KLN 89
KLN 89B

Pilot's Guide

Bendix/King®
GPS Navigation Systems

ORS 01/02

Honeywell

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KLN 89/89B Pilot's Guide

006-08786-0000

for KLN 89 and KLN 89B

with

Operational Revision Status
ORS 01 and 02

IMPORTANT: Special installation procedures must be followed in order for the KLN 89B to be certified for IFR En route, Terminal and Non-precision Approach use. If these procedures are followed, the KLN 89B can be used for IFR use. Consult the KLN 89B Flight Manual Supplement for the operating limitations of this unit.

September 2002

IMPORTANT:

This Pilot's Guide covers both the KLN 89 (VFR only) and KLN 89B (IFR approved for Enroute, Terminal, and Non-precision Approach phases of flight). There are numerous places throughout this guide which discuss features and operational characteristics which specifically apply to KLN 89B, and not to KLN 89. These parts of the Pilot's Guide refer specifically to KLN 89B, and often are marked with a double dagger symbol (‡). Likewise, chapter 5, "Approaches and SID/STARs" applies only to KLN 89B. For features that apply to both KLN 89 and KLN 89B, a generic reference to "KLN 89(B)" is used.

NOTE: A "whiskers" border is used around data on some of the figures in this Pilot's Guide to indicate that the data inside the border is flashing.

WARNING: The KLN 89 and KLN 89B display GPS-derived altitude on the OTH 1 page. Do not use the GPS-derived altitude for navigation. Due to Selective Availability position degradation and other factors, the GPS altitude is normally 300 feet or more in error, which is unacceptable for vertical navigation.

Revision History and Instructions

Manual   KLN 89/KLN 89B Pilot's Guide

Revision   5, September 2002

Part Number   006-08786-0000

This revision contains the following changes:

Changed AlliedSignal to Honeywell throughout.

Editorial Corrections:	Inside Front Cover, Title Page, R-1 through R-4, 3-26, 3-56, 4-11, 4-37 Back Cover
Database Change:	Database Card, 2-0, 2-1, 2-6, 3-6
SET 2 Corrections:	3-9, 3-60, 3-61, 4-47
Misc. Corrections:	4-29, 5-20, 5-22, B-5, B-6, C-1, D-2

Revision History and Instructions

Manual   KLN 89/KLN 89B Pilot's Guide

Revision   4, May 1998

Part Number   006-08786-0000

This revision contains the following changes:

Text corrections to pages 3-64, 3-66, 4-47, and B-5.
Figure 3-196 changed to show new software numbering display
        and the addition of the database number.
Added statements explaining the double dagger (‡) symbol to
        pages B-1 and C-1.
Added more description to APT, CAL, NAV, OTH and SET page
        listings in the index.

Revision History and Instructions

Manual   KLN 89/KLN 89B Pilot's Guide

Revision   3, March 1997

Part Number   006-08786-0000

This revision corrects a typographic error on page 4-47.

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INTRODUCTION

Congratulations for choosing the Bendix/King KLN 89 or KLN 89B GPS! Celestial navigation will now be a way of life for you. The phenomenal accuracy of GPS, along with the KLN 89(B)'s user-friendly operation and graphics display will make flying a delight. Not only will the KLN 89(B) help you to navigate more easily and more accurately, its trip planning features, air data calculations, and other useful features will make you feel like you're flying with a true flight management system.

In addition, KLN 89B may be IFR approved for En route, Terminal, and Non-precision Approach operations. We think you'll find that having an abundance of navigational data (not to mention a moving map!) available to you will make non-precision approaches more precise and more enjoyable.

This Pilot's Guide will be of great help to you. It is written in plain, simple English and it assumes you are not an experienced user of GPS or other type of long range navigation equipment. If you are experienced, so much the better. This Pilot's Guide also includes hundreds of sample screen figures and other illustrations to make your learning easier. It is designed so that you can start at the front and progress in the order presented; however, you may want to skip around and learn things in your own order. Also, on page iv, there is an index of frequently used procedures which will help you find the page that describes how to do exactly what you want to do. There are also several appendices in the back of the manual that you may find useful from time to time.

Be sure to keep this Pilot's Guide handy with you in the airplane. It is designed to fit easily in the glove box, or in the seat pocket. The KLN 89(B) is very simple to operate, but the Pilot's Guide can sure be of help to you.

One last thing. Don't get so involved in learning to use the KLN 89(B) that you forget to fly the airplane. Be careful, and remember to keep a close eye out for other aircraft.

KLN 89(B) SNEAK PREVIEW

If you absolutely can't wait to use your KLN 89(B) until you've read this Pilot's Guide, this section is for you. This page will teach you just enough to get going and then learn by doing. This operational pre-view assumes the KLN 89(B) has been properly installed, the unit was previously operational in the same general geographical loca-tion, and that no peripheral equipment interfaced with the KLN 89(B) (such as external HSIs, CDIs, autopilots, moving map display, etc.) is to be used at this time. If you are using this operational preview in flight, do so only in good VFR conditions and only with an alternate means of navigation (including pilotage) available to cross-check position.

1. Turn the unit on with the On/Off knob (the small knob in lower left hand corner).

2. For a few seconds, the Power On Page is displayed while the unit runs a self-test. Afterwards, the Self-test Page is displayed. If the KLN 89(B) is receiving an altitude from an encoding altime-ter, the present indicated altitude will be displayed on line 2. The bottom line should display **Pass** and a flashing **Ok?**. Press the ENT button to approve the Self-test Page.

3. The Initialization Page will now be displayed. If the date and time are incorrect by more than 10 minutes, refer to section 3.2 of this Pilot's Guide. The right side of the screen should show the identi-fier of the nearest airport to the initial position, along with a radial and distance from that airport waypoint. Press ENT with the cur-sor flashing over **Ok?** to approve the Initialization Page.

4. If you are using a KLN 89, or your KLN 89B has been configured for VFR use only, the VFR page will now be displayed to notify you of the VFR limitation. Press ENT to approve this page.

5. The Data Base Page is now displayed showing the date the data base expires or the date it expired. Press ENT to acknowledge the information displayed on this page.

6. The next page displayed will probably be a page showing the VHF communication frequencies for the airport you are at. For now, use the right outer knob to turn to the NAV page type (watch the lower left corner of the screen and the small bar at the bottom to know when you are there). Then use the right inner knob to select the NAV 2 page if not already there. The NAV 2 page shows your present position relative to a nearby VOR. Verify that this position is correct before proceeding.

7. Press the ⎯⊕⎯ button. A page with the words **DIRECT TO** is now displayed on the screen.

In step 8 you will enter the ICAO identifier of the airport. The identifier will have a "K" prefix for a Continental U.S. airport, a "C" prefix for a Canadian airport, or a "P" prefix (in some cases) for an Alaskan airport if the identifier is all letters. For example, LAX becomes KLAX. For these countries if the identifier contains any numbers, there is no prefix. For example, TX04 is entered TX04. For other areas of the world the airport identifier should be entered identically to how it is charted.

8. Rotate the right inner knob until the first character of the airport identifier is displayed. Turn the right outer knob one step clockwise to move the flashing segment to the second character position. Rotate the right inner knob to select the second character of the identifier. Use this procedure to enter the complete airport identifier.

9. Press ⎡ENT⎤. The display will change to a page showing the identifier, name, city, and state/country of the airport just entered. Confirm that the correct airport is displayed. Press ⎡ENT⎤ a second time to approve the airport data.

10. A Navigation page (specifically the NAV 1 page) is now on the screen. It displays the desired ground track, actual ground track, bearing, and ETE to the destination airport. In addition, it displays a course deviation indicator (CDI).

See—wasn't that easy?

HOW-TO INDEX

This index will help you quickly find important procedures at a glance. The list is alphabetized by action words.

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KLN 89(B) SYSTEM

———— REQUIRED FOR ALL INSTALLATIONS

—·—· REQUIRED FOR IFR APPROACH INSTALLATIONS (OF KLN 89B)

········ OPTIONAL

HEADING
RS-232 INPUT

COMPATIBLE FUEL MANAGEMENT SYSTEM
RS-232 INPUT

COMPATIBLE AIR DATA COMPUTER
RS-232 INPUT

ALTITUDE
GRAY CODE

AIRCRAFT POWER
11-33V

KA 92 GPS ANTENNA

RS-232 OUTPUT

LEFT/RIGHT D-BAR

SELECTED COURSE

MOVING MAP DISPLAYS

GPS APR

WPT ALERT MESSAGE

KI 229

RMI

OR

KNI 582

AUTOPILOT

KI 525A

HSI

OR

KI 206

CDI

REMOTE ANNUNCIATORS

REMOTE SWITCH/ ANNUNCIATOR

1-0

1. KLN 89(B) SYSTEM COMPONENTS

A basic KLN 89(B) system consists of a panel mounted KLN 89(B) GPS and a KA 92 GPS antenna. An altitude input is required to obtain full navigation and operational capabilities. Additional system components may be added or interfaced to the KLN 89(B) which increase its features and capabilities. Some of these optional components include an external course deviation indicator (CDI) or horizontal situation indicator (HSI), autopilot, and external annunciators. Typically, an altitude input, an external indicator, and external annunciators are required for IFR approach certification.

The KLN 89(B) panel mounted unit contains the GPS sensor, the navigation computer, a Gas Plasma Discharge Display, and all controls required to operate the unit. It also includes the data base card which slides into the left side of the front panel.

The KA 92 GPS "patch" antenna is available for use with the KLN 89(B). It is designed to always be mounted on the top of the aircraft.

The KLN 89(B) has analog outputs to drive the left-right deviation bar of most mechanical CDIs and HSIs. In addition, the NAV mode of the Bendix/King KFC 150, KAP 150, KAP 150H, KAP 100, KFC 200, KAP 200, KFC 250, KFC 275, KFC 300, and KFC 325 flight control systems may be coupled to the KLN 89(B). Many other autopilots may also be coupled to the KLN 89(B). Actual autopilot performance and capability when coupled to the KLN 89(B) may vary significantly from one autopilot model to another.

Altitude may be provided to the KLN 89(B) from an encoding altimeter or blind encoder. Altitude is used as an aid in position determination when not enough satellites are in view.

All IFR installations require remote annunciators to be mounted in the aircraft panel in order to select and indicate the status of certain KLN 89(B) functions. En route and terminal IFR certifications require annunciators for message (MSG) and waypoint alert (WPT). Non-precision approach certifications also require a switch/annunciator to select and display when the approach mode is armed or active.

Each KLN 89(B) system includes a configuration module which is attached to the KLN 89(B) mounting rack. The module allows the KLN 89(B) to be configured for the unique characteristics of your equipment installation. Parameters that are set by the configuration module include:

- ‡ Whether the KLN 89B may be used for IFR operations or not, and if it may be used for non-precision approach IFR operations. KLN 89 may only be used for VFR navigation.

- Whether or not the altitude alert function in enabled. See section 4.3.

- Whether or not an external fuel management system is interfaced to the KLN 89(B). See section 4.8.

- Whether or not an external air data computer is interfaced to the KLN 89(B). See section 4.9.

- The conditions for the aircraft bus voltage alert to activate. See section 3.16.

The configuration information is stored both in the module and in the KLN 89(B) internal memory. If the KLN 89(B) detects a difference between the configuration stored in the module and the configuration stored in the internal memory (which should only occur following the exchange of KLN 89 or KLN 89B units), the configuration information will automatically be updated to the configuration specified in the configuration module.

If an error is detected in the configuration data, a warning page stating **Configuration Mem Error** will be displayed during the KLN 89(B) start-up sequence, and the configuration memory will be set to arbitrary default values. See an authorized Honeywell Service center to correct the configuration memory error.

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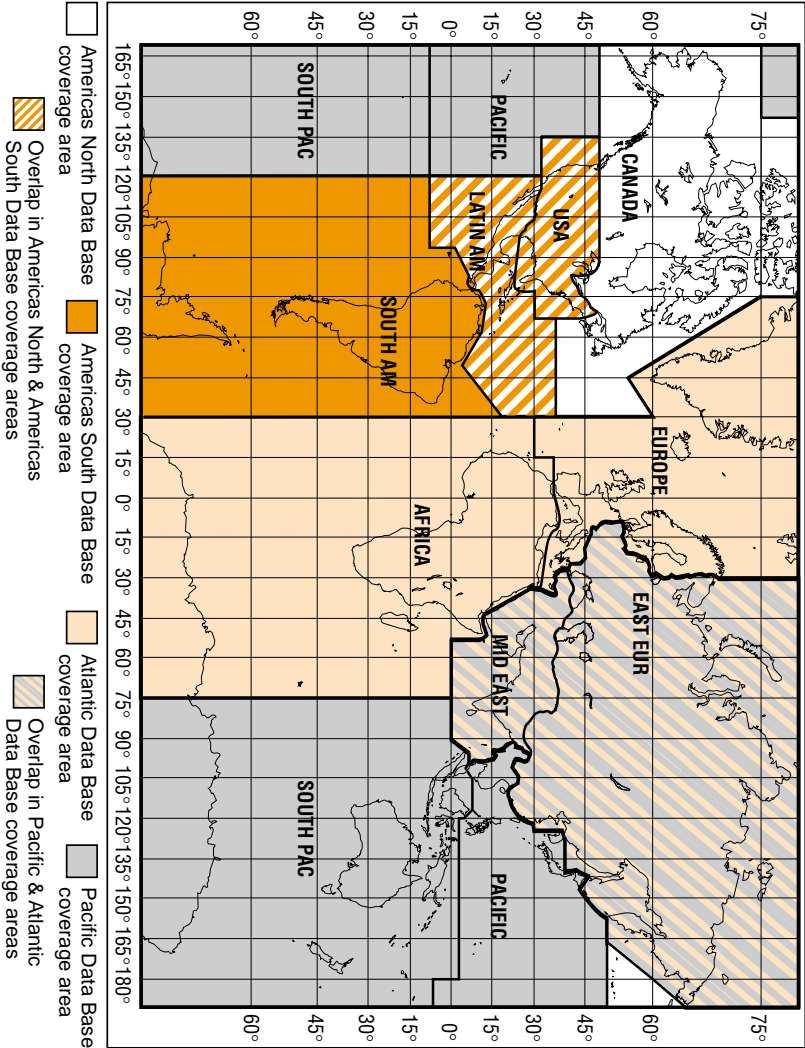
Figure 2-1 KLN 89(B) Data Base Geographical Region

2. DATA BASE

2.1. DATA BASICS

The data base provides two primary functions. First, it makes pilot interface with the GPS sensor much easier. Rather than having to manually look up and then enter the latitude and longitude for a specific waypoint, it allows you to merely enter a simple waypoint identifier. The data base automatically looks up and displays the latitude and longitude associated with the identifier. It should be obvious that the data base saves a lot of tedious latitude/longitude entry and also greatly reduces the potential for data input mistakes.

The second function of the data base is that it serves as a very convenient means to store and easily access aeronautical information. Want to know the name of the airport, the nearest city, or the airport elevation? Just unleash the power of the KLN 89(B) and display the information right on the screen.

‡Thirdly, the KLN 89B data base stores non-precision approaches in their proper sequence. This allows you to select an approach as a whole, rather than entering the approach waypoint by waypoint.

2.2. DATA BASE CONTENTS AND COVERAGE AREAS

There are four data base coverage areas available for the KLN 89(B). They are referred to as the "Americas North" data base, the "Americas South" data base, the "Atlantic" data base, and the "Pacific" data base.

The International Civil Aviation Organization (ICAO) and Aeronautical Radio, Inc. (ARINC) break the world into the ten geographic regions shown in figure 2-1. The KLN 89(B) Americas North data base contains aeronautical information for the group of ICAO regions consisting of Canada, USA and Latin America. The KLN 89(B) Americas South data base contains aeronautical information for the group of ICAO regions consisting of USA, Latin America and South America. The KLN 89(B) Atlantic data base provides information for the ICAO regions Europe, Africa, East Europe, and Mid East. Likewise, the Pacific data base contains information for East Europe, Mid East, Pacific, and South Pacific.

The following is a listing of the KLN 89(B) data base contents:
AIRPORTS
Identifier
Name
City, State or Country
Use type (if heliports, military, or private)
Latitude and Longitude
Elevation
Runway numbers, lengths, surfaces, and lighting
Fuel availability
Approach types available (precision, non-precision, or none)
Radar approach/departure environment
Time difference relative to UTC.
Communication frequencies:
    ATIS
    Clearance delivery
    Tower
    Ground control
    Unicom
    Multicom
    Approach (IFR)
    Departure (IFR)
    Class B, Class C, TRSA, CTA, TMA (VFR)
    Center (when used for approach)
    Arrival
    Radar
    Director
    AWOS (automatic weather observing station)
    ASOS (automatic surface observation system)
    AAS (aeronautical advisory service)
    AFIS (aerodrome flight information service)
    ATF (aerodrome traffic frequency)
    CTAF (common traffic advisory frequency)
    RDO (radio frequency)
    MF (mandatory frequency)
    Ramp control
    PCL (pilot-controlled lighting)

VORs
Identifier
Name
Frequency
Latitude and Longitude
Magnetic variation

NDBs
Identifier
Name
Frequency
Latitude and Longitude
(Note - Outer Compass Locators are stored as Intersections)

Intersections (low altitude, high altitude, SID/STAR, approach, and outer markers)
Identifier
Latitude and Longitude

‡SID/STAR/Approach Procedures (KLN 89B only)
All compatible pilot-nav SID/STAR procedures

Non-precision approaches (except localizer, LDA (Localizer Directional Aid), SDF (Simplified Directional Facility)) approved for GPS overlay use. Includes all public GPS-only approaches.

Miscellaneous
Air Route Traffic Control Center (ARTCC and FIR) frequencies

Flight Service Stations (location of points of communication and associated frequencies)

Minimum Safe Altitudes

Special Use Airspace (SUA) boundaries (Prohibited, Restricted, Alert, Class B, Class C, CTA, TMA, TRSA, Caution, Danger, MOA, Training, Warning)

500 USER DEFINED WAYPOINTS
Identifier
Latitude and Longitude

2.3. ICAO IDENTIFIERS

Waypoints are stored in the KLN 89(B) database almost exclusively by their ICAO identifiers. ICAO (International Civil Aviation Organization) is an internationally accepted reference for the data. In almost all cases the proper ICAO identifiers may be taken directly from Jeppesen-Sanderson or NOS aeronautical charts.

Airport identifiers in the contiguous United States, Alaska, and Canada are special cases in the ICAO system. Many airport identifiers for these areas have four letters beginning with a prefix letter that corresponds to the geographic area in which it is located. The prefix letter for the contiguous U.S. is "K". Thus, the identifier for Dallas/Fort Worth International Airport is KDFW, not DFW (which would be identical to the VOR identifier). Likewise, the identifier for Orlando Executive Airport is KORL while the VOR identifier is ORL. The prefix letter for Canada is "C" and for Alaska is "P".

NOTE: There are several exceptions in Alaska. In many cases, airports with three letter identifiers receive the prefix "P", but there are many that don't. The most reliable method of determining an Alaska airport identifier is to look it up from the airport name or city. See section 3.7.4, "Selecting Waypoints by Name or City".

Incidentally, you can program the KLN 89(B) to default to a certain letter (such as "K") when you are entering a waypoint identifier. See section 3.4.2, "Data Entry" to learn about this handy feature.

Not all airport identifiers receive the prefix letter. Airport identifiers which are combinations of letters and numbers do not apply to the prefix rule. Examples of airport identifiers not using the prefix are 3C2, 7TX6, and M33.

So remember, if you are entering or looking for an airport identifier that is all letters (no numbers) then it will begin with a "K" prefix in the contiguous U.S., a "P" in Alaska (in some cases), or a "C" in Canada. If there are numbers in the identifier then a prefix is not used. For other areas of the world the airport identifier stored in the KLN 89(B) data base is identical to how it is charted.

2.4. UPDATING THE DATA BASE

The information stored in the data base would eventually become obsolete if there wasn't some means to update it. For example, new airports open, navaids can move or change frequency, communication frequencies can change, and on and on.

‡Additionally, by FAA regulation, you are required to have a current data base in order to use the KLN 89B for a non-precision approach.

The data base is contained in a small card which plugs into the left side of the KLN 89(B) front panel. It is designed so that there are two ways for the user to easily keep the data base current. The first is to electronically update the data base by means of a 3.5-inch diskette supplied by Honeywell and an IBM-compatible personal computer. This method does not have to involve removing the KLN 89(B) from the aircraft's instrument panel. A jack, usually mounted in the air-craft's instrument panel, provides a means of interfacing the KLN 89(B) with the computer via an interface cable. The diskettes are not returned to Honeywell.

The second method of data base update is to remove the old card and insert a current card. This method involves returning the old card to Honeywell.

Every 28 days, Honeywell receives new NavData™ information from Jeppesen Sanderson. This information is processed and down-loaded onto both diskettes and data base cards. Honeywell makes these two types of update services available to you in a choice of several subscription or random update programs. See section 2.6 for details on these programs.

NOTE: Honeywell sends the update so that it arrives prior to the next effective date. The new update may be installed any time prior to the effective date and the KLN 89(B) will use the previous data up to the effective date and automatically begin using the new data on the effective date.

WARNING: The accuracy of the data base information is only assured if it is used before the end of the effectivity period. Use of out of date data base information is done entirely at the user's own risk.

2.4.1. COMPUTER UPDATING OF THE DATA BASE

Update information is sent to you on 3.5" disks. In order to use the update program you must have access to a computer having a disk drive capable utilizing 3.5-inch 1.44 megabyte high density diskettes. This computer also needs to have an available COM 1 or COM 2 ser-ial port. If you wish to perform updates in the cockpit, an optional PC Interface kit must be used. Included in the kit is an interface cable that plugs into both the computer and into the data loader jack. The data loader jack is included with the KLN 89(B) installation kit and is typically installed in the aircraft's instrument panel.

Data Base
Chapter 2

CAUTION: The data base must be updated only while the air-craft is on the ground. The KLN 89(B) does not perform any navigation function while the data base is being updated. Since a data base update takes approximately 5 minutes it is a good idea to turn off all electrical equipment on the aircraft except for the KLN 89(B) to avoid running down the aircraft battery.

NOTE: The diskettes sent to you can only be used to update one KLN 89(B), although they can update that specific unit numerous times. The first time the diskettes are used in an update operation, a unique identification code from the KLN 89(B) being used is uploaded to the diskettes. These diskettes may be used in this specific KLN 89(B) an unlimited number of times which could be required if you switch back and forth between the Americas North, Americas South, Atlantic, and Pacific data bases during one update cycle. These diskettes may not, however, be used to update other KLN 89(B)s. This update protection ensures that Jeppesen Sanderson is properly compensated for the use of their NavData™.

To update the KLN 89(B) data base by computer:

1. Plug the 9 pin female connector end of the interface cable into a COM serial port of the computer. If the computer has COM 1 and COM 2 serial ports, either may be used. Some computers use a 9 pin COM serial port connector while other computers use a 25 pin connector. If the computer being used has a 9 pin connector, the interface cable connector will plug directly into the computer's 9 pin connector. If the computer's COM serial port uses a 25 pin connector, use the 25 pin to 9 pin adapter included in the PC interface kit to adapt the interface cable's connector to the computer's connector.

2. If you are using the PC interface kit in the cockpit, plug the other end of the interface cable (4 conductor male connector) into the data loader jack that is mounted in the aircraft panel.

3. Insert the diskette into the computer's disk drive. Turn on the computer being used for the data base update. The program on the disk will automatically "boot" (load) and the computer screen will display "**Ready**" when the computer is ready to continue with the data base update operation.

4. Turn on the KLN 89(B). Press $\boxed{\text{ENT}}$ as required to approve the Self Test, Initialization, and Data Base pages. Use the right outer knob to select the Setup (SET) type pages and the right inner

knob to select the SET 3 page
(figure 2-2).

*NOTE: The database key is shown
on the SET 3 page for ORS 02 soft-
ware only.*

Figure 2-2

5. Press CRSR. **Update Pub DB?** will
    now be flashing as in figure 2-3.

6. Press ENT. The estimated load
    time in minutes is now displayed
    (figure 2-4).

Figure 2-3

*NOTE: In step 6, repeatedly pressing
>CLR will terminate the update process
and bring the display back to the orig-
inal SET 3 page shown in figure 2-2.*

Figure 2-4

7. Press ENT to acknowledge the
    estimated load time and begin
    the erasing of the existing data
    base. The unit will now display
    Erasing data base. After the
    data base has been erased, the
    loading of the new data automati-
    cally begins. As the new data is
    being loaded, the percentage of
    transfer is displayed (figure 2-5).
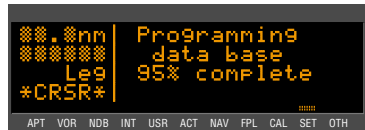
Figure 2-5

8. The KLN 89(B) will indicate when
    the data base update is complete
    as shown in figure 2-6. You may
    either turn the KLN 89(B) off at
    this point or press ENT to restart
    the KLN 89(B).

Figure 2-6

Data Base
Chapter 2

9. Remove the interface cable. Remove the disk from the computer.
    Turn off the computer.

The chances are small of having difficulty updating the data base
but—

If you have a problem:

•   First check that the interface cable is properly connected and that
    the computer is turned on. If there is a problem with the connec-

tion or the computer, the KLN 89(B) will display **Data Loader Not Ready**. When the problem is corrected this prompt is removed and the update operation can continue from where it left off.

- If an internal test fails after the data has been loaded, the KLN 89(B) will display **Checksum Error, Data Base Invalid**. Press ENT to acknowledge. The KLN 89(B) will then display **Data Base Update Failed, Retry?** Use the right outer knob to position the cursor over the desired choice and press ENT .

- There are other error messages that may be displayed. If you have a problem that you can't resolve, write down any error messages to aid your Honeywell Service Center in identifying the problem.

2.4.2 CARD EXCHANGE UPDATING OF THE DATA BASE

Having the front-loading data card makes KLN 89(B) very easy to update the data base by exchanging cards.

Enclose the expired data base card in the mailer that the new card was sent to you in. A return shipping label is included in the mailer. Please affix this label to the outside of the mailer. Also, peel off the protective backing from the adhesive on the end flap of the mailer. Press the flap against the adhesive to seal the container.

Please return the expired card promptly by mailing immediately at any mailbox. No postage is required if mailed from within the U.S. Users will be billed for cards not returned and no additional cards will be sent until either the expired card or payment for the expired card is received.

2.5. USER DEFINED DATA BASE

In addition to the published data base of airports, VORs, NDBs, and Intersections stored in the Jeppesen data base, you may create up to 500 other user-defined waypoints. Section 4.6, "Creating User-defined waypoints" describes this further.

The KLN 89(B) contains an internal lithium battery that is used to "keep-alive" the user-defined data base as well as flight plans. This battery has a typical life of three to five years. It is highly recommended that the battery be replaced every three years at an authorized Honeywell Service Center.

2.6. DATA BASE UPDATE SERVICE OPTIONS

The following tear-out page can be used for ordering Americas, Atlantic, and Pacific data base update services from Honeywell. The forms may be mailed or FAXed for your convenience.
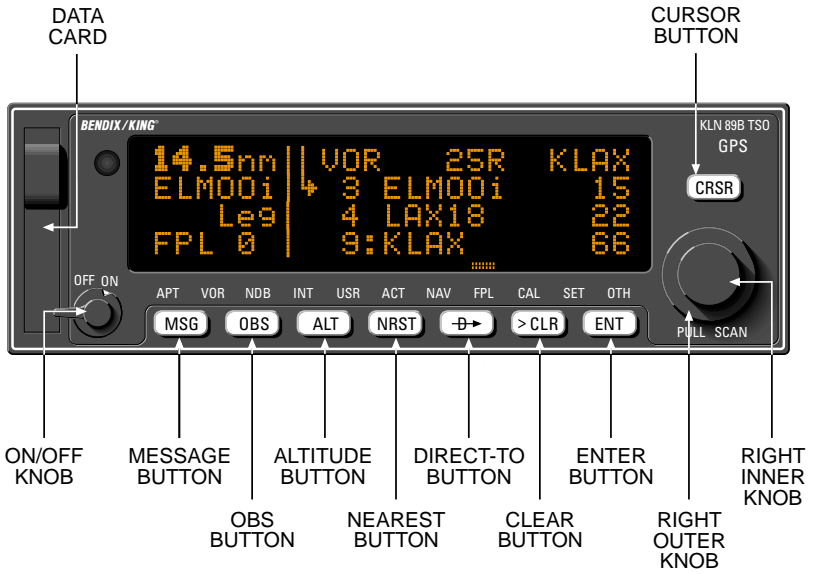
Figure 3-1 KLN 89(B) Controls

3. BASIC GPS OPERATION

3.1. COVERAGE AREA

The KLN 89(B) was designed to provide worldwide navigation coverage from North 74° latitude to South 60° Latitude (figure 3-2). Outside this area, magnetic variation must be manually entered as discussed in section 4.10, "Operation Outside the Primary Coverage Area".   See section 2.2 for the data base geographical regions.
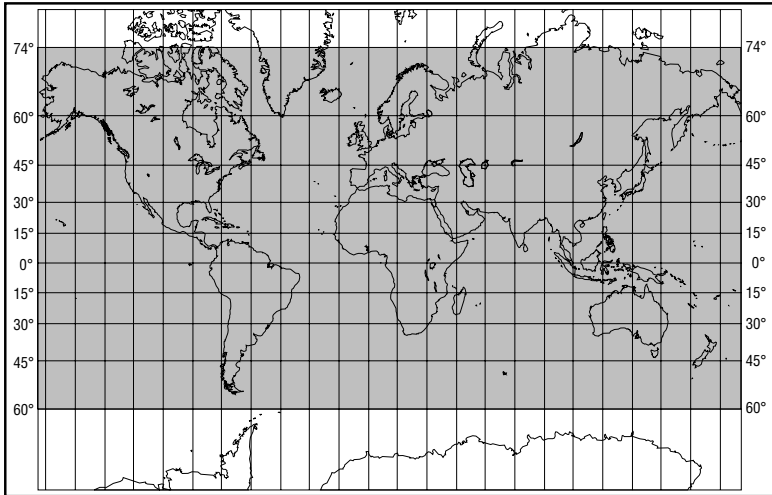
Figure 3-2 KLN 89 Navigation Coverage Area

3.2. TURN-ON AND SELF TEST

Well, it's time to get down to business and actually use the KLN 89(B)! Figure 3-1 can be folded out and used as a reference during the following procedures. This is especially handy if you're learning while away from your GPS. The steps below take a lot of words to explain, but before you know it, you will be "flying" through them.

NOTE: *When power is applied to the KLN 89(B) it always "wakes up" in the Leg mode. Only the Leg mode is described in this chapter. In this mode the KLN 89(B) performs great circle navigation (the shortest distance between two points located on the earth's surface). The course deviation output displayed on the unit's internal course deviation indicator (CDI) and provided to an external horizontal situation indicator (HSI) or CDI is five nautical miles (full scale sensitivity) left and right in Leg mode. The other modes are described in section 4.7 and chapter 5.*

3-1

To turn on and initialize the KLN 89(B):

1. Turn on the KLN 89(B) by turning the small power knob clockwise.

   The Power-On page (figure 3-3) will be displayed for a few seconds. During this time, the KLN 89(B) performs an extensive internal test. The operational revision status (ORS) level number in the upper right corner of

Figure 3-3

the display should match the ORS level indicated on the cover of this Pilot's Guide .
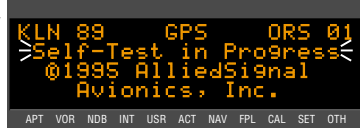
   When the internal test is complete, the Power-On page will automatically be replaced by the Self Test page (figure 3-4).

Figure 3-4

NOTE: If the KLN 89(B) is operating in the Take-Home Mode, the Take-Home Warning Page (figure 3-5) is displayed first and must be acknowledged by pressing ENT *. See section 4.11 for more information on the Take-Home mode.*

Figure 3-5

NOTE: If the data base card is not installed in the KLN89(B), a page will be displayed as in figure 3-6. Turn the KLN 89(B) unit power back off, and replace the data base card in the left side of the front panel. Once the card is in place, you may apply power once again and the unit will operate properly.

Figure 3-6

2. Verify that the data displayed on the Self Test page is the same as is being displayed on the appropriate equipment in the aircraft which is interfaced to the KLN 89(B). If the KLN 89(B) is not connected to any other equipment in the aircraft, you may skip to step 3.

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The distance field in the upper left corner always displays **34.5 nm** (or **63.9 km**). If the KLN 89(B) is interfaced to a compatible indicator that displays DME distance, the indicator should be displaying 34.5 nautical miles.

If the KLN 89(B) is interfaced with a NAV indicator such as an HSI or a course deviation indicator (CDI), the deviation bar (D-bar) should be indicating a half scale deviation to the right. The TO/FROM indicator should be showing FROM.

If the KLN 89(B) is interfaced with a NAV indicator such that the KLN 89(B) can "read" the selected course from the NAV indicator, then the **OBS** field should display the same selected course as on the NAV indicator.

The **RMI** field always displays 130 degrees. If the KLN 89(B) is connected to a compatible RMI in the aircraft, the RMI should indicate a bearing to the station of 130 degrees.

If any of the above checks fail, do not use the associated indicator with the KLN 89(B).

3. If the KLN 89(B) has passed the internal self test, the bottom of the Self Test page will display **Pass** and all external annunciators should be illuminated. If instead, **Fail** is displayed, recycle power to the KLN 89(B). If the Self Test page still displays **Fail**, the KLN 89(B) requires repair and should not be used for navigation.

4. When you are ready to approve the Self-test page, press the ENT button while the **Ok?** is flashing. If it happens not to be flashing, press the CRSR button and use the right outer knob to move the cursor there.

5. The next page displayed will be the Initialization page (figure 3-8). Verify that the date displayed in the top left corner of the Initialization page is correct. The KLN 89(B) has an internal battery

Figure 3-8

powered calendar/clock, so the date and time normally don't require setting. The battery has a life of approximately 3 years. In addition, the KLN 89(B)'s system date and time are automati-

cally updated very precisely when at least one satellite is being received. However, if for some reason the date or time are incorrect, it is necessary to enter the correct date or time so that the KLN 89(B) can reach the navigation mode quickly. The date should be correct and the time should be correct within ten minutes so that the KLN 89(B) will start looking for the correct satellites.
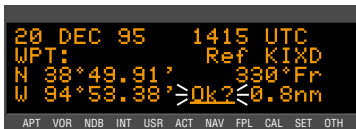
If the date is incorrect, rotate the right outer knob counterclockwise until the cursor is over the entire date field (figure 3-9). Rotate the right inner knob until the correct day of the month is displayed (figure 3-10). Then, move the cursor to the month field by rotating the outer knob one click clockwise and change the month as necessary. Use the same methods to select the correct year (figure 3-11). When the date is correct, press ENT.

Figure 3-9

Figure 3-10

Figure 3-11

6. Verify that the time displayed in the upper right corner of the Initialization page is correct to within ten minutes of the actual time. Remember, once the KLN 89(B) receives the first satellite, it will automatically be very accurately updated by the satellite to the correct time. However, you are responsible for assuring the desired time zone is selected on the KLN 89(B). If it is necessary to reset the time, position the cursor over the time zone field (figure 3-12) and select the desired time zone (figure 3-13).

Figure 3-12

Figure 3-13

3-4

The KLN 89(B) is capable of displaying the following time zones:

UTC   Coordinated Universal Time (Zulu)
GST   Greenland Standard Time (UTC - 3)
GDT   Greenland Daylight Time (UTC - 2)
ATS   Atlantic Standard Time (UTC - 4)
ATD   Atlantic Daylight Time (UTC - 3)
EST   Eastern Standard Time (UTC - 5)
EDT   Eastern Daylight Time (UTC - 4)
CST   Central Standard Time (UTC - 6)
CDT   Central Daylight Time (UTC - 5)
MST   Mountain Standard Time (UTC - 7)
MDT   Mountain Daylight Time (UTC - 6)
PST   Pacific Standard Time (UTC - 8)
PDT   Pacific Daylight Time (UTC - 7)
AKS   Alaska Standard Time (UTC - 9)
AKD   Alaska Daylight Time (UTC - 8)
HAS   Hawaii Standard Time (UTC - 10)
HAD   Hawaii Daylight Time (UTC - 9)
SST   Samoa Standard Time (UTC - 11)
SDT   Samoa Daylight Time (UTC - 10)
LCL   Local Time Zone (user-defined)

You will be able to change the time zone any time you desire on several other pages, so don't worry if you're not sure which time zone to choose. UTC—Coordinated Universal Time (also called "Zulu") is always a safe choice.

The local time zone (LCL) is selected on the SET 2 page, and is defined to be a certain time offset from Zulu (UTC).

Once you have selected the desired time zone, position the cursor over the entire time field and select the correct hour with the right inner knob (figure 3-14). Since 24 hour time is used, be sure to add 12 if the time is after 1:00 P.M. (2:30 P.M. becomes 1430). Now move the cursor to
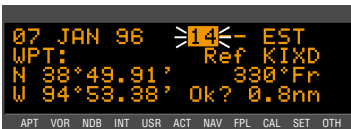
Figure 3-14

the tens of minutes position and select the desired value, and repeat this process for the last digit of the time field. When the correct time has been entered (figure 3-15), press ENT to start the clock running. Don't worry that you can't update the seconds. The KLN 89(B) system time will automatically be corrected very precisely once a satellite is received.

Figure 3-15

3-5
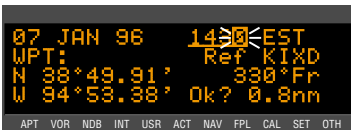
7. To aid the GPS receiver in acquiring your position, it helps to have a reasonable idea of where you are, and the Initialization page is where you have the chance to set this initial position. Check to see if the displayed initial position is where you actually are. This latitude/longitude is the last known position before the power was shut down the last time. Unless the unit has been moved since its last use, this position should be correct. On the right side of the screen will be the identifier of the nearest airport in the data base, with a radial and distance from that airport. If you need to change the initial position to—let's say—John F. Kennedy International (KJFK), move the cursor to the **WPT:** field and use the right inner knob to select a K as the first character of the identifier (figure 3-16). Move the cursor to the right one character and select a J and then right again to select an F. The final K should be filled in by the data base (figure 3-17). When you press ⌊ENT⌋, the latitude and longitude fields will change to those of KJFK (figure 3-18). If necessary, the latitude and longitude may be entered manually.

Figure 3-16

Figure 3-17
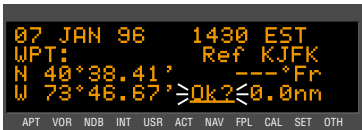
Figure 3-18

8. When all information on the Initialization page is correct, move the cursor to **Ok?** and press ⌊ENT⌋ to move on.

9. If the GPS is for VFR use only, the VFR page will be displayed to notify you of this.

10. The Data Base page will now be displayed with the cursor over **Acknowledge?**. Line 1 indicates whether an Americas North (Americas N), Americas South (Americas S), Atlantic, or Pacific data base is being used. If the data base is current, line 2 will show the date when the data base expires (figure 3-19). If, on the other hand, the data base is out of date, line 2 shows the date that it expired (figure 3-20). The

Figure 3-19

Figure 3-20

KLN 89(B) will still function with an out of date data base; however, you must exercise extreme caution and always verify that the data base information is correct before using information from an out-of-date data base. Press ⌐ENT⌐ to acknowledge the information on the Data Base page.

‡*NOTE: In some installations, KLN 89B is configured for use in IFR En route and Terminal operations, but not for non-precision approaches. If this is the case, line 3 will read **GPS Approaches Disabled** and you will not have access to approaches in the data base.*

WARNING: The accuracy of the data base information is assured only if the data base is current. Operators using an out-of-date data base do so entirely at their own risk.

*NOTE: If your KLN 89(B) is interfaced with a remote Shadin fuel/air data computer but no fuel flow indicator, the Fuel on Board page will be displayed following the Data Base page (figure 3-21). This page allows you to set the amount of fuel on board (FOB) and initializes the Other (**OTH**) 7 and 8 fuel planning pages. Possible units are gallons (**GAL**), pounds (**LB**), imperial gallons (**IMP**),*

Figure 3-21

*liters (**L**), or kilograms (**KG**). If you wish to manually set the FOB, use the right outer knob to move the cursor to line 2 and use the right inner knob to select the desired value. Another option is to move the cursor to **Full?** and press ⌐ENT⌐, which will update the FOB to the tanks-full value set at the time of installation. To go on, move the cursor to **Ok?** and press ⌐ENT⌐.*
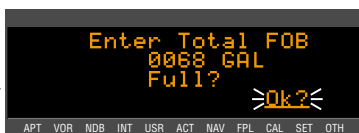
A waypoint page for the waypoint which was active when the KLN 89(B) was last turned off will be displayed on the screen. If the last active waypoint was an airport, the APT 5 page showing the airport's communications frequencies will be displayed (figure 3-22). We thought you'd like that! Almost always, the waypoint which was active when you last turned the KLN 89(B) off is the airport where you landed. Therefore, when you get ready to depart, the

Figure 3-22

airport communication frequencies for that airport will automatically be displayed for you!

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Next, you'll probably want to check the NAV 2 page to see your present position. Use the right outer knob to select the NAV page type and then the right inner knob, if necessary, to select the NAV 2 page. It is quite likely that the present position will be dashed at first (figure 3-23). It takes the KLN 89(B) a couple of minutes to acquire the GPS satellites and to make its initial calculation of your position.

Figure 3-23

When the KLN 89(B) reaches a NAV ready status and is able to navigate, the NAV 2 page will display your present position relative to the nearest VOR (figure 3-24). Verify that the present position shown on the NAV 2 page is correct.
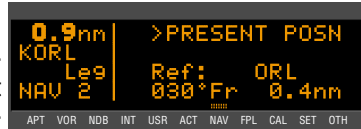
Figure 3-24

NOTE: *In order to reach a Nav ready status, the aircraft must be away from obstructions blocking the GPS antenna's view of required satellites. If the KLN 89(B) fails to reach a Nav ready status within five minutes refer to section 3.6, "Initialization And Time To First Fix".*

3.3. DISPLAY FORMAT

The KLN 89(B) uses a Dot Matrix Gas Plasma Display. In normal operation, the display screen is divided into two segments by a vertical line, called the page divider. In some cases, such as the display of system messages or the turn-on and self test sequence, the page divider disappears and you have a "full-screen" page.

Aeronautical information is presented on the screen in the form of "pages". A page is a presentation of specific data in an organized format. Various page "types" are used to display related kinds of data. For example, one page type is NAV (navigation). NAV pages show information such as distance, groundspeed, bearing, course, and other data relating to navigation. Another page type is APT (airport). APT pages contain information pertinent to a specific airport such as name, city, state, elevation, and direction and distance relative to the aircraft's present position.

The units of measure for displayed information can be changed using the SET 8 page. (Refer to section 2-12 for details on this page.) The altimeter barometric setting can be set to inches of Mercury ("), millibars (mB), or hectopascals (hP). Altitude, airport elevation, and runway lengths can be set to feet (ft) or meters (m). Finally, distances and velocities can be set to nautical miles (nm) and knots (kt) or kilo-

meters (km) and kilometers/hour (k/h). Changing any of the units of measure only affects the information displayed on the unit. It does not affect any of the data output by the unit.

The brightness of the display is controlled by a photocell on the   KLN 89(B) front panel. The brighter the light level, the brighter the display will be. The minimum (nighttime) brightness is set at the factory to a level that is appropriate for most installation. In some cases, however, it may be desired to change the minimum brightness level (e.g. an unusually dark cockpit environment). The SET 11 page controls the minimum brightness.

To adjust the minimum display brightness:

1. Select the SET 11 page (figure 3-25) and turn on the cursor ([CRSR]). The display brightness has a range of zero (0) to 9 with zero being the dimmest, 9 being the brightest, and 4 being the normal default level.

Figure 3-25

2. Turn the right inner knob to select the desired brightness (figure 3-26). To test the brightness level, you will probably want to be in a dark-cockpit condition.

Figure 3-26

    If desired, you can also test it out by placing your finger over the photocell in the upper left corner of the KLN 89(B)

3. Turn off the cursor ([CRSR]).

The top left corner of the screen always displays distance to the active waypoint, in nice large numbers (figure 3-27). The identifier of the active waypoint is usually displayed

Figure 3-27

on the second line. This area of the display will be particularly useful to you if you are shooting non-precision approaches using the KLN 89B, since it lets you know where you're going and how far until you get there.

NOTE: In cases when the active waypoint identifier is displayed on the right side of the page divider, line 2 will display the current groundspeed (figure 3-28).

Figure 3-28

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3-9

NOTE: For purposes of this Pilot's Guide, many of the screen illustrations do not show actual navigation data in this area as in figure 3-29. In these cases, the displayed data is not relevant to the discussion of the KLN 89(B)'s operation.

Figure 3-29

Figure 3-30

The third line of the left side has three purposes: (1) If the KLN 89(B) is ready for you to approve something, such as a selected waypoint, the "**Ent**" prompt will flash (figure 3-30), indicating you should press the ENT button to continue. (2) If the KLN 89(B) has a new message for you which must be viewed on a message page, a large "**M**" will flash in the same area (figure 3-31) telling you to press the MSG button and view the

Figure 3-31

new message. (3) Immediately to the right of the "message/enter" display area, the navigation mode (see section 4.7 for details) is displayed. If the KLN 89(B) is in the Leg mode (the normal mode of operation), "**Leg**" will be displayed here.
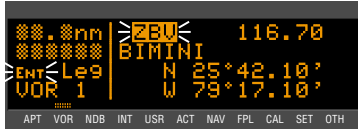
The bottom line on the left side of the page divider indicates the page type that is being displayed on the right side of the screen. In figure 3-31, the NAV 1 (Navigation 1) page is being displayed.

You might think of the page types as the chapters in a book and the page numbers as the pages within a chapter. Just as a chapter in a book may have from one to many pages, a KLN 89(B) page type may have from three to 25 pages associated with it. There are, for example, 25 flight plan pages (FPL 0, FPL 1, FPL 2, … FPL 25) in the flight plan page type and up to eight airport pages (APT 1, APT 2, … APT 8) in the airport page type.

Figure 3-32 shows an example of an APT 5 page. Notice the "+" sign in the page identification. Whenever a "+" sign is part of a page identifier there will be two or more pages, all having the same page number, used to present all of the required information. That is, all of the infor-

Figure 3-32

mation associated with a particular
page number doesn't fit on the page
being viewed. In this case the "**+**" sign
indicates that there are two or more
APT 5 pages. Figure 3-33 shows the
second APT 5 page for KICT (Wichita
Mid-Continent Airport).

Figure 3-33

The lower left corner of the display,
where the page type and number are
usually displayed, can also display
short operational messages to the
user called "scratchpad messages".
These messages are displayed for

Figure 3-34

approximately five seconds, then this area returns to a display of the
page type and number. Figure 3-34 shows an example of a scratch-
pad message indicating a duplicate identifier. A complete listing of
scratchpad messages is available in Appendix C of this Pilot's Guide.

3.4. BASIC OPERATION OF PANEL CONTROLS

The KLN 89(B) controls are very easy to use. Most of the page
selection and data entry is done with the knobs on the right side of
the front panel and the cursor ([CRSR]) button immediately above them.
There are seven buttons across the bottom: [MSG] (Message), [OBS],
[ALT] (Altitude), [NRST] (Nearest), [D▸] (Direct To), [▸CLR] (Clear), and [ENT]
(Enter).

The cursor position is indicated by flashing, underlined text on the
screen. Many pages allow you to add, delete, or change data on the
screen by first pressing the [CRSR] button to turn the cursor function on
and bring the cursor on the screen.
The right knobs are then used to
enter or change data. When the cur-
sor is on the screen, the lower left
corner of the screen will show
CRSR rather than the page name
for that particular page (figure 3-35).
The cursor is over **PRESENT POSN**.
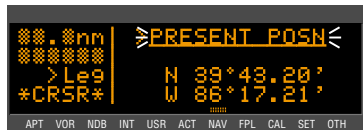
Figure 3-35

In addition, this Pilot's Guide uses white "whiskers" to depict flashing
characters on the screen.

3.4.1. PAGE SELECTION

It is now time to learn to select a desired page.

NOTE: *The cursor function is not used in selecting pages and the* CRSR *button should not be pressed at this time. If* **CRSR** *is annunciated in the lower left corner of the display, press the* CRSR *button to turn the cursor function off.*

The right outer knob is rotated to select one of eleven page types for the display. These eleven page types are the following:

Chapter Name/ Page # Range	Page Type	Page Functions
APT 1-6*	Airport	Directory of published airports
VOR 1-2	VOR	Directory of published VOR stations
NDB 1-2	NDB	Directory of published non-directional beacons (NDB)
INT 1-2	Intersections	Directory of published named intersections
USR 0-3	User Waypoint	Directory of user-defined waypoints
ACT **	Active Waypoint	Information about the active waypoint
NAV 1-4	Navigation	Navigation data
FPL 0-25	Flight Plan	Active and stored flight plans
CAL 1-8	Calculator	Distance, bearing, time and fuel calculator; air data calculations based on pilot-entered inputs
SET 1-11	Setup	Setting initial position and date/time, updating the data base, and selecting certain features
OTH 1-6***	Other	Status reports, and deleting user wpts and remarks

*   KLN 89B's which are approved for non-precision approaches have 8 airport pages.
**   Varies with the type of waypoints in the active flight plan.
***   Up to 12 with fuel management system and air data interfaces.

Remember that the page type is displayed at the lower left corner of the screen. The first three letters of the page type are often used for annunciation on the screen, for example, **CAL** represents Calculator page. The page type is also annunciated by means of a bar at the bottom of the display, which moves as you turn the right outer knob. All the page types are listed across the front panel directly under the display, and the bar will always be over one of them. For example, let's say you were on a NAV page (figure 3-36) and you wanted to turn to a SET page. You would look at the list and see that the SET pages are three places to the right of the NAV pages.

Figure 3-36

Therefore, turning the right outer knob three clicks clockwise will get you to the SET pages (figure 3-37). The annunciator bar and the page labels work kind of like a map to get you from one page type to another. The page type selection wraps

Figure 3-37

around from Other (OTH) to Airport (APT); that is, the knob has no mechanical stops.
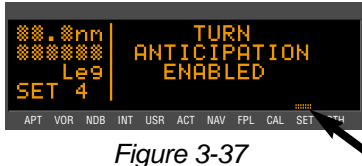
Once you have selected the desired page type using the right outer knob, you may select the page number by rotating the right inner knob. Let's use an example to make sure you understand. You are presently viewing the APT 2 page and you wish to view the NAV 3 page. Rotating the right outer knob 6 (six) clicks clockwise will display the NAV page that you last viewed—we'll say the NAV 2 page. Turning the right inner knob one click clockwise or three clicks counterclockwise will bring you to the NAV 3 page. Got it?

NOTE: In this Pilot's Guide the right smaller knob is assumed to be in the "in" position unless it specifically states that the knob should be in the "out" position. Therefore, the words "rotate the right inner knob" mean to turn the right inner knob while the knob is in the "in" position.

3.4.2. DATA ENTRY

Now that you've learned how to select the desired page, you're ready to learn the means of entering data. It is necessary to enter data, for example, in order to specify a waypoint of your choice to go Direct To. The general procedure for entering a waypoint identifier is

described below and is shown in figures 3-38 through 3-46 for entering a waypoint (in this case, First Flight airport in North Carolina, identifier KFFA) on the Calculator (CAL) 1 page.

Figure 3-38

To enter a waypoint identifier:

1. If the cursor is not on the screen (figure 3-38), press `CRSR` to turn on the cursor function (figure 3-39).

Figure 3-39

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2. If required, rotate the right outer knob to position the cursor (figure 3-40).

Figure 3-40

3. Rotate the right inner knob to select the first character of the waypoint identifier (figure 3-41).

Figure 3-41

4. Turn the right outer knob one click clockwise to move the cursor to the second character position (figure 3-42).

5. Rotate the right inner knob to select the second character (figure 3-43).

Figure 3-42

6. Use the right outer and inner knobs in this manner until the complete waypoint identifier is displayed (figure 3-44). Note that you may not have to enter the last characters of the identifier because each time you enter a character, the KLN 89(B) offers you the first identifier in the data base beginning with the characters you have entered.

Figure 3-43

Figure 3-44

7. If **Ent** is flashing on the left side of the screen, then press `ENT`. This will prompt the KLN 89(B) to display a waypoint page for the waypoint identifier you just entered (figure 3-45).

Figure 3-45

8. Verify the waypoint information displayed, and then press `ENT` again to approve the waypoint page. The display will return to the page previously displayed (figure 3-46).

Often, you will find yourself entering airports that begin with the same character over and over again. In section 2.3, you learned how the KLN

Figure 3-46

3-14

89(B) uses ICAO identifiers, which means that many U.S. airport identifiers begin with the letter K. Also, many airport identifiers in Europe begin with the letter E or the letter L. Especially when flying VFR, you will mostly want to enter Direct To or Flight Plan waypoints which are airports. The KLN 89(B) has a great feature that will save you turns of the knob when you know that the first character will probably be a K, E, L, or other letter that is commonly used in your part of the world. You can set the default first waypoint identifier character on the SET 5 page.

To change the default first way-point identifier character:

1. Select the SET 5 page (figure 3-47) and turn on the cursor (CRSR) (figure 3-48).

Figure 3-47

2. Use the right inner knob to select the desired character (figure 3-49), such as a K in the U.S., a C in Canada, a P in Alaska, an E or an L in Europe, etc.

Figure 3-48

3. Turn off the cursor. To try it out, proceed to the SET 1 page (initial position). Turn the cursor (CRSR) on (it will come on over the way-point field). Try turning the right inner knob one click clockwise (figure 3-50). There's the character you just selected on the SET 5 page!
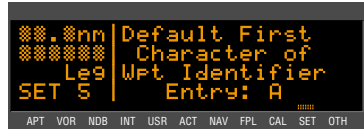
Figure 3-49
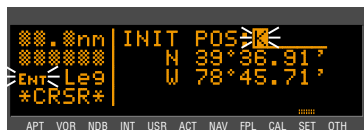
3.4.3. THE DUPLICATE WAYPOINT PAGE

Figure 3-50

There are some waypoints in the data base whose identifiers are not unique. That is, more than one waypoint has the same identifier. When a waypoint identifier has been entered which is not unique to a single waypoint, a Duplicate Waypoint page appears on the screen. The Duplicate Waypoint page is used to select which of the waypoints having the same identifier is actually desired. The waypoint identifier is displayed on the top left of the page. To the right of the identifier is the number of waypoints in the data base having the identifier. Below the identifier is a list of the waypoint

types (APT, VOR, NDB, INT, USR) and the associated countries which use the identifier.

To see an example of a Duplicate Waypoint page, try entering the identifier "D" as a Direct To waypoint or a Flight Plan Waypoint:

1. Press ⏩.

2. Select the letter "**D**" as the waypoint identifier (figure 3-51). **D** is the full identifier of several waypoints in the KLN 89(B) data base.

Figure 3-51

3. Press ᴱᴺᵀ. The Duplicate Waypoint page will be displayed on the screen (figure 3-52). At the time of this writing, there were three waypoints in the Americas data base having the identifier **D**.
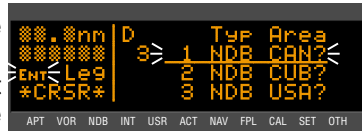
Figure 3-52

If there are more than four waypoints having the same identifier, only the first three are initially shown. The list includes an NDB in Canada, an NDB in Cuba, and an NDB in the U.S. The cursor will be over the first waypoint listed. They are listed with the waypoint closest to the aircraft's present position displayed first and the waypoint farthest from the aircraft displayed last. To view the rest of the choices, rotate the right outer knob clockwise. Doing so will move the flashing cursor over waypoints two, three and then will cause the waypoint list to "scroll" so that the other waypoints in the list may be seen.

4. To select the desired waypoint, move the cursor over the appropriate choice (figure 3-53).

5. Press ᴱᴺᵀ and the display will change to the waypoint page for the selected waypoint (figure 3-54).

Figure 3-53

6. Press ᴱᴺᵀ again to approve the waypoint page.

Figure 3-54

3.4.4. CYCLIC FIELDS

On many of the KLN 89(B) pages, there are *cyclic fields*, which are preceded by a carat (**>**). A cyclic field is one that you as the pilot can select from two or more options. For example, in figure 3-55, the field **>135°To**

Figure 3-55

(magnetic bearing to Austin VOR) is a cyclic field. In this case, the second option is the magnetic radial from Austin VOR to present position.

To change a cyclic field:

1. Turn on the cursor by pressing the ⌊CRSR⌋ button (figure 3-56).

Figure 3-56

2. Using the right outer knob, move the cursor over the cyclic field you wish to change (figure 3-57).

3. Press the ⌊>CLR⌋ button to change the cyclic field (figure 3-58). Notice that repeated ⌊>CLR⌋ presses "cycle" you through the choices. In this case there are only two, so ⌊>CLR⌋ works like a toggle switch.

Figure 3-57

Figure 3-58

3.5. MESSAGE PAGE

Whenever the KLN 89(B) wants to get your attention, the message prompt (a large "M" on the left side of the screen) begins flashing (figure 3-60). If you have a remote message annunciator in your aircraft, it will also

Figure 3-60

begin flashing at that time. You should view the message at your earliest opportunity because the unit may be alerting you to some situation of immediate concern to its condition or to your flight. A description of each possible message is included in Appendix B of this Pilot's Guide.

To view a message:

1. Press the ⎡MSG⎤ button. The MSG page will appear and show the new message (figure 3-61).

Figure 3-61

NOTE: *It is possible that several messages are displayed at one time on the Message page. The newest message appears first and the rest in reverse chronological order.*

2. After reading the message, press ⎡MSG⎤ again to return to the page previously in view. If all of the messages cannot be displayed on one Message page, repeated presses of ⎡MSG⎤ will show the other messages before returning to normal operation. If a message condition exists which requires a specific action by you, the message prompt will remain on but will not flash.

3.6. INITIALIZATION AND TIME TO FIRST FIX

Since the KLN 89(B) stores its position and other required parameters in memory when power to the unit is removed, it is seldom necessary to aid the unit in reaching a NAV ready condition. The time required from power on until the KLN 89(B) determines its present position and is therefore ready to navigate is called "time to first fix." The time to first fix is normally a few minutes or less. In order for the KLN 89(B) to reach a NAV ready condition, it is necessary to meet the following conditions:

1. The KLN 89(B)'s "almanac" data should be current. Almanac data is orbital information for all the satellites and is used for initial acquisition when the KLN 89(B) is first turned on. This data is stored in the KLN 89(B)'s non-volatile memory and is considered current for up to six months. Each satellite sends almanac data for all satellites. Since the KLN 89(B) routinely updates the almanac data during normal operation, the almanac data will become out of date only if the KLN 89(B) hasn't been used for the previous six months or longer. Collecting new almanac data takes place automatically if the data is more than six months old. If the almanac data is out of date and needs to be collected, the KLN 89(B) will take a few minutes to acquire your present position (usually about six (6) minutes, but not more than 12 minutes). The Self Test, Initialization, and Data Base pages should be approved.

2. The aircraft must be located such that the GPS antenna has an unobstructed view of the sky so that required satellite signals are

not being blocked. If possible, position the aircraft away from hangars or other obstructions.

3. It is very helpful for the KLN 89(B) to have the correct time, date and position to be able to determine which satellites should be in view. This information is stored in the battery backed memory of the KLN 89(B) so it is not normally required to update it. If the KLN 89(B) has the correct time, date and position, then the time to first fix will usually be less than two (2) minutes. If this information is not correct, then the KLN 89(B) will start to look for any satellites. Eventually, the KLN 89(B) will find enough satellites to determine the position of the aircraft. This process can take as long as 12 minutes. It is possible for you to update this information manually, which will allow the KLN 89(B) to reach a NAV ready status much faster. To set the time and date follow steps 5 and 6 in section 3.2, "Turn-On and Self-Test." The initial position is usually set during turn-on and self-test, but if for some reason it is necessary to update the position after the power-on sequence, then use the following steps. Remember, if acquisition time is not important then it is not necessary to update the time, date or position.

To initialize the position from the SET 1 page:

1. If the cursor is not on the screen (figure 3-62), press the CRSR button to bring it on the page over the **INIT POS** field (figure 3-63).

Figure 3-62

2. Using the right inner and outer knobs, enter the identifier for the airport where you are presently located or the identifier of a navaid or other airport which is close to your present position (figure 3-64). Any waypoint in the data base which is within 60 miles is acceptable, but the closer the better. Remember, if you are entering an airport identifier that is all letters (no numbers), then it will begin with a "K" prefix in the contiguous U.S., a "P" in Alaska (in some cases; in others, the prefix is not added), or a "C" in Canada. If there are numbers in the identifier then a prefix is not used. Outside the contiguous U.S., Alaska, and Canada, use the airport identifiers as they are charted.

Figure 3-63

Figure 3-64

3. Once you have entered the complete identifier, press $\boxed{\text{ENT}}$. The display will change to the waypoint page for the waypoint you entered (figure 3-65).

Figure 3-65

4. If this is the waypoint you intended to enter, press $\boxed{\text{ENT}}$ again. The display will change back to the SET 1 page.

NOTE: *As an alternative, you can also enter the approximate latitude and longitude of your present position directly on the SET 1 page instead of entering a waypoint.*

5. With the right inner knob, position the cursor over **Ok?**, if it is not already there (figure 3-66).

6. Press $\boxed{\text{ENT}}$ to approve the initial position. The cursor will automatically be removed from the screen.

Figure 3-66

NOTE: *If the KLN 89(B) is in the Take-Home mode, you are allowed to enter the groundspeed (**kt**) and heading (°) fields in order to simulate flight (figure 3-67). They are not used for actual initialization in an aircraft. However, entering a ground speed will allow the KLN 89(B) to "fly" along the active flight plan (or to a direct to waypoint) starting from the initialization waypoint. A heading may be entered in the initial heading field while in the Take-Home mode if the one offered is not desired. See section 4.11 for more details on the Take-Home mode.*

Figure 3-67

7. Select the NAV 2 page. When the KLN 89(B) reaches the NAV ready status and is therefore able to navigate, the NAV 2 page will display the present position. Verify that the latitude and longitude or the waypoint, radial, and distance display of present position are correct.

3.7. SELECTING AND SCANNING WAYPOINTS

There are five types of waypoints: airports, VORs, NDBs, intersections, and user waypoints. Waypoints in the published data base fall into one of the first four types. You can create up to 500 user waypoints to supplement the waypoints in the data base (see section 4.2.1 to create a user waypoint).

There are three methods you may use to select a specific waypoint for viewing. You may enter the waypoint's identifier directly, you may scan through the waypoint identifiers in alphabetical order, or you may enter the waypoint's name. If the waypoint is an airport, you may also select it by entering the city where the airport is located.

3.7.1. SELECTING WAYPOINTS BY IDENTIFIER

The most direct way of selecting a specific waypoint is to simply enter the waypoint's identifier directly on the appropriate waypoint page type (APT, for example). Let's use Chicago O'Hare International Airport whose identifier is KORD as an example.

To select a waypoint by identifier from a waypoint page:

1. Use the right outer and inner knobs to select the Airport 1 (APT 1) page (figure 3-68). (Actually, the airport identifier can be entered on any of the Airport pages but we'll use the APT 1 since it displays the airport name and city).

Figure 3-68

2. Turn on the cursor (CRSR) and make sure the right inner knob is pushed in. The cursor will appear over the first character of the airport identifier (figure 3-69).

Figure 3-69

3. Turn the right inner knob to select a "K" as the first character (figure 3-70). You may turn the knob either clockwise or counterclockwise, and the letters and numbers wrap around with a

Figure 3-70

blank character separating the "9" and the "A". Notice that as you turn through letters, the KLN 89(B) automatically fills in the identifier of the first waypoint in alphanumeric order in the data-

base which matches what you've entered so far (in this case, Hall Airport in Kaufman, Texas). Go ahead and experiment a little bit.

Figure 3-71

4. Use the right outer knob to move the cursor to the second character and select an "O" (figure 3-71).

5. Use the same process to select an "R" and then a "D" (figure 3-72). You are now viewing the APT 1 page for **KORD**.

Figure 3-72

The KLN 89(B) feature of filling in characters of the identifier can be a time saver! For a second example, let's select Bloomington VOR whose identifier is **BMI**.

More selecting a waypoint by identifier:

1. Make sure you have turned the cursor off from the previous example. With the right knobs, select the VOR 1 page (figure 3-73).
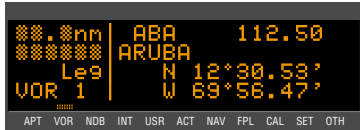
Figure 3-73

2. Turn the cursor ([CRSR]) on.

3. Change the first character to a "**B**" (figure 3-74).

4. Move the cursor to the second character and select "**M**" (figure 3-75). Eureka! When you entered the "**M**", the KLN 89(B) searched its data base for the first VOR identifier beginning with the letters "**BM**" and found **BMI**. Many times you will only have to enter two or three characters of the waypoint identifier and the KLN 89(B) will furnish the rest.
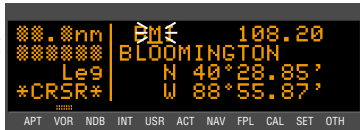
Figure 3-74

Figure 3-75

5. Turn off the cursor ([CRSR]).

3.7.3. SELECTING WAYPOINTS BY SCANNING

You may also select waypoints by scanning through them. This may be done with the cursor either on or off.

To select a waypoint by scanning with the cursor off:

1. Select the page type for the waypoint you are looking for (APT, VOR, NDB, INT or USR).

2. Pull the right inner knob to the "out" position.

3. Turn the right inner knob clockwise to scan through the waypoints in alphabetical order, or counterclockwise to scan in reverse alphabetical order. Remember that numbers are considered lower in order than letters. Thus, the airport identifier **KA2** comes before **KAAF**.

NOTE: The faster you turn the knob while scanning, the larger the step through the waypoints. This variable rate scanning allows you to get from one end of the list to the other very quickly. When the knob is turned slowly, you will go through the waypoints one at a time.

You may also want to scan waypoints with the cursor on. This is especially useful if you remember the first part of the identifier, or if you wanted to scan all airports that start with a **KL**, for example. Let's give it a try.

To select a waypoint by scanning with the cursor on:

1. Select the page type for the waypoint you are looking for (APT, VOR, NDB, INT or USR). In this case, we want the APT 1 page.

2. Turn on the cursor ([CRSR]). It will appear over the first character of the waypoint identifier. Select a **K** with the right inner knob.

Figure 3-76

3. Move the cursor one place to the right and select an **L** (figure 3-76).

4. Move the cursor one place to the right and pull the right inner knob out. The last two characters of the waypoint identifier will be flashing (figure 3-77).

Figure 3-77

5. Use the right inner knob to leaf through all the data base airports whose identifiers begin with **KL**. You will see **KL6**, Little Bear Lake Airport in Saskatchewan (figure 3-78), and **KLAS**, McCarran International in Las Vegas, Nevada among others.

Figure 3-78

3.7.4. SELECTING WAYPOINTS BY NAME OR CITY

When you know the identifier of the desired waypoint you will use one of the two methods just described to select it. However, what if you know the name but you don't know the identifier of your desired waypoint? You're in luck because the KLN 89(B) will allow you to enter the first few characters of the name to help you find it in the data base. We will use a couple of examples to illustrate how this is done. For VORs and NDBs, you may use the navaid name. For airports, you may use the airport name or the city name (where the airport is located).

In this first example we want to view the information in the KLN 89(B) data base for Napoleon VOR (located just east of Kansas City) but we don't remember the identifier for it.

To select a VOR or NDB by navaid name:

1. With the cursor off, use the right knobs to select the VOR 1 page (figure 3-79). The VOR waypoint in view is not important.

Figure 3-79

2. Press CRSR and then make sure the right inner knob is pushed to the "in" position.

3. With the right outer knob, move the cursor over the first character in the VOR name which is being displayed (figure 3-80).

Figure 3-80

4. Change this first character to an "**N**" in this case (figure 3-81).

Figure 3-81

5. Move the cursor one space to the right and select the second character, "**A**" (figure 3-82).

Figure 3-82

6. Select the third character, "**P**" (figure 3-83). Up pops Napoleon and its identifier, ANX!

7. Turn off the cursor (⌗CRSR⌗) so you can view other pages.
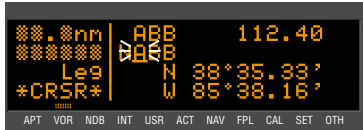
Figure 3-83

We will now use another example to show how we may enter a few characters and then scan through all the waypoints in the data base beginning with those characters. Let's use this method to find La Guardia Airport in New York City.

To select an airport by scanning the airport name:

1. With the cursor off and the right inner knob in the "in" position, select the APT (Airport) 1 page. The airport displayed at this time is not important.

2. Turn on the cursor (⌗CRSR⌗).

3. Move the cursor over the first character in the airport name (figure 3-84).

Figure 3-84

4. Change the first character to an "**L**".

5. Move the cursor one place to the right, and select an "**A**" (figure 3-85).

Figure 3-85

6. Now, move the cursor one place to the right and pull the right inner knob out. The rest of the airport name field will flash (figure 3-86).

Figure 3-86

7. Turn the right inner knob clockwise, scanning through La Crosse Municipal, La Grande/Union airport, and several others. Eventually, you will arrive at "**LA GUARDIA**" (figure 3-87). By turning off the cursor (⌗CRSR⌗), pushing the right

Figure 3-87

inner knob in and turning it, you can leaf through the remainder of the pages for La Guardia.

NOTE: *This same method may be used with the name of the city where the airport is located.*

There are a few changes made to names in order to accommodate the KLN 89(B) display and to make the names easier to find.

1.   Names which are too long to fit on the display are abbreviated. The first six characters are usually exactly correct, but the following are exceptions:

    North, Northern, East, Eastern, etc.—uses N, E
    Southeast, Northwest, etc.—uses SE, NW
    Point—uses PT
    Port—uses PT
    Fort—uses FT
    Saint—uses ST
    General—Deleted, or uses GEN
    Person's name—uses initials for other than last name unless
      very well known (Will Rogers World airport)
    Delete "City of" (City of Colorado Springs Municipal)
    Delete "Greater" (Greater Buffalo Int'l)
    Delete "The" (The Hartsfield Atlanta Int'l)

2.   Unless the first word is greater than eight characters, it is usually not abbreviated.

3.   Delete most punctuation such as periods and apostrophes.

4.   Abbreviations for International are INTL, INT, and IN.

5.   Abbreviations for Regional are REGL and REG.

3.8. "NEAREST" FUNCTIONS

At any time, you can have access to the nearest airports, waypoints, Special Use Airspace (SUA), Flight Service Station (FSS) frequencies, and Center frequencies to your position. Your ticket to do this is the handy NRST button.

When you first press the NRST button, a page is displayed asking which nearest function you would like to select (figure 3-88). The choices are:

Figure 3-88

3-26

APT	Airports
VOR	VORs
NDB	NDBs
INT	Intersections
USR	User-defined waypoints
SUA	Special Use Airspaces
FSS	Flight Service Station Frequencies
CTR	Center Frequencies

To select the desired nearest function, use the right inner knob to move the cursor to the desired selection and press ENT. Notice that the cursor is initially over the **APT** field, so you may press NRST then press ENT immediately to access the nearest airports.

Selecting any of the waypoint types (**APT**, **VOR**, **NDB**, **INT**, or **USR**) takes you immediately to the way-point page for the first nearest waypoint of that type, for example, the nearest airport (figure 3-89).

Figure 3-89

3.8.1. VIEWING THE NEAREST WAYPOINTS

There are actually two waypoint scan lists for airports, VORs, NDBs, intersections and user-defined waypoints. These two lists are the "complete" list and the "nearest" list. The complete list contains all of the waypoints in the data base for a waypoint type (all the airports, for example). The nearest list consists of the nine nearest waypoints (of that type) to your present position. Therefore, if you are in the near-est airport list, it will contain the nine nearest airports relative to your location.

The nearest list is positioned in front of the complete list. That is, instead of using the NRST button, you may scan backwards (turn the right inner knob counterclockwise while in the "pulled out" position) through the complete list to reach the nearest list. You will know when you have reached the nearest list because the top middle por-tion of the waypoint page will flash the relative position of the waypoint to your position. "**1**" indicates nearest (figure 3-89) while "**9**"

indicates the ninth nearest (figure 3-90). As you scan clockwise with the right inner knob "**1**, **2**, **3**, ..., **9**", the next scan position is the beginning of the complete list. The nearest list can

Figure 3-90

only be reached by scanning backwards. It does not wrap around after the last waypoint in the complete list.

Waypoint pages displayed in the nearest list do not contain a latitude and longitude position as they do in the complete list. Instead, the bearing and distance to the waypoint (or the radial and distance from the waypoint) are displayed. In addition, nearest airport pages display the length, surface, and lighting of the longest runway. Once the nearest waypoint is being displayed, the other waypoint pages (for example, APT 2 and APT 3) for that airport are available for display by making sure the right inner knob is pushed in and then turning it to select the desired airport page.

3.8.1.1 Nearest Airport Criteria

The nine airports in the nearest list are the nine airports which meet the criteria selected on the Setup 6 (**SET 6**) page. For example, you probably wouldn't want to take a turboprop into a 1500 foot grass strip! The SET 6 page allows you to specify what criteria you want an airport to meet before it is considered for the nearest airport list.

To specify the nearest airport criteria:

1. Select the SET 6 page and turn on the cursor (CRSR).

2. Use the right inner knob to select the minimum length runway desired for the airport to qualify for the nearest airport list (figure 3-91). Values between 1000 feet and 5000 feet or between 300m and 1500m in 100 foot or meter increments may be selected.

Figure 3-91

3. Rotate the right outer knob clockwise to move the cursor over the runway surface criteria.

4. Turn the right inner knob to select either **HRD** or **ANY**. If **ANY** is chosen, then both hard and soft surface runways meeting the required runway length will be included in the nearest airport list. If **HRD** is chosen, then only hard surface runways will be included. Hard surface runways include concrete, asphalt, pavement, tarmac, brick, bitumen, and sealed. Soft surface runways include turf, gravel, clay, sand, dirt, ice, steel matting, shale, and snow.

For example, if the minimum runway criteria selected is **2200** feet in length and **HRD** surface, then only airport having a hard surface runway at least 2200 feet in length will be displayed in the nearest airport list.

3.8.1.2 Continuous Display of Nearest Airport

When the nearest airport page is initially displayed, "**1**" is displayed in the upper right hand corner of the page to designate this airport as the nearest airport. However, if you continue to fly along your flight plan with this page selected, the same airport will be displayed and its position in the nearest airport list will change from **1** to **2**, **3**, **4** ... **9** until finally it won't be in the nearest airport list at all. The reason for this is that in the event of an actual emergency once you have determined which airport you are heading for, you don't want the nearest airport list to update while you are maneuvering or looking up data on the other airport pages for that airport.

There may be times, however, when you're flying over "unfriendly" terrain when you wish to always have the nearest airport displayed on the screen.

To display the nearest airport continuously:

1. Display the nearest airport page by pressing ⌷NRST⌷ followed by pressing ⌷ENT⌷.

2. Turn on the cursor (⌷CRSR⌷).

3. Rotate the right outer knob clockwise to position the cursor over "**1**" (figure 3-92). As long as the cursor is left in this position, this page will update so that the nearest airport is always shown as the flight progresses.

Figure 3-92

3.8.2. VIEWING THE NEAREST SPECIAL USE AIRSPACES

The KLN 89(B) data base stores the locations of areas of special use airspace (SUA). The types of SUA areas stored in the data base and the abbreviations used to denote these areas are the following:

Class B	**CL B**
Class C	**CL C**
Control Area (used outside USA)	**CTA**
Terminal Area (used outside USA)	**TMA**
Alert Area	**ALRT**
Caution Area	**CAUT**
Danger Area	**DNGR**
Military Operations Area	**MOA**
Prohibited Area	**PROH**
Restricted Area	**REST**

Training Area	**TRNG**
Warning Area	**WARN**
Terminal Radar Service Area	**TRSA**

The nearest special use airspace fea-
ture is constantly keeping track of the
five nearest areas of SUA. Pressing
the NRST button and selecting the **SUA**
option will display the SUA 1 page for
the nearest SUA to your location,
including those which you are inside

Figure 3-93

(figure 3-93). Turn to section 3.17 to learn more about how an alti-
tude input affects special use airspace sensing and how the KLN
89(B) determines if you are inside special use airspace or not.
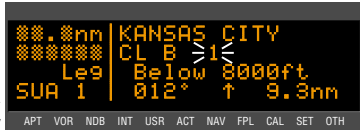
The SUA 1 page displays the following information:

Line 1: The name of the special use airspace area.

Line 2: The SUA type (see the list of abbreviations above, this
particular SUA is Class B airspace), and the sequence number (1st
nearest, 2nd nearest, etc.).

Line 3: The altitude limits of the SUA.

Line 4: The proximity of the nearest point on the border of the SUA,
in the form of the absolute bearing, relative bearing, and distance to
the SUA border. The absolute bearing is the approximate heading
you would fly to most quickly get into the SUA. The relative bearing
arrow in the middle of this line points to the SUA border, telling you if it
is directly ahead of you ($\dagger$), straight off your left wing ($\leftarrow$), etc. Finally,
the distance to the SUA is displayed on the right side of line 4.

If the aircraft is inside the SUA, line 4 will read ***A/C INSIDE SUA***, if
you are above or below the SUA, as
indicated by the encoding altimeter,
line 4 will indicate this (***A/C ABOVE
SUA*** or ***A/C BELOW SUA***).

Figure 3-94

A single clockwise turn of the right
inner knob selects the SUA 2 page,
which displays either the controlling
ATC facility (figure 3-94), or if the spe-
cial use airspace is a Class B, Class
C, CTA, or TMA, the page will be dis-
played as in figure 3-95, instructing
you to press CLR to see the APT 5

Figure 3-95

page (airport communications) for the primary airport so that the correct communications frequency may be determined.

To scan through the remainder of the nearest SUA areas, pull the right inner knob to the "out" position and turn it clockwise to view the SUA pages for the second nearest through fifth nearest SUAs.

NOTE: The KLN 89(B) displays the five nearest SUAs regardless of your present altitude and the altitude limits of the SUA. For instance, it will include SUAs specified as "Below 6000ft" even if you are cruising at 10,000 feet.

3.8.3. Viewing the Nearest Flight Service Station Frequencies

The KLN 89(B) stores in its data base the locations of Flight Service Stations (FSS) and their remote communications sites. In addition, the KLN 89(B) determines which two of these FSS points of communication are closest to your present location. What a convenience for you! Next time you want to file a flight plan from the air or contact an FSS for some other reason, you can easily use the KLN 89(B) to determine a suitable FSS and the appropriate frequency.

NOTE: In some areas of the world the KLN 89(B) provides the location of the nearest point of communication with a facility providing information (INF) or radio (RDO) services.

Pressing the $\boxed{\text{NRST}}$ button and selecting the **FSS** option will display two of the nearest points of communication with Flight Service Stations. There will normally be two FSS 1 pages, one for each of the two points of contact. The name of the FSS is at the top of the page. There can be from one to three frequencies included for a point of contact (figure 3-96). Remember that in the U.S. the frequency 122.00 MHz is used for "Flight Watch" and the frequency 123.60 MHz is used for Aeronautical Advisory Service. As you know, it is often possible to communicate with an FSS by transmitting on 122.10 MHz and listening on the VOR frequency. In cases like this, the FSS 1 page displays the frequencies to use for transmit and receive and also the name of the VOR through which you are communicating (figure 3-97).

Figure 3-96
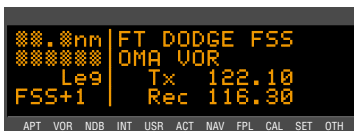
Figure 3-97

3.8.4. Viewing the Nearest Center Frequencies

The KLN 89(B) also stores in its data base the low altitude boundaries of each of the ARTCC "Centers". The KLN 89(B) determines the proper Center to contact and the appropriate frequencies to use for the aircraft's present position. Pressing the [NRST]

Figure 3-98

button and selecting the **CTR** option will display this information to you (figure 3-98). Next time you wish to obtain VFR flight following or communicate with Center for any reason, you have a quick way to get a frequency for establishing contact! Appendix D contains a listing of Center abbreviations used on the CTR page.

NOTE: Frequencies for Area Control Centers are displayed on the CTR page for some areas of the world.

3.9. DIRECT TO OPERATION

The [⊕] button is used to initiate Direct To operation (navigation from your present position direct to your destination). When [⊕] is pressed, the Direct To page will be displayed with a flashing cursor over a waypoint identifier (figure

Figure 3-99

3-99). The waypoint identifier which appears on the Direct To page is chosen by the KLN 89(B) according to the following rules:

1. If the Flight Plan 0 (FPL 0) page is displayed on the screen and the cursor is over one of the waypoint identifiers in FPL 0 when [⊕] is pressed, then that waypoint identifier will appear on the DIR page. You will appreciate this feature when you learn to use flight plans in section 4.2.

2. If the KLN 89(B) is displaying the NAV 4 page and the right inner knob is in the "out" position, then the waypoint highlighted in the lower right hand corner of the NAV 4 map display will be the default waypoint. You will also find this feature useful when operating from the active flight plan especially during approaches with the KLN 89B*.

OR . . .

3. If there is any waypoint page (APT, VOR, NDB, INT, USR, or ACT page) in view when [⊕] is pressed, then the DIR page will contain the identifier for the waypoint just viewed.

If none of the conditions above are occurring, then:

4. When ⬜ is pressed, the waypoint identifier for the current active waypoint will be displayed. ‡However, if the KLN 89B's active waypoint is the Missed Approach Point and the aircraft has flown past the MAP, then the KLN 89B will display the first way-point of the missed approach procedure on the Direct To page.

If there is no active waypoint when ⬜ is pressed, then:

5. The Direct To page displays blanks in the waypoint identifier field. In order for there not to be an active waypoint, there is no Direct To waypoint and there are no waypoints in Flight Plan 0.

3.9.1. INITIATING A DIRECT TO

Now that you know the ground rules, let's go ahead and try some practical examples. First, let's say we wanted to fly directly to Wexford County Airport in Cadillac, Michigan. Its ICAO identifier is KCAD.

To fly Direct To a waypoint (procedure 1):

1. Press ⬜. The Direct To page is displayed (figure 3-100). The cursor will already be on. A waypoint identifier may or may not be displayed, it doesn't matter at this point.

Figure 3-100

2. Rotate the right inner knob to select the first character of the desired waypoint's identifier, in this case, a "**K**" (figure 3-101). Remember to enter the "K", "C", or "P" prefix for certain airports in North America, if required (see section 2.3, "ICAO Identifiers").

Figure 3-101

3. Turn the right outer knob one click clockwise to move the flash-ing portion of the cursor over the second character position (figure 3-102).

Figure 3-102

4. Rotate the right inner knob to select the second character of the identifier (figure 3-103).

Figure 3-103

5. Use right outer and inner knobs as in the previous steps until the desired identifier is completely displayed (figure 3-104).

Figure 3-104

6. Press ENT to display the waypoint page for the selected waypoint (figure 3-105).

7. Press ENT again to approve the displayed waypoint page. The screen will change to the NAV 1 page, and the selected waypoint will now be the active Direct To waypoint (figure 3-106).

Figure 3-105

Figure 3-106

‡*NOTE: In some cases during approach operations, the KLN 89B presents a page asking how a waypoint is used when the waypoint identifier is entered character by character. When this page is presented, simply choose the desired use of the waypoint (e.g. FAF or MAHP) by moving the cursor with the right outer knob and pressing ENT. Choosing the correct use of the waypoint is required to ensure proper waypoint sequencing once the aircraft reaches the waypoint.*

To fly Direct To a waypoint (procedure 2):

1. Select the desired waypoint page (APT, VOR, NDB, INT, or SUP) on the screen (figure 3-107) using one of the three procedures explained in section 3.7.

Figure 3-107

2. Press ⟿. The Direct To page is displayed and it contains the desired waypoint identifier (figure 3-108).

3. Press ENT. The display will revert to the NAV 1 page with the selected waypoint as the Direct To waypoint.

Figure 3-108

If you get off course and wish to recenter the left/right deviation bar (D-Bar) to proceed to the same waypoint, use the following procedure.

To recenter the D-Bar by going direct to the active waypoint:

1. Select a non-waypoint page (**NAV**, **FPL**, **CAL**, **SET**, or **OTH**) on the screen.

2. Press ⬛. The Direct To page is displayed on the left, containing the active waypoint identifier.

3. Press ENT.

‡NOTE: If the KLN 89B is in the approach mode and this method is used to center the D-bar when the missed approach point is the active waypoint, then the approach mode will be cancelled and the KLN89B will revert to the approach arm mode.

3.9.2. CANCELLING A DIRECT TO

The primary reason for wanting to cancel Direct To operation is to return to flight plan operation which is described later in section 4.2.4 "Combining Direct To and Flight Plan Operation".

To cancel Direct To operation:

1. Press ⬛.

2. Press >CLR to blank out the way-point identifier field (figure 3-109).

3. Press ENT.

Figure 3-109

3.9.3. WAYPOINT ALERTING FOR DIRECT TO OPERATION

Approximately 36 seconds prior to reaching a Direct To waypoint, the arrow preceding the waypoint identifier on the waypoint page for the active waypoint will begin flashing. This arrow will also be flashing on any NAV or FPL page displaying the active waypoint identifier. This is called "waypoint alerting". If an external waypoint alert (WPT) annunciator is mounted in the aircraft, this annunciator will begin flashing at the same time.

3.10. NAVIGATION PAGES

As you would expect, the NAV (navigation) pages contain information relating specifically to the KLN 89(B)'s navigation capabilities. The KLN 89(B) has four NAV pages. The procedure for selecting specific pages, including the NAV pages, was described in section 3.4.1, "Page Selection".

3.10.1. THE NAVIGATION 1 (NAV 1) PAGE

The NAV 1 page is the primary navigation display, and is shown in figure 3-110. In normal flight, you will probably rely on this page quite a lot. A NAV 1 page displays the following information:

Figure 3-110

Line 1: The active navigation leg. For Direct To operation this consists of the Direct To symbol, ⊞, followed by the active Direct To waypoint identifier (figure 3-110). For the leg of a flight plan this consists of the "from" waypoint identifier and the active "to" waypoint identifier (figure 3-111). An arrow ✦ precedes the active waypoint identifier.

Figure 3-111

Line 2: A cyclic field which can either be (1) a course deviation indicator (CDI) that graphically displays left and right deviation from desired course (figure 3-111), (2) The direction to fly to intercept the desired track and the crosstrack distance (figure 3-112), or (3) the current CDI scale in use. This is a cyclic field, so you can change back and forth between the three options by turning on the cursor (CRSR) over the second line and pressing the >CLR button.

Figure 3-112

The CDI's vertical bar operates like a navigation deviation needle on a conventional CDI or HSI using VOR/Localizer navigation. An on-course indication is displayed when the vertical deviation bar is centered on the triangle in the middle of the CDI. In en route use, each dot represents one nautical mile deviation from the desired track. Different CDI scales are used during terminal and non-precision approach flight with KLN 89B. For now, let's talk only about en route operations. A vertical deviation bar positioned two dots to the

right of the center triangle indicates the aircraft is two nautical miles to the left of course (figure 3-113). The center triangle also serves as
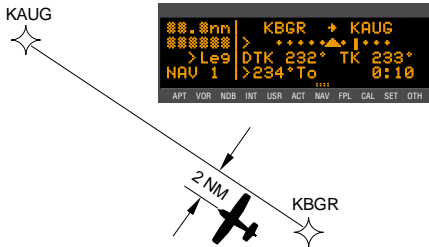
Figure 3-113

the CDI's TO/FROM indicator and operates in the same manner as a conventional CDI TO/FROM indicator; a triangle pointing up indicates "to" the active waypoint while a "down" triangle (figure 3-114) indicates "from" the active waypoint. The word **FLAG** is displayed over the CDI when the KLN 89(B) is not usable for navigation (figure 3-115).

Figure 3-114

Figure 3-115

The numerical crosstrack distance display is especially handy when more than five nautical miles off of course (naturally, you yourself would never deviate more than five nm off course, but not everyone is as good a pilot as you are!) If your crosstrack distance was 13.1 nautical miles left of course, the graphic CDI needle will be pegged on the right side (which doesn't tell you much). But this presentation will show you exactly how far off course you are (figure 3-116). When the KLN 89(B) is not usable for navigation, the crosstrack distance will be dashed out (figure 3-117).

Figure 3-116

Figure 3-117

3-37

Line 3: Magnetic desired track, and magnetic actual track (see Appendix A for navigation terms). In normal on-course flight, it is desirable to steer the aircraft to keep these two numbers equal.

Line 4: A cyclic field which can display either bearing to the active waypoint (**To**), radial from the active waypoint (**Fr**), or the VNAV status, which will either by **Off**, **Armed**, time until VNAV begins, or the suggested VNAV altitude (see section 4.4). By placing the cursor over this field and pressing the ⌜>CLR⌝ button, you may toggle between the three options.

NOTE: Due to "great circle" courses and magnetic variation differences between present position and the active waypoint, the To bearing and From radial may not be exactly 180° different from each other when the system is in the Leg mode. This condition is most likely to occur when long distances are involved, and/or you are operating in very northerly or southerly latitudes. See figure 3-118 for an example depicting a case like this. The aircraft is somewhere over Georgia, and the active waypoint is KPHX. The bearing to steer is 269°, and radial is 72°. Generally, you will want to use bearing (not radial) when long distances are involved.
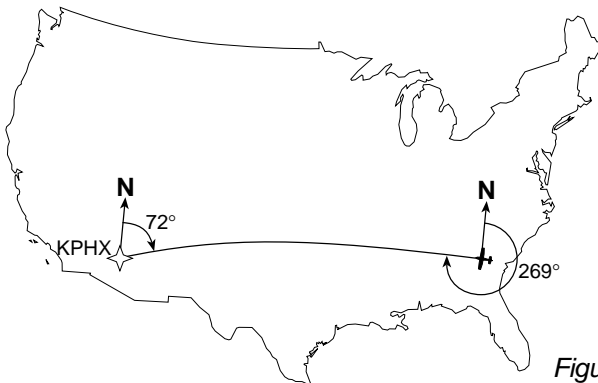
Figure 3-118

Line 4 also displays the estimated time en route (ETE) from present position to active waypoint.

3.10.2. THE NAVIGATION 2 (NAV 2) PAGE

The NAV 2 pages in figures 3-119 and 3-120 display the aircraft's present position in one of two formats. The first line is a cyclic field which allows you to toggle between formats. When the NAV 2 page is first displayed, it defaults to present position in terms of the radial and distance from a nearby VOR. You can change the reference waypoint from the nearby VOR to any waypoint.
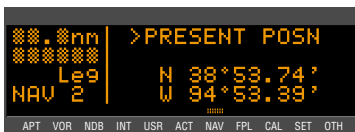
Figure 3-119

Figure 3-120

To change the NAV 2 page present position reference waypoint:

1. With the NAV 2 page on the radial and distance from a reference waypoint format, turn on the cursor ([CRSR]) and move it to the **Ref:** field (figure 3-121).
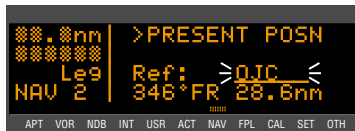
Figure 3-121

2. Use the right inner and outer knobs to enter the waypoint you wish to use as a reference.

3. Press [ENT]. The waypoint page for the identifier just entered will be displayed.

4. If this is the waypoint you intended, press [ENT] again. The display will return to the NAV 2 page (figure 3-122).

Figure 3-122

NOTE: *If you change the reference waypoint, change to a page other than the NAV 2 page, then turn back to the NAV 2 page, the reference waypoint will revert back to a nearby VOR.*

By turning on the cursor ([CRSR]) over the first line and pressing [>CLR], you can change to the latitude and longitude format.

NOTE: *Your present position may be stored as a user-defined waypoint by pressing [ENT] while viewing the NAV 2 page. See section 4.6.1, "Creating a waypoint at your present position."*

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3.10.3. THE NAVIGATION 3 (NAV 3) PAGE

The Navigation (NAV) 3 page shows you several important times pertaining to your flight (figure 3-123).

Figure 3-123

Line 1: The current system time zone and time. The time zone may be changed by turning the cursor (CRSR) on over it and turning the right inner knob. All times shown on the NAV 3 page are in terms of the system time zone (except for the flight time, which is an elapsed time).

Line 2: The time of departure. This is the time when a valid ground-speed was first greater than 30 knots (typically during takeoff).

Line 3: Estimated time of arrival at your destination. If the active waypoint is not part of the active flight plan, the active waypoint will be the destination. Otherwise, the last waypoint in your active flight plan will be the destination.

Line 4: The elapsed flight time, which will be the hours and minutes since the departure time.

3.10.4. THE NAVIGATION 4 (NAV 4) PAGE

The NAV 4 page is a graphical moving map which offers excellent "bird's-eye-view" situational awareness to you as the pilot in command. This page can show you where you are and where you're headed relative to your active flight plan or leg, your destination way-point(s), the nearby airports and VORs, and even the boundaries of nearby special use airspace!

The NAV 4 page (figure 3-124) is a little bit different than some of the other KLN 89(B) pages. Instead of displaying the page type and number (i.e. NAV 4) in the lower left corner of the screen, an additional piece of navigation data is displayed here. We're willing to bet you'll know this is the

Figure 3-124

NAV 4 page anyway, because of its unique graphics.

The left side of the screen displays the distance to go, active way-point identifier, and mode annunciation (either **Leg**, or the OBS selected course), just like it usually would, but the fourth line is a cyclic field for which you may select:

Magnetic Desired Track (degrees)	**DTK123**
Groundspeed (knots or kilometers/hour)	**123kt**
Estimated Time Enroute (hours:minutes)	**1:23**
Crosstrack Correction	**1.21⁺**

NOTE: Magnetic desired track may only be selected when KLN 89(B) is in the Leg navigation mode. When the KLN 89(B) is in the OBS mode, the "desired track" is the same as the OBS selected course displayed on line 3.

To change the data displayed in this cyclic field, simply turn on the cursor (CRSR), rotate the right inner knob counterclockwise to position the cursor over this field (figure 4-125), and press the >CLR button to choose the desired information.

Figure 3-125

Now we move on to the map display area on the right side of the screen. In all KLN 89(B) installations there are three common map orientation formats that may be selected on the NAV 4 page: a True North up display, a desired track up display, or an actual track up display. In addition, if the KLN 89(B) is interfaced with a source of heading in a compatible format then a heading up presentation may also be selected. When the North up display is selected, viewing the NAV 4 page is like looking at a navigation chart with North at the top. When the desired track up display is selected the NAV 4 page is like looking at a chart that is turned so that your course line is always pointing up. When the actual track up display is selected, viewing the NAV 4 page is like looking at a chart that is turned so that the direction the aircraft is tracking over the ground is pointing up. In a no-wind condition, actual track is identical to the aircraft's heading.

CAUTION: When using the actual track up format it is typical for there to be a slight delay from the time a heading change is made until the correct map orientation is displayed. Be careful when using either the desired track up display or the actual track up display to not think that a heading up display is being used.

When you are navigating with a flight plan (see section 4.2), the NAV 4 page displays the waypoints of the active flight plan (FPL 0) with their waypoint identifiers (figure 3-125). Course lines connect the flight plan waypoints.
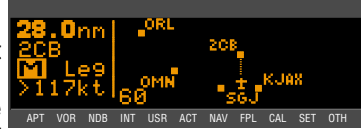
When operating Direct To a waypoint which is not in the active flight plan, the direct to waypoint is shown on the map, and although the waypoints of the active flight plan are still shown on the screen, they are not connected by course lines (figure 3-126).

Figure 3-126

In the lower left corner of the map display area is the map range scale in nautical miles. The range scale indicates the distance from the aircraft's position to the top of the screen. You may select a range scale of 1 NM to 500 NM (2 km to 925 km) with several

Figure 3-127

choices in between by turning on the cursor ($\boxed{\text{CRSR}}$), and using the right inner knob to select the desired range scale. For example, figure 3-127 illustrates the results of changing the range scale of the map in figure 3-126 from 60 nautical miles to 30 nautical miles.
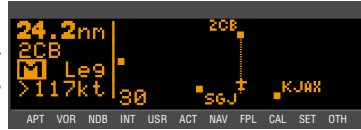
Additionally, there is a choice called **AUTO**, for automatic range scaling. This choice is sandwiched between the 1 NM (2 km) scale and the 500 NM (925 km) scale, such that it is "below" 1 NM (2 km) and "above" 500 NM (925 km). The AUTO scale factor feature "zooms" the map in and out in a useful way so that you don't have to. Specifically, AUTO chooses the smallest map scale that will display the active waypoint and, if there is one, the waypoint after the active waypoint. Choosing the AUTO scale factor means there is one less item for you to worry about. This is especially helpful when conducting non-precision approaches using the KLN 89B.
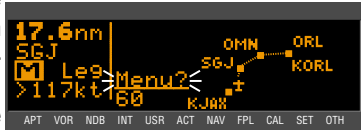
Figure 3-128

Aside from changing the map range scale, all other customization of the map display is done from the menu. Notice that when you turn on the cursor ($\boxed{\text{CRSR}}$), the **Menu?** field appears above the range scale. Turn the right outer knob one step counterclockwise to move the cursor over the **Menu?** field (figure 3-128) and press $\boxed{\text{ENT}}$. The menu now "pops-up" on the screen (figure 3-129).
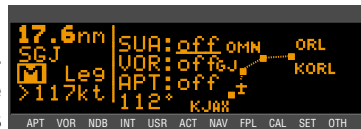
Figure 3-129

To select the desired NAV 4 orienta-
tion, you must first select the menu,
then use the right outer knob to posi-
tion the cursor over the map
orientation field (figure 3-130). Rotate
the right inner knob to display **N**↑ for
North up, **DTK**↑ for desired track up
(figure 3-131), **TK**↑ for actual track
up, or **HDG**↑ for heading up. The
heading up selection is not presented
as a choice if heading is not provided
to the KLN 89(B). If the cursor is
located on a field other than the map
orientation field, then the **DTK**↑, **TK**↑,
or **HDG**↑ annunciation is replaced
with the actual value. The **123°** dis-
played in figure 3-132 shows how the
actual track is displayed when the
cursor is not over the map orientation
field.

Figure 3-130

Figure 3-131

Figure 3-132

If a heading input is available to the KLN 89(B) then heading up is
usually the best map orientation to select. Otherwise, actual track up
display is usually preferred for use in flight. However, the track up
display is only usable when the aircraft is moving 2 knots or more so
the North up display may be a good choice if you are stationary.

Notice that in both the North up format and the desired track up for-
mat, the aircraft's position is depicted by a diamond. In the actual
track up format and the heading up format, the aircraft's position is
depicted by an aircraft symbol.

You may choose to have nearby airports, VORs, and special use air-
space (SUA) displayed on the moving map! To do so, use the
pop-up menu by turning on the cursor and selecting **Menu?**.

When the menu is first displayed the cursor will be on the SUA selec-
tion field. Rotate the right inner knob to select **on** or **off**. When SUAs
are selected, the five nearest SUAs are displayed. However, they will
not be displayed on map range scales larger than 160 NM (300 km).
Special use airspace areas are displayed regardless of your altitude
relative to the airspace. The nearest SUA feature (section 3.8.2) and
the SUA alerting feature (section 3.17) will indicate the altitude limits
of the airspace to you. Section 3.17 will also help you understand
more about the KLN 89(B) special use airspace features as well as
the types of SUA that are included in the KLN 89(B) data base.

NOTE: Only the outer lateral boundaries are displayed for Class B, Class C, CTA, and TMA airspace. The actual SUA may have different lateral limits (i.e. smaller) depending on your present altitude.

In the same manner, the nearest VORs and/or airports may be selected by first using the right outer knob to move the cursor over the VOR or APT selection field and then using the right inner knob to select **on** or **off**. The example in figure 3-133 shows SUAs and airports having been selected.
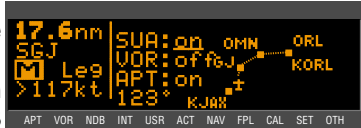
Figure 3-133

When the desired selections have been made, press the CRSR button to remove the menu from the screen (figure 3-134). Notice that the nearest airports are depicted with a small **+** symbol, while the VORs are shown as a small box (▯).

Figure 3-134

One last item of interest on this page: you may change the active waypoint to any of the flight plan waypoints without having to leave the map display. This is done by pulling the right inner knob to the "out" or "scan" position. This will cause the identifier for the active waypoint to be displayed in the bottom right corner of the screen (figure 3-135). The waypoint displayed in this area will be the default waypoint when ➡ is pressed. By turning the right inner knob it is possible to scan through the waypoints of the active flight plan (FPL 0). Turning the knob clockwise

Figure 3-135

will scan through the waypoints in sequence until the end of the flight plan is reached. Turning the knob counter-clockwise will scan through the active flight plan in reverse order until the beginning of the flight plan is reached. Pushing the right inner knob back to the "in" position will remove this text from the map display area.

The following hints will make using the NAV 4 page more enjoyable.

- It is easy to clutter the display with so much data that it is unusable. Select a range scale that allows an uncluttered presentation of the chosen SUAs, VORs, and airports. Or, select another combination of these from the menu. Experiment and continue to make new selections for different phases of your trip.

• Press ⊳CLR to instantly declutter the SUA, VOR, and airport selections from the graphics display. Flight plan and Direct To waypoints will still be displayed. Press ⊳CLR again to restore the selections.

CAUTION: The NAV 4 page does not display weather, terrain, or other data.

3.11. WAYPOINT PAGES

NOTE: Each of the waypoint page types includes a cyclic field which displays present magnetic bearing to or magnetic heading from the waypoint. Due to "great circle" courses and magnetic variation differences between present position and the active waypoint, the To bearing and From radial may not be exactly 180° different from each other. This condition is most likely to occur when long distances are involved, and/or you are operating in very northerly or southerly latitudes. See section 3.10.1 and figure 3-118 for more details.

3.11.1. AIRPORT PAGES

3.11.1.1. The Airport 1 (APT 1) Page

See figure 3-136.

Line 1: The ICAO identifier (see section 2.3) of the airport; an arrow precedes the identifier if it is the active waypoint. The airport elevation above MSL in feet or meters, which is rounded to the nearest 10 feet or nearest meter.

Figure 3-136

Line 2: The name of the airport.

Line 3: The city where the airport is located.

Line 4: The State if the airport is located in the U.S., the Province if located in Canada, or the country if outside the U.S. and Canada. A listing of the abbreviations used for States, Provinces, and countries is contained in Appendix D. The right side of line 4 will read **HELIPORT** if applicable, **MILITARY** if it is a military airport (Figure 3-137), and

Figure 3-137

PRIVATE if it is a private use airport.

If the airport is being viewed as part of the *nearest airports list* (see section 3.8.1, "Viewing the Nearest Waypoints"), the APT 1 page format will differ as follows (see figure 3-138):
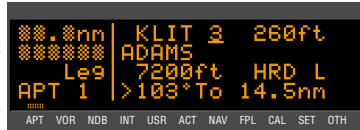
Figure 3-138

Line 1: After the airport identifier, the number designating the airport's position in the nearest airport list is displayed. In figure 3-138, KLIT is the third nearest airport.

Line 2: Same as a normal APT 1 page.

Line 3: The length, surface and lighting of the longest runway.

Line 4: The magnetic bearing to or the magnetic radial from the airport and the distance. Placing the cursor over the radial/bearing field and pressing ▷CLR toggles between radial from and bearing to the airport.

3.11.1.2. The Airport 2 (APT 2) Page

See figure 3-139.

Figure 3-139

Line 1: The ICAO identifier (see section 2.3) of the airport; an arrow precedes the identifier if it is the active waypoint.

Lines 2-3: The latitude and longitude of the airport reference point (the "official" location of the airport).

Line 4: The magnetic bearing to or the magnetic radial from the airport and the distance. Placing the cursor over the radial/bearing field and pressing ▷CLR toggles between radial from and bearing to the airport.

If the airport is being viewed as part of the *nearest airports list* (see section 3.8.1, the APT 2 page format will differ as follows (see figure 3-140):

Figure 3-140

Line 1: After the airport identifier, the number designating the airport's position in the nearest airport list is displayed.

Line 2: The city where the airport is located.

3-46

Line 3: The State if the airport is located in the U.S., the Province if located in Canada, or the country if outside the U.S. and Canada. A listing of the abbreviations used for States, Provinces, and countries is contained in Appendix D. The right side of line 3 displays **HELIPORT**, **MILITARY**, or **PRIVATE** as appropriate.

Line 4: The magnetic bearing to or the magnetic radial from the airport and the distance. Placing the cursor over the radial/bearing field and pressing ▷CLR toggles between radial from and bearing to the airport.

3.11.1.3. The Airport 3 (APT 3) Page

See figure 3-141.

Line 1: The ICAO identifier (see section 2.3) of the airport; an arrow precedes the identifier if it is the active waypoint. Also on line 1 is the

Figure 3-141

environment. For example, the airport in figure 3-141 has overlying Class C airspace. The possible environments are:

CL B	Class B airspace
CL C	Class C airspace
CTA	Control area
TMA	Terminal area
TRSA	Terminal radar service area

Line 2: The airport's time difference from UTC during standard time and during daylight time (in parentheses).

Line 3: Fuel types available at the airport. This line will be blank if there is no fuel available at the airport.

80	80 octane
100	100 octane
100L	100 octane, low-lead
JET	Jet fuel (of any type)
AUTO	Automotive fuel (also known as MOGAS)

Line 4: Approach type(s) available at the airport. If an airport has an ILS approach and/or an MLS approach, no indication of non-precision approach availability will be given.

NO APR	No IFR approach
NP APR	Non-precision approach(es) only
ILS	ILS approach
MLS	MLS approach
ILS/MLS	ILS and MLS approaches

If the airport has a GPS non-precision approach included in the KLN 89B data base, **GPS** will also be displayed on line 4. The lower right corner will display **(R)** if the airport has an approach/departure radar environment.

3.11.1.4. The Airport 4 (APT 4) Page

See figure 3-142

The APT 4 page displays the runway designation, length, surface, and lighting for up to five runways in order of length, beginning with the longest runway. Since there are many times

Figure 3-142

when all of an airport's runway information does not fit on one page, additional APT 4 pages are used to display the data. Remember that a "+" inserted between the page type and the number (**APT+4** in this case) is used to indicate that there is more than one Airport 4 page.

Line 1: The ICAO identifier (see section 2.3) of the airport; an arrow precedes the identifier if it is the active waypoint. To the right is the runway designation for the first runway on the page.

NOTE: In some parts of the world, runway numbers are based on true runway heading rather than magnetic. These runways are prevalent in northern Canada, where there is a large magnetic variation gradient. For these runways, a ᵀ symbol separates the two runway numbers (example 14 ᵀ 32).

Line 2: The runway length for the first runway listed on the page, the runway surface type and the type of lighting (blank if none).

Runway surface abbreviations:

HRD	Hard surface
TRF	Turf
GRV	Gravel
CLY	Clay
SND	Sand
DRT	Dirt
SNW	Snow
ICE	Ice
SHL	Shale
MAT	Steel mat

Runway lighting Abbreviations:

L   Sunset to sunrise
LPC   Pilot controlled lighting
LPT   Part-time or on-request lighting

Lines 3-4: Runway information for the next shortest runway (if any), in the same format as lines 1 and 2.

In the event that there is no runway information for an airport, the following message is displayed on the APT 4 page:

   *No Runway Data
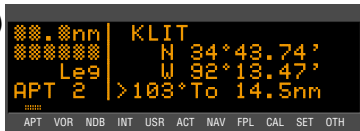
3.11.1.5. The Airport 5 (APT 5) Page

See figure 3-143.

Line 1: The ICAO identifier (see section 2.3) of the airport; an arrow precedes the identifier if it is the active waypoint.

Figure 143

Lines 2-4: The VHF communication frequencies associated with the airport. The type and frequency is listed. The abbreviations are:

AAS   aeronautical advisory service
AFIS   aerodrome flight information service
ARVL   arrival
APR   approach
ASOS   automated surface observation system
ATF   aerodrome traffic frequency
ATIS   automatic terminal information service
AWOS   automatic weather observing station
CL B   class B airspace (formerly terminal control area)(VFR frequency)
CL C   class C airspace (formerly airport radar service area) (VFR frequency)
CLR   clearance delivery
CTA   control area (VFR frequency used outside the U.S.)
CTAF   common traffic advisory frequency
CTR   center (when center is used for approach/departure control)
DEP   departure
DIR   director (approach control/radar)
GRND   ground control
MCOM   multicom
MF   mandatory frequency
PCL   pilot-controlled lighting
PTAX   pre-taxi clearance
RAMP   ramp/taxi control

RDO	radio
RDR	radar-only frequency
TMA	terminal area (VFR frequency used outside the U.S.)
TWR	control tower
UNIC	unicom

Part-time operation, such as for a control tower, is indicated with an asterisk (*) to the right of an airport frequency.

The frequencies associated with class B or C airspace, CTA or TMA are VFR frequencies. Airports which have one of these categories of frequencies also have APR and DEP which are IFR frequencies.

Where required, APR, DEP, CL B, CL C, CTA, and TMA frequencies are sectorized. That is, a frequency may be used only within a certain range of radials from a designated reference location. The format for displaying the sectorization is to show the frequency first, followed by the identifier of the associated reference point, followed next by the associated altitude restrictions. For example, figure 3-144 shows that the Orlando approach control frequency 121.10 MHz is used between the 311° radial and the 60° radial from KMCO (Orlando International Airport) for altitudes at and below 5500 feet.
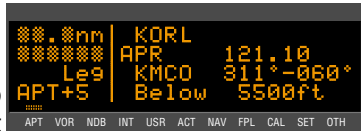
Figure 3-144

In a few cases, APR, DEP, CL B, CL C, CTA, and TMA frequencies are sectorized such that the restrictions cannot be displayed on a single page. When this occurs the following message is displayed on the APT 5 page:

> **Text Of Freq Use**
> **Not Displayed**

3.11.1.6. The Airport 6 (APT 6) Page

See figure 4-145.

Figure 3-145

Line 1: The ICAO identifier (see section 2.3) of the airport; an arrow precedes the identifier if it is the active waypoint.

Lines 2-4: The pilot-entered remarks for the airport. Three lines of 14 characters each are available for the remarks. These remarks might include information on lodging, dining, airport services, etc. Up to 100 waypoints may include remarks. Letters, numbers, hyphens, and spaces may be used in the remark. If no remarks have been entered for the airport, line 2 will display "**[Remarks]**".

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To enter an airport remark on the APT 6 page:

1. Turn on the cursor and move it until the cursor fills line 2 of the screen (figure 3-146).

Figure 3-146

2. With the right inner knob, select the desired character, if any, and move the cursor to the next character on the line (figure 3-147).

3. Repeat step 2 as necessary.

Figure 3-147

4. Press ENT to approve each line of remarks. The cursor will automatically move to the next line (see figure 3-148).

5. Turn the cursor off when you are finished creating the remark (figure 3-149).

Figure 3-148
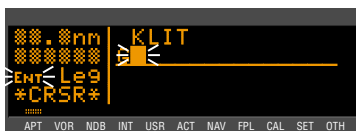
The Other 5 (OTH 5) page is a list of waypoints with associated remarks. Sometimes these are deleted if there are more than 100 waypoints with remarks, or if the remarks are no longer relevant. If you wish to delete a waypoint remark for an airport, see section 3.14.2.

Figure 3-149

‡3.11.1.7. The Airport 7 (APT 7) Page (KLN 89B only)

The APT 7 page shows the SID and STAR procedures that are available for the selected airport. If both SID and STAR procedures are available then there will be two APT 7 pages indicated by **APT+7** (figure 3-150). If there are no SID or STAR procedures in the data base then this page will be as shown in figure 3-151.

Figure 3-150

The details of this page are presented in section 5.2.

Figure 3-151

3-51

‡*3.11.1.8. The Airport 8 (APT 8) Page (KLN 89B only)*

See figure 3-152.

The APT 8 page specifies the non-precision IAPs (Instrument Approach Procedures) available for the airport. Remember that the desired approach must be in the published data base in order to be used by KLN 89B. If there are no approaches for this airport in the data base then this page will be as shown in figure 3-153. To read more about selecting a non-precision approach, see section 5.1.1.
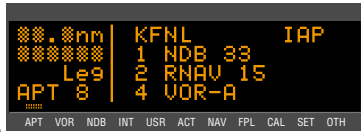
Figure 3-152

Figure 3-153

Line 1: The ICAO identifier (see section 2.3) of the airport; an arrow precedes the identifier if it is the active waypoint.

Lines 2-4: Listing of the instrument approach procedures for the airport. The IAPs are listed in alphabetical order. If there are more than three IAPs, the final one in the list is on line 4 of the screen. To scan through the IAPs that are not in view, turn on the cursor CRSR and turn the right outer knob clockwise.

The different types of IAPs, with examples, are:

GPS 27	GPS approach
LORAN 4	LORAN approach
RNAV 2L	RNAV approach
TACAN 24	TACAN approach
VOR 15	Straight-in VOR approach
VOR-B	Circling VOR approach
VOR/D 31	VOR/DME approach
NDB 26	Straight-in NDB approach
NDB-D	Circling NDB approach
NDB/D 35	NDB/DME approach

3.11.2. VOR PAGES

Two pages of information may be displayed for each VOR in the KLN 89(B). Sample VOR pages are shown in figures 3-154 through 3-156.

3.11.2.1. The VOR 1 Page

See figure 3-154.

Line 1: The VOR identifier, preceded by an arrow if it is the active waypoint.

Figure 3-154

To the right of the identifier is the frequency of the VOR in megahertz.

Line 2: The name of the VOR.

Lines 3-4: The latitude and longitude of the VOR

If the VOR is being viewed as part of the *nearest VORs list* (see section 3.8.1), the VOR 1 page format will differ as follows (see figure 3-155):

Figure 3-155

Line 1: After the VOR identifier, the number designating the VOR's position in the nearest VOR list is displayed. In figure 3-155, MEX is the second nearest VOR.

Lines 3-4: In place of the latitude/longitude, line 3 is blank and line 4 displays the magnetic bearing to or the magnetic radial from the VOR and the distance. Placing the cursor over the radial/bearing field and pressing ⏵CLR toggles between radial from and bearing to station.

3.11.2.2. The VOR 2 Page

See figure 3-156.

Line 1: The VOR identifier, preceded by an arrow if it is the active waypoint.

Figure 3-156

Line 2: The published magnetic station declination of the VOR. Magnetic station declination is another way to say the published magnetic variation for the VOR.

Line 4: The magnetic bearing to or the magnetic radial from the VOR and the distance. Placing the cursor over the radial/bearing field and pressing ⏵CLR toggles between radial from and bearing to station.

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3.11.3. NDB PAGES

Two pages of information may be displayed for each NDB in the KLN 89(B). Sample NDB pages are shown in figures 3-157 through 3-159.

3.11.3.1. The NDB 1 Page

See figure 3-157.

Line 1: The NDB identifier, preceded by an arrow if it is the active waypoint. To the right of the identifier is the frequency of the NDB in kilohertz.

Figure 3-157

Line 2: The name of the NDB.

Lines 3-4: The latitude and longitude of the NDB

If the NDB is being viewed as part of the *nearest NDBs list* (see section 3.8.1), the NDB 1 page format will differ as follows (see figure 3-158):

Figure 3-158

Line 1: After the NDB identifier, the number designating the NDB's position in the nearest NDB list is displayed. In figure 3-158, DFI is the nearest NDB.

Lines 3-4: In place of the latitude/longitude, line 3 is blank and line 4 displays the magnetic bearing to or the magnetic radial from the NDB and the distance. Placing the cursor over the radial/bearing field and pressing ⌐CLR⌐ toggles between radial from and bearing to station.

3.11.3.2. The NDB 2 Page

See figure 3-159.

Line 1: The NDB identifier, preceded by an arrow if it is the active waypoint.

Figure 3-159

Line 4: The magnetic bearing to or the magnetic radial from the NDB and the distance. Placing the cursor over the radial/bearing field and pressing ⌐CLR⌐ toggles between radial from and bearing to station.

3.11.4. INTERSECTION PAGES

The Intersection pages contain low altitude, high altitude, approach, and SID/STAR intersections as well as outer markers and outer compass locators. The Intersection pages for waypoint ELVIS (figures 3-160 and 3-161) are used as an example of what is displayed for Intersection pages

3.11.4.1. The Intersection 1 (INT 1) Page
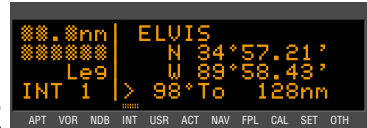
See figure 3-160.

Line 1: The intersection identifier, preceded by an arrow if it is the active waypoint.

Figure 3-160

Lines 2-3: The latitude and longitude of the intersection.

Line 4: The magnetic bearing to or the magnetic radial from the user-defined waypoint and the distance. Placing the cursor over the radial/bearing field and pressing ⏵CLR toggles between radial from and bearing to station.

3.11.4.2. The Intersection 2 (INT 2) Page

See figure 3-161.

Line 1: The intersection identifier, preceded by an arrow if it is the active waypoint.

Figure 3-161

Line 2: The identifier of the intersection's reference waypoint. When this page is first viewed, the reference waypoint is the nearest VOR to the intersection. The reference waypoint may be changed by the pilot. However, once you leave this page and come back, the reference waypoint reverts back to a nearby VOR.

Line 3: The magnetic radial from the reference waypoint to the intersection.

Line 4: The distance from the reference waypoint to the intersection.

3.11.5. USER WAYPOINT PAGES

The User waypoint pages (USR 0, USR 1, USR 2, and USR 3) allow you to create "custom" waypoints for use in navigation. A crop sprayer might want to create a waypoint on a field that is sprayed regularly, for instance. Another candidate might be a small airport which is not included in the KLN 89(B) database. To learn how to create a user-defined waypoint, see section 4.6.

3.11.5.1. The User 0 (USR 0) Page

See figure 3-162.

NOTE: The USR 0 page is only displayed for waypoint identifiers that do not have a previously defined position.
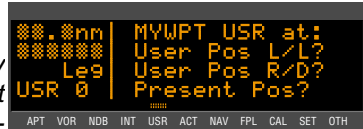
Figure 3-162

Line 1: The identifier for the as-yet-undefined waypoint.

Lines 2-4: Cursor fields for the three possible user-defined waypoint creation methods. For information on creating user-defined waypoints, see section 4.6.

3.11.5.2. The User 1 (USR 1) Page

See figure 3-163.

Line 1: The user-defined waypoint identifier, preceded by an arrow if it is the active waypoint.
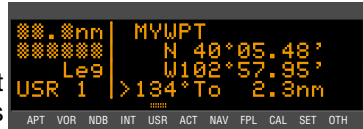
Figure 3-163

Lines 2-3: The latitude and longitude of the user-defined waypoint.

Line 4: The magnetic bearing to or the magnetic radial from the user-defined waypoint and the distance. Placing the cursor over the radial/bearing field and pressing ⌐CLR⌐ toggles between radial from and bearing to station.

3.11.5.3. The User 2 (USR 2) Page

See figure 3-164.

Line 1: The user-defined waypoint identifier, preceded by an arrow if it is the active waypoint.
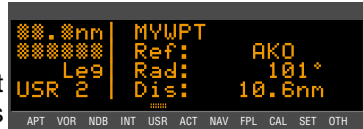
Figure 3-164

Line 2: The identifier of the user-defined waypoint's reference waypoint. When this page is first viewed, the reference waypoint is the

3-56

nearest VOR to the user waypoint. The reference waypoint may be changed by the pilot. However, once you leave this page and come back, the reference waypoint reverts back to a nearby VOR.

Line 3: The magnetic radial from the reference waypoint to the user waypoint.

Line 4: The distance from the reference waypoint to the user waypoint.

3.11.5.4. The User 3 (USR 3) Page

See figure 3-165.

Line 1: The identifier of the user-defined waypoint; an arrow precedes the identifier if it is the active waypoint.

Figure 3-165

Lines 2-4: The pilot-entered remarks for the user waypoint. Three lines of 14 characters each are available for the remarks. Up to 100 waypoints may include remarks. Letters, numbers, hyphens, and spaces may be used in the remark. If no remarks have been entered for the user-defined waypoint, line 2 will display **[Remarks]**.

To enter a user-defined waypoint remark on the USR 3 page:

1. Turn on the cursor and move it until the cursor fills line 2 of the screen (figure 3-166).

Figure 3-166

2. Select the desired character, if any, and move the cursor to the next character on the line (figure 3-167).

3. Repeat step 2 as necessary.

Figure 3-167

4. Press ENT to approve each line of remarks. The cursor will automatically move to the next line (see figure 3-168).

5. Turn the cursor off when you are finished creating the remark.

Figure 3-168

The Other 5 (OTH 5) page is a list of waypoints with associated remarks. Sometimes these are deleted if there are more than 100 waypoints with remarks, or if the remarks are no longer relevant. If you wish to delete a waypoint remark for a user-defined waypoint, see section 3.14.2.

3.12. ALTITUDE PAGES

The ALT (altitude) pages are used to control and display most of the altitude-related functions of the KLN 89(B), including minimum safe altitudes and vertical navigation (VNAV). The ALT pages are accessed by pressing the ⌊ALT⌋ button. The first time the ⌊ALT⌋ button is pressed, the ALT 1 page is displayed (figure 3-169). If the ⌊ALT⌋ button is pressed again while the ALT 1 page is displayed, the display changes to the ALT 2 page. Pressing ⌊ALT⌋ a third time goes back to the page which you were on before you changed to the ALT pages.

Figure 3-169

NOTE: *For a detailed discussion of the ALT 2 page, see section 4.4, "Advisory VNAV Operation".*

The ALT 1 page is used to set the current barometric pressure or "baro setting". Since all encoding altimeters and some air data computers output pressure altitude, it is often required that you manually input the proper baro setting in order to get accurate altitude functions. The KLN 89(B) functions which use the altitude input are special use airspace (SUA) alerting, altitude alerting, and vertical navigation (VNAV). It is a good idea to update the altimeter baro setting on the ALT 1 page each time you make a change to the aircraft's altimeter setting.

To Change the Baro Setting:

1. Press ⌊ALT⌋. The ALT 1 page will be displayed with the cursor over the altimeter baro setting field (figure 3-169).

NOTE: *The SET 8 page (figure 3-170) is used to set the unit of measure for various parameters. The altimeter barometric setting can be set to inches of Mercury ("), millibars (mB), or hecto-topascals (hP). Altitude, airport elevation, and runway lengths can be set to feet (ft) or meters (m). Finally,*

Figure 3-170

distances and velocities can be set to nautical miles (nm) and knots (kt) or kilometers (km) and kilometers/hour (k/h). To change a unit of measure: select the SET 8 page; turn on the cursor (CRSR) and move it over the desired unit of measure using the right outer knob; turn the right inner knob to select the desired unit of measure; and turn the cursor off again. This format for the SET 8 page applies to ORS 02 software. ORS 01 software only allows the selection of barometric setting units.

2. Use the right inner knob to update the altimeter baro setting (figure 3-171).

Figure 3-171

Line 3 displays the Minimum Safe Altitude (**MSA**)

IMPORTANT: The minimum safe altitude displayed is the altitude defined by Jeppesen as "Grid Minimum Off-Route Altitude (Grid MORA)". This altitude is derived by Jeppesen for sectors which are one degree of latitude by one degree of longitude in size. One degree of latitude is 60 nautical miles. One degree of longitude is 60 nautical miles at the equator and progressively less than 60 nautical miles as one travels away from the equator. One degree of longitude is approximately 50 nautical miles at the southern most parts of the U.S. and is approximately 40 nautical miles at the northern most parts of the U.S. The MSA altitude information is contained in the data base and is updateed when the data base cartridge is updated.

The minimum safe altitude (MSA) provides "reference point" clearance within these one degree latitude by one degree longitude sectors. Jeppesen defines a reference point as "a natural (Peak, Knoll, Hill, etc.) or man-made (Tower, Stack, Tank, Building, etc.) object". Jeppesen states the following about the Grid Minimum Off-Route altitude: "Grid MORA values clear all reference points by 1000 feet in areas where the highest reference points are 5000 feet MSL or lower. MORA values clear all reference points by 2000 feet in areas where the highest reference points are 5001 feet MSL or higher". The KLN 89(B) displays dashes for areas outside the data base coverage area or for areas where the Grid MORA is not defined.

Line 4 displays the Minimum Enroute Safe Altitude (**ESA**).

IMPORTANT: When the KLN 89(B) is in the Leg mode, the minimum enroute safe altitude is the highest MSA sector altitude from the present position to the active waypoint, then to the destination waypoint along the active flight plan. See figure 3-172. When the KLN 89(B) is in
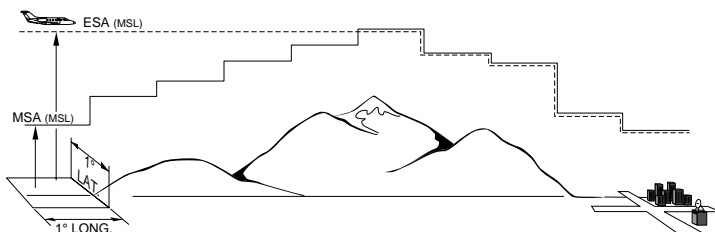
Figure 3-172

the OBS mode, the minimum enroute safe altitude is the highest MSA sector altitude from the present position to the active waypoint.

WARNING: The MSA and ESA altitudes displayed are advisory in nature only. They should not be relied upon as the sole source of obstacle and terrain avoidance information. Refer to current aero-nautical charts for appropriate minimum clearance altitudes.

3.13. VIEWING AND SETTING THE DATE AND TIME

The KLN 89(B) system time and date should seldom, if ever, require updating because they are automatically updated when at least one satellite is received. In addition, the KLN 89(B) contains an internal battery powered calendar/clock to keep system time and date when the unit is not being used. You will normally check to make sure the KLN 89(B) is set to the correct time and date shortly after you turn the unit on while you verify the Self Test Page. You can, however, also check the time and date on the Setup (SET) 2 page anytime you desire. There are several pages as well as some internal functions of the KLN 89(B), such as magnetic variation and proper use of data base informa-tion, that depend on having the proper time and date.

NOTE: You will not be able to update the time or date if the KLN 89(B) is receiving a time and date from a satellite.

To set the date on the SET 2 page:

1. Select the SET 2 page (figure 3-173).

2. Turn on the cursor. The cursor will be over the entire date field (figure 3-174).

Figure 3-173

3. Select the correct day of the month with the right inner knob.

4. Move the flashing part of the cursor to the month field (middle three dashes) with the right outer knob, and select the proper month (figure 3-175).

Figure 3-174

5. Move the flashing part of the cursor to the tens digit of the year field, and select the proper number (figure 3-176).
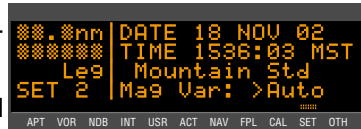
Figure 3-175

6. Repeat step 5 for the ones digit of the year field.

7. Press $\boxed{ENT}$ to start the KLN 89(B) using the newly entered date (figure 3-177).

Figure 3-176

To set the time on the SET 2 page:

1. Select the SET 2 page if it is not already selected.

2. Turn on the cursor and move it to the time zone field (figure 3-178).
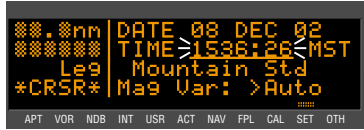
Figure 3-177

3. Change the time zone with the right inner knob, if desired   (figure 3-179). A listing of the time zones and their abbreviations is contained in section 3.2, "Turn-on and Self Test".

Figure 3-178

4. Move the cursor to the time field. The hours and minutes will appear in inverse video.
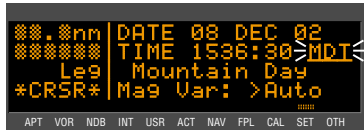
5. Select the correct hour   (figure 3-180). Remember, the KLN 89(B) uses 24 hour time. If it is 1:00 P.M. or later, add 12 hours (for example, 2:30 P.M. becomes 14:30).

Figure 3-179

Figure 3-180

6. Move the flashing part of the cursor to the tens of minutes, select the proper number   (figure 3-181), then move on to the last digit and set it.

7. Press $\boxed{ENT}$ to start the clock running (figure 3-182). Note that the seconds reset to zero when you do this.
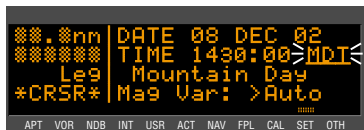
Figure 3-181

NOTE: The above format for the SET2 page applies to ORS 02 software. ORS 01 software has a different page layout; however, the same steps are followed to set the date or time.

Figure 3-182

**Basic GPS Operation
Chapter 3**

3.14.   THE OTHER (OTH) PAGES

3.14.1. DETERMINING THE STATUS OF THE GPS SIGNALS

The Other (OTH) 1 and OTH 2 pages may be viewed at any time to determine the status of the GPS receiver and the GPS satellites being received. This includes which satellites are being tracked, the satellites' health, the signal strength for each of these satellites, the elevation of each satellite above the horizon, the azimuth of each satellite referenced to your present position, the estimated position error, and the present GPS-derived altitude.

The GPS receiver in the KLN 89(B) is capable of using signals from up to eight satellites to determine its position. A valid position may be determined using as few as four satellites alone or three satellites with a valid electronic altitude input. However, four satellites alone or three satellites with an altitude input do not necessarily ensure that navigation can take place. The satellites must be positioned relative to your location such that sufficient "geometry" exists to determine an accurate position. The satellite constellation geometry is continually changing as each satellite, "rises", travels across the sky, and eventually "sets" relative to your position. The GPS satellites are not in geosynchronous orbits positioned over the same spot on earth at all times like some television communication satellites with which you may be familiar. Rather, the GPS satellites are in orbits that allow them to circle the earth about two times each day.

A representative OTH 1 page is shown in figure 3-183. The OTH 1 page displays the GPS receiver state and the system's estimate of the position error expressed in nautical miles or kilometers.

Figure 3-183

The GPS state is indicated on line 1. The possibilities are:

INIT	initialization
ACQ	acquisition
TRAN	transition
NAV	navigation
NAV A	navigation with altitude aiding
NAV D	navigation with data collection
DEGRD	navigation with position degradation
FAILR	receiver failure

In the initialization state the GPS receiver is in the process of initializing itself, collecting information such as the date, time, and last present position. Next, the receiver collects data from its own memory to determine which satellites should be visible. After completing the initialization process the receiver begins the acquisition process. During this time, the visible satellites are being acquired and data is obtained from them.

The transition state indicates an adequate number of satellites for navigation has been acquired and is being tracked but no position data can yet be produced.

Normal navigation is indicated by a **NAV**, **NAV A**, or **NAV D** GPS state. **NAV A** indicates that the altitude input is being used in the position solution. **NAV D** indicates that besides calculation position, the receiver is collecting and storing in its memory additional data from the satellites (called ephemeris and almanac data).

Line 2 of the OTH 1 page displays the present GPS-derived altitude, that is, the altitude that is being indicated by the GPS position solution.

WARNING: Do not use the GPS-derived altitude for navigation. Due to Selective Availability position degradation and other factors, the GPS altitude is normally 300 feet or more in error, which is unacceptable for vertical navigation.

Lines 3 and 4 of the OTH 1 page display the KLN 89(B)'s estimated position error. The KLN 89(B)'s position error depends upon such factors as the number of satellites being received, the strength of the GPS signals, and the geometry of the satellites presently being used for navigation.

Figure 3-184

Figures 3-184, 3-185 and 3-186 show a representative example of a set of OTH 2 pages. There will be three OTH 2 pages if more than six satellites are being received as in this example. The following information is displayed for each satellite on the OTH 2 pages:
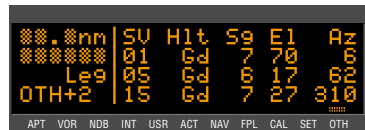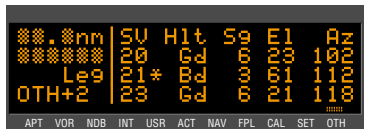
Figure 3-185

Figure 3-186

- The specific GPS satellites or "space vehicles" (**SV**) being received are displayed in the left column. Each satellite has its own identification number. A * symbol to the right of the satellite number indicates this particular satellite is not presently being tracked by the receiver.

NOTE: At some times, you may desire to deselect certain satellites if you know them to be inaccurate, so that they are not used to determine the GPS position. Should a satellite be inaccurate, it could cause a RAIM failure, rendering the system unusable for primary IFR navigation. To deselect a specific satellite, turn on the cursor ($\boxed{\text{CRSR}}$) and move it over the desired SV number (figure 3-187). Turn the right inner knob to deselect (or reselect) the desired satellite.

- The satellite's "health" (**Hlt**) is indicated to the right of the satellite number. The health of the satellite can be described as **Gd** for Good, **Wk** for Weak, and **Bd** for Bad. **Ds** indicates the satellite was deselected by the pilot. **Fd** indicates the receiver detected a fault and excluded that satellite.

- The signal strength (**Sg**) for each satellite is displayed next and indicates the signal strength for each satellite in the range of 0 (zero) to 9 (nine). The higher the value the stronger the signal.

- The elevation (**El**) above the horizon for each satellite is provided in the right column and will range from 5° to 90°.

- The local azimuth (**Az**) of the satellite relative to your present

Figure 3-187

position, referenced to true north (rather than magnetic north). For example, in figure 3-187 satellite (SV) number 25 has an azimuth of 198° and is therefore south-southwest of you.

NOTE: The OTH 3 page predicts if and when RAIM (Receiver Autonomous Integrity Monitoring) capability will be available when you are ready to shoot a non-precision approach at your destination airport. See section 5.1.9 for more information on using OTH 3 page.

3.14.2. VIEWING AND DELETING USER WAYPOINTS AND WAYPOINT REMARKS

The OTH 4 and OTH 5 pages list the user-defined waypoints and waypoint remarks, respectively, which are currently stored in the KLN 89(B)'s memory.

3.14.2.1. The OTH 4 Page

An example of an OTH 4 page is shown in figure 3-188. All currently stored user-defined waypoints are listed in alphanumeric order. If the user-defined waypoint is the active waypoint, an arrow (✦) follows the identifier. If the waypoint is used in one or more flight plans, then the number of the first flight plan in which it is used is displayed on the right side. If there are more than three user waypoints in storage, you can see the rest of the list by turning on the cursor (CRSR) and turning the right outer knob to scroll through the list.
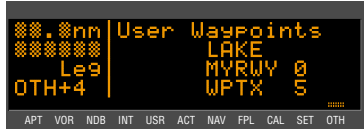
Figure 3-188
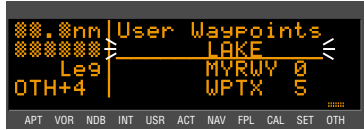
Figure 3-189

Figure 3-190

To delete a user-defined waypoint from the OTH 4 page:
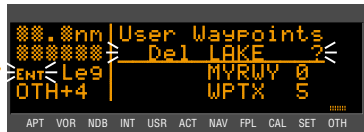
1. Turn on the cursor and position it over the desired waypoint (figure 3-189). If there are more than three user-defined waypoints, you will have to scroll the cursor down the list.

2. Press ▷CLR. The KLN 89(B) will ask if you wish to delete that user-waypoint (figure 3-190). If the waypoint is active or used in a flight plan, the deletion will not be allowed and you will receive a scratchpad message telling you this (figure 3-191).

3. Press ENT to approve the deletion (figure 3-192).

Figure 3-191

Figure 3-192

3.14.2.2. The OTH 5 Page

An example of an OTH 5 page is shown in figure 3-193. All waypoints with remarks are listed in alphanumeric order. Remarks can be stored for airports (on the APT 3 page) or user-defined waypoints (on the USR 3 page). If the way-

Figure 3-193

point is an airport, then an "**A**" is displayed on the right side; likewise, a "**U**" represents a user-defined waypoint. If there are more than three waypoints, you can see the rest of the list by turning on the cursor (CRSR) and turning the right outer knob to scroll through the list.

To delete a waypoint remark from the OTH 5 page:

1. Turn on the cursor and position it over the desired waypoint (figure 3-194). If there are more than three airports with remarks, you will have to scroll the cursor down the list.

Figure 3-194

2. Press >CLR. The KLN 89(B) will ask if you wish to delete that remark (figure 3-195).

3. Press ENT to approve the deletion.

Figure 3-195

3.14.3. VIEWING THE KLN 89(B) SOFTWARE STATUS (THE OTH 6 PAGE)
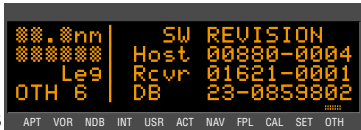
The OTH 6 page (figure 3-196) shows the software status of the KLN 89(B) host computer (line 2), the GPS receiver (line 3), and the Database Cartridge (line 4).

Figure 3-196

3.15. REMOTE MOUNTED ANNUNCIATORS

The KLN 89(B) has outputs capable of driving two remote annunciator lights: waypoint alert and message. Although these annunciators are optional, it is desirable to have them mounted in the pilot's normal scan area so that these annunciators are easily seen. A typical annunciator is shown in figure 3-197; however, actual annunciation abbreviations and configurations may be different.

Figure 3-197

The remote waypoint alert annunciator is on whenever waypoint alerting is occurring. See sections 3.9.3, "Waypoint Alerting for Direct To Operation" and 4.2.2, "Turn Anticipation and Waypoint Alerting".

The remote message annunciator is on whenever the message prompt is on. See section 3.5.

In addition, there may be a NAV/GPS switch/annunciator to switch a CDI or HSI indicator's navigation source between the KLN 89(B) and a VOR/ILS system, and a GPS APR switch/annunciator which allows display and control of the KLN 89B approach modes (see section 5.1).

3.16 AVIONICS BUS VOLTAGE ALERTING

The SET 10 page serves as a monitor of your avionics power bus. It gives you a digital readout of the voltage supplied to your avionics, down to tenths of volts. You will find this feature valuable as an extra layer of security in cases of electrical or charging system problems.

A voltage alert feature is also available on this page, to warn you of an electrical system problem, regardless of whether you are viewing the SET 10 page or not. It is set up so that the avionics bus voltage must drop below the alert limit for a certain length of time. This time delay is so that brief power interruptions don't trigger the voltage alert.

The alert voltage and the alert delay are set at the time of installation and stored in the KLN 89(B) configuration module. As the pilot, your two options are to have the voltage alert disabled, or to have it enabled with the predefined voltage and time delay values.

To enable the voltage alert feature:

1. Select the SET 10 page (figure 3-198) and turn on the cursor (CRSR).

Figure 3-198

2. Turn the right inner knob to enable the alert feature. The alert voltage and alert delay will be displayed on lines 2 and 3 (figure 3-199).

3. Turn off the cursor (CRSR).
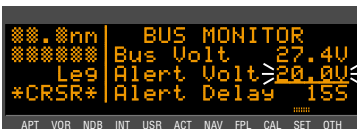
Figure 3-199

If the avionics bus voltage drops below the alert voltage for the specified delay time, the message

*Low Bus Voltage
 Check Charging System

will be displayed. This message may be indicative of a problem with the aircraft's charging system. Consult your aircraft's Pilot Operating

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Handbook to troubleshoot the problem. You may desire to turn off some of the aircraft's electrical devices which are non-essential for your particular phase(s) of flight, so that the battery will not discharge as quickly.

Appropriate alert voltage and alert delays will vary from aircraft to aircraft. If your KLN 89(B) is frequently giving you this alert message, it may become a nuisance, and you may desire to have your Honeywell Service Center adjust the voltage alert parameters.

3.17. SPECIAL USE AIRSPACE ALERTING

The KLN 89(B) data base contains the location of areas of special use airspace (SUA). The types of SUA areas stored in the data base and the abbreviations used to denote these areas are the following:

Class B	**CL B**
Class C	**CL C**
Control Area (used outside USA)	**CTA**
Terminal Area (used outside USA)	**TMA**
Alert Area	**ALRT**
Caution Area	**CAUT**
Danger Area	**DNGR**
Military Operations Area	**MOA**
Prohibited Area	**PROH**
Restricted Area	**REST**
Training Area	**TRNG**
Warning Area	**WARN**
Terminal Radar Service Area	**TRSA**

The KLN 89(B) will normally alert you prior to entering one of these areas with a message prompt. When the Message page is viewed it will display Airspace Alert and will also display the name and type of the special use airspace (figure 3-200). If the special use airspace is a Class B, Class C, CTA, or TMA, the message page will also instruct you to press the >CLR button if you wish to see the Airport 5 page (airport communications) for the primary airport so that the correct communications frequency may be determined (figure 3-201).

Figure 3-200
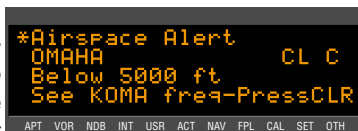
Figure 3-201

NOTE: In addition to the message page messages that alert you to special use airspace, the KLN 89(B) can also display the five nearest areas of SUA. It will even give you the direction and distance to the nearest edge of the SUA. See section 3.8.2 for more details.

The SUA alert feature is three dimensional. The SUA areas are stored in the KLN 89(B) data base with regard to altitude when the actual SUA altitude limitations are charted in terms of mean sea level (MSL). Therefore, if you are flying either above or below an SUA area you won't be inconvenienced with nuisance alert messages. However, if the actual lower limit of an SUA is charted in terms of an altitude above ground level (AGL), then it is stored in the KLN 89(B) as all altitude below the upper limit of the SUA. If the actual upper limit of an SUA is charted in terms of AGL, it is stored in the KLN 89(B) as "unlimited".

If the altitude input to the KLN 89(B) is pressure altitude from an altitude encoder or air data computer, then you must manually update the KLN 89(B) with an altimeter setting (baro correction in order to receive accurate SUA alerting. You may easily update the altimeter setting by pressing the ALT button to display the Altitude 1 (ALT 1) page (figure 3-202) The right inner knob is used to change the altimeter setting. When the setting is complete, press ALT twice to return to the page previously in view.

Figure 3-202

CAUTION: Failure to keep the altimeter baro setting updated will result in inaccurate special use airspace alerting. If this feature is used, it is a good idea to update the altimeter baro setting on the ALT 1 page each time you make a change to an aircraft's altimeter setting.

NOTE: If there is no altitude input to the KLN 89(B), all altitudes will be regarded as being within the boundary of the SUA area.

Only the outer lateral boundaries are stored for Class B, Class C, CTA, and TMA airspace. These SUA areas are stored as "cylinders" of airspace so all altitudes below the upper limit of these areas are considered to be in the SUA.

The message prompt for a special use airspace alert will occur when the aircraft's position is at a point such that a projection of the aircraft's existing track over the ground is approximately 10 minutes from penetrating the outer boundary of one of these areas. It will also

occur if the aircraft is within approximately two nautical miles of one of these areas even if the aircraft's projected track over the ground won't actually penetrate the SUA area (figure 3-203). If one of the SUA areas is penetrated, another message will state: **Inside SUA**.

Figure 3-203

The SUA alert feature may be disabled (or enabled) on the Setup 7 (SET 7) page, shown in figure 3-204. Select the SET 7 page, turn on the cursor (CRSR). The right inner knob is used to choose between **SUA ALERT ENABLED** and **SUA ALERT DISABLED**.

Figure 3-204

If the SUA alert feature has been enabled, the KLN 89(B) allows you to select a vertical buffer on the SET 7 page in order to provide an additional layer of protection from inadvertently entering an SUA. To select a vertical buffer, make sure the SUA alert feature has been enabled. Turn on the cursor (CRSR) (figure 3-205) and then use the right inner knob to select the buffer (figure 3-206). The buffer may be selected in one hundred foot or ten meter increments. After the desired selection has been made, turn the CRSR off.
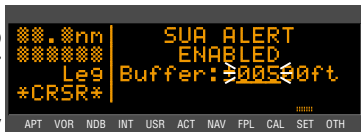
Figure 3-205
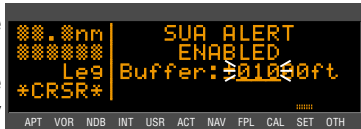
Figure 3-206

The vertical buffer serves to "stretch" the SUA area in both directions (up and down) by the selected buffer altitude. For example, let's say you have selected a buffer of 1,000 feet and the actual SUA area exists from 5,000 feet MSL to 12,000 feet MSL. In this case you will receive SUA alert messages if you fly at any altitude between 4,000 and 13,000 feet MSL.

CAUTION: It is the pilot's responsibility to avoid those areas of special use airspace where ATC clearance to penetrate is required but has not been obtained. The KLN 89(B)'s special use airspace alert is only a tool to assist the pilot and should never be relied upon as the sole means of avoiding these areas.

‡NOTE: *Special Use Airspace alerting is disabled when the KLN 89B is in the approach arm or approach active modes.*

3.18 SAMPLE TRIP

We've talked a lot about the features of the KLN 89(B), and now it's time to put those features to work for us and try a sample trip! Our trip will be from Adams field (KLIT) in Little Rock, Arkansas to Mueller Municipal airport (KAUS) in Austin, Texas. The weather is perfect and we decide to make trip VFR and fly direct to Austin.

3.18.1 PRE-DEPARTURE

1. Apply power to the KLN 89(B) by turning the power knob to the ON position.

2. Verify that the information on the Self Test and Initialization pages is correct, including the time and date. Enter the altimeter baro setting. Position the cursor over **Ok?** and press ENT to approve the Initialization page.

3. Read the Data Base page and acknowledge it by pressing ENT.

4. The APT 5 page for Adams field (**KLIT**), which shows the communications frequencies, is now displayed on the screen since **KLIT** was the active waypoint when you last removed power from the KLN 89(B). The first APT 5 page indicates that the ATIS frequency is 125.65 MHz, the pre-taxi clearance delivery frequency is 118.95 MHz, and the ground control frequency is 121.90 MHz. After listening to ATIS, we contact clearance delivery for our clearance out of the Little Rock Class C airspace. Next, we give ground control a call and receive our taxi clearance.

5. By this time the KLN 89(B) has reached a NAV ready status. We can verify this by turning to the NAV 2 page. It shows a valid present position, in this case 3.8 nautical miles on the 320 degree radial from Little Rock (**LIT**) VOR.

6. Press ⊕ to bring up the Direct To page. Use the right inner and outer knobs to enter the identifier of Mueller Municipal airport

(KAUS) by using the right inner knob to select the characters and the right outer knob to move the flashing part of the cursor to the desired cursor location.

7. Press ⌷ENT⌷. The APT 1 page for Mueller Municipal is now displayed on the screen.

8. Press ⌷ENT⌷ again to approve the waypoint page. The NAV 1 page is now displayed. The NAV 1 page indicates it is 384 nautical miles to Austin and that the bearing is 225 degrees. After take-off, the NAV 1 page will also display groundspeed and estimated time en route.

3.18.2 EN ROUTE

1. We depart from runway 36 at Little Rock and are told to "maintain runway heading." After several radar vectors for traffic avoidance we are finally cleared on course. The D-Bar indicates that the radar vectors have taken us north of the original course and we decide to proceed Direct To Austin from our present position. To recenter the D-Bar, press ⌷ᐅ⌷, and then press ⌷ENT⌷.

2. In order to determine the minimum enroute safe altitude (ESA) for our flight, you view the ALT 1 page by pressing the ⌷ALT⌷ button. It indicates an ESA of 4300 feet for the trip and a minimum safe altitude for our present position of 3400 feet.

3. After departure control has directed "squawk 1200, frequency change approved," you decide it would be a good idea to obtain VFR flight following. To obtain the frequency for Center, press the ⌷NRST⌷ button, move the cursor to the **CTR?** selection, and press ⌷ENT⌷. The KLN 89(B) indicates that for our position, we should be able to contact Memphis Center on 118.85 MHz.

4. We've only flown about 100 nautical miles, but we begin wondering where we would go if an engine suddenly started running rough. We decide to use the KLN 89(B) to determine where the nearest airports are from our present location. To view the nearest airports press ⌷NRST⌷, and then press ⌷ENT⌷. The nearest airport is Hope Municipal (**M18**) which is eight nautical miles from our position on a bearing to the airport of 11 degrees. You now rotate the right inner knob to view the other APT pages for Hope Municipal. We learn, for example, that it is located in Hope, Arkansas, and has two hard surface runways that are each 5500 feet in length. By pulling the right inner knob to the "out" position, you may now scan clockwise through the remaining eight airports in the nearest airport list.

5. For the majority of the en route portion of the flight, you select the NAV 4 page's moving map display. Pressing the right `CRSR` button, you select the 30 nautical mile range scale using the right inner knob. Moving the cursor to **Menu?** And pressing `ENT` brings up the display menu on the screen. You then use the right knobs to select **APT:on** and **SUA:on** so that nearby airports and special use airspace (SUA) are shown on the moving map display. While the menu is displayed, select the track up map orientation (**TK†**) as well, Pressing the `CRSR` button again removes the menu from the screen.

6. Since it is a good idea to not rely on just one navigation source, you suggest we cross check the KLN 89(B) position against other equipment in the aircraft. The NAV 2 page indicates we are presently located on the Texarkana (**TXK**) VOR 68 degree radial at a distance of 19 nautical miles. By tuning our NAV receiver and DME to **TXK**, we are able to confirm that this is the correct position.

3.18.3 TERMINAL AREA

1. About 50 nautical miles from Austin's Mueller airport we start preparing four our arrival. Viewing the APT 5 page for **KAUS** you determine that the ATIS frequency is 119.20 MHz and tower is 121.00 MHz.

2. A few minutes later, the message prompt begins flashing. When you press `MSG`, the message page advises **Airspace Alert - Austin CL C - Below 4600 ft - See KAUS freq-Press CLR**. The Special Use Airspace Alert feature has determined that you are within 10 minutes of penetrating the Austin Class C airspace. When you press `CLR` and view the APT 5 page for KAUS, you see that the Class C airspace frequencies are sectorized. You determine from the APT 5 page that the proper frequency to use is 124.90 MHz since we are Northeast of Austin and 124.90 MHz is the appropriate frequency to use from 3 degrees to 170 degrees. You turn to the NAV 4 page so that we can see the outer boundary of the Austin Class C airspace relative to our location and route.

3. After you call Austin approach control for clearance into the Class C airspace, you view the rest of the APT pages for KAUS to determine the field elevation and available runways.

4. After landing, the KLN 89(B) is turned off either by rotating the KLN 89(B) power knob to OFF, or with the avionics master switch if one is installed.

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4. ADVANCED GPS OPERATION

4.1. CREATING AND MODIFYING FLIGHT PLANS

The following rules and considerations apply to KLN 89(B) flight plans:

- The KLN 89(B) is capable of storing in its memory 25 flight plans plus an active flight plan.

- Each of the flight plans may contain up to 20 waypoints. The waypoints may consist of any combination of published waypoints from the data base or user created waypoints. The active flight plan may contain up to 35 waypoints if it includes approach and SID/STAR waypoints.

- The flight plans are numbered 0 through 25 (FPL 0, FPL 1, FPL 2, . . . , FPL 25).

- The active flight plan is **always** FPL 0. The standard procedure is to create a flight plan using one of the flight plans numbered as FPL 1, FPL 2, etc. When one of these numbered flight plans is activated, it becomes FPL 0, the active flight plan. This Pilot's Guide will refer to FPL 0 as the "active flight plan" and FPL 1 through FPL 25 as the "numbered flight plans." If desired, a flight plan can be created directly in the active flight plan. This avoids creating the flight plan in a numbered flight plan and then having to activate it. The disadvantage is that if a numbered flight plan is subsequently made active, the one programmed directly into FPL 0 will be lost.

- Modifications may be made to FPL 0 without affecting the way it is stored as a numbered flight plan.

- Unless Direct To operation is being used, the active flight plan (FPL 0) must contain at least two waypoints. Otherwise, the KLN 89(B) navigation system will be flagged.

4.1.1. *CREATING A FLIGHT PLAN*

A flight plan for a flight from Lakefront airport in New Orleans, LA to St. Petersburg/Clearwater, FL International airport will be used as an example of how to create a flight plan. The waypoints making up the flight plan are: **KNEW** (Lakefront airport), **GPT** (Gulfport VOR), **SJI** (Semmes VOR), **CEW** (Crestview VOR), **MAI** (Marianna VOR), **TLH** (Tallahassee VOR), **CTY** (Cross City VOR), and **KPIE** (St. Petersburg/Clearwater International airport).

To create a flight plan:

1. Select the flight plan (FPL) pages with the right outer knob.

2. Select a flight plan page (preferably other than FPL 0) which does not contain a flight plan (figure 4-1). If all of the flight plan pages contain flight plans, refer to section 4.1.6, "Deleting Flight Plans".

Figure 4-1

3. Turn on the cursor (CRSR).

*NOTE: The KLN 89(B) flight plan operation is designed so that the first waypoint in the flight plan should always be the departure point. Remember to enter the **K, P,** or **C** prefix for certain airports in the United States, Alaska (some, but not all cases), or Canada, respectively. See section 2.3, "ICAO Identifiers".*

4. Use the right inner knob to select the first character of the departure waypoint identifier (figure 4-2). If you have set the default first waypoint character to **K** on the SET 5 page, you will just need one turn clockwise (see section 3.4.2, "Data Entry")

Figure 4-2

5. Turn the right outer knob to move the flashing part of the cursor over the second character, then select the desired character.

6. Use the above procedure to select the entire identifier for the first waypoint (figure 4-3).

Figure 4-3

7. Press ENT. A waypoint page for the identifier just entered will be displayed on the screen (figure 4-4). If a mistake was made and the wrong waypoint identifier was entered, press CLR and begin again. If no mistake was made but the waypoint identifier just entered isn't in the data base, a

Figure 4-4

page allowing creation of a user defined waypoint will appear on the screen. Refer to section 4.6 for instructions on how to create a user-defined waypoint.

4-2

8. Press `ENT` again to approve the waypoint page being displayed. The cursor will move automatically to the second waypoint position (figure 4-5).

Figure 4-5

NOTE: *A small number of waypoints are stored in the data base as "fly-over" waypoints. These waypoints are associated with SID/STAR procedures. "Fly-over" means that, for some reason, the governing agencies have decided that it is important to fly directly over the way-point instead of being able to "cut the corner" by using turn anticipation (see section 4.2.2). In these cases the KLN 89(B) will*

present a waypoint type identification page (figure 4-6). Simply select the way in which the waypoint is intended to be used with the right outer knob and press `ENT`*. If the* ***SID/STAR*** *choice is selected, the KLN 89(B) will disable turn anticipation for that way-*

Figure 4-6

point (if previously enabled). The KLN 89(B) will enable turn anticipation after the waypoint has been passed (if turn anticipation was previously enabled). If ***En Route*** *is selected, then normal turn anticipation occurs.*
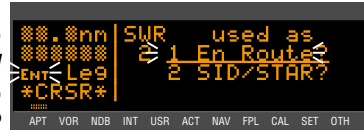
9. Use the same procedure to enter the rest of the waypoints in the flight plan (figure 4-7). If the flight plan consists of three or more waypoints, the waypoints will automatically scroll as necessary to allow entry of the next waypoint.

Figure 4-7

10. When all of the waypoints have been entered in the flight plan, the right outer knob may be rotated to move the cursor up and down and manually "scroll" through the waypoints making up this flight plan. This is useful if the flight plan contains four or more waypoints since not all of the waypoints can be displayed at one time. When the right outer knob is rotated counterclockwise, the cursor may be positioned over **Use?**. If there are more than three waypoints in the flight plan, the first two waypoints will then be displayed followed by the last waypoint in the flight plan. Rotate the right outer knob to move the cursor and manually scroll to see the missing intermediate waypoints.

11. Turn off the cursor (`CRSR`). Additional flight plans may now be created in the same manner.

4.1.2. *VIEWING DISTANCE AND DESIRED TRACK BETWEEN STORED FLIGHT PLAN WAYPOINTS*

The stored flight plan (FPL 1-25) pages have a field to the right of each waypoint in the flight plan. This field may be used to display the cumulative distance (**Dis**) to each waypoint or the magnetic desired track (**Dtk**) from the previous waypoint.

If you have more than three waypoints in the stored flight plan, you may wish to view flight data for waypoints which are not displayed on the screen. If this is the case, turn on the cursor (`CRSR`) and use the right outer knob to scroll down the flight plan until the waypoint of interest is on the screen.

This display will default to the distance presentation at power-on. The area in the upper right hand area of the screen is a cyclic field.

To cycle between distance and desired track display on a numbered flight plan page:

1. Turn on the cursor (`CRSR`); it will come up over the cyclic field, which in this case is displaying distance (**Dis**) in nautical miles or kilometers (figure 4-8).

Figure 4-8

2. Press `>CLR`. The cyclic field will change to magnetic desired track (**Dtk**) (figure 4-9). An additional `>CLR` press cycles back to **Dis**.

Figure 4-9

4.1.3. *ACTIVATING A NUMBERED FLIGHT PLAN*

To activate one of the previously created numbered flight plans:

1. Use the right outer and inner knobs to select the desired flight plan page (figure 4-10).

Figure 4-10

2. Press `CRSR` to turn on the cursor. It will appear over **Use?** (figure 4-11). If you haven't left the numbered flight plan since creating this flight plan, rotate the outer knob counterclockwise to position the cursor over **Use?**

Figure 4-11

4-4

3. Press ENT to activate the flight plan in the order shown (figure 4-12). To activate the flight plan in inverse order (first waypoint becomes last and last waypoint becomes first), rotate the outer knob one step clockwise to position the cursor over **Use? Inverted?** before pressing ENT. The result is shown in figure 4-13.

Figure 4-12

Figure 4-13

4. The selected flight plan is now displayed as FPL 0, the active flight plan. Any changes made to FPL 0 will not affect how this flight plan is stored as the numbered flight plan.

4.1.4.   ADDING A WAYPOINT TO A FLIGHT PLAN

A waypoint may be added to any flight plan containing fewer than 20 waypoints

To add a waypoint to a flight plan:

1. Turn on the cursor with the CRSR button.

2. With the outer knob, position the cursor over the waypoint identifier which you desire to follow the waypoint being added. Another way to think of this is to position the cursor over the location in the flight plan you wish the new waypoint to be added. For example, if **SJI** is presently the second waypoint in the flight plan and you wish to insert **GPT** in the number 2 position in front of **SJI**, move the cursor over **SJI** (figure 4-14).

3. Use the inner knob to enter the first character of the waypoint being inserted. As you begin to turn the knob, the existing waypoint in this position automatically jumps down to the next position. In this case, **SJI** automatically moves to waypoint 3 and KPIE changes to waypoint 8 (figure 4-15).

Figure 4-14

Figure 4-15

4. Complete the waypoint entry operation (figure 4-16).

Figure 4-16

NOTE: *If adding a waypoint or way-points (such as adding SID/STAR/ Approach procedures) would exceed the capacity of FPL 0, KLN 89(B) will notify you that it is deleting waypoints from the beginning of FPL 0 to make room for the addition.*

Figure 4-17

5. Press ENT to display the waypoint page on the right side for the identifier just entered (figure 4-17).
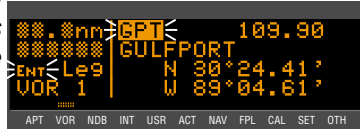
6. Press ENT again to approve the waypoint page (figure 4-18).

Figure 4-18

7. Turn off the cursor (CRSR).

4.1.5. DELETING A WAYPOINT FROM A FLIGHT PLAN

To delete a waypoint from a flight plan:

1. Press CRSR to enable the cursor if it is not on already.

2. Move the cursor over the waypoint you wish to delete (figure 4-19).

Figure 4-19

3. Press >CLR. The letters **Del** (delete) will appear to the left of the identifier and a question mark will appear to the right of the identifier (figure 4-20). If a mistake was made and you do not wish to delete this waypoint, press >CLR.

Figure 4-20

4. Press ENT and the waypoint will be deleted from the flight plan. The other waypoints in the flight plan will be correctly repositioned (figure 4-21).

Figure 4-21

5. Turn off the cursor (CRSR).

4.1.6. DELETING FLIGHT PLANS

To delete a flight plan which is no longer required:

1. Display the flight plan (FPL 0, FPL 1, . . ., or FPL 25) which is to be cleared (figure 4-22).

Figure 4-22

2. Make sure that the cursor is turned off, and use the `CRSR` button if it is not.

3. Press `>CLR`. The words **Delete FPL?** will appear at the top of the page (figure 4-23). If a mistake was made and you do not wish to clear this flight plan, press `>CLR` again.

Figure 4-23

4. Press `ENT` to clear the flight plan. The flight plan page will appear as in figure 4-24.
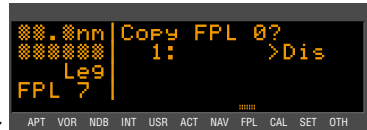
Figure 4-24

4.1.7. STORING FPL 0 AS A NUMBERED FLIGHT PLAN

The active flight plan may be loaded into a numbered flight plan so that it can be recalled for later use. This may be desirable, for example, if the active flight plan was originally created on the FPL 0 page and not as a numbered flight plan.

To store the active flight plan as a numbered flight plan:

1. Select a numbered flight plan page which does not contain any waypoints (figure 4-24). If none exist, use the procedure described in section 4.1.6, "Deleting Flight Plans," to clear a flight plan which is no longer required.

Figure 4-25

2. Turn on the cursor (`CRSR`). It will appear over the blank first waypoint position (figure 4-25).

3. Rotate the right outer knob counterclockwise to position the cursor over **Copy FPL 0?** (figure 4-26).

Figure 4-26

4. Press ENT to load the active flight plan into this numbered flight plan (figure 4-27).

Figure 4-27

4.2. OPERATING FROM THE ACTIVE FLIGHT PLAN

4.2.1. GENERAL PROCEDURES

Everything you have learned in this Pilot's Guide thus far is applicable to using the KLN 89(B) for flight plan operation. The following rules and considerations apply for flight plan operation while the KLN 89(B) is in the Leg mode:

• Always verify that you are viewing the active flight plan page (FPL 0) and not one of the other numbered flight plan pages.

• The active leg of the flight plan is designated with a ⌐ symbol. A leg is defined as the course line between a pair of waypoint (a "from" waypoint and a "to" waypoint). The head of the arrow is positioned to the left of and points to the active "to" waypoint. In figure 4-28, SLC (Salt Lake City VOR) is the "to" waypoint. The tail of the ⌐ symbol is positioned to the left of the "from" waypoint. KPVU (Provo Municipal) is the "from" waypoint in figure

4-28. The ⌐ symbol is not displayed unless the KLN 89(B) is actually receiving GPS signals suitable for navigation. *(**Note:** If the unit is in the take-home mode, it has been "tricked" into thinking it is receiving signals and therefore the ⌐ symbol can be displayed).* Also, the ⌐ symbol will not be displayed if Direct To navigation is occurring and the Direct To waypoint is not in FPL 0. If in doubt as to whether or not Direct To operation is occurring, view the NAV 1 page. If the top line shows the ↦ symbol (figure 4-29) instead of a "from" waypoint (figure 4-30), then Direct To navigation is occurring. If it is desired

Figure 4-28

Figure 4-29

Figure 4-30

4-8

to cancel the Direct To operation and operate from the active
flight plan, press `⊕→`, `>CLR`, and then `ENT`.

• As flight plan waypoints are reached, the active leg symbol auto-
  matically shifts to the next leg.

• If the flight plan contains more
  waypoints than can be displayed
  on the screen at one time, the
  page will automatically scroll as
  progress is made along the flight
  plan so that the active leg is
  always displayed (figure 4-31).

Figure 4-31

• The last waypoint in the flight plan is always displayed at the bot-
  tom of the FPL 0 page, even if all of the waypoints in the flight
  plan can't be displayed on the page at one time. To view inter-
  mediate waypoints, turn the cursor on and use the right outer
  knob to manually scroll through all of the waypoints, as desired.

  If scrolling is performed all the
  way to the end of the flight plan, a
  blank waypoint position will exist
  so that a waypoint may be added
  to the end of the flight plan
  (figure 4-32).

Figure 4-32

4.2.2.   TURN ANTICIPATION AND WAYPOINT ALERTING

Prior to reaching a waypoint in the active flight
plan, the KLN 89(B) will provide navigation along
a curved path segment to ensure a smooth transi-
tion between two adjacent legs in the flight plan.
That is, the CDI or HSI left/right deviation will be
referenced to the dashed line in figure 4-33. This
feature is called turn anticipation. The transition
course is based upon the aircraft's actual ground-
speed and the amount of course angle change
between the two legs. The KLN 89(B) automati-
cally sequences to the next leg after passing the
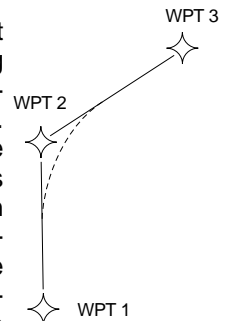midpoint in the transition segment.

Figure 4-33

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Approximately 20 seconds prior to the beginning of turn anticipation, the arrow preceding the active waypoint identifier will begin flashing on the FPL 0 page and on any Navigation page or waypoint page displaying the active waypoint identifier (figures 4-34 and 4-35). This is called "waypoint alerting". If an external waypoint alert annunciator is mounted in the aircraft, this annunciator will begin flashing at the same time.

Figure 4-34

Figure 4-35

To utilize the turn anticipation feature, start the turn transition to the next leg in the flight plan at the very beginning of turn anticipation. This occurs when the external waypoint alert annunciator stops flashing and goes on steady. At this time, the KLN 89(B) will notify you with a message on the Message page of the new desired track to select on your HSI or CDI.

*Adj Nav Crs to 123°

A message will not be given if the change in desired track (course change) is less than 5°.

The desired track (**DTK**) displayed on the NAV 1 page and optionally on the NAV 4 page also changes to the value for the next leg at the beginning of turn anticipation. Turn anticipation becomes inactive when transition to the next leg has been made.
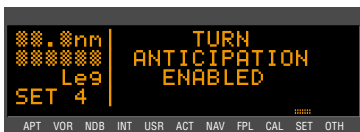
Figure 4-36

If desired, turn anticipation may be disabled (or enabled) on the Setup (**SET**) 4 page by pressing the CRSR button and then rotating the right inner knob to change back and forth between **ENABLED** (figure 4-36) and **DISABLED** (figure 4-37). If turn anticipation is disabled, navigation is provided all the way to the way-point, and waypoint alerting occurs approximately 36 seconds prior to actually reaching the waypoint.
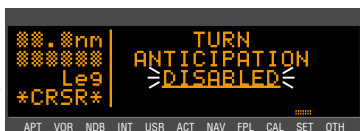

Figure 4-37

4.2.3. VIEWING THE WAYPOINT PAGES FOR THE ACTIVE FLIGHT PLAN WAYPOINTS

The waypoint pages for each of the waypoints in the active flight plan may be easily displayed by selecting the Active (ACT) Waypoint page type. When the ACT page type is first selected, the waypoint page for the active waypoint will be displayed (figure 4-38). The location of the waypoint in the flight plan (waypoint 1, waypoint 2, etc.) is annunciated with a number to the left of the identifier. In addition, an arrow to the left of the waypoint number designates the active waypoint. If there is a letter to the far right of the identifier, it designates the type of way-

Figure 4-38

Figure 4-39

point: **I** = intersection, **U** = user-defined waypoint. If the waypoint is an airport, the airport elevation is displayed here. If the waypoint is a VOR or an NDB, the navaid frequency is displayed in this area (figure 4-39).

Figure 4-40

To view the waypoints in the flight plan that are not the active way-point:

Figure 4-41

1. Pull the right inner knob to the "out" position and turn it to view each of the rest of the waypoints in the order they are contained in the flight plan (figure 4-40).

2. Once the desired waypoint is found, the right inner knob may be pushed back to the "in" position and rotated to display any of the other waypoint pages for that waypoint (figure 4-41).

3. Pulling the knob back out will allow further scanning of the waypoints in the active flight plan.

4.2.4. COMBINING DIRECT TO AND FLIGHT PLAN OPERATION

It is very common when using flight plan operation to use the Direct To function to proceed directly to a waypoint which exists in the active flight plan. For example, after takeoff on an IFR flight plan, it is

common to receive vectors in the terminal area and then be given a clearance direct to the first point in the flight plan that was filed. The KLN 89(B), as an advisory navigation source, makes this kind of operation very easy to accomplish. Whenever you do a Direct To operation to a waypoint which is in the active flight plan (FPL 0), the system will provide navigation to the waypoint and then automatically resume navigation along the flight plan when the Direct To waypoint is reached. Waypoints which exist prior to the Direct To waypoint in the active flight plan are bypassed. Of course, the active flight plan will never be resumed if the Direct To operation is to a waypoint which is not in the active flight plan.

Any of the several methods previously described for initiating Direct To operation may be used, although the one below is the easiest for this application.

Figure 4-42

To fly direct to a waypoint in the active flight plan (FPL 0):

1. Select the FPL 0 page.

Figure 4-43

2. Turn on the cursor (CRSR) and use the left outer knob to position the cursor over the desired waypoint (figure 4-42).

3. Press ⎵. The display will change to the Direct To Page (figure 4-43), with the identifier of the selected waypoint.

Figure 4-44

4. Press ENT to approve the Direct To. The NAV 1 page will be displayed (figure 4-44) reflecting the new active waypoint.

Figure 4-45

5. If you now turn back to the FPL 0 page, you will see that the active waypoint is now preceded by an arrow only, instead of the ⌐ symbol (figure 4-45). This is because there is no "from" waypoint in the flight plan.

If it is desired to cancel the Direct To operation prior to reaching the Direct To waypoint in order to proceed along the flight plan leg, press ⎵, then press CLR, then ENT.

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4.2.5. VIEWING DISTANCE, ETE, ETA, OR DESIRED TRACK TO FLIGHT PLAN WAYPOINTS

The active flight plan (FPL 0) page has a data field to the right of each waypoint in the flight plan. This field may be used to display the cumulative distance (**Dis**) from the present position to each waypoint, the estimated time en route (**ETE**), the estimated time of arrival (ETA), for which the time zone abbreviation is displayed, or the magnetic desired track (**Dtk**) between each waypoint.

If you have more than four waypoints in FPL 0, you may wish to view flight data for waypoints which are not displayed on the screen. If this is the case, turn on the cursor (CRSR) and use the right outer knob to scroll down the flight plan until the waypoint of interest is on the screen.

This display will default to the distance (**Dis**) presentation at power-on (figure 4-45). The area in the upper right hand corner of the screen is a cyclic field, which means that . . .

Figure 4-46

To cycle between distance, ETE, ETA, and desired track on the FPL 0 page:

1. Turn on the cursor (CRSR); it will come up over the cyclic field, which in this case is displaying distance (**Dis**) in nautical miles or kilometers (figure 4-46).

Figure 4-47

2. Press ▷CLR. Subsequent presses of the ▷CLR button will cycle through **ETE** in hours:minutes (figure 4-47), ETA in terms of the system time zone (figure 4-48), magnetic **Dtk** (figure 4-49), then back to **Dis**.

Figure 4-48

NOTE: When the cursor is over the cyclic field and it is displaying the ETA time zone, turning the right inner knob changes the system time zone (figure 4-50).

Figure 4-49

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Figure 4-50

NOTE: *When the KLN 89(B) is in OBS mode, the FPL 0 page will pre-sent OBS selected course (**OBS**) as an option instead of magnetic desired track (**Dtk**). The selected course will be displayed to the right of the active waypoint, and the **OBS** fields for all other waypoints will be dashed (figure 4-51).*

Figure 4-51

4.3. ALTITUDE ALERTING

If your aircraft does not already have an altitude alerting capability you may wish to use the KLN 89(B)'s capability of assisting you with alti-tude management during your flying. Altitude alerting allows you to select a target altitude and it then provides you with an aural alarm 1000 feet prior to reaching the selected altitude, another aural alarm upon reaching the selected altitude, and another aural alarm if you deviate from the selected altitude.

NOTE: *The altitude alerting function of the KLN 89(B) does not meet FAR Part 91 for turbojet-powered civil airplanes.*

NOTE: *Before you use the altitude alerting function, it is a good idea to make sure that the KLN 89(B) baro setting is current. To do this, press the* ALT *button and use the right inner knob to modify the baro setting.*

To Use Altitude Alerting:

1. Select the Setup (SET) 9 page and turn on the cursor (CRSR). It will come on over the **Alert:** field. If **OFF** is displayed, turn the right inner knob to select **ON**   (figure 4-52).

Figure 4-52

2. Select a warn altitude deviation by positioning the cursor over the **Warn:** field. Use the right inner knob to select the desired value (figure 4-53). It is selectable in one hundred foot increments from 200 feet up to 900 feet or in ten m increments from 60 meters to 270 meters. Normally, you will use the same value all the time so you only have to enter this the first time you use altitude alerting. The recommended warn altitude devia-tion is 300 feet or 100 meters.

Figure 4-53

4-14

3. If necessary, adjust the altitude alert audio volume by moving the cursor to the **Volume:** field. Use the left inner knob to select a desired volume between 00 and 99. The larger the number, the louder the volume (figure 4-54).

Figure 4-54

4. Press ⏹ALT⏹ . The Altitude 1 (ALT 1) page will be displayed with the cursor over the altimeter baro set field.

NOTE: *The altimeter baro set units may be changed between inches, millibars and hectopascals on the SET 8 page (see section 3.3).*

5. Use the right inner knob to update the altimeter baro setting if required (figure 4-55).

6. Press the ⏹ALT⏹ button again to move on to the ALT 2 page (figure 4-56). Only line 2 of the ALT 2 page is used for altitude alerting. The remainder of the ALT 2 page is used only for vertical navigation, or VNAV (see section 4.4). The first altitude displayed

Figure 4-55

Figure 4-56

on line 2 is the current indicated altitude (9000 feet in figure 4-56). With the proper altimeter baro setting, the indicated altitude should be the same as the aircraft's actual altimeter.
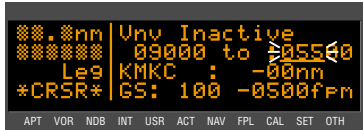
NOTE: *There may be some difference (less than 100 feet) between the indicated altitude and the aircraft's actual altitude if the altitude input to the KLN 89(B) is from an altitude encoder because these encoders only provide altitude in 100 foot increments.*

7. The cursor should be positioned on the selected (or to) altitude field (figure 4-56). Enter the selected altitude using the right inner knob (figure 4-57).

Figure 4-57

8. Press ⏹ALT⏹ to return to the page which was previously displayed. Notice that when you are on an ordinary (non-altitude) page, the first press of the ⏹ALT⏹ button brings up the ALT 1 page, the second press of ⏹ALT⏹ brings up the ALT 2 page, and the third press takes you back to the original page.

4-15

9. The aural alarm activates as follows:

- 1000 feet prior to reaching the selected altitude--three short tones

- Upon reaching the selected altitude--two short tones

- Deviating above or below the selected altitude by more than the warn altitude--four short tones

NOTE: Due to the resolution of the altitude input, it may be necessary to descend slightly below or climb slightly above the selected altitude before the two tones are activated indicating that the selected altitude has been reached. This selected altitude alert must be activated to arm the system for providing the altitude deviation alert.

The KLN 89(B) can provide the aural alarm tones in either of two ways: it may be connected to an audio input of an audio amplifier contained in an audio panel so that the aural alarm is heard through the aircraft's speaker and headphones. Or the KLN 89(B) may be interfaced with an external tone generator installed in the aircraft.

In order to use altitude alerting, the KLN 89(B) must have an altitude input. If the altitude input is from an altitude encoder or from an air data computer not having a baro altitude output, then it will be necessary for you to manually input the proper altimeter setting in order to get accurate alerting. Remember, the altitude coming from an encoder is pressure altitude and must be corrected with the proper altimeter setting to convert to actual altitude. This altimeter setting is easily accomplished by entering the altimeter baro setting on the Altitude (ALT) 1 page. Press $\boxed{\text{ALT}}$ twice more to return to the page previously displayed. It's so easy you have no excuses for not keeping the baro setting updated!

CAUTION: The altitude alerting feature will only be accurate if the altimeter baro correction is kept updated. If altitude alerting is used, it is a good idea to update the altimeter baro set on the ALT 1 page each time you make a change to the aircraft's altimeter setting.

*NOTE: The altitude alerting feature can be disabled in the KLN 89(B) at the time of installation so that these features are not selectable by the pilot. When this has been done, the SET 9 page displays **Feature Disabled**.*

4.4.   ADVISORY VNAV OPERATION

The KLN 89(B)'s advisory vertical navigation (VNAV) feature allows you to program a descent or ascent path, and then provides you with an advisory altitude to fly that will provide guidance along the vertical path. For example, you can program the VNAV to provide descent guidance so that you arrive at your active waypoint or a waypoint in the active flight plan at an altitude that you specify. The KLN 89(B) will alert you of when to start the descent, and display the advisory altitudes to fly throughout the descent.

4.4.1.   VNAV FOR DIRECT TO OPERATION

The Altitude 2 (**ALT 2**) page is used to program the KLN 89(B) for vertical navigation. To get to the ALT 2 page from any non-altitude page, press the ⌊ALT⌋ button twice. The following example will be used to illustrate how to use the VNAV feature. You are using the KLN 89(B) to fly direct to your destination airport, Dubuque Municipal airport (KDBQ) located in Dubuque, Iowa. You are presently about 65 nautical miles west of Dubuque, flying at 7500 feet MSL (figure 4-58). You desire to use the VNAV to provide vertical guidance to Dubuque's traffic pattern altitude of 1900 feet MSL

Figure 4-58

To use VNAV on a Direct To:

1. Select the ALT 2 page by pressing the ⌊ALT⌋ button twice (figure 4-59). The aircraft's actual altitude (7500 feet) is displayed on the left side of line 2. If the displayed altitude is incorrect it is probably because you have not recently updated the KLN 89(B)'s altimeter baro setting on the ALT 1 page (see section 3.3).

Figure 4-59

NOTE: There may be some difference (less than 100 feet) between the indicated altitude and the aircraft's actual altitude if the altitude input to the KLN 89(B) is from an altitude encoder because these encoders only provide altitude in 100 foot increments.

The identifier for the active waypoint (**KDBQ**) is automatically displayed on the ALT 2 page. Prior to programming a VNAV operation, the top of the page displays that the VNAV is inactive (**Vnv Inactive**).

2. The cursor should be on and over the selected altitude field on the right side of line 2. If the cursor is not on, press `CRSR`.

3. Enter the desired altitude of 1900 feet in the selected altitude field, using the right inner knob. The altitude may be entered in 100 foot or 10 meter increments (figure 4-60).

Figure 4-60

NOTE: If the KLN 89(B) does not have an altitude input, the indicated altitude field on the left side of line 2 will be preceded by a colon (:), indicating that you should manually enter the aircraft's present altitude, as well as the desired altitude.

4. Use the right outer knob to move the cursor to the offset field adjacent to the active waypoint identifier. Entering an offset allows you to reach the desired altitude a specified distance before or after reaching the way-

Figure 4-61

point. If you wished to reach a certain altitude 5 miles after passing a waypoint, you would enter **+05**. In this example you desire to reach traffic pattern altitude two nautical miles prior to the airport, which allows sufficient time to slow down and prepare for the landing. Enter an offset of **-02** nm (figure 4-61).

5. Use the right outer knob to move the cursor to the groundspeed (**GS:**) field. Use the right inner knob to select your anticipated groundspeed for the descent (figure 4-62), remembering that it

Figure 4-62

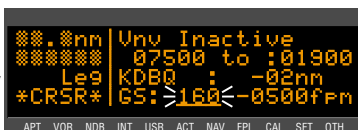may increase from your current groundspeed when you start descending.

Notice that the bottom right corner of the ALT 2 page now displays a vertical speed. If you wish to start your descent now using the displayed vertical speed, use the outer knob to position the cursor over the vertical speed field (figure 4-63). VNAV oper-

Figure 4-63

ation is initiated by bringing the cursor over the vertical speed field. Or, by leaving the cursor off of this field, you may watch the required vertical speed increase as you fly toward your waypoint. When the

desired vertical speed is reached, position the cursor over the vertical speed field and VNAV will commence. When VNAV begins, the top of the page displays an advisory altitude. Descending at the vertical speed displayed on line 4 should keep you very close to the VNAV advisory altitude, but you may need to make slight adjustments to stay right on pace.

A better way yet to initiate VNAV is to program a desired vertical speed to use for the descent, after you have entered the desired altitude, waypoint, offset, and groundspeed. To program a vertical speed, do the following step:

6. Use the right outer knob to move the cursor to the vertical speed field, and then enter the desired value (figure 4-64). Vertical speed may be selected in increments of 100 feet per minute or

Figure 4-64

10 meters per minute. If the time to begin your descent is greater than one hour, **Vnv Armed** will now be displayed on the top line of the page. If the time is less than one hour, the top line displays a countdown to the time to begin the descent.
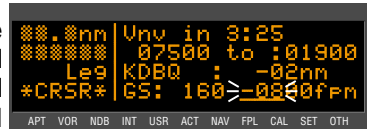
7. Return to any desired page for now by pressing the ⌜ALT⌝ button once. Alternatively, you may turn off the ⌜CRSR⌝ and use the outer knob to change pages. Approximately 90 seconds before the time to begin descent, the message prompt will flash. When you view the Message page, it will display **Vnv Alert**. This is notification for you to view the ALT 2 or NAV 1 page (see section 4.4.3) because it is getting close to the time to begin your descent.

8. When the countdown timer reaches 0:00, the time will be replaced with an advisory altitude (figure 4-65). Begin your descent at a rate such that the altitude

Figure 4-65

displayed on your altimeter matches the advisory altitude.

NOTE: *During your descent, check your actual groundspeed to verify that it is similar to the one you entered on the ALT 2 page. If it is different, you should enter your actual groundspeed so that the VNAV function will work properly.*

If you make any changes to the "from" or "to" altitudes, the VNAV waypoint, or the waypoint offset once VNAV has been armed, or is actually in progress, the VNAV status will change to "Inactive".

Additionally, you may force the VNAV into "Inactive" status by changing the vertical speed to **+0000fpm**. To reactivate VNAV after changing a parameter, simply move the cursor to the vertical speed field, or select the new desired vertical speed.

If you make a change to the groundspeed during the time VNAV is active, VNAV will remain active, and a new vertical speed will be calculated and displayed. If you wish to change this vertical speed, go ahead and do so and the VNAV descent or ascent will be modified for the new parameters.

CAUTION: Advisory VNAV operation will only be accurate if the altimeter baro correction is kept updated. If advisory VNAV is used, it is a good idea to update the altimeter baro set on the ALT page each time you make a change to the aircraft's altimeter setting.

4.4.2.   VNAV FOR FLIGHT PLAN OPERATION

Using the vertical navigation function when flying via a flight plan is virtually the same as for the previous Direct To example. The ALT 2 page will initially contain the identifier for the active "to" waypoint in the flight plan. You may program the vertical ascent or descent referencing this waypoint or you may use the right inner knob to cycle through the waypoints in the active flight plan (FPL 0) which are still in front of the aircraft's position. When another valid waypoint in the flight plan is entered on the ALT 2 page, the aircraft's lateral flight path is not altered. This means that you may program a vertical flight path having an ascent or descent point that begins prior to the flight plan leg containing the selected VNAV waypoint.

4.4.3.   VNAV FROM THE NAV 1 PAGE

The NAV 1 page can be configured to display the VNAV status. This means that you will not have to change pages as much to see what altitude you should be at. You will still need to set up the VNAV problem by using the ALT 2 page as described in section 4.4.1.

To use the NAV 1 page to view the VNAV status:

1.   Set up the VNAV situation on the ALT 2 page.

2.   Select the NAV 1 page.

3.   Turn on the cursor and use the right outer knob to move the cursor to the cyclic field on the bottom line (figure 4-66).

Figure 4-66

4.   This field displays bearing to
     active waypoint, radial from
     active waypoint, or VNAV status.
     Press the ⏺CLR button until the
     VNAV status is displayed (figure
     4-67). Turn off the cursor.

Figure 4-67

The NAV 1 page will now display VNAV status until you change the
page configuration to display something else. If the VNAV problem
has not been defined yet, then **Vnv Off** will be displayed. If the time
to start VNAV operation is greater than one hour then **Vnv Armed** is
displayed. When the time to VNAV operation is less than one hour
then the NAV 1 page will display the time until VNAV operation will
start. For example, **Vnv 4:53** would be displayed if the time until
VNAV operation is 4 minutes and 53 seconds. If the VNAV function
has started and is suggesting an altitude then the NAV 1 page will
display this altitude. For example **Vnv 4300** would be displayed if
the suggested altitude was 4300 feet.

4.5.   CALCULATOR PAGES

The Calculator (CAL) pages are used for trip planning and calculation
of a variety of flight-related information. They are convenient both on
the ground before you begin your flight, and in the air.

Data entered on any of the Calculator pages has no effect on naviga-
tion data provided on any Navigation (NAV) or Flight Plan (FPL)
pages. You may perform trip calculations without disturbing ongoing
navigation.

*NOTE: The Calculator pages rely on pilot enterable inputs for
groundspeed, fuel flow, fuel reserve requirements, altitudes,
temperature, airspeed, etc. These pages do not utilize inputs from
fuel flow or air data sensors.*

4.5.1.   THE CALCULATOR 1 (CAL 1) PAGE

The CAL 1 page allows you to do distance, bearing, time, and mini-
mum enroute safe altitude (ESA) calculations that you might
otherwise need a chart, ruler, and pocket calculator for. The KLN
89(B) will perform these calculations either from waypoint to waypoint
(for in-flight calculations, your present position can be one of the way-
points), or for one of your flight plans (active or stored).

To calculate distance, bearing, time , and ESA from waypoint to waypoint:

1. From the CAL 1 page (figure 4-68), turn on the cursor (`CRSR`). It will appear over a cyclic field that either displays **Wpt** (waypoint to waypoint) or **Fpl** (flight plan).

Figure 4-68

2. For this type of calculation, the cyclic field should display **Wpt**. Press `>CLR` to toggle if this is not the case (figure 4-69).

Figure 4-69

3. Turn the right outer knob clockwise to move the cursor to the "from" waypoint in the upper right corner of the screen   (figure 4-70).

4. Enter the desired identifier for the "from" waypoint and press `ENT`. You will be shown the waypoint page for the waypoint you entered. Press `ENT` again to approve.

Figure 4-70

NOTE: On either of the two waypoint fields on this page, you can select your present position. To do this, press `>CLR` while the cursor is on the desired waypoint field. The results will only be displayed when your KLN 89(B) is receiving a valid position, or if you happen to be in the Take Home mode (see section 4.11).

5. With the cursor over the "to" waypoint, enter the desired identifier (figure 4-71) and press `ENT` twice. The bearing will be displayed on line 2, and the distance will be displayed on line 3.

Figure 4-71

6. Use the right outer knob to move the cursor over the groundspeed field on line 4.

7. Select your estimated groundspeed for the trip. As you change it, the estimated time en route (**ETE**) calculation will be updated (figure 4-72).

Figure 4-72

To calculate distance, time and ESA for a flight plan:

1.   From the CAL 1 page, turn on the cursor (⌜CRSR⌝). It will appear over a cyclic field that either displays **Wpt** (waypoint to waypoint) or **Fpl** (flight plan).

2.   For this type of calculation, the cyclic field should display **Fpl**. Press ⌜>CLR⌝ to toggle if this is not the case.

3.   Turn the right outer knob clockwise to place the cursor over the flight plan number. As you cycle through the flight plans, the first and last waypoints of each flight plan will be displayed, along with the total distance and the minimum enroute safe altitude for the flight plan   (figure 4-73).
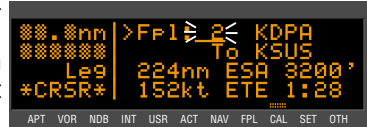

Figure 4-73

4.   Once you have selected the desired flight plan, move the cursor to the groundspeed field on line 4.

5.   Select your estimated ground-speed for the trip. As you change it, the estimated time en route (ETE) calculation will be updated (figure 4-74).

Figure 4-74

4.5.2.   THE CALCULATOR 2 (CAL 2) PAGE

The CAL 2 page is for calculating fuel requirements for a trip. To use these pages, you need to have a good idea what the typical fuel flow rate for your aircraft is. This information can often be found for given cruise power settings in a "performance" section of the Pilot's Operating Handbook for the aircraft. The units for fuel are not specified on this page, but the units of time are always hours. This means that you can use gallons per hour, pounds per hour, kilograms per hour, etc. Like with the CAL 1 page, the fuel calculations can be done from waypoint to waypoint (including present position), or for one of your flight plans.

To calculate fuel requirements from waypoint to waypoint:

1.   From the CAL 2 page, turn on the cursor (⌜CRSR⌝). It will appear over a cyclic field that either displays **Wpt** (waypoint to waypoint) or **Fpl** (flight plan).

2.   For this type of calculation, the cyclic field should display **Wpt**. Press ⌜>CLR⌝ to toggle if this is not the case.

3. Turn the right outer knob clockwise to move the cursor to the "from" waypoint in the upper right corner of the screen   (figure 4-75).

Figure 4-75

4. Enter the desired identifier for the "from" waypoint and press ⟦ENT⟧. The waypoint page for the iden-tifier you just entered will be displayed. If it is the correct one, press ⟦ENT⟧ again.

NOTE: On either of the two waypoint fields on this page, you can select your present position. To do this, press ⟦>CLR⟧ while the cursor is on the desired waypoint field (figure 4-76). The results will only be displayed when your KLN 89(B) is receiving a valid position, or if you happen to be in the Take Home mode (see section 4.11, "Using the Take-home Mode").
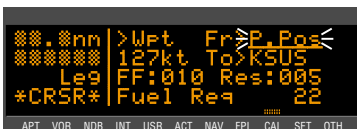
Figure 4-76

5. Move the cursor to the groundspeed field on line 2.

6. Select your estimated ground-speed for the trip (figure 4-77).

Figure 4-77

7. With the cursor over the "to" waypoint, enter the desired identi-fier (figure 4-78) and press ⟦ENT⟧.
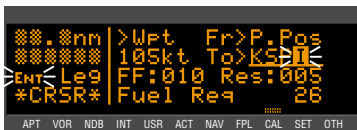
Figure 4-78

8. Move the cursor to the fuel flow rate field and use the right inner knob to select the desired value (figure 4-79). Remember that this can be in any units you desire (as long as it's per hour), but the same fuel units must carry through the calculations.
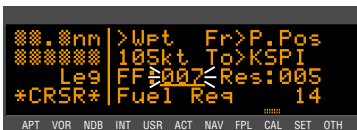
Figure 4-79

9. Move the cursor to the fuel reserve requirement field and enter the desired value. As you do, watch the calculation of fuel required on line 4 change (figure 4-80).
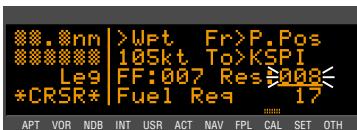
Figure 4-80

To calculate fuel requirements for a flight plan:

1. From the CAL 2 page, turn on the cursor ($\boxed{\text{CRSR}}$). It will appear over a cyclic field that either displays **Wpt** (waypoint to waypoint) or **Fpl** (flight plan).

2. For this type of calculation, the cyclic field should display **Fpl**. Press $\boxed{\text{>CLR}}$ to toggle if this is not the case.

3. Turn the right outer knob clockwise to place the cursor over the flight plan number. As you cycle through the flight plans, the first and last waypoints of each flight plan will be displayed (figure 4-81).
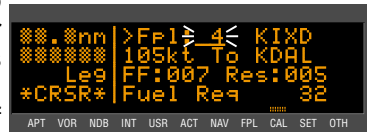
Figure 4-81

4. Once you have selected the desired flight plan, move the cursor to the groundspeed field on line 2.

5. Select your estimated groundspeed for the trip.

6. Move the cursor to the fuel flow rate field and use the right inner knob to select the desired value. Remember that this can be in any units you desire (as long as it's per hour), but the same fuel units must carry through the calculations.

7. Move the cursor to the fuel reserve requirement field and enter the desired value. As you do, watch the calculation of fuel required on line 4 change (figure 4-82).

Figure 4-82

4.5.3.   THE CALCULATOR 3 (CAL 3) PAGE

The CAL 3 page may be used to set a timed alarm. Instances where you might want to use it include as a reminder to switch between left and right fuel tanks or maybe just to remind you to eat lunch! Line 1 of the CAL 3 page shows the current time in the system time zone. The alarm may be set by either of two methods: entering the time of day you wish the alarm to activate, or the time interval from present time (i.e. twenty minutes from now). Line 4 displays the elapsed time since the KLN89(B) was turned on.

To set the alarm:

1. Turn on the cursor (CRSR). If necessary, change the system time zone to the desired one on line 1 of the CAL 3 page.

2. To set the alarm to activate at a certain time, more the cursor to the **at:** field on line 2. Select the desired hours, and then minutes (figure 4-83). Notice that as you change it, the interval from pre-sent time to alarm time is updated on line 3.

Figure 4-83

3. To set the alarm to activate in a certain length of time, move the cursor to the in: field on line 3 and select the desired hours and min-utes, up to 9 hours and 59 minutes (figure 4-84). Turn off the cursor
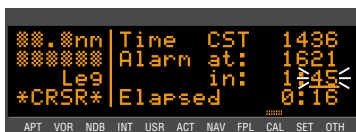

Figure 4-84

4. When the alarm goes off, the KLN89(B) will display the message page message:

*Timer expired

4.5.4. THE CALCULATOR 4 (CAL 4) PAGE

The CAL 4 page is used to determine pressure altitude.

To calculate the pressure altitude:

1. Turn on the cursor (CRSR).

2. Enter the altitude indicated on the aircraft's altimeter (**Ind**) to the nearest hundred feet or ten meters by using the right inner knob to select the desired value (figure 4-85).

Figure 4-85

3. Use the right outer knob to move the cursor to the **Baro** field, and then use the right inner knob to enter the current altimeter setting (figure 4-86). The pressure altitude (**Prs**) is now displayed.

Figure 4-86

NOTE: The altimeter baro set units may be changed between inches, millibars and hectopascals on the SET 8 page (see section 3.3).

4.5.5.   THE CALCULATOR 5 (CAL 5) PAGE

The CAL 5 page is used to determine density altitude.

To calculate the density altitude:

1. Turn on the cursor (CRSR).

2. The pressure altitude (**Prs**) displayed will be either the last entered pressure altitude on this page, or the last calculated pressure altitude from the CAL 4 page. If you desire to change it, enter the current pressure altitude to the nearest hundred feet or ten meters by using the right inner knob (figure 4-87).
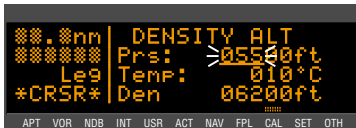
Figure 4-87

3. Use the right outer knob to move the cursor to the first **Temp:** field, and then use the right inner and outer knobs to enter the outside air temperature (degrees Celsius) (figure 4-88). The first digit of the temperature is either "0" if the temperature is above zero or "-" if the temperature is below zero. For maximum accuracy, the static air tempera-

Figure 4-88

ture should be entered. This is the temperature of air without the effect of heating due to the aircraft's movement through the air. For the airspeeds of most piston aircraft, the difference between static air temperature and the observed air temperature (or "total air temperature") is negligible. The density altitude (**Den**) is now displayed.
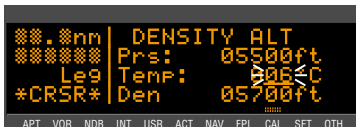
*NOTE: If a compatible air data system is interfaced to the KLN89(B), the Other 12 (**OTH 12**) page displays pressure and density altitude directly for the present conditions.*

4.5.6.   THE CALCULATOR 6 (CAL 6) PAGE

The CAL 6 page is used to determine the true airspeed (**TAS**) of the aircraft.

To calculate the true airspeed (TAS):

1   Turn on the cursor (CRSR).

2. Enter the aircraft's calibrated airspeed by using the right inner

knob (figure 4-89). If the
calibrated airspeed isn't known,
use the indicated airspeed. For
most aircraft the difference
between the calibrated airspeed
and the indicated airspeed is
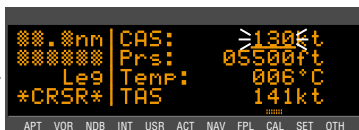small at cruise airspeeds.

Figure 4-89

3. Use the right outer knob to move the cursor to the **Prs** field, and
   then use the right inner knob to enter the aircraft's pressure
   altitude. If the pressure altitude was previously calculated on the
   CAL 4 page, or entered on the CAL 5 page, it will already be
   displayed.

4. Move the cursor to the first **Temp** position, and then enter the
   outside air temperature (degrees C) by using the right inner and
   outer knobs (figure 4-90). The
   first digit of the temperature is
   either "0" if the temperature is
   above zero or "-" if the tempera-
   ture is below zero. For maximum
   accuracy, the total air tempera-
   ture should be entered. This is

Figure 4-90

the temperature of air including the effect of heating due to the
aircraft's movement through the air. The temperature read on a
standard outside air temperature gauge found on most piston air-
craft is "total air temperature". Since the difference between
static air temperature and the observed air temperature (or "total
air temperature") is usually negligible, any temperature entered
on the CAL 5 page is transferred to this page. The true airspeed
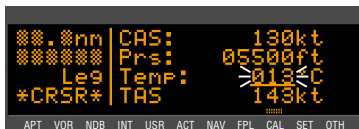(**TAS**) is now displayed.

NOTE: *If a compatible air data system is interfaced to the KLN89(B),
true airspeed (**TAS**) is displayed directly on the Other 11 (**OTH 11**)
page for the present conditions.*

4.5.7.   THE CALCULATOR 7 (CAL 7) PAGE

The CAL 7 page is used to determine the present wind direction and
speed. In addition, the headwind or tailwind component of the wind is
displayed.

To calculate the winds aloft:

1. Turn on the cursor ([CRSR]).

2. Enter the aircraft's true airspeed by using the right inner knob (figure 4-91). If the CAL 6 page was previously used to calculate true airspeed, it will already be displayed.

Figure 4-91

3. Use the right outer knob to move the cursor to the **Hdg** field, and then use the right inner knob to enter the aircraft's heading (figure 4-92). The headwind or tailwind and the wind direction and speed are now displayed. The wind direction is relative to true North.

Figure 4-92

NOTE: The wind calculations are only correct when you have entered the correct aircraft heading and true airspeed. Make sure to re-enter new values if you change airspeed or heading.

NOTE: If the KLN89(B) is interfaced with a compatible source of heading information, line 2 automatically displays the aircraft's heading. Heading is then automatically input and used in the wind calculation displayed on the CAL 7 page. If the KLN89(B) is interfaced with a compatible air data system in addition to a compatible heading source, the Other 11 (OTH 11) page displays wind information directly.

4.5.8.   THE CALCULATOR 8 (CAL 8) PAGE

The CAL 8 page is used to determine the times of sunrise and sunset for any waypoint in the published or user data base.

To calculate sunrise/sunset times:

1. Select the CAL 8 page (figure 4-93). The first time the CAL 8 page is selected after the KLN89(B) is turned on, the waypoint identifier defaults to the current destination, the date defaults to the current date, and the time zone defaults to the system time zone. Each of these three items may, however, be changed. The sunrise and sunset are displayed at the bottom of the page.
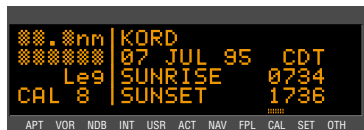
Figure 4-93

NOTE: The time zone initially displayed is the system time zone. This is the same as the one on the SET 2 page. Note that the time zone displayed may not be appropriate for the waypoint shown. For

*example, the waypoint shown could be **KLAX** and the time zone may be Eastern Standard Time (**EST**) Make sure you select the appropriate time zone for the displayed waypoint.*

2. Turn on the cursor (CRSR).

3. If desired, select another waypoint identifier using the right inner and outer knobs. Press ENT to view the waypoint page for the waypoint entered. Press ENT again to approve the waypoint page (figure 4-94).
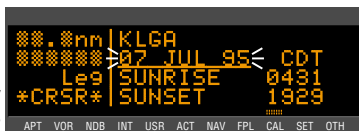
Figure 4-94

4. If desired, select another date using the right inner and outer knobs. You must press ENT to enter the date (figure 4-95).
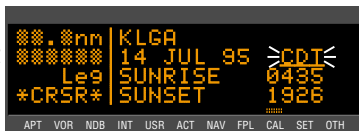
Figure 4-95

5. If desired, select another time zone. The sunrise and sunset times for the selected waypoint, date, and time zone are now displayed (figure 4-96).

Figure 4-96

4.6. CREATING USER-DEFINED WAYPOINTS

You may create and store up to 500 user-defined waypoints. These waypoints will be very helpful to you. One major application is private use airstrips, which are not included in the Jeppesen data base. They are also handy for points which you fly over frequently, and wish to navigate to. For example, a crop sprayer would want to store the locations of the fields he or she dusts often.

There are three ways to create a user-defined waypoint. If you happen to know the latitude and longitude of the point, that is one option. The waypoint can also be defined as a radial and distance from another waypoint. A third choice is just to store your present position under the identifier you have chosen.

NOTE: *Whenever you are in a waypoint entry situation, such as a Direct To waypoint or flight plan, and you enter an identifier which is not in the data base, the KLN 89(B) will automatically start the user-defined waypoint creation process.*

To delete a user-defined waypoint that is no longer needed, see section 3.14.2, "Viewing and Deleting User Waypoints and Waypoint Remarks".

4.6.1. CREATING A WAYPOINT AT YOUR PRESENT POSITION

Creating a waypoint at your present position is the simplest possible way to create a user-defined waypoint. This is nice for "remembering" a spot you are at. Let's suppose you're at a private strip that you want to name "VALLY"

To create a user-defined waypoint at your present position:

1. Select the NAV 2 page (present position) and press the `ENT` button. A page like the one in figure 4-97 will be displayed with your latitude and longitude at the time you pressed the button. The user-defined waypoint is initially given the name USR##, where ## is the first available number between 01 and 99.
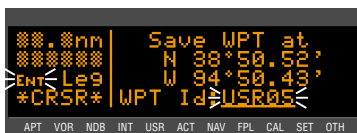
Figure 4-97

Figure 4-98

2. If you wish to use this waypoint name, press `ENT` and the waypoint creation is complete (figure 4-98). If you want to choose your own name for it, turn the right inner knob to select the first character of the identifier (figure 4-99). Remember that when the cursor is on, the right inner knob changes the character and the right outer knob moves the cursor around.

Figure 4-99

Figure 4-100

3. Spell out the rest of the identifier using the right inner and outer knobs (figure 4-100).

4. Press `ENT`. The USR 1 page for your new waypoint will be displayed with its latitude and longitude (figure 4-101). The cursor is turned off automatically.

Figure 4-101

NOTE: Another way to create a user-defined waypoint at your present position is to select the USR pages, spell out the identifier letter by letter (see next section), and then select the **Present Pos?** *option (figure 4-102) and press* ENT .

Figure 4-102

4.6.2. CREATING A WAYPOINT AT A CERTAIN LATITUDE/LONGITUDE

It is also possible to create a user-defined waypoint by manually entering a latitude and longitude. Let's say you wanted to create a user waypoint over your hypothetical farm at N 42°56.32', W 76°29.95'

To create a user-defined waypoint with latitude/longitude:

1. From any user waypoint (USR) page, turn on the cursor (CRSR). It will flash over the first character in the waypoint identifier field (figure 4-103).

Figure 4-103

2. Use the right inner knob to select the first character of the identifier (figure 4-104). Remember that when the cursor is on, the right inner knob changes the character and the right outer knob moves the cursor around.
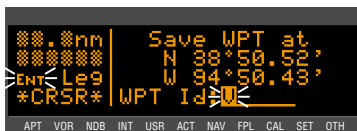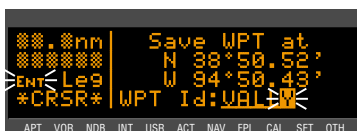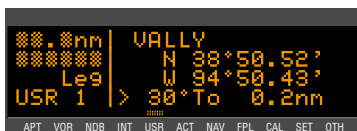
Figure 4-104

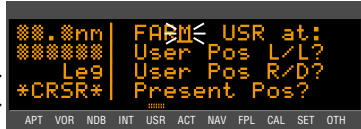3. Spell out the rest of the identifier using the right inner and outer knobs (figure 4-105).

Figure 4-105

4. Move the cursor down to the second line, over **User Pos L/L?** (figure 4-106).

Figure 4-106

5. Press ENT. The display will change to a format like figure 4-107.

Figure 4-107

6. Use the right inner knob to select N for north or S for south (figure 4-108).

Figure 4-108

7. Use the right outer knob to move the cursor, and the right inner knob to select the proper numbers to complete the latitude entry (figure 4-109).

Figure 4-109

8. Press ENT. The cursor will move to the longitude field.

9. Enter the longitude in the same manner as the latitude (figure 4-110).
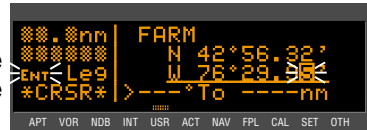
Figure 4-110

10. Press ENT to approve this position. The cursor will automatically turn off (figure 4-111).
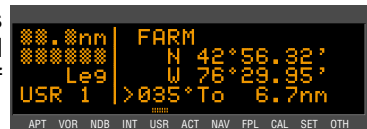
Figure 4-111

4.6.3. CREATING A WAYPOINT REFERENCED FROM ANOTHER WAYPOINT

The third method of creating a user-defined waypoint is as a radial and distance from a known waypoint.

To create a user-defined waypoint using the radial/distance method:

1. From any user waypoint (USR) page, turn on the cursor (CRSR). It will flash over the first character in the waypoint identifier field.

2. Use the right inner knob to select the first character of the identifier. Remember that when the cursor is on, the right inner

knob changes the character and
the right outer knob moves the
cursor around.

Figure 4-112

3. Spell out the rest of the identifier
   using the right inner and outer
   knobs (figure 4-112).

4. Move the cursor down to the third
   line, over **User Pos R/D?**
   (figure 4-113).

Figure 4-113

5. Press ENT. The display will
   change to a format like
   figure 4-114 with the cursor over
   the reference waypoint field.

6. Use the right inner and outer
   knobs to select the identifier of
   the desired reference waypoint
   (figure 4-115).

Figure 4-114

7. Press ENT. The waypoint page
   for the waypoint you just entered
   will be displayed (figure 4-116).

8. Press ENT again to approve the
   waypoint. You will be returned to
   the waypoint creation page.
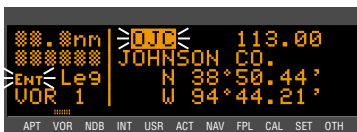
Figure 4-115

9. Use the right inner and outer
   knobs to select the desired radial.
   Notice that you may enter the
   angle down to the tenth of a
   degree (figure 4-117).

Figure 4-116

10. Press ENT to approve the radial.
    The cursor will move to line 4.

11. Use the right inner and outer
    knobs to select the desired dis-
    tance from the reference
    waypoint (figure 4-118).

Figure 4-117

12. Press ENT to approve the dis-
    tance. The cursor will
    automatically be removed from
    the screen.

Figure 4-118

4.7. NAVIGATION MODES

The KLN 89(B) allows you to choose how the course to the active waypoint is defined. This is done by selecting between the two course modes, LEG and OBS. The LEG mode means that the course to the active waypoint is selected by the KLN 89(B), and is the default mode when the KLN 89(B) starts up. The other course mode, OBS, is the mode that allows you to select the course to or from the active waypoint. In this mode, the KLN 89(B) operates very much like a VOR receiver. This is the mode that you will use quite often if you conduct any non-precision approaches using the KLN 89B.

‡The KLN 89B also has three modes that are associated with approach operations. These are Enroute, Approach Arm and Approach Active. These modes will be explained in Chapter 5.

Figure 4-119

The course mode is annunciated on the left side of the screen, line 3. When in the Leg mode, it displays **Leg** (figure 4-119), and when in the OBS mode, it displays the selected magnetic course (figure 4-120).

Figure 4-120

4.7.1. SELECTING THE LEG MODE OR THE OBS MODE

To change course modes:

1. Press the `OBS` button.

2. If the KLN 89(B) was previously in the Leg mode, it will now be in the OBS mode, and vice versa.

4.7.2. THE LEG MODE

The following are the characteristics of the Leg Mode:

1. The default course deviation indicator (CDI) sensitivity is plus and minus five nautical miles, full scale. This applies to the CDI on the NAV 1 page as well as any external CDIs or HSIs interfaced to the KLN 89(B). If the CDI or HSI has five dots left and right of the center position, then each dot represents one nautical mile of deviation.

2. Navigation is provided along the great circle path between two waypoints. As you probably know, great circle navigation is the shortest distance between two points located on the earth's surface. In the case of Direct To operation, the "from" waypoint is not displayed but it is the point where Direct To operation was initiated. The course to fly while in this mode is referred to as the desired track (**Dtk**). The desired track is displayed on the NAV 1 and may be selected for display on the NAV 4 page. To fly a great circle course between two points, the desired track may be constantly changing. A good way to illustrate this concept is with a world globe and a piece of string. You can determine the great circle path between Denver, Colorado and Manila, Philippines by stretching the string over the globe between these two points. Notice that you would start the flight with a northwesterly desired track, which gradually becomes due westerly, and finally south-westerly by the time you reach Manila. Of course, your trips with the KLN 89(B) will be substantially shorter and the desired track will probably change only a few degrees.

3. Automatic waypoint sequencing is provided during flight plan operation. As you reach a waypoint in your flight plan, the next leg of the flight plan automatically becomes active. ‡There are some situations during approach operations in which automatic leg sequencing is automatically disabled. See Chapter 5.

4. Turn anticipation may be utilized in flight plan operation as described in section 4.2.2.

5. The Minimum Enroute Safe Altitude (ESA) displayed on the ALT 1 page is the highest MSA sector altitude from the present position to the destination waypoint along the active flight plan or Direct To route (whichever is in use). See section 3.12.

4.7.3. THE OBS MODE

The following are characteristics of the OBS mode.

1. The course deviation indicator (CDI) sensitivity is plus and minus five nautical miles, full scale. This applies to the CDI on the NAV 1 page as well as any external CDIs or HSIs interfaced to the KLN 89(B). If the CDI or HSI has five dots left and right of the center position, then each dot represents one nautical mile of deviation.

2. The course is defined by the active waypoint and the selected magnetic course. A course "to" or "from" the active waypoint may be selected.

3.   The course selection is normally made by changing the selected course displayed on an external indicator such as an HSI or CDI. When this is done, the pilot must verify that the proper course has been selected by confirming the digital selected course readout displayed on the KLN 89(B). In the OBS mode the selected course is always displayed as part of the mode annunciation on line 3 of the left side of the KLN 89(B) screen. In many installations, two or more navigation sources can be displayed on one indicator. In these situations there is a switch in the aircraft panel which will determine what navigation source is displayed. For the KLN 89(B) to properly read the external indicator the KLN 89(B) must be the displayed navigation source on the external indicator.

When the KLN 89(B) is not the displayed navigation source on the external indicator, it is possible to change the selected course from the KLN 89(B) screen using the procedure below.

To change the selected course in OBS mode:

1.   If the KLN 89(B) is not in OBS mode, select OBS mode by pressing the `OBS` button. If already in OBS mode, turn on the cursor (`CRSR`). The cursor will automatically be turned on over the OBS selected course field (figure 4-121).

Figure 4-121

2.   Turn the right inner knob until the correct selected course is displayed (figure 4-122).

Figure 4-122

3.   Turn off the cursor (`CRSR`).

NOTE: The above procedures apply to ORS 02 software. For ORS 01 software, the cursor does not automatically come on when the OBS mode is selected and must be activated by using the `CRSR` button. In addition, the OBS selected course field is not the default cursor location. The right outer knob must be used to position the cursor over this field after it has been turned on.

4.   There is no automatic leg sequencing or turn anticipation.

5.   The Minimum Enroute Safe Altitude (**ESA**) displayed on the ALT 1 page is the highest MSA sector altitude between the present position and the active waypoint. See section 3.12. Other waypoints in the active flight plan do not affect the ESA.

6. When the active waypoint is a VOR, and the AUTO magnetic variation mode is active (see section 4.10), the published magnetic variation for the VOR is utilized rather than the calculated magnetic variation, so that the KLN 89(B) indication will be identical to a NAV receiver indication.

4.7.4. SWITCHING FROM THE LEG MODE TO THE OBS MODE

The following mode transition occurs if the KLN 89(B) is in the Leg mode and the mode is changed to the OBS mode.:

1. The waypoint that was active in Leg mode prior to the mode change remains the active waypoint in OBS mode.

2. The selected course is defined by two different methods depending on the installation and the status of the unit.

   i.   If the KLN 89(B) is the displayed navigation source when the change is made to OBS mode, then the selected course becomes whatever was set on the external indicator prior to changing to the OBS mode. This value should normally be the desired track to the active waypoint if you had the external indicator set to the correct value prior to switching to the OBS mode.

   ii.   If the KLN 89(B) is not displayed on the external indicator, then the selected course is chosen such that the deviation from the selected course remains the same.

3. If the OBS value chosen by default from rule 2 above is unacceptable, you can always define the desired course by the methods described in section 4.7.3.

4.7.5. EFFECTS OF SWITCHING FROM OBS MODE TO LEG MODE

The following mode transition occurs if the KLN 89(B) is in the OBS mode with a TO indication and the mode is switched to the Leg mode:

1. The waypoint that was active while in the OBS mode remains the active waypoint when the Leg mode is activated. The system does not attempt to orient itself on a leg of the active flight plan unless the TO/FROM indicator is indicating FROM. In the FROM case, the KLN 89(B) will reorient on the active flight plan.

2. The selected course (**Obs**) that was active in the OBS mode prior to switching to Leg mode becomes the desired track (**Dtk**) in

the Leg mode, unless the mode change was made on the "from" side in which case the KLN 89(B) will calculate the correct desired track for the new leg.

3. With the exception of #2 above, the characteristics of normal Direct To operation apply.

4. If the active waypoint was part of the active flight plan (FPL 0), the system will revert to normal flight plan operation once the active waypoint is reached.

4.7.6. *GOING DIRECT TO A WAYPOINT WHILE IN THE OBS MODE*

The direct-to function will select the OBS value that will take the aircraft from the present position direct to the active waypoint when the KLN 89(B) is not the displayed navigation source on the external indicator.

If the KLN 89(B) is the displayed navigation source on an HSI or CDI it is not possible for the KLN 89(B) to change the OBS value. In these situations the KLN 89(B) will provide a scratchpad message that will tell you what OBS value should be selected to go direct to the active waypoint (figure 4-123).

Figure 4-123

4.7.7. *ACTIVATING A WAYPOINT WHILE IN THE OBS MODE*

While in the OBS mode, you may activate another waypoint by using the normal Direct To method or by using a second method. This second method activates another waypoint without changing the selected course (OBS). In other words, when the new waypoint is activated, the D-Bar is not necessarily recentered. In figure 4-124 the KLN 89(B) is in the OBS mode and the selected course is 149°. You have just crossed ARG and desire to activate the next waypoint in the flight plan, GQE, without recentering the D-Bar.

Figure 4-124

To activate a waypoint in OBS mode without changing the selected course:

1. Press ⟨ ▣► ⟩ (figure 4-125). The rules described in section 3.8, "Direct To Operation", dictate which waypoint identifier will be initially displayed on the Direct To page.

Figure 4-125

2. Press ⟨ ▣► ⟩ a second time. The annunciation **DIRECT TO** changes to **ACTIVATE** (figure 4-126). Repeated presses of ⟨ ▣► ⟩ cause the annunciation to alternate between **DIRECT TO** and **ACTIVATE**. Make sure **ACTIVATE** is displayed.

Figure 4-126

3. If the desired waypoint is not the one that was suggested by the KLN 89(B), enter the desired identifier. Press ⟨ ENT ⟩.

Figure 4-127

4. Press ⟨ ENT ⟩ to approve the waypoint page and activate the waypoint (figure 4-127). The selected course does not change, therefore this method does not center the D-Bar like a Direct To operation does.

4.7.8. CHANGING THE CDI SCALE FACTOR

The CDI scale factor can be changed by using the NAV 1 page. In normal operations it is possible to select a CDI scale factor which is plus or minus 5 NM, 1 NM or 0.3 NM full scale deflection. This means that if the scale factor was ± 1 NM and the needle was deflected full scale to the right, the aircraft would be 1 NM left of course. The default CDI scale factor is ± 5 NM.

To change the CDI scale factor:

1. Select the NAV 1 page.

2. Turn on the cursor (⟨CRSR⟩). It will appear over the second line of the NAV 1 page, which usually displays the course deviation indicator (figure 4-128). This is a cyclic field, as indicated by the carat (**>**) preceding it.

Figure 4-128

3. Press the >CLR button until this line changes to the CDI scale field (figure 4-129).

Figure 4-129

4. Rotate the right inner knob to select the desired CDI scale factor (figure 4-130). The valid choices are 5.0 NM, 1.0 NM, and 0.3 NM or 9.3 km, 1.9 km, and .56 km.

5. If desired, you may press >CLR to switch the display back to the graphical CDI.

Figure 4-130

6. Turn off the CRSR. The CDI scale factor change is complete.

‡NOTE: The KLN 89B will automatically select a scale factor while in one of the approach modes. When the KLN 89B selects a CDI scale factor it is not possible to select a scale factor that is less sensitive than what the KLN 89B has automatically chosen. For example, as you will see in the next chapter, the approach-arm mode usually has a scale factor of ± 1 NM. While in the approach-arm mode it is not possible for you to select the ± 5 NM scale factor. This is to ensure proper operation of the approach modes.

4.8.   THE FUEL MANAGEMENT PAGES

Certain models of fuel management computers manufactured by Shadin Company, ARNAV Systems, Inc., and Sheltech Ltd. May be interfaced with the KLN 89(B). The primary benefit of having the KLN 89(B) interfaced with a "real time" fuel management computer is that the system can continuously compute the amount of fuel required to reach the destination and the amount of fuel that will be on board upon reaching the destination. The concept is the following. The fuel management computer continuously sends the rate of fuel flow and the amount of fuel remaining to the KLN 89(B). The KLN 89(B) continuously calculates the aircraft's distance, groundspeed, and estimated time enroute (ETE) to the destination waypoint. The fuel required to reach the destination waypoint is the ETE multiplied by the current rate of fuel flow. The amount of fuel that will be remaining at the destination is the amount of fuel presently remaining minus the fuel required to reach the destination.

CAUTION: The KLN 89(B) fuel calculations are based on the present rate of fuel flow, the present groundspeed, the present distance to destination along the programmed route, and the amount of fuel presently remaining. Before take-off, the fuel flow computer must be properly initialized with the amount of fuel on board (FOB) the aircraft. For some Shadin fuel computers without display units, you may enter the initial FOB during the KLN 89(B) Turn-on and Self Test (see section 3.2). Since many factors influence the required amount of fuel to reach the destination, it is the pilot's responsibility to view the fuel management pages often to check for any significant changes. Some factors affecting the amount of fuel required are power changes, altitude changes, headwind/tailwind component changes, fuel/air mixture adjustments, and routing changes.

The OTH 7, OTH 8, OTH 9, and OTH 10 pages are used to display fuel management information for KLN 89(B)s interfaced with compatible fuel management computers. If there is no fuel management computer interface, these fuel management pages are not displayed.

4.8.1.   THE OTHER 7 (OTH 7) PAGE

The OTH 7 pages display the following information (figures 4-131 and 4-132):

Figure 4-131

- The destination waypoint (the final waypoint in FPL 0 or a direct to waypoint if the waypoint is not included in FPL 0). An arrow is displayed to the left of the identifier if the waypoint is the active waypoint.

Figure 4-132

- The fuel units as received from the fuel management computer.

GAL	gallons
LB	pounds
IMP	imperial gallons
L	liters
KG	Kilograms

- The fuel presently on board **(Fuel OB)**. In most installations this is defined by using the fuel flow computer's control unit. However, if

the KLN 89(B) is interfaced with a compatible Shadin fuel flow computer, it is possible to define the fuel on board by using the KLN 89(B). In these installations it is not required to have the fuel flow computer's control head installed in the aircraft.

To change the present fuel on board:

1. Select the first OTH 7 page and turn on the cursor $\boxed{\text{CRSR}}$.

2. If it is possible to enter the present fuel on board by using the KLN 89(B) there will be a colon (**:**) following **Fuel OB** on the display. If the colon exists press the left $\boxed{\text{CRSR}}$ (figure 4-133), if the colon does not exist it is not possible to change the fuel on board through the KLN 89(B).
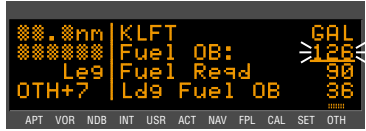
Figure 4-133

3. Enter the current fuel on board using the right inner knob. Make sure the amount entered is consistent with the units used by the fuel flow computer.

    *   The fuel required to reach the destination waypoint at the current rate of fuel flow and the present groundspeed (**Fuel Reqd**).

    *   The landing fuel on board (**Ldg Fuel OB**) is the fuel presently on board minus the fuel required to reach the destination.

The second OTH 7 page displays:

    *   The desired fuel reserve. You may enter here the amount of reserve fuel you wish to have upon landing. The fuel must be entered in the same units as displayed on the first line. To enter the reserve, press the left $\boxed{\text{CRSR}}$ and use the right inner knob to select the desired value. Turn off the $\boxed{\text{CRSR}}$ when finished.

    *   The calculated extra fuel. This is the landing fuel on board minus the fuel reserve you entered.

4.8.2.   THE OTHER 8 (OTH 8) PAGE

The OTH 8 page displays the following information (figure 4-134):

    *   The desired fuel reserve. Same as displayed on the OTH 7 page. Changing the reserve on one of the two pages also changes it on the other page.
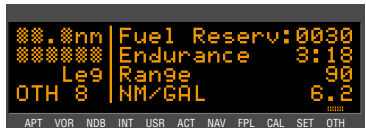
Figure 4-134

4-43

- The endurance in hours and minutes. The endurance is calculated based on the amount of fuel remaining after subtracting out the reserve you entered on the OTH 7 or the OTH 8 page from the present fuel on board.

- The range, which is the distance (nautical miles or kilometers) that could be flown based on the endurance calculated above and the present groundspeed.

- The fuel efficiency in nautical miles or kilometers per fuel unit (gallons in this case), which is the groundspeed divided by the present fuel flow.

4.8.3.   THE OTHER 9 (OTH 9) PAGE

The OTH 9 page displays rate of fuel flow. It has two formats depending on whether the aircraft is a twin engine (figure 4-135) or a single engine (figure 4-136).
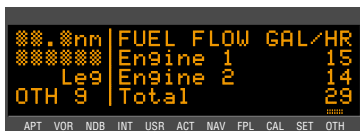
Figure 4-135

4.8.4.   THE OTHER 10 (OTH 10) PAGE

The OTH 10 page displays the amount of fuel used. If interfaced with the ARNAV fuel management computer, this page displays dashes since the ARNAV system does not output fuel used. There are two formats depending on whether the aircraft is a twin engine (figure 4-137) or a single engine (figure 4-138).
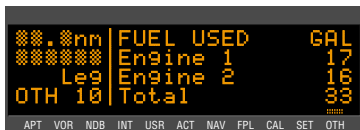
Figure 4-136

Figure 4-137

4.9.   THE AIR DATA PAGES

Specific models of Shadin Company air data systems may be interfaced to the KLN 89(B). When interfaced with one

Figure 4-138

of these systems, the KLN 89(B) will display real time air data parameters such as true airspeed (TAS), static air temperature (SAT), total air temperature (TAT), Mach number, density altitude, and pressure altitude. With a TAS input from an air data computer and a compatible heading input, the KLN 89(B) will calculate and display real time wind data (magnitude and direction).

NOTE: Heading information inputs to the KLN 89(B) must be in a format which is different than available from most mechanical compass systems, including the Bendix/King KCS 55A (KI 525A HSI with bootstrap heading synchro) and KCS 305 compass systems. However, the compatible Shadin air data system will convert three wire analog heading information from these mechanical systems into the proper format.

The Other 11 and Other 12 (**OTH 11** and **OTH 12**) pages are used to display air data information if both a fuel management system and an air data system are interfaced to the KLN 89(B). If there is no fuel management system, air data information is displayed on the Other 7 and Other 8 pages. If there is no air data system interface, these pages are not displayed.

NOTE: These air data pages receive inputs from air data sensors and display real time air data information. They are independent of the CAL 4, CAL 5, CAL 6 and CAL 7 pages which rely on manual pilot inputs to calculate air data information.

4.9.1.   THE OTHER 11 (OTH 11) PAGE

Without a fuel management system this becomes the OTH 7 page. The following information is displayed (figure 4-139):

Figure 4-139

| **TAS** | True airspeed (the true speed of an aircraft through the surrounding air mass). |
| **Mach** | Mach number (the ratio of the true airspeed to the speed of sound at a particular flight condition). |

If a compatible source of heading information is provided to the KLN 89(B), the following wind data is also displayed (figure 4-140):

Figure 4-140

Tailwind	Tailwind component of the wind.
Headwind	Headwind component of the wind.
Wind	The wind direction relative to true North and the wind speed.

4.9.2.   THE OTHER 12 (OTH 12) PAGE

Without a fuel management system this becomes the OTH 8 page. The following information is displayed (figure 4-141):

Figure 4-141

- **SAT** Static air temperature (the actual temperature of the surrounding air mass).

- **TAT** Total air temperature (the air temperature including heat rise due to compressibility. This is the temperature measured directly by the outside air temperature (OAT) probe.

- **Prs** Pressure altitude (to nearest 100 feet or 10 meters).

- **Den** Density altitude (to nearest 100 feet 10 meters).

4.10. MAGNETIC VARIATION

The KLN 89(B)'s primary coverage area is from N 74° to S 60° as was shown in figure 3-1. Magnetic variation is automatically computed within this coverage area when Mag Var is in the default AUTO mode on the SET 2 page. Navigation outside this area is automatically referenced to true North unless a manual input of magnetic variation is made on the SET 2 page. The following message will be displayed on the Message page:

> ***Magnetic Var Invalid**
> **Nav Data Referenced**
> **To True North**

A user-defined magnetic variation may be entered on line 4 of the SET 2 page. When a user-entered magnetic variation of 0 degrees is being used, the following message will be displayed on the Message page:

> ***Nav Data Referenced**
> **To True North**

When a user-defined magnetic variation other than 0 degrees is being used, the following message will be displayed:

> ***Nav Data Referenced To**
> **User-Defined Mag Var**

There are two exceptions when a user-defined magnetic variation will not be used for navigation. When the active waypoint is part of an approach

procedure, the magnetic variation for the published approach will be used and the follwing message will be displayed:

***Mag Var for Published
Approach Being Used**

Also, when the unit is in the OBS mode and the active waypoint is a VOR, the magnetic variation associated with the VOR station willl be used and the following message will be displayed:

***Mag Var for Published
VOR Being Used**

NOTE: A user-entered magnetic variation will not be retained if power is off for more than 5 minutes. Use of automatically computed magnetic variation will be restored if power is off for more than 5 minutes and the unit is within the primary coverage area.

To enter the local magnetic variation manually on the SET 2 page:

1. Turn on the cursor (CRSR).

2. Move the cursor over the numerical field on line 4   (figure 4-142).

Figure 4-142

3. Press the >CLR button to toggle the magnetic variation cycles field from automatic to manual if required. (ORS 02 only) (figure 4-143)

4. Use the right knobs to select the magnetic variation, from 0 to 99 degrees.

Figure 4-143

5. Move the flashing part of the cursor to the E/W (east/west) field and select whether the magnetic variation is easterly or westerly (figure 4-143).

6. Press ENT to approve and turn the cursor (CRSR) off.
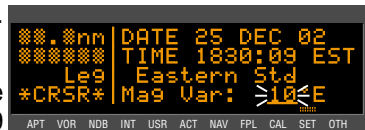
NOTE: The above format for the SET 2 page applies to ORS 02 software. ORS 01 software only allows the selection of a user-entered magnetic variation when the unit is outside of the primary coverage area, while ORS 02 software always allows the user to specify the magnetic variation.

4.11.   USING THE TAKE-HOME MODE

It is very likely that the KLN 89(B) will become your "best friend" in the cockpit. As with any good friend, you may need some time to get well-acquainted. This will allow you to utilize it to the maximum extent. A great way to get to know the KLN 89(B) is to use it outside the airplane, using what we call the "take-home mode".

There are products available which allow you to use the KLN 89(B) at your home, office, or hotel to have get-acquainted time in the take-home mode, for instance the Commander 2000 from Lone Star Aviation. It is also helpful to do flight planning and perform data base updates outside the airplane, perhaps with a home personal computer.

For more information on the Commander 2000, or to place an order, contact:

> Lone Star Aviation Corp.
> 1306 Tatum Drive
> Arlington, TX 76012
> Phone: (817) 548-7768
> FAX: (817) 261-8692

When the KLN 89(B) is in the take-home mode, it performs as if it is receiving adequate satellite signals to determine its position. It displays the latitude and longitude of its last known position or of whatever position it is initialized to on the Setup 1 (SET 1) page (see section 3.6, "Initialization and Time to First Fix"). In addition, a ground speed and heading may be entered on the SET 1 page and the KLN 89(B) will track a flight plan or a direct to waypoint just as if it was actually functioning in an aircraft. Distances count down, waypoints sequence, and the deviation bar follows the progress of the simulated flight. Using the take-home mode is an excellent way to learn the operation of the KLN 89(B) without worrying about the engine running, other traffic, or even terrain. Fortunately, these phenomena are not simulated in the take-home mode!

5. APPROACHES AND SID/STARS (KLN 89B ONLY)

This is the last chapter on the operation of the KLN 89(B). In this chapter you will learn how to use the KLN 89B for non-precision approach and SID/STAR procedures. Note that only KLN 89Bs which are configured for IFR approaches are capable of performing the procedures discussed in this chapter. KLN 89Bs which are configured for en route and terminal operations only will give you access to SID/STAR procedures but not non-precision procedures. All of these procedures require that you are comfortable with the operation of the unit as presented up to this point. In particular, you need to be comfortable with flight plan operation (sections 4.1 and 4.2) and the OBS mode (section 4.7).

5.1. NON-PRECISION APPROACH OPERATIONS

Flying non-precision approaches using the KLN 89B are not in themselves very difficult. However, it is different than using traditional equipment such as VORs and NDBs. With this in mind, make sure that you practice with the KLN 89B in VFR weather with a check pilot before attempting to use the KLN 89B in actual IFR conditions.

CAUTION: The KLN 89B obtains approach information from the data base. Therefore, it is extremely important that the data base is current. The KLN 89B is approved for IFR non-precision approaches only when the data base is current. If you attempt to select an approach when the data base is out of date, you will be given the status-line message: "D Base Expire" in the bottom left portion of the screen as a reminder.

The following sections assume that your KLN 89B is properly installed in the aircraft with all of the necessary accessories to fly non-precision approaches. In most cases this will mean that the aircraft has external switch/annunciators to arm the approach mode. An external annunciator to indicate when a message is active and when waypoint sequencing is about to occur will also be installed. In some installations the aircraft will have a NAV/GPS switch to select which navigation source is displayed on the primary HSI or CDI.

The NAV 4 page has been specifically designed to provide most of the functions needed for non-precision approaches. This page provides an interface that presents pertinent navigation information, a way to access the flight plan, and a graphic presentation of the present position relative to the flight plan waypoints. You will find this page to be a good friend while performing GPS based non-precision approaches.

NOTE: *There are some approach procedures in the world that are not suited for the operational characteristics of the KLN 89B. These procedures are not included in the data base. Therefore it is not possible to use the KLN 89B for these approaches. It is good pre-flight practice ensure that the KLN 89B contains anticipated procedures for the flight.*

In addition to the two course modes (Leg and OBS) described in section 4.7, there are also two approach modes. These are approach arm and approach active. The status of the approach mode is indicated on an external switch/annunciator. In most installations the external annunciator will indicate **ARM** for the approach arm mode and approach active will be annunciated by **ACTV**. The main difference of these modes from the normal en route mode is that the integrity monitoring is set to a tighter level. Another difference between these modes and the en route mode is that the CDI scale factor will usually change to ±1.0 NM for ARM and will always change to ±0.3 NM when in the APR ACTV mode.

The ARM mode can be selected in two ways. The normal way is that this mode will be selected automatically by the KLN 89B when the aircraft is within 30 NM of an airport and an approach is loaded in the flight plan for that airport. It is possible to arm the approach mode at a distance greater than 30 NM from the airport by pressing the external GPS approach switch, but the KLN 89B will not change the CDI scale factor until the aircraft reaches the 30 NM point. If the GPS APR external switch is pressed while the approach mode is armed, then the KLN 89B will disarm the approach and change back to en route mode. The CDI scale factor will also change back to ±5.0 NM. The approach can be re-armed by simply pressing the GPS APR switch again.

The APR ACTV mode can only be engaged automatically by the KLN 89B. To cancel the APR ACTV mode press the external GPS APR switch. This will change the mode to APR ARM. Once past the FAF, it is not possible to return to the approach active mode without conducting a missed approach and flying back to the FAF.

General Procedure for Non-Precision Approaches

Non-precision approaches will all have the general flow of events as follows. Refer to figure 5-1.

1. **Select and load the approach into the flight plan.** This can be done at almost any time but must be completed before reaching the Final Approach Fix and should be done as soon as possible.
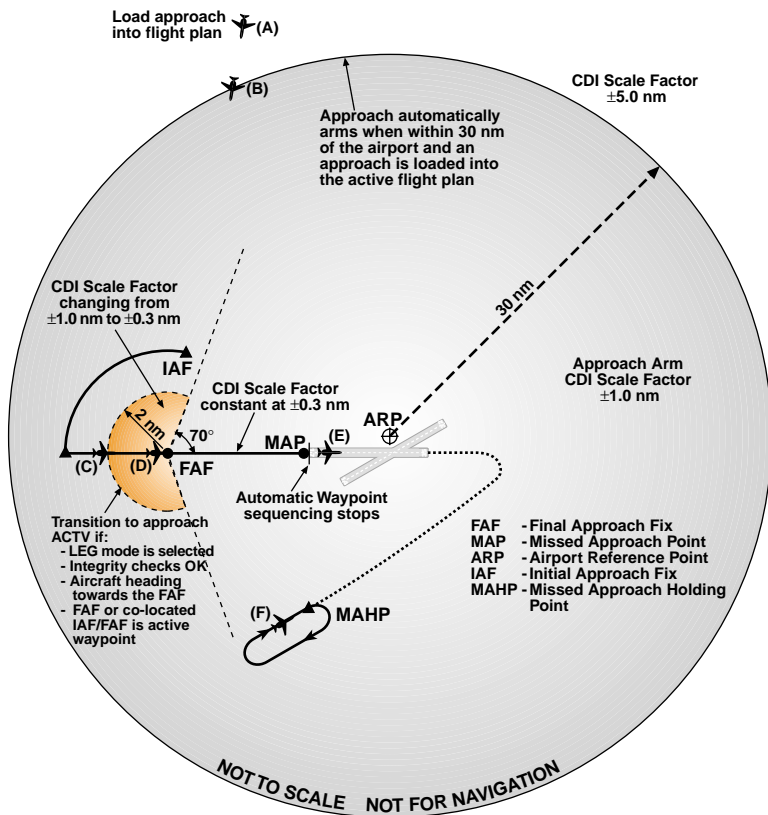
Figure 5-1

This corresponds to point A in figure 5-1. If the aircraft is greater than 30 NM from the airport, then the CDI scale factor will remain at the default ±5 NM full scale deflection.

2. **Transition to the approach arm mode.** This will occur automatically when the aircraft is within 30 NM of the airport and there is an approach loaded into the flight plan (position B in figure 5-1). The CDI scale factor will change to ±1.0 NM over the next 30 seconds and the external annunciator will indicate **ARM**.

3. **Get established on the final approach course.**

   • NoPT arrival route

   • Radar vectors (requires OBS mode)

   • Procedure turn or holding pattern (requires OBS mode)

   • DME arc

4. **Transition to the approach active mode.** This mode change is automatic and occurs at position C in figure 5-1 when:

- the aircraft is 2 NM from the FAF and the approach mode is armed

- the LEG mode is selected

- the aircraft is heading towards the FAF

- the FAF or a co-located IAF/FAF is the active waypoint

- the KLN 89B confirms that adequate integrity monitoring is available to complete the approach.

- RAIM is available at FAF & MAP

If any of these conditions are not met, the KLN 89B will not transition to the approach active mode and a missed approach will be required if the conditions do not change before reaching the FAF. If all of these conditions are met then the CDI scale factor will start to change to ±0.3 NM and the external annunciator will indicate **ACTV**.

5. At the FAF (position D in figure 5-1) the CDI scale factor will be at ±0.3 NM and will remain at this scale factor until you manually cancel the approach mode by either pressing the external GPS APR button to change to the **ARM** mode, by initiating a direct to operation or by changing to OBS mode.

WARNING: It is not approved to conduct the final portion of the approach unless the KLN 89B is in the approach active mode (ACTV on external annunciator).

6. Fly to the Missed Approach Point. (position E in figure 5-1). The KLN 89B will not automatically sequence to the next waypoint. You must manually change to the appropriate waypoint according to the situation. By default, the KLN 89B will nominate the first waypoint of the published missed approach procedure when ⟶⊞ is pressed, and the active waypoint is the MAP, and you have flown past the MAP (rule number 4 in section 3.9).

7. If necessary conduct the missed approach procedure. Remember to always refer to the paper chart when conducting a missed approach. The OBS mode is usually needed at some point during a missed approach and is always required to fly the holding pattern (position F in figure 5-1).

The details of the above operations as well as several examples of how to conduct non-precision approaches using the KLN 89B are given in the following sections.

5.1.1. SELECTING AN APPROACH

The first item in the list from the previous section is to select and load the approach into the active flight plan. Approaches are selected from the APT 8 (or ACT 8) page of the airport for which you desire to shoot the approach. If you are operating from a flight plan, the easiest way to get to the approach information is by turning to the ACT page for your destination as described in section 4.2.3.

The following example will use the VOR or GPS RWY 25R approach to Los Angeles International airport (KLAX).

*To select and load an approach
into the active flight plan (FPL 0):*

1. Turn to one of the APT pages and select KLAX by using the cursor, inner, and outer knobs (figure 5-2)

Figure 5-2

2. Use the right inner knob to turn to the APT 8 page. If you selected KLAX from the APT 1 page turn the inner knob one click counter-clockwise to reach the APT 8 page.

3. Turn the cursor on by pressing `CRSR`. The cursor comes up on the first approach in the list of approaches. Use the right outer knob to move the cursor to different approaches (figure 5-3). If there are more than 3 approaches to an airport you can move the cursor down to "scroll" the other procedures into view by rotating the right outer knob.

Figure 5-3

4. With the flashing cursor over **VOR 25R** press `ENT`.

5. The KLN 89B will present a list of Initial Approach Fixes (IAFs) corresponding to this approach. In this example we want the ELMOO IAF. Select this by pressing `ENT` when the cursor is over **ELMOO** (figure 5-4).

Figure 5-4

Note: If there is only one IAF for a procedure, then the KLN 89B will skip this step and go on to the next step.

In many cases ATC will not tell you explicitly which IAF to use. In these cases you need to select an IAF which is closest to the route of flight that you expect. If you expect radar vectors, then the selection of the correct IAF is less important because you will be given vectors to the FAF and will not need to use the IAF.

6. The KLN 89B next presents a list of waypoints that make up the approach. Review these waypoints to make sure that you have selected the correct IAF. If there are more than four waypoints in the approach you can move the cursor up to "scroll" the other waypoints into view by rotating the right outer knob (figure 5-5).

Figure 5-5

Figure 5-6

7. Move the cursor over **ADD TO FPL 0?** (figure 5-6) and press `ENT`.

8. The KLN 89B will then bring up the FPL 0 page and put the sequence of approach waypoints in front of the airport reference point (figure 5-7).
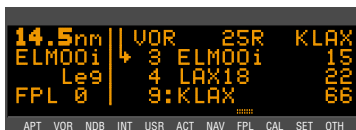
Figure 5-7

NOTE: *At any time during the process of selecting an approach you can easily return to the previous step by pressing the* `>CLR` *button.*

The waypoints that make up the approach procedure are loaded into the flight plan. At the top of the list of approach waypoints is a "header" that describes the approach that follows. An example of this is shown on line 1 of figure 5-7, which indicates that the VOR 25R approach for Los Angeles International Airport is in the active flight plan (FPL 0).

After the approach has been entered into the flight plan the KLN 89B checks to make sure that the resulting flight plan "makes sense". If the KLN 89B detects any waypoints that are in both the en route portion of the flight plan and the portion that makes up the approach, then the following message will be given:

> ***Redundant Wpts in FPL**
> **Edit En Route Wpts**
> **As Necessary**

Examine the flight plan and delete those en route waypoints that are not necessary.

NOTE: Approaches can only be entered into FPL 0, the active flight plan. If the KLN 89B is turned off for more than 5 minutes, then the approach is deleted when power is turned back on.

5.1.2. INTERPRETING WHAT YOU SEE

In the example above, you may have noticed a couple of waypoints with somewhat strange names. The second waypoint of the approach procedure, LAX18, has a name that is not normal for a waypoint. This is an example of what are called "terminal" waypoints. These are waypoints that are associated with a specific airport. They are used to define a spot on the ground that does not have a normal waypoint name. In the case of "LAX18" this point is 18 NM from the LAX VOR on the 68° radial. The fifth waypoint in the approach procedure, MA25B, is another type of terminal waypoint. In this case this point is the missed approach point for runway 25. This approach applies to both the left and right runways so the letter B is used to mean "both".

There are few other types of terminal waypoints that you will need to be familiar with to fully understand GPS non-precision approaches. The naming convention for these waypoints are as follows:

Fxyyy • F stands for Final Approach Fix

Ixyyy • I stands for Intermediate Fix

Cxyyy • C stands for Course Fix

Mxyyy • M stands for Missed Approach Point

RWzzz • RW stands for Runway Fix. This is usually the MAP for the approach

• zzz will be a runway number possibly including L for Left, R for Right, C for Center, or B for Both.

Daaab • D stands for DME arc waypoint

• aaa is the radial that the fix is on from the reference VOR

• b will be a letter corresponding to the distance from the reference VOR. For example, G is the seventh letter of the alphabet so D234G would be a point on the 234° radial 7 NM from the reference

VOR. DME arcs greater than 26 NM will have
waypoints where the first two characters are the
first two letters of the DME identifier. The next
three characters will be the radial that the arc way
point is on.

In the rules above x and yyy are defined as follows. For runways with
only one approach, x will be replaced with an "A" or a "F". For run-
ways that have multiple approaches, x will be replaced with "V" for
VOR, "N" for NDB, or "R" for RNAV. The letters yyy will be replaced
with either the runway identifier (e.g., FF25L) or, for circling
approaches, the inbound course to the missed approach point (e.g.,
MA259).

Waypoints along a given radial will be named such that the first three
letters are the reference VOR/DME and the next two are the DME
distance. If the distance is greater than 100 NM the order is reversed.
For example, LAX18 is 18 NM from LAX while 26FLW is 126 NM
from FLW.

If the aircraft is not too far from the destination airport, the NAV 4
page can be used to determine where some of these waypoints are
relative to others in the approach. At the time of this writing, all of the
NOS charts and some Jeppesen charts do not show the special ter-
minal waypoints that are required for GPS approaches. For this
reason it is a good idea to understand what the special waypoints are
used for and what they mean.

You may have also noticed that some waypoints have a small letter
at the end of the waypoint name. The small letter is an aid that we
have added to the name of some waypoints to help you recognize
important points in the approach. These suffixes are displayed on
many of the KLN 89B pages. The definitions of these suffixes are:

i - The Initial Approach Fix (IAF) of the approach.

f - The Final Approach Fix (FAF) of the approach

m - The Missed Approach Point (MAP) of the approach

h - The Missed Approach Holding Point (MAHP) for the approach

Every approach will have a FAF and a MAP. Almost all will have an
IAF and missed approach holding point.

Another item that you should notice in
the flight plan is the line that has **NO
WPT SEQ** on it (figure 5-8). This is
what is referred to as a fence and the
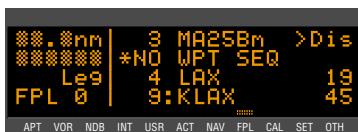purpose of this line is to tell you that

Figure 5-8

5-8

the KLN 89B will not automatically sequence past the waypoint that precedes the fence. The waypoint before the fence is always the missed approach point. The reason that waypoint sequencing is not allowed is that many missed approach procedures require specific actions before going to the missed approach holding point (e.g., climbing on a fixed heading until reaching an altitude).

5.1.3. CHANGING OR DELETING AN APPROACH ONCE LOADED INTO THE FLIGHT PLAN

The sequence of waypoints that are retrieved from the data base of the KLN 89B define the approach procedures as they are charted. To ensure that the proper path over the ground is followed, it is not possible to either delete or add waypoints to the approach section of the flight plan. To help you see which waypoints are en route waypoints and which are approach waypoints, the KLN 89B does not display a colon next to the waypoint number on the FPL 0 page if the waypoint is an approach waypoint.

It is only possible to replace the existing approach with another one, or delete the entire approach from the flight plan.

To replace an existing approach, or delete an approach:

1. With the left page displaying the active flight plan (FPL 0) turn the cursor on by pressing `CRSR` (figure 5-9).

Figure 5-9

2. Move the cursor so that it covers the approach header at the top of the approach procedure. Once the cursor comes over the approach header, it will automatically change to read **CHANGE APPR?** (figure 5-10). If you press `ENT` in this condition the KLN 89B will bring up the APT 8 page that corresponds to the current approach. At this point it is possible to select different approach procedures, different IAFs, or both.

Figure 5-10

3. If you press the `CLR` button while the cursor is over the approach header it will change to read **DELETE APPR?** (figure 5-12). If you press `ENT` now, the KLN 89B

Figure 5-11

will remove the entire approach procedure from the active flight plan. If the KLN 89B was in the approach arm or the approach active mode, then deleting the approach will cause the KLN 89B to change back to en route mode. This means that the CDI scale factor will change back to the default ±5.0 NM scale.

5.1.4. EXAMPLE APPROACH: NO PROCEDURE TURN

Now that you know the basics of inserting an approach into the flight plan, we can now show the approach operation of the unit by several examples. This first example will use the approach that was loaded into the flight plan in section 5.1.1. This example will show how the KLN 89B sequences through an approach and what type of annunci-ations and scale factor changes can be expected. The KLN 89B will remain in the familiar Leg mode so there will be no need to change between Leg and OBS mode in this example. Refer to the approach plate for this approach (figure 5-12) to see what the procedure looks like.

For this example it is assumed that you are on an active flight plan with the final destination being the Los Angeles International airport, KLAX. It is also assumed that ATC will not give you radar vectors during this approach.

1. Load the VOR 25R approach to KLAX as demonstrated in sec-tion 5.1.1.

2. When you are within 30 NM of the airport, the KLN 89B will auto-matically arm the approach mode and provide the following message:

    *Press ALT To Set Baro

The message acts as a reminder to make sure the KLN 89B is using the correct barometric pressure. If the barometric information is not correct, then the integrity monitoring provided by the KLN 89B will not be as good as it could be. Press ALT to bring up the ALT 1 page and verify that the barometric pressure is correct.

NOTE: If the KLN 89B is interfaced with a compatible air data com-puter that provides the correct barometric pressure to the KLN 89B, then the previous message is not displayed and it is not necessary to update the barometric pressure.

At this time the KLN 89B will smoothly change the CDI scale factor to ±1.0 NM. The external approach annunciator installed in the aircraft will indicate that the approach is in the ARM mode.
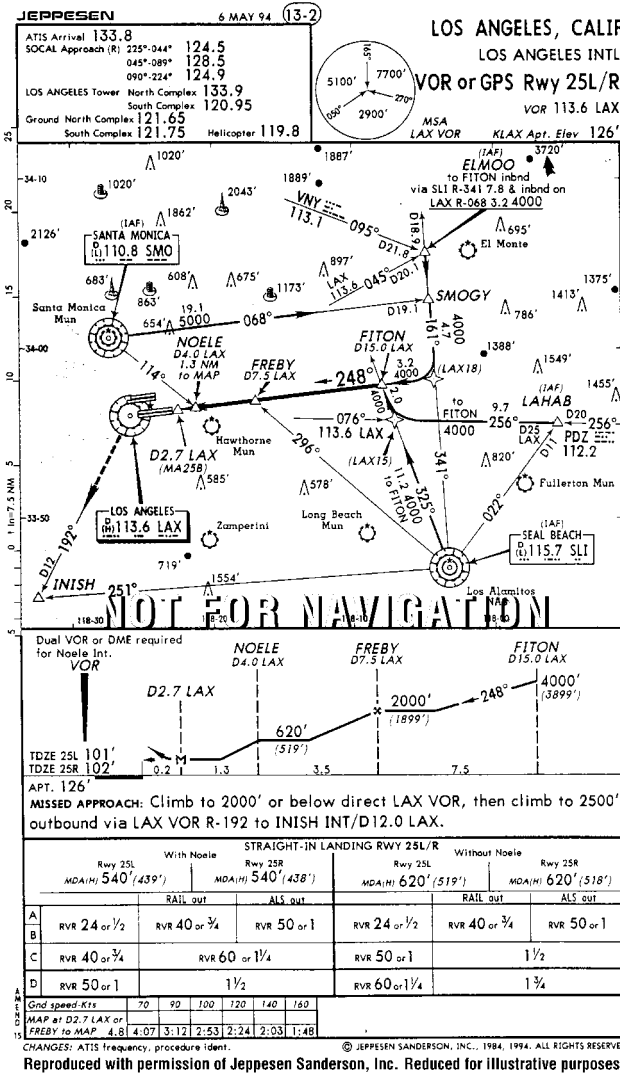
Figure 5-12

3. As you approach ELMOO, the KLN 89B will provide waypoint alerting on the external annunciator as well as on the screen of the KLN 89B. Once you pass ELMOO, the KLN 89B will automatically sequence to the next waypoint in the approach, LAX18.

4. This may be a good time to select the NAV 4 page. This page is especially useful for getting a feeling of where you are in the approach (figure 5-13).

Figure 5-13

5. As the aircraft approaches the LAX18 waypoint, the KLN 89B will again provide waypoint alerting. As the aircraft passes LAX18 and sequences to FITON, the KLN 89B will provide a message telling you to set the external indicator (CDI or HSI) to a new value. If desired track (DTK) is shown on the screen, this value will flash when the external selected course does not match the DTK within 10°.

6. As the aircraft approaches the FAF (FREBY) it is a good idea to check over the status of the KLN 89B. Look at the KLN 89B screen to verify that LEG sequencing is selected. Remember, the KLN 89B will not transition to the approach active mode if the OBS mode is selected. If the KLN 89B shares an HSI or CDI with other NAV sources, it is also good to verify that the NAV/GPS switch is set to GPS.

7. By the time the aircraft is 2 NM from FREBY (figure 5-14), the Final Approach Fix, the KLN 89B will make a prediction to see if integrity will be available at the FAF and at the MAP. If the pre-diction indicates that integrity

Figure 5-14

monitoring will be available, and RAIM is currently available, the KLN 89B will change the GPS APR annunciator to read ACTV. At this time the KLN 89B will also start to change the CDI scale factor. By the time the aircraft reaches the FAF (FREBY) the CDI scale factor will be down to ±0.3 NM.

8. The fix NOELE is not included in the list of waypoints provided in the data base. You will need to identify this point by using the along track distances given in the profile view of the approach plate. In this example NOELE is located 1.3 NM from the MAP. When the distance to MA25B is 1.3 NM, then the aircraft is at NOELE and you can descend to the MDA for this approach.

NOTE: Some approach procedures require that you add up several along-track distances to be able to identify a step down fix.

9. The KLN 89B will again provide waypoint alerting as you approach MA25B. This is shown on the NAV 4 page by a flashing active waypoint identifier (figure 5-15).
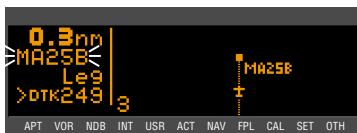
Figure 5-15

The following steps would need to be performed if a missed approach is required.

11. Upon reaching MA25B and not seeing the runway you decide to perform a missed approach. Remember, the KLN 89B will not automatically sequence past the missed approach point. This is shown on the NAV 4 page by not showing any lines connecting waypoints that are past the MAP. To perform the published missed approach procedure, press ⎕➔ to bring up the direct-to page. The default waypoint will be the first waypoint of the missed approach procedure. In this case the first waypoint is LAX. Confirm this waypoint as the direct to waypoint and press ⎕ENT .

12. Upon reaching LAX, the KLN 89B will sequence to the next way-point in the missed approach procedure, INISH. In this example, there is no holding pattern published for the missed approach so you can expect further instructions upon reaching INISH.

NOTE: *If ATC gives you instructions for a missed approach that is different from the published missed approach procedure, it is always possible for you to select a different direct to waypoint than the default direct to waypoint.*

5.1.5. EXAMPLE APPROACH: OFF-AIRPORT NAVAID

An approach that is quite common is an approach that is based off of an off-airport navaid. An example of this is the VOR RWY 22 approach to Clovis New Mexico Municipal airport, KCVN. To fly this procedure as published use the following steps and refer to figure 5-16 for the procedure. For this example assume that the aircraft is

Reproduced with permission of Jeppesen Sanderson, Inc. Reduced for illustrative purposes
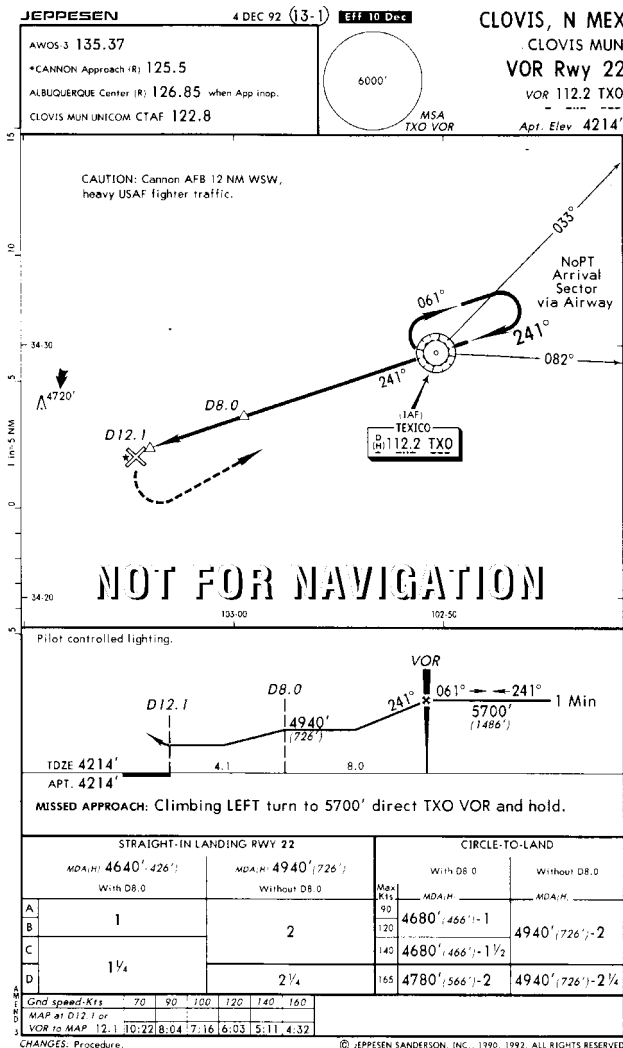
Figure 5-16

approaching from the Northeast going Direct-to the Clovis airport with no active flight plan.

1. Load the approach into the flight plan as described in section 5.1.1. In this case there is only one IAF so the KLN 89B does not present the option for you to select an IAF. In this example, there is no active flight plan to begin with so the KLN 89B will ask to add the approach to FPL 0.

2. Approaching the area ATC tells you to go direct-to the TXO VOR and clears you for the approach to KCVN. This is easy to do from the NAV 4 page by pulling out on the right inner knob and scanning through the active flight plan by turning the inner knob. Once TXO is displayed in the scanning window (figure 5-17), press ⟨ 🔄 ⟩ and then ⟨ ENT ⟩ to initiate a direct to operation to the TXO VOR.

Figure 5-17

3. At a distance of 4 NM to the TXO VOR, the KLN 89B will give the following message:

*If Required Select OBS

This message provides a reminder that to fly a course reversal the OBS mode needs to be selected. Note from the approach chart that there is a NoPT Arrival Sector for this approach. If you are approaching TXO within the indicated area there is no need to perform a course reversal and you need to ignore this message. The NoPT sector is not stored in the data base so it is not possible for the KLN 89B to know if a course reversal is required or not; as a result, the KLN 89B will always give this message whenever a waypoint could be used for a course reversal. The KLN 89B will properly sequence to the FAF to MAP leg and transition to the approach mode when 2 NM from the IAF/FAF.

If, however, you are approaching from any other direction a course reversal is required and the OBS mode will need to be selected. If the OBS mode is not selected before reaching TXO, then the KLN 89B will automatically sequence to the missed approach point. This is not desirable when performing a course reversal so the OBS mode must be selected before reaching TXO.

NOTE: The KLN 89B will only remind you to select OBS mode if the IAF is the active waypoint. Therefore if a course reversal is required, make sure the IAF is the selected waypoint.

4. If a course reversal is required, then upon reaching TXO perform the appropriate holding pattern entry and set the inbound course on the external CDI or HSI. In this example the inbound course is 241°. At this point the KLN 89B works very similar to a conventional VOR/DME.

5. Once established on the inbound course of 241°, switch back to the Leg mode. When Leg mode is selected the FAF is automatically made the active waypoint when the IAF and the FAF are at the same waypoint.

NOTE: It is mandatory that the unit be in LEG mode with the FAF as the active waypoint before crossing the FAF to activate the approach active mode and change to ±0.3 NM scale factor. The CDI scale factor changes from ±1.0 NM to ±0.3 NM over the two miles to the FAF. Delaying the switch from OBS to Leg mode compresses the scale factor change. This will make the transition more abrupt. If the switch from OBS to Leg is delayed too long it will not be possible for the KLN 89B to change to the approach active mode.

6. When the aircraft is 2 NM from the FAF, the KLN 89B will verify that the proper integrity is available. If integrity monitoring is available for the approach, then the KLN 89B will change to the Approach Active mode. This will be annunciated on the external approach status annunciator as well as on the KLN 89B. The CDI scale factor will also start to change from ±1.0 NM to ±0.3 NM.

7. Upon reaching TXO, the KLN 89B will automatically sequence to RW22, the missed approach point.

8. <u>The fix at 8 DME from TXO along the final approach course is not included in the waypoints that come from the data base. Since the distance that the KLN 89B is giving you is distance TO the MAP, you will need to mentally figure out when the aircraft has reached this point.</u> This is done by looking at the along track distances given in the plan view of the approach. In this case the fix is 4.1 NM from RW22. Upon reaching this distance you can descend to the MDA for this approach.

If a missed approach is required for this approach, then the following steps would be required.

9. The published missed approach procedure for this approach is to make a climbing left turn to 5700 feet and proceed direct to the TXO VOR. In this case TXO will be the default direct to waypoint

when ⌈⊕⌉ is pressed. This is the desired waypoint so press ⌈ENT⌉ to confirm the waypoint and proceed direct to the VOR.

NOTE: If ATC gives you instructions for a missed approach that are different from the published missed approach procedure, it is always possible for you to select a different direct to waypoint than the default direct to waypoint.

10. As the aircraft approaches TXO you will need to select OBS mode to stop waypoint sequencing and define the inbound course for the holding pattern. If you do not select the OBS mode before the aircraft is within 4 NM of the holding point, then the KLN 89B presents a message reminding you to select the OBS mode.

NOTE: If another attempt at the approach is desired after holding, it is necessary to manually change the active waypoint. When the FAF and the missed approach holding point are at the same place then the KLN 89B will automatically change the active waypoint to the FAF when you change from OBS to LEG. Make sure to make this change as soon as possible to ensure you get into the approach active mode.

5.1.6. EXAMPLE APPROACH: RADAR VECTORS

For this example we will use the same approach that was used in the previous section except this approach will be conducted with the help of radar vectors from approach control. The aircraft will be assumed to be arriving from the West, although this does not change the way the approach will be flown using the KLN 89B.

1. The approach has been selected and entered into the flight plan and the aircraft is going direct to KCVN (Clovis, New Mexico Municipal) as described in section 5.1.5.

2. As soon as ATC mentions radar vectors you should immediately start to think of the OBS mode. Once given radar vectors, change the active waypoint to TXO and select the OBS mode. Note that it is not important what order these events take place. It is just as effective to change to OBS mode and then change the active waypoint as it is to change the active waypoint and then switch to OBS mode.

3. Next, change the selected course on the CDI or HSI to the final approach course. For this exam-
ple, the inbound course is 241°.
It is now possible to watch your
progress on the NAV 4 page and
anticipate when you will be given
new headings to fly (figure 5-18).
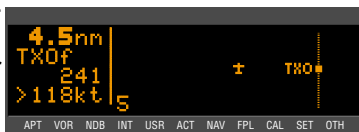
Figure 5-18

4. Once established on the inbound course, you will need to change back to the Leg mode to allow for proper approach operation and automatic leg sequencing. For best performance, the change back to Leg mode should be made before the aircraft is 2 NM from the FAF.

NOTE: It is mandatory that the unit be in LEG mode with the FAF as the active waypoint before crossing the FAF to activate the approach active mode and change to ±0.3 NM scale factor. The CDI scale factor changes from ±1.0 NM to ±0.3 NM over the two miles to the FAF. Delaying the switch from OBS to Leg mode compresses the scale factor change. This will make the transition more abrupt. If the switch from OBS to Leg is delayed too long it will not be possible for the KLN 89B to change to the approach active mode.

5. The rest of this approach would be flown using the same steps as presented in section 5.1.5.

5.1.7. EXAMPLE APPROACH: ON-AIRPORT NAVAID

Another common type of approach is an approach that is based on an on-airport navaid. These could be either VOR or NDB approaches. An example of this type of approach is the VOR RWY 24 approach to Bowman airport in Louisville, Kentucky (Figure 5-19). The airport identifier for this airport is KLOU.
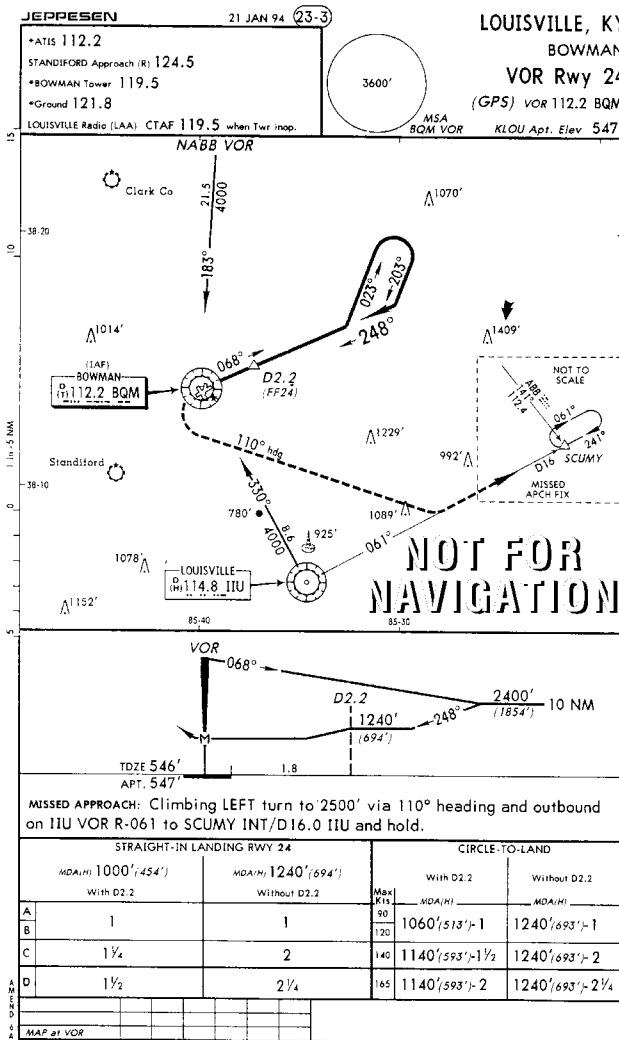
Figure 5-19

For this example assume that the aircraft is approaching KLOU from the Nabb VOR.

1. After passing the Nabb VOR, you are told to expect the VOR 24 approach at KLOU. You load the approach using the procedure described in section 5.1.1.

2. When the distance from the present position to the destination airport reaches 30 NM, the KLN 89B will automatically arm the approach mode. The CDI scale factor will transition to ±1.0 NM and the KLN 89B will provide more sensitive integrity monitoring. You also press $\boxed{\text{ALT}}$ to update the barometric information.

3. When the aircraft is 4 NM from the BQM VOR, the KLN 89B will give a message reminding you to select the OBS mode. The OBS mode is required for the procedure turn. After passing BQM, select the outbound course of 068° on the external CDI or HSI.

4. The aircraft is now headed outbound for the procedure turn. As soon a practical, you will need to change the active waypoint to FF24, the final approach fix. This is done by pulling out on the right inner knob and scanning until FF24f is displayed in the window (figure 5-20) then pressing $\boxed{\text{→}}$, then pressing $\boxed{\text{ENT}}$. The OBS course will still be what is selected on the external CDI or HSI (68°).
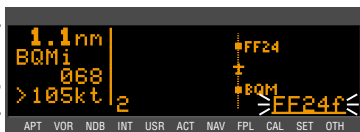
Figure 5-20

5. With the OBS mode selected and FF24 as the active waypoint, it is possible to fly the procedure turn. Allow enough distance past FF24 to complete the procedure turn and still be 2 NM away before reaching the FAF. After completing the outbound portion of the procedure turn, change the selected course to the inbound course of 248° on the external CDI or HSI.

6. Once established on the inbound course the Leg mode will again need to be selected so that proper approach operation and waypoint sequencing will occur.

NOTE: *It is mandatory that the unit be in LEG mode with the FAF as the active waypoint before crossing the FAF to activate the approach active mode and change to ±0.3 NM scale factor. The CDI scale factor changes from ±1.0 NM to ±0.3 NM over the two miles to the FAF. Delaying the switch from OBS to Leg mode compresses the scale*

factor change. This makes the transition more abrupt. If the switch from OBS to Leg is delayed too long it will not be possible for the KLN 89B to change to the approach active mode.

7.   When the aircraft is 2 NM from the FAF, the KLN 89B will verify that the proper GPS integrity is available. If integrity monitoring is available for the approach, then the KLN 89B will change to the Approach Active mode. This will be annunciated on the external approach status annunciator as well as on the KLN 89B. The CDI scale factor will also start to change from ±1.0 NM to ±0.3 NM.

8.   Normal waypoint alerting will occur as the aircraft passes the final approach fix. The leg from the final approach fix to the missed approach point will become active and the CDI scale factor will remain at ±0.3 NM. If the AUTO scale factor was selected on the NAV 4 page, then the scale factor will zoom in on the airport as the aircraft gets closer and closer to the missed approach point. Eventually the map scale changes to 1 NM.

The following steps are followed if a missed approach is required.

9.   The missed approach instructions call for a climbing left turn to a heading of 110° until intercepting the 061° inbound course to the missed approach holding fix, SCUMY. To fly this with the KLN 89B it will be necessary to put the KLN 89B into the OBS mode and make SCUMY the active waypoint. Change the selected course on the external CDI or HSI to 061°.

10. Once the aircraft reaches SCUMY, you will need to perform a holding pattern entry suitable for this holding pattern and set the selected course to 241° for the holding pattern.

5.1.8. EXAMPLE APPROACH: DME ARC

DME arc procedures with the KLN 89B are completely different from using traditional VOR and DME equipment. Don't worry though because DME arc procedures using the KLN 89B are also easier than using traditional equipment. This is because the KLN 89B provides left/right guidance around the arc. No more having to watch distance in one place and radial in another!

When being vectored, a DME arc is really a whole bunch of initial approach fixes placed one next to each other to form an arc. Very rarely do you actually fly to the beginning of an arc, especially in a radar environment. Instead, the flight path of the aircraft generally intersects the arc at some point. Once the aircraft is near the arc, it is then possible to turn so that the arc distance is maintained until time to turn to the inbound fix.

The following example will show how DME arc procedures are flown using the KLN 89B. This example approach will be to use the VOR RWY 12 approach to Owatonna, Minnesota, KOWA. The approach plate for this approach is in figure 5-22. Assume that the aircraft is approaching from the North and is in a radar environment.

1. ATC assigns the VOR RWY 12 approach. Turn to the APT 8 page for KOWA to select the approach. You select the VOR 12 approach and the KLN 89B presents the IAF selection page (figure 5-21).

Figure 5-21

2. There are five choices for the IAF. Three of these choices you can recognize but the other two, D040L and D220L, are unfamiliar and not shown on this chart. These two waypoints are the data base identifiers for the ends of the arc. D040L means DME arc point, 040 is the radial on which the waypoint lies, and L indicates the distance of the arc. L is the twelfth letter of the alphabet so the L indicates that this is a 12 DME arc. In a similar manner D220L can also be decoded. In this example the aircraft is approaching from the north so the D040L IAF will be selected.

3. The KLN 89B knows that this point is associated with a DME arc. Once an arc waypoint is chosen, the KLN 89B determines what radial of the reference VOR the aircraft is presently located on. A waypoint is created that is located at the intersection of the present radial and the DME arc. This waypoint is the first waypoint in the list of waypoints presented on the APT 8 page before loading
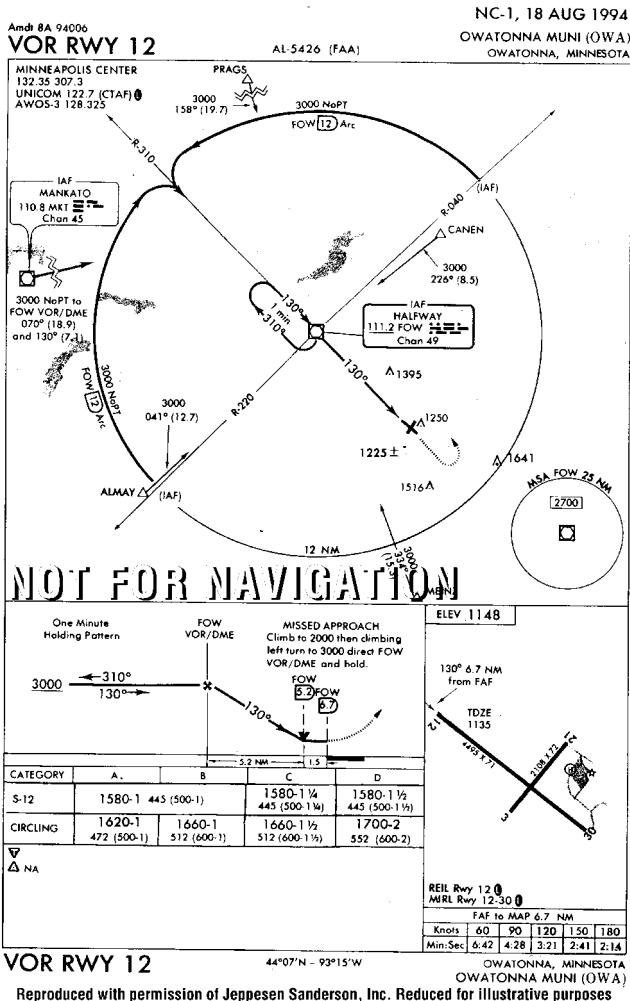
Figure 5-22

the approach into the flight plan (figure 5-23). This waypoint is named using the same convention discussed earlier.

Figure 5-23

NOTE: *If the present radial from the reference VOR is outside of the defined arc, then the KLN 89B will default to the beginning of the arc.*

**CAUTION: The KLN 89B does not take into account the geome-
try of the active flight plan when determining the arc intercept
point. This point is defined solely on the present radial and the
defined arc distance from the reference VOR. For this reason it
is better to delay selecting approaches that contain DME arcs
until the aircraft is closer to the destination.**

4. With the cursor over **ADD TO FPL 0?**, Press $\boxed{\text{ENT}}$. The approach
   will be loaded into the active flight plan just like any other
   approach would be.

5. After the approach is loaded into the flight plan the KLN 89B may
   give the message:
   > ***Redundant Wpts In FPL**
   > **Edit En Route Wpts**
   > **As Necessary**

   This message is given because very often it will be necessary to
   edit the active flight plan to ensure that proper waypoint sequenc-
   ing occurs. Examine the flight plan and, if practical, observe the
   NAV 4 page to make sure that the sequence of waypoints does
   not have any unnecessary legs in it.

6. The KLN 89B will now provide guidance to the arc intercept point.
   The NAV 4 page displays the entire arc on the screen. The por-
   tion that is between the beginning
   of the arc and the arc intercept is
   drawn with a dashed line. The
   part that is between the arc inter-
   cept point and the end of the arc
   is drawn with the normal solid line
   (figure 5-24).

Figure 5-24

7. In some cases ATC may provide radar vectors to the arc. The
   KLN 89B provides a means to define a new intercept point based
   on the current track of the aircraft over the ground. This can be
   done from either the NAV 4 page or from the FPL 0 page. The
   dashed line displayed on the NAV 4 page will help you to deter-
   mine if ATC is giving you correct vectors.

   • From the NAV 4 page, pull out the right inner knob to bring
     up the waypoint scanning window.

   • Turn the right inner knob until the first waypoint of the arc is
     displayed, D011L in this example. For approaches this will
     have a small (i) appended to the waypoint name. If the
     recalculation is to be done from the FPL 0 page, then turn on
     the cursor and move it over the first waypoint of the arc.

• From either page press ⌈>CLR⌉. This will change the waypoint to read **MOVE?** (figure 5-25).   If it is desired to recompute the arc intercept point then press ⌈ENT⌉. If a new arc intercept point is not desired then press ⌈>CLR⌉ again.

Figure 5-25

• If ⌈ENT⌉ was pressed, then the KLN 89B will calculate an arc intercept point based on the present track of the aircraft over   the ground.

*NOTE: If the present track does not intercept the arc, then the KLN 89B will display **No Intcpt** in the scratchpad area of the screen.*

8.   When the aircraft approaches the arc the KLN 89B will provide waypoint alerting and turn anticipation to join the arc.

9.   Once established on the arc the KLN 89B provides left/right guidance relative to the curved arc. Distance to the active waypoint is the distance from the present position to the active waypoint, NOT the distance along the arc. Refer to Appendix A for the geometry of the arc.

10. During the arc, the desired track will be constantly changing. To help you keep the orientation correct the NAV 4 page will automatically display DTK on the fourth line. It is not possible to change this to something else while on the arc. The value displayed for the desired track will flash when the difference between the CDI or HSI and the current desired track is greater than 10°.

11. Some DME arcs have defined radials that serve as step down fixes. These points are not stored in the data base. To help you determine your position relative to these step-down points along the arc, the KLN 89B will display a new value in the bottom right corner of the display on the NAV 4 page. This new bit of information is denoted by the letters **ARC** followed by three numbers. The three numbers represent the current radial that you are on relative to the reference VOR/DME. The arc radial is forced into this position when the aircraft is 30 NM from the arc. The **ARC** display is shown in figure 5-24. Just watch this value and when it reads the same as one of the step-down points you can descend as necessary. This particular example does not have such points, but there are quite a few approaches that do.

NOTE: Autopilot performance may not be satisfactory if coupled in the NAV mode while flying the arc. Many autopilots were never designed to fly curved paths. If autopilot performance is not satisfactory while flying DME arcs, select the HDG mode and keep changing the heading bug to keep the D-bar centered.

12. As the aircraft approaches the end of the arc, the KLN 89B will provide waypoint alerting and turn anticipation to the next leg.

13. When the aircraft is 2 NM from FOW VOR, the FAF, the KLN 89B will attempt to transition to the approach active mode. Since the DME arc procedure is flown entirely in the LEG mode the only possible problem would be if the integrity monitoring did not check out.

14. The visual descent point is identified by the along track distance to the MAP to be 1.5 NM. When the aircraft reaches this point (figure 5-26), and the runway environment is in sight, it is possible to descend for a landing.

Figure 5-26

If a missed approach is needed use the following steps:

15. The missed approach calls for a climb to 2000 and then a left turn direct to FOW. The KLN 89B will not automatically sequence past the MAP.

16. Once 2000 feet has been reached press ⬛, the missed approach holding point will be the default direct to waypoint. Press ENT to confirm the direct to waypoint and proceed to the FOW VOR.

NOTE: If ATC gives you instructions for a missed approach that is different from the published missed approach procedure, it is always possible for you to select a different direct to waypoint than the default direct to waypoint.

17. The OBS mode will need to be selected to accomplish the holding pattern. If this is not done before the aircraft is 4 NM from FOW, the KLN 89B will provide a message reminding you to select the OBS mode.

NOTE: If another attempt at the approach is desired after holding, it is necessary to manually change the active waypoint. When the FAF and the missed approach holding point are at the same place then the KLN 89B will automatically change the active waypoint to the FAF when you change from OBS to LEG. Make sure to make this change as soon as possible to ensure you get into the approach active mode.

5.1.9. APPROACH PROBLEMS

Very rarely there will be a problem with the integrity of the GPS system while you are conducting non-precision approaches with the KLN 89B. In some cases the KLN 89B will determine that there will not be sufficient integrity monitoring for the leg between the FAF and the MAP, or RAIM is not currently available. In these cases the KLN 89B will not go into the approach active mode and will present the following message:

> ***RAIM Not Available**
> **APR Mode Inhibited**
> **Predict RAIM on OTH 3**

In these cases you will not be able to finish the approach because there is insufficient integrity monitoring. The OTH 3 (Other 3) page provides a means for you to predict when RAIM will be available.

To perform a RAIM prediction on the OTH 3 page two pieces of information are needed. The first is the location that the prediction will be for and the second is the time for the prediction.

The destination waypoint will, by default, be the missed approach point of an approach loaded in the flight plan. If there is no approach in the flight plan, then the default waypoint is the last waypoint in the active flight plan. Of course it is possible for you to enter any waypoint in this field.

The time used for the RAIM prediction will be the current ETA to the destination airport or the MAP. This time is automatically updated by the KLN 89B so there is usually no need to enter a value. If you are making a RAIM calculation for planning purposes, it is also possible to enter a time in this field. An important point about this time is that the time used for RAIM prediction is always in the future and limited to 24 hours from the present time. For example, if the time is now 19:30 and the time entered for the ETA is 18:30, then the prediction will be made for the next day not one hour ago.

To perform a manual RAIM calculation:

1. Turn the left outer and inner knobs to select the OTH 3 page.

2. Press ⌈CRSR⌉. The cursor will be over the **RAIM @Dest** field.

3. Enter the desired waypoint identifier by using the inner and outer knobs just like you do for any other waypoint entry.

4. Once the desired waypoint identifier is entered (figure 5-27), press ⌈ENT⌉. Press ⌈ENT⌉ again if the waypoint information is correct.

Figure 5-27

5. The cursor will now be over the ETA field. Use the inner knob to enter the desired hour. Note that the current time zone is displayed next to the ETA field. Use the outer knob to move the cursor over the minutes field. Use the inner and outer knobs to select tens of minutes and single minutes as required. When the desired time is selected press ⌈ENT⌉. The RAIM calculations will start.

6. The RAIM calculation will usually take a few seconds before an answer is reached. During this time the OTH 3 page will be as shown in figure 5-28.

Figure 5-28

7. Once the RAIM calculation is complete, the OTH 3 page will indicate the results of the test.

An example is shown in figure 5-29 and 5-30. RAIM is available from 15 minutes before ETA until 5 minutes after ETA. However, RAIM is predicted not to be available from then until 15 minutes after the ETA. By showing the times when RAIM will be available it is possible for you to how to alter your ETA to ensure that there will not be any RAIM problems.

Figure 5-29

Figure 5-30

Even more rare will be the case when the KLN 89B cannot provide sufficient integrity monitoring or if there is an actual satellite failure while the aircraft is on the leg from the FAF to the MAP. In these cases the KLN

89B will FLAG the navigation solution and a missed approach will have to be flown. The KLN 89B will provide the following message:

   ***Press GPS APR For NAV**

This message is telling you to cancel the approach mode by pressing the external switch/annunciator. This will change the unit to the approach-arm mode and navigation information will be restored.

5.2. SID/STAR PROCEDURES

The KLN 89B allows access to navigation SIDs (Standard Instrument Departures) and STARs (Standard Terminal Arrival Routes) by SID/STAR name. SID/STAR procedures stored in the data base can only be considered accurate as long as the data base is current. Even though the data base contains SID and STAR procedures, there is a lot of information that is not included in the data base. Therefore, the paper chart is still the primary source of information. For example, many procedures require the aircraft to fly to a certain altitude, along a heading until intercepting a course, and many other procedures that the KLN 89B can not automatically accomplish. Many procedures require pilot action to ensure that the proper path is flown over the ground. The main purpose of loading a SID or a STAR into the active flight plan is to provide you with a quick way of loading a potentially large number of waypoints.

SID and STAR procedures can be as challenging to fly as some approaches are. Therefore it is mandatory that you are comfortable with the operation of the KLN 89B before attempting to fly SID and STAR procedures. In particular, flight plan operation and the OBS mode should be second nature to you.

NOTE: There are some SID/STAR procedures in the world that are not suited for the operational characteristics of the KLN 89B. These procedures are not included in the data base and therefore the way-points that make up these procedures would have to be entered manually. It is good preflight practice ensure that the KLN 89B contains anticipated procedures for the flight.

SID and STAR procedures are stored with the airport for which they apply. SID and STAR procedures are accessed through the APT 7 page. If there are both SIDs and STARs for a given airport, then there will be two APT 7 pages, one to select a SID and the other to select a STAR. This is indicated by APT+7. It is also possible to have only a SID or only a STAR in which case there is only one APT 7 page.

SID and STAR procedures are defined in three parts. The parts are the SID or STAR name (e.g., PORTE9), a transition (e.g., Fellows), and a runway specific component (e.g., RW 01L). The APT 7 pages lead you through the selection process.

5.2.1. SELECTING A SID

Use the following procedure to select a SID. Some steps may not be necessary depending on the procedure that you wish to fly. For this example, the PORTE NINE departure from San Francisco International (KSFO) will be used.

To select a SID:

1. Select KSFO on one of the airport pages (figure 5-31). If you are operating from an active flight plan you can use the ACT 7 page for KSFO by scanning through the active flight plan (see section 4.2.3).

Figure 5-31

2. If not already displayed, rotate the right inner knob until the APT 7 page appears as in figure 5-32. Make sure that "**SID**" is displayed in the upper right corner of the display. This will allow the selection of SID procedures.
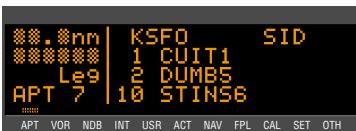
Figure 5-32

3. Turn the cursor on by pressing CRSR, and rotate the right outer knob until the flashing cursor is over **PORTE9** (figure 5-33). With the cursor over **PORTE9**, press ENT.

Figure 5-33

4. The KLN 89B will now ask which runway that you will be using. For this example select **RW01B** (figure 5-34) and press ENT. The "**B**" stands for "Both" so selecting **RW01B** means it is applicable to runways 1L and 1R.

Figure 5-34

5. The last bit of information needed to define this SID is the transition. This example uses the Fellows transition. To select the Fellows transition, move the cursor down to **FLW** (figure 5-35) and press `ENT`.

Figure 5-35

6. The KLN 89B now presents a list of waypoints that make up the SID. Review these waypoints if desired. If the waypoints look correct then press `ENT` with the cursor over **ADD TO FPL 0?** to load the SID into the active flight plan (figure 5-36).
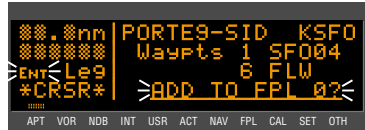
Figure 5-36

7. The KLN 89B will then add the SID procedure after the airport reference point in the active flight

Figure 5-37

plan (figure 5-37). If the airport reference point is not included in the active flight plan, then the KLN 89B will ask to add this waypoint to the active flight plan.

Section 5.2.4 gives the actions required to fly this SID.

5.2.2. SELECTING A STAR

The steps required to select a STAR are very similar to those required to select a SID. The only difference is the order of the steps to define the STAR and where the STAR is loaded into the flight plan. The steps required to define Acton Four arrival with the Wink transition serve as an example of how to select a STAR. This STAR is to the Dallas/Fort Worth International airport (KDFW).

To select a STAR:

1. Select KDFW on one of the airport pages (figure 5-38). If you are operating from an active flight plan you can use the ACT 7 page for KDFW by scanning through the active flight plan (see section 4.2.3).

Figure 5-38

2. Turn to the APT 7 page for KDFW. Make sure that "**STAR**" is displayed in the upper right corner of the screen.
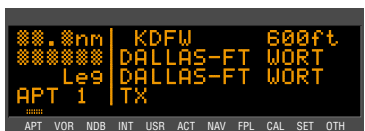
3. Turn the cursor on by pressing the `CRSR`, and, if necessary, rotate the right outer knob until the flashing cursor is over the desired STAR. With the cursor over **AQN4** (figure 5-39), press `ENT`.

Figure 5-39

4. The KLN 89B will now ask which transition you want to use. For this example select **INK** (figure 5-40) and press `ENT`.

Figure 5-40

5. In some cases, the STAR procedure requires you to select a specific runway. To select a specific runway move the cursor over the desired runway and press `ENT`. In this example the STAR does not require a specific runway so the KLN 89B skips this step.

6. The KLN 89B now presents a list of waypoints that make up the STAR (figure 5-41). Review these waypoints if desired and then press `ENT` to load the STAR into the active flight plan.
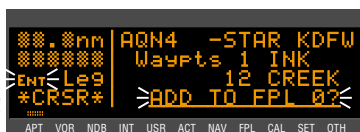
Figure 5-41

7. The KLN 89B will then add the STAR procedure before the air-port reference point in the active flight plan (figure 5-42). If the airport reference point is not included in the active flight plan, then the KLN 89B will ask to add this waypoint to the active flight plan.

Figure 5-42

NOTE: It is not possible to load a SID or STAR into a flight plan other than FPL 0. Furthermore, SID and STAR procedures are deleted from FPL 0 after the power is off for more than 5 minutes.

5.2.3. EDITING A SID OR STAR

From the proceeding two examples you may have noticed that SID and STAR procedures have procedure "headers" just as approaches do. It is possible to use these headers to delete and change the entire procedure just like is done with approach procedures. One difference between SID and STAR procedures and approaches is that it is possible to add waypoints to and delete waypoints from the pub-

lished procedure. To help you differentiate between approaches (no adding or deleting waypoints allowed) and SID or STAR procedures (adding and deleting waypoints allowed) the waypoint number has a period (**.**) next to it instead of a blank space. The period also differentiates a SID or STAR waypoint from a "regular" waypoint that has a colon (**:**) next to the waypoint number.

To add an individual waypoint in the SID or STAR procedure:

1. Use the right knobs to select the FPL 0 page.

2. Turn the cursor on by pressing the ⌐CRSR⌐.   Rotate the right outer knob as necessary to position the cursor over the waypoint identifier which you desire to follow the waypoint being added.

3. Use the right inner and outer knobs in the normal manner to define the desired waypoint.

4. Press ⌐ENT⌐ to display the waypoint page for this identifier. If the waypoint is correct, then press ⌐ENT⌐ a second time to confirm the waypoint page. The new waypoint is added to the waypoints that make up the SID or STAR procedure.

To delete an individual waypoint in a SID or STAR procedure:

1. Use the right knobs to select the FPL 0 page.

2. Rotate the right outer knob to place the cursor over the waypoint to be deleted.

3. Press ⌐>CLR⌐. The letters **DEL** (delete) will appear to the left of the identifier and a question mark will appear to the right of the identifier.

4. If this is the desired waypoint to delete, then press ⌐ENT⌐. If it is not the desired waypoint, press ⌐>CLR⌐.

NOTE: Adding waypoints to or deleting waypoints from SID or STAR procedures does not change the way that they are stored in the published data base.

To change or delete an entire SID or STAR procedure from the active flight plan:

1. Use the right knobs to select the FPL 0 page.

2. Turn the cursor on by pressing the ⌐CRSR⌐. Move the cursor over the SID or STAR procedure header by using the left outer knob.

3. With the cursor over the procedure header, press ENT to change the SID or STAR or press >CLR and then ENT to delete the entire procedure.

NOTE: Any waypoints manually added to a SID or STAR will be deleted if the SID or STAR is changed or deleted using the above procedure.

5.2.4. EXAMPLE OF A SID PROCEDURE

To illustrate the use of the KLN 89B with a SID, the Porte Nine departure loaded into the flight plan in section 5.2.1 will be used. Remember that "RW01B" was selected meaning that the procedure is applicable to both runways 1L and 1R. The Fellows (FLW) transition was also selected. This procedure is one of the more difficult that you are likely to come across. Most procedures are not this difficult, but this SID serves as a good example for what steps to take when you encounter a difficult procedure.

To fly this procedure use the following steps and refer to the chart for this SID (figure 5-43):

1. Load the SID as described in section 5.2.1.

2. The procedure states "Intercept and proceed via SFO R-350, cross the 4 DME fix at or above 1600'...". To accomplish this portion of the SID, put the KLN 89B into the OBS mode with SFO04 as the active waypoint and make 350° the selected course. It is easiest to accomplish these steps before take-off. SFO04 is the waypoint that is 4 DME from the SFO VORTAC and 350° is the inbound course to this fix. After take-off climb to 1600' as required by the SID.

3. Once the aircraft reaches SFO04, turn left to a heading of 200°. At this point it is necessary to manually change the active waypoint to "PORTE". This is done easily from either the NAV 4 page or from the FPL 0 page. In either case, once PORTE is highlighted by the cursor, press � to bring up the direct to page.

4. Press ENT to confirm PORTE as the direct to waypoint.

5. Change the selected course on the HSI or CDI to the new value of 135°. As required by the SID, continue flying a heading of 200° until the HSI or CDI needle centers and then fly to keep the needle centered and fly to PORTE.

JEPPESEN   29 JAN 93 (10-3C2) Eff 4 Feb   SAN FRANCISCO, CALIF
BAY Departure (R) 135.1   SAN FRANCISCO INTL

PORTE NINE DEPARTURE (PORTE9.WAGES) (PILOT NAV)
MT SAN BRUNO WEATHER INFORMATION AVAILABLE ON 118.05
(RADAR REQUIRED FOR RWYS 1 L/R DEPARTURES) (DME REQUIRED)

This SID requires the following minimum climb gradients for obstacle clearance:
Rwy 19L: 480' per NM to 1400'.
Rwy 19R: CAT A & B, 480' per NM to 1400';
CAT C & D, 530' per NM to 1800'.
Rwy 28L/R: 300' per NM to 2000'.

Gnd speed-Kts	75	100	150	200	250	300
300' per NM	375	500	750	1000	1250	1500
480' per NM	600	800	1200	1600	2000	2400
530' per NM	663	883	1325	1767	2208	2650

TAKE-OFF
Rwys 1 L/R: Intercept and proceed via SFO R-350, cross the 4 DME fix at or above 1600', then turn LEFT to a 200° heading to intercept and proceed via PYE R-135 to cross Porte Int at or above 9000' and Pesca Int at or above 13000'. Then turn LEFT to a 090° heading to intercept and proceed via OSI R-116 to cross Wages Int at or above FL 200 or at assigned LOWER altitude/flight level. Thence via (transition) or (assigned route). Expect further clearance to filed altitude 10 minutes after departure.
Rwys 10L/R and 19L/R: Turn LEFT and climb via the SFO R-090 to intercept the OAK R-135

at or above 5000'. (Rwys 19L/R departures turn LEFT as soon as practicable due to steeply rising terrain to 2000' immediately south of airport). Proceed via OAK R-135 to cross the OAK 25 DME fix at or above 9000'. Cross Wages Int at or above FL 200 or at assigned LOWER altitude/flight level. Thence via (transition) or (assigned route). Expect further clearance to filed altitude 10 minutes after departure.
Rwys 28L/R: Intercept and proceed via SFO R-281, cross the 6 DME fix at or above 2500' then turn LEFT to a 180° heading to intercept and proceed via PYE R-135 to cross Porte Int at or above 9000' and Pesca Int at or above 13000'. Then turn LEFT to a 090° heading to intercept and proceed via OSI R-116 to cross Wages Int at or above FL 200 or at assigned LOWER altitude/flight level. Thence via (transition) or (assigned route). Expect further clearance to filed altitude 10 minutes after departure. When SFO VOR is inoperative, Rwy 28 departures Expect radar vectors to PYE R-135 then resume SID.
TRANSITIONS
Avenal (PORTE9.AVE): From Wages Int to AVE VOR: Via OSI R-116 and AVE R-298. Cross OSI R-116/60 DME fix at or above FL 240 or at assigned LOWER altitude/flight level.
Clovis (PORTE9.CZQ): From Wages Int to CZQ VOR: Via CZQ R-259.
Fellows (PORTE9.FLW): From Wages Int to FLW VOR: Via FLW R-306. Cross FLW R-306/126 DME fix at or above FL 240 or at assigned LOWER altitude/flight level.
Panoche (PORTE9.PXN): From Wages Int to PXN VOR: Via PXN R-273.

POINT REYES
(H) 113.7 PYE
N38 04.8 W122 52.1

OAKLAND
(H) 116.8 OAK
N37 43.6 W122 13.4

D6 SFO
N37 40.0 W122 29.0
At or above 2500'

D4 SFO
N37 41.1 W122 21.8
At or above 1600'

200° hdg   281°   350°   135°   090°

SAN FRANCISCO
(L) 115.8 SFO
N37 37.2 W122 22.4

PORTE
N37 29.4 W122 28.5
At or above 9000'

San Francisco Intl 11
D40
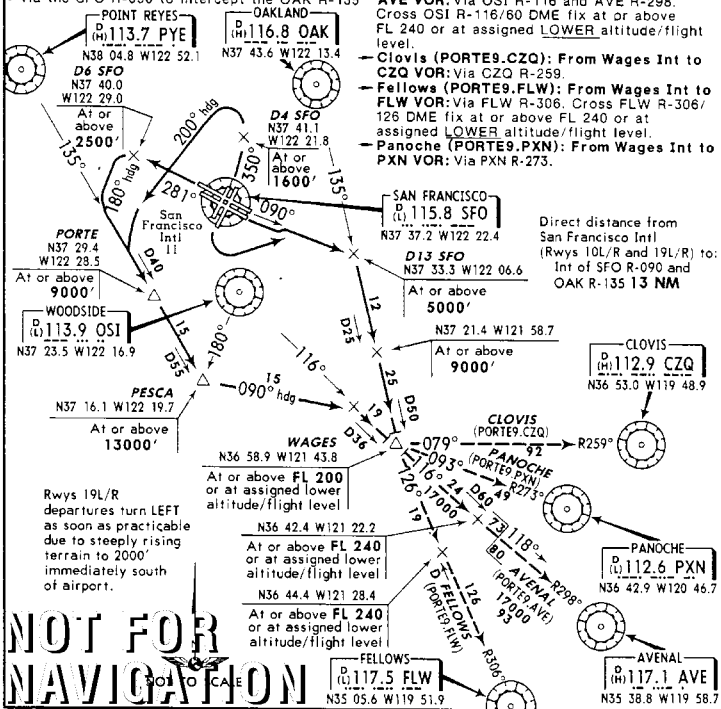
Direct distance from San Francisco Intl (Rwys 10L/R and 19L/R) to: Int of SFO R-090 and OAK R-135 **13 NM**

WOODSIDE
(L) 113.9 OSI
N37 23.5 W122 16.9

D13 SFO
N37 33.3 W122 06.6
At or above 5000'

180°   116°   D55   D25   D50   D36   15   19   25

N37 21.4 W121 58.7
At or above 9000'

PESCA
N37 16.1 W122 19.7
At or above 13000'

WAGES
N36 58.9 W121 43.8
At or above FL 200 or at assigned lower altitude/flight level

CLOVIS
(PORTE9.CZQ)
R259°
92

CLOVIS
(H) 112.9 CZQ
N36 53.0 W119 48.9

-079°   -093°   PANOCHE (PORTE9.PXN)   R273°

Rwys 19L/R departures turn LEFT as soon as practicable due to steeply rising terrain to 2000' immediately south of airport.

N36 42.4 W121 22.2
At or above FL 240 or at assigned lower altitude/flight level

N36 44.4 W121 28.4
At or above FL 240 or at assigned lower altitude/flight level

PANOCHE
(L) 112.6 PXN
N36 42.9 W120 46.7

AVENAL (PORTE9.AVE)   R298°   R306

FELLOWS (PORTE9.FLW)   126   17000

FELLOWS
(L) 117.5 FLW
N35 05.6 W119 51.9

AVENAL
(H) 117.1 AVE
N35 38.8 W119 58.7

NOT FOR NAVIGATION

CHANGES: Departure number, rwys 10L/R & 19L/R take-off.   © JEPPESEN SANDERSON, INC., 1988, 1993. ALL RIGHTS RESERVED.

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Figure 5-43

Approaches and SID/STARs Chapter 5

6. Before reaching PORTE, change back to the Leg mode to enable automatic waypoint sequencing. Once the aircraft reaches PORTE the KLN 89B will automatically sequence to the next waypoint, PESCA.

7. After passing PESCA, the procedure calls for a 090° heading until intercepting the 116° course to WAGES intersection. To do this with the KLN 89B, change back to the OBS mode and make sure that WAGES is the active waypoint. Set the selected course to 116°.

8. Before reaching WAGES change to the Leg mode. This will allow automatic waypoint sequencing upon reaching WAGES.

9. There is an altitude restriction marked with an "x" on the chart. The name of this point is 26FLW. 26FLW means that the waypoint is 126 NM from the FLW VOR/DME. Make sure to meet any altitude requirements upon reaching this waypoint.

10. Once the aircraft reaches FLW, proceed on with the rest of the flight plan as required.

5.2.5. EXAMPLE OF A STAR PROCEDURE

To illustrate the use of the KLN 89B with STAR procedures the steps required to fly Acton Four arrival to Dallas/Fort Worth International will be shown in this section. This procedure is considerably simpler than the SID example shown in section 5.2.4.

For this example assume that the aircraft departs from El Paso, Texas and files for the Acton Four arrival with the Wink transition. Use the following steps to fly this procedure with the KLN 89B and refer to the chart for this STAR (figure 5-44):

1. Load the STAR into the flight plan as described in section 5.2.2.

2. This STAR is very simple and the KLN 89B will automatically guide the aircraft along the proper route until the AQN VOR.

3. Long before reaching AQN examine this procedure and notice that there are two different routes depending on what type of aircraft is flying the STAR. Turbojets fly to CREEK intersection while non-turbojets fly to RENDY intersection. The data base in the KLN 89B has the sequence of waypoints for the turbojet procedure NOT the sequence for non-turbojets.

NOTE: It is extremely rare to have a different path over the ground for turbojets and non-turbojets, but be sure to cross check with your paper charts.
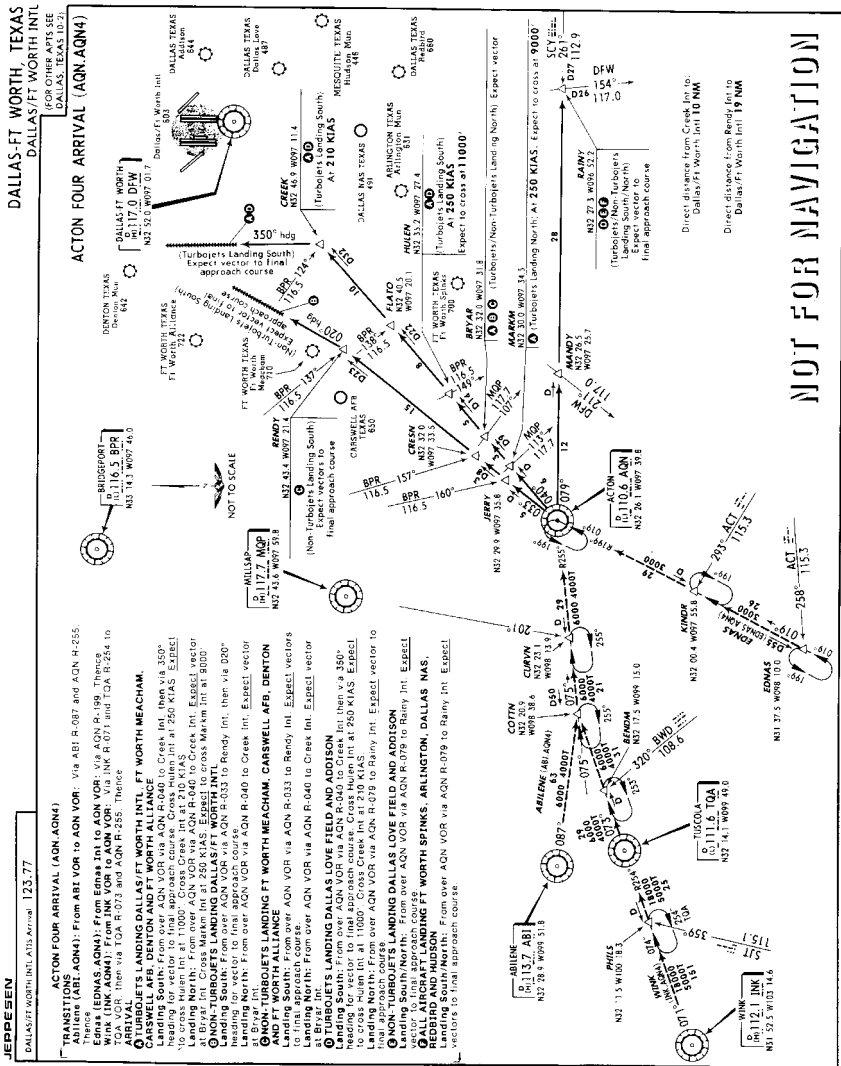
Figure 5-44

If the aircraft you are flying in is a turbojet, then fly the rest of the STAR as depicted on the chart with no changes to the flight plan. If the aircraft is not a turbojet then follow these steps:

4. Turn to the FPL 0 page and delete the following waypoints: MARKUM, BRYAR, HULEN, FLATO, and CREEK. To do this turn on the cursor and rotate the right outer knob until the cursor is over one of the above waypoints.

5. Press `>CLR` and then `ENT` to delete a waypoint.

6. Repeat steps 4 and 5 until all of the unnecessary waypoints are deleted.

7. Now add JERRY, CRESN, and RENDY to FPL 0 by using the right inner and outer knobs and `ENT` as necessary.

8. The rest of the STAR can now be flown.

APPENDIX A - NAVIGATION TERMS

ARC - Radial from reference VOR when executing an approach procedure with a DME arc.
BRG - Bearing to waypoint (degrees)
DA - Drift Angle (degrees)-not displayed on KLN 89(B)
DIS - Distance to waypoint (nm)
DTK - Desired Track (degrees)
ETE - Estimated Time Enroute (hrs:min)
ETA - Estimated Time of Arrival
GS - Groundspeed (nm/hr)
HDG - Heading (degrees)
OBS - Selected Course
POS - Present position
TK - Actual Track (degrees)
WPT - Waypoint
XTK - Cross Track Error Correction (nm) displayed as "FLY L 2.3 nm"

A-1
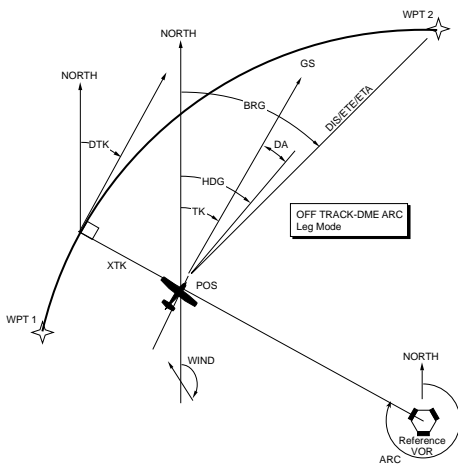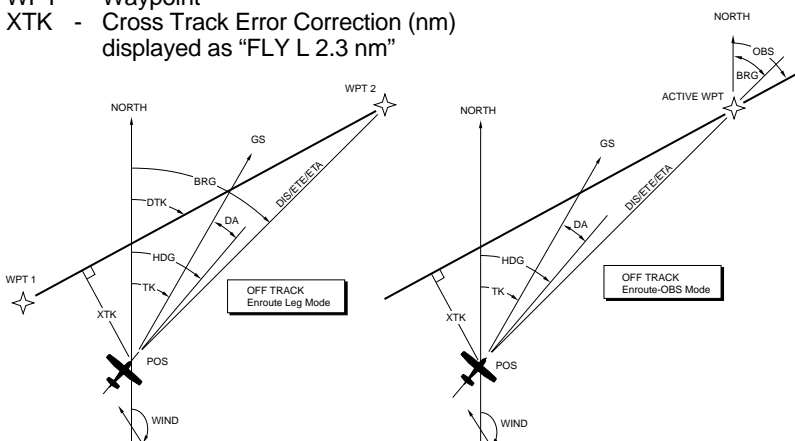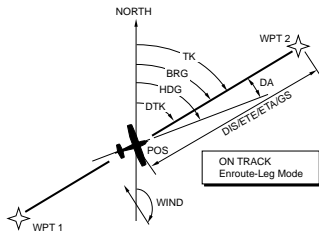
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APPENDIX B - MESSAGE PAGE MESSAGES

NOTE: Those messages marked with a double dagger symbol (‡) refer to the KLN 89B only.

XXXXX Deleted
From FPL 0 — The displayed waypoint has been deleted from the active flight plan (FPL 0) when an approach, SID or STAR was added to FPL 0. The pre-existing waypoint was deleted because adding the APR/SID/STAR to the flight plan caused the same waypoint to be listed consecutively in FPL 0. If the APR/SID/STAR is later deleted from FPL 0 the original waypoint can only be restored by manual re-entry.

Adj Nav Crs to XXX° — (Adjust navigation indicator course to XXX°) When this message appears, you should select the suggested course on the HSI or CDI. When the KLN 89(B) is in the Leg mode, this message occurs during turn anticipation (prior to reaching the active waypoint) if the upcoming course change is greater than 5° and anytime the indicator's selected course needs to be adjusted to match the KLN 89(B) desired track. This message will only be displayed if the KLN 89(B) is installed such that it can "read" the selected HSI or CDI course. See section 4.2.2.

Airspace Alert
[name and type of special use airspace]
[altitude boundaries]
[responsible ATC facility] -- This message appears when the estimated time to enter a special use airspace (SUA) is approximately 10 minutes or when the distance from an area of special use airspace is less than two nautical miles. See section 3.17.

All Wpt Remarks Used,
Delete on OTH 4 Page — This message will be displayed if you attempt to enter a waypoint remark and the user data base already contains 100 waypoint remarks.

Altitude Fail — This message will be displayed if the altitude input becomes invalid during operation.

‡APR ACTV Annunciator
Fail -- This message appears when there is a failure of the KLN 89B ACTV annunciator drive circuitry. Service unit as soon as possible.

‡APR ARM Annunciator
Fail -- This message appears when there is a failure of the KLN 89B ARM annunciator drive circuitry. Service unit as soon as possible.

‡Arm GPS Approach -- If the approach ARM mode has been disarmed, the KLN 89B will remind you to arm the approach mode when the aircraft is 3 nautical miles from the Final Approach Fix (FAF). Arm the approach mode if it is desired to use the KLN 89B for conducting an approach.

‡Bad Satellite Geometry
And RAIM Not Available -- This message appears only when the KLN 89B is in the approach active mode, RAIM is not available and the satellite geometry has further degraded to cause more uncertainty of the aircraft position. This message may be followed by a NAV flag (in a couple of minutes) if conditions continue to degrade.

‡Bad Satellite Geometry
See EPE on OTH 1 page -- This message appears following a message that RAIM is not available. This means that the geometry of the satellites is such that the possible error in position is greater than allowed for IFR use. Cross check the position of the aircraft with other means of navigation every 15 minutes to verify that the position is still accurate.

‡Check APR ACTV
Annunciator -- This message appears when an overcurrent condition is detected on the ACTV annunciator output. It is usually indicative of a failure of the wiring between the KLN 89B and the ACTV annunciator. Have the installation checked to determine the problem.

‡Check APR ARM
Annunciator -- This message appears when an overcurrent condition is detected on the ARM annunciator output. It is usually indicative of a failure of the wiring between the KLN 89B and the ARM annunciator. Have the installation checked to determine the problem.

Check MSG Annunciator -- This message appears when an overcurrent condition is detected on the MSG annunciator output. It is usually indicative of a failure of the wiring between the KLN 89(B) and the MSG annunciator. Have the installation checked to determine the problem.

Check Real Time Clock -- This message appears when a possible fault is detected with the KLN 89(B)'s internal real time clock. This condition does not require immediate service. Manually initialize the time on the Initialization Page to minimize the time to first fix (see section 3.6).

Check WPT Annunciator -- This message appears when an overcurrent condition is detected on the WPT annunciator output. It is usually indicative of a failure of the wiring between the KLN 89(B) and the WPT annunciator. Have the installation checked to determine the problem.

Data Base Error: Publ
Data Not Useable,
Service Required — This message appears if the data base fails an internal test when the KLN 89(B) is turned on.

Data Base Outdated,
All Data Must be
Confirmed Before Use — This message appears when the data base is

out of date as a result of a date and time entered on the SET 2 page or Self-Test page or as a result of a pilot-entered date being overridden by a date from the GPS receiver.

GEN RS-232 Data In
Error -- This message appears when an error is detected in the received RS-232 data such as from a fuel management or air data system.

GPS Course is XXX° -- This message is displayed to notify the user that the GPS desired track (DTK) has changed. This message will only be displayed when the KLN 89(B) is not "reading" selected course from an external HSI or CDI. When the KLN 89(B) is in Leg mode, this message occurs if the course change is greater than 5°. See section 4.2.2.

‡If Required Select OBS -- This message appears when the aircraft is 4 nautical miles from a waypoint which could be used as the basis for either a procedure turn or a holding pattern and the KLN 89B is in the LEG mode. Select the OBS mode when flying procedure turns or holding patterns. This message is advisory only. If no procedure turn is required then no action is required.

Inside SUA
[name and type of special use airspace]
[altitude boundaries]
[responsible ATC facility] -- (Inside Special Use Airspace) This message appears when the aircraft is inside special use airspace (SUA). See section 3.17.

Internal Battery Low:
Service Required to
Prevent Data Loss-- This message appears when the KLN 89(B)'s internal battery is low and needs replacing at an authorized Honeywell service center. The battery should be replaced within a week to prevent the loss of all user-defined data including waypoint, airport remarks, flight plans, etc. Typical battery life is approximately three to five years.

Low Bus Voltage
Check Charging System -- This message appears when the voltage on the aircraft power bus drops below the alert voltage for longer than the alert delay time. Both the alert voltage and alert delay time are displayed on the SET 10 page and set at the time of KLN 89(B) installation. In addition, the SET 10 page displays the present power bus voltage. This message may be indicative of a problem with the aircraft's charging system. Consult your aircraft's Pilot Operating Handbook to troubleshoot the problem. You may desire to turn off some of the aircraft's electrical devices which are non-essential for your particular phase(s) of flight, so that the battery will not discharge as quickly.

Magnetic Var for Published
Approach Being Used —This message appears when a user-defined magnetic variation has been selected on the SET 2 page and an approach waypoint is active. The KLN 89B will use the magnetic variatiion association with the approach waypoint.

Magnetic Var Invalid
Nav Data Referenced
To True North — This message appears when the magnetic variation is invalid due to operation outside of the data base magnetic variation area without having a pilot-entered magnetic variation. See section 4.10.

Mag Var for Published
VOR Being Used – This message appears when a user-defined magnetic variation has been selected on the SET 2 page; the unit is in OBS mode: and the active waypoint is a VOR. In this case, the magnetic variation asociated with the VOR station will be used.

MSG Annunciator Fail -- This message appears when there is a failure of the KLN 89(B) MSG annunciator drive circuitry. To determine if there are any messages to be viewed you will need to look at the KLN 89(B) display because the annunciator will not be working if this message has been given. Service the KLN 89(B) as soon as possible.

Nav Data Referenced
To True North – This message appears when a user-defined magnetic variation of 0 degrees is being used for navigation data.

Nav Data Referenced To
User-Defined Mag Var – This message appears when a user-defined magnetic variation other than 0 degrees is being used for navigation data.

NAV Super Flag Failure -- This message appears when an internal test fails for a specific NAV flag output. The KLN 89(B) is still usable, but anything connected to the super flag (such as some HSIs and autopilots) should not be used with the KLN 89(B).

No GEN RS-232 In Data -- This message appears when no input is received on the RS-232 input (such as from a fuel management or air data system).

No GPS Receiver Data — This message appears when the KLN 89(B) fails a specific internal test for the GPS receiver. This failure will prevent the unit from providing any navigation capability.

OBS Waypoint > 200nm — **(**or **OBS Waypoint >370 km)** This message is displayed when the KLN 89(B) is in the OBS mode and the distance to the active waypoint is more than 200 nautical miles or 370 kilometers.

Other WPTs Deleted — (Other waypoints deleted) This message is displayed whenever more than 10 waypoints used in a flight plan (including the active waypoint) have been deleted.

Position of _____ has Changed -- This message appears when either the latitude or the longitude of a waypoint used in a flight plan or the active waypoint has changed by more than .33 minutes as a result of updating the data base.

Positions of Other WPTs Have Changed -- This message appears when the above message " Position of _____ has Changed" would be effective for more than ten waypoints.

‡Press ALT To Set Baro -- This message appears when the approach mode is armed. Press the [ALT] button to update the barometric pressure for proper integrity monitoring.

‡Press GPS APR for NAV -- This message appears after the NAV flag has been set due to a RAIM problem while the KLN 89B is in the approach mode. By pressing the GPS APR button, the KLN 89B may be able to restore navigation information so that you can conduct a missed approach based on navigation information provided by the KLN 89B.

‡RAIM Not Available
APR Mode Inhibited
Predict RAIM on OTH 3 -- This message appears when integrity monitoring (RAIM) is predicted to not be available at either the FAF or the MAP. The KLN 89B will not go into the approach active mode until conditions improve. Turn to the OTH 3 (Other 3) page to perform a RAIM prediction. The OTH 3 page will give an indication of how long it will be until RAIM is available so that the approach can be flown using the KLN 89B (see section 5.1.9 on performing a RAIM prediction).

‡RAIM Not Available
Cross Check Position -- This message appears when there are not enough received GPS satellite signals to compute integrity (RAIM). Cross check the position of the aircraft with other means of navigation every 15 minutes to verify that the position is still accurate.

‡RAIM Position Error
Cross Check Position -- This message appears when the KLN 89B has detected a problem with one of the satellites and the position can not be assured to be within IFR limits for the particular mode of flight. Cross check the position of the aircraft with other means of navigation every 15 minutes to verify that the position is still accurate.

RCVR HW Error:_____ -- (Receiver Hardware Error) This message appears when the KLN 89(B) fails a specific internal test for the GPS receiver. The blanks will contain a value which may provide assistance to maintenance personnel.

Recycle Power to Use
Valid Data Base Data -- This message appears when the date entered on the Initialization page is before the data base effective date and the date entered later on the SET 2 page is after the data base effective date, or vice versa. Turn the KLN 89(B) off and back on so that the correct data base data is utilized.

‡Redundant WPTs In FPL
Edit Enroute WPTs
As Necessary -- This message appears after the pilot inserts an approach in the flight plan and the KLN 89B determines that some way-points that were in the flight plan are no longer needed. Examine the active flight plan and remove those waypoints that occur both in the enroute and the approach sections of the flight plan.

Timer Expired -- This message appears when the alarm time on the CAL 3 page is reached.

User Data Base Lost -- This message appears when the KLN 89(B) determines that the internal memory backup battery is dead or that some other internal failure has occurred which has caused user-entered way-points, flight plans, and waypoint remarks to be lost.

User Data Lost -- This message appears when the KLN 89(B) deter-mines that the internal memory backup battery is dead or that some other internal failure has occurred which has caused user data such as page setups to be lost.

Using Emergency
Battery -- This message appears when the back-up battery pack (if installed) is supplying unit power.

Vnv Alert -- (Vertical Navigation Alert) This message appears when a VNAV operation has been programmed on the ALT 2 page and the esti-mated time to start the climb or descent is approximately 90 seconds. This message serves as notification to select the ALT 2 page so that the VNAV operation may be executed. This message does not appear if the ALT 2 page is already being displayed. VNAV status can also be dis-played on the NAV 1 page.

WPT Annunciator Fail -- This message appears when there is a failure of the KLN 89(B) WPT annunciator drive circuitry. To determine if way-point alerting is being given you will need to look at the KLN 89(B) display because the annunciator will not be working if this message has been given. Service the KLN 89(B) as soon as possible.

WPT _____ Deleted -- This message appears when a waypoint used in a flight plan, or the active waypoint, no longer exists as a result of updating the data base. The blank space is filled in with the waypoint identifier. The waypoint is deleted from flight plans in which it was used.

APPENDIX C - SCRATCHPAD MESSAGES

NOTE: Those messages marked with a double dagger symbol (‡) refer to the KLN 89B only.

Active
Wpt — (Active Waypoint) Appears when you attempt to delete a user-defined waypoint on the OTH 4 page if the waypoint is the active waypoint (the waypoint you are navigating to). Another waypoint must be made the active waypoint before this waypoint can be deleted from the user-defined waypoint list.

‡D Base
Expire – (Data Base Expired) Appears whenever the pilot attempts to select an approach from the data base on the APT 8 or ACT 8 page and the data base has expired.

‡D>CRS
XXX° – (Direct To Course XXX°) Appears when the KLN 89B is in the OBS mode and is interfaced with an external indicator for which the KLN 89B cannot change the selected course and the pilot performs a Direct To operation. Since the KLN 89B cannot change the selected course to the direct to course, the KLN 89B gives you this message telling you the OBS value that will take the aircraft direct to the active waypoint.

Dup
Ident — (Duplicate Identifier) Appears when you select a waypoint identifier on one of the waypoint type pages if there is more than one waypoint of that waypoint type having the same identifier.

‡Fpl Is
Full – (Flight Plan is Full) Appears when an attempt is made to add a new waypoint to the active flight plan (FPL 0) when it already contains 20 waypoints and the first waypoint is part of the active leg. Change the active waypoint or delete another waypoint before adding any more waypoints.

‡Invald
Add – (Invalid Add) Appears when an attempt is made to add a new waypoint into the approach. Approach procedures must be flown as they are stored in the data base.

‡Invald
Del – (Invalid Delete) Appears when an attempt is made to delete an approach waypoint. Individual approach waypoints cannot be deleted, you must delete or replace the entire approach.

Invald
Ent — (Invalid Entry) Appears when you attempt to enter data which is not a valid entry. For example, trying to enter a date of 30 FEB 95.

No Act

Wpt — (No Active Waypoint) Appears when you attempt to activate the OBS mode if there is no active waypoint. To have an active waypoint, a flight plan must be activated or a Direct To must be initiated.

‡No Apr

In Fpl – (No Approach in Flight Plan) Appears when an attempt is made to arm the GPS approach mode when there is no approach loaded into the active flight plan. Load an approach into the flight plan before trying to arm the approach mode.

‡No

Intcpt – (No Intercept) Appears when an attempt is made to recalculate the intercept point on a DME arc and the actual track does not intercept with the arc. Change the track (heading) of the aircraft so that the actual track does intercept the DME arc and try again.

No

Nrst – (No Nearest) Appears when the pilot selects a nearest list (APT, VOR, NDB, INT, USR, SUA, FSS or CTR), and there are no nearest items of that type within a 200 nm radius of the aircraft's present position.

NoSuch

Wpt — (No Such Waypoint) Appears when there is no waypoint in the data base corresponding to the entered identifier on the Supplemental Waypoint page.

Remrks

Full — (Remarks Full) Appears when you attempt to create a user-entered Airport or Supplemental Waypoint remark on the APT 6 or SUP 3 page if 100 user-entered remarks already exist. In order to create additional airport remarks, some existing remarks must be deleted on the OTH 4 page.

Used

In Fpl — (Used in Flight Plan) Appears when you attempt to delete a user-defined waypoint on the OTH 4 page if the waypoint is used in a flight plan. Either this waypoint must be deleted from the flight plan or the entire flight plan must be deleted before this waypoint can be deleted from the user-defined waypoint list.

USR DB

Full — (User Data Base Full) Appears when you attempt to create a user-defined waypoint if the user data base already contains 500 waypoints. In order to create additional user-defined waypoints, it will first be necessary to delete existing user-defined waypoints on the OTH 4 page.

APPENDIX D - ABBREVIATIONS

STATE ABBREVIATIONS

ABBREVIATION	*STATE*
AK	Alaska
AL	Alabama
AR	Arkansas
AZ	Arizona
CA	California
CO	Colorado
CT	Connecticut
DC	District of Columbia
DE	Delaware
FL	Florida
GA	Georgia
IA	Iowa
ID	Idaho
IL	Illinois
IN	Indiana
KS	Kansas
KY	Kentucky
LA	Louisiana
MA	Massachusetts
MD	Maryland
ME	Maine
MI	Michigan
MN	Minnesota
MO	Missouri
MS	Mississippi
MT	Montana
NC	North Carolina
ND	North Dakota
NE	Nebraska
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NV	Nevada
NY	New York
OH	Ohio
OK	Oklahoma

Abbreviations
Appendix D

STATE ABBREVIATIONS (Cont'd)
OR	Oregon
PA	Pennsylvania
RI	Rhode Island
SC	South Carolina
SD	South Dakota
TN	Tennessee
TX	Texas
UT	Utah
VA	Virginia
VT	Vermont
WA	Washington
WI	Wisconsin
WV	West Virginia
WY	Wyoming

CANADIAN PROVINCE ABBREVIATIONS

ABBREVIATION	*PROVINCE*
AB	Alberta
BC	British Columbia
MB	Manitoba
NB	New Brunswick
NF	Newfoundland
NS	Nova Scotia
NT & NU	Northwest Territory
ON	Ontario
PE	Prince Edward Island
PQ	Quebec
SK	Saskatchewan
YK	Yukon

COUNTRY ABBREVIATIONS

ABBREVIATION	*COUNTRY*
AFG	Afghanistan
AGO	Angola
AIA	Anguilla Isl.
ALB	Albania
ANT	Antarctica/Netherlands Antilles/Aruba

COUNTRY ABBREVIATIONS (Cont'd)

ARE	United Arab Emirates
ARG	Argentina
ASM	American/Western Samoa
ATG	Antigua/Barbuda
AUS	Australia
AUT	Austria
BDI	Burundi
BEL	Belgium
BEN	Benin
BFA	Burkina Faso
BGD	Bangladesh
BGR	Bulgaria
BHR	Bahrain
BHS	Bahamas
BHU	Bhutan
BLZ	Belize
BMU	Bermuda
BOL	Bolivia
BOS	Bosnia/Herzegovia
BRA	Brazil
BRB	Barbados
BRN	Brunei
BWA	Botswana
CAF	Central African Republic
CAN	Canada
CHE	Switzerland
CHL	Chile/Easter Isl.
CHN	China
CIV	Ivory Coast
CMR	Cameroon
CNR	Canary Islands
COG	Congo
COK	Cook Islands
COL	Colombia/San Andres
CRI	Costa Rica
CRO	Croatia
CSK	Czechoslovakia
CUB	Cuba
CYM	Cayman Islands
CYP	Cypress

Abbreviations
Appendix D

COUNTRY ABBREVIATIONS (Cont'd)

DEU	Germany
DJI	Djibouti
DMA	Dominica
DNK	Denmark
DOM	Dominican Republic
DZA	Algeria
ECU	Ecuador
EGY	Egypt
ERI	Eritrea
ESP	Spain
ETH	Ethiopia
FIN	Finland
FJI	Fiji/Tonga
FLK	Falkland Islands
FRA	France
GAB	Gabon
GBR	United Kingdom
GHA	Ghana
GIB	Gibraltar
GIN	Guinea
GLP	Guadeloupe/Martinique
GMB	Gambia
GNB	Guinea-Bissau
GNQ	Equatorial Guinea
GPV	Cape Verde
GRC	Greece
GRD	Grenada
GRL	Greenland
GTM	Guatemala
GUF	French Guiana
GUY	Guyana
HKG	Hong Kong
HND	Honduras
HTI	Haiti
HUN	Hungary
IDN	Indonesia
IND	India
IOT	British Indian Ocean Territory
IRL	Ireland
IRN	Iran

COUNTRY ABBREVIATIONS (Cont'd)

IRQ	Iraq
ISL	Iceland
ISR	Israel
ITA	Italy
JAM	Jamaica
JOR	Jordan
JPN	Japan/Okinawa
JTN	Johnston Island
KEN	Kenya
KHM	Cambodia/Kampuchea
KIR	Kiribati/Tuvalu/Phoenix I./Line I.
KNA	St. Kitts/Nevis
KOR	Korea
KWT	Kuwait
LAO	Laos
LAT	Latvia
LBN	Lebanon
LBR	Liberia
LBY	Libya/SPA Jamahiriya
LCA	St. Lucia
LKA	Sri Lanka
LSO	Lesotho
LUX	Luxembourg
MAC	Macau
MAR	Morocco
MCD	Macedonia
MDG	Madagascar/Comoros/Mayotte I./Reunion
MDV	Maldives
MEL	Melilla
MEX	Mexico
MHL	Marshall Island
MID	Midway Island
MLI	Mali
MLT	Malta
MNP	Mariana Islands
MOL	Moldova
MOZ	Mozambique
MRT	Mauritania
MSR	Monserrat Isl.
MUS	Mauritius
MWI	Malawi

COUNTRY ABBREVIATIONS (Cont'd)

MYR	Myanmar
MYS	Malaysia
NAM	Namibia
NCL	New Caledonia
NER	Niger
NGA	Nigeria
NIC	Nicaragua
NIU	Niue Island
NLD	Netherlands
NOR	Norway
NPL	Nepal
NRU	Naura
NZL	New Zealand
OMN	Oman
PAC	Oakland OTCA (PACIFIC)
PAK	Pakistan
PAN	Panama
PCI	Caroline Island/Micronesia
PER	Peru
PHL	Philippines
PNG	Papua New Guinea
POL	Poland
PRI	Puerto Rico
PRK	Korea (Dem. Peoples Republic)
PRT	Portugal/Azores/Madeira Isl.
PRY	Paraguay
PYF	French Polynesia/Society Isl./Tuamotu
QAT	Qatar
ROM	Romania
RWA	Rwanda
SAU	Saudi Arabia
SDN	Sudan
SEN	Senegal
SGP	Singapore
SHN	Ascension Island/St. Helena
SLB	Solomon Islands
SLE	Sierra Leone
SLO	Slovenia
SLV	El Salvador
SOM	Somalia

COUNTRY ABBREVIATIONS (Cont'd)

SPM	St. Pierre/Miquelon
STP	Sao Tome/Principe
SUR	Suriname
SVK	Slovakia
SWE	Sweden
SWZ	Swaziland
SYC	Seychelles
SYR	Syria
TCA	Turks and Caicos Islands
TCD	Chad
TGO	Togo
THA	Thailand
TTO	Trinidad/Tabago
TUN	Tunisia
TUR	Turkey
TWN	Taiwan
TZA	Tanzania
UGA	Uganda
URY	Uruguay
USA	United States of America
VCT	St. Vincent
VEN	Venezuela
VGB	Virgin Islands (U.K.)
VIR	Virgin Islands (U.S.)
VNM	Vietnam
VUT	Vanautu
WAK	Wake Island
WLF	Wallis/Futuna Islands
XJ1	Kazakhstan/Kyrgyzstan
XJ2	Armenia/Georgia
XJ3	Ukraine/Moldova
XJ4	Estonia/Russia
XJ5	Belarus/Latvia/Lithuania/Russia
XJ6	Kazakhstan/Russia
XJ7	Kazakhstan/Tajikistan/Turkmenistan/ Uzbekistan
XJJ	Azerbaijan
XJR	Russia
YEM	Yemen (Arab Republic)
YUG	Yugoslavia

ZAF	South Africa
ZAM	Zambia
ZAR	Zaire
ZWE	Zimbabwe

ARTCC ABBREVIATIONS

ABBREVIATION	*ARTCC*
ABQ	ALBUQUERQUE
ACC	ACCRA
ADD	ADDIS ABABA
ADE	ADELAIDE
ADN	ADEN
AKM	AKMOLA
AKT	AKTYUBINSK
ALG	ALGIERS
ALM	ALMATY
AMD	AMDERMA
AMM	AMMAN
AMS	AMSTERDAM
ANA	ANADYR
ANC	ANCHORAGE ARCTIC
ANC	ANCHORAGE
ANC	ANCHORAGE OCEANIC
ANK	ANKARA
ANT	ANTANANARIVO
ARK	ARKHANGELSK
ASH	ASHKHABAD
ASM	ASMARA
AST	ASTRAKHAN
ASU	ASUNCION
ATF	ANTOFAGASTA
ATH	ATHENS
ATL	ATLANTA
ATY	ATYRAU
AUC	AUCKLAND OCEANIC
AUC	AUKLAND
BAG	BAGHDAD
BAH	BAHRAIN
BAK	BAKU
BAL	BALI
BAN	BANGKOK

ARTCC ABBREVIATIONS (Cont'd)

BAR	BARCELONA
BAT	BATAGAY
BEI	BEIJING
BEL	BELEM
BER	BERMUDA
BIA	BIAK
BIS	BISHKEK
BLA	BLAGOVESHCHENSK
BLG	BELGRADE
BLO	BLOEMFONTEIN
BOD	BODO
BOD	BODO OCEANIC
BOG	BOGOTA
BOM	BOMBAY
BOR	BORDEAUX
BOS	BOSTON
BRA	BEIRA
BRD	BRINDISI
BRE	BREMEN
BRI	BRISBANE
BRL	BERLIN
BRN	BARNAUL
BRR	BARRANQUILLA
BRS	BRASILIA /UTA
BRT	BEIRUT
BRU	BRUSSELS
BRV	BRATISLAVA
BRY	BERYOZOVO
BRZ	BRAZZAVILLE
BSK	BRATSK
BST	BREST
BUC	BUCHAREST
BUD	BUDAPEST
BUJ	BUJUMBURA
CAI	CAIRO
CAL	CALCUTTA
CAM	CAMPO GRANDE
CAM	CENTRAL AMERICA
CAN	CANARIES
CAP	CAPE TOWN

ARTCC ABBREVIATIONS (Cont'd)

CAS	CASABLANCA
CHA	CHAYBUKHA
CHE	CHELYABINSK
CHI	CHICAGO
CHO	CHOKURDAKH
CHR	CHERSKY
CHT	CHITA
CHU	CHULMAN
CLE	CLEVELAND
COC	COCOS I
COL	COLOMBO
COM	COMODORO RIVIADAVIA
COP	COPENHAGEN
COR	CORDOBA
CRT	CURITIBA
CUR	CURACAO
DAK	DAKAR
DAK	DAKAR OCEANIC
DAM	DAMASCUS
DAR	DARWIN
DEL	DELHI
DEN	DENVER
DES	DAR-ES-SALAAM
DHA	DHAKA
DIK	DIKSON
DOR	DORNOD
DSS	DUSSELDORF
DUR	DURBAN
DUS	DUSHANBE
EDM	EDMONTON
EMI	EMIRATES
ENT	ENTEBBE
EZE	EZEIZA
FRA	FRANKFURT
FW	FT WORTH
GAB	GABORONE
GAN	GANDER DOMESTIC
GAN	GANDER OCEANIC
GEN	GENEVA
GEO	GEORGETOWN
GUA	GUANGZHOU

ARTCC ABBREVIATIONS (Cont'd)

GUY	GUAYAQUIL
HAN	HANOI
HAR	HARARE
HAV	HAVANA
HK	HONG KONG
HNR	HONIARA
HOC	HOCHIMINH
HON	HONOLULU CERAP
HOU	HOUSTON
HOU	HOUSTON OCEANIC
IND	INDIANAPOLIS
IRK	IRKUTSK
ISL	ISLA DE PASCUA
IST	ISTANBUL
JAK	JAKARTA
JAX	JACKSONVILLE
JED	JEDDAH
JOH	JOHANNESBURG
KAB	KABUL
KAL	KALININGRAD
KAM	KAMENNYI MYS
KAN	KANO
KAR	KARACHI
KAT	KATHMANDU
KAZ	KAZAN
KC	KANSAS CITY
KHA	KHABAROVSK
KHR	KHARKOV
KHT	KHATANGA
KIE	KIEV
KIG	KIGALI
KIN	KINGSTON
KIR	KIRENSK
KIS	KISANGANI
KK	KOTA KINABALU
KL	KUALA LUMPUR
KM	KHANTY-MANSIYSK
KNS	KINSHASA
KO	KZYL-ORDA
KOL	KOLPASHEVO

ARTCC ABBREVIATIONS (Cont'd)

KOS	KOSTANAY
KRA	KRASNOVODSK
KRS	KRASNOYARSK
KRV	KIROV
KSH	KISHINAU
KTM	KHARTOUM
KUN	KUNMING
KUR	KURGAN
LAH	LAHORE
LAN	LANZHOU
LAP	LA PAZ
LAX	LOS ANGELES
LIL	LILONGWE
LIM	LIMA
LIS	LISBON
LJU	LJUBLJANA
LON	LONDON
LUA	LUANDA
LUB	LUBUMBASHI
LUS	LUSAKA
LVO	LVOV
MAD	MADRID
MAG	MAGADAN
MAI	MAIQUETIA
MAL	MALE
MAN	MANILA
MAR	MARSEILLE
MAU	MAURITIUS
MAZ	MAZATLAN
MAZ	MAZATLAN OCEANIC
MDR	MADRAS
MEL	MELBOURNE
MEM	MEMPHIS
MEN	MENDOZA
MER	MERIDA
MEX	MEXICO
MGD	MAGDAGACHI
MIA	MIAMI
MIA	MIAMI OCEANIC
MIL	MILAN

ARTCC ABBREVIATIONS (Cont'd)

MIN	MINNEAPOLIS
MIR	MIRNY
MLM	MALMO
MLT	MALTA
MNC	MONCTON NORTHERN
MNC	MONCTON SOUTHERN
MNS	MANAUS
MNT	MONTERREY
MOG	MOGADISHU
MON	MONTREAL
MOS	MOSCOW
MRM	MURMANSK
MS	MYS SHMIDTA
MSK	MINSK
MTV	MONTEVIDEO
MUM	MUMBAI
MUN	MUNICH
MUR	MUREN
MUS	MUSCAT
NAD	NADI OCEANIC
NAH	NAHA
NAI	NAIROBI
NAS	NASSAU
NDJ	N'DJAMENA
NIC	NICOSIA
NIK	NIKOLAEVSK-NA-AMURE
NMY	NIAMEY
NOR	NORILSK
NOV	NOVOSIBIRSK
NUK	NUKUS
NY	NEW YORK
NY	NEW YORK OCEANIC
NZE	NEW ZEALAND
OAK	OAKLAND
OAK	OAKLAND OCEANIC
ODE	ODESSA
OKH	OKHA
OMS	OMSK
ORN	ORENBURG
OSK	OKHOTSK
OSL	OSLO

ARTCC ABBREVIATIONS (Contd)

PA	PUNTA ARENAS
PAN	PANAMA OCEANIC
PAP	PORT-AU-PRINCE
PAR	PARIS
PE	PORT ELIZABETH
PEC	PECHORA
PEM	PERM
PEN	PENZA
PER	PERTH
PET	PETERSBURG
PEV	PEVEK
PHN	PHNOM PENH
PIA	PIARCO
PM	PORT MORESBY
PMT	PUERTO MONTT
PRA	PRAGUE
PRM	PARAMARIBO /UTA
PTR	PETROPAVLOVSK-KAM.
PV	PORTO VELHO
PYO	PYONGYANG
REC	RECIFE
RES	RESISTENCIA
REY	REYKJAVIK
RIG	RIGA
RIV	RIVADAVIA
RMS	REIMS
ROB	ROBERTS
ROC	ROCHAMBEAU
ROM	ROME
ROS	ROSTOV
ROV	ROVANIEMI
SAI	SAINSHAND
SAL	SAL OCEANIC
SAM	SAMARA
SAN	SANTIAGO
SAR	SARAJEVO
SCO	SCOTTISH
SDO	SANTO DOMINGO
SEA	SEATTLE
SEM	SEMIPALATINSK
SEY	SEYCHELLES

ARTCC ABBREVIATIONS (Cont'd)

SHA	SHANGHAI
SHE	SHENYANG
SHN	SHANNON
SHW	SHANWICK OCEANIC
SIM	SIMFEROPOL
SIN	SINGAPORE
SJU	SAN JUAN OCEANIC
SKO	SKOPJE
SLC	SALT LAKE CITY
SLK	SALEKHARD
SM	SANTA MARIA OCEANIC
SMR	SAMARKAND
SNA	SANAA
SOF	SOFIA
SON	SONDRESTROM
STA	STAVANGER
STO	STOCKHOLM
SUK	SUKHUMI
SUN	SUNDSVALL
SUR	SURGUT
SWI	SWITZERLAND
SYD	SYDNEY
SYK	SYKTYVKAR
SYM	SEYMCHAN
TAE	TAEGU
TAH	TAHITI OCEANIC
TAI	TAIPEI
TAL	TALLINN
TAM	TAMPERE
TAS	TASHKENT
TAZ	TASHAUZ
TBI	TBILISI
TEH	TEHRAN
TEL	TEL AVIV
TIK	TIKSI
TIL	TILICHIKI
TIR	TIRANA
TOK	TOKYO
TOR	TORONTO
TRI	TRIPOLI

ARTCC ABBREVIATIONS (Cont'd)

TRO	TRONDHEIM
TUN	TUNIS
TUR	TURUKHANSK
TYU	TYUMEN
UFA	UFA
UJU	UJUNG PANDANG
ULA	ULAANBAATAR
UND	UNDERHAAN
URA	URALSK
URU	URUMQI
VAN	VANCOUVER
VAR	VARNA
VEL	VELIKIYE LUKI
VIE	VIENNA
VIL	VILNIUS
VLA	VLADIVOSTOK
VLO	VOLOGDA
VNT	VIENTIANE
VOL	VOLGOGRAD
VRK	VORKUTA
WAR	WARSAW
WAS	WASHINGTON
WEL	WELLINGTON
WIN	WINNIPEG
WND	WINDHOEK
WUH	WUHAN
YAK	YAKUTSK
YAN	YANGON
YEK	YEKATERINBURG
YEN	YENISEYSK
YER	YEREVAN
YS	YUZHNO-SAKHALINSK
ZAG	ZAGREB
ZHK	ZHEZKAZGAN
ZHY	ZHYGANSK
ZUR	ZURICH
ZYR	ZYRYANKA

OTHER ABBREVIATIONS USED ON KLN 89(B) PAGES

A	Airport waypoint
A/C	Aircraft
ACQ	Acquisition
ACT	Active flight plan waypoints
ADJ	Adjust
AKD	Alaska Daylight Time
AKS	Alaska Standard Time
ALT	Altitude
APT	Airport
ATD	Atlantic Daylight Time
ATS	Atlantic Standard Time
BRG	Bearing
CAL	Calculator
CDT	Central Daylight Time
CHAR	Character
CRS	Course
CRSR	Cursor
CST	Central Standard Time
DB	Data base
DEGRD	Degraded navigation
DIS	Distance
DTK	Desired track
DUP	Duplicate
E	East
EDT	Eastern Daylight Time
ELE	Elevation
ENT	Enter
EST	Eastern Standard Time
ETA	Estimated time of arrival
ETE	Estimated time en route
FAILR	Failure of receiver
FPL	Flight plan
FPM	Feet per minute
FR	From
GDT	Greenland Daylight Time
GS	Groundspeed
GST	Greenland Standard Time
HAD	Hawaii Daylight Time
HAS	Hawaii Standard Time

OTHER ABBREVIATIONS (Cont'd)

HLT	Health of space vehicle signal
IDENT	Identifier
INIT	Initialization
KM	Kilometers
KT	Knots
L	Left
LCL	Local
M	Meters
MAG VAR	Magnetic variation
MDT	Mountain Daylight Time
MPM	Meters per minute
MSG	Message
MST	Mountain Standard Time
N	NDB waypoint
N	North
NAV	Navigation
NAV A	Navigation with altitude aiding
NAV D	Navigation with data collection
NM	Nautical miles
OBS	Omni bearing selection
ORS	Operational Revision Status
OTH	Other
P.POS	Present position
PDT	Pacific Daylight Time
POS	Position
POSN	Position
PRES	Present
PRS	Pressure
PST	Pacific Standard Time
PUB	Published
PWR	Power
RAD	Radial
RCVR	Receiver
REF	Reference
REQ	Required
RES	Reserve fuel
S	South
S	Supplemental waypoint
SDT	Samoa Daylight Time
SET	Setup

OTHER ABBREVIATIONS (Cont'd)

SNR	Signal-to-noise ratio
SST	Samoa Standard Time
SUP	Supplemental
SV	Space vehicle
SW	Software
TK	Actual track
TOT	Total
U	User-defined waypoint
USR	User-defined waypoint
UTC	Coordinated Universal Time (Zulu)
V	VOR waypoint
W	West
WPT	Waypoint
Z	Zulu time

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APPENDIX E - LAT/LON CONVERSIONS

The KLN 89(B) utilizes latitude and longitude expressed in degrees, minutes, and hundredths of a minute. You may occasionally see a document expressing latitude and longitude in degrees, minutes, and seconds. This table may be used to convert seconds to hundredths of a minute.

SECONDS (")	_HUNDREDTHS OF A MINUTE (')_
00	.00
01	.02
02	.03
03	.05
04	.07
05	.08
06	.10
07	.12
08	.13
09	.15
10	.17
11	.18
12	.20
13	.22
14	.23
15	.25
16	.27
17	.28
18	.30
19	.32
20	.33
21	.35
22	.37
23	.38
24	.40
25	.42
26	.43
27	.45
28	.47
29	.48
30	.50
31	.52
32	.53

LAT/LON CONVERSIONS (Cont'd)

SECONDS (")	HUNDREDTHS OF A MINUTE (')
33	.55
34	.57
35	.58
36	.60
37	.62
38	.63
39	.65
40	.67
41	.68
42	.70
43	.72
44	.73
45	.75
46	.77
47	.78
48	.80
49	.82
50	.83
51	.85
52	.87
53	.88
54	.90
55	.92
56	.93
57	.95
58	.97
59	.98

For example:

35° 46' 24" is the same as 35° 46.40'

32° 15' 58" is the same as 32° 15.97'

APPENDIX F— GPS PRIMER
BACKGROUND

The Global Positioning System (GPS) is a satellite-based navigation system that was originally conceived and implemented by the United States Department of Defense (DoD). The system is, however, available to all civilian users free of charge. GPS provides extremely precise position, velocity, and time information.

The satellites are not geosynchronous, as is the case with many weather and television satellites. That is, each satellite is not above a fixed spot on the Earth all the time, but rather is continuously moving across the sky. In fact, each satellite completely orbits the Earth two times per day.

The Department of Defense imposes an intentional accuracy degradation of the GPS system. This degradation is known as Selective Availability (SA). When SA is active, only U.S. military users have access to full GPS accuracy. For civilian users, position accuracy is degraded to no worse than 100 meters. At the time of this writing, Selective Availability is on (and therefore accuracy is degraded) nearly 100% of the time.

GPS POSITION DETERMINING CONCEPT

The technique used to determine position is fundamentally very simple. The complicated part is accounting for and correcting all the possible errors in the position.

The GPS receiver is able to determine the time it takes a radio signal to travel from the satellite to the GPS antenna. Since this radio signal travels at the speed of light (approximately 186,000 statute miles per second), the time delay can very easily be used to determine the receiver's distance from a given satellite. If measurements are taken from four satellites (or three satellites and an input from an aircraft altimeter), the receiver can identify its position very precisely.

For example, the GPS receiver might determine that it is exactly 12,000 miles from satellite A, 12,700 miles from satellite B, and 13,100 miles from satellite C. At the same time, the aircraft's encoding altimeter might be indicating an altitude of 9,500 feet MSL. There is only one point in space that satisfies these four measurements.

12,000 NM

12,700 NM

13,100 NM

9500 FT
MSL

NOT TO SCALE
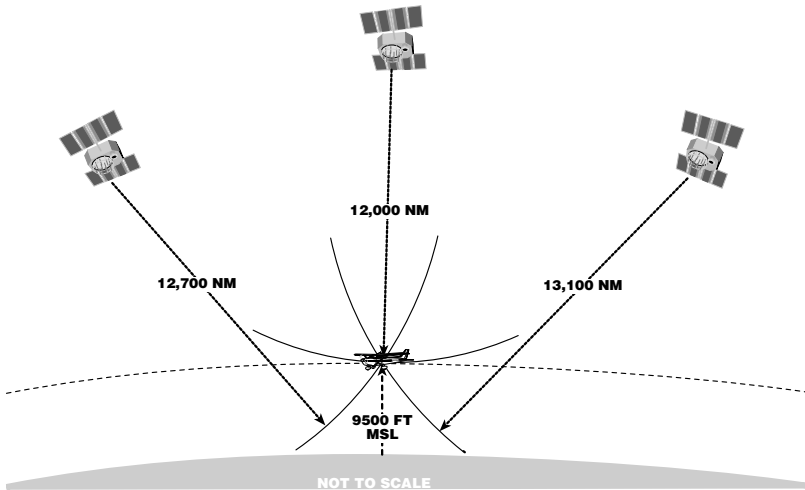
GPS DATA SIGNALS

Two of the primary types of signals that the GPS satellites broadcast are almanac and ephemeris data. These signals enable the GPS receiver to quickly lock on to the satellites in view. Otherwise, the receiver would have to look for each of the 24 satellites to determine which ones could be used.

Almanac data is very crude data which describes the approximate orbital position of the satellites. Each of the 24 satellites transmits the almanac data for all satellites, so a GPS receiver has only to listen to one satellite in order to know which satellites are "visible" (in the sky) at that particular time. Almanac data is good for about six months, so when you turn the receiver off, then back on a month later, it will know what satellites to look for.

Ephemeris data is very precise data which each satellite transmits to tell the GPS receiver exactly where it is and what its orbital parameters will be for about the next four hours. Each satellite transmits its own unique ephemeris data.

GPS SYSTEM SEGMENTS

The GPS system is composed of three segments: the Space Segment, the Control Segment, and the User Segment.

The Space Segment consists of the 24 NAVSTAR satellites which orbit the earth at an altitude of 10,898 nautical miles. The satellite orbits are very precisely planned so that the entire surface of the earth may use the GPS system 24 hours a day, every day. There are almost always more than six satellites in view from anywhere on Earth.

The Control Segment consists of a network of ground-based monitoring and control stations. The Master Control Station is located in Colorado Springs, Colorado. All satellite data which is collected by the other ground stations is assimilated and analyzed at Colorado Springs. Based on these analyses, ephemeris updates (such as system clock corrections) are sent (uplinked) to the satellites through radio transmitters at the ground stations. These ground stations are located at Kwajalein (west of Hawaii in the central Pacific Ocean), Diego Garcia (in the Indian Ocean), and Ascension (in the south Atlantic Ocean).

As an owner of a GPS system, you can now claim to be a certified member of the GPS User Segment! GPS has many users and uses, and more are being dreamed up all the time. Not only are aircraft using GPS navigation, so are military systems and personnel, boaters, hikers, and surveyors. Personal automobiles and transport trucks use Intelligent Transportation Systems, or ITS, to find their destinations, and track their movements. Some biologists attach GPS receivers to animals to monitor their movement and migration patterns. Geologists even use GPS to track the movement of glaciers and to analyze plate tectonics (movements of the Earth's crust). What an exciting new technology as we move into the 21st Century!

RAIM

Receiver Autonomous Integrity Monitoring (RAIM) is a function that every IFR-certified GPS receiver must continuously perform to assure an accurate position. One characteristic of the GPS Space and Control Segments is that they can't instantly fix a satellite if it begins sending misleading positioning information. For this reason, a GPS receiver can't rely on the GPS satellites to tell it when there is a possible error. The words "receiver autonomous" indicate that the GPS

receiver, on it's own, can detect an inaccuracy in the GPS system. It does this by using distance measurements from as many satellites as possible to check the consistency of the position (this is called an over-determined position solution).

If there are not enough satellites in view to assure the position integrity, the KLN 89(B) notifies the pilot. Five measurements with good geometry (relative positions of the satellites) are needed to provide RAIM. This means that at least five satellites or four satellites and a pressure altitude input from the aircraft's altimeter are required to assure RAIM availability. Likewise, if this check shows some inconsistency in the position, the KLN 89(B) notifies the user that other navigation sources should be used to cross-check the position. Additionally, sometimes the receiver is unable to assure the position to enough accuracy for the phase of flight, due to the location of the satellites at that instant.

RAIM availability is very seldom a difficulty when in the en route and terminal phases of navigation. The allowable limits are much tighter when a non-precision approach is performed with a KLN 89B. For this reason, the KLN 89B Other (OTH) 3 page allows the pilot to enter a time and location, and the GPS receiver will predict if RAIM will be available to shoot the non-precision approach. See section 5.1.9 for more information about the RAIM prediction capability.

GPS XPRESS™ CARD 8-CHANNEL RECEIVER

The KLN 89 and KLN 89B use an Honeywell GPS receiver known as the GPS Xpress™ card. It was dubbed this way because it is identical in size to an everyday credit card, and its faster acquisition time than previous single-channel designs. The GPS receiver has eight parallel channels, which means each channel can continuously track a satellite, for continuous tracking of up to eight GPS satellites. The parallel receiver design has several advantages:

- Excellent performance during high dynamic conditions (high velocity and/or acceleration).

- Improved position acquisition time (also known as time-to-first-fix) over single-channel designs.

- Improved position accuracy.

- The ability of the GPS receiver to perform the RAIM calculations is enhanced without degrading position tracking.

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