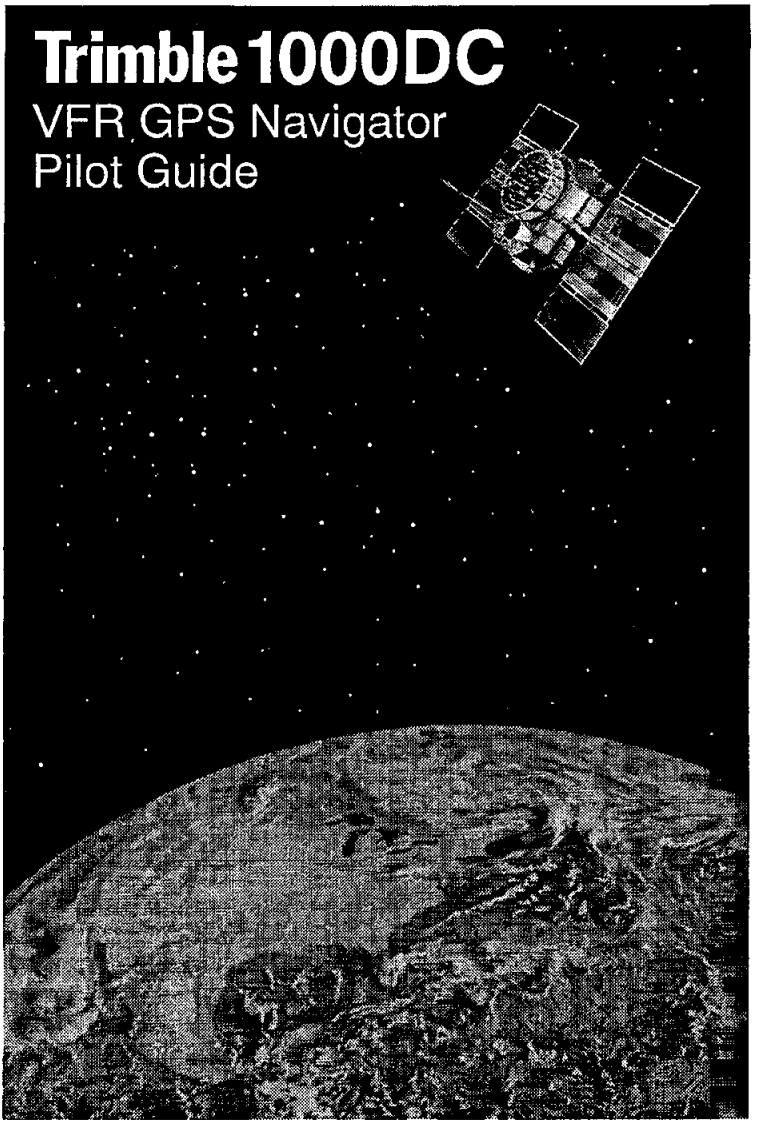
612

Trimble



Trimble
2105 Donley Drive
Austin, TX 78758

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Limited Warranty

Trimble

I. HARDWARE

TRIMBLE NAVIGATION, LTD. ("TRIMBLE"), 2105 Donley Drive, Austin, TX 78758, hereby warrants to the first retail purchaser only, that hardware purchased hereunder will be free from defects in material and workmanship for a period of two (2) years from the date of installation, not to exceed thirty (30) months from the date of shipment from TRIMBLE's factory. Should defects be found, TRIMBLE at its option, will repair or replace the product in which physical defects in materials or workmanship occur. The foregoing states the sole liability and obligation of TRIMBLE arising out of this warranty, and such warranty is subject to the following CONDITIONS AND LIMITATIONS.

(A) The defect shall occur under normal use and service for which this product was intended. TRIMBLE shall not be obligated or liable under this Warranty for defects which TRIMBLE's examination discloses are due to: (1) tampering, (2) misuse, (3) abuse, (4) neglect, (5) improper storage or maintenance, (6) use in a manner beyond which such equipment is normally intended to be used, (7) improper repair or poor workmanship by those who are not authorized by TRIMBLE to repair the products or use of defective material by such unauthorized persons, and (8) any other cause except for defects in material or workmanship caused by TRIMBLE.

(B) The warranty card supplied with the product must be completed and returned to TRIMBLE within 15 days of installation of the product in order for this Warranty to become effective.

(C) The product is sold and installed by an authorized dealer. A list of all authorized TRIMBLE dealers may be obtained from TRIMBLE.

(D) The company must have received a copy of a completed FAA Form 337 covering installation of the product in the purchaser's aircraft, or equivalent documentation showing installation of the product by the authorized TRIMBLE dealer.

(E) The product shall be returned to TRIMBLE via the dealer with transportation charges prepaid. After correction of the defects, the products will be returned to the purchaser, transportation charges prepaid, except for returns to purchasers in foreign countries, which purchasers shall be responsible for payment of such charges from the American Port of exit to purchaser's place of business. The risk of loss or damage to all products in transit shall be assumed by the party initiating the transportation of such products.

II. DATA

TRIMBLE warrants that the media on which the database is recorded will be free from defects in materials and workmanship under normal use for a period of two (2) years from the Delivery Date. Purchaser's sole and exclusive remedy, and TRIMBLE's sole and exclusive liability, under this warranty will be TRIMBLE's replacement of the media.

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To obtain service under this warranty contact: Trimble Avionics Service at (512) 432-0400.

Purchase Date	Model Number	Serial Number

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Glossary of Terms

Introduction

Congratulations! With your purchase of the Trimble 1000DC GPS Navigator, your aircraft is equipped for navigation position accuracies up to 15 meters; ANYWHERE, ANYTIME and in ANY WEATHER. Your new Navigator is the ultimate in radio navigation. It has a low susceptibility to jamming and interference, and since GPS is an integral part of the future ATC system, its growth potential is unlimited.

The Trimble 1000DC GPS Navigator calculates your position in 3-dimensions: Latitude, Longitude and Altitude. It is able to use the space-age Global Positioning System (GPS) satellites, is completely automatic and requires *no* initialization.

Your Trimble 1000DC GPS Navigator is a state-of-the art, panel-mounted design. The system features:

- A three-channel GPS receiver which calculates present position and monitors signal integrity.
- Direct access to worldwide data on airports, VORs, NDBs, intersections, and special use airspaces in the Jeppesen database card used by the Navigator. This information can be accessed using either the standard identifier (for example, LAX), the ICAO identifier (for example, CYYZ) or the city or object name.

- Its push-button and knob-select functions are simple and consistent, making them easy to learn and remember. Its annunciator lights clearly show your unit's mode of operation and any messages it issues. And, you never have to specify beforehand which waypoints you will be using—all waypoint information in the Jeppesen database is quickly and easily accessible.

The Navigator Functions

The Trimble 1000DC GPS Navigator performs a wide variety of navigation functions:

Direct Navigation	Designate a destination and fly directly to it from any position.
Flight Plan Navigation	Define a flight plan with up to 19 legs or 20 waypoints and be guided automatically along the proper route.
Position Finding	Determine current position in terms of latitude and longitude or bearing and distance from any point.
ETA/Fuel Consumption	Monitor a flight's progression and determine accurately the time of arrival and fuel consumption.
Emergency Navigation	Determine the nearest Airport or VOR, NDB or Agency with the press of one button.
Preflight Planning	Determine the distance and bearing to destination, distance and bearing of any leg, total flight plan distance, and other useful information before departure.

Navigator Functions	Access information or perform calculations including Waypoint data (such as airport communication frequencies; runway lengths, and approach type); Estimated time enroute and time of arrival; Ground track and ground speed; Minimum safe altitude; Minimum enroute safe altitude; Desired and actual tracks; Vertical navigation; Winds aloft; Fuel range; True air speed; Density altitude calculation.

Safety First

Although Trimble Navigation Ltd. has designed and built the Trimble 1000DC GPS Navigator with all possible care, many factors can affect aircraft safety. Please observe the following precautions:

Follow the fundamental rule of aircraft navigation: NEVER RELY ON A SINGLE NAVIGATION SYSTEM! Errors or malfunctions are always possible in any system, and double-checking navigation information should be a normal part of flying.

The Trimble 1000DC GPS Navigator and other equipment must be properly maintained in order to perform according to specifications.

The Jeppesen database card must be updated regularly in order to ensure that its information is current. Jeppesen issues an update approximately every 28 days. See the Jeppesen subscription packet enclosed with the Trimble 1000DC GPS Navigator or refer to the subscription form in this manual for information on subscribing to this update service.

Although the Trimble 1000DC is a powerful navigation tool, don't be tempted to violate IFR regulations because of the accuracy of the GPS receiver. When flying IFR, navigation must be based only on IFR-approved instruments. GPS receivers are not yet FAA-approved.

THE TRIMBLE NAVIGATOR

Although the Trimble 1000DC GPS Navigator has a wealth of features and information, remember that "SEE AND BE SEEN" is the most important rule for VFR flight.

Other Things You Should Know

Warranty Information

Be sure to fill out and return the Registration and Warranty Card as soon as you purchase your unit. The tear-out card is located at the front of this guide. When you return this card, we will send you a complimentary copy of Trimble's *GPS: A Guide to the Next Utility.*

Service Information

Authorized service for your Trimble 1000DC GPS Navigator is available by returning the unit to Trimble or to a Trimble-authorized repair center. Any customization of the unit will be erased during system servicing (i.e., Serial Setups, Flight Plans, User Waypoints, Personal Messages). If you have purchased the optional flight planning and configuration software, be sure to save your customized settings so they can be restored when the unit is returned to you. To return the unit directly to Trimble, send the unit to:

Trimble - Austin
2105 Donley Drive
Austin, Texas 78758
Attn: Service Department
Phone: (512) 432-0400
FAX: (512) 836-9413

Quick Reference Card

A separate Reference Card is included with this guide. The card summarizes the steps required to perform frequently used Navigator functions. Once you become familiar with the operation of your Trimble 1000DC GPS Navigator, this card will be a helpful reminder.

Installation Manual

Installation information for your Trimble 1000DC GPS Navigator is contained in a separate Installation Manual that came with the unit. The person who installs your Navigator—probably your dealer—will use this manual to install the unit in your aircraft.

Jeppesen Database - General Use

The navigation database used with the Navigator is produced by Jeppesen NavData Services. This database provides access to reliable data on Airports, VORs, NDBs, and Intersections. Both the North American and International database cards are required for complete worldwide information. Although this database information is very reliable, it is recommended that you double-check waypoint information. For example, about 120 NDB and Intersection identifiers are repeated anywhere from 2 to 5 times in the Jeppesen database. Instructions for selecting between similar identifiers are located in Section 4.4.2.

Another important note regards the insertion or removal of the database card. NEVER insert or remove this card from the Navigator when the power is on. The system automatically resets when the card is removed and there is also a risk of data corruption and other system errors.

Users finding information in the database which they know to be incorrect are encouraged to report the problem to Jeppesen NavData Services. This can be done by calling (303) 799-9090 and asking to report a Trimble database problem.

Instructions regarding these and other database characteristics are included in this guide, as each topic is introduced.

Jeppesen Database - International Use

Database coverage for International airspaces is limited. For example, there are no TWR, ATIS, APPR, UNI, GRND, or CTAF frequencies available in the International database. We recommend that you contact Jeppesen NavData Services for complete information on coverage for International use.

Altitude Sources

Barometric altitude is the Navigator's standard source of altitude information when a digital barometric input is supplied. The Navigator uses this altitude to aid in GPS positioning when in 2-D navigation (3 satellites).

Air and Fuel Data Computer

The ADC-200 Air and Fuel Data Computer, produced by Shadin Co., Inc., can be used to supply the following data to the Navigator:

- Fuel Flow
- Pressure Altitude
- Outside Air Temperature
- Indicated Air Speed
- Heading

The Navigator receives the data via its serial port and uses it for automatic calculation of fuel remaining, flight time remaining, fuel to destination, fuel efficiency, fuel consumed, density altitude, true airspeed, wind direction and speed, and crosswinds.

How To Use This Guide

This guide is designed to get you up to speed as quickly as possible, using the Trimble 1000DC GPS Navigator.

Chapter 1, ***Getting Started,*** gives a solid introduction to the Trimble 1000DC GPS Navigator including physical descriptions of the Navigator components, their uses and functions.

Chapter 2, ***Using the Navigator,*** will be the most frequently used chapter in this guide. Following the step-by-step instructions and accompanying graphics, you'll learn to use the Trimble 1000DC GPS Navigator in record time. This section is purposely not cluttered with details.

Chapters 3-8 will primarily be used for reference. They include detailed information on the Trimble 1000DC GPS Navigator modes, displays and functions. In-depth information on the topics covered in Chapter 2 is also located in these chapters.

The *Appendices* include detailed information about GPS technology and are followed by a complete glossary of terms and an extensive index.

You may also wish to use the Trimble 1000DC GPS Navigator's Demo capability which lets you try out many of the unit's functions while on the ground. Instructions for using the Demo feature are located in Chapter 7.

GPS Satellite Navigation Information

GPS is a three-dimensional (3-D) precise location and navigation system. The high order of accuracy that can be obtained from the GPS satellite constellation requires four or more satellites in view. LAT/LON can be received from only three satellites making position accuracy dependent upon an automatic or manual altitude input.

The Navigator operates in 3-D mode whenever four or more satellites are available. In a 3-D solution, altitude is part of the solution. When only three satellites are available, the Navigator automatically defaults to a two-dimensional (2-D) operating mode. The GPS indicator light will flash to advise the pilot that the unit is operating in 2-D mode. The Navigator then relies on an external altitude input to calculate accurate position information.

External altitude information may be provided through an external altitude encoder or altitude serializer, or entered manually. An automatic altimeter input will provide full 3-D operation automatically. If an external source is not available, the pilot should enter altitude information manually. When the altitude is entered manually the LAT/LON error may be as much as twice the altitude error. For example, a one mile altitude error could yield as much as a two mile position error.

The flashing GPS indicator light reminds the user that the Navigator is operating in 2-D mode.

Chapter 1

Getting Started

The Trimble 1000DC GPS Navigator is a powerful tool designed for simple operation. Its wide range of capabilities is easily accessible. This chapter introduces the user to the components and functions of the Trimble 1000DC GPS Navigator.

This chapter covers the following topics:

- Information Displays
- Mode Keys
- Function Keys
- Selector Knobs
- Annunciator Lights

1.1 The Navigator Components

The front panel of the Trimble 1000DC GPS Navigator includes six components:

- Jeppesen database credit-card slot
- A push/pull power switch
- The LCD display
- The operation keys
- Two selector knobs
- Annunciator lights

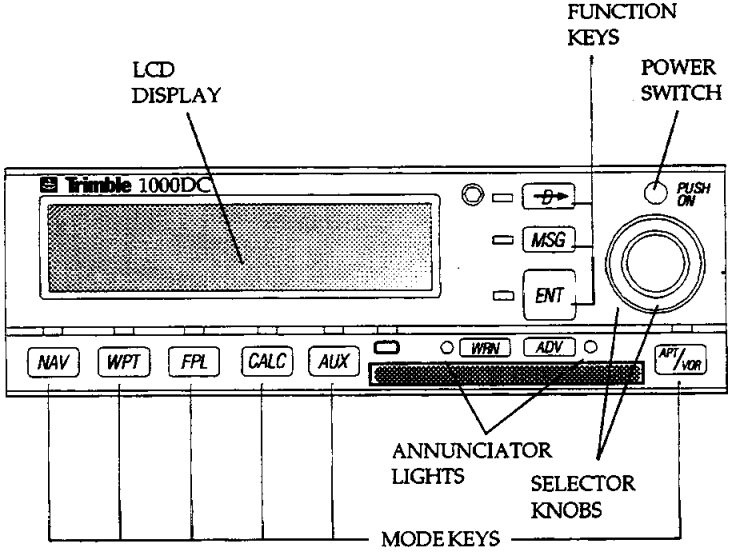


Figure 1-1: **Primary Navigator Components**

1.2 The Jeppesen Navigation Database

The Navigation Database for the Navigator Series is produced by Jeppesen NavData Services. This electronic database system is a sophisticated product, providing access to reliable, worldwide data on Airports, VORs, NDBs, and Intersections. Both the North American and International database cards are required for complete worldwide information.

A current NavData Database Card is supplied with the Navigator. Since this database information is updated every 28 days, it is important to monitor the database expiration date. Once the card is expired, the Navigator system provides an Advisory message which must be acknowledged by the operator. Although the system will continue to operate normally, the warning message will be repeated on each power-up to remind the user that the database is out of date. To eliminate this warning, and ensure data integrity, Jeppesen provides a NavData update Subscription Service.

To receive database updates every 28 days, complete the subscription form enclosed with the system or use the form located in the front of this guide.

The Jeppesen NavData system is easy to use. Simply insert the Database Card into the slot located on the front of the Navigator.

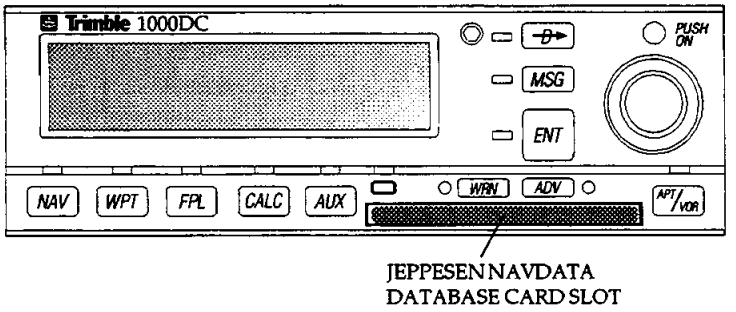


Figure 1-2: **The Jeppesen Database Card Slot**

WARNING:

Do not remove the NavData card from the system when the power is on. To prevent corrupted data and random system errors, the system will automatically RESET if the card is removed.

1.3 The Power Switch

The Navigator has one power switch, located at the top right corner of the unit. To turn the power on, push the switch; to turn the power off, pull the switch.

When the power is turned on, the system goes through a series of self diagnostic tests. When these tests are successfully completed the Fuel on Board Message appears. The process of determining the aircraft's current position is also initiated. Refer to Section 2.1 for information on completing initialization.

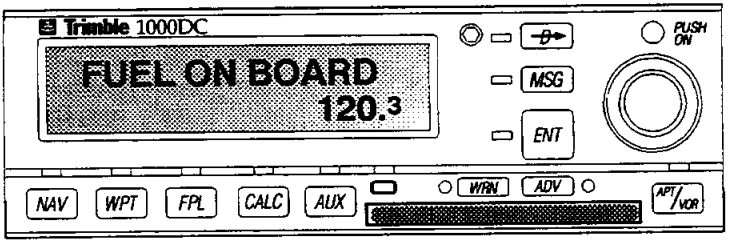


Figure 1-3: **The Power Switch**

1.4 The LCD Display

The Navigator displays information on a two line LCD screen. The information displayed on these two lines changes depending upon which mode is currently in use. Several different sets of information are displayed in each mode.

For example, when working in the Navigation (NAV) mode the primary display in Figure 1-4 appears. The top line of this display provides the bearing, distance and estimated time enroute (ETE) for the current identifier and destination. The bottom line displays the course deviation indicator (CDI), current ground track and ground speed.

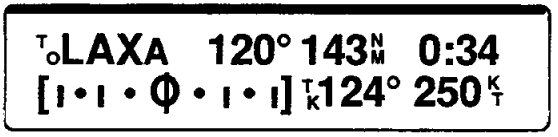


Figure 1-4: **Primary NAV Mode Display**

The top line of the display in Figure 1-4 indicates that to the Los Angeles Airport, bearing is 120°; distance is 143 nautical miles; estimated time enroute is 34 minutes. The bottom line indicates that the CDI is centered; current track is 124°; current ground speed is 250 knots.

NOTE:

This LCD screen features automatic dimming. The screen intensity is automatically adjusted based on the ambient or surrounding light. The brightness level range may be manually adjusted (refer to Chapter 7 in this guide).

1.5 The Operation Keys

The following two groups of keys control the operation of the Navigator:

1. Mode keys
2. Function keys

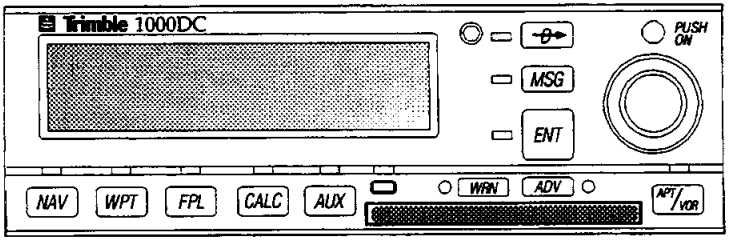


Figure 1-5: **The Mode Keys**

1.5.1 The Mode Keys

The six Mode keys are located in a row at the bottom of the front panel and are used to select the Navigator's mode of operation. When a key is pressed, it lights to confirm selection of that mode.

The following is a brief description of each mode key and its function:

NAV — The Navigation mode is used to access navigation information. This includes the aircraft's current ground speed, direction, destination, estimated time enroute and more.

WPT — The Waypoint mode provides access to database information. Complete information is available on airports, VORs, NDBs, enroute and terminal Intersections and User waypoints. Destination selection is also a function of this mode.

The Flight Plan mode is used to plan the route of a flight. Flight plans may be created, edited, reversed or erased. They are used to navigate to a chosen destination. The Navigator can store up to 20 different flight plans.

The Calculator mode performs many common E6B computer functions. This mode is used to save present position and calculate VNAV profiles, wind speed and direction, fuel ranges, flight plan summaries and more.

The Auxiliary mode provides access to less commonly used functions. The mode is divided into five categories: Checklists, System Status Information, Sensor Status Information, System Setup, and Installation.

The Airport/VOR mode provides information on the 20 nearest airports, VORs, NDBs, Intersections and User waypoints.

1.5.2 The Function Keys

The three Function keys are located to the right of the LCD display. Each function key has a unique set of applications. The following paragraphs contain a brief description of each function key:

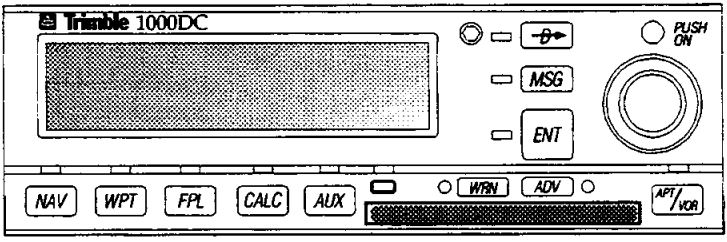
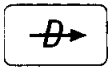
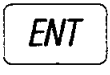


Figure 1-6: **The Function Keys**



The function of the Direct key is to select the current destination or a new destination. It may also be used to select a direct track, re-center the CDI and activate a flight plan.

The Message key is used to view messages on the LCD display. Annunciator lights indicate that a message is present. When the Warning (WRN) or Advisory (ADV) annunciator lights are on, simply press the Message key to display the message.



The Enter key is used to enter, select or change the information currently displayed on the LCD screen. This key is generally used in conjunction with the selector knobs.

1.6 The Selector Knobs

The Navigator has two selector knobs which control the display of information on the LCD screen.

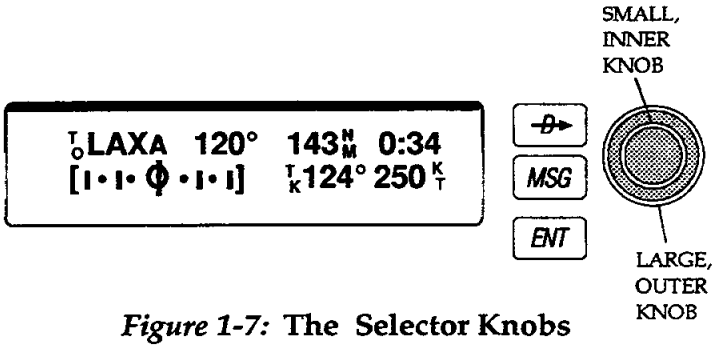


Figure 1-7: **The Selector Knobs**

For NAV functions, the small, inner knob changes the information in the top line of the LCD display. The large, outer knob changes the information in the bottom line of the LCD display.

There are usually several lines of information available in each mode of operation. A clockwise turn of either knob scrolls forward through the information, while a counterclockwise turn scrolls backward.

The selector knobs also control the change of information on these lines and are used for data entry. When data is being entered, the small, inner knob is used to select a data item such as a letter in the alphabet. The large, outer knob is used to move from one character field to the next.

1.7 The Annunciator Lights

The Annunciator Lights are located above the Database Card. They are not visible unless lit.

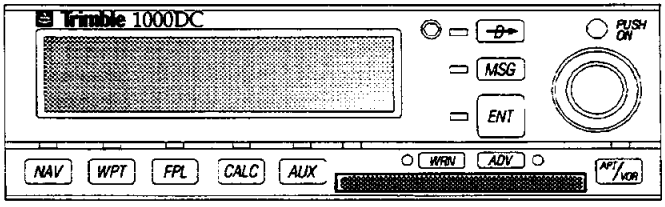


Figure 1-8: **The Annunciator Lights**

The following paragraphs contain a brief description of each annunciator light:

WRN The WRN annunciator light alerts the pilot that a warning message is waiting. Warning messages relate to the accuracy of the position shown or to possible problems with the Navigator. Press the MSG key to display the message. The WRN annunciator light will flash until the MSG key is pressed to read all warning messages. The WRN light is displayed in red.

ADV The ADV annunciator light alerts the user that an advisory message is waiting. Advisory messages require the pilot's attention or action. Press the MSG key to display the message.

Chapter 2

Using the Trimble 1000DC GPS Navigator

This chapter covers the most frequently used features of the Trimble 1000DC GPS Navigator. Explanations and step-by-step instructions are provided for the primary Trimble 1000DC GPS Navigator functions. All users, including those experienced with other long range navigation systems, will benefit from reviewing this chapter.

After completing this chapter you will be able to :

- Select a Direct Destination
- Access flight information in Navigation mode
- View destination waypoint information from the Navigation mode
- Access complete information on waypoints (Airports, VORs, NDBs, Intersections and User)
- Use the APT/VOR mode to access the 20 nearest waypoints
- Navigate to the nearest Airport, VOR, NDB or Intersection
- Access information in the CALC and AUX modes
- Enter Vertical Navigation Profiles
- Access Warning and Advisory Messages

2.1 The Navigator Power-up

To activate the Trimble 1000DC GPS Navigator, push in the power switch located at the top right of the unit. In a few seconds the power-up sequence is completed. After system messages, the fuel level (in gallons) is shown. This is required to initialize the fuel management capabilities.

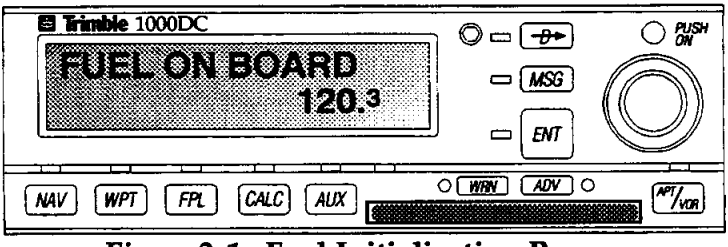


Figure 2-1: **Fuel Initialization Page**

If the displayed value is correct, or if the Navigator's fuel management abilities are not going to be used, press the ENT key to continue.

To change the value displayed, perform the following steps:

- Turn the large, outer selector knob to select the digit to modify.
- Turn the small, inner selector knob to change the displayed digit.
- Press the ENT key to complete the selection.

NOTE:

If Fuel on Board is set to zero, the Navigator's fuel management functions will be disabled.

When the System Ready message appears, press any mode key to begin navigating.

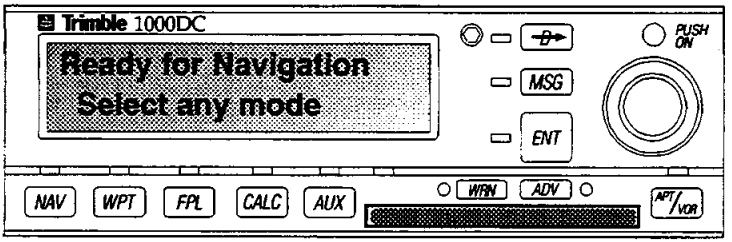


Figure 2-2: **System Ready Display**

TIP:

Once the Navigator's diagnostic procedure has begun, the user may press any of the Mode keys to bypass the fuel input process and remaining system messages and begin navigating.

2.2 Waypoint Information

The Navigator series uses the Jeppesen NavData Database Card to provide direct access to worldwide data on Airports, VORs, NDBs, and Intersections. Both the North American and International database cards are required for complete world-wide information. The system also stores up to 250 User waypoints. The small letter after a waypoint identifier denotes the waypoint category.

The following database information may be accessed from the Waypoint mode:

Airports (A) or (M)
Identifier, city name, airport name, communications frequencies, field elevation, runway information, lighting, approach information, services, and latitude/longitude. The (M) denotes a military operation.

VORs (V)
Identifier, city name, VOR name, navigation frequency, Morse code for identifier, and latitude/longitude.

NDBs (N)
Identifier, city name, NDB name, navigation frequency, Morse code for identifier, and latitude/longitude.

Intersections (I)
Identifier, region name, and latitude/longitude.

WARNING:

Do not remove the NavData card from the system when the power is on. To prevent corrupted data and random system errors, the system will automatically RESET if the card is removed.

User Waypoint (U)
User identifier and latitude/longitude.

All Categories
- Bearing to waypoint
- Distance to waypoint
- Radial from waypoint

2.2.1 Accessing Waypoint Information

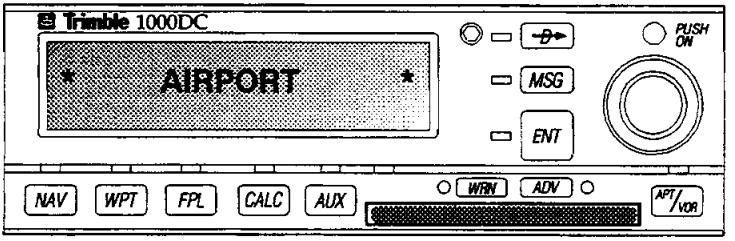


***Figure 2-3:* The Waypoint Mode**

Waypoint information is stored in the Waypoint mode. To access the Waypoint mode, press the WPT key. Each time the key is pressed, a different waypoint category becomes active.

- Press the WPT key to select the Waypoint mode.
- Press the WPT key until the desired waypoint category is selected.

When the WPT key is pressed, the last selected waypoint category (Airport, VOR, NDB, Intersection, User) flashes on the screen followed by the identifier for the last selected waypoint.

TIP:

To return to the Airport display at any time, press and hold the WPT key for at least one second.

2.2.2 *The Waypoint Displays*

The Waypoint mode includes several different information displays or pages for each identifier. These pages are controlled by the large selector knob and appear in the bottom line of the display.

Figure 2-4 provides examples of the waypoint displays for the Airport category:

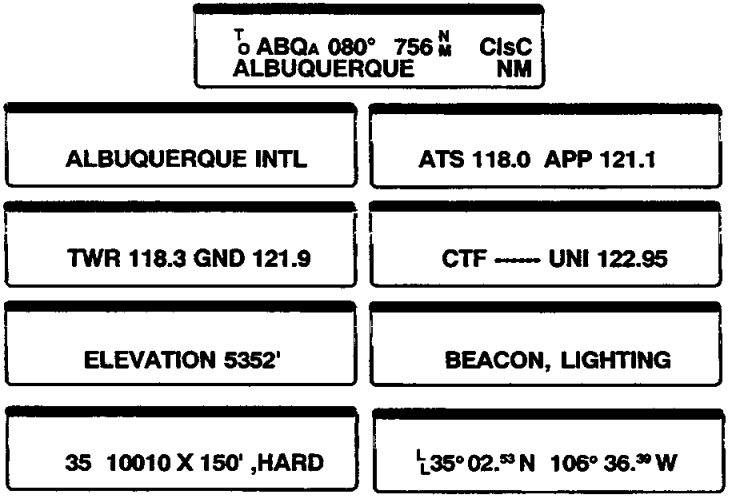


Figure 2-4: **The Airport Displays: Bottom Line**

To access these displays:

- Press the WPT key until the Airport category is selected.
- Turn the large, outer selector knob clockwise to view the different displays.

Each time the large, outer knob is turned, the next information page for the current waypoint is displayed in the bottom line.

2.2.3 Selecting Waypoints

Once a waypoint category is chosen, a waypoint may be selected. There are four methods for selecting waypoints:

- Scan the identifiers in the database
- Enter the waypoint identifier
- Enter the waypoint city name
- Enter the waypoint name

This chapter describes the first two methods for selecting waypoints. For instructions on selecting waypoints by name or city, refer to Chapter 4.

2.2.3.1 Scanning the Database Identifiers

The identifiers in each waypoint category are organized alphabetically. To locate a specific waypoint, turn the small, inner selector knob. A clockwise turn of the knob scrolls forward through the information, while a counter-clockwise turn scrolls backward.

For example, follow the steps listed below to scan the database and select the identifier for the San Francisco Airport (SFO):

- Press the WPT key until the Airport category is selected.
- Turn the small, inner selector knob, in either direction, until the WPT identifier for the San Francisco Airport (SFO) is displayed.

Figure 2-5: **SFO Identifier**

Each turn of the knob brings up the next available airport identifier in alphabetical order. The bottom line continues to display the same field information for each new waypoint.

2.2.3.2 *Selecting Waypoints by Identifier*

Any waypoint may be accessed by entering the identifier.

To select a waypoint by the identifier, perform the following steps:

- Press the WPT key until the desired category is selected.

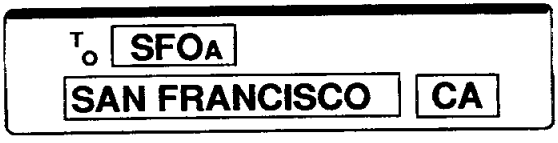


Figure 2-6: **Database Fields**

- Press the ENT key.

The ENT key and the first letter of the waypoint identifier begin to flash.

- Turn the small, inner selector knob, in either direction, until the desired letter is displayed.

When the small selector knob is turned, only the letters that spell a valid identifier appear. A nonexistent identifier cannot be entered.

- Turn the large, outer selector knob clockwise to select the next field to edit.
- Repeat the previous three steps until the desired waypoint identifier is displayed
- Press the ENT key to complete the selection.

Once the desired identifier is selected, additional waypoint information may be viewed in the bottom line of the display.

- Turn the large, outer selector knob to view additional waypoint information on the bottom line of the screen.

2.3 Activating a Direct Destination

Any waypoint, in any waypoint category, may be selected as a direct destination. A destination is selected one of three ways:

- From the WPT mode using the [⌀►] key (see below)
- From the APT/VOR mode, selecting the nearest waypoint (refer to Section 2.4.1)
- By activating a Flight Plan (refer to Chapter 5)

2.3.1 *Selecting a Destination Waypoint from the WPT Mode*

To select a destination waypoint from the WPT mode, perform the following steps:

- Select a waypoint as described in Section 2.2.3.
- Press the [⌀►] key twice to select the waypoint as the destination.

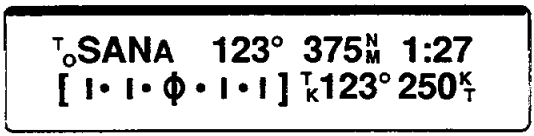


Figure 2-7: **Primary NAV Mode Display**

The NAV mode becomes active. The aircraft is now navigating towards the destination shown above and the CDI is automatically centered.

TIP:

From the NAV mode, the CDI may be re-centered at any time by pressing the [⌀►] key twice.

2.4 Nearest Waypoints

2.4.1 Identifying Nearest Waypoints

The APT/VOR mode provides the user with immediate access for up to 20 of the nearest Airports, VORs, NDBs, Intersections and User-created waypoints within a 200 nm radius. Waypoints are displayed in order of their distance from the aircraft's current position.

The waypoint data available in the APT/VOR mode is the same information that is accessed from the WPT mode. The APT/VOR displays are also controlled by the selector knobs.

To locate the waypoint that is closest to the aircraft's current position:

- Press the APT/VOR key until the desired waypoint category is opened.

The selected category flashes on the screen followed by information on the nearest waypoint.

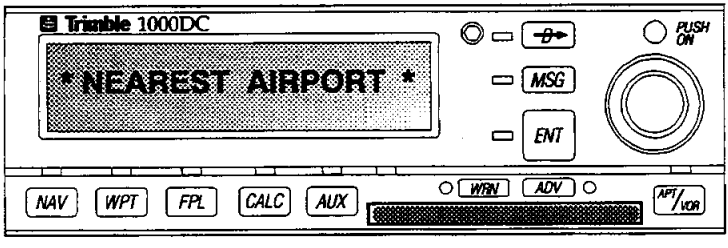


Figure 2-8: **The Airport Category Message**

- Turn the small, inner selector knob clockwise to rotate through the 20 nearest waypoints.

Each turn of the knob brings up the next waypoint, in order of proximity to the aircraft's current position.

To access additional information on the displayed waypoint:

- Turn the large, outer selector knob.

Figure 2-9: **Nearest Waypoint Information**

To select the displayed waypoint as a destination

- Press the [D→] key once to select this waypoint as the desired destination.
- Press the [D→] key a second time to confirm this selection and begin navigating.

The NAV mode becomes active. The aircraft is now navigating towards the destination shown above and the CDI is automatically centered.

2.5 The Navigation Mode

Once a direct destination has been selected, the Navigation (NAV) mode becomes active. The primary function of this mode is to provide information required by the pilot to navigate the aircraft.

The top line of the Primary NAV Mode page displays the current destination. The CDI and current track are displayed in the bottom line.

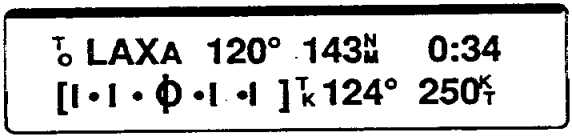


Figure 2-10: The Primary NAV Mode Display

TIP:

To quickly return to the primary Navigation display at any time, press and hold the NAV key for at least one second.

2.5.1 The Navigation Displays

Navigation information appears within a series of displays or pages. The top and bottom line display options allow the user to create display combinations according to personal preference.

Figures 2-13 and 2-14 illustrate the different NAV Mode displays for the top and bottom lines respectively, corresponding to the order in which they appear (clockwise).

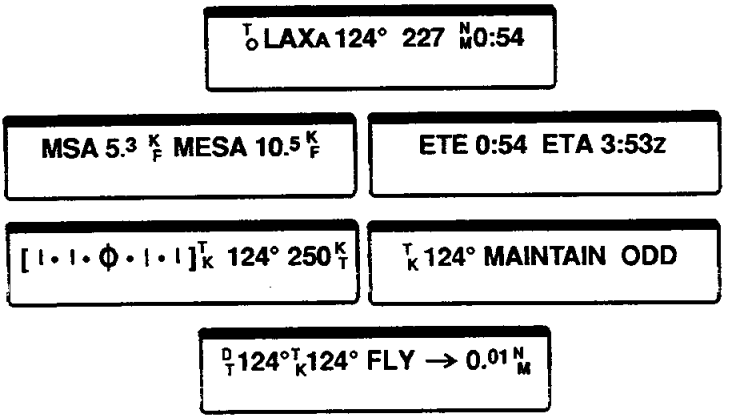


Figure 2-13: Top Line NAV Mode Displays

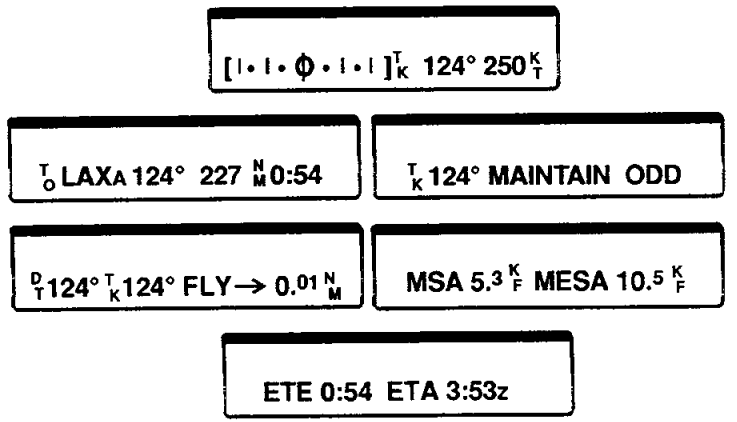


Figure 2-14: Bottom Line NAV Mode Displays

2.5.2 *Accessing the Navigation Displays*

When the NAV mode is active, the user may create display combinations according to personal preference. The small, inner knob controls the display of information on the top line. The large, outer knob controls the display of information on the bottom line.

To change the NAV mode display:

- Press the NAV key to select the NAV mode.
- Turn the small, inner selector knob until the desired top line display is shown.
- Turn the large, outer selector knob until the desired bottom line display is shown.

2.5.3 Destination Waypoint Information

To view destination waypoint information while in the NAV mode:

- Press the NAV key to access the destination waypoint information.

***Figure 2-13:* Destination Waypoint Display**

The "Destination Waypoint" message flashes on the screen.

- Turn the large, outer selector knob to display additional information.

Each time the large, outer knob is turned, additional waypoint information is displayed on the bottom line. This is the same information that is available in the WPT mode.

To return to the NAV mode displays:

- Press the NAV key.

2.5.4 *Alternate Waypoint Information*

The Alternate Waypoint display allows the user to review bearing and distance to any selected waypoint, simultaneously with the selected destination.

The Alternate Waypoint feature is linked to the WPT and APT/VOR modes, providing real-time navigation information on the last selected waypoint in either mode. This information is only available on the bottom line of the NAV mode display.

To access Alternate Waypoint information from the NAV mode:

- Select an alternate waypoint using the WPT or APT/VOR modes.
- When the desired waypoint is displayed, press the NAV key to return to the NAV mode.
- Turn the large, outer selector knob to display alternate waypoint information on the bottom line.

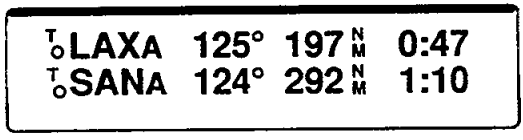


Figure 2-14: Alternate Waypoint Display

Bearing, distance and time to the requested identifier are now available on the bottom line of the display.

2.6 The Calculator Mode

The Calculator (CALC) mode allows the user to perform many common E6B computer functions and calculate the following information:

- VNAV Profiles
- Time, Distance and Speed
- Fuel Management
- Winds Aloft
- Pressure Altitude
- Density Altitude
- True Airspeed
- Crosswind and Headwind
- Save Present Position

The CALC mode is accessed by pressing the CALC key. When this key is pressed, it lights to confirm the mode selection and remains lit until another mode is chosen.

- Press the CALC key.

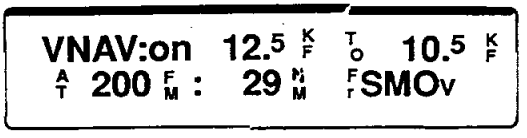


Figure 2-15: **The Primary CALC Mode Display**

The CALC mode is now active. The first page in this mode is the VNAV display. This display indicates that the aircraft will descend from 12,500 feet to 10,500 feet at 200 feet per minute, ending 29 nautical miles from the Santa Monica VOR.

2.6.1 *Vertical Navigation Profiles*

One of the most common uses of the CALC mode is to calculate Vertical Navigation Profiles (VNAV) for aircraft descent.

VNAV Profiles are calculated based on the aircraft's current speed. When entering VNAV data, altitudes are set in 100 foot increments and vertical speed is set in 10 foot per minute or 0.1° increments.

To create a VNAV Profile, the pilot must enter the starting altitude, ending altitude, the desired rate of descent or ascent, the desired distance from the destination for ending altitude and the destination identifier. See Section 6.3.2 for more information

NOTE:

The Navigator will provide a series of Advisory messages to indicate when the level-off point has been reached. Advisory messages are indicated by the ADV annunciator light. When this light is on, press the MSG key to display the message.

To enter a VNAV profile:

- Press the CALC key to access the CALC mode, and then the VNAV page.
- Press the ENT key.
- Turn the large, outer selector knob to the right to move to the desired field.
- Turn the small, inner selector knob to change the number in a field.
- Repeat the steps above until all VNAV information is entered.
- Press the ENT key a second time to complete the entries.

2.6.2 *Saving Present Position*

The CALC mode may also be used to save the aircraft's present position. The Navigator provides 10 locations (alpha - julet) for temporary storage of these positions. Once these 10 locations are filled, rename any positions that should be saved. The Navigator automatically writes over the existing positions when the temporary locations are filled.

To save a present position:

- Press the CALC key to activate the CALC mode.
- Press the CALC key to save the present position.
- Press the CALC key a third time to return to CALC mode.

The present position is saved to a temporary location. The position may be renamed from the WPT mode.

2.7 The Auxiliary Mode

The Auxiliary (AUX) mode allows the user to control and monitor information from the Navigator.

The AUX mode is divided into four functions:

- System Status
- Sensor Status
- System Setup
- Install

Each time the AUX key is pressed, a different function becomes active.

2.7.1 System Status Function

The Status function provides quick access to system status information including:

2.7.2 The Sensor Status Function

The Sensor Status function provides access to system diagnostic information as well as the system navigation mode.

Time Display
Present Position Altitude Information
Voltage and Temperature Display
Database Revision Information
Software Revision Information

2.7.3 The System Setup Function

The System Setup function allows quick access to frequently used setup features including Database Search Regions.

Database Search Regions

This page allows the user to select the states and regions that a database search covers. Narrowing down the search parameters reduces the number of objects that are scanned to locate a specific object.

2.7.4 The Install Function

The Install function is used for installation purposes. These pages are set by the installer and are not usually accessed by the user.

2.8 Interpreting Messages

The Navigator uses two different annunciator lights to communicate special messages to the user:

- WRN (Warning Light)
- ADV (Advisory Light)

New Warning messages (WRN) or Advisory messages (ADV) are indicated by the flashing indicators WRN and ADV. Old messages which are still relevant cause the message indicators to stay lit.

Messages are displayed in order of priority. New Warning messages have highest priority, followed by new Advisory messages.

To display messages:

- Press the MSG key.

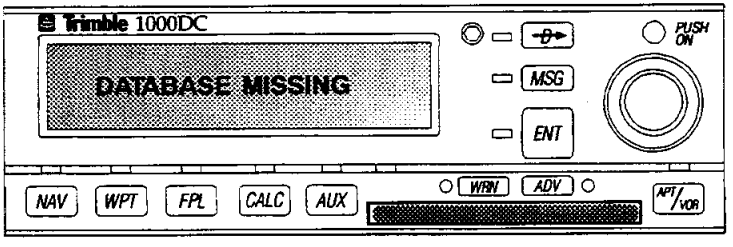


Figure 2-16: **Message Display**

If more than one message is waiting, the MSG key will remain lit. Continue to press the MSG key to read through all waiting messages. The annunciator lights remain flashing until all advisories have been viewed by the pilot.

If a message continues to be relevant, the appropriate annunciator remains lit. The message may be viewed again by pressing the MSG key.

2.9 Practice Flight

This chapter has touched on just a few of the Navigator's many capabilities. With just these basic features, a pilot can successfully navigate an aircraft to any desired destination. Follow the flight path outlined below to practice using the Navigator (must be receiving satellites).

This Practice Flight departs from San Francisco International Airport and follows the west coast down into southern California. The first destination is the Priest VOR. From there, fly a heading to the San Luis Obispo Airport and then on to the final destination of Santa Barbara, California. (Of course, any nearby airports and VORs may be substituted for these.)

Selecting the Destination

Next, the current destination should be selected. The Navigator knows the current position of the aircraft at all times, so it isn't necessary to key in this information.

To locate the first destination for this flight, the Priest VOR:

- Press the WPT key until the VOR category appears.
- Use the selector knobs to display the Priest VOR (ROM).
- Press the D→ key twice to select this as the current destination and begin navigating.

The aircraft is now navigating towards the Priest VOR. The Navigator automatically returns to the NAV mode and displays the current destination on the top line and the CDI on the bottom line.

2.9 Practice Flight (Continued)

Re-center the CDI

To save time along the way and eliminate cross-track errors, press the [⊕→] key twice, whenever needed, to re-center the CDI.

Accessing Additional VOR Information

To access additional information on this VOR:

- Press the [NAV] key to display information on the current destination.
- Turn the large, outer selector knob to access additional information on this waypoint.

Return to the NAV Mode

Then, to return to the original NAV mode display:

- Press the [NAV] key.

Select the Next Destination

As the aircraft approaches the Priest VOR, use the Waypoint mode once again to select the next current destination, the San Luis Obispo Airport.

- Press the [WPT] key until the Airport category is displayed.
- Turn the small, inner selector knob to locate the identifier for the San Luis Obispo Airport.
- Press the [⊕→] key twice to select this as the current destination and to begin navigating.

2.9 Practice Flight (Continued)

Access the 20 Closest Airports

Along any route it's a good idea to be familiar with the location of the closest airport. For quick access to the 20 closest airports:

- Press the APT/VOR key.
- Turn the small, inner selector knob to display the other nearest waypoints in the airport category.

VOR Information

To determine the aircraft's exact position, use the APT/VOR mode to access the "FROM" radial information:

- Press the APT/VOR key until the VOR category is displayed.
- Turn the small, inner knob to display the desired VOR.

Return to the NAV Mode Display

To return to the NAV mode display:

- Press the NAV key for at least one second.

Minimum Safe Altitude Information.

The NAV mode is also a good source of information. If thisarea is unfamiliar, use the MSA readouts to ensure a safe operating altitude.

- Turn the small, inner knob in either direction until the Minimum Safe Altitude display appears.

2.9 Practice Flight (Continued)

Select the Final Destination

As the aircraft approaches the San Luis Obispo Airport, select the final destination, Santa Barbara Airport (SBA):

- Press the WPT key.
- Use the small, inner selector knob to display the identifier for the Santa Barbara Airport (SBA).
- Press the D→ key twice to select this as the current destination and begin navigating.

Then, enter a VNAV profile to calculate the aircraft's descent to the final destination:

- Press the CALC key.
- Use the selector knobs and the ENT key to enter the VNAV profile information (page 2-18).
- Press the NAV key to return to the NAV mode. The profile information may be viewed from here.

After a few flights with the Trimble Navigator, you'll never want to fly without it!

Chapter 3

The Navigation Mode

The Navigation mode provides the user with extensive information on the current destination or current leg of a flight plan.

After reading this chapter you will be able to :

- Interpret NAV mode displays
- Access "FROM" radial information
- Correct cross-track errors
- Track bearing and distance to two waypoints simultaneously
- Access Alternate Waypoint information
- Access Destination Waypoint information

3.1 Navigation Mode Summary

Navigation information appears within a series of five displays or pages:

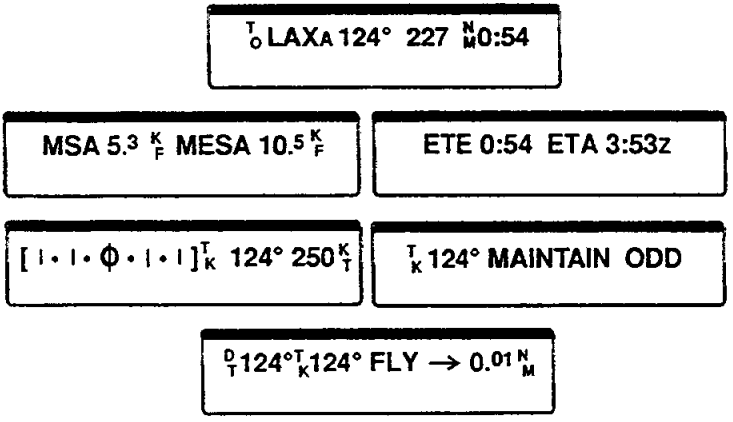


Figure 3-1: Top Line NAV Mode Displays

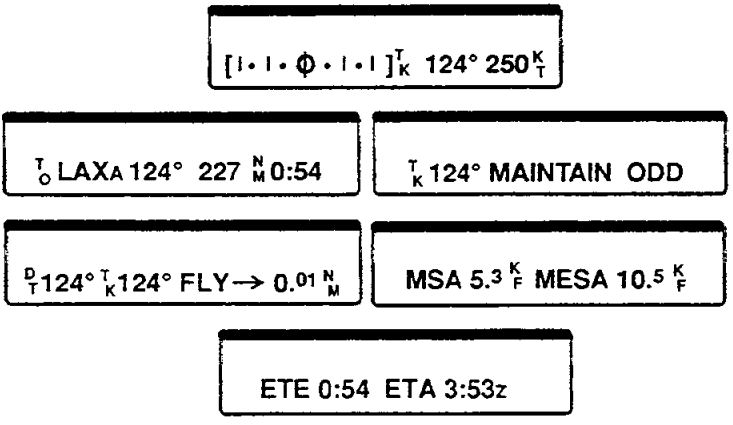


Figure 3-2: Bottom Line NAV Mode Displays

The Navigation mode displays always contain two lines of information. The small, inner selector knob controls the display of information on the top line. The large, outer selector knob controls the display of information on the bottom line. Since each line operates independently, the user may create display combinations according to personal preference.

The following abbreviations are used in the NAV mode displays:

N_M	Nautical miles
D_T	Desired track
K_T	Knots
K_F	Kilofeet (thousands of feet)
F_r	From (radial)
A_T	Current expected altitude
T_K	Ground track
F_M	Feet per minute

3.2 Accessing the Navigation Mode

To access the Navigation (NAV) mode, press the NAV key. When the NAV key is pressed, it lights to confirm selection and remains lit until another mode is chosen.

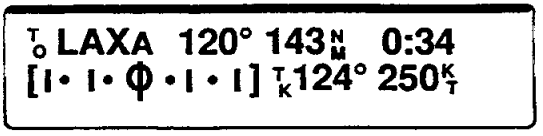


Figure 3-3: **The Primary NAV Mode Display**

The Primary NAV Mode display in Figure 3-3 is the most frequently used display in this mode. Destination information is located in the top line; the course deviation indicator (CDI) and current track are in the bottom line.

To select a different display:

- Turn the small, inner selector knob in either direction until the desired display appears in the top line.
- Turn the large, outer selector knob in either direction until the desired display appears in the bottom line.

TIP:

The last display selected before leaving the NAV mode is retained. When the user returns to this mode, the navigation display that was last selected will appear.

3.3 The Primary Navigation Display

When a destination is selected, the Navigator automatically returns to the Primary NAV Mode display. The Destination page is displayed on the top line and the CDI page is displayed on the bottom line.

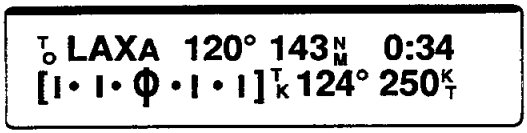


Figure 3-4: **Primary NAV Mode Display**

The top line of the display in Figure 3-4 indicates that the current destination is the Los Angeles International Airport; bearing is 120°; distance is 143 nautical miles; ETE is 34 minutes. (Time can be shown in hours and minutes or in minutes and seconds.)

The bottom line in the Primary NAV Mode display is the CDI page. The display in Figure 3-4 indicates that the CDI is centered; ground track is 124°; ground speed is 250 knots.

3.4 Navigation Mode Displays

3.4.1 Waypoint Displays

The two waypoint displays are the Destination and the Alternate. Both displays contain information on the bearing and distance to the waypoint and the Estimated Time Enroute (ETE) at the current ground speed.

The "T_O" that precedes the LAX identifier indicates that the bearing shown is *to* the waypoint. A small capital letter "A" identifies this waypoint as an airport.

Waypoints are always identified as one of the following:

A: Airport
M: Military airport
V: VOR
N: NDB
I: Intersection
U: User waypoint

3.4.1.1 Destination Display

The Destination Display is always shown on the top line of the display. The destination is either the current destination selected from the WPT or APT/VOR mode or the destination waypoint of the current leg of an active flight plan.

- *The "from" Radial Display*

The destination display shows great circle bearing *to* all waypoints except VORs, which are displayed as a radial *from*.

To view the radial *from* Airports, NDBs, Intersections, and User Waypoints or to view the bearing *to* a VOR:

- Press and hold the ENT key for at least one second.

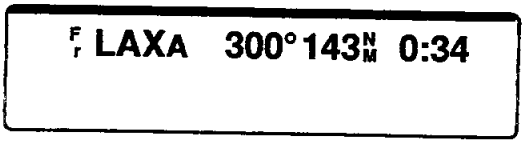


Figure 3-5: **"from" Radial Display**

The "Fr" that now precedes the LAX identifier indicates that from the destination, the Los Angeles International Airport, the radial is 300°; distance is 143 nautical miles; ETE is 34 minutes.

When the ENT key is released, the original display is returned.

- ***Flying a Direct Track***

The destination display shows the bearing *to* a waypoint. A direct track may also be defined.

To specify a direct track:

- Press the ⊖► key once while viewing the current destination in the NAV mode.
- Turn either selector knob to increase or decrease the desired track.

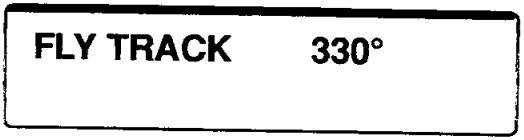


Figure 3-6: **Flying a Direct Track**

- Press the ⊖► key to confirm the new track and return to the NAV mode display.

3.4.1.2 The Alternate Waypoint Display

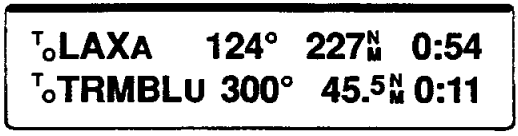


Figure 3-7: **Alternate Waypoint Display**

The Alternate Waypoint display allows the user to review bearing and distance to any selected waypoint, simultaneously with the selected destination. This feature is linked to the WPT and APT/VOR modes, providing real-time navigation information to the last selected waypoint in the database or the APT/VOR mode.

Alternate Waypoint information is only available in the bottom line of the NAV mode display.

To select the Alternate Waypoint display:

- Press the WPT key or the APT/VOR key until the desired waypoint category is selected.
- Turn the small, inner selector knob to select the identifier or, in the WPT mode, use the ENT key and selector knobs to enter the identifier.
- When the desired information is displayed, press the NAV key to return to the navigation displays.
- Turn the large, outer selector knob to display bearing and distance to the alternate waypoint.

3.4.2 The Time Display

The Time page provides information on the Estimated Time Enroute and Estimated Time of Arrival to the next waypoint.

Figure 3-8: **The Time Display**

The display in Figure 3-8 indicates that the ETE to the next waypoint is 0 hours, 43 minutes; ETA to the next waypoint is 12:43 Zulu (refer to Chapter 7, The Auxiliary Mode, for instructions for setting local time).

The Navigator determines the ETE by dividing the distance to the next destination by the current ground speed. The ETA is determined by adding the ETE to the current time (local or Zulu).

In Figure 3-9, plane A is travelling along the desired track. The computed ETE is 45 min. Plane B has the same ground speed and distance to destination as plane A, but with a different track. The computed ETE is also 45 min. If both planes continue along their same course, the ETE for plane A will decrease faster than that of plane B.

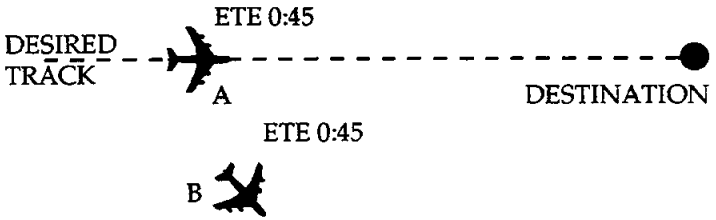


Figure 3-9: **ETE/ETA Calculation**

TIP:

If a flight plan is active, the ETE and ETA for the final destination can be determined in CALC mode.

3.4.3 *The Vertical Navigation Display*

The Vertical Navigation display (VNAV) provides the pilot with descent/climb information.

If the descent/climb starting point has not yet been reached (if the aircraft is not descending or climbing) or VNAV instructions have not been entered in the CALC mode, a display similar to Figure 3-10 will appear:

Figure 3-10: **Vertical Navigation Display**

This display indicates that the current track is 124°; maintain ODD altitude based on VFR/IFR altitude rules.

The current ground track (shown as "tk") is displayed in degrees.

The desired altitude is given as ODD or EVEN depending on the course over ground.

If VNAV instructions have been given in the CALC mode (as described in Section 6.3.2), the ODD/EVEN display is replaced with the current desired altitude after the descent/climb profile is active.

Figure 3-11: **VNAV Calculation Display**

The display in Figure 3-11 indicates that the current altitude should be 12,500 feet; destination altitude will be 5,300 feet; descent should be made at 600 feet per minute.

3.4.4 *Ground Track Display*

The Ground Track page provides information on the desired track (dt), the ground track (tk) and the distance off-track, in nautical miles (nm).

Figure 3-12: **Ground Track Display**

The display in Figure 3-12 indicates that the desired track is 115°; current track is 124°; fly 0.12 miles to the right to reach course line.

The Navigator usually selects the desired track as the direct course line from the present position to the selected destination. If a Flight Plan is active, the desired track is selected as the direct course line to the destination of the next leg of the Flight Plan.

The following diagram illustrates an aircraft off-track and the corresponding track relationships.

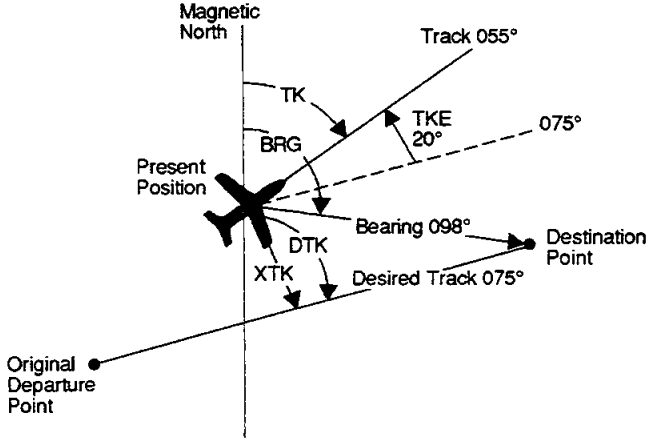


Figure 3-13: **Track Relationships**

3.4.5 *CDI Display*

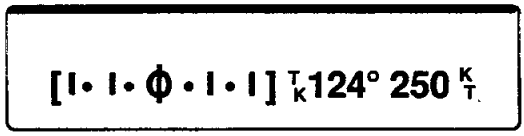


Figure 3-14: **CDI Display**

3.4.5.1 *Cross-Track Errors - Ground Track*

The CDI in Figure 3-14 simulates a mechanical course deviation indicator. When the flashing vertical bar is centered on the O, the aircraft is on course. If the flashing bar is to the left or right of the O, a cross-track error is occurring. To correct the error, fly towards the "needle" as in conventional VOR navigation. If the cross-track error is greater than the display allows, the left or right bracket will change to a flashing arrow. Steer in the direction of the arrow to center the CDI.

3.4.5.2 *CDI Scale*

Each mark on the CDI (O, vertical bar, or dot) corresponds to one dot on a standard analog CDI. CDI sensitivity is set at one half mile per dot when the system is delivered from the factory. Full scale deflection represents five nautical miles of cross-track error. CDI sensitivity may be adjusted for individual preference and stored in memory.

3.4.5.3 *Re-Centering the CDI*

To save time and eliminate large cross-track errors on the CDI, simply re-enter the current destination. The system will automatically compute present position direct navigation information and display a centered CDI.

To re-center the CDI:

- Press the [⌀→] key to re-select the destination.
- Press the [⌀→] key again to confirm the selection.

3.4.6 The Minimum Safe Altitude Display

Information on the altitudes of potential obstructions is provided by the Jeppesen NavData Database Card. The Navigator determines the altitudes of obstructions within one radial block of airspace from the aircraft, one-half degree in longitude and one-half degree in latitude, or approximately 20 to 27 nm by 30 nm for operation in the U.S. Where applicable in the International database, MSA readouts are restricted to one degree by one degree.

3.4.6.1 Minimum Safe Altitude (MSA)

MSA is displayed in thousands of feet (kilofeet, shown as "k_f"). MSA is calculated based on the highest object in the block in which the aircraft is currently located.

3.4.6.2 Minimum Enroute Safe Altitude (MESA)

MESA is displayed in thousands of feet (kilofeet, shown as "k_f"). MESA is calculated based on the highest object in all blocks through which the aircraft will pass enroute to its final destination.

If the MSA or MESA shown is 7,000 feet or less, the aircraft will clear all known obstructions and terrain by 1,000 feet if the altitude is maintained. If the MSA or MESA shown is more than 7,000 feet, the aircraft will clear all known obstructions and terrain by 2,000 feet if the altitude is maintained.

Figure 3-15: **The Altitude Display**

The display in Figure 3-15 indicates that the minimum safe altitude at the current location is 10,500 feet; minimum enroute safe altitude is 12,500 feet.

3.4.6.3 Altitude Accuracy

Altitude accuracy is essential to flight safety. Use caution and observe all safety precautions.

- Never rely on a single navigation system.
- Maintain the Trimble Navigator and other navigation equipment properly.
- Keep the Jeppesen database up to date.
- Observe VFR regulations when using navigation equipment that does not have IFR approval.
- Don't forget to see and be seen.

NOTE:

Refer to Section 7.2.2.1 for additional altitude information.

3.5 The Destination Waypoint Display

The NAV mode also provides quick access to waypoint information for the current destination.

To access destination waypoint information:

- Press the NAV key from any display within the NAV mode.

The "Destination Waypoint" message flashes on the screen.

- Turn the large, outer selector knob to view the destination waypoint information in the bottom line of the display.

Figure 3-15: **Destination Waypoint Display**

- Press the NAV key a second time to return to the previous display.

Chapter 4

The Waypoint Mode

The Waypoint mode provides access to comprehensive, reliable information on Airports, VORs, NDBs, Intersections and User-created waypoints.

After reading this chapter you will be able to:

- Select waypoint categories and identifiers
- Access extensive information on each waypoint in the NavData database
- Interpret waypoint mode displays
- Select waypoint bearing/radial
- Select any direct destination
- Create User waypoints
- Edit User waypoints
- Erase User waypoints

4.1 The Jeppesen Navigation Database

Waypoint information is stored in the Jeppesen NavData Database Card. A current Database Card is supplied with the Navigator. The information stored on this Database Card is updated every 28 days. The expiration date is listed on the back of the card.

To receive an updated Database Card every 28 days, complete the Jeppesen subscription form in the Introductory section of this manual, or refer to the Jeppesen information packet enclosed with the Navigator.

A list of the States, Provinces, and Countries included in the Database Card is located in Appendix A. User waypoints are not stored on the Database Card and are not erased by updating the database.

NOTE:

The pilot should use the most current NavData Database Card. To receive an updated NavData Database Card on a regular basis, complete the subscription form in the Introductory section of this guide.

WARNING:

Do not remove the NavData Database Card from the system when the power is on. To prevent corrupted data and random system errors, the system will automatically RESET if the card is removed.

Most waypoints in the database have a unique identifier. These identifiers are assigned based on the waypoint type (Airport, VOR, NDB, Intersection, User) and location. The following information pertains to airport identifiers only:

Continental U.S.

Waypoint identifiers in the continental U.S. are shown with FAA-standard designations. For example, the identifier for the San Francisco International Airport is SFO.

Alaska and Hawaii

Identifiers for some waypoints in Alaska and Hawaii use ICAO identifiers. For example, the identifier for the Anchorage airport is PANC.

International

For waypoints outside the U.S., standard ICAO identifiers are used. Refer to Appendix A for a complete list of state, province and country codes.

4.2 Waypoint Categories

Waypoint information is divided into five categories:

- Airports
- VORs
- NDBs
- Intersections
- User waypoints

Each waypoint category provides a different set of information:

All Categories Contain:

- Bearing to waypoint
- Bearing from waypoint
- Distance to waypoint

Airports

Identifier, city, state or country name, airport name, communications frequencies, field elevation, runway information, lighting, approach information, services and latitude/longitude.

VORs

Identifier, city, state or country name, VOR name, navigation frequency, Morse code for identifier, and latitude/longitude.

NDBs

Identifier, city, state or country name, NDB name, navigation frequency, Morse code for identifier, and latitude/longitude.

Intersections

Identifier, region name, and latitude/longitude.

User Waypoints

User identifier and latitude/longitude.

The WPT key is used to select a specific waypoint category. Each time this key is pressed, the next waypoint category flashes on the screen.

Waypoint categories appear in the following order. Once the last category in this list appears, the cycle begins again.

1. Airport
2. VOR
3. NDB
4. Intersection
5. User

TIP:

To return directly to the Airport display from any other waypoint category, just press and hold the WPT key for at least one second.

4.3 Accessing the Waypoint Mode

To access the Waypoint (WPT) mode, press the WPT key. When this key is pressed, it lights to confirm the mode selection and remains lit until another mode is chosen.

When the WPT mode is selected after system power-up, the Airport category flashes on the screen.

Figure 4-1: **Airport Category Display**

Then the last waypoint selected in the Airport category is displayed. The primary airport display in Figure 4-2 indicates that the bearing to San Francisco Airport from present position is 313°; distance is 243 nautical miles; the SFO Airport has Class B airspace.

Figure 4-2: **The Primary Airport Display**

4.4 Selecting Waypoints

The Navigator provides the following four methods for selecting waypoints:

- Scan the identifiers in the database
- Enter the waypoint identifier
- Enter the waypoint city
- Enter the waypoint name

4.4.1 Scanning the Identifiers in the Database

The identifiers in each waypoint category are organized alphabetically, with numbers 0-9 following Z. To scan the database and select a specific waypoint, turn the small, inner selector knob. A clockwise turn of the knob scrolls forward through the information, while a counterclockwise turn scrolls backward.

For example, to scan the database and select the identifier for the San Francisco Airport, SFO:

- Press the WPT key until the Airport category is selected.
- Turn the small, inner selector knob, in either direction, until the desired waypoint identifier is displayed.

Each time this knob is turned, a new identifier is displayed in the top line of the screen, except at either end of the list of waypoints in the given category.

4.4.2 Selecting Waypoints by Identifier

Any waypoint may be selected by entering the waypoint identifier into the appropriate database fields.

The ENT key and the selector knobs are used to enter field information. The small, inner selector knob changes a letter, number or character in a field. The large, outer selector knob is used to move from one field to the next.

For example, to select the identifier for the Los Angeles International Airport, LAX, follow these steps:

- Press the WPT key until the Airport category is selected.
- Press the ENT key once

The ENT key and the first letter of the Airport identifier begin to flash.

- Turn the small, inner selector knob in the appropriate direction until the first letter of the Airport identifier changes to "L".
- Turn the large, outer selector knob clockwise to move to the next field.
- Repeat the previous two steps until the "LAX" identifier is displayed.
- Press the ENT key to complete the selection.

Figure 4-3: **Los Angeles Airport Identifier**

The waypoint identifier for the Los Angeles International Airport is now displayed.

- **Selecting Between Similar Identifiers**

Not all waypoints in the Jeppesen database have unique identifiers. To confirm that the correct waypoint has been selected, check the waypoint city or latitude and longitude.

- Press [WPT] key to select the desired waypoint category and identifier.
- Once the identifier is displayed in the top line, turn the large, outer selector knob to display the latitude and longitude or city in the bottom line.

Similar identifiers are listed in sequence. If the selected identifier is not correct:

- Turn the small, inner selector knob to select the next similar identifier.

NOTE:

Although there are some occurrences of duplicate identifiers in the U.S. Database, most similarities occur in the International database.

4.4.3 Selecting Waypoints by City or Name

Waypoints may also be selected by entering their city or name. To enter a city or name, the correct bottom line display must first be selected.

To select the bottom line displays:

- Press the [WPT] key to access the Waypoint mode.
- Turn the large, outer selector knob until the desired category (city or name) for the current waypoint is displayed in the bottom line.

Once the correct bottom line display is selected, the city or name may be entered. The same steps that are used for entering waypoint identifiers may be used to enter this information.

For example, to select a San Diego Airport by city:

- Press the WPT key to access the Waypoint mode and select the Airport category.
- Turn the large, outer selector knob to display the city name for the current waypoint.
- Press the ENT key.
- Turn the large, outer selector knob until the cursor is displayed in the city line.
- Turn the small, inner selector knob, in either direction, until the first letter of the city reads "S".
- Turn the large, outer selector knob clockwise to move to the next field.
- Turn the small, inner selector knob to change the selected field.
- Repeat the previous two steps until the airport city reads, "SAN DIEGO".
- Press the ENT key to complete the selection.

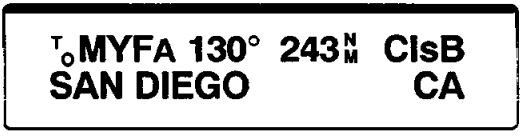


Figure 4-4: **Waypoint Display**

NOTE:

If the state or province code displayed does not match the desired city, follow the procedures for "Selecting Waypoints by City with Multiple Airports."

- **Selecting Waypoints by City with Multiple Airports**

Enter the city name as described in the previous paragraph, "Selecting Waypoints by City or Name." Proceed as follows:

- Place the cursor under the last letter of the city.
- Turn the small, inner selector knob to select other waypoints located in that city (or in other cities of that name in other states or provinces).

4.5 Selecting Waypoint Displays

Each waypoint in the database has a series of two-line information displays. The top line usually displays the identifier for the selected waypoint and the bearing and distance *to* the waypoint from the current location. The bottom line displays additional information for the current waypoint.

To access the additional information on the bottom line:

- Select a waypoint (refer to Section 4.4).
- Turn the large, outer selector knob.

Each time the large, outer selector knob is turned, a new page of information is displayed. An example in Figure 4-5 includes the displays for the Albuquerque Airport. Descriptions of these displays are included in the following sections.

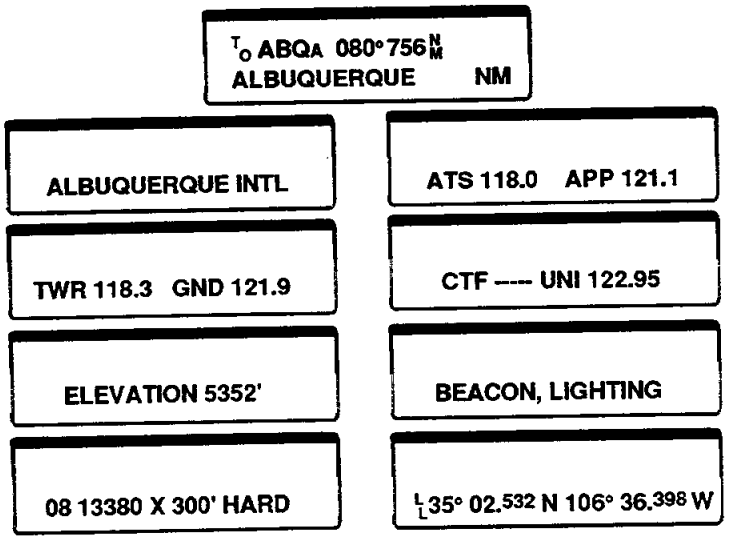


Figure 4-5: Airport Bottom Line Displays

TIP:

The last display that is selected before leaving the WPT mode is retained. The next time the WPT mode is accessed, that display will be shown.

4.5.1 The Airport Displays

The Primary Airport display appears after the Airport category is selected from the Waypoint mode.

Figure 4-6: **The Primary Airport Display**

The top line of the Primary Airport display includes the airport identifier followed by a small letter "A" to indicate airport; the bearing to the airport; the distance to the airport in nautical miles; and the control area for the airport (Class B or Class C) if one exists. The bearing and distance information in this page continuously updates for real time display of relative position.

The bottom line of the Primary Airport display includes the airport name and the city where the airport is located. The following pages of information may also be displayed in this line:

- Airport name
- City and state where the airport is located
- Communication frequencies
- Field elevation
- Lights, approach and service information
- Runway information
- Latitude and longitude

To select these pages, turn the large, outer selector knob. Each time this knob is turned, the next page appears in the bottom line of the display.

4.5.1.1 The Communication Frequencies Page

Communication Frequencies are displayed in a series of three pages. The following frequencies and abbreviations appear in these pages:

ATIS	ATS
Approach	APP
Tower	TWR
Ground	GND
UNICOM	UNI
CTAF	CTF

To access the Frequencies pages:

- Press the WPT key to access the Airport category in the WPT mode.
- Turn the large, outer selector knob until the frequencies pages appear in the bottom line of the display.

Figure 4-7: **The Frequency Page**

The display in Figure 4-7 indicates that ATIS frequency is 108.9; the approach frequency is 132.55.

NOTE:

If a frequency is not displayed, a series of dashes (- - -) appears in its place. If no frequencies exist, the message "NO COM FREQUENCIES" appears.

4.5.1.2 The Lights, Approach and Service Page

The Lights, Approach and Services page displays messages concerning the lights, approach and services for the current airport. These messages scroll horizontally across the screen, from right to left.

To access this page:

- Press the WPT key to access the Airport category in the Waypoint mode.
- Turn the large, outer selector knob until the Lights, Approach and Service page appears in the bottom line of the display.

The following messages and abbreviations appear in these pages:

Beacon Messages

no BEACON	No Beacon available
BEACON	Beacon at airport

Lighting Messages

no LIGHT	No lighting available
??	Lighting availability unknown
LIGHTING	Lighting available
pc LIGHT	Pilot-controlled lighting

Approach Messages

no APCH	No IFR approach
IFR APCH	IFR approach available

Service Messages

no SERVICE	No services available
SERVICES	Services available

NOTE:

An airport is considered to have services if it sells 100LL fuel.

4.5.1.3 The Runway Information Page

To access the Runway Information page:

- Press the WPT key to access the Airport category in the Waypoint mode.
- Turn the large, outer selector knob until the Runway Information page appears in the bottom line of the display.

When the Airport Runway page is selected, the longest runway is displayed first. If there are other runways at least 2000 feet in length, they may be displayed by turning the large, outer selector knob to the right.

The following information and abbreviations appear in these pages:

Runway Designations

L	Left
R	Right
M	Middle
-	No parallel runways

Runway Surfaces

HARD	Hard Surface
TURF	Turf Surface
GRVL	Gravel Surface
DIRT	Dirt Surface

Pattern Traffic Directions

LEFT
RIGHT
UNKNOWN

4.5.2 *VOR and NDB Displays*

The VOR and NDB displays appear after their respective categories are selected from the WPT mode.

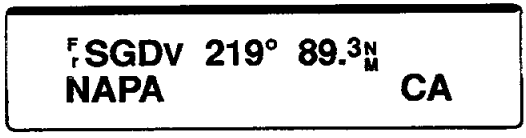


Figure 4-8: **The Primary VOR Display**

The top line of the VOR and NDB displays includes the identifier for the last selected waypoint, followed by a small sized letter "V" to indicate VOR or "N" to indicate NDB; the radial from the waypoint for VORs or the bearing to the waypoint for NDBs; and the distance to the waypoint in nautical miles.

The bottom line of these displays may include any one of the following pages:

City and state, province or country code
Waypoint name
Navigation frequency
Morse code identifier
Latitude and longitude

To select these pages, turn the large, outer selector knob. Each time this knob is turned, the next page appears in the bottom line of the display.

4.5.3 Intersection Display

The Jeppesen NavData Database Card contains both enroute and terminal intersections. The Primary Intersection page appears after the Intersection category is selected from the WPT mode.

Figure 4-9: **The Primary Intersection Display**

The top line of the Intersection display includes the identifier for the last intersection selected, followed by a small letter "I" to indicate Intersection, the bearing to the intersection, and the distance in nautical miles.

The bottom line of this display may include either of the following pages:

Intersection region
Latitude and longitude

These pages are selected from the Waypoint mode. Each time the large, outer knob is turned, the next page appears in the bottom line of the display.

4.5.4 *User Waypoint Display*

The User Waypoint display appears after the User category is selected from the WPT mode.

Figure 4-10: **The Primary User Waypoint Display**

The top line of this display includes the identifier for the last User waypoint selected, followed by a small capital letter "U" to indicate User waypoint; the bearing to the User waypoint; and the distance in nautical miles.

The bottom line of this display includes the waypoint latitude and longitude displayed in degrees, minutes, and thousandths of minutes.

4.6 Selecting Waypoint Bearing/Radial

Airports, NDBs and Intersections are normally displayed with the great circle bearing "to" information. The VOR pages display great circle radial "from" information.

These pages can be changed to display either radial or bearing information by pressing and holding the ENT key for at least one second.

For example, in Figure 4-11 the "$^{T}_{O}$" that precedes the SFO identifier indicates that this is the bearing information to the San Francisco International Airport.

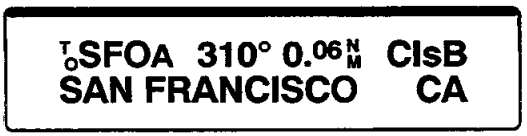


Figure 4-11: **Bearing "to" Display**

To display the radial "from" this identifier:

- Select the desired Waypoint category and identifier.
- While viewing the desired waypoint, press and hold the ENT key for at least one second.

Figure 4-12: **Radial "from" Display**

The radial "from" information is displayed as long as the ENT key is pressed. The "$^{T}_{O}$" that preceded the SFO identifier in Figure 4-11 changes to "$^{F}_{r}$". The display in Figure 4-12 indicates that the radial "from" the San Francisco Airport to present position is 130°.

4.7 Selecting a Destination

A direct destination is usually selected from the WPT mode. Any waypoint (Airport, VOR, NDB, Intersection, User) may be selected as a destination. The [⊣D→] key is used to confirm the selection and begin navigating.

For example, suppose the destination for this flight is the San Francisco International Airport:

- Press the [WPT] key.
- Select the SFO identifier from the Airport category. (Refer to Section 4.4)

Figure 4-13: SFO Identifier WPT Mode

- Press the [⊣D→] key once to select this identifier as the desired destination.
- Press the [⊣D→] key a second time to confirm this selection and begin navigating.

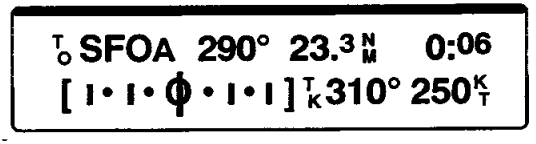


Figure 4-14: Destination Display NAV Mode

The display returns to the NAV mode. The aircraft is assumed to be navigating towards this destination and the CDI is automatically centered.

4.8 User Waypoint Information

Up to 250 User waypoints may be created and stored in the Navigator's database.

When creating User waypoints, name the waypoint first and then define the waypoint position (refer to Section 4.8.1).

A User waypoint name can be up to 5 characters long and may include any combination of letters and numbers. To eliminate confusion, do not use a name that matches the name of any existing Airport, VOR, NDB, or Intersection in the database.

The position of a User waypoint may be defined by the current position of the aircraft, latitude and longitude or range and bearing from any stored waypoint.

User phonetic waypoints, "alpha" to "julet" (lowercase), already exist as user waypoints and are used to capture the pilot's present position. This is accomplished by pressing the CALC key twice at that position.

The pilot must change the name to uppercase to edit the phonetic waypoint as follows:

- Turn the large, outer knob in either direction until the "EDIT" message appears.
- Press the ENT key. The waypoint name changes to uppercase.
- The waypoint may now be edited.
- Press the ENT key to complete the edit.

4.8.1 *Creating User Waypoints*

User waypoint names are entered just like other waypoint information, using a combination of the ENT key and the selector knobs.

For example, to create a User waypoint called TRMBL:

- Press the WPT key to access the WPT mode and the User category.
- Turn the large, outer knob until the display reads, "Add Waypoint? (ENT)".
- Press the ENT key.

The flashing letter "A" appears as the first letter of the waypoint.

- Turn the small, inner selector knob to select the first letter of the waypoint name.
- Turn the large, outer knob to move to the next field.
- Repeat the previous two steps until the waypoint name "TRMBL" is entered.

Figure 4-15: **User Waypoint Name Display**

- Press the ENT key to accept the waypoint name.

The User waypoint is now named. The waypoint position may now be defined.

TIP:

If a name already exists, a message will be displayed that tells the user to enter a different name. The name must be changed before continuing.

Once a User waypoint is named, it must be defined by one of the following:

- Present position
- Latitude and longitude
- Range and bearing from another waypoint

These options are selected from the User waypoint pages.

4.8.1.1 Defining a User Waypoint by Present Position

After a User waypoint is named, the display prompts the user to save the present position as the location for the waypoint.

Figure 4-16: **Current Position Display**

- Press the ENT key once to define this waypoint by the current aircraft position.

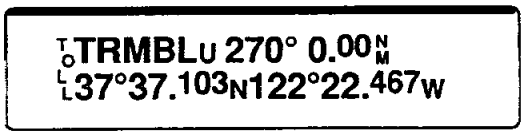


Figure 4-17: **Current Position Defined**

The display briefly indicates that the waypoint has been saved and the new User waypoint appears.

4.8.1.2 Defining a Waypoint by Latitude and Longitude

To define a User waypoint by latitude and longitude, follow these steps:

- Enter the User waypoint name.
- Press the ENT key to save the new name.
- Turn the large, outer selector knob until the display in Figure 4-18 appears.

Figure 4-18: **Saving Via Latitude and Longitude**

- Press the ENT key.

Figure 4-19: **Latitude and Longitude Display**

The display changes to include the latitude and longitude of the present or last known aircraft position. The first digit of the latitude is flashing.

- Use the selector knobs to enter the latitude and longitude for the new waypoint.
- If a change to a cardinal direction is required, the designator will begin flashing. Turn the small, inner selector knob to select "N", "E", "S", or "W".
- When the latitude and longitude entry is completed, press the ENT key to save the information.

4.8.1.3 Defining a User Waypoint by Range and Bearing from Another Waypoint

A User waypoint may also be defined as a range and bearing from an existing waypoint. The first step is to name the waypoint.

- Press the WPT key to access the User category.
- Enter the User waypoint name.
- Turn the large, outer selector knob until the display in Figure 4-20 appears.

***Figure 4-20:* Range and Bearing Display**

The (ENT) message flashes on the screen and the ENT key begins to flash.

- Press the ENT key.

The ⊣D→ *key begins to flicker. The WPT mode is now active.*

- Press the WPT or APT/VOR key to select the desired waypoint category.
- Use the inner and outer selector knobs to locate the reference waypoint.
- Press the ⊣D→ key to select the waypoint.

Once the reference waypoint is selected, the Navigator automatically prompts the user to enter the bearing and distance.

Use the selector knobs to select a bearing between 0 and 359°.

- Turn the small, inner selector knob to enter each digit.
- Turn the large, outer selector knob to move between fields.

Figure 4-21: Entering Bearing

The bearing is now entered.

Next, enter the desired distance:

- Turn the large, outer knob clockwise, one click to the right, or until the desired digit of the distance field begins flashing.
- Turn the small, inner knob until the correct digit appears; repeat for other positions until the desired distance (in nautical miles) appears.

Figure 4-22: Entering Distance

- Press the ENT key.

The waypoint is now saved.

4.8.2 *Editing User Waypoints*

Once a User waypoint is created, the User waypoint name and its latitude and longitude may be changed or edited.

4.8.2.1 Editing a User Waypoint Name

To edit a User waypoint name, follow these steps:

- Press the WPT key to access the User category.
- Turn the small, inner selector knob to select the waypoint.
- Turn the large, outer selector knob until the display in Figure 4-23 appears.

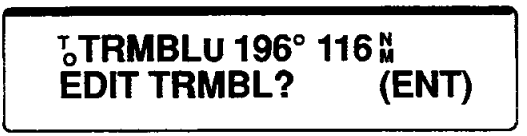


Figure 4-23: **Edit Display**

- Press the ENT key.

The first letter of the identifier begins flashing.

- Use the selector knobs to enter the new User waypoint name.
- Press the ENT key to complete the entry.

TIP:

If a waypoint name already exists, the display will prompt the user to enter a different name.

4.8.2.2 Editing User Waypoint Latitude and Longitude

To edit the latitude and longitude of a User waypoint, follow these steps:

- Press the WPT key to access the User category.
- Turn the large, outer selector knob until the Edit display appears.
- Press the ENT key.

The first letter of the identifier begins to flash.

Figure 4-24: **Entering Latitude and Longitude**

- Use the inner and outer selector knobs to move to the latitude and longitude fields and enter the new data.
- If a cardinal heading (N, S, E, W) is flashing, turn the inner selector knob to select "N" or "S" for the latitude, or "E" or "W" for the longitude.
- Press the ENT key to complete the entry.

4.8.3 Erasing User Waypoints

When a User waypoint is erased, it is permanently removed from the Navigator's database.

To erase a User waypoint:

- Press the WPT key to select the User category.
- Turn the small, inner selector knob to locate the desired User waypoint.
- Turn the large, outer selector knob until the erase display in Figure 4-25 appears:

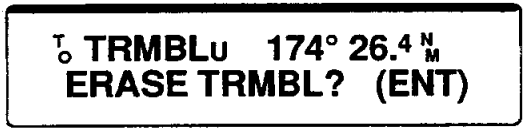


Figure 4-25: **Erasing a User Waypoint**

- Press the ENT key.

Figure 4-26: **Erased Message Display**

- Press the WPT key.

A message confirming erasure appears briefly and the display returns to the alpha waypoint.

The waypoint has been erased. The next User waypoint in the database is now displayed.

Chapter 5

The Flight Plan Mode

The Flight Plan mode is used to plan the route of a flight. The Navigator can store up to 20 different flight plans, each consisting of multiple waypoints.

After reading this Chapter you will be able to:

- Create a Flight Plan
- Activate a Flight Plan
- Reverse a Flight Plan
- Edit a Flight Plan
- Delete a Flight Plan
- Cancel a Flight Plan

5.1 Accessing the Flight Plan Mode

The Navigator can store up to 20 different flight plans, each consisting of multiple waypoints. These waypoints may be Airports, VORs, NDBs, Intersections or User waypoints.

To access the Flight Plan mode (FPL), press the FPL key. When this key is pressed, it lights to confirm the mode selection and remains lit until another mode is chosen.

When the FPL mode is accessed, the last selected flight plan is displayed (Figure 5-1). If a flight plan has not been created yet, the "NO DEFINED FLIGHT PLANS" message will appear.

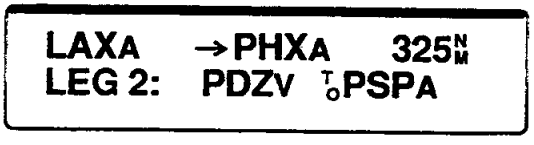


Figure 5-1: **FPL Mode Display**

The Flight Plan page in Figure 5-1 indicates that the flight plan is from the Los Angeles Airport to the Phoenix Airport; the total distance is 335 nautical miles; the second leg of the flight plan is from the Paradise VOR to the Palm Springs Airport.

Flight plans are arranged in alphabetical order by destination waypoints.

To access the different flight plans:

- Turn the small, inner selector knob in either direction.

To display the individual legs of a flight plan:

- Turn the large, outer selector knob.

TIP:

To quickly return to the active flight plan at any time, press and hold the FPL key for at least one second.

5.2 The Primary Flight Plan Display

The Primary Flight Plan page appears whenever the FPL mode is selected after the Navigator is initially turned on.

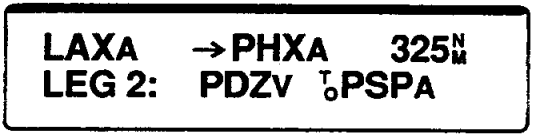


Figure 5-2: **Primary Flight Plan Display**

The top line of the Primary Flight Plan page displays the origin and destination of the last selected flight plan and the distance between them in nautical miles. The arrow points to the destination.

The bottom line displays the last selected leg of the flight plan and the origin and destination for that leg.

When a flight plan is not active, the legs are displayed as leg numbers (see Figure 5-2). When a flight plan is active, the legs are displayed relative to the leg that is currently being flown (see Figures 5-3 and 5-4).

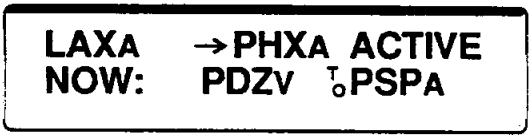


Figure 5-3: Active Leg Display

Figure 5-4: Next Leg Display

TIP:

If a plan is active, the distance field is replaced with the "Active" message. If a plan is reversed, the arrow points from right to left.

5.3 The Secondary Flight Plan Display

The Secondary Flight Plan page displays detailed information about a selected leg, including the origin, destination, bearing, distance and ETE.

To access the Secondary display:

- Press the FPL key to access the FPL mode and display the Primary Flight Plan page.
- Press the FPL key a second time to access the Secondary Flight Plan page.
- Turn the inner selector knob to display information on subsequent legs.

Figure 5-5: **Secondary Flight Plan Display**

The display in Figure 5-5 indicates that the second leg of this flight plan is from the Paradise VOR to the Palm Springs Airport; the leg bearing is 96°; leg distance is 51.3 nautical miles; ETE, using the current ground speed (120 knots) is 26 minutes.

5.4 Flight Plan Leg Sequencing

When a flight plan is active, the Navigator will automatically sequence between legs.

5.5 Creating a Flight Plan

Flight plans are created in the FPL mode. The legs or way-points for a flight plan are selected just like the identifiers in the WPT mode.

To create a flight plan:

- Press the FPL key to access the Primary Flight Plan Display.
- Turn the large, outer selector knob until the "EDIT NEW FLIGHT PLAN" message is displayed.

***Figure 5-6:* Edit Message Display**

The "end" message alternates with the "<- Add" message. The ENT key begins to flash.

- Press the ENT key to add the first waypoint.

The display changes to the Waypoint mode; the last selected waypoint is displayed; the WPT key is lit; the FPL key begins to flicker. Waypoints may now be added to this flight plan.

To add waypoints or legs to a flight plan use the standard methods for selecting waypoints:

- Press the WPT key to select the desired waypoint category.
- Turn the small, inner selector knob to locate the desired identifier, or use the ENT key and the selector knobs to enter the identifier or city name.
- Press the FPL key to complete the selection of this waypoint.

The FPL key remains lit. The ENT key begins to flash.

- Press the [ENT] key to begin entering the next waypoint.
- Repeat the steps above to enter the next waypoint.
- When the last desired waypoint is entered, press the [FPL] key to finalize the plan.

TIP:

The [APT/VOR] key can be used instead of the [WPT] key to select nearby waypoints.

5.5.1 Creating a Sample Flight Plan

This flight plan originates at the Los Angeles Airport. The destination is the Phoenix, Arizona Airport. Follow the steps listed above to create this sample flight plan.

Leg	From	To	
1	LAX Airport	PDZ VOR	(Paradise)
2	PDZ VOR	PSP Airport	(Palm Springs)
3	PSP Airport	BLH VOR	(Blythe)
4	BLH VOR	BXK VOR	(Buckeye)
5	BXK VOR	PXR VOR	(Phoenix)
6	PXR VOR	PHX Airport	(Phoenix)

5.6 Activating a Flight Plan

A flight plan may be activated on any of its legs. The previous legs will be shown as having been completed.

When activating a flight plan, the pilot is given two options: 1) Joining the displayed leg; or 2) Flying direct to either waypoint in the leg. In the latter case, the Navigator adds an additional leg by inserting the current location as a waypoint (shown as the -D> symbol) before the waypoint chosen.

5.6.1 Joining a Displayed Leg

- Press the FPL key to access the Primary Flight Plan Page.
- Turn the small, inner selector knob to display the desired flight plan.
- Turn the large, outer selector knob until the desired leg is displayed in the bottom line.

Figure 5-7: The Selected Flight Plan Leg

- Press the -D► key to activate the JOIN LEG option.

```
JOIN LEG 078°  LAXA
To PDZV        (DIR)
```

Figure 5-8: Track Between Waypoints

- Press [⊣⊢] to complete the selection.

NOTE:

The top line of this display indicates a track between the two waypoints displayed. In NAV mode, the display will show the actual bearing from the aircraft's position to the current destination (the second of the two waypoints in the flight plan leg), and the CDI will indicate the cross-track error as the deviation from the desired track between the two waypoints. With this information, the pilot may fly direct and center the CDI by pressing [⊣⊢] twice in NAV mode. The figure and display below illustrate joining a leg 2 nm from the desired track:

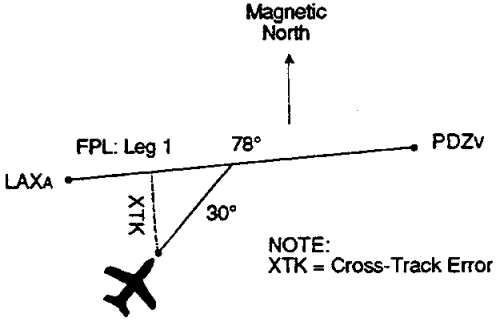


Figure 5-9: Course to Second Waypoint Cross-Track Error

```
TOPDZV 075°  41.9 NM   0:21
[ |•I•O•I•I ]TK030°  120KT
```

Figure 5-10: NAV Mode

5.6.2 Flying to Either Waypoint in a Leg

The other option is to activate a plan to fly to the either waypoint in a leg. In the previous flight plan, for example, the pilot may be several miles from LAXA and want to begin the plan at the current location instead of at LAXA. This option adds the current location as a waypoint to create an additional leg before picking up the flight plan at the selected waypoint.

In the example, the pilot chooses to fly direct to PDZv and pick up the flight plan at that waypoint.

- Press the FPL key and turn the small, inner knob to display the LAXA -> PHXA flight plan.
- Turn the large, outer knob until the first leg is displayed (Figure 5-7).
- Press the D→ key to activate the join leg option (Figure 5-8).
- Turn the large, outer knob clockwise and the display will change to the FLY DIRECT option for the second waypoint (PDZv).

Figure 5-11: **Direct Course to Waypoint**

- Press the D→ key again to confirm the waypoint selection and the flight plan is activated.

NOTE:

The following example is identical in function to the previous example. The only difference is that the second leg (PDZV -> PSPA) is displayed when the FLY DIRECT option is chosen.

- Press the FPL key and turn the small, inner knob to display the LAXA -> PHXA flight plan.
- Turn the large, outer knob until the second leg is displayed.

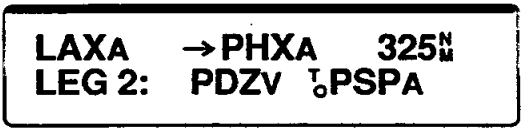


Figure 5-12: **The Selected Flight Plan Leg (2)**

- Press the key to activate the join leg option.

Figure 5-13: **Track Between Waypoints (2)**

- Turn the large, outer knob counter-clockwise and the display will change to the FLY DIRECT option for the first waypoint (PDZV) of that leg.
- Press the key again to confirm the waypoint selection and the flight plan is activated.

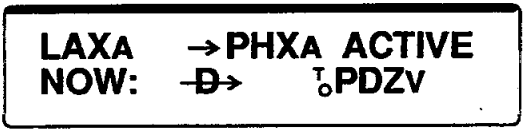


Figure 5-14: **The Active Flight Plan**

When a flight plan is active, its route distance is replaced with the "ACTIVE" message. The remaining plan distance, ETE and ETA may be located on the Flight Plan page in the CALC mode.

NOTE:

When a new flight plan is activated, the previously active flight plan is cancelled.

NOTE:

The following sections may only be performed on non-active flight plans:

Reversing FPL (page 5-13)
Adding/Deleting WPTs (pages 5-15 and 5-16)
Deleting FPLs (page 5-17)
Editing FPLs (page 5-14)

5.7 Cancelling an Active Flight Plan

There are three ways to cancel a flight plan:

- Use the "CANCEL" selection.
- Activate a different flight plan.
- Select a new destination with the [⌀→] key.

To cancel a flight plan displayed as "ACTIVE":

- Press the [FPL] key to display the active flight plan.
- Turn the large, outer selector knob until the "CANCEL" message is displayed.

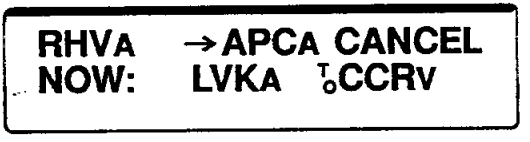


Figure 5-15: **Cancel Message**

The "ACTIVE" message is replaced by the flashing "CANCEL" message, and the ENT key begins to flash.

- Press the [ENT] key to cancel the flight plan.

When a flight plan is cancelled, the Navigator continues navigating to the current destination until a new destination is selected.

5.8 Reversing a Flight Plan

Return flight plans may be created by reversing the direction of an existing flight plan. The reversed flight plan replaces the original flight plan. To restore the original plan, reverse the flight plan a second time.

To reverse a flight plan follow these steps:

- Press the FPL key to select the desired flight plan.
- Turn the large, outer selector knob until the "REVRSE" message is displayed.

Figure 5-16: **Reverse Message**

The distance on the display is replaced with the flashing "REVRSE" message, and the ENT key begins to flash.

- Press the ENT key to reverse the flight plan.

Figure 5-17: **Reversed Flight Plan**

The arrow in the top line now points to the left indicating that the flight plan is reversed.

5.9 Editing a Flight Plan

The edit feature allows the user to accomplish the following:

- Add waypoints to a flight plan
- Delete waypoints from a flight plan

5.9.1 Selecting the Edit Mode

To edit a flight plan, follow these steps:

- Press the FPL key to select the desired flight plan.
- Turn the large, outer selector knob until the "EDIT" message is displayed.

Figure 5-18: **Edit Display**

- Press the ENT key to begin editing the displayed flight plan.

The "EDIT FLIGHT PLAN" message appears in the top line, and up to three waypoints in the plan appear in the bottom line.

To display other waypoints in the current plan:

- Turn the large, outer selector knob to scroll through the waypoints of the flight plan.

5.9.2 Adding Waypoints to an Existing Flight Plan

To add a waypoint to a flight plan:

- Select the Edit mode, as described in Section 5.9.1.
- Turn the large, outer selector knob until the waypoint that will follow the new waypoint is centered in the bottom line.

***Figure 5-19:* Add Waypoint Display**

The center waypoint (AEGA above) alternates with the "<-Add" message. The arrow indicates that the new waypoint will be inserted before this waypoint. The ENT key begins to flash.

- Press the [ENT] key to select the new waypoint.

The display changes to the WPT mode, showing the last waypoint selected. The WPT key lights and the FPL key begins to flicker.

- Press the [WPT] key to select the desired waypoint category.
- Use the standard method for selecting waypoints to select the new waypoint.
- Press the [FPL] key to add this waypoint to the flight plan and return to the FPL mode.
- Repeat the previous five steps to add other waypoints.
- When editing is completed, press the [FPL] key to exit the edit mode.

TIP:

The [APT/VOR] key can be used instead of the [WPT] key to select nearby waypoints.

5.9.3 *Deleting Waypoints from a Flight Plan*

To delete a waypoint from a flight plan:

- Select the Edit mode, as described in Section 5.9.1.
- Turn the large, outer selector knob until the waypoint to be deleted is centered in the bottom line of the display.

The center waypoint alternates in the display with the "<-Add" message.

- Turn the small, inner selector knob in either direction to display the "Delete" message.

The center waypoint alternates with the "Delete" message and the ENT key begins to flash.

- Press the ENT key to delete the waypoint.

A confirmation message will be displayed.

Figure 5-20: Erasing Waypoint Display

- Press the FPL key to confirm the deletion.
- Repeat the previous four steps to delete other waypoints.
- Press the FPL key a second time to exit the Edit mode and return to the flight plan.

TIP:

If all of the waypoints in a plan are deleted, the plan will be erased and the Navigator will leave the Edit mode.

5.10 Deleting a Flight Plan

When a flight plan is deleted, it is permanently removed from the database.

To delete a flight plan:

- Press the FPL key to select the desired flight plan.
- Turn the large, outer selector knob until the "ERASE" message is displayed.

Figure 5-21: **Deleting a Flight Plan**

The flight plan distance is replaced by the flashing "ERASE" message and the ENT key begins to flash.

- Press the ENT key.

The "ERASE FLIGHT PLAN" message is displayed and the FPL key begins to flash.

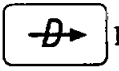
- Press the FPL key to delete the plan.

The current flight plan is deleted and the next flight plan is displayed.

Helpful Hints - How to Modify an Active Flight Plan

1. If given a new destination:

   a. Locate the new destination in WPT mode.

   b. Push the  key two times. The Navigator will now be flying to the new destination. The flight plan has been cancelled.

   c. While flying to a new destination, edit the flight plan, as required, and activate at the current leg.

2. If given a new routing:

   a. Cancel the active flight plan. The Navigator will continue to fly to the current destination.

   b. Edit the flight plan, as required, and activate at the current leg.

NOTE:

Navigation to the last entered next waypoint is still in progress until the modified flight plan is activated.

Chapter 6

The Calculator Mode

The CALC mode allows the user to perform many common E6B computer functions and other calculations.

After reading this chapter you will be able to :

- Save the Present Position
- Create VNAV Profiles
- Calculate Time, Distance and Speed
- Perform Fuel Management Calculations
- Calculate Winds Aloft
- Determine Pressure Altitude
- Determine Density Altitude
- Calculate True Airspeed
- Determine Crosswind and Headwind

6.1 Accessing the Calculator Mode

To access the Calculator (CALC) mode, press the CALC key. When the key is pressed, it lights to confirm the mode selection and remains lit until another mode is chosen.

- Press the CALC key.

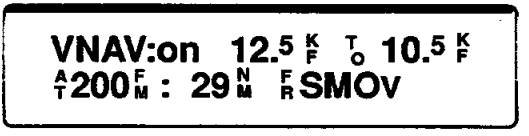


Figure 6-1: **CALC Mode Display: VNAV Page**

The CALC mode is now active. The first page in this mode displays VNAV information. The display in Figure 6-1 indicates a descent from 12,500 feet to 10,500 feet at 200 feet per minute, ending 29 nautical miles from the Santa Monica VOR.

NOTE:

When the user returns to the CALC mode, the last selected sub-mode is displayed.

6.2 Entering Data in the CALC Mode

To enter information and perform calculations in the CALC mode, follow the steps below:

- Press the CALC key to access the desired display.
- Press the ENT key.
- Turn the large, outer selector knob to move to the desired field.
- Turn the small, inner selector knob to change information in a field.

When this knob is turned quickly, the information in the selected field changes rapidly.

- Continue this procedure until all information is entered.
- Press the ENT key to complete the entry.

TIP:

When one field is updated, all pages containing that field reflect the current information.

6.3 Calculator Mode Functions

6.3.1 Saving the Present Position

In addition to the calculator functions, the CALC mode may also be used to save the aircraft's present position. The Navigator conveniently provides ten locations (alpha - julet) for temporary storage of these positions.

NOTE:

Once the temporary locations are filled, the user should rename the positions to be saved. The Navigator automatically writes over the existing temporary positions when the locations are full.

Once a position is saved, the location may be reviewed, edited or renamed from the User waypoint mode.

To save a present position:

- Press the CALC key to activate the CALC mode.
- Press the CALC key to save the present position to a temporary location.

Figure 6-2: Present Position Display

- Press the CALC key a third time to return to the CALC mode.

The present position is saved to a temporary location. The position may be renamed from the WPT mode.

NOTE:

Once the present position is saved, any mode may be selected by pressing the appropriate mode key.

6.3.2 *Vertical Navigation Profiles*

Vertical Navigation Profiles (VNAV) are created in the CALC mode.

VNAV Profiles are calculated based on the aircraft's current ground speed. To create a VNAV profile, the pilot must enter the starting altitude, ending altitude, the desired rate of descent or climb, the desired distance from the destination for ending altitude and the destination identifier.

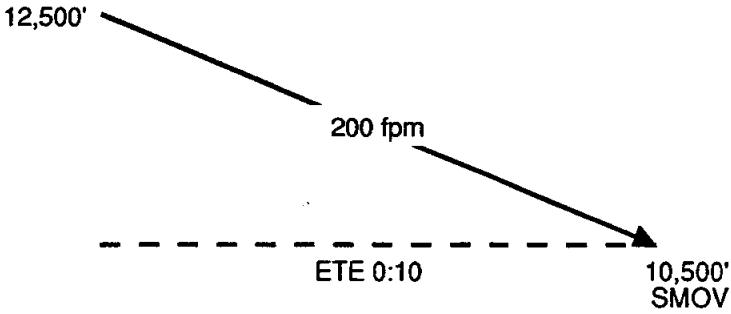


Figure 6-3: **VNAV Calculation**

The illustration in Figure 6-3 indicates that the aircraft descent is from 12,500 feet to 10,500 feet, at a rate of 200 feet per minute; the destination is the Santa Monica VOR at 10,500 feet. Based on this information, the Navigator will automatically calculate the VNAV descent starting point and the altitude the aircraft must maintain to follow the descent profile. VNAV can be used for climb profiles as well as descent profiles.

NOTE:

The Navigator will provide a series of Advisory messages to indicate when the level-off point has been reached. Advisory messages are indicated by the ADV annunciator light. When this annunciator light is lit, press the MSG key to display the message.

To enter VNAV profile information, follow the steps below:

- Press the CALC key to access the CALC mode and display the VNAV page.

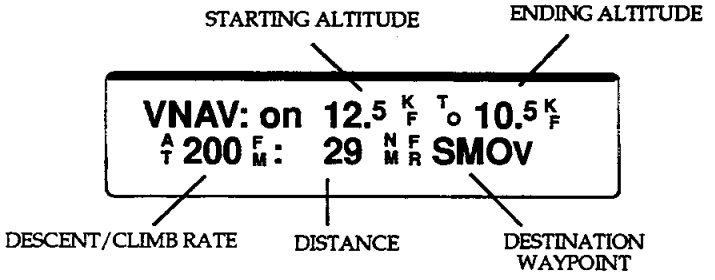


Figure 6-4: **VNAV Profile Display**

- Press the ENT key.

The "o" of the "on" or "off" begins to flash.

- Turn the small, inner selector knob to the right to turn VNAV on.
- Turn the large, outer selector knob to move to the next field.
- Turn the small, inner selector knob to select the correct digit or character for this field.
- Turn the large, outer selector knob to move to the next field.

TIP:

When entering VNAV information, altitudes are set in 100 foot increments and vertical speed is set in 10 foot increments.

NOTE:

Descent/climb may be entered as an angle by positioning the cursor over $^{F}_{M}$ and rotating the small knob to read degrees °. The rate will be calculated.

- Repeat the previous two steps until the desired information has been entered into each VNAV field.
- Press the ENT key when all entries are completed.

Once a VNAV profile has been started, the profile information may be viewed from the NAV mode.

6.4 Flight Plan Calculations

Flight plan calculations are accessed in the Fuel Management and Time, Distance, and Speed pages. These pages are designed to reflect current flight data and information when available. They may also be used as a flight planning calculator.

To access these displays:

- Press the CALC key.
- Turn the small, inner selector knob clockwise.

If the pilot is flying an active flight plan, these pages utilize the current ground speed and external fuel computer or user-entered rate of fuel consumption to compute the following:

- Estimated Time Enroute (ETE)
- Estimated Time of Arrival (ETA)
- Flight Plan Distance (DIST)
- Miles Per Gallon (MPG)

The Fuel Management and Time, Distance, and Speed pages also estimate the amount of fuel required to arrive at the current destination. If flying a multi-leg flight plan, these calculations reflect the current leg through the last leg.

Figure 6-5: **Flight Plan Calculation Display**

6.4.1 Time, Distance and Speed Calculations

The Time, Distance and Speed page shown in Figure 6-6 utilizes a sample flight plan from LAXA (Los Angeles Airport) to KICA (King City Airport):

Figure 6-6: **Time, Distance, Speed Display**

The Time, Distance, and Speed page shown in Figure 6-6 indicates the flight plan ground speed is 160 knots; flight plan distance is 191 nautical miles; the flight plan time (ETE) is 1 hour and 11 minutes; the estimated time of arrival (ETA) is 9:25 LOCAL time.

The fields (except ETA) displayed in Figure 6-6 may be edited at any time for different flight plan calculations.

For example, the user may wish to determine trip time at an accelerated ground speed:

- Press the ENT key. The first digit in the FPL GS field begins to blink.

Follow the standard data entry techniques explained on page 6-3 to enter a new ground speed (200 kts).

- Press the ENT key.

The ETE and ETA change as shown in Figure 6-7 below:

Figure 6-7: **Time, Distance, Speed Display**

Distance, ground speed, and ETE may be manually edited to view different flight plan data. The following chart shows how each changed field initiates new calculations:

Changed Field	Calculation Effected
ETE	Distance, ETA
Distance	ETE, ETA
Ground Speed	ETE, ETA

NOTE:

All the CALC mode displays (except pressure altitude page) use data provided by the Navigator or external sensors. When manually editing data, returning to NAV mode erases the changes. Press NAV key to return to NAV mode and view the current flight data.

6.4.2 *Fuel Management Calculations*

To access the Fuel Management page:

- Press the CALC key.
- Turn the small, inner selector knob clockwise.

The Fuel Management page shown in Figure 6-8 utilizes a sample flight plan from LAXA (Los Angeles Airport) to KICA (King City Airport):

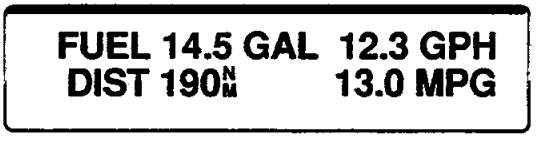


Figure 6-8: **Fuel Management Display**

The Fuel Management page in Figure 6-8 indicates that the estimated fuel required to reach the destination is 14.5 gallons; fuel consumption rate is 12.3 gallons per hour; the remaining distance is 190 nautical miles; fuel efficiency is 13.0 nautical miles per gallon. The fuel consumption rate is taken from the Air and Fuel Data Computer input, if available, or from user input.

The fuel, current fuel consumption rate, and remaining distance may be entered. The fuel efficiency is always computed by using the ground speed from the Time, Distance, and Speed page. This is the aircraft's current ground speed unless a new value has been entered.

For flight planning, the user can determine the maximum remaining flight range and fuel efficiency. Enter the remaining usable fuel and current fuel consumption rate as follows:

- Press the ENT key. The first digit in the FUEL field begins to blink.

To enter the remaining fuel (20 gallons), follow the standard data entry techniques explained on page 6-3.

- Press the ENT key.

The DIST field changes, showing the maximum remaining flight range of 260 nautical miles as shown in the following display:

***Figure 6-9:* Fuel Management Display**

Editing the fuel, rate of consumption, or distance field results in changed values as shown below:

Changed Field	Calculation Effected
Fuel	Distance
Rate	Distance, MPG
Distance	Fuel

Distance is used on the Time, Distance, and Speed page. Changing or computing a value on one page automatically results in the new value being passed onto the other page, but does not affect current flight data.

NOTE:

Fuel management calculations are based on the information that the user enters and the aircraft's current ground speed. The user is responsible for monitoring fuel reserves, changes in fuel consumption rates and changing wind conditions.

NOTE:

The RS-422 output from the Navigator has been configured for use with some digital fuel flow instruments.

6.4.2.1 Fuel Remaining Page

To access the Fuel Remaining Page:

- Press the CALC key.
- Turn the small, inner selector knob clockwise to access the Fuel Management Page.
- Turn the large, outer selector knob clockwise.

Figure 6-10: **Fuel Remaining Display**

The Fuel Remaining Page provides the following information:

- Fuel Remaining (in gallons; initial fuel minus fuel used)
- Flight Time Remaining (in hours and minutes; Fuel Remaining divided by fuel consumption rate)
- Range (in nautical miles; Flight Time Remaining times ground speed)

The initial fuel on board is entered during the power-up sequence (see Section 2.1). The Navigator keeps track of Fuel Remaining, based on fuel rate information from the Air and Fuel Data Computer, if one is used, or from user input.

The user may edit the Fuel Remaining field at any time to show fuel on board, using the standard data entry techniques explained on page 6-3.

- Press the ENT key to begin data entry.

6.4.2.2 Fuel At Arrival Page

To access the Fuel At Arrival Page:

- Press the CALC key.
- Turn the small, inner selector knob clockwise to access the Fuel Management Page.
- Turn the large, outer selector knob clockwise as required to give the display in Figure 6-11.

Figure 6-11: **Fuel At Arrival Display**

The Fuel At Arrival Page provides the following information:

- Fuel At Arrival (gallons; Fuel Remaining minus fuel to destination)
- Flight Time Reserve (hours and minutes; Fuel At Arrival divided by fuel consumption rate)
- Reserve (nautical miles; Flight Time Reserve times ground speed)

The Navigator calculates the amount of fuel which will be available on board when the aircraft reaches its final destination. This display provides the pilot with the necessary information to evaluate the reserve fuel situation early enough to take necessary action. See Section 6.4.2.1 for the sources of Fuel Remaining.

The distance and flight time remaining will be recomputed using the new Fuel Remaining.

6.4.2.3 Total Fuel Used Page

To access the Total Fuel Used Page:

- Press the CALC key.
- Turn the small, inner selector knob clockwise to access the Fuel Management Page.
- Turn the large, outer selector knob clockwise as required to give the display in Figure 6-12.

Figure 6-12: **Total Fuel Used Display**

The Total Fuel Used Page provides the following information:

- Total Fuel Used (gallons)
- Total Used by Left Tank (gallons)
- Total Used by Right Tank (gallons)

The Navigator keeps track of the fuel used since the last fuel entry. When installed in a single engine aircraft, or without an Air and Fuel Data Computer, the second line (Left and Right Tank usage) is not displayed.

NOTE:

After powering off the Navigator, the Fuel Used is reset to zero. The Fuel Remaining is not reset. This feature is useful for multi-stop flights where the fuel used for each leg may be monitored while keeping track of the total fuel remaining.

6.4.2.4 Engine Fuel Flow Page

To access the Engine Fuel Flow Page (not available on single engine aircraft):

- Press the CALC key.
- Turn the small, inner selector knob clockwise to access the Fuel Management Page.
- Turn the large, outer selector knob clockwise as required to give the display in Figure 6-13.

***Figure 6-13:* Engine Fuel Flow Display**

The Navigator provides a digital readout of the engine fuel flow quantity to a tenth of a GPH (gallon per hour). This page is not displayed when the Navigator is installed in a single engine aircraft or when there is no Air and Fuel Data Computer. (Total fuel flow information is available on the main Fuel Management page; see Section 6.4.2.)

6.4.3 *Pressure Altitude Calculations*

The Pressure Altitude page provides the following information:

- Pressure Altitude
- Barometric Pressure Setting (lowest: 28.00; highest: 31.00)
- Indicated Altitude

Figure 6-14: **Pressure Altitude Display**

The Pressure Altitude page in Figure 6-14 indicates that the pressure altitude is 12,800 feet; barometric pressure setting is 28.61 inches of mercury; indicated altitude is 11,600 feet.

To enter the information required for pressure altitude calculations, follow the standard data entry techniques explained on page 6-3.

- Press the ENT key to begin data entry.

A change in either barometric setting or indicated altitude initiates new calculations in related fields, according to the chart below:

Changed Field	Calculation Effected
Barometric Setting	Pressure Altitude
Indicated Altitude	Pressure Altitude

NOTE:

Changes made for pressure altitude will be reflected in the Density Altitude and TAS displays.

6.4.4 *Density Altitude Calculations*

The Density Altitude page provides the following information:

- Density Altitude
- Outside Air Temperature
- Pressure Altitude

Figure 6-15: **Density Altitude Display**

The Density Altitude page in Figure 6-15 indicates that density altitude is 13,700 feet; the outside air temperature is 19° Celsius; pressure altitude is 10,500 feet.

To enter the information required for density altitude calculations, follow the standard data entry techniques explained on page 6-3.

- Press the ENT key to begin data entry.

A change in either OAT or pressure altitude initiates new calculations in related fields, according to the chart below:

Changed Field	Calculation Effected
OAT	Density Altitude
Pressure Altitude	Density Altitude
Density Altitude	OAT

NOTE:

When the user returns to the CALC mode, the last selected sub-mode is displayed.

6.4.5 True Airspeed (TAS) Calculations

The True Airspeed page provides the following information:

- True Airspeed
- Indicated Airspeed
- Outside Air Temperature
- Pressure Altitude

Figure 6-16: **True Airspeed Display**

The True Airspeed page in Figure 6-16 indicates that true airspeed is 145 knots; indicated airspeed is 118 knots; the outside air temperature is 19° Celsius; pressure altitude is 10,500 feet.

To enter the information required for true airspeed calculations, follow the standard data entry techniques explained on page 6-3.

- Press the ENT key to begin data entry.

A change in either IAS, OAT, pressure altitude, or TAS initiates new calculations in related fields, according to the chart below:

Changed Field	Calculation Effected
IAS	TAS
OAT	TAS
Pressure Altitude	TAS
TAS	IAS

NOTE:

Changes made for TAS calculations will be reflected in the winds aloft calculations.

6.4.6 Winds Aloft Calculations

The Winds Aloft page provides the following information:

- Wind Direction and Speed
- True Airspeed and Heading

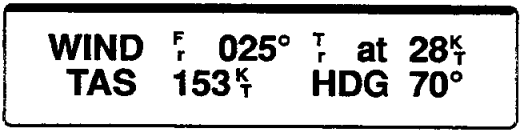


***Figure 6-17:* Winds Aloft Display**

The Winds Aloft page in Figure 6-17 indicates that the wind is from 025° true at 28 knots; given a true airspeed of 153 knots and a heading of 070°. Wind direction is given in degrees TRUE, not degrees magnetic.

This page is primarily used to determine the winds aloft based on the (1) current track and ground speed from the NAV page, (2) the current magnetic variation from the AUX-SETUP mode, (3) the TAS from the TAS page, and, (4) the manually-entered HDG, or HDG from the Air and Fuel Data Computer.

- Press the ENT key to begin data entry.

A change in either the TAS or heading fields initiates new calculations in related fields, according to the chart below:

Changed Field	Calculation Effected
TAS	Wind Speed, Wind Direction
Heading	Wind Speed, Wind Direction

6.4.7 *Crosswind and Headwind Calculations*

The Crosswind and Headwind page provides the following information:

- Crosswind
- Headwind
- Runway Direction
- Wind Direction (magnetic) and Speed

Figure 6-18: **Crosswind and Headwind Display**

The Crosswind and Headwind page in Figure 6-18 indicates that the crosswind component is 16 knots; the headwind component is 19 knots for runway 31, when the wind is from 270° magnetic and 25 knots.

To enter the information required for crosswind and headwind calculations, follow the standard data entry techniques explained on page 6-3.

- Press the ENT key to begin data entry.

A change in either the runway number, wind direction or wind speed initiates new calculations in related fields, according to the chart below:

Changed Field	Calculation Effected
Runway Number	Crosswind, Headwind
Wind Direction	Crosswind, Headwind
Wind Speed	Crosswind, Headwind

Chapter 7

The Auxiliary Mode

The Auxiliary mode is used to control and monitor information from the Trimble 1000DC GPS Navigation system.

After reading this chapter, you will be able to:

- Set the Date, Time and Zulu Time
- View the Present Position and Altitude
- Obtain current status information on the GPS receiver
- Access information on GPS Satellite availability
- Specify Database Search Regions
- Enable Dead Reckoning
- Set CDI Sensitivity and Calibration

Accessing the Auxiliary Mode

To access the Auxiliary (AUX) mode, press the AUX key. When this key is pressed, it lights to confirm the mode selection, and remains lit until another mode is chosen.

Selecting Functions

The AUX mode is divided into four functional areas:

- System Status Information
- Sensor Status Information
- Setup
- Installation

Selecting the Function Displays

Once the desired function is selected, turn the small, inner and large, outer selector knobs to access additional information displays.

TIP:

To quickly return to the first function in the AUX mode, press and hold the AUX key for at least one second.

7.1 The System Status Function

The System Status function provides quick access to system status information. The six status pages include the following:

Time Display
Present Position/Altitude Information
Voltage and Temperature Display
Database Revision Information
Software Revision Information

7.1.1 The Time Display

The first page in the System Status function displays the local date, local time, time zone and Zulu (UTC) time.

Figure 7-1: **Time Display**

The Time page in Figure 7-1 indicates that the current date is October 17, 1990; the day is Wednesday; the time is 9:53, the time zone is Pacific Standard Time; the current Zulu time is 17:53:11.

NOTE:

When GPS Satellites are available, the time and date are set automatically.

Time zones are selected from the following list:

PST Pacific Standard Time
PDT Pacific Daylight Savings Time
MST Mountain Standard Time
MDTMountain Daylight Savings Time
CST Central Standard Time
CDT Central Daylight Savings Time
EST Eastern Standard Time
EDT Eastern Daylight Savings Time
AST Atlantic Standard Time
ADT Atlantic Daylight Savings Time

Each time zone in the database has a corresponding time offset. For example, the time offset for Pacific Standard Time is -8. Pre-programmed time zones are not available for International use. For operation outside of North America, enter the time offset from UTC. For example, the time offset for Melbourne, Australia would be UTC + 10.

To select a time zone or time offset:

- Press the AUX key to access the System Status function.
- Press the ENT key.
- Turn the large, outer selector knob to the right, until the first character in the time zone/offset field begins to flash.
- Turn the small, inner selector knob to select the desired time zone or time offset.

Time zones are listed before time offsets. After the last time zone appears, continue turning the small, inner selector knob to the right to select time offsets.

- Press the ENT key to confirm the selection.

7.1.2 The Present Position Display

The Present Position page displays the aircraft's current position in terms of latitude and longitude, UTM, or MGRS. (See Section 7.4.2 for selecting display units.)

Figure 7-2: **Present Position Display**

The Present Position page in Figure 7-2 indicates a present position of latitude, 31° and 56.203 minutes north; longitude, 109° and 24.412 minutes west.

NOTE:

The starting position for Dead Reckoning is set under Setup mode on the Dead Reckoning page (Demo Mode).

7.1.2.1 The Altitude Display

The Altitude page follows the Present Position page in the database, and displays the current altitude source and altitude.

To access the Altitude page:

- Press the AUX key to access System Status.
- Turn the small, inner selector knob to display the Present Position page.
- Turn the large, outer selector knob to display the Altitude page.

Figure 7-3: The Altitude Page

The Altitude page in Figure 7-3 indicates that the current altitude is 10, 253 feet. The altitude source is GPS-3D.

Altitude Sources and Information

The Navigator relies on different sources of altitude information depending on the current operating mode.

Barometric

The altitude is determined on an external barometric input. If a barometric altitude input is supplied, this source is automatically selected and may not be changed.

The Barometric altitude source may be displayed in one of three ways on this page to provide additional information:

BARO/GPS-3D: GPS altitude is available as a back-up in case of loss of barometric altitude.

BARO/GPS-2D: GPS position is available, but in 2-D mode. The barometric altitude is used to aid the GPS position solution.

BARO ONLY: The altitude source is barometric; no GPS position is available.

GPS 3-D (GPS-3D)

If the receiver is currently in GPS 3-D mode, using 4 satellites, and the barometric input is absent, GPS is automatically selected as the altitude source. When the Navigator is operating in 3-D mode, the GPS indicator light remains lit. GPS altitude may differ from barometric altitude by as much as 1,000 feet.

Held GPS (HELD/GPS-2D)

If the Navigator is using just 3 satellites, it will depend on an altitude input to supply the additional dimension for the GPS position solution. If an external barometric altitude is available, that source is automatically used.

When no barometric altitude is available and the Navigator initially transitions from 3-D to 2-D mode, there is a 60 second period in which the Navigator will hold the last GPS altitude before prompting for manual input. If a fourth satellite does not become usable by the end of the period, or manual altitude is not entered, the GPS indicator light will flash and the Navigator will display the following message for a few seconds:

Figure 7-4: **Altitude Confirmation**

The Navigator will then be placed in Edit mode on the altitude source page to allow a change to the altitude (if required) before confirming with ENT (see Section 7.1.2.2).

Manual (MANUAL/GPS-2D)

If an altitude has been entered or confirmed and the Navigator is in 2-D mode, the GPS indicator light will flash and the altitude displayed will be used to aid the GPS position solution. A new altitude may be entered.

Old (OLD)

If there is no barometric input and the receiver is not generating a position solution, the altitude source will be OLD. The last altitude in use will be displayed, and a manual altitude may be entered by the user.

7.1.2.2 Entering the Altitude

When the Navigator is using just three satellites for position solutions (2-D), position accuracy is tied to an external altitude input. If an external altitude encoder or altitude serializer is not being used, altitude may be entered manually.

Sixty seconds after the Navigator enters 2-D mode operation, the GPS indicator begins to flash and the WRN annunciator lights.

To display the Warning message:

- Press the MSG key.

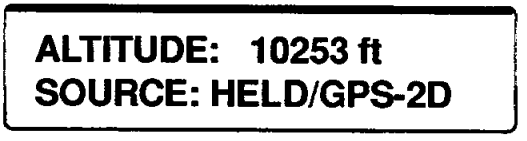


Figure 7-5: **Held Altitude Display**

The message in Figure 7-4 (previous page) is displayed, followed by the last GPS 3-D altitude. The ENT key begins to flash.

To enter the current aircraft altitude:

- Press the ENT key.
- Turn the outer selector knob to move to the first digit in the altitude field.
- Turn the inner selector knob to select the current altitude.
- Press the ENT key to confirm this entry.

The display changes to reflect the manually entered altitude:

Figure 7-6: Manual Altitude

The Warning message is now downgraded to an Advisory message. The ADV annunciator light remains lit to remind the pilot to periodically update this altitude information. To update the altitude input, press the MSG key and follow the steps above to enter the current aircraft altitude.

7.1.2.3 Pressure Altitude and GPS Altitude

- Turn the large, outer selector knob to the right to view the current pressure and GPS altitudes.

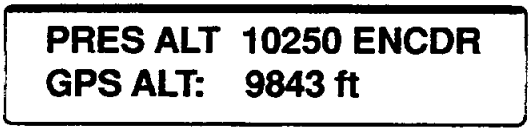


Figure 7-7: **Current Pressure and GPS Altitudes**

The display in Figure 7-7 indicates that the current pressure altitude is 10,250 feet. The source is barometric encoder input. GPS altitude is 9843 feet. Altitude displays may include the following sources:

- ENCDR (Encoder)

  The receiver is receiving the pressure altitude from an external barometric encoder.

- None

  The altitude source is not available and altitude will be displayed as dashes (for either pressure or GPS altitude).

7.1.3 The Battery Voltage and Temperature Display

The Voltage and Temperature page in Figure 7-8 indicates that the internal battery voltage is 3.6 volts; temperature inside the unit is 33° Celsius.

Figure 7-8: **Battery and Temperature Display**

7.1.3.1 The Crystal Offset Display

The Crystal Offset page in Figure 7-9 indicates that the crystal frequency offset is 13 Hz out of 16.368 MHz. This page is primarily accessed when the Navigator is being serviced.

Figure 7-9: **Crystal Frequency Display**

- Turn the large, outer selector knob while viewing the Voltage and Temperature page to access this display.

7.1.3.2 *The GPS Antenna Display*

The GPS Antenna page display shown below indicates that the voltage across the antenna leads is currently 4.36 volts and the current is 85 milliamps.

- Turn the large, outer selector knob while viewing the Voltage and Temperature page or the Crystal Offset page to access this display.

Figure 7-10: GPS Antenna Display

7.1.4 *The Database Expiration Display*

The Database Expiration page provides the expiration date for the current NavData credit-card database.

The Database Expiration page in Figure 7-11 indicates that the current database expires on December 10, 1992.

Figure 7-11: Database Expiration Display

WARNING

Do not remove the NavData card from the system when the power is on. To prevent corrupted data and random system errors, the system will automatically RESET if the card is removed.

7.1.5 The Software Revisions Display

The Software Revision page in Figure 7-12 provides information on the version of software that is currently being used by the Trimble 1000DC GPS Navigator.

Figure 7-12: **Software Revisions Display**

7.2 The Sensor Status Function

The Sensor Status function allows quick access to sensor diagnostic information as well as the system navigation mode. The sensor status pages include the following:

- GPS Status
- Estimated Accuracy
- GPS Satellite Status
- GPS Sensor Reset
- GPS Satellite Availability

7.2.1 GPS Sensor Status

GPS status and satellite data are available in the Sensor Status pages of the AUX mode. The first display under Sensor Status is the GPS Sensor Status page.

Figure 7-13: **GPS Sensor Status Page**

The display in Figure 7-13 indicates that the GPS receiver is tracking sufficient satellites for three-dimensional positioning. A detailed list of GPS Status messages is located in Appendix A.

7.2.1.1 Estimated Accuracy

Based on the accuracy of the signals and the geometry of the transmitters, the Navigator computes an estimate of the worst case error on position. This is shown on the Estimated Accuracy page. While viewing the GPS Sensor Status page, turn the large, outer selector knob clockwise.

Figure 7-14: **Estimated Accuracy**

The display in Figure 7-14 indicates that the estimated accuracy of the GPS sensor is .06 nautical miles. Therefore, the estimated accuracy of the receiver is .06 nautical miles.

7.2.2 GPS Status Display

To access GPS satellite information:

- Press the AUX key to access Sensor Status.
- Turn the small, inner selector knob clockwise past the GPS Sensor Status page.

The GPS Status page displays current GPS information and Position Dilution of Precision (PDOP). PDOP is a measurement of the geometry of the satellites. The smaller the number, the greater the precision. A list of GPS Status Messages is located in Appendix A.

Figure 7-15: **GPS Status Display**

The GPS Status page in Figure 7-15 indicates that the GPS receiver is currently using 4 satellites; the receiver is computing position in three dimensions; the position dilution of precision is 1.8. The satellites being used for a position fix are numbers 16, 8, 3, and 24.

- Turn the large, outer selector knob clockwise to view all the satellites being tracked by the GPS receiver.

7.2.2.1 GPS Satellites Tracked Display

The GPS Satellites Tracked page displays the numbers of all the satellites being tracked by the GPS receiver.

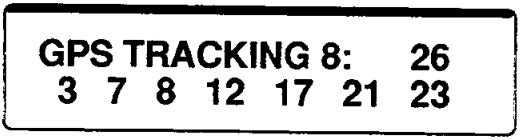


Figure 7-16: **GPS Satellites Being Tracked**

The GPS Satellites Tracked page in Figure 7-16 indicates that the GPS receiver is currently tracking 8 satellites. The satellites being tracked are numbers 3, 7, 8, 12, 17, 21, 23, and 26.

- Turn the large, outer selector knob clockwise to view individual satellite information.

7.2.2.2 GPS Satellite Status Display

The GPS Satellite Status page displays information on each satellite: elevation, azimuth, and signal level.

Figure 7-17: GPS Satellite Status Display

The GPS Satellite Status page in Figure 7-17 indicates that satellite (SV for Space Vehicle) number 3 is being received with a signal to noise ratio of 10.0; it is currently at an elevation of 29° and an azimuth of 248°.

If a negative elevation appears in this page, it is an indicator that the satellite is below the horizon and cannot be used to obtain a position fix.

To access information on each satellite:

- Turn the large, outer selector knob clockwise. The status of all satellites can be displayed, whether or not they are currently being tracked.

The Navigator allows the user to manually disable the GPS receiver from using any satellite in the 24 satellite constellation. To activate this procedure, access the display shown in Figure 7-18.

- Press the ENT key and turn the small, inner selector knob. The top line shows "DISABLE" blinking.
- Press the ENT key and the receiver no longer uses that satellite for its position solution:

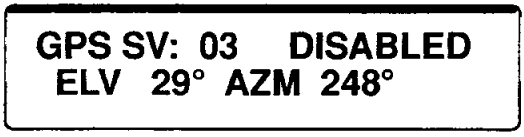


Figure 7-18: GPS Satellite De-selection

- Turn the large, outer knob clockwise to repeat the above procedure for the rest of the satellites. If the Navigator is turned off and on, any satellites which have been manually deselected are re-enabled.

7.2.2.3 GPS Sensor Reset

From the Satellite Status pages, turn the outer selector knob clockwise to access GPS Sensor Reset:

Figure 7-19: **GPS Sensor Reset Display**

- Press the ENT key. The display shown in Figure 7-20 will ask the user to confirm the reset.

Figure 7-20: **GPS Sensor Reset Confirmation Display**

Sensor reset causes the GPS receiver to go through its power-on and satellite acquisition sequence as if the unit had been turned off and on. This function is not needed during normal operation of the Navigator.

7.2.3 *GPS Satellite Availability*

- Turn the small, inner selector knob clockwise to view the display shown in Figure 7-21.

The Satellite Availability page shown in Figure 7-21 indicates that GPS three dimensional positioning is available on November 9, 1992 from 8:30 to 19:45 Zulu time.

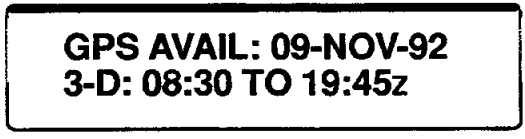


Figure 7-21: **GPS Satellite Availability Display**

To access information on the next available satellite navigation period, turn the large, outer selector knob clockwise. To enter a specific date or to select between visibility computation for two or three dimensional positioning, press the ENT key. This information may be entered using the standard data entry techniques.

The position used for satellite visibility computations is the last computed fixed position. If the Dead Reckoning mode has been set, the visibility will be computed for the present DR position. (Refer to Section 7.3.6.)

7.3 The Setup Function

The Setup function is used to establish parameters for the following:

- Database Search Regions
- CDI Sensitivity
- Magnetic Variation
- Dead Reckoning

7.3.1 Database Search Regions

A user may select the specific states and regions that a database search covers. These search parameters can include up to 6 regions, states, provinces or countries (Depending upon the database card installed). This will reduce the number of objects the user will have to view when trying to locate the area of interest. "ALL" is the factory default setting for this page.

A database search can also be restricted by specifying the following regions in the United States:

nw	North West
sw	South West
nc	North Central
sc	South Central
ec	East Central
ne	North East
se	South East

These U.S. Regions correspond to the ARINC regions. Their boundaries are different from those used in government publications. Refer to Appendix A for regional maps, and a list of state, province and country codes.

Figure 7-22: **International Search Regions Display**

The display in Figure 7-22 indicates that database searches will be made for the individual countries of France, Germany and Italy.

Figure 7-23: **Domestic Search Regions Display**

The display in Figure 7-23 indicates that database searches will be made for the northeast region, California, Nevada, Arizona, Utah, and Colorado.

To establish Database Search Regions, follow these steps:

- Press the AUX key until the Setup function is selected.
- Press the ENT key.

The first character in the region field begins to flash.

- Turn the small, inner selector knob to select the desired region, state, province, or country code.
- Turn the large, outer selector knob to move to the next field.
- Continue using the inner and outer selector knobs to enter up to 6 search parameters.
- Press the ENT key to complete the selection.

NOTE:

Defining a search region will not restrict searches in the APT/VOR mode.

7.3.2 Selecting a Parallel Offset

Parallel Offsets from 99.99 nm LEFT to 99.99 nm RIGHT may be selected.

- Press the AUX key to access the Setup function.
- Turn the small, inner selector knob to the right until the Parallel Offset page is displayed.

When this page is first displayed, the current offset setting is shown:

Figure 7-24: **Parallel Offset Setting**

The display in Figure 7-24 indicates a parallel offset of 10 nautical miles to the right of the designated track has been set.

- Press the ENT key to display a flashing cursor in the first digit field.
- Turn the large, outer selector knob to the right to select the digit field or to move to the LEFT/RIGHT field.
- Turn the small, inner selector knob to change the digit field or LEFT/RIGHT field.
- Press the ENT key to select the new offset.

If a parallel offset other than 0.00 nm is selected, the parallel offset can be viewed by pressing the MSG key.

The parallel offset feature does not affect the course or distance to the destination waypoint. Parallel offset changes the cross-track error distance and the CDI, and the turn computations if a flight plan is active.

Parallel offset is cancelled automatically when the course to the destination waypoint differs from the desired track by 45 degrees or more, or when the one minute to arrival message is displayed. If flying a flight plan, destination refers only to the last waypoint on the final leg of the plan.

Parallel offset is also automatically cancelled when the Direct function is used.

7.3.3 The CDI Sensitivity Display

7.3.3.1 Internal CDI Sensitivity

Internal electronic CDI sensitivity may be set by the user. The factory default setting is 1/2 mile per dot; the CDI sensitivity may be changed to 1, 1/2, 1/4, 1/8, 1/16, or 1/32 miles per dot.

The Navigator's electronic CDI is extremely sensitive. At 1/32 mile per dot, the minimum visible cross-track distance, one pixel width, is just 37.5 feet.

- Press the AUX key to select the Setup function.
- Turn the small, inner selector knob to access the CDI sensitivity display.

  When the CDI page is first displayed, the current setting is shown:

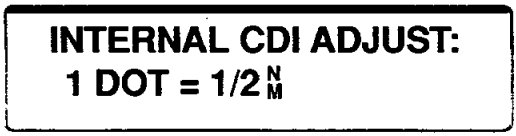


Figure 7-25: Internal CDI Sensitivity Setting

To select previous or subsequent settings:

- Press the ENT key.
- Turn the small, inner selector knob.

The new setting is displayed along with the flashing (ENT) message. The ENT key begins to flash.

- Press the ENT key to confirm the new setting.

7.3.3.2 External CDI Sensitivity

The Navigator is capable of driving external CDIs and providing left/right information to an autopilot. The sensitivity scale for an external CDI is limited to two settings: 1 nautical mile and 1/4 nautical mile per dot (factory default is 1 nm). For optimal autopilot tracking performance, 1/4 nm per dot is recommended.

To set external CDI sensitivity:

- Press the AUX key to access SETUP.
- Turn the small, inner selector knob to access:

Figure 7-26: External CDI Sensitivity Setting

Adjust the sensitivity scale as discussed in the previous section. For further discussion on flying the Navigator with an autopilot, see Appendix D.

7.3.4 The Magnetic Variation Display

Magnetic Variation may be set to AUTO or any value between 180° West and 180° East. AUTO is the factory default setting.

When this page is first displayed, the current setting is shown.

Figure 7-27: **Magnetic Variation Setting**

The display in Figure 7-27 indicates that the Magnetic Variation at the current position is 15° East.

To select previous or subsequent settings, turn the small, inner selector knob. A clockwise turn of this knob increases the variation to the East; a counterclockwise turn of the knob increases the variation to the West. The AUTO setting is located in the middle of the East and West settings.

For example, to select a setting of 5° East:

- Press the AUX key to access the Setup function.
- Turn the small, inner selector knob to select the Magnetic Variation display.
- Press the ENT key.
- Turn the small, inner selector knob until a variation of 5° East is displayed.

The new setting is displayed and the (ENT) message flashes.

- Press the ENT key to confirm the new selection.

NOTE:

To operate in true degrees, enter 0° magnetic variation.

7.3.5 The Dead Reckoning Display - Demo Mode

The Dead Reckoning (DR) feature allows the user to navigate in areas where GPS signal coverage is not available. It may only be activated if the Navigator is not receiving signals sufficient for a position fix. This mode may also be used outside the aircraft, to demonstrate the Navigator features.

When Dead Reckoning is activated, the WRN annunciator is lit. This warning message may be viewed by pressing the MSG key.

When the Dead Reckoning page is first displayed, the current ON/OFF setting is shown. If the OFF setting is selected, only the top line in Figure 7-29 is displayed.

Figure 7-28: **Dead Reckoning Display**

To select the starting position for DR or Demo mode operation:

- Press the AUX key to select the Setup function.
- Turn the small, inner selector knob to select the Dead Reckoning display.
- Press the ENT key to select Dead Reckoning.

Figure 7-29: **Starting Position Display**

The Starting Position display flashes on the screen. The Waypoint mode becomes active and the AUX key begins to flicker.

To set the starting point:

- Use the standard method of selecting a waypoint from the WPT or APT/VOR mode.
- Press the AUX key.

To set the destination, activate a flight plan or navigate directly to a waypoint.

To activate a ground speed from the starting position:

Figure 7-30: **Ground Track/Speed Entry Display**

- Press the NAV key to return to the Primary NAV Mode display.
- Press the ENT key.

The first digit in a ground track field begins to flash.

- Turn the small, inner selector knob to select a ground track.
- Turn the large, outer selector knob to move to the ground speed field.
- Turn the inner and outer selector knobs to set the ground speed field.
- Press the ENT key.

The entry is now complete and the Dead Reckoning/Demo mode is enabled. You may now use the DR mode for navigation or the Demo mode to demonstrate the Navigator features.

7.4 The Install Function

The Install function provides quick access to system installation information. These pages are normally set by the installer, but may be accessed by the user.

From the Install function, the user may modify the following features:

- Select User Units
- Personal Messages
- ETA Display Time
- Display Intensity
- CDI Calibration
- RAM Card Save/Load
- Serial I/O Save/Load
- Serial I/O Setup
- GPS Antenna Height
- Display Diagnostic

7.4.1 Select User Units

- Press the AUX key to access the Install mode.
- Turn the small, inner selector knob until the display in Figure 7-31 appears.

Figure 7-31: **Select User Units**

- Turn the large, outer selector knob clockwise until Figure 7-32 appears.

Figure 7-32: **Select LAT/LON Display**

- Press the ENT key.

The ENT key and the ENT indicator on the display begin to flash.

- Turn the small, inner selector knob to select LAT/LON, MGRS, or UTM.
- Press the ENT key to conclude the selection.

7.4.2 *Creating Personal Messages*

Personal messages are displayed when the Navigator is initially turned on.

To enter a personal message:

- Press the AUX key until the Install function is selected.
- Turn the small, inner selector knob to access the "New Personal Message" display.
- Press the ENT key.

The top line of the message is entered first.

To enter or modify information in a line, use the inner and

Figure 7-33: Personal Message Display

outer selector knobs.

- Use the ENT key and the selector knobs to enter the desired message.
- Press the ENT key a second time, when the entry is completed.

7.4.3 *Estimated Time of Arrival (ETA) Display*

The user may select the time zone with which to display ETA and GPS availability.

- Press the AUX key to access the Install mode.
- Turn the small, inner selector knob until the display in Figure 7-34 appears.

Figure 7-34: **ETA Time Zone Selection**

- Press the ENT key.

The ENT key begins to flash.

- Turn the small, inner selector knob to select either Local or Zulu time.
- Press the ENT key to conclude the selection.

7.4.4 *Setting the Display Light Intensity*

The Display Intensity page enables the user to set the backlight and night intensity levels on the display.

To set the backlight and night intensity levels:

Figure 7-35: **Set Display Light Level**

- Press the AUX key to access the Install mode.
- Turn the small, inner selector knob until the display in Figure 7-36 appears.
- Press the ENT key.

Figure 7-36: **Set Keylight and Contrast**

The display in Figure 7-36 appears indicating that the inner knob may be used to set the keylight and the outer knob may be used to set the contrast.

- Turn the small, inner selector knob to set the keylighting for push-button keys.

Turning the knob to the right increases the intensity level.

- Turn the large, outer selector knob to set the contrast of the display.

Turning the knob to the right increases the contrast.

- Press the ENT key to complete the calibration.

NOTE:

Calibration of light intensity should be done in the dark.

7.4.5 The CDI Calibration Feature

The CDI Calibration feature allows the user to set or check the following:

- CDI indicator position
- Flag or External Annunciator

To set or check these indicator positions and the External Annunciator(s), follow these steps:

- Press the AUX key until the Install function is displayed.
- Turn the small, inner selector knob to select the CDI Calibration and Annunciator page.
- Press the ENT key.

Figure 7-37: **CDI Calibration Display**

The CDI test page in Figure 7-38 indicates that the user is testing the external analog CDI for no deflection of the indicator.

- Turn the inner or outer selector knob until the CDI meter is centered.
- Press the ENT key.

Figure 7-38: **CDI Calibration Test Page**

The CDI test page in Figure 7-39 indicates that the user is testing the external analog CDI for full-scale deflection to the left.

- Turn the inner or outer selector knob counter-clockwise until the CDI indicator is positioned at the left-most position.
- Press the ENT key.

Figure 7-39: **CDI Calibration Test Page**

The CDI test page in Figure 7-39 indicates that the external analog CDI indicator should display a full-scale deflection to the left.

- Turn the inner selector knob one click clockwise.

The external CDI display indicator should move right one dot. The display in Figure 7-39 will now indicate "4L".

- Turn the inner selector knob one click clockwise.

The external CDI display indicator should move right one more dot. The display in Figure 7-39 will now indicate "3L".

- Continue turning the inner selector knob one click at a time, clockwise, until the Navigator display indicates "5R", meaning that the CDI display indicator should be at the right-most position.
- Press the ENT key.

Figure 7-40: **CDI "FROM" Flag Display**

The external CDI display displays the "FROM" flag.

- Turn the inner selector knob clockwise one click.

Figure 7-41: **CDI "TO" Flag Display**

The external CDI display displays the "TO" flag.

- Turn the inner selector knob clockwise one additional click.

Figure 7-42: **CDI Flag "OFF" Display**

The external CDI display "FROM" and "TO" flags are not visible.

- Continue turning the inner selector knob clockwise, one click at a time, while testing the appearance of the following on the external CDI display:
  - NAV flag no longer displayed
  - PTK annunciator lit
  - WRN annunciator lit
- Turn the inner selector knob counterclockwise at any time to repeat any of these tests.
- Press the ENT key to end CDI calibration testing.

7.4.6 Loading and Saving Configuration with the Memory Card

The Memory Card (also called the RAM Card) is a memory storage device that fits in the slot on the front of the Navigator normally used by the Jeppesen NavData Database Card.

This may be used to load or save the Navigator configuration. The data on the card may be updated using the optional Trimble Flight Planning and Configuration software.

WARNING:

Always TURN OFF the Navigator before inserting or removing either the Memory Card or the NavData Database Card from the system. To prevent corrupted data and random system errors, the system will automatically RESET if the card is removed.

WARNING:

Do not load or save configuration data during navigation. Data should be loaded or saved immediately following the Navigator's power-on procedure.

7.4.6.1 Storing Configuration on the Memory Card

To save the current Navigator configuration onto the Memory Card:

- Press the AUX key until the Install function is selected.
- Turn the small, inner selector knob until the "LOAD/SAVE RAM CARD" message is displayed.
- Turn the large, outer selector knob to select "SAVE CONFIGURATION".
- Press the ENT key. The Navigator will then display the status of the Memory Card and ask confirmation to write to the card.
- Press the ENT key to start data transfer to the Memory Card.

During the data transfer, the display will indicate the amount of data transferred by showing the percentage of transfer in the upper right-hand corner. When the transfer is completed, the display will show 100%.

During the SAVE process, the Navigator can detect some problems with the Memory Card. If an error occurs, the user can exit the SAVE process by pressing any of the Navigator Mode Keys.

To return the Navigator to normal operation:

- Turn the Navigator off
- Replace the RAM Card with the Database Card.
- Turn the Navigator on.

7.4.6.2 Loading Configuration from the Memory Card

To load the Navigator configuration from the Memory Card:

- Press the AUX key until the Install function is selected.
- Turn the small, inner selector knob until the "LOAD/SAVE RAM CARD" message is displayed.
- Turn the large, outer selector knob to select "LOAD CONFIGURATION".
- Press the ENT key to select this function.

The display will now read: CLEAR BEFORE LOAD? The user has two options:

- Press the ENT key to clear the existing configuration and load the new one.

OR

- Turn the small, inner knob to display "APPEND CARD DATA", then press the ENT key to add the configuration from the Memory Card to the existing configuration.

During the data transfer, the display will indicate the amount of data transferred by showing the percentage of transfer in the upper right-hand corner. When the transfer is completed, the display will show 100%. It is not possible to stop the data transfer once it is started (other than by turning off Navigator power).

If an error is detected before the transfer begins, the transfer will not start. In this case, an advisory message appears and the ADV key on the Navigator starts to flash. The advisory message directs the user to make the necessary corrections.

During the LOAD process, if a record error is detected, an advisory message is displayed on the bottom line. If an error is found in a record, that record is not transferred to the Navigator, but the load operation continues.

During a LOAD process for which the user has selected the APPEND option, the data being loaded is automatically checked for compatibility with the existing data. If an incompatibility is found in a record, that record is not transferred to the Navigator, but the load operation continues.

If there are more than 10 errors or incompatibilities detected, the data transfer is aborted. The following error message is displayed:

Figure 7-43: Memory Card Load Error Display

When any errors are reported, the Navigator contains a partial (and probably corrupted) data set. The configuration process should be repeated.

7.4.7 *Loading and Saving Configuration via Serial Port*

It is possible to store the current Navigator configuration onto an IBM PC compatible, or to load a configuration into the Navigator from an IBM PC compatible.

The PC must contain Trimble's Flight Planning and Configuration software.

WARNING:

Do not load or save configuration data during navigation. Data should be loaded or saved immediately following the Navigator's power-on procedure.

7.4.7.1 Storing Configuration via Serial Port

To save the current Navigator configuration onto an IBM PC compatible:

- Press the AUX key until the Install function is selected.
- Turn the small, inner selector knob until the "LOAD/SAVE VIA SERIAL" message is displayed.
- Turn the large, outer selector knob to select "SAVE CONFIGURATION".
- Press the ENT key.
- Prepare the PC to receive navigation data and write it into a file.

During the data transfer, the display will indicate the amount of data transferred by showing the percentage of transfer in the upper right-hand corner. When the transfer is completed, the display will show 100%.

During the SAVE process, the Navigator can detect some processing problems. If an error occurs, the user can exit the SAVE process by pressing any of the Navigator Mode Keys.

NOTE:

To ensure proper Navigator operation, turn the Navigator off and then back on after the Save operation.

7.4.7.2 Loading Configuration via Serial Port

To load the Navigator configuration from an IBM PC compatible:

- Press the AUX key until the Install function is selected.
- Turn the small, inner selector knob until the "LOAD/SAVE VIA SERIAL" message is displayed.
- Turn the large, outer selector knob to select "LOAD CONFIGURATION".
- Press the ENT key to select this function.

The display will now read: CLEAR BEFORE LOAD? The user has two options:

- Press the ENT key to clear the existing configuration and load the new one.

OR

- Turn the small, inner knob to display "APPEND CARD DATA", then press the ENT key to add the configuration from the serial port to the existing configuration.

Finally, for either option:

- Prepare the PC to send the data file to the Navigator.

During the data transfer, the display will indicate the amount of data transferred by showing the percentage of transfer in the upper right-hand corner. When the transfer is completed, the display will show 100%. It is not possible to stop the data transfer once it is started (other than by turning off Navigator power).

If an error is detected before the transfer begins, the transfer will not start. In this case, an advisory message appears and the ADV key on the Navigator starts to flash. The advisory message directs the user to make the necessary corrections.

During the LOAD process, if a record error is detected, an advisory message is displayed on the bottom line. If an error is found in a record, that record is not transferred to the Navigator, but the load operation continues.

During a LOAD process for which the user has selected the APPEND option, the data being loaded is automatically checked for compatibility with the existing data. If errors are detected, the ADV key begins to flash. The number of the bad record and the number of the character within the record are displayed on the second line. If an incompatibility is found in a record, that record is not transferred to the Navigator, but the load operation continues.

If there are more than 50 errors or incompatibilities detected, the data transfer is aborted. The following error message is displayed:

Figure 7-44 **Serial Port Load Error Display**

When any errors are reported, the Navigator contains a partial (and probably corrupted) data set. The configuration process should be repeated.

NOTE:

To ensure proper Navigator operation, turn the Navigator off and then back on after the Load operation.

7.4.8 Setting the Serial Port and Protocol

The Serial Port and Protocol feature allows the user to set input/output, the serial port and baud rate, the data update rate and the data protocol.

Figure 7-45: **Serial Port and Protocol Display**

The display in Figure 7-45 indicates that the serial channel number 1 output port is programmed for RNAV output mode 0; data will be output every 10 seconds at a rate of 9600 bits per second.

7.4.8.1 The Serial Port Channels

The Navigator features four independent serial data channels. Two of these channels are dedicated to input, and two are dedicated to output. Depending on the application, these channels may be used independently or in combination with one another. There are six possible input and output channel choices:

I/O Channels	Default Mode Settings
Serial - 1 in:	ENCODER (9600 baud, no rate)
Serial - 1 out:	K0 (9600 baud, 1 sec.)
Serial - 1 I/O:	None (no baud or rate, factory test mode)
Serial - 2 in:	None
Serial - 2 out:	None
Serial - 2 I/O:	None (no baud or rate, factory test mode)

The following are possible configurations of the serial channels:

I/O Channel	Possible Settings
Serial - 1 in:	none, ENCODER (9600 baud only), RMI (1200 baud only)
Serial - 1 out:	none, K0, K1, R0, R1, X0, X1 (1 sec, 9600 baud default)
Serial - 1 I/O	none (factory use only)
Serial - 2 in:	none, ENCODER (9600 baud only), RMI (1200 baud only)
Serial - 2 out:	none, K0, K1, R0, R1, X0, X1 (1 sec, 9600 baud default)
Serial - 2 I/O	none (factory use only)

To select the settings for a serial channel:

- Press the AUX key to access the Install mode.
- Turn the small, inner selector knob until the first serial port page is displayed.

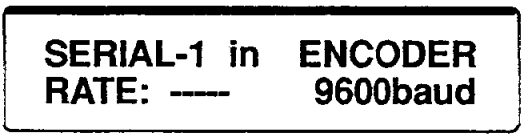


Figure 7-46: Serial Port Page Display

- Turn the large, outer selector knob until the serial port to be configured is displayed.
- Press the ENT key to enable configuration changes.

The ENT key and the first letter of the port's current serial protocol setting begin to flash.

- Turn the small, inner selector knob until the desired protocol is displayed.
- Turn the large, outer selector knob to adjust the data update rate and the baud rate setting.
- Press the ENT key when serial port configuration is complete.

7.4.8.2 Data Protocol

When a data protocol is selected, the matching input/output port will automatically default to that mode. The following input and output modes may be selected:

Output Mode Selections

none	NONE
R0	RNAV unformatted mode with carriage returns
R1	RNAV unformatted mode with carriage returns and line feeds
K0	King unformatted mode with carriage returns
K1	King unformatted mode with carriage returns and line feeds
X0	Extended K0 format
X1	Extended K1 format

Input Mode Selections

none	NONE
ENCODER	Either ICARUS or Rosetta serial encoder or Shadin air and fuel data input
RMI	Rocky Mountain Instrument air data input

7.4.8.3 Baud Rates

The serial port may be programmed for the following baud rates:

1200	1200 bits per second (R0/R1 only)
2400	2400 bits per second (R0/R1 only)
4800	4800 bits per second (R0/R1 only)
9600	9600 bits per second
38.4(K)	38400 bits per second

When an input channel is selected, the baud rate is not displayed. If a mode of "none" is selected, the baud rate and input rates will appear as a series of dashes (---).

To select a baud rate:

- Press the ENT key.
- Use the selector knobs to enter the desired rate.
- Press the ENT key when done.

7.4.8.4 The Data Update Rate

The data update rate may be set between 1 and 999 seconds. For some protocols, this rate is ignored

7.4.9 GPS Antenna Height Setup

To "fine-tune" the altitude component of GPS position, the Navigator allows specification of how high the GPS antenna is above a reference point. When GPS altitude is displayed, the value will have been reduced by the antenna height offset.

To change the antenna height offset:

- Press the AUX key to access the Install mode.

- Turn the small, inner selector knob until the display in Figure 7-47 appears.

Figure 7-47: **GPS Antenna Height Setup**

- Press the ENT key to edit the displayed height.
- Enter a height from 0 to 99 feet. Use the large, outer knob to select the position to change; use the small, inner knob to dial in the appropriate digit
- Press the ENT key to confirm the new value.

7.4.10 The Display Test Page

The Display Test page enables the user to check that the display lights and functions are in working order.

To access the Display Test page:

- Press the AUX key to access the Install mode.
- Turn the small, inner selector knob until the display in Figure 7-48 appears.

Figure 7-48: **The Display Test Page**

The "DISPLAY DIAGNOSTIC" message appears briefly. Then a horizontal bar appears across the characters in both lines of the display and sequences through each character. The annunciator lights and push-button keys light in sequence to assure that they are also in good working order.

Chapter 8

The Message Function

The Navigator keeps the pilot apprised of all critical information that relates to the current flight.

After reading this Chapter you will be able to:

- Interpret Warning, Parallel Track and Advisory messages
- Understand message priority
- Understand the use of flashing and non-flashing indicators
- Display messages

8.1 Accessing Messages

The Navigator uses two different annunciator lights to communicate special messages to the user:

WRN	(Warning Light)
ADV	(Advisory Light)

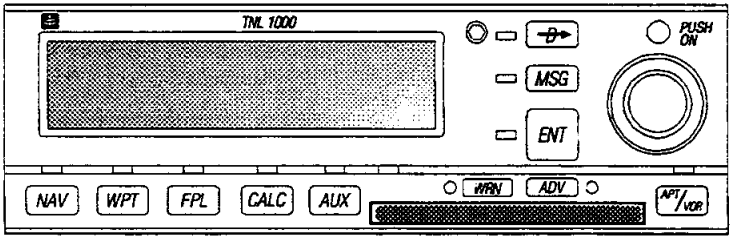


Figure 8-1: **Annunciator Lights**

New Warning messages (WRN) or Advisory messages (ADV) are indicated by the flashing indicators WRN and ADV. Old messages which are still relevant cause the message indicators to stay lit.

Messages are displayed in order of priority. New Warning messages have highest priority:

New Warnings
New Advisories
Old Warnings
Old Advisories
Parallel Track Offset

If a message is waiting, the MSG key is lit.
To access messages:

- Press the MSG key.

Figure 8-2: **Message Display**

The first message appears on the screen. If more than one message is waiting, the MSG key will remain lit. If this is the case, continue to press the MSG key and read through all waiting messages.

The message in Figure 8-2 is an Advisory message indicating that the current Jeppesen NavData Database Card is out of date.

When the MSG key is no longer lit, all messages have been viewed and the Navigator is returned to the previous mode in use.

If a message continues to be relevant, the appropriate annunciator remains lit. The message can be viewed again by pressing the MSG key.

8.2 Warning Messages

New warning messages are given highest priority and are always displayed first.

The following is a list of Warning messages and an explanation for each:

BATTERY BACK-UP FAIL	The internal battery has failed. As a result, all stored waypoints and flight plans were erased. The battery should be replaced immediately.
DATABASE MISSING	The database card is missing or is not installed properly.
EXTERNAL ALTIMETER LOST COMMUNICATION	The communication link to the altimeter has failed.
EXTERNAL ALTIMETER IS IN ERROR	Bad data was received from the altimeter.
GPS: ANTENNA FAULT	The GPS antenna is not connected or is not functioning. Check GPS antenna voltage and current on AUX system status display.
GPS: RECEIVER FAIL	The GPS receiver is not functioning properly and requires service.
LOW VOLTAGE INPUT VOLTAGE: 10.6V	The input voltage is below 11V or in a range between 18V and 22V.

NO USABLE POSITION DEAD RECKONING ON	The receiver has not located enough satellites to make a position fix. The message may also be an indication of a poor antenna connection. This Warning message is always issued when the Navigator is first turned on. If very poor signal conditions exist, the message will remain.
UNIT RESET DUE TO LOW INPUT VOLTAGE	The input voltage was below the minimum for the Navigator to operate.

8.3 Advisory Messages

Advisory messages provide the pilot with information on a variety of topics. The following is a list of Advisory messages and an explanation for each:

8.3.1 Database Advisory Message

DATABASE OUT OF DATE	The database card contains data which may not be current.
DATABASE CARD TYPE NOT VALID	The database card is bad.

8.3.2 Vertical Navigation Advisory Messages

BEGIN VNAV DESCENT 500 fm IN 59 SECONDS	VNAV has been enabled. The pilot will receive a 60 second warning before reaching the point at which the altitude change should begin.
BEGIN VNAV DESCENT TO 2.0 AT 500fm NOW	VNAV has been enabled and the aircraft *should* be at the point to begin the altitude change.*
PREPARE TO LEVEL OFF IN 29 SECONDS	VNAV is nearing completion. The pilot will receive a 30 second warning before reaching the point at which VNAV should end.*
VNAV COMPLETED LEVEL OFF AT 2.0kf	The final VNAV advisory. The final altitude point has been reached. This is an indication that the aircraft should have reached the desired altitude by this point. It does not indicate the aircraft has actually reached the desired altitude.*

8.3.3 Flight Plan Advisory Messages

The Turn Anticipation display will continuously update to keep the pilot apprised of the approaching turn. Once this message is displayed, the ADV annunciator light remains lit until display timer reaches zero.*

If the turn angle is less than 90°, this display will direct the pilot to make the turn.*

If the turn angle is greater than 90°, this display will direct the pilot to make the turn.*

When approaching final destination, the pilot receives a 60 second countdown advisory.*

* This message will "pop-up" by itself. Press the MSG key to clear this and any other active messages and return the display to its previous mode.

8.3.4 *Parallel Track Advisory Messages*

If a parallel offset has been previously set and is still in effect. Press the MSG button to display the offset that has been selected.

Parallel offset is canceled when the course to destination differs from the desired track by 45° or more, or when the one minute to arrival message is displayed.

8.3.5 Fuel Management Advisory Messages

When the fuel on board is not zero, the following messages may appear.

If the amount of time remaining at current fuel flow rate is less than the time to reach the destination plus 45 minutes, this advisory will appear. Once this message is displayed, it will remain until the Fuel Remaining is zero or the time remaining exceeds the time to destination plus 59 minutes.

The calculated fuel to reach the destination on the Fuel Management Page is more than the fuel remaining on the Fuel Remaining Page. Once this message is displayed, it will remain until the Fuel Remaining is zero or the time remaining on the Fuel at Arrival Page exceeds 15 minutes.

The flight time remaining on the Fuel Remaining page is less than 30 minutes. Once displayed, the message will remain and will count down time to fuel exhaustion until the Fuel Remaining is zero or the time to fuel exhaustion exceeds 59 minutes.

Appendix A

Reference

A.1 State and Province Codes

The following codes are used to identify States and Provinces in the Jeppesen North American NavData database listed in alphabetical order by identifier.

State or Province	Code	State or Province	Code
ALBERTA	AB	JAMAICA	JAM
ANGUILLA	AIA	JOHNSTON IS	JTN
ALABAMA	AL	ST KITTIS	KNA
ALASKA	AK	KANSAS	KS
ARUBA	ANT	KENTUCKY	KY
ARKANSAS	AR	LOUISIANA	LA
ANTIGUA	ATG	ST LUCIA	LCA
ARIZONA	AZ	MASSACHUSETTS	MA
BRITISH COLUMBIA	BC	MANITOBA	MB
BAHAMAS	BHS	MARYLAND	MD
BELIZE	BLZ	MAINE	ME
BERMUDA	BMU	MEXICO	MEX
BARBADOS	BRB	MICHIGAN	MI
CALIFORNIA	CA	MINNESOTA	MN
CANADA	CAN	MISSOURI	MO
COLORADO	CO	MISSISSIPPI	MS
COLOMBIA	COL	MONTSERRAT IS	MSR
COSTA RICA	CRI	MONTANA	MT
CONNECTICUT	CT	MARTINIQUE	MTQ
CUBA	CUB	NEW BRUNSWICK	NB
CAYMAN ISLANDS	CYN	NORTH CAROLINA	NC
DISTRICT OF COLUMBIA	DC	NORTH DAKOTA	ND
DELAWARE	DE	NEBRASKA	NE
DOMINICA	DMA	NEWFOUNDLAND	NF
DOMINICAN REPUBLIC	DOM	NEW HAMPSHIRE	NH
FLORIDA	FL	NICARAGUA	NIC
GEORGIA	GA	NEW JERSEY	NJ
GUADELOUPE	GLP	NEW MEXICO	NM
GRENADA	GRD	NOVA SCOTIA	NS
GUATEMALA	GTM	NEVADA	NV
HAWAII	HI	NORTHWEST TERRITORIES	NW
HONDURAS	HND	NEW YORK	NY
HAITI	HTI	OHIO	OH
IOWA	IA	OKLAHOMA	OK
IDAHO	ID	ONTARIO	ON
ILLINOIS	IL	OREGON	OR
INDIANA	IN	PENNSYLVANIA	PA

State or Province	Code
PANAMA	PAN
PRINCE EDWARD IS	PE
QUEBEC	PQ
PUERTO RICO	PRI
RHODE ISLAND	RI
RUSSIA	RUS
SOUTH CAROLINA	SC
SOUTH DAKOTA	SD
EL SALVADOR	SLV
SASKATCHEWAN	SK
MIQUELON IS	SPM
CAICOS IS	TCA
TURKS IS	TCA
TENNESSEE	TN
TOBAGO	TTO
TEXAS	TX
UNITED STATES OF AMERICA	USA
UTAH	UT
VIRGINIA	VA
ST VINCENT	VCA
BRITISH VIRGIN IS	VGB
VIRGIN IS	VIR
VERMONT	VT
WASHINGTON	WA
WISCONSIN	WI
WEST VIRGINIA	WV
WYOMING	WY
YUKON TERRITORY	YK

A.2 Country Codes

The following codes are used to identify Countries in the Jeppesen International NavData database.

Country	Code	Country	Code
AFGANISTAN	AFG	ALGERIA	DZA
ANGOLA	AGO	ECUADOR	ECU
ALBANIA	ALB	EGYPT	EGY
UNITED ARAB EMIRATES	ARE	CANARY IS	ESP
ARGENTINA	ARG	MELILLA	ESP
ARMENIA	ARM	SPAIN	ESP
AMERICAN SAMOA	ASM	ESTONIA	EST
ANTARCTICA	AUS	ETHIOPIA	ETH
AUSTRALIA	AUS	FINLAND	FIN
AUSTRIA	AUT	FIJI IS	FJI
AZERBAIJAN	AZE	FALKLAND IS	FLK
BURUNDI	BDI	FRANCE	FRA
BELGIUM	BEL	FAERO IS	FRO
BENIN	BEN	CAROLINE IS	FSM
BURKINA FASO	BFA	MICRONESIA	FSM
BANGLADESH	BGD	PALAU	FSM
BULGARIA	BGR	GABON	GAB
BAHRAIN	BHR	UNITED KINGDOM	GBR
BELORUSSIA	BLR	GEORGIA	GEO
BOLIVIA	BOL	GHANA	GHA
BRAZIL	BRA	GIBRALTAR	GIB
BRUNEI	BRN	GUINEA REP	GIN
BHUTAN	BTN	GAMBIA	GMB
BOTSWANA	BWA	GUINEA-BISSAU	GNB
CENTRAL AFRICAN REP	CAF	EQUTORIAL GUINEA	GNQ
SWITZERLAND	CHE	GREECE	GRC
CHILE	CHL	GREENLAND	GRL
CHINA, PR OF	CHN	FRENCH GUIANA	GUF
IVORY COAST	CIV	GUAM	GUM
CAMEROON	CMR	MARIANA IS	GUM
CONGO	COG	HAWAII	HI
COOK IS	COK	HONG KONG	HKG
COLOMBIA	COL	CROATIA	HRV
COMOROS	COM	HUNGARY	HUN
CAPE VERDE	CPV	INDONESIA	IDN
CZECHOSLOVAKIA	CSK	INDIA	IND
CYPRUS	CYP	CHAGOS ARCH	IOT
GERMANY	DEU	IRELAND	IRL
DJIBOUTI	DJI	IRAN	IRN
DENMARK	DNK	IRAQ	IRQ
FAROE IS	DNK	ICELAND	ISL

Country Codes

Country	Code	Country	Code
ISRAEL	ISR	NAURU	NRU
ITALY	ITA	NEW ZEALAND	NZL
JORDAN	JOR	OMAN	OMN
JAPAN	JPN	PAKISTAN	PAK
JOHNSTON I	JTN	PERU	PER
KAZAKHSTAN	KAZ	PHILLIPINES	PHL
KENYA	KEN	PAPUA NEW GUINEA	PNG
KYRGYZSTAN	KGZ	POLAND	POL
KAMPUCHEA	KHM	KOREA, DPR OF	PRK
KIRIBATI	KIR	PORTUGAL	PRT
KOREA	KOR	PARAGUAY	PRY
KUWAIT	KWT	FRENCH POLYNESIA	PYF
LAOS	LAO	QATAR	QAT
LEBANON	LBN	REUNION	REU
LIBERIA	LBR	ROMANIA	ROM
LIBYA, SPA JAMAH.	LBY	RUSSIA	RUS
SRI LANKA	LKA	RWANDA	RWA
LESOTHO	LSO	SAUDI ARABIA	SAU
LITHUANIA	LTU	SUDAN	SDN
LUXEMBOURG	LUX	SENEGAL	SEN
LATVIA	LVA	SINGAPORE	SGP
MOROCCO	MAR	ASCENSION	SHN
MOLDOVA	MDA	ST HELENA	SHN
MADAGASCAR	MDG	SOLOMON IS	SLB
MALDIVES	MDV	SIERRA LEONE	SLE
MARSHALL IS	MHL	SOMALIA	SOM
MIDWAY I	MID	SAO TOME & PRINCIPE	STP
MALI	MLI	SURINAME	SUR
MALTA	MLT	SLOVENIA	SVN
UNION OF MYANMAR	MMR	SWAZILAND	SWZ
MONGOLIA	MNG	SWEDEN	SWE
MARIANA IS	MNP	SEYCHELLES	SYC
MOZAMBIQUE	MOZ	SYRIA	SYR
MAURITANIA	MRT	CHAD	TCD
MAURITIUS	MUS	TOGO	TGO
MALAWI	MWI	THAILAND	THA
MALAYSIA	MYS	TAJIKISTAN	TJK
NAMIBIA	NAM	TURKMENISTAN	TKM
NEW CALEDONIA	NCL	TONGA	TON
NIGER	NER	TUNISIA	TUN
NIGERIA	NGA	TURKEY	TUR
NIUE	NIU	TUVALU	TUV
NETHERLANDS	NLD	TAIWAN	TWN
NORWAY	NOR	TANZANIA	TZA
NEPAL	NPL	UGANDA	UGA

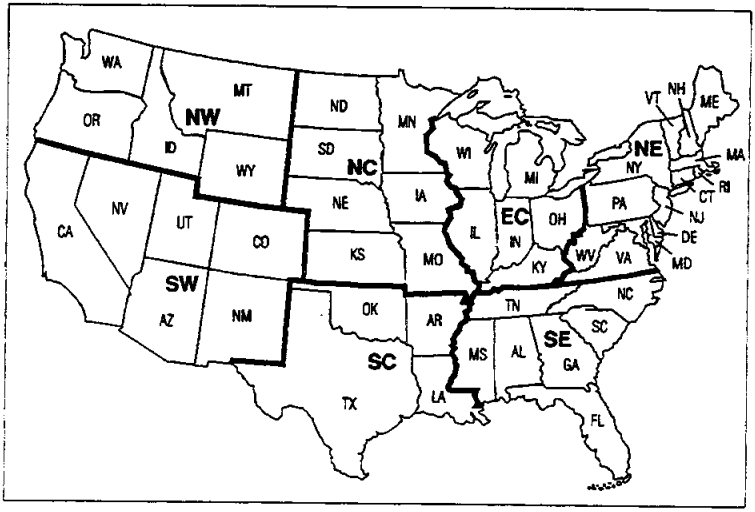
Country Codes

Country	Code
UKRAINE	UKR
URUGUAY	URY
UNITED STATES OF AMERICA	USA
UZBEKISTAN	UZB
VENEZUELA	VEN
VIETNAM	VNM
VANUATU	VUT
FUTUNA IS	WLF
WESTERN SAMOA	WSM
ARMENIA	XJA
KYRGYZSTAN	XJI
AZERBAIJAN	XJJ
KAZAKHSTAN	XJK
MOLDOVA	XJO
RUSSIA	XJR
TAJIKISTAN	XJT
WAKE I	XJW
YEMEN ARAB REP	YEM
YUGOSLAVIA	YUG
BOPHUTHATSWANA	ZAF
CISKEI	ZAF
NAMIBIA	ZAF
SOUTH AFRICAN REP	ZAF
SOUTHWEST AFRICA	ZAF
TRANSKEI	ZAF
VENDA	ZAF
ZAIRE	ZAR
ZAMBIA	ZMB
ZIMBABWE	ZWE

A.3 ARINC Maps

A.3.1 United States

5.0 RNAV DATA - FIELD DEFINITIONS
7 SUBDIVISIONS FOR UNITED STATES



REVISED: January 31, 1986

Figure A-1: **ARINC Map (United States)**

A.3.2 Standard ARINC Geographic Coverages

Refer to Figure A-2 for the standard ARINC geographic coverages.

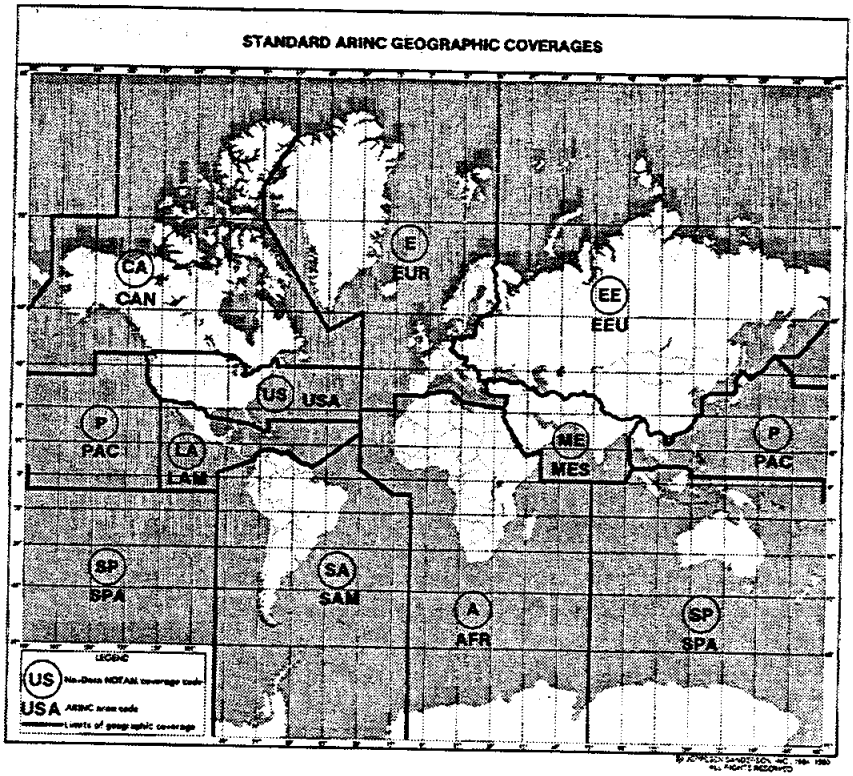


Figure A-2: Standard ARINC Geographic Coverages

A.4 GPS Status Messages

GPS Status Messages include the following:

GPS: ANTENNA FAULT
The GPS antenna is not connected or is not operating properly.

GPS: NO GPS TIME
Satellite signal levels are too low to receive.

GPS: NO SV AVAILABLE
No satellites are in view at this time.

GPS: NO USABLE SVs
Tracking at least one SV. Time is being obtained.

GPS: NOT AVAILABLe
GPS sensor has failed.

GPS: ONLY n USABLE SV
Tracking 1 or 2 SVs. Need 3 for position fix.

GPS: PDOP TOO HIGH
Tracking at least three SVs, but geometry is bad.

GPS: RECEIVER FAIL
The GPS receiver is not functioning correctly and requires service.

GPS: USING n SV 2-D
Tracking 3 or more SVs. Computing a 2-D position.

GPS: USING 4 SV 3-D
Tracking 4 or more SVs. Computing a 3-D position.

A.5 Changing NavData Cards During Flight

It is possible to change the NavData card during flight without disturbing the active flight plan.

It is necessary to accomplish this if flying between international boundaries.

Perform the following steps to change the NavData card:

1. Power down the Navigator.
2. Remove the NavData card currently being used.
3. Insert the desired NavData card.
4. Power up the Navigator.

The Navigator resumes executing the active flight plan after being powered back on.

The Domestic and International NavData cards have few overlapping waypoints (except Hawaii). When crossing international boundaries, we recommend making two separate flight plans, one for each card. Fly the flight plan of the card currently being used. When it becomes necessary to change cards, activate the second flight plan to continue on the next leg.

NOTES

NOTES

Appendix B

The GPS System: How It Works

GPS (Global Positioning System) is a navigation system based on a constellation of 24 satellites orbiting the earth at very high altitude. This system was established and is maintained by the U.S. Department of Defense. GPS can give three-dimensional position measurements accurate to within 50 feet (15 m).

GPS is based on satellite ranging: calculating a position by measuring the distance to several different satellites. If we know that the distance from satellite A is 11,000 miles, then we must be somewhere on an imaginary sphere centered on the satellite and having a radius of 11,000 miles as shown in Figure B-1. If, at the same time, the distance from satellite B is known to be 12,000 miles, then we must be on the circle where the two spheres intersect, as shown in Figure B-2.

If we also know that we are 13,000 miles from satellite C, our position is further restricted to the two points in space where the three spheres intersect, as shown in Figure B-3. One of these points is usually impossible (for example, far out in space). GPS receivers have various techniques for distinguishing the correct point from the incorrect one. Theoretically, these three measurements are all we need to determine the position of our aircraft.

The basic idea behind measuring the distance to a satellite is the "velocity times travel-time" equation we all learned in school:

Distance = Velocity x Time

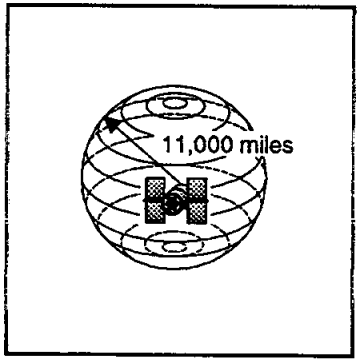


Figure B-1

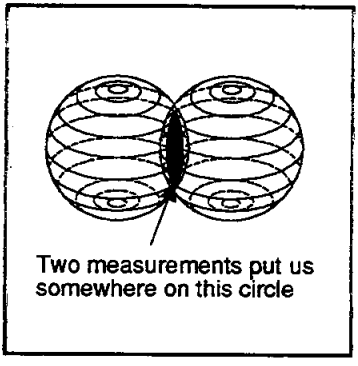


Figure B-2

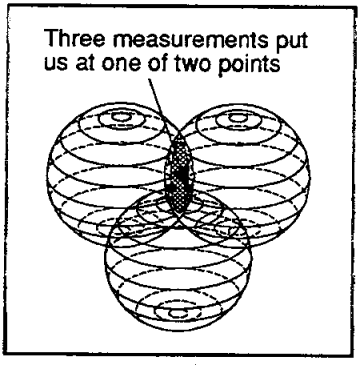


Figure B-3

The GPS system works by calculating how long a radio signal from a satellite takes to reach us, and then calculating the distance to the satellite based on that time. We know the velocity of light (about 186,000 miles per second). So if we can determine exactly when the GPS satellite started sending its radio signal, and exactly when we received it, we can calculate how long the signal took to reach us.

How can the GPS receiver determine exactly when the signal left the satellite? The satellites and receivers are very precisely synchronized to generate the same pattern of radio signals at exactly the same time. This pattern, or code, is a complicated string of pulses that appears to be random, but is in fact, carefully determined. Since the code appears to be random, it is often referred to as "pseudo-random code."

When the GPS receiver receives a satellite code, it measures the time that elapsed between when it generated that code and when it received the same satellite code. Plugging this value into the equation above will give us the distance from our aircraft to the satellite.

Of course, the measurements must be very precise—down to a nanosecond, or one billionth of a second. The satellites achieve this accuracy by means of atomic clocks that are amazingly precise. GPS receivers are equipped with very precise electronic clocks—but not always precise enough. Fortunately, trigonometry says that if three perfect measurements locate a point in three-dimensional space, then four imperfect measurements can eliminate any clock offset (as long as the offset is consistent). So by making an extra satellite range measurement, we can eliminate clock offset.

An example will help explain this. For simplicity (and to eliminate the need for three-dimensional graphics), let's use a two-dimensional example, such as a ship at sea (where altitude is already known). This means that, if our clocks were perfect, we would need only two range measurements to locate ourselves exactly on the surface of the earth. The third range measurement will be our "extra" one.

Consider the example in Figure B-4. Suppose our receiver's clock is consistent, but is 1 second slow. And, let's say that the signal from satellite A takes 4 seconds to reach us, while the signal from satellite B takes 6 seconds. So we really are where the two solid lines intersect.

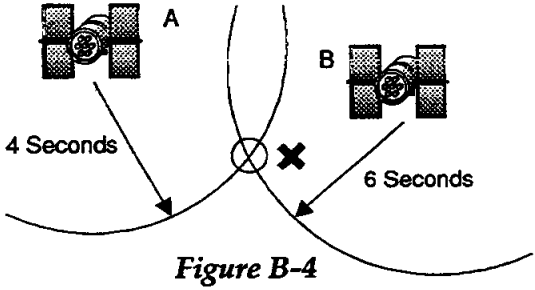


Figure B-4

But, our imperfect receiver would think the signal from satellite A took 5 seconds to reach us, and that from satellite B, 7 seconds. So our receiver thinks we are where the two shaded lines intersect—which could be miles from our actual location.

Now let's add a third measurement to the calculation. The signal from satellite C takes 8 seconds to reach us, and our receiver thinks it's 9. From Figure B-5 we can see that the three solid lines intersect at our true location.

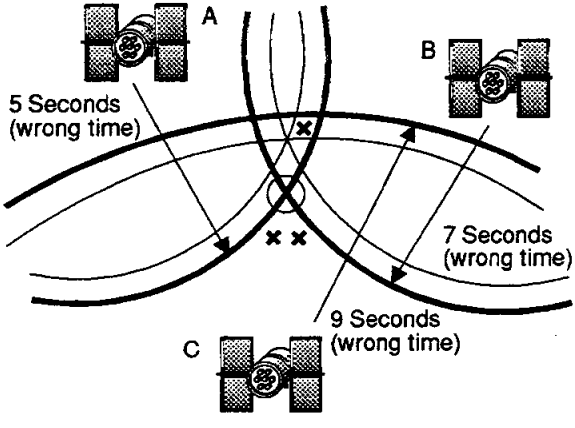


Figure B-5

But, if we add our one-second offset to the drawing, the three shaded lines show three possibilities for our location—the "pseudo ranges" caused by our slow clock.

The GPS receiver, upon receiving this series of points, assumes that its clock is off. It applies algebra to compute where the three points could possibly intersect, and gives this intersection as our true location.

Since an aircraft GPS system operates in three dimensions, it needs four measurements to cancel out any error. This means that it can't determine a truly accurate position unless it has four satellites within range above the horizon. Until all 24 satellites are in place, there may be times when fewer than four satellites are available overhead. During these times, altitude from an encoder or manual input can permit continued navigation at reduced accuracy.

There are some other sources of minor errors in the GPS system. Tiny variations can occur in the altitude, speed, and position of a satellite. These changes are monitored by the Department of Defense, and the corrections are sent back to the satellite, where they are broadcast along with the pseudo codes. Other variations can be caused by ionospheric and atmospheric delays. Another possible source of error is "Geometric Dilution of Precision," which means that the intersection point of two ranges is slightly less accurate when the satellites are close together. In a typical case, the sum of these errors would amount to no more than 100 feet (30m); in a worst case, no more than 200 feet (70m).

For military purposes, the Department of Defense can also introduce deliberate errors into the system using an operational mode called "selective availability," or S/A. The stated accuracy with S/A on is as follows:

- Better than 100m, 95% of the time
- Better than 300m, 99% of the time

The other 1% is undetermined, the DOD can set the accuracy reduction much higher!

A sophisticated form of GPS, differential GPS, allows precise measurements down to a centimeter (1" = 2.54 cm). Such ultra-precise measurements are based on at least fifteen minutes of GPS data collection at a stationary location and very precise knowledge of a reference point. This form of GPS is used in surveying and is being tested as a precision landing system.

Here is a quick summary of the types of GPS receivers available:

Single-Channel Receivers

These collect satellite data through a single channel, which moves from one satellite to the next. Their power consumption and price are the lowest of any type of GPS receiver. Some are battery-powered and portable. The process of sequencing, or moving between satellites, can interrupt positioning and will limit overall accuracy. They are not designed for aircraft navigation. Fast-multiplexing single-channel receivers move very quickly between satellites and can function continuously, but cost as much as a two-channel receiver.

Multi-Channel Sequencing Receivers

These use one channel to continuously monitor position data and the other channels to track and lock onto the next satellites. These systems can provide continuous navigation functions and have much better signal-to-noise ratio than single-channel systems. They usually cost more and use more power than single-channel systems.

Continuous receivers

These come in configurations of from five to twelve channels. They can give instantaneous position and velocity readings and can eliminate the GDOP problem by tracking more than four satellites. They are used in applications that are highly dynamic or require high accuracy, such as surveying and scientific work. Their cost and power consumption are the highest of any GPS system. A six-channel GPS receiver is used in the Navigator.

B.1 GPS Information Center

Precise Worldwide Position, Velocity, and Time

GPS is providing several hours of highly accurate data daily. When fully operational, GPS will enable land, sea, and airborne users to determine their three-dimensional position, velocity, and time anywhere in the world with unprecedented accuracy. Satellite-based GPS is the most precise radio navigation system available today or in the foreseeable future.

GPS consists of three segments: space, control, and user. The space segment will ultimately contain 21 operational satellites about 10,900 nautical miles above the earth. The satellites complete an orbit cycle every 12 hours and provide direct line-of-sight radio frequency signals to users worldwide. A ground control network tracks the satellites, determines orbits precisely, and transmits orbit definition data to each satellite. Navigation and position fixing using GPS is accomplished by passive trilateration. Users measure range to and compute the position of four satellites and process the measurements to determine three-dimensional position and time.

Although GPS was originally designed to enhance the warfighting capability of U.S. and allied military forces, the unprecedented accuracies already available from the system have given rise to a wide variety of civil GPS applications. As the GPS reaches full maturity, applications are anticipated to continue to emerge, and worldwide civil land, sea, and airborne users are expected to out number military users by a sizeable margin.

Civil GPS Information Center

In order to accommodate the needs of the large worldwide civil GPS user community, the U.S. Government has established GPS Information Center (GPSIC). Operated and maintained by the United States Coast Guard for the Department of Transportation, the primary functions of the GPSIC are to provide information to and serve as the point of contact for civil GPS users.

Information Available

Information available from the GPSIC is called the Operational Advisory Broadcast, which contains the following general categories of GPS performance data:

- Current constellation status (satellite health data)
- Future status (planned outages of satellites)
- Almanac data (suitable for making GPS coverage and satellite visibility predictions)

Information Media

GPS Operational Advisory Broadcast information is available from the GPSIC in the following forms:

- Computer bulletin boards
- Voice tape recording
- Voice broadcasts
- Facsimile broadcast

All GPSIC services are provided free of charge. Registration for the GPSIC bulletin board is done online at the first session.

COMMS PARAMETERS

- Asynchronous - 8 Data Bits
- 1 Start Bit, 1 Stop Bit
- No Parity
- Full Duplex
- XOn/XOff
- Both Bell and CCITT Protocols

The GPSIC computer bulletin board may be accessed by dialing (703) 866-3890 for modem speeds of 300 - 2400 bps or (703) 866-3894 for modem speeds up to 9600 bps.

The telephone number for the voice tape recording is (703) 866-3826.

Information Requests

In additional to the prerecorded Operational Advisory Broadcast information available, the GPSIC is prepared to respond to individual user inquiries, comments, or concerns regarding civil access to and use of the GPS. The GPSIC will accept calls of this nature from civil users Monday through Friday from 8:00 a.m. to 4:00 p.m. Eastern Time. The number is (703) 866-3806.

Written comments, questions, or concerns on the GPS or operation of the GPSIC may be addressed to:

Commanding Officer
U.S. Coast Guard ONSCEN
7323 Telegraph Road
Alexandria, VA 22310-3998

Other Information Sources

GPS status information may also be obtained from the following sources:

- WWV/WWVHHF radio broadcasts WWV minutes 14 and 15; WWVH minutes 43 and 44)
  - (5, 10, 15, 20 MHz)
- Defense Mapping Agency (DMA) weekly Notices to Mariners
- DMA broadcast warnings (NAVAREA, HYDROLANT, and HYDROPAC)
- DMA NavInfoNet, ANMS
  - (301) 227-3351 (300 BAUD)
  - (301) 227-5925 (1200 BAUD)
  - (301) 227-4360 (2400 BAUD)
- USCG Broadcast Notices to Mariners
- NAVTEX Data Broadcast
  - (518 kHz)

Users must register off-line before accessing the DMA NavInfoNet. A user ID and information booklet is available by writing the DMA Hydrographic/Topographic Center (ATTN: MCN/NAV-INFONET) Washington, D.C. 20315-0030 or calling (301) 227-3296.

GPS Information Center Users' Manual

Detailed information on the GPSIC services and how the services may be obtained is available in a GPS Information Center Users' Manual. The Users' Manual may be obtained by calling (703) 866-3806 or writing the Information Center.

> **NOTE**
>
> Satellite visibility window predictions are not offered by the GPSIC. This information is available from commercial sources or from commercially available software.

Civil GPS Service Steering Committee

In addition to the services provided by the GPSIC, the U.S. Government has established a Civil GPS Service Steering Committee (CGSSC). The purpose of the CGSSC is to address issues and problems that relate to the civil use of the GPS and to provide a forum for discussions between civil GPS users and the DOD.

The CGSSC consists of an Executive Council, General Committee, and five Subcommittees:

- Precise Positioning and Surveying
- Timing
- Reference Station
- International
- Carrier Phase Tracking

The CGSSC is jointly chaired by the U.S. Department of Transportation and the U.S. Coast Guard. Points of contact are:

U.S. Department of Transportation
Research and Special Programs Administration
400 7th Street, S.W., Room 9402
Washington, DC 20590-0001
Phone: (202) 366-4355
Fax: (202) 366-3272

Commandant (G-NRN)
U.S. Coast Guard
2100 Second Street, S.W.
Washington, DC 20593-0001
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The CGSSC meets about every three months, and the General Committee meetings are open to all interested parties.

Appendix C

Flying with the Autopilot

C.1 Considerations for Autopilot Interfacing

All of the common autopilots installed in the general aviation fleet were designed to be coupled to VOR CDIs. One of the problems that autopilot manufacturers have been faced with is how to track a VOR radial (which is your desired course) when the CDI sensitivity changes as a function of distance to the VOR station. Common problems with autopilots coupled to VORs include sluggish tracking (drifting off course), or zig-zagging across the desired course, often referred to as "scalloping". Most autopilots are designed to provide optimal tracking performance about 15 miles from a VOR, which is equivalent to CDI sensitivity of 1/4 nm per dot. The sensitivity increases as you approach the station and decreases as you leave the station.

One of the benefits of long range navigation equipment, such as the Navigator, is that CDI sensitivity remains fixed, regardless of your distance from a waypoint. With the external CDI sensitivity (setup mode) set for 1/4 nm per dot, the Navigator is providing optimal CDI inputs to your autopilot.

C.2 Suggested Autopilot Flying Technique

By following this procedure, the pilot establishes the aircraft on the desired course prior to engaging the autopilot, and will obtain satisfactory autopilot tracking performance with most general aviation autopilots.

1. On the Navigator, select the desired waypoint. Note the bearing to the waypoint, which immediately follows the waypoint identifier. Turn the OBS on the external CDI or HSI that is coupled to the Navigator to the bearing to waypoint.

2. Turn the aircraft to a heading that corresponds to the bearing to waypoint.

3. Once the aircraft is established on the proper heading, press the -D-> key twice to enter the NAV mode. The Navigator is now providing cross-track corrections for the desired waypoint.

4. Couple the autopilot to the Navigator, using the proper ,procedures as established by the autopilot manufacturer.

NOTE:

If you are flying a multi-leg flight plan with heading changes in excess of 15 degrees, it is recommended that the autopilot be disengaged and "hand-flown" through the heading changes. Once the aircraft is established on the new heading, the autopilot can be reengaged.

Glossary of Terms

absolute altitude
Actual altitude above the surface of the earth.

auto fix
The ability of a GPS receiver to start position calculations without being given an approximate location and approximate time.

AUX (auxiliary mode)
AUX mode contains the functions not used directly for navigation, but as an auxiliary to navigation functions.

barometric altitude
Altitude above the surface of the earth as measured by barometric pressure; a relative measure of altitude.

bandwidth
The range of frequencies in a signal.

C/A code
The standard (Clear/Acquisition) GPS code: a sequence of 1023 pseudo-random, binary, biphase modulations on the GPS carrier at a chip rate of 1.023 MHz. Also known as the "civilian code."

carrier-aided tracking
A signal processing strategy that uses the GPS carrier signal to aid the code loop tracking.

carrier frequency
The frequency of the unmodulated fundamental output of a radio transmitter.

CDI
Course Deviation Indicator; a visual display of distance offset from the desired course.

channel
A channel of a GPS receiver, consisting of the circuitry necessary to track the signal from a single GPS satellite.

clock bias
The difference between the clock's indicated time and true universal time.

continuous receiver
A GPS Receiver which has from five to twelve channels used in environments that are highly dynamic or require high accuracy.

control segment
A worldwide network of GPS monitoring and control stations that ensure the accuracy of satellite positions and their clocks.

cross-track error
A measure of the distance of an aircraft from its desired track; usually in nautical miles.

data message
A 1500-bit message included in the GPS signal that reports the satellite's location, clock corrections, and condition. Included is rough information on the other satellites in the constellation.

desired track
The track between the origin and destination waypoints relative to the current position. Aircraft HSI's OBS (OMNI bearing selector) or HDG bug should be set to match the desired track.

differential positioning
Precise measurement of the relative positions of two receivers tracking the same GPS signals.

Dilution of Precision
The multiplicative factor that modifies range error. It is caused solely by the geometry between the user and the set of satellites used. Known as DOP, GDOP or PDOP.

Doppler-aided
A signal processing strategy that uses a measured Doppler shift to help the receiver smoothly track the GPS signal. Allows more precise velocity and position measurement.

Doppler shift
The apparent change in the frequency of a signal caused by the relative motion of the transmitter and receiver. Doppler shift measurements provide extremely accurate velocity measurements.

ephemeris data
Predictions of current satellite positions that are transmitted to the user in the data message.

field
A part of the Navigator's LED display that contains one discrete piece of information; for example, one letter of an identifier, or the bearing to a waypoint.

frequency band
A particular range of frequencies.

frequency spectrum
The distribution of signal amplitudes as a function of frequency.

function keys
The Navigator's —D-> (DIRECT), ENT, and MSG keys.

GPS
Global Positioning System; a satellite-based navigation system.

great circle
The shortest distance between two points on the earth's surface.

ICAO
International Civil Aviation Organization; assigns identifiers to waypoints throughout the world. The Navigator uses these identifiers for international waypoints; it uses FAA identifiers for waypoints in the continental U.S.

identifier
The FAA code or ICAO code that identifies an Airport, VOR, NDB, or Intersection.

intersection
The crossing of two VOR radials or victor airways.

ionosphere
The band of charged particles 80-120 miles above the earth's surface.

ionospheric refraction
The change in the propagation speed of a signal as it passes through the ionosphere.

L-band
The group of radio frequencies extending from 390 MHz to 1550 MHz. The GPS carrier frequencies (1227.6 MHz and 1575.42 MHz) are in the L-band.

LCD
Liquid Crystal Display, used in the Navigator's display.

LSEA
Lowest Safe Enroute Altitude.

MEA
Minimum Enroute Altitude.

MESA
Minimum Enroute Safe Altitude to destination waypoint, allowing at least 1000 feet of clearance over the highest terrain.

mode keys
The NAV, WPT, FPL, CALC, AUX, and APT/VOR keys on the Navigator, which determine the mode in which it is operating.

MSA
Minimum Safe Altitude calculated for present position, allowing at least 1000 feet over highest terrain and obstacles in current geographic sector..

multi-channel receiver
A GPS receiver that can simultaneously track more than one satellite signal.

multiplexing channel
A channel of a GPS receiver that can quickly sequence through a number of satellite signals.

NDB
Non-Directional Beacon.

P-code
The Precise or Protected code. A very long sequence of pseudo-random binary biphase modulations on the GPS carrier at a chip rate of 10.23 MHz, which repeats about every 267 days. Each one-week segment of this code is unique to one GPS satellite and is reset each week.

PDOP
See Dilution of Precision (DOP).

pseudo-random code
A signal with random-noise-like properties. It is a very complicated, repeating pattern of 1s and 0s.

pseudo-range
A distance measurement based on the correlation of a satellite-transmitted code and the local receiver's reference code, not corrected for errors in synchronization between the transmitter's clock and the receiver's clock.

satellite constellation
The arrangement in space of a set of satellites. The GPS constellation consists of 24 satellites in 6 orbital planes.

scroll
To move (characters) to the left across the LED display in order to show more information.

sequencing receiver
A receiver of less than five channels that collects GPS data by switching from one satellite to the next in sequence.

space segment
The part of the whole GPS system that is in space (i.e., the satellites).

spread spectrum
A system in which the transmitted signal is spread over a frequency band much wider than the minimum bandwidth needed to transmit the information. This is done by modulating with a pseudo-random code (for GPS).

static positioning
Location determination when the receiver's antenna is presumed to be stationary in the earth. This allows the use of various averaging techniques that improve accuracy by factors of over 1000.

TK
Track, the actual magnetic course.

true altitude
Altitude above mean sea level.

user interface
The way a receiver conveys information to the person using it; the controls and displays.

user segment
The part of the whole GPS system that includes the receivers of GPS signals.

UTC
Coordinated Universal Time.

VNAV
Vertical Navigation; the ability to establish a vertical descent profile. The Navigator provides for a VNAV calculation and provides vertical guidance information to the pilot.

VOR
Very High-Frequency Omnidirectional Range transmitter used for aircraft navigation.

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Trimble 1000DC Navigator

Quick Reference Card

Selecting a Destination

- Press the [WPT] key to access the WPT mode and select a waypoint category.
- Use the selector knobs to rotate through the database and locate the destination waypoint.
- Press the [-D-] key twice.

Correcting Cross-Track Errors

- Press the [-D-] key twice.
- Steer towards the "needle".

Locating Waypoints by Identifier/City Name

- Press the [WPT] key to access the WPT mode and select a waypoint category.
- Press the [ENT] key.
- The first letter of the waypoint identifier will flash. Use the large selector knob to move the cursor to the other letters of the waypoint identifier, or the first letter of the waypoint city name.
- Turn the small selector knob to enter the correct letters in the waypoint identifier or city name fields.
- Turn the large selector knob to move from one character to the next.
- Press the [ENT] key when the correct identifier or city name is displayed to review the database information.

or

- Press the [-D-] key twice to begin navigating to this destination.

(Continued)

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Trimble 1000DC Navigator

Quick Reference Card

Navigating to the Nearest Airport

- Press the [APT/VOR] key.
- Turn the small selector knob to select one of the 20 nearest airports.
- Press the [-D-] key twice to begin navigating to this destination.

Creating Waypoints

- Press the [WPT] key until the User category is displayed.
- Turn the large selector knob to display the "Add Waypoint" message.
- Press the [ENT] key.
- Use the selector knobs to enter the waypoint name.
- Press the [ENT] key to complete the entry.
- Turn the large selector knob to display the "LAT/LON?" or "WPT + RNG & BRG?" message.
- Press the [ENT] key.
- Use the selector knobs to enter the waypoint latitude and longitude or range and bearing from an existing waypoint.
- Press the [ENT] key to complete the entry.

Adjusting Screen Contrast (only after Power-Up)

- Press the [AUX] key four times.
- Rotate the small, inner selector knob clockwise twice.
- Press the [ENT] key.
- Use the large, outer selector knob to adjust the screen contrast.
- Press the [ENT] key to complete the entry.

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