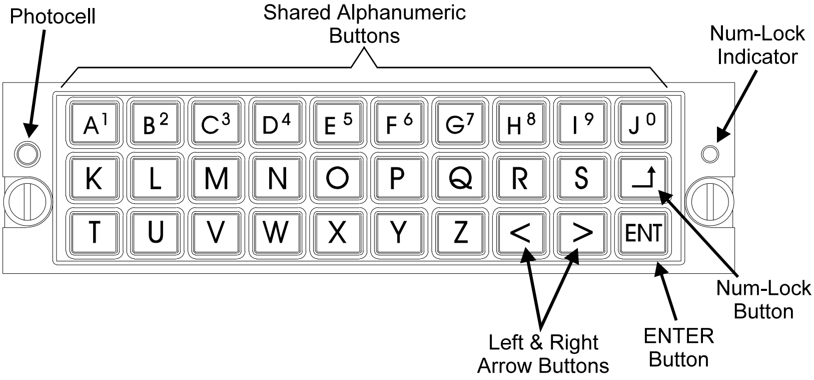
Using the Keypad

The left and right arrow buttons serve the same function as the large knob on the NMC to choose which character on the display will flash. The keypad cannot be used to scroll through top-level displays for each mode; you must use the Large knob on the NMC.

When the desired character on the NMC flashes, use the keypad to enter the appropriate letter or numeric character. The NMC will only allow the entry of characters that you could also have selected with the Small knob for any given function. For instance, if a number value is flashing, you can only enter a number. A letter would not be allowed. When the NMC accepts a character, the next character to the right will flash. This allows you to use the keypad to continue changing other characters without turning the knobs on the NMC.

The **ENT** button on the keypad serves the same function as on the front panel of the NMC. Press the **ENT** button to save the entered characters.

The keypad can send alpha characters A to Z and numeric characters 0 to 9. The buttons on the top row for letters A to J are shared with the numbers 0 to 9. The **UP** arrow (**NUM-LOCK**) button on the right side of the keypad allows you to select between entering numbers or letters on the top row. After you press the **NUM-LOCK** button the Num-Lock indicator lights to indicate that numbers will be selected when a button on the top row is pressed. Press the **NUM-LOCK** button again to allow entry of letters and the indicator light will be off. If the keypad is used on a strictly numeric field, the A-J keys are automatically changed to 0-9. All other keys become 0.



Buttons on the keypad are backlighted for easy viewing in low light conditions. Backlight intensity is controlled by a photocell on the front panel of the keypad.

Waypoint Retriever Operation

While you are searching for waypoints, the keypad uses shortcuts for selecting waypoint types. Pressing the letter on the keypad will select the following waypoint types as shown below:

Press this Keypad Letter	Waypoint Item Selected
“L”	Airport (LFAC - Landing Facility)
“I”	Intersection *
“V”	VOR
“N”	NDB
“R”	Runways, if in your database

* Intersections will be displayed as INT(x), where “x” is the database type. Pressing “I” will take you to the Intersection waypoint type. You then turn the **Large** knob to move to the identifier field. Pressing the letter that is displayed between the parantheses will take you directly to the identifier field.

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