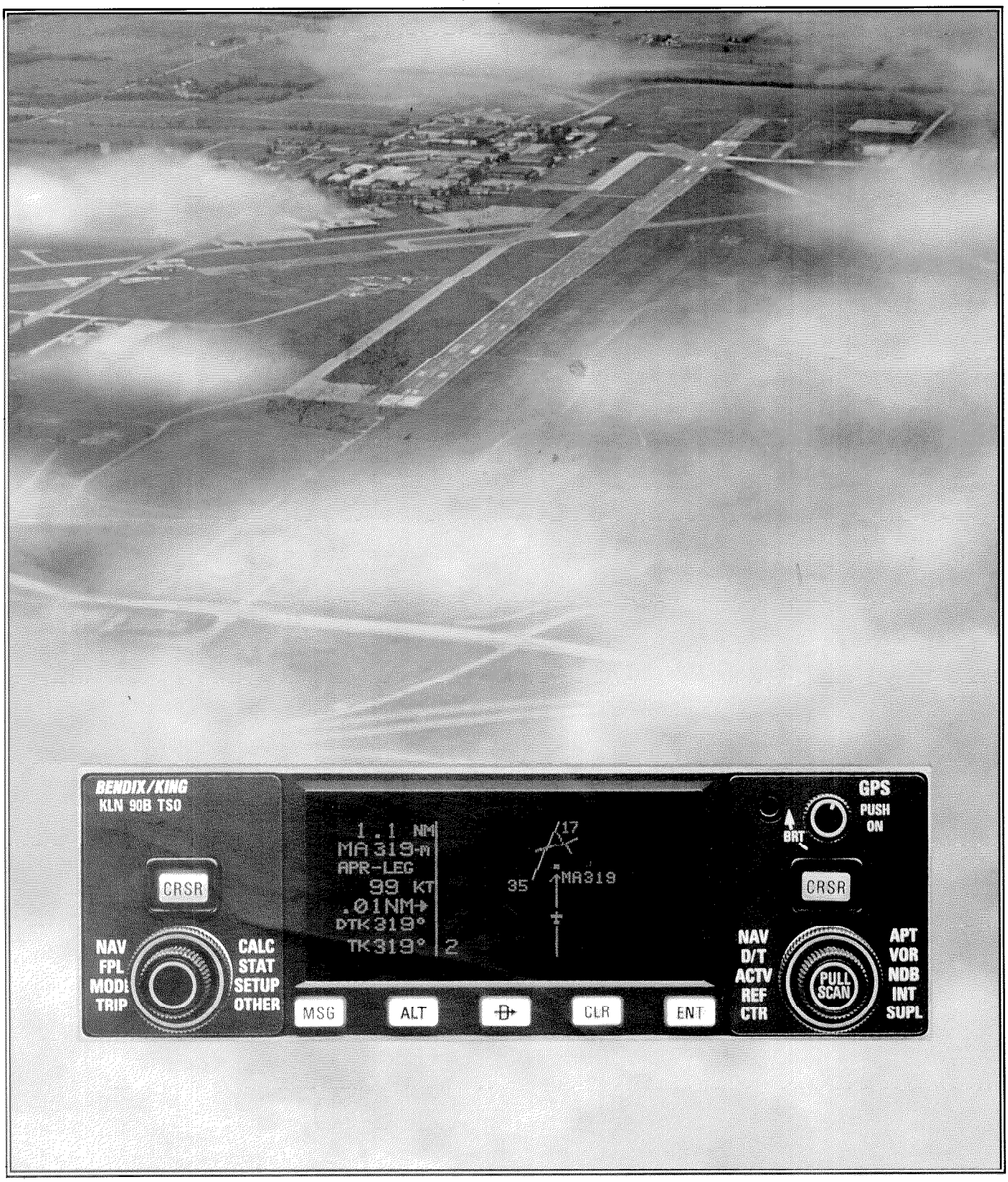
Pilot's Guide

KLN 90B

Bendix/King®
TSO'd GPS Navigation System



ORS 20

AlliedSignal
AEROSPACE

KLN 90B PILOT'S GUIDE

006-08773-0000

for KLN 90Bs with

OPERATIONAL REVISION STATUS (ORS) 20

IMPORTANT: *Special installation procedures must be followed in order for the KLN 90B to be certified for IFR use. Consult the KLN 90B Flight Manual Supplement for the operating limitations of this unit.*

For Important Database Update Information

See Section 2.7

May, 1997

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INTRODUCTION

The KLN 90B is an extremely sophisticated navigational device, capable of providing highly accurate navigation over most parts of the world. You will be amazed at all of the navigational and other aeronautical functions that the unit can perform. However, you don't need to master all of the KLN 90B's capabilities at once. In just a short time you will be confidently using it to make your flying duties easier and more enjoyable. You will learn new features as you have a need or desire to learn them and soon will establish the best way of using the KLN 90B to meet your particular flying requirements.

Don't let the size of this Pilot's Guide intimidate you! It is written in plain, simple English instead of "computer-eeze" and it assumes you are not an experienced user of GPS or other types 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. There are several appendices in the back that you may find useful from time to time.

As you become proficient with using the KLN 90B, don't be tempted to rely on it as the sole means of navigation. A good pilot never relies on just one source of navigation for either VFR or IFR flying. Cross check your position using VOR, DME, ADF, or other navigational devices you may have in the cockpit - including your eyes!

Be sure and keep a copy of this Pilot's Guide in the aircraft to use as a reference. You never know when you may have a question you'll want to look up.

One last thing. Don't get so involved in learning to use the KLN 90B that you forget to fly the aircraft. Be careful, and remember to keep a close eye out for other aircraft.

NOTE: A white 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. An example of this is figure 3-5 where the white border around the characters **ACKNOWLEDGE?** and **ENT** is used to indicate that both are flashing.

PREVIEW OF OPERATION

No doubt you are going to read this entire manual just as soon as you possibly can. But just to get an idea of how easy the KLN 90B is to operate, the following operational preview is presented. This operational preview assumes the KLN 90B has been properly installed, the unit was previously operational in the same general geographical location, and that no peripheral equipment interfaced with the KLN 90B (such as external HSIs, CDIs, autopilots, RMIs, fuel flow systems, 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 available to cross-check position.

1. Push the power/brightness knob located in the upper right corner of the unit to the "in" position.

2. After a few seconds of warm up, the screen will show a Turn-On page with the words **SELF TEST IN PROGRESS** at the bottom of the page. Rotate the power/brightness knob to select the desired screen brightness. After a few seconds the Turn-On page will automatically be replaced with the Self Test page. (Note: If the KLN 90B is being used in the take-home mode, a Take-Home Warning page is displayed before the Self Test page and must be acknowledged by pressing [ENT].) The Self Test page is recognizable because it shows the date and time on the right side. If the date and time are incorrect by more than 10 minutes, refer to section 3.2 of this manual. The bottom left side of the Self Test page must display **ANNUN ON** to indicate that the KLN 90B has passed an internal self test.

   In most KLN 90B installations the first two characters of the altimeter setting **BARO** field will be highlighted in inverse video (dark characters on a light background) on the right side of the screen. This area of inverse video is called the cursor. Use the right inner knob to select the correct first two characters of the altimeter setting. Next, turn the right outer knob one step clockwise to position the cursor over the third character of the altimeter setting. Use the right inner knob to select the correct number. Once again turn the right outer knob one step clockwise to position the cursor over the last character of the altimeter setting. Use the right inner knob to complete entering the correct altimeter setting.

   Turn the right outer knob clockwise to position the cursor over the word **APPROVE?** if the cursor is not there already. Press [ENT] to approve the Self Test page. (Note: If the KLN 90B is installed for VFR only operation, a VFR only warning page is diplayed after the self test page has been approved. This warning page must be acknowledged by pressing [ENT].)

3. A Database 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.

4. A page displaying the letters **PRESENT POS** at the top will now be on the left side of the screen. In a couple minutes or less, this page will display the aircraft's present position. It shows the position both in latitude/longitude and in terms of the radial and distance from a nearby VOR. Verify that the position is correct before proceeding.

5. Press the [D→] button. A page with the words **DIRECT TO** is now displayed on the left.

   In step 6 you will enter the ICAO identifier of the destination 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 many 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 entered should be identical to how it is charted.

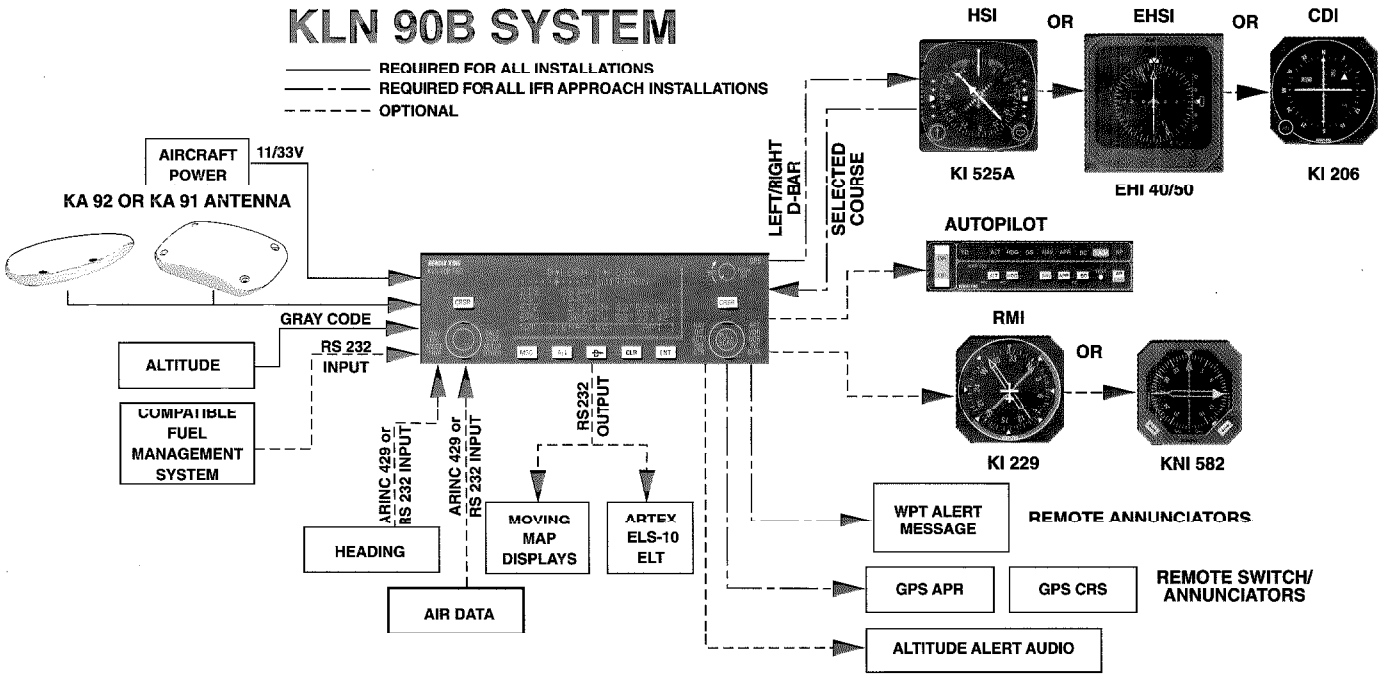
6. Rotate the left inner knob until the first character of the airport identifier is displayed. Turn the left outer knob one step clockwise to move the flashing segment to the second character position. Rotate the left inner knob to select the second character of the identifier. Use this procedure to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

7. Press [ENT]. The right side will display a page showing the identifier, name and position of the airport just entered. Confirm that the correct airport is displayed. Press [ENT] a second time to approve the airport data.

8. A Navigation page is now on the right side of the screen. It displays the distance, ETE, and bearing to the destination airport. In addition, it displays groundspeed and a course deviation indicator. If the left inner knob is rotated one step counterclockwise, you will get an enlarged Navigation page occupying the entire screen.

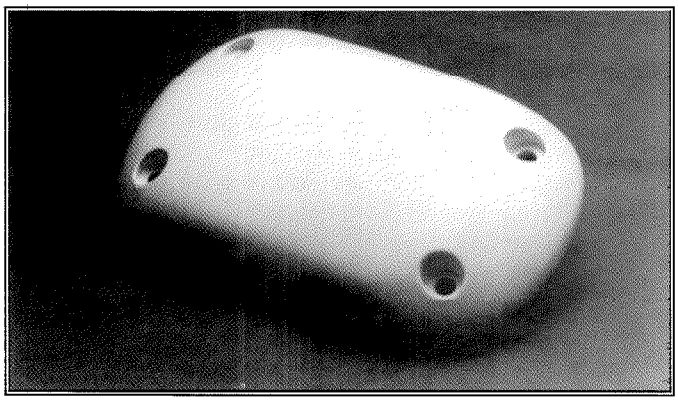
CHAPTER 1 - KLN 90B SYSTEM COMPONENTS

A basic KLN 90B system consists of a panel mounted KLN 90B GPS sensor/navigation computer, a data base cartridge, and an antenna. An altitude input is required to obtain full navigation and operational capabilities. Additional system components may be added or interfaced to the KLN 90B which increase its features and capabilities. Some of these optional components include an external course deviation indicator (CDI) or HSI, RMI, fuel management system, air data system, ARTEX ELS-10 emergency locator transmitter (ELT), autopilot, and external annunciators.

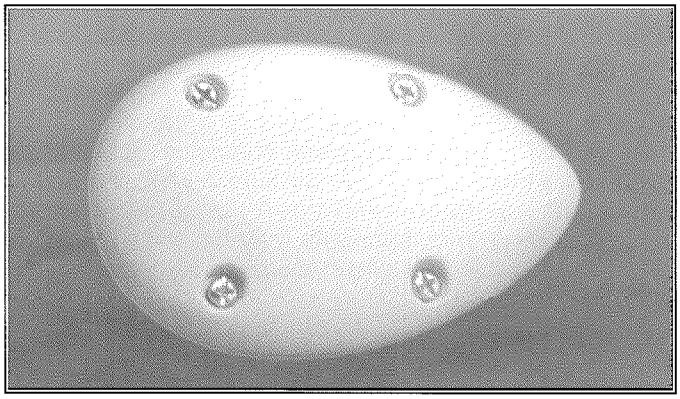


The KLN 90B panel mounted unit contains the GPS sensor, the navigation computer, a CRT display, and all controls required to operate the unit. It also houses the data base cartridge which plugs directly into the back of the unit.

The database cartridge is an electronic memory containing a vast amount of information on airports, navaids, intersections, special use airspace, and other items of value to the pilot. The database is designed to be easily updated by the user by using a laptop computer and AlliedSignal furnished 3.5 inch diskettes. The database may also be updated by removing the obsolete cartridge and replacing it with a current one.



KA 91 GPS Antenna



KA 92 GPS Antenna

Two GPS antennas can be used with the KLN 90B. One is the KA91 and the other is the KA 92. The KA 92 is used with new production KLN 90Bs and the KA 91 is used with units that have been upgraded from either a KLN 90 or a KLN 90A. They are "patch" antennas designed to always be mounted on the top of the aircraft.

The KLN 90B has analog outputs to drive the left-right deviation bar of most mechanical CDIs and HSIs. In addition, it has digital outputs to automatically drive the course pointer and display flight plan waypoints on the Bendix/King EHI 40 and EHI 50 electronic HSIs.

The Bendix/King KI 229 and KNI 582 RMIs may be interfaced to the KLN 90B to provide a display of magnetic bearing to the waypoint.

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, KFC 325, KFC 400 and KFC 500 Flight Control Systems may be coupled to the KLN 90B. Many other autopilots may also be coupled to the KLN 90B. Actual autopilot performance and capability when coupled to the KLN 90B may vary significantly from one autopilot model to another.

Certain Digiflo™ and Miniflo™ fuel management systems manufactured by Shadin Co. Inc. as well as certain fuel computers manufactured by ARNAV Systems, Inc. and SHELTECH LTD interface with the KLN 90B. These interfaces allow the pilot to view fuel related parameters calculated by the KLN 90B such as how much fuel will be remaining when the aircraft lands at the destination. With certain Shadin fuel management systems it is possible to update the fuel on board through the KLN 90B. In these cases a separate panel mounted interface to the fuel management computer is not required.

Compatible air data systems are available from Bendix/King and Shadin Co. An air data system is capable of providing the KLN 90B with true air speed data which is used for wind determination. The Shadin air data system also will convert heading data from the Bendix/King KCS 55A and some other compass systems to a format that allows wind calculations to be fully automatic.

Altitude may be provided to the KLN 90B from an encoding altimeter, blind encoder, or one of the air data computers mentioned above. Altitude is used as an aid in position determination when not enough satellites are in view. Altitude is also used in several altitude related features such as three dimensional special use airspace alerting, height above airport, and altitude alerting.

Some installations may require remote annunciators to be mounted in the aircraft panel in order to indicate the status of certain KLN 90B functions. Specifically, the KLN 90B has outputs to provide annunciation for waypoint alert and message.

In installations where the KLN 90B will be used for approaches, the installations are more complicated. External switches and annunciators are required to change approach modes as well as how the KLN 90B defines the course to the active waypoint. Selected course is generally required to be provided to the KLN 90B through an HSI, CDI or EFIS.

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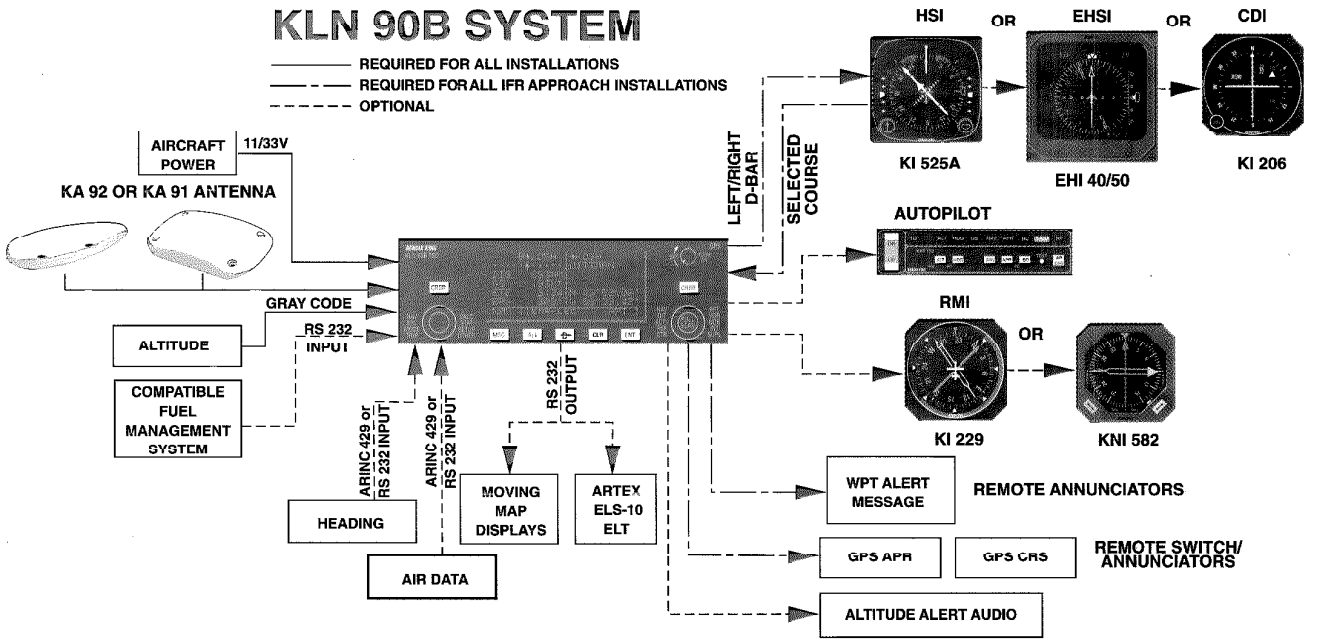

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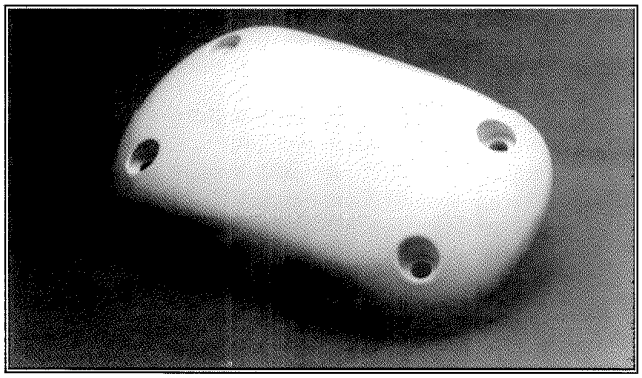

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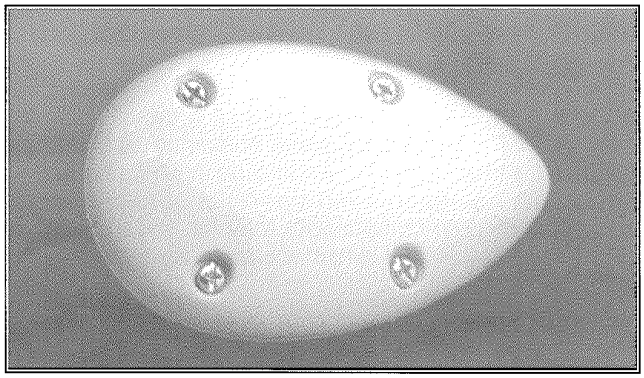

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One reason the KLN 90B is such a powerful navigation system is because of its extensive database. A database is an area of electronic memory used to store a large catalog of navigational and aeronautical information.

2.1 FUNCTIONS OF THE DATABASE

The database 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 database automatically looks up and displays the latitude and longitude associated with the identifier. It's obvious that the database saves a lot of tedious latitude/longitude entry and also greatly reduces the potential for data input mistakes.

The second function of the database is that it serves as a very convenient means to store and easily access a vast amount of aeronautical information. Want to know the tower frequency or the length of the runways at a specific airport? No need to look them up in a book - just turn a couple knobs and display the information right on the KLN 90B.

2.2 DATABASE COVERAGE AREAS AND CONTENTS

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 databases for the KLN 90B have a primary and a secondary coverage area. The primary coverage areas are indicated in figure 2-1 and contain more detailed information. The secondary area contains less detailed information for the rest of the world.

Specifically, all databases contain complete information for all worldwide VORs, NDBs, and minimum safe altitudes (MSAs). For its primary area, the database contains public use and military airports which have any runway at least 1000 feet in length. For its secondary area, the database also contains airports having a hard surface runway at least 3000 feet in length. Airport communication frequencies and runway information are provided

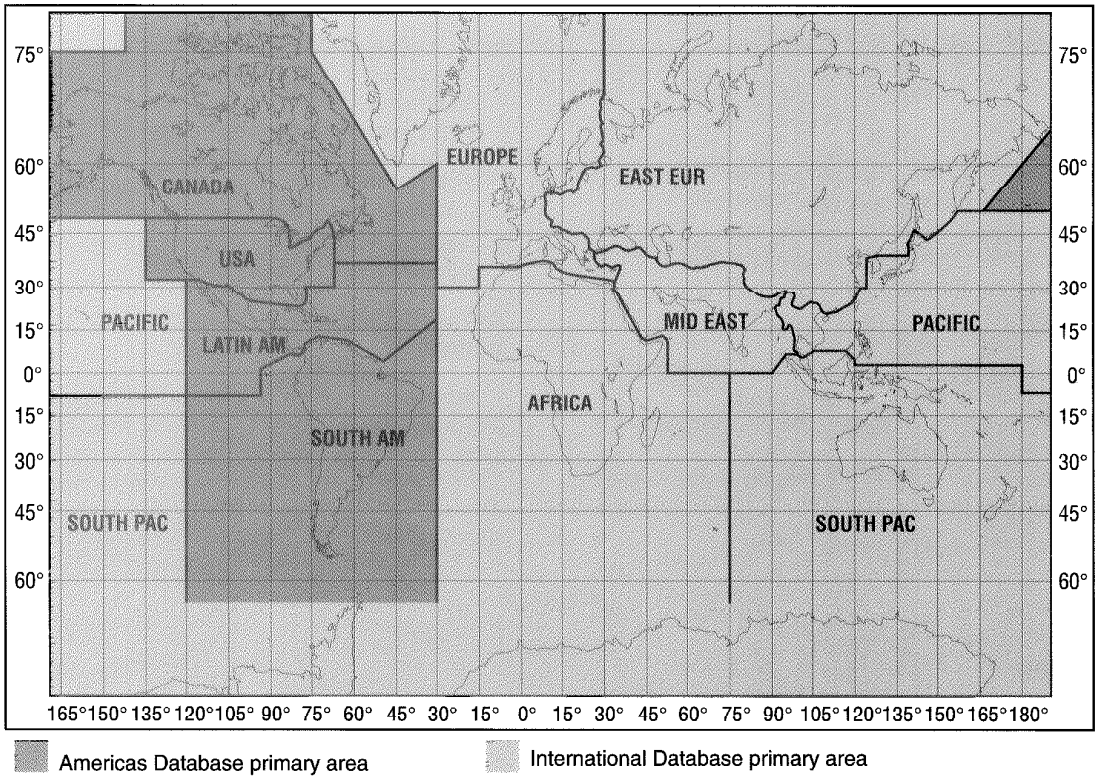

Figure 2-1. KLN 90B Database Geographical Regions

only for airports in the primary area of the database. Intersections, air route traffic control center data, flight service station frequencies, and special use airspace are also provided only for the primary area.

The following is a list of the KLN 90B database contents:

***AIRPORTS**
- Identifier
- Name
- City, State or Country
- Type (public or military)
- Latitude and Longitude
- Elevation
- Approach indicator for precision, non-precision or no instrument approach at airport
- Radar approach/departure environment indicator
- Whether airport underlies CL B, TRSA, CL C, CTA, or TMA
- Time relative to UTC (Zulu)
- Communication frequencies (VHF and HF):
  - 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
  - Radio
  - AWOS (automatic weather observing station)
  - AAS (aeronautical advisory service)
  - ATF (Aerodrome traffic frequency)
  - CTAF (common traffic advisory frequency)
  - MF (mandatory frequency)
  - Ramp control
  - PCL (pilot-controlled lights)
- Runway data (designation, length, surface, lighting, traffic pattern direction)
- Airport Services (fuel, oxygen, customs, indicator for presence of a landing fee)
- Airport Comments (user may manually enter remarks of up to 33 characters at any 100 airports in database)

VORs
- Identifier
- Name
- Frequency
- DME indicator
- Class (high altitude, low altitude, terminal, undefined)
- 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**
- All compatible pilot-nav SID/STAR procedures
- Non-precision approaches (except localizer, LDA (Localizer Directional Aid), SDF (Simplified Directional Facility)) approved for overlay use. Includes all public GPS only approaches.

MISCELLANEOUS
- *Air Route Traffic Control Center (ARTCCs and FIRs) boundaries and frequencies (VHF and HF)
- *Flight Service Stations (Location of points of communication and associated frequencies - VHF and HF)
- Minimum Safe Altitudes
- *Special Use Airspace boundaries (Prohibited, Restricted, Warning, Alert, MOA, Class B, TRSA, Class C, CTA, TMA)

250 USER DEFINED WAYPOINTS
- Identifier
- Latitude and Longitude
- Additional data depending on how user defines waypoint:
  - User airports (elevation and surface of longest runway)
  - User VOR (frequency and magnetic variation)
  - User NDB (frequency)

And you think your telephone directory has a lot of information!

* Items indicated with asterisk are included in the primary database coverage area, but not in secondary coverage area. The exception is that airports in primary coverage area include those public and military bases having a runway at least 1000 feet in length. Airports in secondary coverage area are those having a hard surface runway at least 3000 feet in length.

2.3 USE OF ICAO IDENTIFIERS

Waypoints are stored in the KLN 90B database almost exclusively by their ICAO identifiers. ICAO is an internationally accepted reference for the data. In almost all cases the proper ICAO identifiers may be taken directly from Jeppesen Sanderson or government aeronautical charts. For example, Dallas and Los Angeles VORs have the familiar ICAO identifiers DFW and LAX, respectively.

Please note that one area of potential confusion is airport identifiers in the Continental United States, Alaska, and Canada. Many airport identifiers in the database have four letters beginning with a prefix letter that corresponds to the geographic area in which it is located. The prefix letter for the Continental United States is "K". Thus, the identifier for Dallas/Fort Worth International airport is KDFW, not DFW. This distinguishes the airport identifier from the VOR identifier. Likewise, the identifier for Los Angeles International airport is KLAX while the VOR identifier is LAX. The prefix letter for Alaska is "P" and for Canada is "C".

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".*

Not all airport identifiers receive the prefix letter. Airport identifiers which are combinations of letters and numbers do not receive the prefix letter. 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 Continental U.S., a "P" in Alaska, 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 90B database is identical to how it is charted.

2.4 UPDATING THE DATABASE

The information stored in the database would eventually become obsolete if there wasn't some means to update it. For example, navaids can move or change frequency, new runways can be added to an airport, communication frequencies can change, and on and on.

The database is housed in a cartridge which plugs directly into the back of the KLN 90B. It is designed so that there are two ways for the user to easily keep the database current. The first is to electronically update the database by means of 3.5" diskettes supplied by AlliedSignal and a laptop computer. This method does not involve removing the KLN 90B from the aircraft's instrument panel. A jack, usually mounted in the aircraft's instrument panel, provides a means of interfacing the KLN 90B with the computer via an interface cable. The diskettes are not returned to AlliedSignal.

The second method of database update is to remove the old cartridge and insert a current cartridge. This method involves returning the old cartridge to AlliedSignal.

Every 28 days, AlliedSignal receives new NavData™ information from Jeppesen Sanderson. This information is processed and downloaded onto both diskettes and database cartridges. AlliedSignal makes these two types of update services available to you in a choice of several subscription or random update programs. See section 2.7 of this manual for details on these programs.

Regardless of whether the computer method or the cartridge exchange method of database updating is used, AlliedSignal 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 90B will use the previous data up to the effective date and automatically begin using the new data on the effective date.

In order to get maximum utilization from the KLN 90B, AlliedSignal highly encourages you to update the database on a frequent basis, if not every 28 days. It is also a matter of safety to not fly with out of date information.

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

2.4.1 Computer Updating Of The Database

Update information is sent to you on several 3.5" disks. In order to use this update method you must have access to an IBM compatible computer having a disk drive capable of using and booting (loading) from 3.5" 1.44 megabyte high density disks. This computer also needs to have an available COM 1 or COM 2 serial port. In addition, an optional PC Interface kit must be used. Included in the kit are a data loader jack (wired to the KLN 90B and usually installed in the aircraft's instrument panel) and an interface cable that plugs into both the computer and into the data loader jack.

CAUTION: The database must be updated only while the aircraft is on the ground. The KLN 90B does not perform any navigation functions while the database is being updated. Since a database update takes approximately 10 minutes it is a good idea to turn off all electrical equipment on the aircraft except for the KLN 90B to avoid running down the aircraft battery.

NOTE: *The disks sent to you can only be used to update one KLN 90B, although they can update this specific unit numerous times. The first time the disks are used in an update operation, a unique identification code from the KLN 90B being used is uploaded to the disks. These disks may be used in this specific KLN 90B an unlimited number of times which could be required if you switch back and forth between the North American and International data bases during one update cycle. These disks may not, however, be used to update other KLN 90Bs. This update protection ensures that Jeppesen Sanderson is properly compensated for the use of their NavData™.*

Follow these steps to update the KLN 90B:

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. Plug the other end of the interface cable (4 conductor male plug) into the data loader jack that is mounted in the aircraft.

3. Turn on the computer being used for the database update. Insert Disk 1 into the computer's disk drive. There can be either 2 or 3 disks used for the update so be sure the label on the outside of the disk says "Disk 1 of 2" or "Disk 1 of 3". 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 database update operation.

4. Turn on the KLN 90B. Press [ENT] as required to approve the Self Test and Database pages. Use the left outer knob to select the Setup (SET) type pages and the left inner knob to select the SET 0 page (figure 2-2).

5. Press the left [CRSR]. **UPDATE PUBLISHED DB** will now be displayed as in figure 2-3.

6. Press [ENT]. The database region and the expiration date of the database presently loaded in the KLN 90B is displayed (figure 2-4). If the database is out of date the word **EXPIRES** changes to **EXPIRED**.

7. Press [ENT] to acknowledge the information on this page and to continue the update procedure. The estimated load time in minutes is now displayed (figure 2-5).

NOTE: *In steps 5, 6, and 7, repeated presses of [CLR] will terminate the update process and bring the display back to the original SET 0 page shown in figure 2-2.*

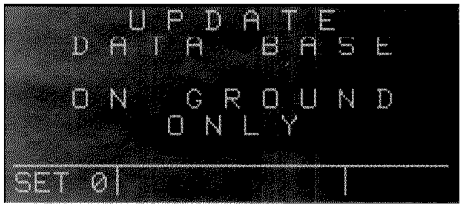

Figure 2-2

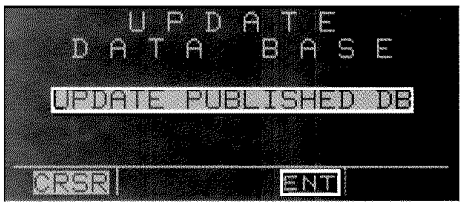

Figure 2-3

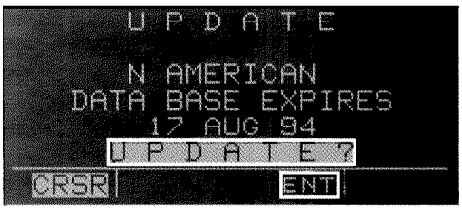

Figure 2-4

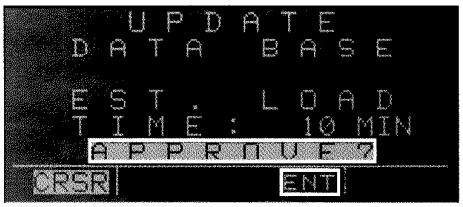

Figure 2-5

8. Press [ENT] to acknowledge the estimated load time and begin erasing the existing database. The unit will now display **ERASING DATA BASE** (figure 2-6). After the database has been erased, loading of the new data begins automatically. As the new data is being loaded, the percentage of transfer is displayed (figure 2-7).

9. Monitor the computer screen. When the first disk is complete the computer screen will display "Insert Disk 2 then press any key to continue." Disk 1 should now be removed from the disk drive and disk 2 should be inserted. Press any key on the computer. The load operation will continue. If there are 3 disks the computer screen will prompt when to use disk 3.

10. The KLN 90B will indicate when the database update is complete as shown in figure 2-8. The computer screen will display the new database expiration date. You may either turn the KLN 90B off at this point or press [ENT] to restart the KLN 90B.

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

The chances are small of having difficulty updating the database 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 connection or the computer the KLN 90B will display **LOADER NOT READY**. When the problem is corrected this prompt is removed and the update operation can continue from where it left off.

If the wrong disk is inserted the computer screen will display "Incorrect Disk - please insert disk __.", where the number 2 or 3 is inserted in the blank.

If an internal test fails after the data has been loaded, the KLN 90B will display **CHECKSUM ERROR, DATA BASE INVALID, ACKNOWLEDGE?**. Press [ENT] to acknowledge. The KLN 90B will then display **RETRY** and **EXIT**. Use the left 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 Bendix/King Service Center in identifying the problem.

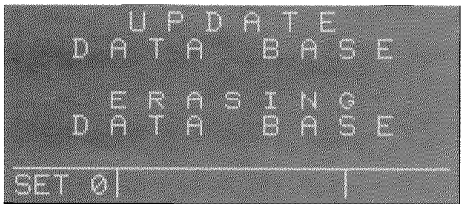

Figure 2-6

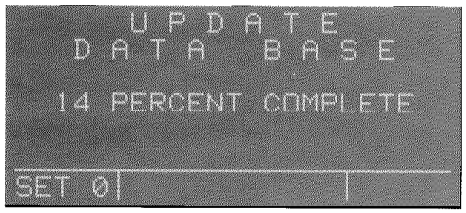

Figure 2-7

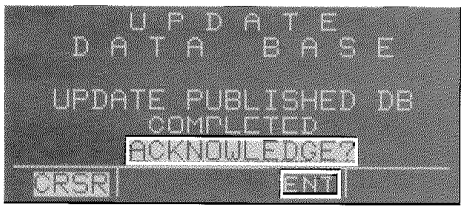

Figure 2-8

2.4.2 Cartridge Exchange Updating of the Database

To exchange the KLN 90B cartridge it is necessary to remove the KLN 90B from the aircraft's instrument panel. The KLN 90B and the mounting rack have been designed to provide for easy removal. Follow these steps to update the database cartridge.

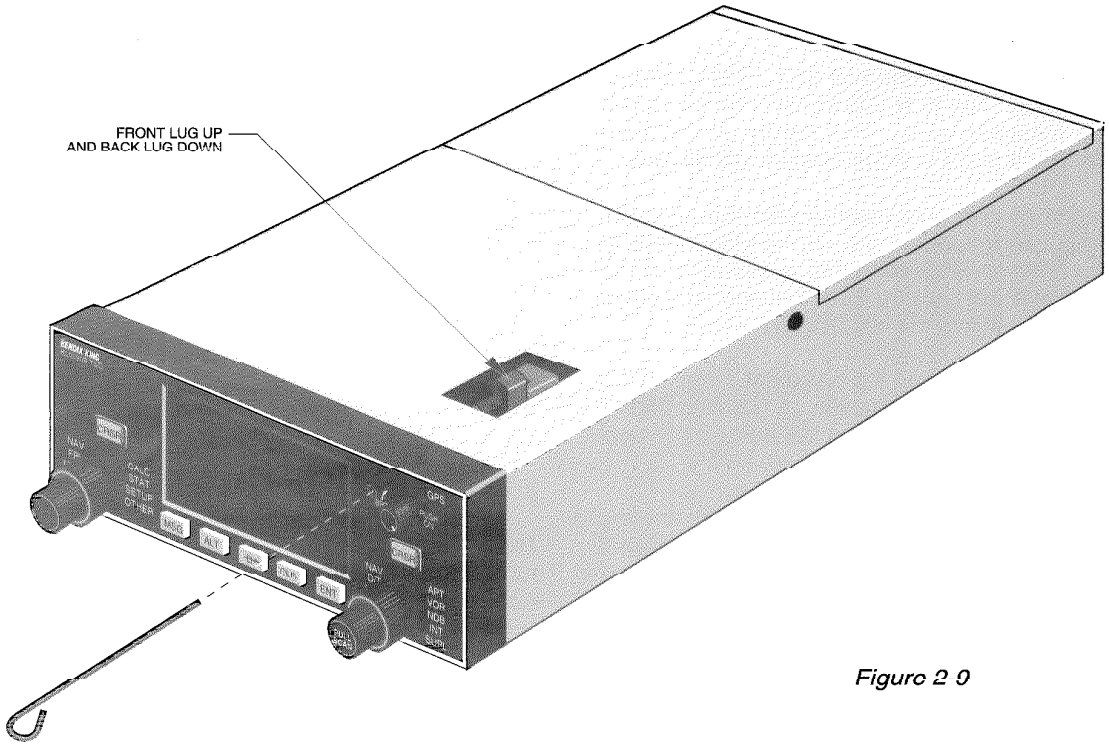

Figure 2-9

1. Insert the KLN 90B insertion/removal tool (supplied with unit) in the small hole located on the right side of the front of the unit (figure 2-9). A standard 3/32 inch Allen wrench may also be used.

2. Turn the tool counterclockwise until the locking mechanism becomes loose and then continue turning counterclockwise until it just barely begins to become snug. Do not turn so far counterclockwise that the mechanism starts to bind and can no longer be turned.

3. The KLN 90B should now be loose from the rack. Pull the unit out of the rack by pulling on the sides of the radio's front panel. DO NOT REMOVE BY PULLING ON THE KNOBS.

4. Remove the old database cartridge by pulling it straight out the back of the KLN 90B (figure 2-10).

5. Remove the new database cartridge from its shipping container. Note that the label on the cartridge indicates

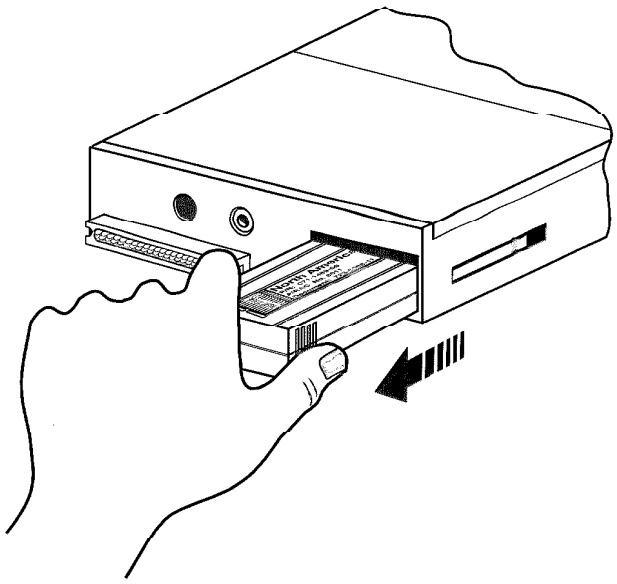

Figure 2-10

which side is up and which end to insert into the KLN 90B. Insert the new cartridge into the back of the unit. When the cartridge is properly inserted, the "Insert To Here" marking on the label can just be seen protruding from the rear of the KLN 90B (figure 2-11).

6. Make sure that the front lug of the locking mechanism is in the up position (figure 2-9). Insert the KLN 90B back in the rack as far as it will go.

7. Re-insert the insertion/removal tool. Turn the tool clockwise until snug. The KLN 90B should now be locked back into the mounting rack. Pull gently on the front panel to verify that the unit is indeed locked into its rack.

8. The container which was used to ship the new cartridge to you is used to return the old cartridge back to AlliedSignal. A return shipping label is included in the container. Remove the backing from the label and place it in the address position of the shipping container.

9. Insert the old cartridge into the container. Peel off the protective backing from the adhesive on the end flap of the container. Press the flap against the adhesive to seal the container.

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

2.5 USER DEFINED DATABASE

In addition to the published database of airports, VORs, NDBs, and intersections stored in the cartridge, you may create up to 250 other waypoints. These waypoints may be designated by you to be one of the four waypoint types above or as a waypoint not falling into one of these types. In the latter case the waypoint is called a Supplemental waypoint. Section 5.4 describes how you may create a user-defined waypoint.

2.6 INTERNAL MEMORY BACKUP BATTERY

The KLN 90B contains an internal lithium battery that is used to "keep-alive" the user-defined database 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 Bendix/King Service Center.*

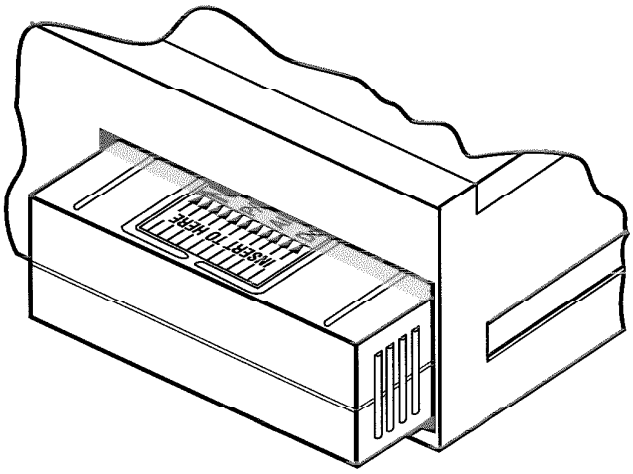

Figure 2-11

2.7 DATABASE UPDATE SERVICE OPTIONS

The following tear-out pages can be used for ordering the North American and International database update services from AlliedSignal. The forms may be mailed or faxed for your convenience.

CHAPTER 4 - LEVEL 2 OPERATION

This is the second of four chapters specifically dealing with operating the KLN 90B. In this chapter you will learn to create and use flight plans. A flight plan is an organized listing of waypoints defining your route of flight.

You may feel that you learned all you need to know in chapter 3 about operating the KLN 90B, since you can use the Direct To operation to fly anywhere you want to go. However, you would be selling yourself and the KLN 90B short if you stop there. Using the unit's flight plan capabilities provides more information and, in some respects, reduces your enroute workload regardless of whether your flying is done VFR or IFR. Other advantages of creating flight plans are: (1) the entire route of flight for an upcoming trip can be created and stored prior to departure; and (2) the routes for frequently made trips need to be created just once and may then be recalled as required for later use. Using the KLN 90B only for Direct To operation would be like flying a retractable gear aircraft with the gear down all the time — you're just not getting the most out of your equipment!

4.1 CREATING AND MODIFYING FLIGHT PLANS

The following rules and considerations apply to KLN 90B flight plans:

- The KLN 90B is capable of storing in its memory 25 flight plans plus an active flight plan.
- Each of the flight plans may contain up to 30 waypoints. These waypoints may consist of any combination of published waypoints from the database or user created 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 in one of the flight plans numbered as FPL 1, FPL 2, FPL 3,..., or FPL 25. 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 90B 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 the flight plan:

1. Rotate the left outer knob to select the flight plan (FPL) type pages (figure 4-1).

2. Turn the left inner knob to select a flight plan page (preferably other than FPL 0) which does not contain a flight plan (figure 4-2). If all of the flight plan pages contain flight plans, refer to section 4.1.5, "Deleting Flight Plans."

3. Press the left CRSR to turn on the cursor function for the left page (figure 4-3).

NOTE: *The KLN 90B 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, or Canada. See section 2.3, "USE OF ICAO IDENTIFIERS."*

4. Use the left inner knob to select the first character of the departure waypoint identifier (figure 4-4).

5. Turn the left outer knob one step clockwise to move the flashing portion of the cursor over the second character position, and then use the left inner knob to select the desired character.

6. Use the above procedure to select the entire identifier for the first waypoint (figure 4-5).

7. Press ENT. A waypoint page for the identifier just entered will be displayed on the right side (figure 4-6). If a mistake was made and the wrong waypoint identifier was entered, press CLR and begin again. If a mistake was not made but the waypoint identifier just entered isn't in the database, a page allowing creation of a user defined waypoint will appear on the right side. Refer to section 5.4, "USER-DEFINED WAYPOINTS", for instruction on how to define a user created waypoint.

8. Press ENT again to approve the waypoint page being displayed. The cursor will move to the second waypoint position (figure 4-7).

NOTE: *A small number of waypoints are stored in the database as "fly-over" waypoints. These waypoints are associated with SID/STAR procedures. "Fly-over" means*

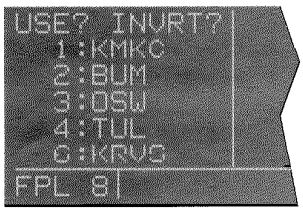

Figure 4-1

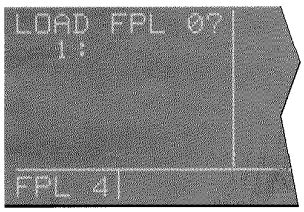

Figure 4-2

Figure 4-3

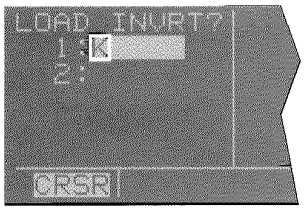

Figure 4-4

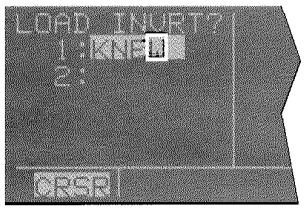

Figure 4-5

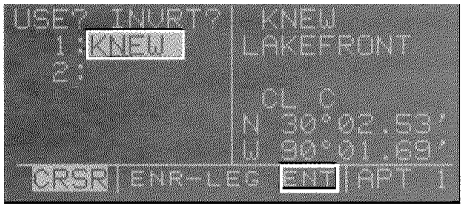

Figure 4-6

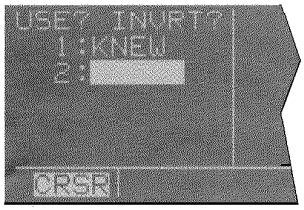

Figure 4-7

that, for some reason, the governing agencies have decided that it is important to fly directly over the waypoint instead of being able to "cut the corner" by using turn anticipation (see section 4.2.2). In these cases the KLN 90B will present a waypoint type identification page (Figure 4-7a). Simply select the way in which the waypoint is intended to be used with the left outer knob and press ENT. *If the SID/STAR choice is selected, the KLN 90B will disable turn anticipation for that waypoint (if previously enabled). The KLN 90B 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.*

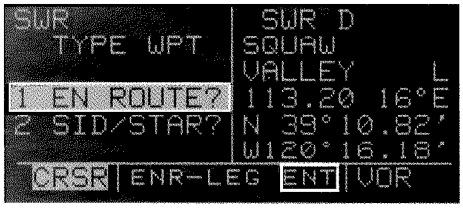

Figure 4-7a

9. Use the same procedure to enter the rest of the waypoints in the flight plan (figure 4-8). If the flight plan consists of five or more waypoints, the waypoints will automatically scroll as necessary to allow entry of the next waypoint.

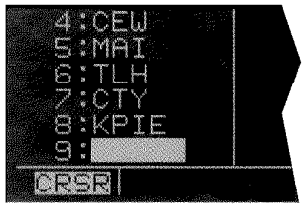

Figure 4-8

10. When all of the waypoints have been entered in the flight plan, the left 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 six or more waypoints since not all of the waypoints can be displayed at one time. When the left outer knob is rotated to the full counterclockwise position, the cursor will be positioned over **USE?** (figure 4-9). If there are more than five waypoints in the flight plan, the first four waypoints will then be displayed followed by the last waypoint in the flight plan. Rotate the left outer knob to move the cursor and manually scroll to see the missing intermediate waypoints.

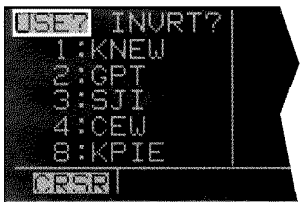

Figure 4-9

11. Press the left CRSR to turn off the left cursor function. Additional flight plans may now be created in the same manner.

4.1.2 Activating A Numbered Flight Plan

To activate one of the previously created numbered flight plans:

1. Use the left outer knob to select the flight plan (FPL) type pages.

2. Rotate the left inner knob to select the desired flight plan (figure 4-10).

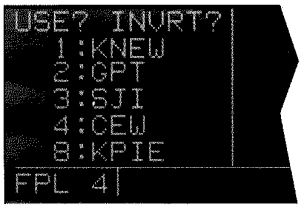

Figure 4-10

3. Press the left CRSR to enable the left cursor function. The cursor will appear over **USE?** (figure 4-11). If you haven't left the numbered flight plan page since creating this flight plan, rotate the left outer knob all the way counterclockwise to position the cursor over **USE?**

Figure 4-11

4. 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 left outer knob one step clockwise to position the cursor over **USE? INVRT?** before pressing ENT (figure 4-13).

5. 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.

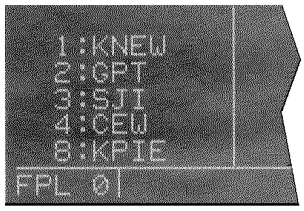

Figure 4-12

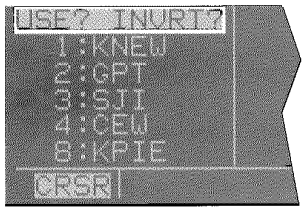

Figure 4-13

4.1.3 Adding A Waypoint To A Flight Plan

A waypoint may be added to any flight plan containing fewer than 30 waypoints. To add a waypoint to a flight plan:

1. Press the left CRSR to enable the left cursor function if it is not on already (figure 4-14).

2. Rotate the left outer knob as necessary to 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 third waypoint in the flight plan and you wish to insert **BUGLE** intersection in the number three position in front of **SJI**, move the cursor over **SJI** (figure 4-15).

3. Use the left 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 four (figure 4-16).

4. Use the left outer and inner knobs in the normal manner to complete entering the waypoint identifier (figure 4-17).

5. Press ENT to display the waypoint page on the right side for the identifier just entered.

6. Press ENT again to approve the waypoint page (figure 4-18).

7. Press the left CRSR to turn off the left cursor function.

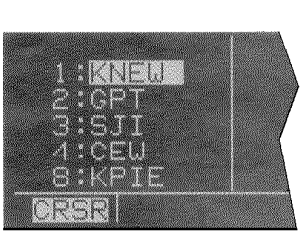

Figure 4-14

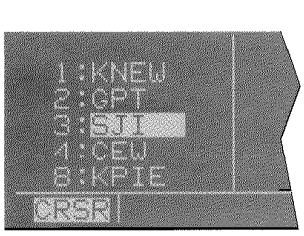

Figure 4-15

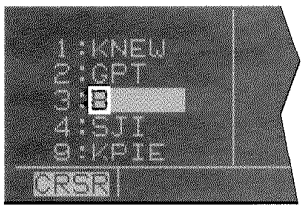

Figure 4-16

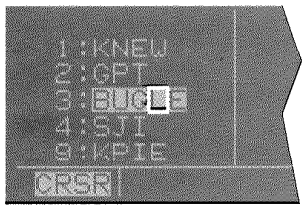

Figure 4-17

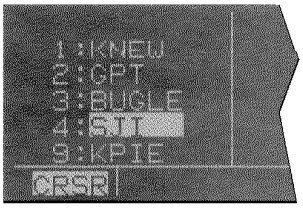

Figure 4-18

4.1.4 Deleting A Waypoint From A Flight Plan

To delete a waypoint from a flight plan:

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

2. Rotate the left outer knob as necessary to position the cursor over the waypoint to be deleted (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.

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).

5. Press the left CRSR to turn off the left cursor function.

Figure 4-19

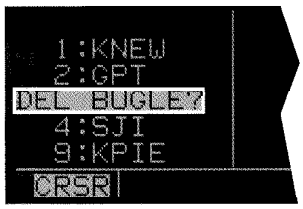

Figure 4-20

Figure 4-21

4.1.5 Deleting Flight Plans

To delete a flight plan which is no longer required:

1. Display the flight plan (FPL 0, FPL 1, FPL 2,..., or FPL 25) which is to be cleared (figure 4-22).

2. Make sure the left cursor function is turned off. If the left cursor is on, press the left CRSR to turn it off.

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.

4. Press ENT to clear the flight plan (figure 4-24).

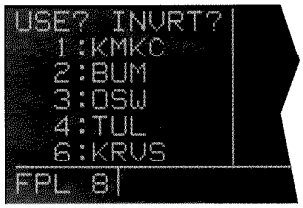

Figure 4-22

Figure 4-23

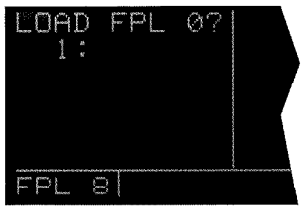

Figure 4-24

4.1.6 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 4-25). If none exist, use the procedure described in section 4.1.5, "Deleting Flight Plans," to clear a flight plan which is no longer required.

2. Press the left CRSR to turn on the left cursor function with the cursor over the blank first waypoint position (figure 4-26).

3. Rotate the left outer knob one step counterclockwise to position the cursor over **LOAD FPL 0?** (figure 4-27).

4. Press ENT to load the active flight plan into this numbered flight plan (figure 4-28).

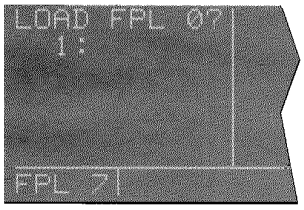

Figure 4-25

Figure 4-26

Figure 4-27

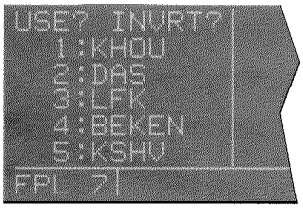

Figure 4-28

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 90B for flight plan operation. The following rules and considerations apply for flight plan operation while the KLN 90B is in the Leg mode:

- Although any of the KLN 90B pages may be utilized while operating along a flight plan, common page selections are the FPL 0 page on the left side while simultaneously displaying one of three Distance/Time pages (D/T 1, D/T 2, D/T 3) or the NAV 5 page (navigation graphics) on the right side. The information contained on the Distance/Time pages is explained later, beginning in section 4.2.5, "The Distance/Time Pages". The Super NAV 5 page is especially useful for flight plan operation. It provides you with a visual orientation of your position in the active flight plan and displays the alphanumeric identifiers of the flight plan waypoints. Of course the other four Navigation pages may also be used extensively. Now would be a good time to take a couple of minutes and review the NAV 5 and Super NAV 5 pages as they relate to flight plan operation (see sections 3.9.6 and 3.9.7).

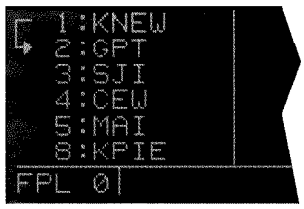

Figure 4-29

- 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 waypoints (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 4-29, **GPT** is the "to" waypoint. The tail of the ↳ symbol is positioned to the left of the "from" waypoint. **KNEW** is the "from" waypoint in figure 4-29. The ↳ symbol is not displayed unless the KLN 90B is actually receiving navigation 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. If in doubt as to whether or not Direct To operation is occurring, view the NAV 1 page. If the top line shows the B→ symbol (figure 4-30) instead of a "from" waypoint (figure 4-31), then Direct To navigation is occurring. If it is desired to cancel the Direct To operation and operate from the active flight plan; press [B→], then press [CLR], then press [ENT].

Figure 4-30

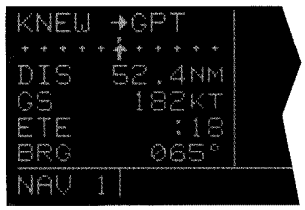

Figure 4-31

- As flight plan waypoints are reached, the active leg symbol automatically orients itself on 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 4-32).

- The last waypoint in the flight plan is always displayed at the bottom 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 intermediate waypoints, turn the left cursor function on and use the left 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 4-33).

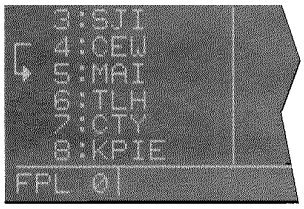

Figure 4-32

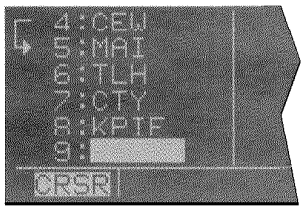

Figure 4-33

4.2.2 Turn Anticipation And Waypoint Alerting

Prior to reaching a waypoint in the active flight plan, the KLN 90B will provide navigation along a curved path segment to ensure a smooth transition 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 4-34. This feature is called turn anticipation. The transition course is based upon the aircraft's actual groundspeed and the amount of course angle change between the two legs. The KLN 90B automatically sequences to the next leg after passing the midpoint in the transition segment.

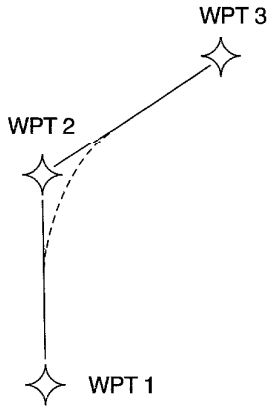

Figure 4-34

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, Distance/Time page, or waypoint page displaying the active waypoint identifier (figure 4-35). On the Super NAV 5 page, the entire active waypoint identifier will start to flash. 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.

To utilize the turn anticipation feature, start the turn transitioning to the next leg in the flight plan at the very beginning of turn anticipation. This occurs when the external waypoint alert annunciator or the active waypoint identifier on the Super NAV 5 page stops flashing and goes on steady. At this time the KLN 90B will notify you with a message on the Message page of the new desired track to select on your HSI or CDI.

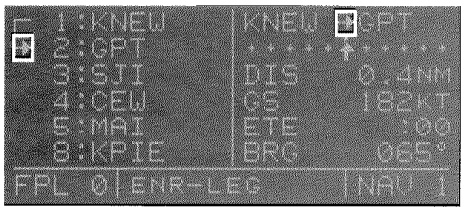

Figure 4-35

ADJ NAV IND CRS TO 123°

A message will not be given if the change in desired track (course change) is less than 5°. In addition, a message will not be given if the KLN 90B is interfaced with an EHSI or HSI having a course pointer that is automatically slewed to the correct desired track.

The desired track (**DTK**) displayed on the NAV 3 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.

In some installtions the KLN 90B can "read" the selected course set on external CDIs or HSIs. In these installations the KLN 90B will flash the value of desired track (DTK) on both the NAV 3 and Super NAV 5 pages when the desired track and the selected course differ by more than 10°. Set the selected course to match the desired track. This will make sure that the orientation "picture" is always correct.

If desired, turn anticipation may be disabled (or enabled) on the Setup 6 page (**SET 6**) using the left CRSR and the left inner knob to select between **DISABLE** or **ENABLE** (figure 4-36). If turn anticipation is disabled, navigation is provided all the way to the waypoint, and waypoint alerting occurs approximately 36 seconds prior to actually reaching the waypoint.

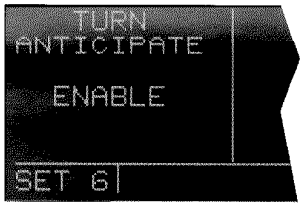

Figure 4-36

4.2.3 Viewing The Waypoint Pages For The Active Flight Plan Waypoints

The waypoint pages(s) for each of the waypoints in the active flight plan may be easily displayed by selecting the Active Waypoint page type (**ACT**) on the right side. When the ACT page type is first selected, the waypoint page for the active waypoint will be displayed (figure 4-37). 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. The letter to the far right of the identifier designates the type of waypoint: **A** = airport, **V** = VOR, **N** = NDB, **I** = intersection, **S** = supplemental or **T** = terminal (for details on terminal waypoints see section 6.1.2). For VORs having DME capability, the letter D is displayed between the VOR identifier and the V. To view the other waypoints in the flight plan, pull the right inner knob to the "out" position and turn it to view each of the waypoints in the order they are contained in the flight plan (figure 4-38). For airport waypoints, the right inner knob may be pushed back to the "in" position and rotated to display any of the eight airport pages (figure 4-39). Pulling the knob back out will allow further scanning of the waypoint pages in the active flight plan.

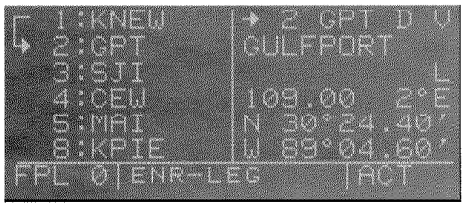

Figure 4-37

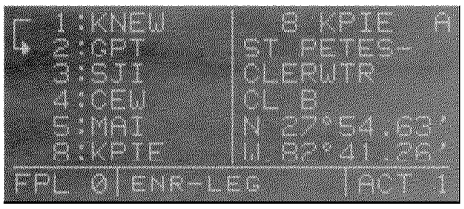

Figure 4-38

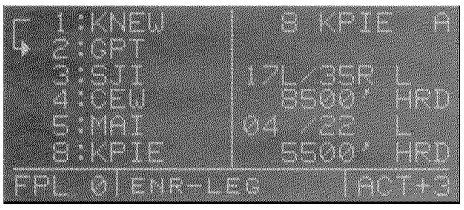

Figure 4-39

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 flight plan. For example, after takeoff it is common to receive radar 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 90B 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. The procedure below takes advantage of rule number 1 described in section 3.8.

1. Select the FPL 0 page of the left side.

2. Press the left CRSR and then use the left outer knob to position the cursor over the desired waypoint (figure 4-40).

3. Press D→. The waypoint page for the selected waypoint in FPL 0 will be displayed on the right side (figure 4-41).

4. Press ENT to approve the waypoint page. The Direct To waypoint identifier in the active flight plan will now be preceded by just an arrow (figure 4-42). The ↳ symbol is not displayed since there is no "from" waypoint in the flight plan.

An alternative method is to use the Super NAV 5 page to select the direct to waypoint. This is done by pulling out on the right inner knob. With the inner knob out, it is possible to scan through the waypoints of the active flight plan as described in section 3.9.7. When the desired waypoint is highlighted, press D→ and then ENT.

If for some reason 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 D→, then press CLR, and then press ENT.

4.2.5 The Distance/Time Pages

As stated earlier, it is common to use the Distance/Time pages in conjunction with flight plan operation. The Distance/Time pages are specially designed to be most useful when the active flight plan page (FPL 0) is displayed simultaneously on the left side.

4.2.6 The Distance/Time 1 Page (D/T 1)

When the FPL 0 page is displayed on the left side and the D/T 1 page is displayed on the right side, the distance (**DIS**) and estimated time enroute (**ETE**) are displayed for each of the active flight plan waypoints (figure 4-43). The distance displayed is the cumulative distance from the aircraft's present position to each waypoint along the flight plan route. The ETE is displayed in hours:minutes. If Direct To operation is occurring to a waypoint that is not in the active flight plan, then the D/T 1 page is blank when the FPL 0 page is displayed on the left (figure 4-44).

If a numbered flight plan page (FPL 1 though FPL 25) is displayed on the left side, the distances displayed are from the first waypoint in the flight plan and have nothing to do with the aircraft's present position. No ETEs are then shown (figure 4-45).

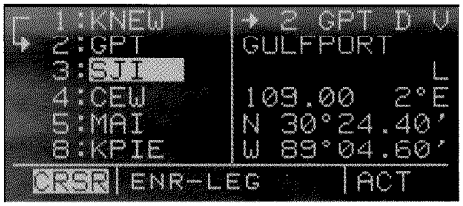

Figure 4-40

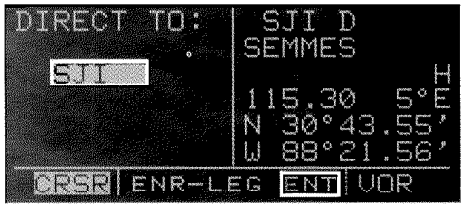

Figure 4-41

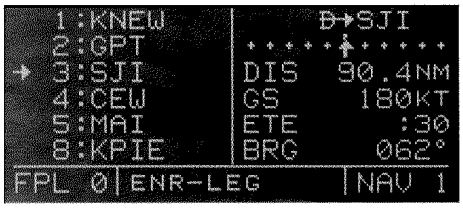

Figure 4-42

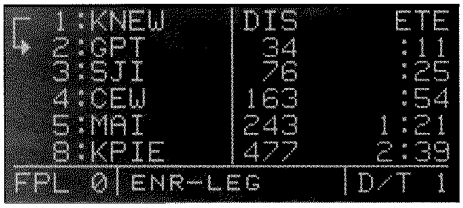

Figure 4-43

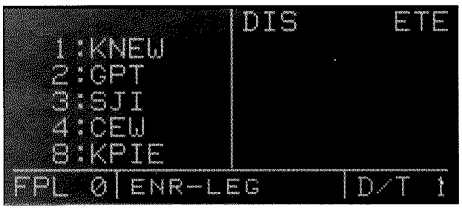

Figure 4-44

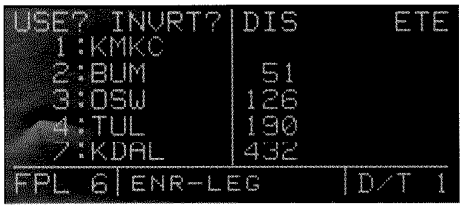

Figure 4-45

If a non-flight plan page is displayed on the left, the format of the D/T 1 page changes to display just the distance and ETE for the active waypoint and for the last waypoint in the flight plan (figure 4-46).

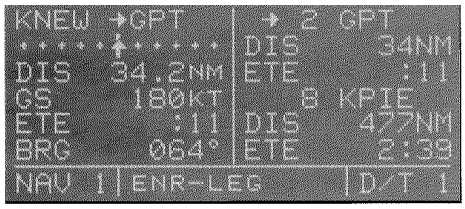

Figure 4-46

4.2.7 The Distance/Time 2 Page (D/T 2)

When the FPL 0 page is displayed on the left side and the D/T 2 page is displayed on the right side, the distance and estimated time of arrival are displayed for each of the active flight plan waypoints (figure 4-47). The distances are as described for the D/T 1 page. The time zone associated with the estimated time of arrival is annunciated at the top right of the D/T 2 page. The time zone may be changed by enabling the right cursor function to bring the cursor over the time zone, and then turning the right inner knob to select the desired time zone (figure 4-48). Changing the time zone on the D/T 2 page changes the time zone on other pages where time is displayed.

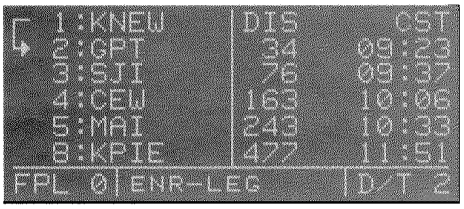

Figure 4-47

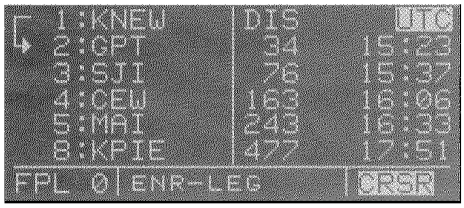

Figure 4-48

If a numbered flight plan page other than FPL 0 is displayed on the left side, no estimated times of arrival are displayed (figure 4-49).

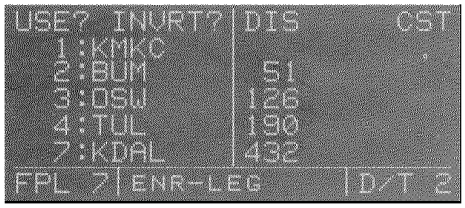

Figure 4-49

If a non-flight plan page is displayed on the left side, the format of the D/T 2 page changes to display just the distance and estimated time of arrival for the active waypoint and for the last waypoint in the flight plan (figure 4-50).

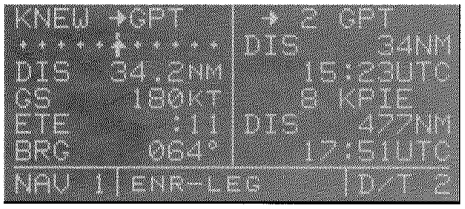

Figure 4-50

4.2.8 The Distance/Time 3 Page (D/T 3)

When any flight plan page is displayed on the left side and the D/T 3 page is displayed on the right side, the distance and desired track (**DTK**) are displayed (figure 4-51). The distances are as described for the D/T 1 page. The desired track is the great circle course between two waypoints. You should view the diagram in Appendix A if you are unfamiliar with this term.

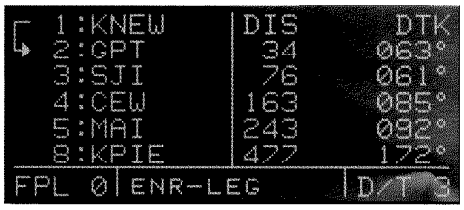

Figure 4-51

If a non-flight plan page is displayed on the left side, the format of the D/T 3 page changes to display just the distance and desired track for the active waypoint and for the next waypoint in the flight plan (figure 4-52). Note that this is different than for the D/T 1 and D/T 2 pages.

Figure 4-52

4.2.9 The Distance/Time 4 Page (D/T 4)

The format of the D/T 4 page does not change. It displays on a single page the pertinent times for the flight regardless of what is displayed on the left page and regardless of whether flight plan or Direct To operation is occurring (figure 4-53). The information displayed on the D/T 4 page is the following:

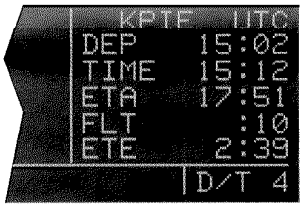

Figure 4-53

Figure 4-54

- The destination waypoint.
- The selected time zone. The time zone may be changed by pressing the right CRSR and using the right inner knob to select the desired time zone.
- **DEP** - The departure time. There are two definitions of departure time depending on what has been selected on the Setup 4 page (**SET 4** - see figure 4-54). If the SET 4 page displays **RUN WHEN GS > 30KT**, then the departure time is that time when the groundspeed first reached 30 knots. If instead, the SET 4 page displays **RUN WHEN POWER IS ON**, then the departure time is the time when power was applied to the KLN 90B. The SET 4 page may be changed by pressing the left CRSR while the SET 4 page is displayed on the left side and then rotating the left inner knob. Press the left CRSR again to turn the left cursor function off.
- **TIME** - The present time. The time may be reset on the Self Test page at system turn-on or on the SET 2 page.
- **ETA** - The estimated time of arrival at the destination waypoint.
- **FLT** - The flight time. If **RUN WHEN GS > 30 KT** is selected on the SET 4 page, then flight time is the amount of time that the aircraft's groundspeed has been above 30 knots. Normally, this will be the time since takeoff. However, time spent at groundspeeds less than 30 knots such as intermediate stops without shutting down power or helicopter hovering is not counted as flight time.

  If the present position flags (NAV flag) after being valid in the NAV mode, the flight timer continues to run if the groundspeed was more than 30 knots immediately before the flag.

  If **RUN WHEN POWER IS ON** is selected on the SET 4 page, then flight time is the time since power on.
- **ETE** - Estimated time enroute to the destination waypoint.

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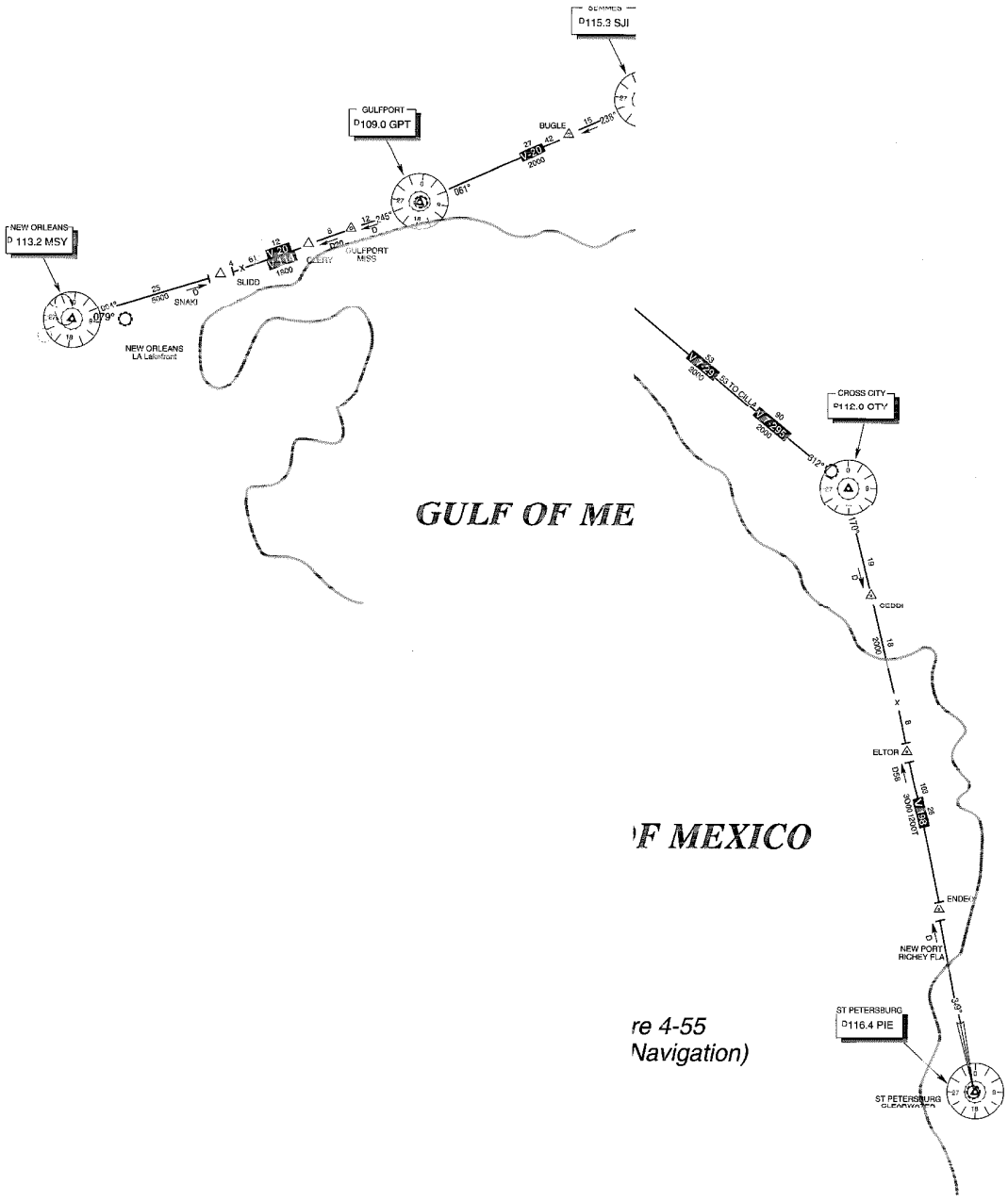
4.3 SAMPLE TRIP

Let's use a sample trip to illustrate some of the KLN 90B's fl
Pilot's Guide. The flight will be from Lakefront airport in Ne
international airport (**KPIE**). You decide to fly mostly an inla
restricted areas and MOAs and also to avoid thunderstorms w
4-55). The pages viewed in this scenario assume that the Kl
installation is not interfaced with an external HSI or CDI, the
NAV 1 and Super NAV 1 pages than presented here.



*F MEXICO

re 4-55
Navigation)

4.3.1 Pre-Departure

1. After turn-on and approval of the Self Test and Database pages, the APT 4 page (airport communication frequencies) for **KNEW** is displayed on the right side of the screen. Viewing the APT 4 page, you set up the COMMs for ATIS, Clearance Delivery, Ground, and Tower.

2. You create the flight plan on the FPL 4 page exactly as described for this route in section 4.1.1. The flight plan route is from **KNEW**, to **GPT** (Gulfport VOR), to **SJI** (Semmes VOR), to **CEW** (Crestview VOR), to **MAI** (Marianna VOR), to **TLH** (Tallahassee VOR), to **CTY** (Cross City VOR), to **KPIE**.

3. The flight plan is now activated (made FPL 0) as described in section 4.1.2.

4. Until the KLN 90B reaches a NAV ready status, there is no ↳ symbol to indicate the active flight plan leg on the FPL 0 page and no distances displayed on the D/T 1 page (figure 4-56).

5. Shortly, the KLN 90B reaches a NAV ready status (figure 4-57). You see that the distance is 496 NM to St. Petersburg/Clearwater along the flight plan route. The active leg of the flight plan is **KNEW - GPT** and is so indicated on the FPL 0 page 2 with the ↳ symbol.

6. You briefly view the D/T 3 page to determine that the desired track to the first waypoint, **GPT**, is 63 degrees (figure 4-58).

4.3.2 Enroute

1. After departure from runway 18R at Lakefront airport, you receive radar vectors out of the New Orleans Class B airspace. Finally, you are cleared direct Gulfport. At this point you are slightly South of the original course because of the radar vectors. Since you are displaying the D/T 1 page (a non-waypoint page) on the right side, to proceed direct to the active waypoint in the flight plan you press [D→], and then press [ENT] (figure 4-59). Remember that if a waypoint page would have been displayed on the right side when [D→] was pressed, the Direct To page would have contained that waypoint's identifier, not the active waypoint's identifier). You reselect the D/T 1 page on the right side (figure 4-60). Since you are still climbing at 120 knots, the ETEs are not representative of what they will be when you level off at cruise speed.

2. Approaching Gulfport, the arrow adjacent to **GPT** begins flashing. This waypoint alert notification begins approximately 20 seconds before the time to start your turn to join the second flight plan leg, **GPT - SJI**. You briefly view the D/T 3 page to see that the next desired track is 61 degrees.

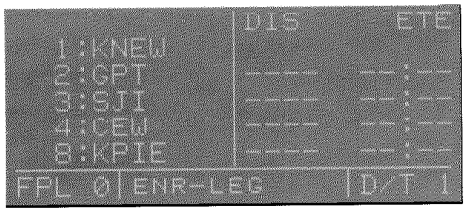


Figure 4-56

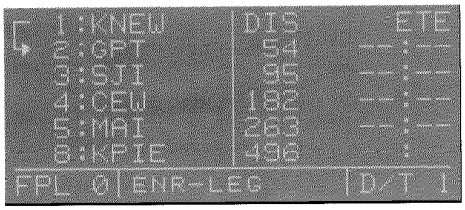


Figure 4-57

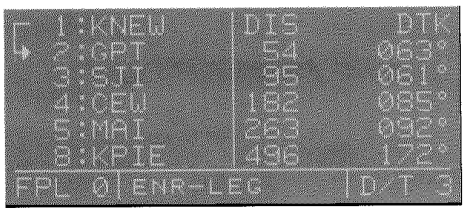


Figure 4-58

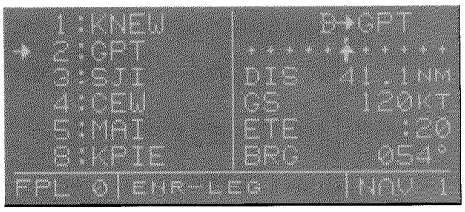


Figure 4-59

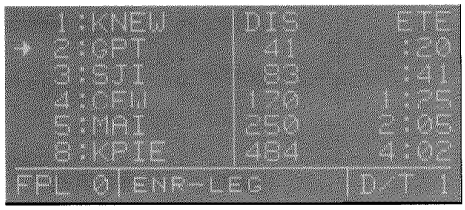


Figure 4-60

3. As you pass abeam GPT, the leg orientation automatically changes to the second leg (figure 4-61).

4. After joining the second leg of the flight plan, you view the D/T 1 page to see that the ETE to **SJI** is 14 minutes and that the ETE to your destination is 2 hours and 28 minutes. The D/T 2 page indicates you should arrive over **SJI** at 9:37 am Central Standard Time and at **KPIE** at 11:51 am. Since **KPIE** is on Eastern Standard Time, you use the right cursor and right inner knob to change the time zone to **EST** (figure 4-62). You may decide a better alternative is to select Coordinated Universal Time (UTC, which is also called Zulu time). In addition, you briefly check the D/T 4 page to get a display of your departure time, the actual time, the flight time so far, and the ETA and ETE to **KPIE** (figure 4-63).

5. Just prior to reaching Semmes (**SJI**) the waypoint alert notification begins flashing to indicate the upcoming arrival at Semmes. A few seconds later you view a message on the Message page stating: **ADJ NAV IND CRS TO 85°.** This is your notification that there is a course change of at least 5° and that you should set the course pointer on your HSI or CDI to 85°. You should immediately begin a turn to intercept the new desired track of 85°.

6. About 80 NM from Crestview (**CEW**), you decide to view the Super NAV 5 page with the 160 NM range scale selected (figure 4-64). The track up map orientation (**TKt**) has been selected on the Super NAV 5 page.

7. As your aircraft continues toward Crestview, you decide to take advantage of the moving map display capability of the Super NAV 5 page. While on the 60 nm range of the Super NAV 5 page, you press the right CRSR to bring the menu selection on the page as you learned in section 3.9.7. Using the right inner knob you select low and high altitude VORs. Pressing the right CRSR once again removes the menu from the page and Monroeville (**MVC**), Saufley (**NUN**), and Brookley (**BFM**) VORs are now displayed on the map (figure 4-65).

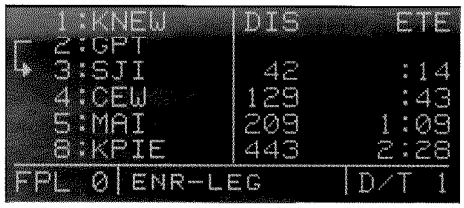


Figure 4-61

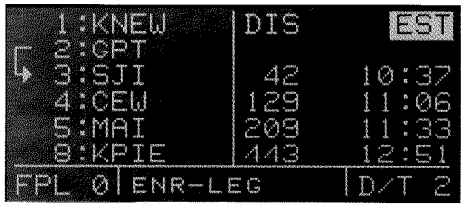


Figure 4-62

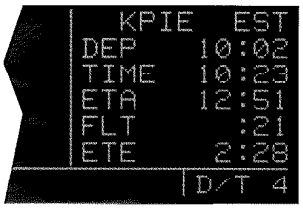


Figure 4-63

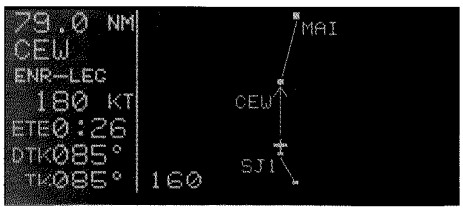


Figure 4-64

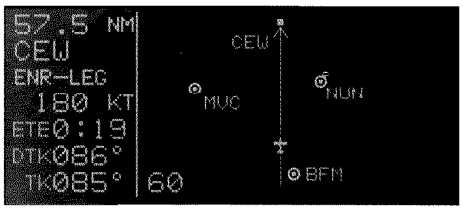


Figure 4-65

8. When you are 20 NM West of **MAI**, you decide to proceed direct to Cross City VOR (**CTY**). To do this from the Super NAV 5 page, you pull out the right inner knob and scan through the active flight plan until CTY is displayed (figure 4-66). Next, you press [D→] to view the waypoint page for CTY, and then press [ENT] to navigate directly to CTY (figure 4-67).

9. Over **CTY** you check the weather and determine that it is currently marginal VFR at St. Petersburg and that you may have to shoot the ILS 17L approach. You add **CAPOK**, the outer compass locator for runway 17L, to your flight plan using the same procedure as described in section 4.1.3 (figure 4-68).

10. To prepare yourself for the arrival into St. Petersburg/Clearwater International airport, you familiarize yourself with the database information for **KPIE**. The easiest way to do this is to select the ACT pages on the right side. If necessary, scan the waypoints in the active flight plan by first pulling the right inner knob to the "out" position. Then, rotate it to view the desired waypoint. For **KPIE**, push the right inner knob back to the "in" position and rotate it to display the eight airport pages.

11. By the time you get to the St. Petersburg terminal area, the weather has cleared so that an instrument approach is not necessary. You delete **CAPOK** from the flight plan exactly as described in section 4.1.4.

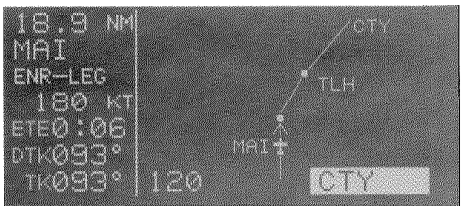


Figure 4-66

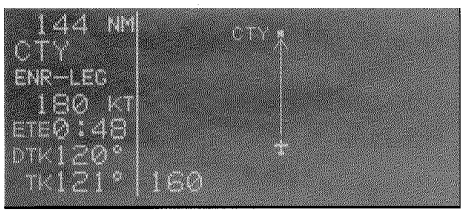


Figure 4-67

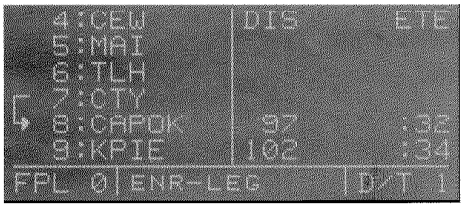


Figure 4-68

CHAPTER 5 - LEVEL 3 OPERATION

This is the third of four chapters specifically dealing with operating the KLN 90B. In this chapter you will learn to use many of the supplementary features of the KLN 90B. These include such things as the Advisory VNAV, the Trip Planning pages, the Calculator pages, and other features that you may find very beneficial and convenient to use in your flying.

5.1 TRIP PLANNING

There are seven Trip Planning pages (**TRI**) that can be displayed on the left side of the screen. The KLN 90B allows three kinds of trip planning. The TRI 1 and TRI 2 pages team together to provide trip planning from your present position to any waypoint of your choice. The TRI 3 and TRI 4 pages provide trip planning between any two waypoints, and the TRI 5 and TRI 6 pages provide an analysis of any of the 26 flight plans (FPL 0, FPL 1, FPL 2, ..., FPL 25) stored in the Flight Plan pages. The TRI 0 page is used to enter estimates of your true airspeed and of the winds so that the KLN 90B can perform wind triangle calculations for use on the other Trip Planning pages.

Data entered on any of the Trip Planning pages has no effect on navigation data provided on any Navigation (NAV) or Flight Plan (FPL) pages. You may perform trip planning without disturbing ongoing navigation.

NOTE: *The Trip Planning pages rely on pilot enterable inputs for true airspeed, groundspeed, and fuel flow. These pages do not utilize inputs from fuel flow or air data sensors. Fuel management and air data pages are discussed in section 5.10 and 5.11.*

NOTE: *Areas of special use airspace are displayed on the Trip Planning pages without regard to altitude.*

5.1.1 The Trip Planning 0 Page (TRI 0)

If desired, you may enter the aircraft's true airspeed (**TAS**) and the winds aloft on the TRI 0 page so that this information is utilized on the other Trip Planning pages. The KLN 90B uses the TAS and winds entered on the TRI 0 page to calculate your estimated groundspeed for specific trip planning routes you enter on the other Trip Planning pages.

To enter data on the TRI 0 page:

1. Select the TRI 0 page on the left side (figure 5-1).
2. Press the left CRSR to turn on the left cursor function.
3. Enter the aircraft's true airspeed by using the left outer knob to move the cursor to the desired location and the left inner knob to select each individual digit (figure 5-2).
4. Rotate the left outer knob clockwise to position the cursor over the first two digits of the wind direction (figure 5-3).
5. Turn the left inner knob to select the first two digits of the wind direction (figure 5-4).
6. Rotate the left outer knob one step clockwise to position the cursor over the last digit of the wind direction, and then use the left inner knob to complete the winds direction entry.
7. Enter the wind speed by using the left outer knob to move the cursor and the left inner knob to select each individual digit (figure 5-5).
8. Press the left CRSR to turn off the left cursor function.

Let's say you enter a TAS of 200 knots and winds of 180 degrees at 25 knots on the TRI 0 page. If you entered two waypoints on the TRI 3 page (trip planning between two waypoints) and the bearing from the first waypoint you entered to the second was 180 degrees, then the TRI 3 page would contain a groundspeed of about 175 knots. The reason we say **about** 175 knots is that the direction of the winds you enter are relative to true North and the bearing displayed is relative to magnetic North. Remember that winds information you get from a Flight Service Station or from an ATC facility is always provided relative to true North. On the TRI 5 and TRI 6 pages (trip planning for a flight plan), the winds are applied to each individual leg of the flight plan.

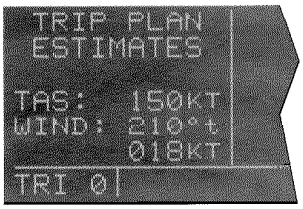


Figure 5-1

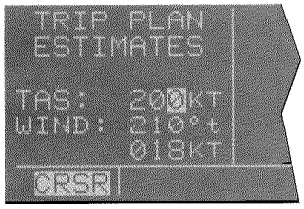


Figure 5-2

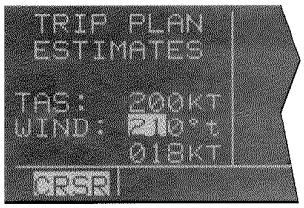


Figure 5-3

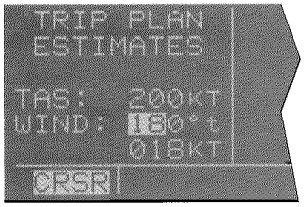


Figure 5-4

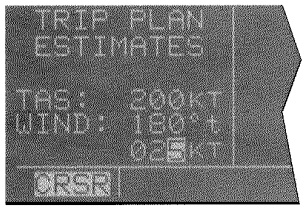


Figure 5-5

5.1.2 The Trip Planning 1 And Trip Planning 2 Pages (TRI 1 and TRI 2)

The TRI 1 and TRI 2 pages allow trip planning from your present position to any waypoint of your choice. Unlike the other Trip Planning pages, in order to utilize the TRI 1 and TRI 2 pages, the KLN 90B must either be receiving GPS signals sufficient to be in the NAV ready status or the KLN 90B must be in the take-home mode.

The TRI 1 page provides estimates of distance, estimated time enroute, bearing, and fuel requirements. The TRI 2 page displays the minimum enroute safe altitude (**ESA**) and any areas of special use airspace that lay between your present position and the selected waypoint. The TRI 1 and TRI 2 pages are useful, for example, while you are airborne and wish to determine distance, time, fuel, and altitude requirements direct to an alternate location.

NOTE: *Prior to using the TRI 1 and TRI 2 pages while the KLN 90B is in the take-home mode, use the SET 1 page to enter your present position. See section 3.6, "INITIALIZATION AND TIME TO FIRST FIX", for an explanation of entering position on the SET 1 page.*

For the following example let's say the aircraft is located over Battle Mountain VOR (**BAM**) enroute to Lake Tahoe and you wish to perform trip planning back to Salt Lake City International airport (**KSLC**). To perform trip planning on the TRI 1 and TRI 2 pages:

1. Use the left outer knob to select the TRI type pages on the left side.
2. Rotate the left inner knob to display the TRI 1 page on the left side (figure 5-6).
3. Press the left CRSR to turn on the left cursor function. The cursor will be over the waypoint identifier at the top of the page.
4. Use the left inner and outer knobs to enter the identifier of the selected waypoint (figure 5-7).
5. Press ENT to view the waypoint page for the selected waypoint on the right side.
6. Press ENT again to acknowledge the waypoint page. The distance, bearing, and estimated time enroute are now displayed (figure 5-8).

If you entered true airspeed and wind velocity information on the TRI 0 page, the groundspeed displayed is a result of those inputs applied to the direction of flight specified on the TRI 1 page. You may also enter any groundspeed you desire by using the left outer knob to position the cursor over each digit of the groundspeed and using the left inner knob to select each individual digit.

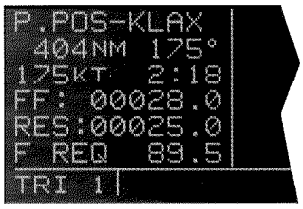


Figure 5-6

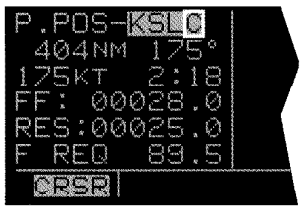


Figure 5-7

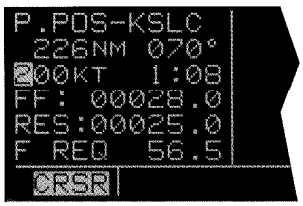


Figure 5-8

7. You can also calculate an estimate of the fuel required to the selected waypoint. Turn the left outer knob to position the cursor over the appropriate first digit adjacent to fuel flow (**FF**).

8. Use the left inner and outer knobs as before to enter the aircraft's rate of fuel flow. The unit (gallons, pounds, etc.) is not important as long as you are consistent (figure 5-9).

9. Use the left inner and outer knobs to enter the amount of reserve fuel (**RES**) desired when you reach the selected waypoint (figure 5-10). The estimated amount of fuel required (**F REQ**) to fly to the selected waypoint with the specified reserve is now displayed. Entering the fuel flow and reserve fuel on the TRI 1 page also inputs this same information on the TRI 3 and TRI 5 pages.

10. Press the left CRSR to turn off the left cursor function.

11. Select the TRI 2 page (figure 5-11). The minimum enroute safe altitude (ESA)) and a listing of areas of special use airspace along the route are displayed. If all of the areas of special use airspace won't fit on one page, there will be multiple TRI 2 pages indicated by **TRI+2.**

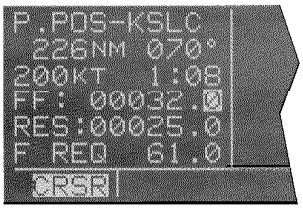


Figure 5-9

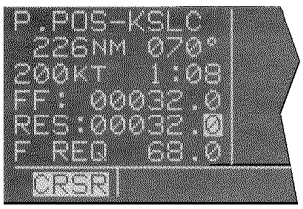


Figure 5-10

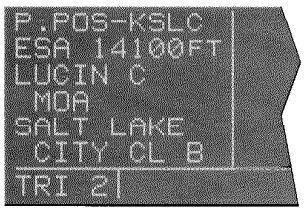


Figure 5-11

5.1.3 The Trip Planning 3 And Trip Planning 4 Pages (TRI 3 and TRI 4)

The TRI 3 and TRI 4 pages allow trip planning between any two waypoints. The KLN 90B does not have to be receiving GPS signals or even be connected to an antenna in order to utilize these pages. To use the TRI 3 and TRI 4 pages:

1. Select the TRI 3 page on the left side (figure 5-12).

2. Press the left CRSR to turn on the left cursor function. The cursor will be located over the "from" waypoint identifier (figure 5-13).

3. Use the left inner and outer knobs to enter the identifier of the "from" waypoint (figure 5-14).

4. Press ENT to view the waypoint page on the right side for the waypoint just entered.

5. Press ENT to approve the waypoint page. The cursor will be positioned over the "to" waypoint identifier (figure 5-15).

6. Use the left inner and outer knobs to enter the identifier of the "to" waypoint.

7. Press ENT to view the waypoint page on the right side for the waypoint just entered.

8. Press ENT to approve the waypoint page. The distance, bearing, and estimated time enroute are now displayed (figure 5-16).

If you entered true airspeed and wind velocity information on the TRI 0 page, the groundspeed displayed is a result of those inputs applied to the direction of flight specified on the TRI 3 page. You may also enter any groundspeed you desire by using the left outer knob to position the cursor over each digit of the groundspeed and using the left inner knob to select each individual digit.

If data is entered for fuel flow (**FF**) and reserve fuel (**RES**), as described for the TRI 1 page, the fuel required for the trip is now displayed. Fuel flow and reserve fuel entries made on the TRI 3 page also input this same data on the TRI 1 and the TRI 5 pages.

9. Turn off the left cursor function and then select the TRI 4 page (figure 5-17). The minimum enroute safe altitude (**ESA**) and a listing of areas of special use airspace along the route are displayed. If all of the areas of special use airspace won't fit on one page, there will be multiple TRI 4 pages by **TRI+4.**

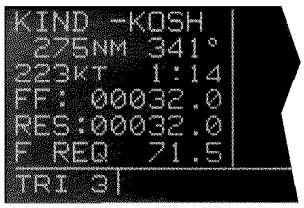


Figure 5-12

Figure 5-13

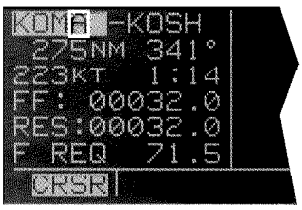


Figure 5-14

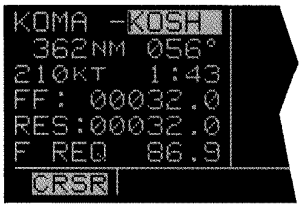


Figure 5-15

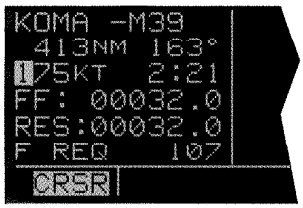


Figure 5-16

Figure 5-17

5.1.4 The Trip Planning 5 And Trip Planning 6 Pages (TRI 5 and TRI 6)

The TRI 5 and TRI 6 pages are used to do trip planning for any one of the previously entered flight plans (FPL 0, FPL 1, FPL 2, ..., FPL 25). The KLN 90B does not have to be receiving GPS signals or even be connected to an antenna in order to utilize these pages. To use the TRI 5 and TRI 6 pages:

1. Select the TRI 5 page on the left side (figure 5-18).

2. Press the left CRSR to turn on the left cursor function. The cursor will be located over the flight plan number.

3. Rotate the left inner knob to select the desired flight plan to be analyzed (figure 5-19). The first and last waypoints in the selected flight plan are displayed on the second line. The distance and estimated time enroute are also displayed. There is no bearing display since the flight plan can have up to 30 waypoints which creates 29 flight plan legs.

Figure 5-18

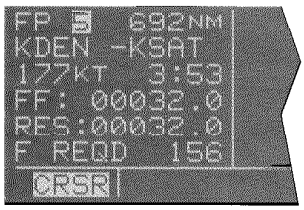


Figure 5-19

If you entered true airspeed and wind velocity information on the TRI 0 page, the groundspeed displayed is the average groundspeed for the flight plan. It is the result of the true airspeed and wind velocity entered on the TRI 0 page applied to each leg of the flight plan. You may also enter any groundspeed you desire by using the left outer knob to position the cursor over each digit of the groundspeed and using the left inner knob to select each individual digit.

If data is entered for fuel flow (**FF**) and reserve fuel (**RES**), as described for the TRI 1 page, the fuel required for the trip is now displayed. Fuel flow and reserve fuel entries made on the TRI 5 page also input this same data on the TRI 1 and the TRI 3 pages.

4. Turn off the left cursor function and then select the TRI 6 page (figure 5-20). The minimum enroute safe altitude (**ESA**) and a listing of areas of special use airspace along the flight plan route are displayed. If all of the areas of special use airspace won't fit on one page, there will be multiple TRI 6 pages indicated by **TRI+6.**

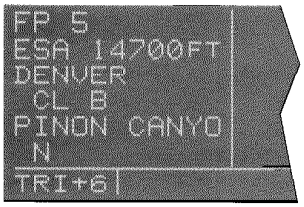


Figure 5-20

5.2 ADVISORY VNAV OPERATION

The KLN 90B's vertical navigation feature (VNAV) 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 90B will alert you of when to start the descent, and display the advisory altitudes to fly throughout the descent.

Figure 5-21

5.2.1 VNAV For Direct To Operation

The Navigation 4 (**NAV 4**) page is used to program the KLN 90B for vertical navigation. The following example will be used to illustrate how to use the VNAV feature. You are using the KLN 90B to fly direct to your destination airport, Dubuque Municipal airport (**KDBQ**) located in Dubuque, Iowa. You are presently about 65 nm West of Dubuque, flying at 7500 feet MSL (figure 5-21). You desire to use the VNAV to provide vertical guidance to Dubuque's traffic pattern altitude of 1900 feet MSL.

Figure 5-22

1. Select the NAV 4 page on either side of the screen (figure 5-22). You can select the NAV 4 page either by using the knobs or by pressing ALT to bring up the NAV 4 page on the right side and the ALT page on the left. The aircraft's actual altitude is displayed in the **IND** field. If the displayed altitude is incorrect it is probably because you have not recently updated the KLN 90B's altimeter baro setting on the ALT page (see section 3.15).

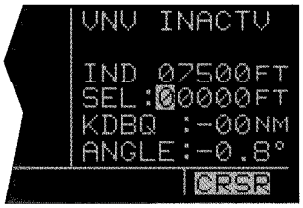


Figure 5-23

NOTE: *There may be some difference (less than 100 feet) between the indicated altitude (**IND**) and the aircraft's actual altitude if the altitude input to the KLN 90B 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 NAV 4 page. Prior to programming a VNAV operation, the top of the page displays that the VNAV is inactive (**VNV INACTV**).

2. Press the appropriate CRSR button to turn on the cursor function if it is not already on (figure 5-23).

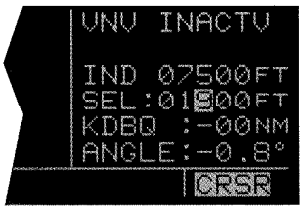


Figure 5-24

3. Enter the desired altitude of 1900 feet in the **SEL** field. The outer knob is used to move the cursor and the inner knob is used to select the digits. The altitude may be entered in 100 foot increments (figure 5-24).

NOTE: *If the KLN 90B does not have an altitude input, the **IND** and **SEL** fields will be labeled **FR** (from) and **TO** respectively. The aircraft's present altitude must be entered into the **FR** field and the desired altitude into the **TO** field.*

4. Use the 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 reaching the waypoint. 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 2 nm (figure 5-25).

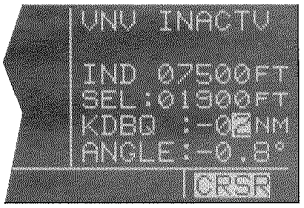


Figure 5-25

Notice that the bottom of the NAV 4 page now displays an angle. If you wish to start your descent now using the displayed descent angle, use the outer knob to position the cursor over the **ANGLE** field (figure 5-26). VNAV operation is initiated by bringing the cursor over the **ANGLE** field. Or, by leaving the cursor off of the **ANGLE** field, you may watch the VNAV angle increase as you fly toward your waypoint. When the desired angle is reached, position the cursor over the **ANGLE** field and VNAV will commence. When VNAV begins, the top of the page displays an advisory altitude. Just start a rate of descent so that the aircraft's altimeter matches the advisory altitude.

Figure 5-26

A better way yet to initiate VNAV is to program a desired angle to use for the descent. If you are not sure what a suitable descent angle is, use the CAL 4 page to calculate one for you. The CAL 4 page is described in section 5.3.4. After a little experience using the VNAV feature, you will soon learn what angles to use for your normal speeds and rates of descent. To program a descent angle:

5. Use the outer knob to move the cursor to the **ANGLE** field, and then enter the desired descent angle (figure 5-27). If the time to begin your descent is greater than ten minutes, **VNV ARMED** will now be displayed on the top line of the NAV 4 page. If the time is less than ten minutes, the top line displays a countdown to the time to begin the descent.

6. Return to any desired page for now. If you got to the NAV 4 page by pressing ALT, press ALT once again to return to the pages previously in view. If you got to the NAV 4 page using the inner and outer knobs, press CRSR to turn off the cursor function and then use the inner and outer knobs to select the desired page. Approximately 90 seconds before the time to begin descent, the message prompt will flash. When you view the Message page, it will display "**VNAV ALERT**". This is notification for you to view the NAV 4 page because it is getting close to the time to begin your descent.

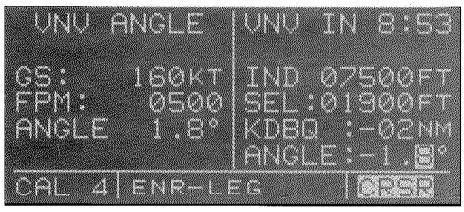


Figure 5-27

7. When the countdown reaches 0:00, the time will be replaced with an advisory altitude (figure 5-28). Begin your rate of descent so that the altitude displayed on your altimeter matches the advisory altitude.

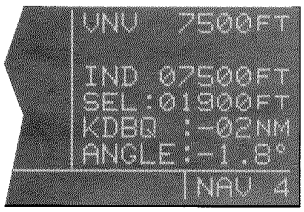


Figure 5-28

5.2.2 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 NAV 4 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 enter the identifier for any waypoint in the active flight plan which is still in front of the aircraft's position.** When another valid waypoint in the flight plan is entered on the NAV 4 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.

5.2.3 VNAV From the Super NAV 5 Page

The Super NAV 5 page can be configured to display the VNAV status. This means that you will not have to change pages to see what altitude you should be at. You will still need to set up the VNAV problem by using the NAV 4 page as described in section 5.2.1. To use the Super NAV 5 page to view the VNAV status use the following steps.

1. Set up the VNAV situation from the NAV 4 page.
2. Turn to the Super NAV 5 page by selecting NAV 5 on both sides of the display.
3. Turn on the left cursor and rotate the left outer knob counter-clockwise until the cursor is over the third line from the bottom of the display (figure 5-28a).
4. Rotate the left inner knob until "VNAV" is displayed (figure 5-28b). Turn the left cursor off by pressing the left CRSR.
5. The Super NAV 5 page will now display the VNAV status. If the VNAV problem has not been defined yet, then **V OFF** will be displayed. If the time to start VNAV operation is greater than 10 minutes then **V ARM** is displayed. When the time to VNAV operation is less than 10 minutes then the Super NAV 5 page will display the time until VNAV operation will start. For example, **V 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 Super NAV 5 display will display this altitude. For example **V 4300** would be displayed if the suggested altitude was 4300 feet.

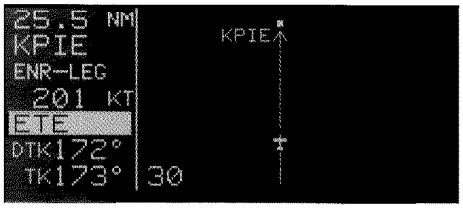


Figure 5-28a

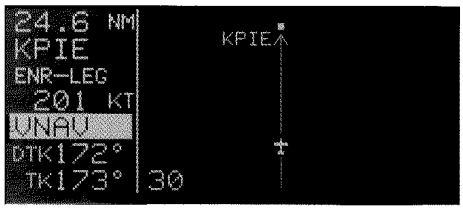


Figure 5-28b

NOTE: *If you used the CAL 4 page to determine the ascent/descent angle, the aircraft's groundspeed during the ascent/descent should match that entered on the CAL 4 page. If a different groundspeed is actually flown, a different rate of ascent/descent from the one entered on the CAL 4 page will be required.*

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.

5.3 CALCULATOR PAGES

There are seven Calculator pages which may be used to calculate a variety of flight related information such as pressure and density altitude, true airspeed, winds aloft, VNAV angle, and time zone conversions. The Calculator pages allow you to make "what if" calculations for conditions other than the present situation. Therefore, the Calculator pages rely on you to make manual inputs of air data parameters such as altitude and true airspeed even if the KLN 90B is interfaced to air data sensors. If the KLN 90B is interfaced with a compatible air data system, the Other 9 and Other 10 (**OTH 9** and **OTH 10)** pages display the air data information directly.

5.3.1 The Calculator 1 Page (CAL 1)

The CAL 1 page is used to determine pressure altitude and density altitude. To calculate these values:

1. Display the CAL 1 page on the left side (figure 5-29).

2. Press the left CRSR to turn on the left cursor function.

3. Enter the altitude indicated on the aircraft's altimeter (**IND**) to the nearest hundred feet by using the left outer knob to move the cursor to the desired position and the left inner knob to select each digit (figure 5-30).

4. Use the left outer knob to move the cursor to the first **BARO** position, and then enter the current altimeter setting by using the left inner and outer knobs (figure 5-31). The pressure altitude is now displayed (**PRS**).

***NOTE**: The SET 7 page (figure 5-32) is used to select whether the altimeter setting on the CAL 1 page is made in inches of Mercury (") or millibars (MB). To change the altimeter setting from inches to millibars, or vice versa, select the SET 7 page, press the left CRSR, and rotate the left inner knob to make your selection. When finished, press the left CRSR to turn off the cursor function.*

***NOTE**: Some areas of the world use hectopascals as a barometric unit. Hectopascals are numerically the same as millibars so choose millibars as the barometric unit in these areas.*

5. Use the left outer knob to move the cursor to the first **TEMP** position, and then enter the outside air temperature (degrees C) by using the left inner and outer knobs (figure 5-33). 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 temperature should be entered. This is the temperature of air without the effect of heating due to 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.

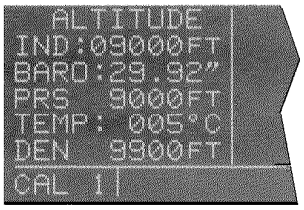


Figure 5-29

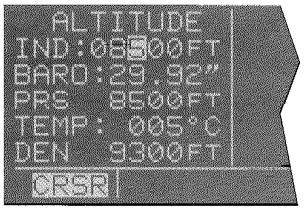


Figure 5-30

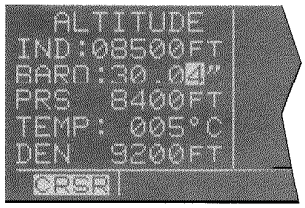


Figure 5-31

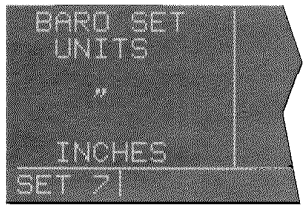


Figure 5-32

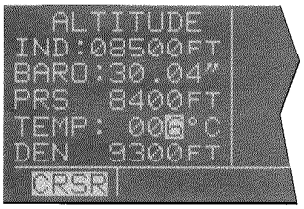


Figure 5-33

The density altitude (**DEN**) is now displayed.

6. Press the left CRSR to turn off the left cursor function.

NOTE: *If a compatible air data system is interfaced to the KLN 90B the Other 10 (**OTH 10**) page displays pressure and density altitude directly for the present conditions.*

5.3.2 The Calculator 2 Page (CAL 2)

The CAL 2 page is used to determine the true airspeed (**TAS**) of the aircraft. To calculate the true airspeed:

1. Select the CAL 2 page on the left side (figure 5-34).

2. Press the left CRSR to turn on the left cursor function.

3. Enter the aircraft's calibrated airspeed by using the left inner and outer knobs (figure 5-35). 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.

4. Use the left outer knob to move the cursor to the first **ALT** position, and then enter the aircraft's indicated altitude using the left inner and outer knobs. If the indicated altitude was previously entered on the CAL 1 page, it will already be displayed.

5. Turn the left outer knob to move the cursor to the first **BARO** position and then enter the current altimeter setting using the left inner and outer knobs. If the altimeter setting was made on the CAL 1 page, it will already be displayed. The SET 7 page is used to select between making the altimeter setting in inches of mercury (") or millibars (MB).

6. Rotate the left outer knob to move the cursor to the first **TEMP** position, and then enter the outside air temperature (degrees C) by using the left outer and inner knobs (figure 5-36). 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 "total air temperature" should be entered. This is the temperature of air including the effect of heating due to movement through the air. The temperature read on a standard outside air temperature gauge found on most piston aircraft is "total air temperature". Note that because of the two types of temperature, a temperature entry made on the CAL 1 page is not transferred to the CAL 2 page.

   The true airspeed (**TAS**) is now displayed.

7. Press the left CRSR to turn off the left cursor function.

NOTE: *If a compatible air data system is interfaced to the KLN 90B, true airspeed (**TAS**) is displayed directly on the Other 9 (**OTH 9**) page for the present conditions.*

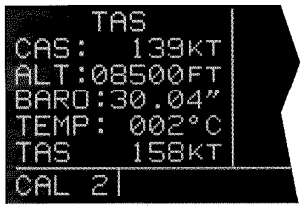


Figure 5-34

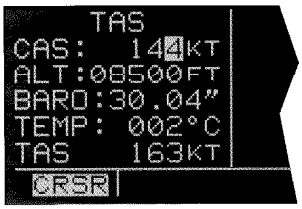


Figure 5-35

Figure 5-36

5.3.3 The Calculator 3 Page (CAL 3)

The CAL 3 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 these values:

1. Select the CAL 3 page on the left side (figure 5-37).
2. Press the left CRSR to turn on the left cursor function.
3. Enter the aircraft's true airspeed (**TAS**) by using the left inner and outer knobs. If the CAL 2 page was previously used to calculate true airspeed, it will already be displayed.
4. Use the left outer knob to move the cursor to the first **HDG** position, and then enter the aircraft's heading using the left inner and outer knobs (figure 5-38). The headwind (**HDWND**) or tailwind (**TLWND**) and the wind direction and speed are now displayed. The wind direction is relative to true North.

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.*

5. Press the left CRSR to turn off the left cursor function.

NOTE: *If the KLN 90B is interfaced with a compatible source of heading information, line three of the CAL 3 page is blank. Heading is then automatically input and used in the wind calculation displayed on the CAL 3 page. If the KLN 90B is interfaced with a compatible air data system in addition to a compatible heading source, the Other 9 (**OTH 9**) page displays wind information directly.*

5.3.4 The Calculator 4 Page (CAL 4)

The CAL 4 page is used to determine vertical navigation descent/ascent angles to use on the NAV 4 page. To calculate the required angle:

1. Select the CAL 4 page on the left side (figure 5-39).
2. Press the left CRSR to turn on the left cursor function.
3. Use the left inner and outer knobs to enter what the aircraft's groundspeed will be during the descent or ascent (figure 5-40).
4. Turn the left outer knob to move the cursor to the first **FPM** position, and then enter the desired rate of descent or ascent (in feet per minute) using the left inner and outer knobs (figure 5-41). The descent/ascent angle is now displayed.

   In addition, you may enter an angle and determine what rate of descent or ascent will be required for the selected combination of groundspeed and angle.
5. Press the left CRSR to turn off the left cursor function.

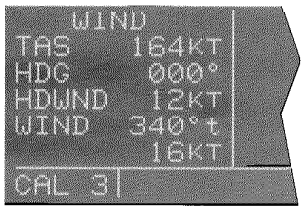


Figure 5-37

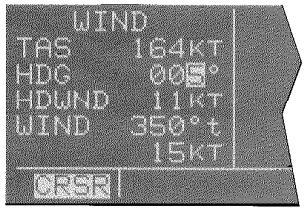


Figure 5-38

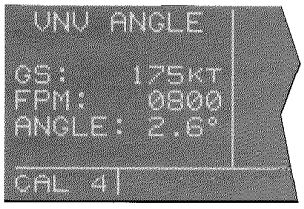


Figure 5-39

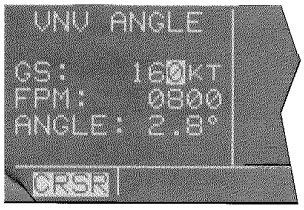


Figure 5-40

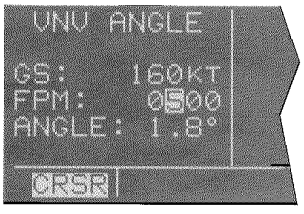


Figure 5-41

5.3.5 The Calculator 5 Page (CAL 5)

The CAL 5 page is used to perform two types of conversions: 1) Degrees Centigrade (C) to degrees Fahrenheit (F) and vice versa and 2) knots (**KT**) to miles per hour (**MPH**) and vice versa. To use the CAL 5 page:

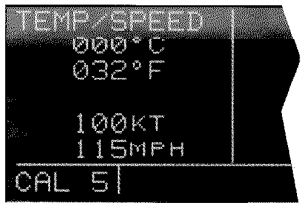


Figure 5-42

1. Display the CAL 5 page on the left side (figure 5-42).

2. Press the left CRSR to turn on the left cursor function.

3. To convert degrees C to degrees F, use the left outer knob to position the cursor over the appropriate Centigrade digits and use the left inner knob to select the desired values of temperature. When the desired temperature in degrees C is selected, the corresponding temperature in degrees F is displayed (figure 5-43).

   To convert degrees F to degrees C, use the left outer knob to position the cursor over the appropriate Fahrenheit digits and use the left inner knob to select the desired values of temperature. When the desired temperature in degrees F is selected, the corresponding temperature in degrees C is displayed.

Figure 5-43

   To convert knots to miles per hour, use the left outer knob to position the cursor over the appropriate knots digits and use the left inner knob to select the desired values of speed. When the desired speed in knots is selected, the corresponding speed in miles per hour is displayed (figure 5-44).

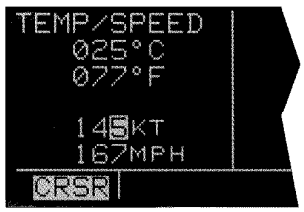


Figure 5-44

   To convert miles per hour to knots, use the left outer knob to position the cursor over the appropriate MPH digits and use the left inner knob to select the desired values of speed. When the desired speed in miles per hour is selected, the corresponding speed in knots is displayed.

4. Press the left CRSR to turn off the left cursor function.

5.3.6 The Calculator 6 Page (CAL 6)

The CAL 6 page is used to convert any time in one time zone to the corresponding time in another time zone. A listing of available time zones is contained in section 3.2. For example, it if is presently 9:56 am Pacific Standard Time (**PST**) and you wished to determine the time in Eastern Standard Time (**EST**):

1. Select the CAL 6 page on the left side (figure 5-45). The first time the CAL 6 page is viewed after the KLN 90B has been turned on, the top time showing will be the current system time. That is, it will be the same time as displayed on the SET 2 page. Also, the bottom time will be the current time referenced to the Coordinated Universal Time (**UTC**) time zone. Remember that UTC is the same as "Zulu".

2. Press the left CRSR to turn on the left cursor function.

3. Rotate the left outer knob to position the cursor over the top time zone abbreviation (figure 5-46).

4. Turn the left inner knob to select the desired time zone (figure 5-47).

5. Rotate the left outer knob to position the cursor over the bottom time zone abbreviation, and then use the left inner knob to select the desired time zone (figure 5-48). The corresponding time is now displayed.

   In addition, you may enter a time different than the actual time in either the top or bottom time display. When either the top or bottom time is changed, the other one also changes to show the correct corresponding time.

6. Press the left CRSR to turn off the left cursor function.

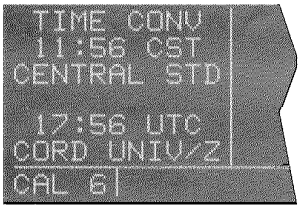


Figure 5-45

Figure 5-46

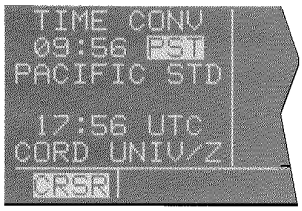


Figure 5-47

Figure 5-48

5.3.7 The Calculator 7 Page (CAL 7)

The CAL 7 page is used to display the times of sunrise and sunset for any waypoint in the published or user database. It can do this for any date you desire until December 31, 2087. Amazing you say! Yes, but it's true! To use the CAL 7 page:

1. Select the CAL 7 page on the left side (figure 5-49). The first time the CAL 7 page is selected after the KLN 90B 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.

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. Press the left CRSR to turn on the left cursor function.

3. If desired, select another waypoint identifier using the left inner and outer knobs. Press ENT to view the waypoint page for the waypoint entered. Press ENT again to approve the waypoint page (figure 5-50).

4. If desired, select another date using the left inner and outer knobs. You must press ENT to enter the date (figure 5-51).

5. If desired, select another time zone. The sunrise and sunset times for the selected waypoint, date, and time zone are now displayed (figure 5-52).

6. Press the left CRSR to turn off the left cursor function.

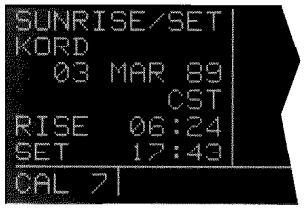


Figure 5-49

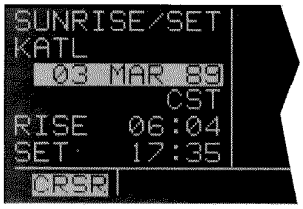


Figure 5-50

Figure 5-51

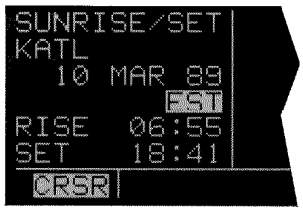


Figure 5-52

5.4 USER-DEFINED WAYPOINTS

Up to 250 user-defined waypoints may be created. These waypoints may be defined as a user-defined airport, VOR, NDB, or intersection. If the waypoint doesn't fit into one of these categories, it may be defined as a supplemental (SUP) waypoint. An advantage of defining a user waypoint as a supplemental waypoint is that its location may be entered as a radial and distance from a VOR or from any other waypoint in the database.

5.4.1 Creating An Airport User Waypoint

A user defined airport waypoint must contain an identifier, latitude, and longitude. In addition, any combination of airport elevation, one runway length and associated runway surface (hard or soft), and remarks can also be stored. Communication frequencies cannot be stored on the APT 4 page, airport services cannot be stored on the APT 6 page, SIDs and STARs cannot be stored on the APT 7 page, and approach procedures cannot be stored on the APT 8 page. To create a user waypoint as an airport:

1. Use the right outer knob to select the airport (**APT**) type waypoints.

2. Rotate the right inner knob to select the APT 1 page.

3. Press the right CRSR to turn on the right cursor function. The cursor will appear over the first character of the identifier (figure 5-53).

4. The next step is to select the identifier of the user waypoint. The identifier can be one to four characters in length. Use the right inner knob to select the first character of the identifier.

5. Turn the right outer knob one step clockwise to position the cursor over the second character and then use the right inner knob to select the desired character.

6. Use the right outer and inner knobs as described above to finish selecting the identifier (figure 5-54).

7. If you wish to create a waypoint at your present position (the position shown on the NAV 2 page), turn the right outer knob clockwise to position the cursor over **PRES POS?** and press ENT. The APT 1 page will now be displayed with the latitude and longitude of the waypoint at the bottom of the page (figure 5-55).

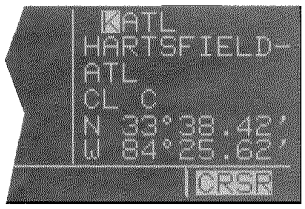


Figure 5-53

Figure 5-54

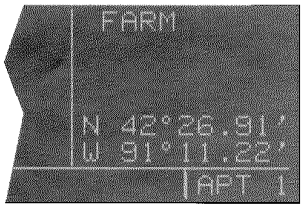


Figure 5-55

8. If instead, you wish to create a waypoint at a position that you specify, position the cursor over **USER POS?** and press [ENT]. A page with the identifier at the top and dashes at the bottom will now be displayed (figure 5-56). The cursor will be over the dashed latitude field. The latitude and longitude of the waypoint must be entered. To do so, turn the right inner knob to display an **N** (for North) or an **S** (for South). Next, select the latitude in degrees, minutes, and hundreths of a minute by using the right outer knob to position the cursor and the right inner knob to select the desired numbers (figure 5-57). When the complete latitude has been selected, press [ENT]. The cursor will jump down to the longitude field. Turn the right inner knob to select **W** (for West) or **E** (for East). Use the right outer and inner knobs to select the longitude. Press [ENT] to approve the waypoint position (figure 5-58).

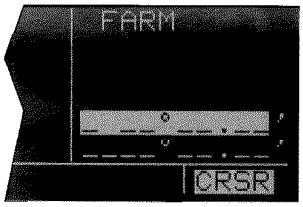


Figure 5-56

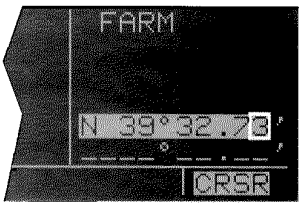


Figure 5-57

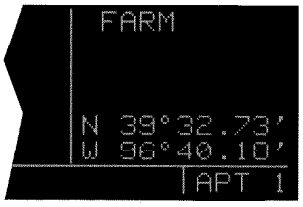


Figure 5-58

9. Turn the right inner knob one step clockwise to display the APT 2 page (figure 5-59). To enter an airport elevation press the right [CRSR] and rotate the right outer knob to position the cursor over the dashes to the right of **ELV**. Use the right outer knob to position the cursor until the entire elevation is selected. Press [ENT] to store. Press the right [CRSR] to turn off the right cursor function (figure 5-60).

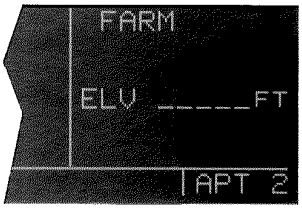


Figure 5-59

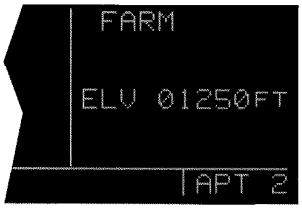


Figure 5-60

10. Turn the right inner knob one step clockwise to display the APT 3 page (figure 5-61). To enter a runway length, press the right [CRSR] and rotate the right outer knob to position the cursor over the five dashes directly beneath **RWY LEN**. Use the right inner knob to select each individual digit and the right outer knob to position the cursor until the entire runway length is selected. Press [ENT] to approve the runway length. The cursor will move to the surface position. Turn the right inner knob to select either **HRD** (for hard surface) or **SFT** (for soft surface). Press [ENT] to approve the runway surface. Press the right [CRSR] to turn off the right cursor function (figure 5-62).

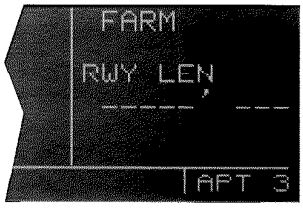


Figure 5-61

Figure 5-62

11. Airport remarks may be stored on the APT 5 page using the procedure described in section 3.11.6, "The Airport 5 Page (**APT 5**)".

5.4.2 Creating A VOR User Waypoint

A user-defined VOR waypoint must contain an identifier, magnetic variation, latitude, and longitude. The magnetic variation may be manually entered or, if one is not entered, one will automatically be calculated and stored. In addition, a VOR frequency may be stored. The procedure for creating a VOR user waypoint is similar to that just described for creating an airport user waypoint. Begin by selecting the VOR type waypoints instead of the airport type waypoints. The VOR identifier can be one to three characters in length. A VOR user waypoint page that has not yet been defined by the user contains the user identifier at the top of the page and three lines of dashes (figure 5-63). The top line of dashes may be filled in with frequency and magnetic variation. The second line is for latitude and the third line is for longitude (figure 5-64). A user-defined VOR is stored as an "undefined" (**U**) class.

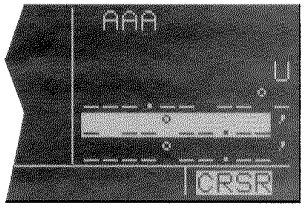


Figure 5-63

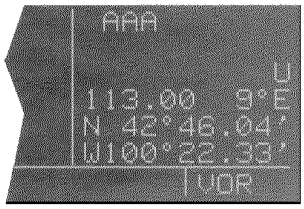


Figure 5-64

5.4.3 Creating An NDB User Waypoint

A user-defined NDB waypoint must contain an identifier, latitude, and longitude. In addition, an NDB frequency may be stored. The procedure for creating an NDB user waypoint is similar to that described for creating an airport user waypoint. Begin by selecting the NDB type waypoints instead of the airport type waypoints. The NDB identifier can be one to three characters in length. An NDB user waypoint page that has not yet been defined by the user contains the user identifier at the top of the page and three lines of dashes (figure 5-65). The top line of dashes may be filled in with the NDB frequency. The second line is for latitude and the third line is for longitude (figure 5-66).

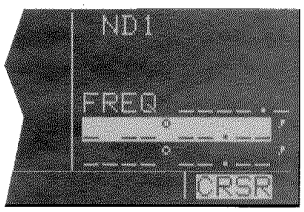


Figure 5-65

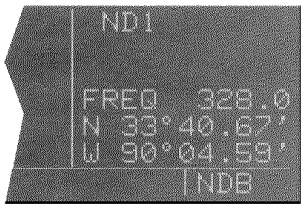


Figure 5-66

5.4.4 Creating Intersection Or Supplemental User Waypoints

A user defined intersection or supplemental waypoint must contain an identifier, latitude, and longitude. The identifier for either can be one to five characters in length. There are two procedures which may be used to define these waypoints. Both procedures begin by selecting the **INT** or **SUP** type waypoints, as appropriate.

The first method is similar to that described for creating an airport, VOR, or NDB user waypoint. Only a latitude and longitude need be entered to complete creating the waypoint.

The second method is to define the waypoint's position in terms of a radial and distance from any other published or previously defined user waypoint. To create a user waypoint in this manner:

1. Use the right outer knob to select **INT** or **SUP** type waypoints, as appropriate (figure 5-67).

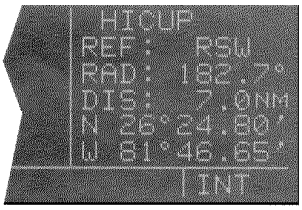


Figure 5-67

2. Use the right CRSR and the right inner and outer knobs in the manner previously described in section 5.4.1, "Creating An Airport User Waypoint", to select the waypoint identifier (figure 5-68).

3. Rotate the right outer knob to position the cursor over **USER POS?** and press ENT. A user waypoint page will appear with the identifier at the top with the cursor over a dashed latitude field (figure 5-69).

4. Turn the right outer knob counterclockwise to position the cursor over the dashes to the right of **REF** (figure 5-70).

5. Rotate the right inner knob to select the first character of an identifier for a "reference waypoint". This waypoint may be any existing waypoint.

6. Use the right outer knob to position the cursor, and the right inner knob to select the characters so that the entire identifier for the reference waypoint is displayed (figure 5-71).

7. Press ENT to see the waypoint page for the reference waypoint just entered.

8. Press ENT again to approve this waypoint page. The waypoint page being created will return with the cursor over the dashes to the right of **RAD** (figure 5-72).

9. Use the right inner and outer knobs to select the radial (from the reference waypoint). The radial may be selected to the nearest tenth of a degree (figure 5-73).

10. Press ENT. The cursor will move to the dashes to the right of **DIS**.

11. Use the right inner and outer knob to select the distance. The distance may be selected to the nearest tenth of a nautical mile (figure 5-74).

12. Press ENT. The latitude and longitude is calculated and displayed. The user waypoint is now defined (figure 5-75).

***NOTE**: Entering the reference waypoint, radial, and distance is done only to define the user waypoint's latitude and longitude position. The reference waypoint, radial, and distance are not stored as part of the user waypoint. As soon as another page is viewed on the right side, these parameters are lost. If the waypoint page for a user-defined intersection or Supplemental waypoint is viewed later on, it will display the radial and distance from the VOR nearest the user-defined waypoint (figure 5-76). The original reference waypoint may be re-entered at any time.*

Figure 5-68

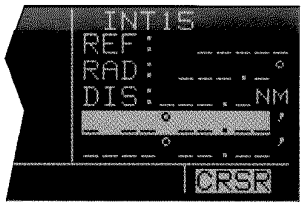


Figure 5-69

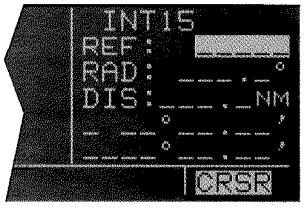


Figure 5-70

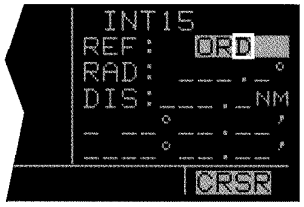


Figure 5-71

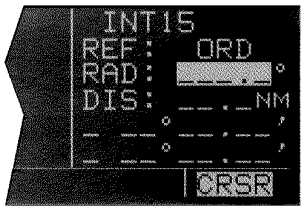


Figure 5-72

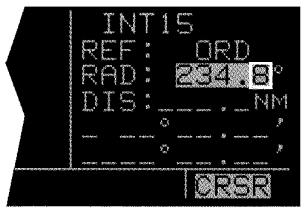


Figure 5-73

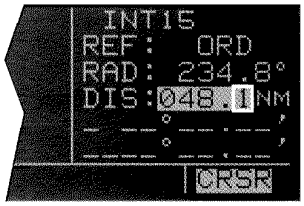


Figure 5-74

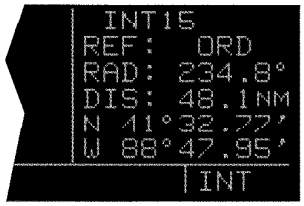


Figure 5-75

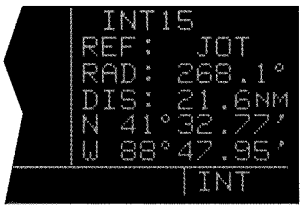


Figure 5-76

5.4.5 Deleting User-Defined Waypoints

A listing of all user-defined waypoints is contained on the Other 3 page (**OTH 3**). See figure 5-77. The user-defined waypoints are listed by category; airports (**A**) are first, VORs (**V**) are second, NDBs (**N**) are third, intersections (**I**) are fourth, and Supplemental waypoints (**S**) are last. Within each category, the waypoints are alphabetized by identifier. To the right of the identifier is the type waypoint defined (**A, V, N, I,** or **S**). If the waypoint is used in a flight plan, the flight plan number is shown to the right of the waypoint type. If more than five user waypoints exist, it is necessary to press the left CRSR and then use the left outer knob to scroll through the complete list. To delete a user waypoint:

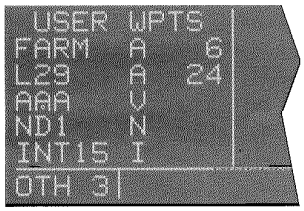


Figure 5-77

1. Select the OTH 3 page.

2. Press the left CRSR and use the left outer knob to move the cursor over the waypoint to be deleted (figure 5-78). If more than five user-defined waypoints exist, it is necessary to use the left outer knob to scroll through the complete list. A waypoint contained in a flight plan cannot be deleted without first either deleting the waypoint from the flight plan or deleting the entire flight plan.

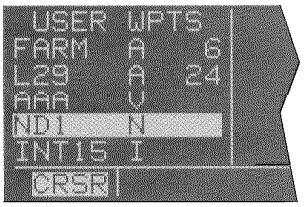


Figure 5-78

3. Press **CLR** (figure 5-79). The waypoint page for the waypoint to be deleted appears on the right side.

4. Press ENT (figure 5-80).

5. Press the left CRSR to turn off the left cursor function.

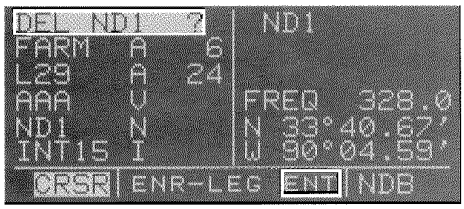


Figure 5-79

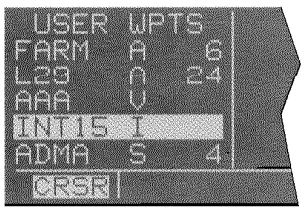


Figure 5-80

5.5 REFERENCE WAYPOINTS

Creating a Reference Waypoint is a method of adding a waypoint to any flight plan. The Reference Waypoint lies on the great circle route between two other waypoints in the flight plan. The point where the Reference Waypoint lies on the great circle route is the point where the route passes closest to a point that you designate. The feature may be utilized on the ground as an aid in defining a route before filing a flight plan, or in the air as an easy way to comply with an ATC request for additional waypoints. It is also useful, at times, to use the Reference Waypoint feature just to see how close your flight will come to some point that you designate. An example will illustrate the Reference Waypoint feature.

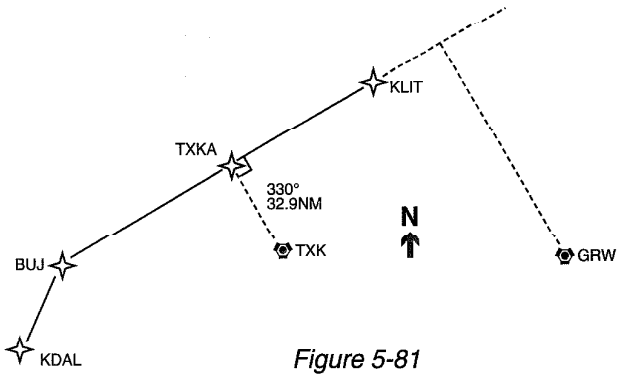


Figure 5-81

A flight plan is created from Dallas Love airport (**KDAL**) in Dallas, Texas to Adams Field (**KLIT**) in Little Rock, Arkansas. Blue Ridge VOR (**BUJ**) is added as a departure waypoint outside the Dallas-Ft. Worth Class B airspace. You desire to add a waypoint to your flight plan approximately half way between the 223 nautical mile distance from **BUJ** to **KLIT**. Looking at your chart, you determine that Texarkana VOR (**TXK**) is in the vicinity of your route, but appears to be a little South of the route. Since you don't want to fly any out of your way, you decide to create a reference waypoint using **TXK**.

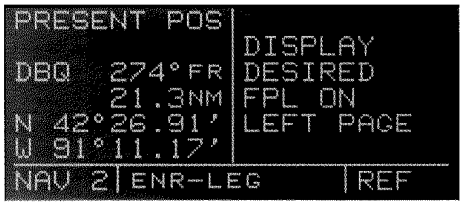


Figure 5-82

1. Select the Reference Waypoint (**REF**) page on the right side. If a flight plan page is not displayed on the left side, the REF page looks like the one in figure 5-82.

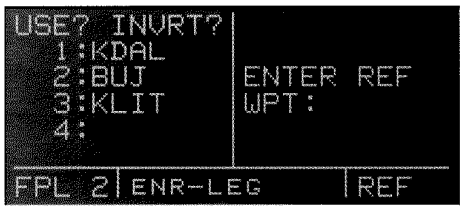


Figure 5-83

2. Display the desired flight plan on the left side (figure 5-83). The Reference Waypoint feature may be used on the active flight plan or on any of the 25 numbered flight plans that contain at least two waypoints.

3. Press the right CRSR to turn on the right cursor function.

4. Use the right inner and outer knobs to enter the identifier of the desired waypoint (figure 5-84).

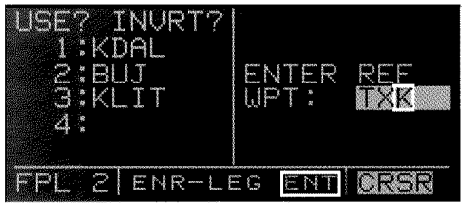


Figure 5-84

NOTE: *The waypoint which is used to create the Reference Waypoint may be in the published or user database. This waypoint must be located relative to the flight plan such that it is possible to draw a perpendicular line from this waypoint to a segment of the flight plan. figure 5-81 shows that* ***TXK*** *is an acceptable waypoint to use in creating a Reference Waypoint. figure 5-81 also shows that Greenwood VOR (****GRW****) would not be an acceptable waypoint since a perpendicular line can be drawn to an extension of the flight plan, but not to the flight plan itself.*

5. Press ENT to display the waypoint page for the waypoint just entered.

6. Press ENT again to display the waypoint page for the newly created Reference Waypoint (figure 5-85). The waypoint that was used to create the Reference Waypoint is automatically inserted into the **REF** field. The radial and distance as well as the latitude and longitude are also displayed. The left side of the screen shows where the Reference Waypoint will be inserted in the flight plan.

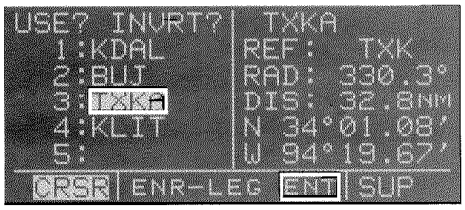


Figure 5-85

The KLN 90B automatically names the Reference Waypoint by appending the first available alphabetic character to the identifier of the waypoint which you entered. Thus, **TXK** becomes **TXKA** in this case. If you later use **TXK** to create a Reference Waypoint in another flight plan, this second Reference Waypoint would be named **TXKB**. If you create a Reference Waypoint using a waypoint with five characters in its identifier, the fifth character will be dropped (for example, **DUSTT** becomes **DUSTA**).

7. Press ENT once again to approve the waypoint page for the Reference Waypoint and insert it into the flight plan (figure 5-86).

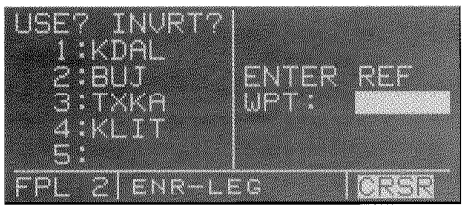


Figure 5-86

8. Press the right CRSR to turn off the right cursor function.

A Reference Waypoint is stored as a supplemental waypoint and counts as one of the 250 possible user-defined waypoints. Reference Waypoints that are part of a flight plan show up on the listing of user-defined waypoints displayed on the Other 3 (**OTH 3**) page. However, Reference Waypoints that are no longer part of a flight plan are deleted from the list of user-defined waypoints when the KLN 90B is turned off.

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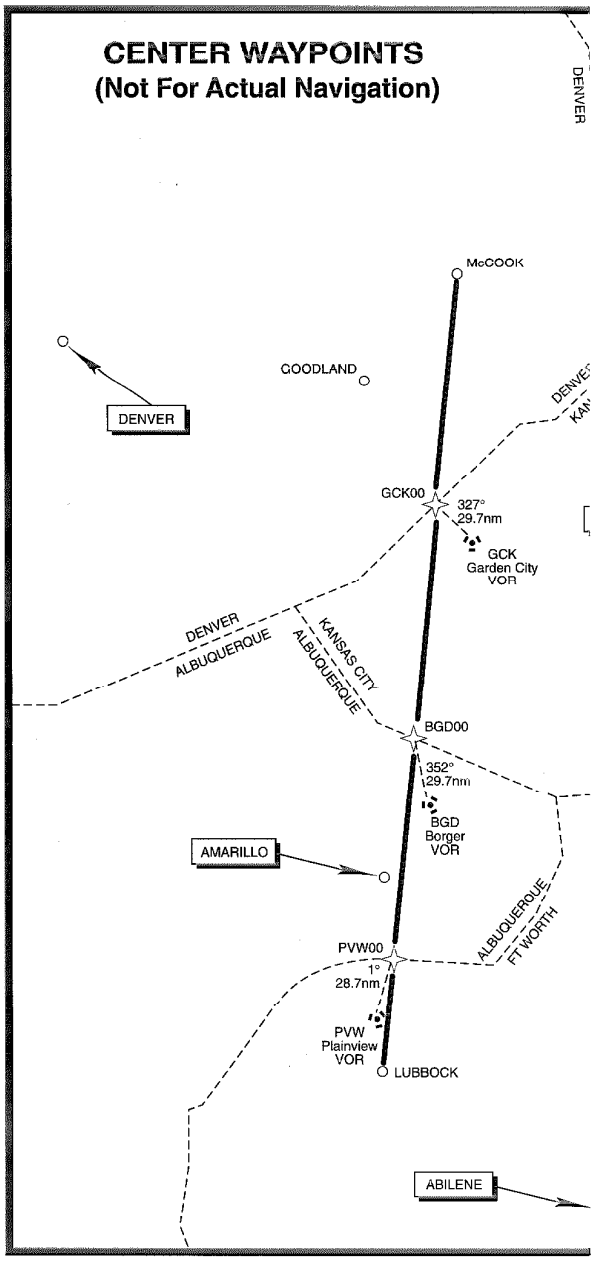
CENTER WAYPOINTS
(Not For Actual Navigation)
DENVER
McCOOK
GOODLAND
DENVER
GCK00
327°
29.7nm
GCK
Garden City
VOR
DENVER
ALBUQUERQUE
KANSAS CITY
ALBUQUERQUE
BGD00
352°
29.7nm
BGD
Borger
VOR
AMARILLO
ALBUQUERQUE
FT WORTH
PVW00
1°
28.7nm
PVW
Plainview
VOR
LUBBOCK
ABILENE

Figur

5.6 CENTER WAYPOINTS

Like Reference Waypoints, creating Center Waypoints is a method of adding waypoints to a flight plan. The word "Center" refers to air route traffic control center (ARTCC) or area control center (ACC). In some parts of the world these are referred to as "FIRs". Center Waypoints are waypoints at locations where a flight plan intersects the "Center" boundaries. You may find Center waypoints useful when filing flight plans or complying with ATC requests to make sure that you have at least one waypoint in each Center's airspace. Placing waypoints on the boundaries results in the minimum number of waypoints required to meet the criteria of having one waypoint in each Center's airspace. The Center boundaries are stored in the database.

An example will illustrate the Center Waypoint feature. You are planning a flight from Lubbock, Texas International airport (**KLBB**) to McCook, Nebraska Municipal airport (**KMCK**) as shown in figure 5-87. A flight plan is initially created with just these two waypoints (figure 5-88). In order to give ATC more waypoints for your intended direct routing, you decide to utilize the Center Waypoint feature.

Figure 5-88

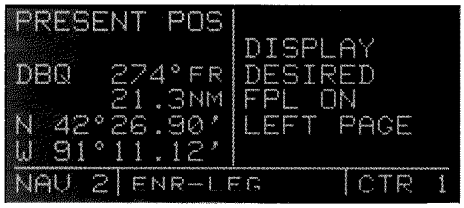

Figure 5-89

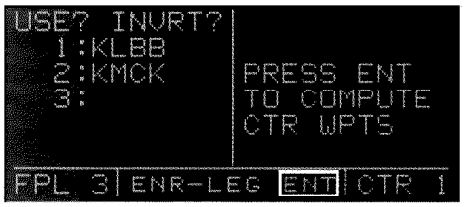

Figure 5-90

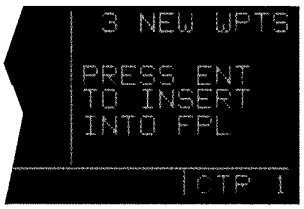

Figure 5-91

Figure 5-92

5.6.1 Creating Center Waypoints And Inserting Them in Flight Plans

To create the Center Waypoints:

1. Select the Center Waypoint 1 (CTR 1) page on the right side. If a flight plan page is not being displayed on the left side, the CTR 1 page will be as shown in figure 5-89.

2. Select the desired flight plan page on the left side. At this point it may be the active flight plan or one of the other 25 numbered flight plans (figure 5-90).

3. Press ENT to compute the Center waypoints. A Center Waypoint will be created at each intersection of the flight plan with a center boundary. When computation is complete, the CTR 1 page will display how many Center waypoints have been computed (figure 5-91).

4. If you wish to view the Center Waypoints before inserting them into the flight plan, turn the right inner knob to view the CTR 2 page(s). If there are multiple Center Waypoints, there will be an equal number of CTR+2 pages.

An example of a CTR 2 page is figure 5-92. The top line contains the identifier of the Center Waypoint. The KLN 90B automatically creates the identifier by appending the first available 2-digit number to the identifier of the nearest VOR to the waypoint. Thus, if Plainview

(**PVW**) is the nearest VOR to the first Center Waypoint location, the **00** is appended to **PVW** to create **PVW00**. If **PVW** were later used in the creation of another Center Waypoint, the second waypoint's identifier would be **PVW01**.

The second line of the CTR 2 page shows the "from" Center followed by the "to" Center. In our example, **PVW00** lies on the boundary between Ft. Worth (**FW**) and Albuquerque (**ABQ**) Centers. See figure 5-87. A listing of the Center abbreviations is contained in Appendix D.

The third and fourth lines of the CTR 2 page display the Center Waypoint location in terms of the identifier of the nearest VOR to the Center Waypoint and the distance and radial from this VOR to the Center Waypoint. Lines five and six display the Center Waypoint location in terms of latitude and longitude.

5. Insert the Center Waypoints into the displayed flight plan by returning to the CTR 1 page on the right side and pressing ENT (figure 5-93). The Center Waypoints are inserted into the flight plan in the correct order.

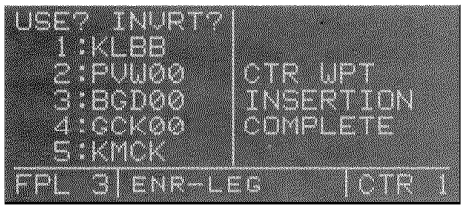

Figure 5-93

In the example above, the initial flight plan had just one leg; however, the Center Waypoint feature may be used with flight plans containing multiple legs as well. If inserting the Center Waypoints would cause the number of waypoints to exceed 30, then no Center Waypoints are displayed and the CTR 1 page will display the statement "**NOT ENOUGH ROOM IN FPL**".

5.6.2 Viewing the Center Waypoints After Insertion Into A Flight Plan

After the Center Waypoints have been inserted into a flight plan, you may go back and view the CTR 2 pages at any time. As long as you keep the same flight plan page displayed on the left side of the screen, you may view the Center Waypoints on the CTR 2 page(s) by merely displaying the CTR 2 page(s). However, the CTR 1 and CTR 2 pages revert to the format of figure 5-90 anytime you leave the specific flight plan page on the left side and then return to it. Under these circumstances you must press ENT to view the Center Waypoints on the CTR 2 page(s).

Center Waypoints are stored as part of the 250 user-defined waypoints and are considered supplemental waypoints. When Center Waypoints are viewed on the SUP page or on the Active Waypoint (ACT) pages, they appear in the normal supplemental waypoint format (figure 5-94). Center Waypoints that are part of a flight plan show up on the Other 3 (**OTH 3**) page. Center Waypoints that are no longer part of a flight plan are deleted from the list of user-defined waypoints when the KLN 90B is turned off.

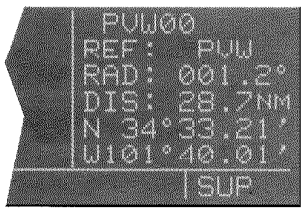

Figure 5-94

5.6.3 Creating Center Waypoints After Modifying A Flight Plan

Once Center Waypoints have been inserted into a flight plan, they are treated like any other waypoints in the flight plan. If a flight plan containing Center Waypoints is modified in any way, you may recompute new Center Waypoints. The original Center Waypoints are now part of the flight plan and new Center Waypoints are computed by treating the original Center Waypoints the same as any other waypoints in the flight plan.

If the interior of a flight plan containing Center Waypoints is modified, it may be desirable to manually delete obsolete Center Waypoints from the flight plan before computing new ones. However, if the flight plan is modified by adding new waypoints to the end of the flight plan, this may not be necessary. For example, let's say you decide to modify your existing flight plan from Lubbock to McCook by extending your flight to Omaha (figure 5-95). When you use the CTR 1 page to computer Center Waypoints, the CTR 1 page will now be as shown in figure 5-96. The newly computed Center Waypoint is identified as "NEW" on the CTR 2 page (figure 5-97) while the existing Center Waypoints no longer contain the "NEW" label.

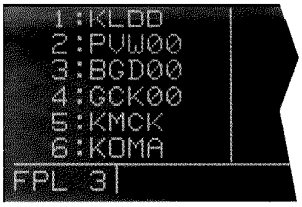

Figure 5-95

Figure 5-96

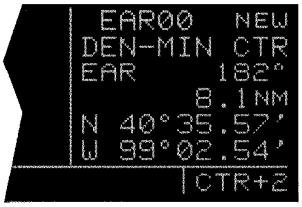

Figure 5-97

5.7 PROGRAMMING THE TURN-ON PAGE

You may personalize your KLN 90B by programming information on the Turn-On page. Up to four lines, each containing 23 characters, may be entered. The characters A through Z, the numbers 0 through 9, and spaces may be used. Once programmed, this information will be displayed for a few seconds each time you apply power to your KLN 90B. The example in figure 5-98 might give you some ideas, but use your imagination. How about programming the date your medical expires, or the date of your next biennial is due, or your wedding anniversary so that you'll be reminded each time you turn-on the unit? To program data on the Turn-On page:

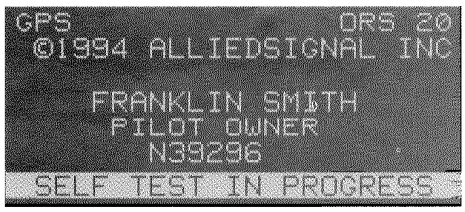

Figure 5-98

1. Turn the KLN 90B off if it is on.

2. Turn on the unit. As soon as you see the Turn On page (figure 5-99, press the left CRSR). You'll have to be ready because the Turn-On page is only displayed for a few seconds before automatically being replaced by the Self Test page (or the Take-Home page if the KLN 90B is being used in the take-home mode).

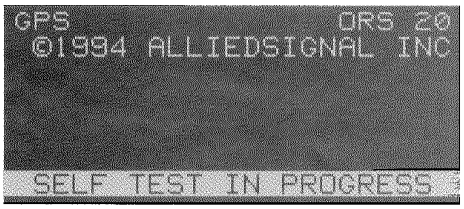

Figure 5-99

3. To program the first line (third line of display), use the left inner knob to select each desired character, and use the left outer knob to move the cursor. Spaces may be entered at the beginning of a line to center the text. If you make a mistake, you may move the cursor back to the desired location and re-enter the character. When the first line is complete, press ENT. The cursor will move to the second line.

4. Program the second, third, and fourth lines as you did the first line. Remember that you must press ENT to approve each line, including the last one.

5. If you wish to delete the text on a line you have already approved, use the left outer knob to position the cursor over the entire line. Enter a space for the first character in the line, and then press ENT.

6. When you are finished programming the Turn-On page, press the left CRSR. Turn the unit off and back on - how does it look?

5.8 THE STATUS PAGES

There are four Status pages. The Status 1 and Status 2 pages display information pertaining specifically to the GPS receiver while the Status 3 and Status 4 pages display supplementary information pertaining to the KLN 90B.

5.8.1 Determining The Status Of The GPS Signals

The Status 1 (**STA 1**) and Status 2 (**STA 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-to-noise ratio for each of these satellites, the elevation of each satellite above the horizon, and the estimated position error.

The GPS receiver in the KLN 90B 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 an 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.

Figures 5-100 and 5-101 show a representative example of a set of STA 1 pages. There will be two STA 1 pages if more than four satellites are being received as in this example. The fact that there are two Status 1 pages is indicated in the page identification segment by the "+" in **STA+1**. The following information is displayed on a STA 1 page.

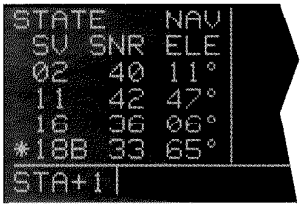

Figure 5-100

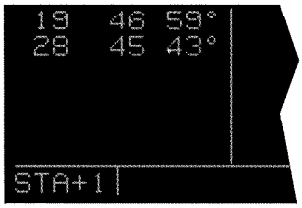

Figure 5-101

The GPS state is indicated on line 1:

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 from them is obtained.

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 calculating position, the receiver is collecting and storing in its memory additional data information from the satellites (called ephemeris and almanac data).

- 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 left of the satellite number indicates this particular satellite is not presently being used in the navigation position solution.

- The satellite's "health" is indicated to the right of the satellite number. This health information is transmitted by the satellites:

B	bad
W	weak
-	unknown
blank	good

- The signal-to-noise ratio (**SNR**) for each satellite being received is displayed in the middle column and indicates the signal strength for each satellite. The higher the SNR value the stronger the signal. Values usable for navigation will be in the mid 30s to mid 50s; however, typical values are in the middle of this range.

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

A representative Status 2 page is shown in figure 5-102. The STA 2 page displays the system's estimate of the position error expressed in nautical miles. The KLN 90B'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.

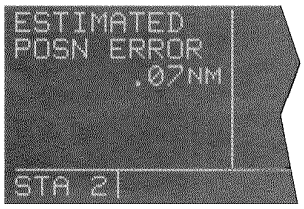

Figure 5-102

5.8.2 Determining KLN 90B Software Status And Operational Time

The Status 3 page (figure 5-103) displays the software revision status of the KLN 90B host computer and of the GPS receiver. A field called OBS CAL is also included on this page. This value indicates the calibration of the internal resolver circuitry of the KLN 90B. If for some reason your KLN 90B requires service, the information on this page may be useful.

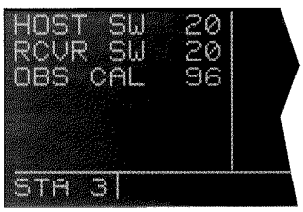

Figure 5-103

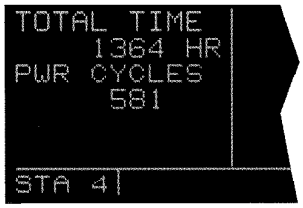

Figure 5-104

The Status 4 page displays the KLN 90B's total operational time and also the number of times the unit has been turned on (figure 5-104). Kind of like having a built in Hobbs meter, isn't it! These values are set to zero if the KLN 90B's nonvolatile memory is cleared.

5.9 MODES OF OPERATION

The KLN 90B 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 90B, and is the default mode when the KLN 90B starts up. The other course mode, OBS, is the mode that allows you to define the course to the active waypoint. This is the mode that you will use quite often if you conduct any non-precision approaches using the KLN 90B.

The KLN 90B 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 6.

The status of the course modes and the approach modes are annunciated in the lower center segment of the screen (figure 5-105). The exceptions to this are on the Turn-On page where the mode is not annunciated, and on the Super NAV 5 page where the mode is annunciated on the left side of the screen (figure 5-106). The following abbreviations are used for mode annunciation.

Mode	Annunciation
Enroute-Leg	**ENR-LEG**
Enroute-OBS	**ENR:274**
Approach Arm-Leg	**ARM-LEG**
Approach Arm-OBS	**ARM:259**
Approach Active-Leg	**APR-LEG**

The approach active-OBS mode is not a valid mode and cannot be selected.

For the OBS modes, the number included in the annunciation is the selected magnetic course. The course may be changed by several different methods which are described below.

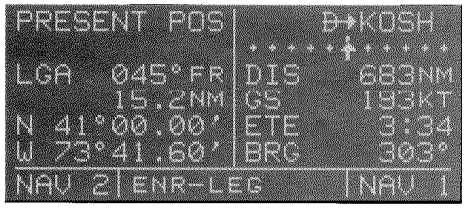

Figure 5-105

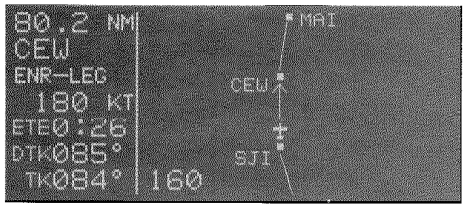

Figure 5-106

5.9.1 Selecting The Leg Mode Or The OBS Mode

You will use one of two methods to change between course modes depending on how the KLN 90B is installed in your aircraft. In some installations, there will be some type of external switch and annunciators that will select the mode and indicate the status of the course modes. In other installations these switches will not be installed.

Use the following procedure to change to either the Leg mode or the OBS mode when no external course mode switch is installed:

1. Select the MOD type pages on the left side. The MOD page corresponding to the active mode will be displayed (figure 5-107).

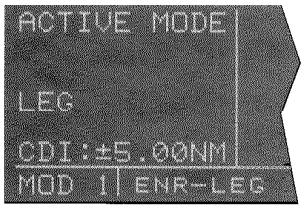

Figure 5-107

2. Rotate the left inner knob to select the MOD page for the desired mode: MOD 1 to select Leg or MOD 2 to select OBS (figure 5-108).

3. Press ENT (figure 5-109). The mode change is complete and you may return to any desired page.

It is not possible to change the mode by using the MOD pages when an external switch is installed. If you attempt to change the mode by using the MOD pages they will appear as shown in figure 5-110. Use the following procedure when an external LEG/OBS switch is installed in the aircraft:

1. Locate the external switch in the panel of the aircraft. An example of an external switch annunciator is shown in figure 5-111.

2. Change the position of the external switch. In the case of the combination switch/annunciator all that you have to do is press the unit and it will switch modes (figure 5-112).

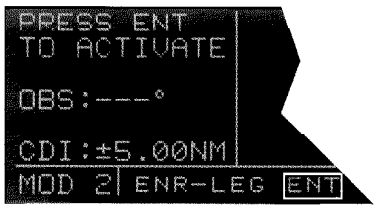

Figure 5-108

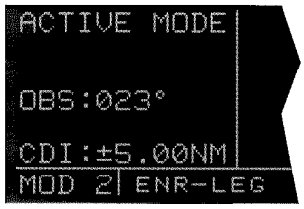

Figure 5-109

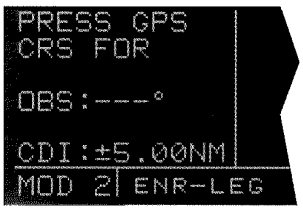

Figure 5-110

Figure 5-111

Figure 5-112

5.9.2 The Leg Mode

The following are 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 90B. If the CDI or HSI has five dots left and right of the center position, then each dot represents one nautical mile of deviation.

NOTE: *In some installations where the KLN 90B is interfaced to certain models of EFIS equipment, the scale factor will be plus or minus 7.5 nautical miles, full scale. Refer to the Flight Manual Supplement for the aircraft or the Pilot's Guide for the EFIS equipment for details.*

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 3 and D/T 3 pages. You can also configure the Super NAV 5 page to display desired track, see section 3.9.7. 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 Southwesterly by the time you reach Manila. Of course, your trips with the KLN 90B 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 sequencing is automatically disabled, see chapter 6.

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 NAV 3 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 3.9.4.

5.9.3 The OBS Mode

The following are characteristics of the OBS mode. Item 1 is the same as for 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 90B. If the CDI or HSI has five dots left and right of the center position, then each dot represents one nautical mile of deviation.

NOTE: *In some installations where the KLN 90B is interfaced to certain models of EFIS equipment, the scale factor will be plus or minus 7.5 nautical miles, full scale. Refer to the Flight Manual Supplement for the aircraft or the Pilot's Guide for the EFIS equipment for details.*

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, CDI or EFIS. 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 90B. In the OBS mode the selected course is always displayed as part of the mode annunciation at the bottom center of the screen on all pages but the Super NAV 5 page. On the Super NAV 5 page, the mode/annunciation is displayed on the left side of the screen. In many installations, two or more navigation sources can displayed on one indicator. In these situations there is a switch in the panel which will determine what navigation source is displayed. For the KLN 90B to properly read the external indicator the KLN 90B

must be the displayed navigation source on the external indicator.

When the KLN 90B is not the displayed navigation source on the external indicator or if the KLN 90B is interfaced with an EFIS system, it is possible to change the selected course from several pages on the KLN 90B. This can be done from the NAV 3 or Mode 2 (MOD 2) pages as well as the Super NAV 5 page if it is configured to display the desired track on the left hand side. To change the selected course from one of these pages:

a. Select the NAV 3, MOD 2 or Super NAV 5 page (figure 5-113).

b. Press the appropriate CRSR to turn on the cursor function. If the course is being changed from the Super NAV 5 page. use the left outer knob to rotate the cursor over the OBS angle field.

c. Turn the appropriate inner knob to select the desired course (figure 5-114).

d. Press the appropriate CRSR to turn off the cursor function.

Figure 5-113

Figure 5-114

NOTE: *It is easy to tell if it is possible to enter the OBS value on the KLN 90B. All that has to be done is to look next to the letters "OBS" displayed on either the MOD 2, NAV 3 or Super NAV 5 pages. If a colon (:) follows the letters OBS, then it is possible to enter a value from the KLN 90B. If the colon is missing, then the course must be changed from the external indicator.*

NOTE: *If the KLN 90B is interfaced to EFIS or if the KLN 90B is interfaced to certain mechanical indicators through an optional KA 90 adapter, the external indicator will be slewed to agree with what you entered on the KLN 90B.*

4. There is no automatic leg sequencing or turn anticipation.

5. The Minimum Enroute Safe Altitude (**ESA**) displayed on the NAV 3 page is the highest MSA sector altitude from the present position to the active waypoint. See section 3.9.4. Other waypoints in the active flight plan do not affect the ESA.

6. When the active waypoint is a VOR or an approach waypoint, the published magnetic variation for the VOR or approach waypoint is utilized rather than the calculated magnetic variation.

5.9.4 Switching From The Leg Mode To The OBS Mode

The following mode transition occurs if the KLN 90B 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 90B 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 90B is interfaced with compatible EFIS systems, a compatible mechanical HSI interfaced through a KA 90 adapter, or if the KLN 90B 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 5.9.3.

5.9.5 Switching From The OBS Mode To The Leg Mode

The following mode transition occurs if the KLN 90B is in the OBS mode 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 this case the KLN 90B will reorient on the active flight plan.

2. The selected course (**OBS**) that was active in the OBS mode prior to switching to a Leg mode becomes the desired track (**DTK**) in the Leg mode, unless the switch was made on the "from" side in which case the KLN 90B 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.

5.9.6 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 90B is interfaced to EFIS, a compatible mechanical HSI interfaced through a KA 90, or when the KLN 90B is not the displayed navigation source on the external indicator.

If the KLN 90B is the displayed navigation source on a non-driven HSI or a CDI it is not possible for the KLN 90B to change the OBS value. In these situations the KLN 90B will provide a scratch-pad message that will tell you what OBS value should be selected to go direct to the active waypoint (figure 5-115).

Figure 5-115

5.9.7 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 recentered. In figure 5-116 the KLN 90B is in the OBS mode and the selected course is 90°. You have just crossed INITT intersection and desire to activate the next waypoint in the flight plan, FINAL, without recentering the D-Bar.

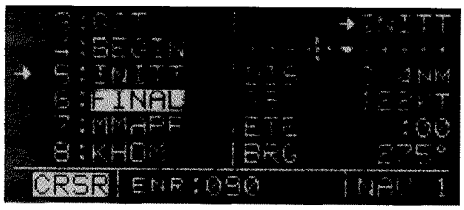

Figure 5-116

1. Press D→ (figure 5-117). The rules described in section 3.8, "DIRECT TO OPERATION", dictate which waypoint identifier will be initially displayed on the Direct To page.

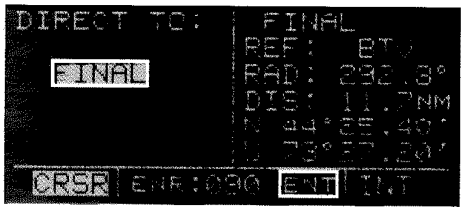

Figure 5-117

2. Press D→ a second time. The annunciation **DIRECT TO** changes to **ACTIVATE** (figure 5-118). The right side still displays the appropriate waypoint page. Repeated presses of D→ alternates between **DIRECT TO** and **ACTIVATE**. Make sure **ACTIVATE** is displayed.

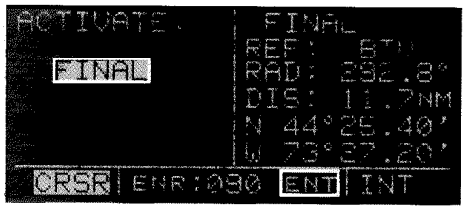

Figure 5-118

3. Press ENT to approve the waypoint page and activate the waypoint (figure 5-119). The selected course does not change, therefore this method does not center the D-Bar like a Direct To operation.

5.9.8 Changing the CDI Scale Factor

The CDI scale factor can be changed by using either the MOD 1 or MOD 2 pages. 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.

Figure 5-119

If it is desired to change the CDI scale factor to another value, use the following procedure:

1. Select either the MOD 1 or MOD 2 page.
2. Press the left CRSR. If necessary, use the left outer knob to move the cursor over the value of the CDI scale (figure 5-120)
3. Rotate the left inner knob to select the desired CDI scale factor (figure 5-121).
4. Turn the left CRSR off. The CDI scale factor change is complete.

NOTE: *The KLN 90B will automatically select a scale factor while in one of the approach modes. When the KLN 90B selects a CDI scale factor it is not possible to select a scale factor that is less sensitive than what the KLN 90B 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.*

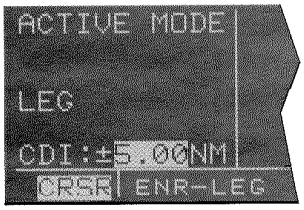

Figure 5-120

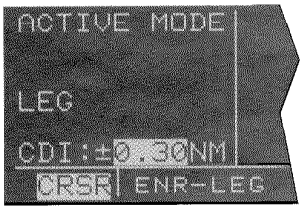

Figure 5-121

5.10 THE FUEL MANAGEMENT PAGES

Certain models of fuel management computers manufactured by Shadin Company, ARNAV System, Inc, and Sheltech Ltd. may be interfaced with the KLN 90B. The primary benefit of having the KLN 90B 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 90B. The KLN 90B 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 90B 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 the aircraft. 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 5, OTH 6, OTH 7, AND OTH 8 pages are used to display fuel management information for KLN 90B's interfaced with compatible fuel management computers. If there is no fuel management computer interface, these fuel management pages are not displayed.

5.10.1 The Other 5 Page (OTH 5)

The OTH 5 page displays the following information (figure 5-122):

- The destination waypoint. An arrow is displayed to the left of the identifier if the waypoint is the active waypoint.
- The fuel units as received from the fuel management computer.

GAL	gallons
IMP	imperial gallons
L	liters
KG	Kilograms
LB	pounds

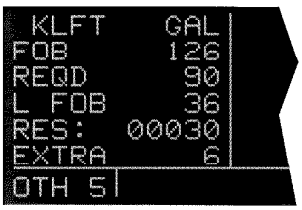

Figure 5-122

- The fuel presently on board (**FOB**). In most installations this is defined by using the fuel flow computer's control unit. However, if the KLN 90B is interfaced with a compatible Shadin fuel flow computer, it is possible to define the fuel on board by using the KLN 90B. 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 (FOB) use the following procedure:

  1. Turn to the OTH 5 page.

  2. If it is possible to enter the present fuel on board by using the KLN 90B there will be a colon (:) following FOB on the display. If the colon exists press the left CRSR (figure 5-123), if the colon does not exist it is not possible to change the fuel on board through the KLN 90B (figure 5-122).

  3. Enter the current fuel on board (FOB) using the left inner knob (figure 5-124). Make sure the amount entered is consistent with the units used by the fuel flow computer.

  4. Turn the left CRSR off.

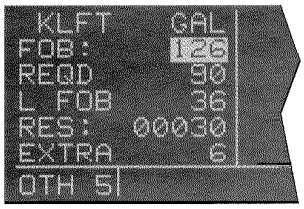

Figure 5-123

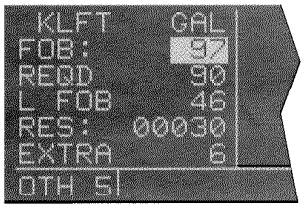

Figure 5-124

- The fuel required to reach the destination waypoint at the current rate of fuel flow and the present groundspeed (**REQD**).

- The landing fuel on board (**L FOB**) is the fuel presently on board minus the fuel required to reach the destination.

- The desired fuel reserve (**RES**). 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 CRSR, rotate the left outer knob to move the cursor over each of the desired reserve digits, and use the left inner knob to select each digit. Press the left CRSR when finished to turn off the left cursor function.

- The calculated extra fuel (**EXTRA**). This is the landing fuel on board (**L FOB**) minus the fuel reserve (**RES**) you entered.

5.10.2 The Other 6 Page (OTH 6)

The OTH 6 page displays the following information (figure 5-125):

- The endurance (**ENDUR**) in hours and minutes. The endurance is calculated based on the amount of fuel remaining after subtracting out the reserve (**RES**) you entered on the OTH 5 or the OTH 6 page from the present fuel on board.
- The range (**RANGE**), which is the distance (nautical miles) that could be flown based on the endurance calculated above and the present groundspeed.
- The fuel efficiency, which is the groundspeed divided by the present fuel flow.
- The desired fuel reserve (**RES**). Same as displayed on the OTH 5 page. Changing the reserve on one of the two pages also changes it on the other page.

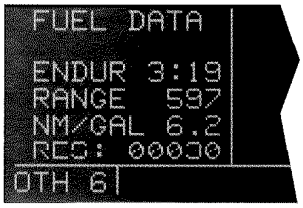

Figure 5-125

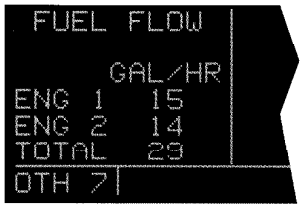

Figure 5-126

5.10.3 The Other 7 Page (OTH 7)

The OTH 7 page displays rate of fuel flow. It has two formats depending on whether the aircraft is a twin engine (figure 5-126) or a single engine (figure 5-127).

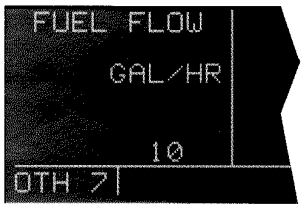

Figure 5-127

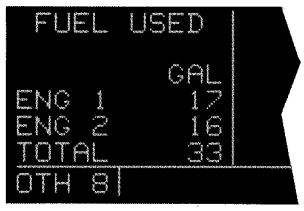

Figure 5-128

5.10.4 The Other 8 Page (OTH 8)

The OTH 8 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 for the page, depending on whether the aircraft is a twin engine (figure 5-128) or single engine (figure 5-129).

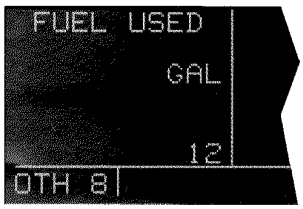

Figure 5-129

5.11 THE AIR DATA PAGES

The Bendix/King KAD 280 and KAD 480 air data systems as well as specific models of Shadin Company air data systems may be interfaced to the KLN 90B. When interfaced with one of these systems, the KLN 90B 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 90B will calculate and display real time wind data (magnitude and direction).

NOTE: *Heading information inputs to the KLN 90B must be in a format which is different than available from most mechanical compass systems, including the Bendix/King KCS 55A (KI 525A with bootstrap heading synchro) and KCS 305 compass systems. However, the Bendix/King KA 90 adapter as well as the compatible Shadin air data system will convert three wire analog heading information from these mechanical systems into the proper format. Bendix/King electronic HSIs such as the EHI 40 and EHI 50 directly provide heading information to the KLN 90B.*

The Other 9 and Other 10 (**OTH 9** and **OTH 10**) pages are used to display air data information if both a fuel management system and an air data system are interfaced to the KLN 90B. If there is no fuel management system, air data information is displayed on the Other 5 and Other 6 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 1, CAL 2, and CAL 3 pages which rely on manual pilot inputs to calculate air data information.*

5.11.1 The Other 9 Page (OTH 9)

Without a fuel management system this becomes the OTH 5 page. The following information is displayed (figure 5-130):

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 90B, the following wind data is also displayed (figure 5-131):

TLWND Tailwind component of the wind
HDWND Headwind component of the wind
WIND The wind direction relative to true North and the wind speed

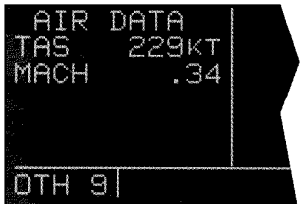

Figure 5-130

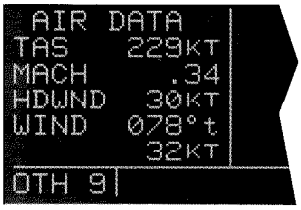

Figure 5-131

5.11.2 The Other 10 Page (OTH 10)

Without a fuel management system this become the OTH 6 page. The following information is displayed (figure 5-132):

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 OAT probe.

PRS Pressure altitude (to nearest 100 feet)

DEN Density altitude (to nearest 100 feet).

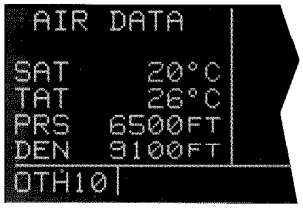

Figure 5-132

5.12 OPERATION OUTSIDE THE PRIMARY COVERAGE AREA

The KLN 90B's primary coverage area is from N 74° to S 60° latitude as was shown in figure 3-1. All navigation data presented outside this area is automatically referenced to true North unless a manual input of magnetic variation is made on the SET 2 page. The same is true anytime the KLN 90B is in the OBS mode and the active waypoint is outside the primary coverage area. Under both of these conditions, the following message will be displayed on the Message page:

MAGNETIC VAR INVALID
ALL DATA REFERENCED
TO TRUE NORTH

When navigation is within the primary coverage area, the SET 2 page does not display magnetic variation (figure 5-133). However, under the conditions stated above, a user entered magnetic variation may be made on line 6 of the SET 2 page using the left CRSR and left set of knobs (figure 5-134).

Figure 5-133

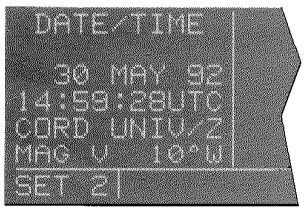

Figure 5-134

5.13 OPERATION WITHOUT A DATABASE CARTRIDGE

The KLN 90B is designed so that a database cartridge is required for normal operation. However, in the event that the cartridge is inadvertently not inserted or that the cartridge fails, there is a reversionary mode providing partial operation that may be used.

NOTE: *Reversionary operation without a database cartridge should only be used for VFR flight, not for IFR.*

Without a database cartridge inserted, the Database page appears as in figure 5-135. All published waypoints (those that originated from the database cartridge) have been deleted from the active flight plan, FPL 0. Therefore, the only waypoints remaining in FPL 0 are any user-defined waypoints that were originally included in the flight plan.

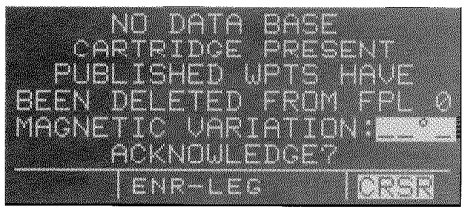

Figure 5-135

The KLN 90B is unable to calculate magnetic variation without the database cartridge. Therefore, a magnetic variation must be manually inserted on the Database page when there is no cartridge. Use the right inner and outer knobs to enter the desired magnetic variation and press ENT to enter (figure 5-136). With the cursor positioned over **ACKNOWLEDGE?**, press ENT to approve the Database page. The magnetic variation can be entered on the Database page and on line 6 of the SET 2 page (figure 5-134).

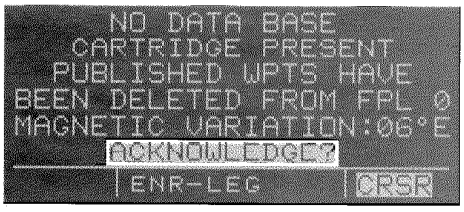

Figure 5-136

The active flight plan is the only flight plan available when there is no database cartridge. There is no way to gain access to flight plans one through 25. Functions not requiring the published database are operative. Some functions, such as nearest airport, nearest VOR, nearest NDB, Reference Waypoint, and trip planning, are operational but only to the extent that user-defined waypoints are utilized. *Functions that depend on the database cartridge are not operative.* Some of these include Special Use Airspace, Minimum Safe Altitudes, ARTCC waypoints, FSS frequencies on the OTH 1 page, and ARTCC frequencies on the OTH 2 page. Non-precision approaches, SIDs and STARs are also disabled.

5.14 USING THE TAKE-HOME MODE

It is very likely that the KLN 90B 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 90B 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 90B 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 database updates outside the airplane, perhaps with a home personal computer.

When the KLN 90B 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 (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 90B 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 90B without worrying about the engine running, other traffic, or even terrain (fortunately, these phenomena are not simulated in the take-home mode!)

This is the last chapter on the operation of the KLN 90B. In this chapter you will learn how to use the KLN 90B for non-precision approaches as well as SID/STAR 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 (chapter 4) and the OBS mode (section 5.9).

6.1 NON-PRECISION APPROACH OPERATIONS

Flying non-precision approaches using the KLN 90B 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 90B in VFR weather with a check pilot before attempting to use the KLN 90B in actual IFR conditions.

CAUTION: The KLN 90B obtains approach information from the database. Therefore, it is extremely important that the database is current. The KLN 90B is approved for IFR non-precision approaches only when the database is current. If you attempt to select an approach when the database is out of date, you will be given the status-line message: "OUTDATED DB" in the bottom center portion of the screen as a reminder.

The following sections assume that your KLN 90B 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 and to select the LEG or OBS modes. 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 Super NAV 5 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 90B. These procedures are not included in the database. Therefore it is not possible to use the KLN 90B for these approaches. It is good preflight practice ensure that the KLN 90B contains anticipated procedures for the flight.*

In addition to the two course modes (Leg and OBS) described in section 5.9, there are also two approach modes. These are approach arm and approach active. The status of the approach mode is indicated both on an external switch/annunciator and on the status line of the KLN 90B. 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 enroute mode is that the integrity monitoring is set to a tighter level. Another difference between these modes and the enroute 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 90B 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 90B 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 90B will disarm the approach and change back to enroute 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 90B. 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.

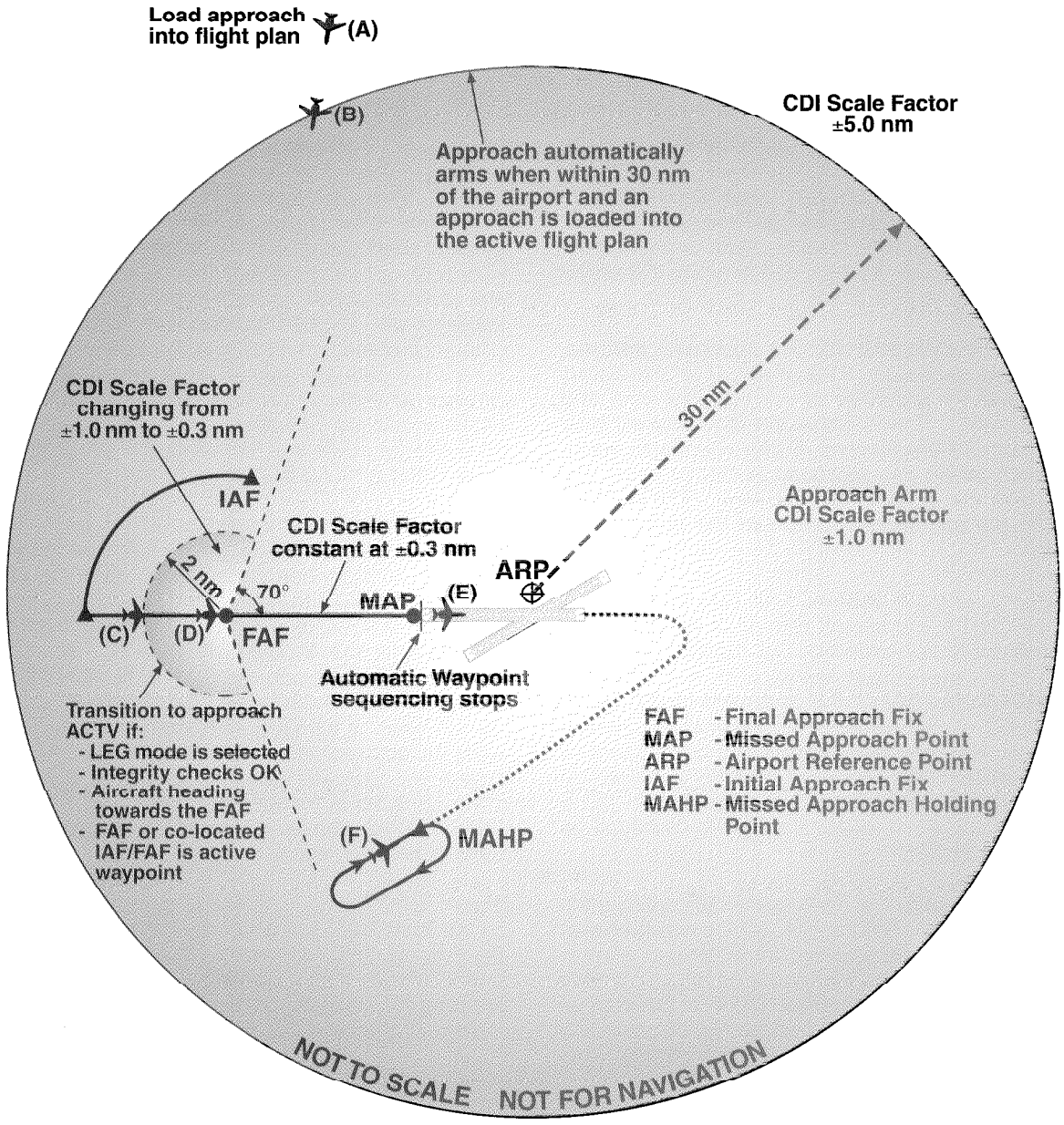

Figure 6-1 KLN 90B Approach Diagram

General Procedure for Non-Precision Approaches

Non-precision approaches will all have the general flow of events as follows. Refer to figure 6-1.

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. This corresponds to point A in figure 6-1. 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 6-1). 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 6-1 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 90B 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 90B 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 6-1) 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 90B is in the approach active mode (ACTV on external annunciator).

6. **Fly to the Missed Approach Point.** (position E in figure 6-1). The KLN 90B will not automatically sequence to the next waypoint. You must manually change to the appropriate waypoint according to the situation. By default, the KLN 90B will nominate the first waypoint of the published missed approach procedure when [D→] is pressed and the active waypoint is the MAP (rule number 4 in section 3.8).

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 6-1).

The details of the above operations as well as several examples of how to conduct non-precision approaches using the KLN 90B are given in the following sections.

6.1.1 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 Angles International airport (KLAX).

1. Turn to one of the APT pages and select KLAX by using the right cursor, inner, and outer knobs (figure 6-2)

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 right cursor on by pressing the right 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 6-3). If there are more than 5 approaches to an airport you can move the cursor down to "scroll" the other procedures into view by rotating the right outer knob.

4. With the flashing cursor over "VOR 25R" press ENT.

5. The KLN 90B 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 6-4). Note: If there is only one IAF for a procedure, then the KLN 90B 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 90B 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 6-5).

7. If the cursor is over **LOAD IN FPL** (figure 6-6) and you press ENT, then KLN 90B checks to see if this airport is in the active flight plan. If it is not, the KLN 90B will ask if you want to add the approach and the airport reference point to the active flight plan (FPL 0). In most cases this is desirable, so press ENT (figure 6-7).

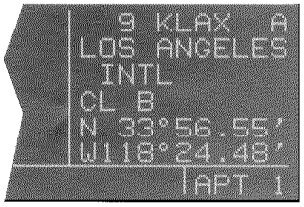

Figure 6-2

Figure 6-3

Figure 6-4

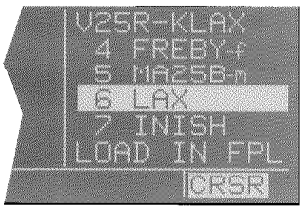

Figure 6-5

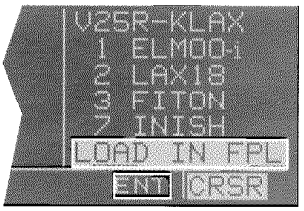

Figure 6-6

Figure 6-7

8. The KLN 90B will then bring up the FPL 0 page and put the sequence of approach waypoints in front of the airport reference point (figure 6-8).

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. The form of this header is ABBBB-CCCC. A is the first letter of the type of approach being flown (e.g. V for a VOR approach). BBBB will be filled in with the runway that the approach is to. Finally CCCC corresponds to the identifier of the airport which the approach is to. An example of this is shown in figure 6-8 where V25R-KLAX means the VOR 25R approach to KLAX.

After the approach has been entered into the flight plan the KLN 90B checks to make sure that the resulting flight plan "makes sense". If the KLN 90B detects any waypoints that are in both the enroute 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 ENROUTE WPTS
AS NECESSARY

Examine the flight plan and delete those enroute waypoints that are not necessary.

NOTE: *Approaches can only be entered into FPL 0, the active flight plan. If the KLN 90B is turned off for more than 5 minutes, then the approach is deleted when power is turned back on.*

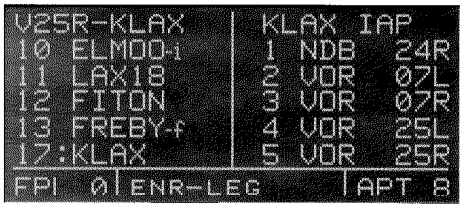

Figure 6-8

6.1.2 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 waypoint 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 runways 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 Super NAV 5 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 terminal 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 dash and 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 the FPL 0 page, the Super NAV 5 page, and the Super NAV 1 page. The definitions of these suffixes are:

i - The Initial Approach Fix (IAF) of the approach.
f - This is the Final Approach Fix (FAF) of the approach

m - The Missed Approach Point (MAP) of the approach
h - The missed approach holding point 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 6-9). This is what is referred to as a fence and the purpose of this line is to tell you that the KLN 90B 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).

Figure 6-9

6.1.3 Changing Or Deleting An Approach Once Loaded Into The Flight Plan

The sequence of waypoints that are retrieved from the database of the KLN 90B 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 enroute waypoints and which are approach waypoints, the KLN 90B 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, follow these steps.

1. With the left page displaying the active flight plan (FPL 0) turn the left cursor on by pressing the left CRSR (figure 6-10).

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 APR?** (figure 6-11). If you press ENT in this condition the KLN 90B 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 6-10

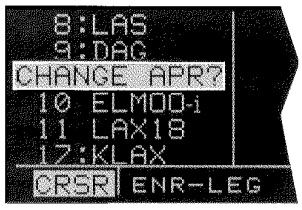

Figure 6-11

3. If you press the CLR button while the cursor is over the approach header it will change to read **DELETE APR?** (figure 6-12). If you press ENT now, the KLN 90B will remove the entire approach procedure from the active flight plan. If the KLN 90B was in the approach arm or the approach active modes, then deleting the approach will cause the KLN 90B to change back to enroute mode. This means that the CDI scale factor will change back to the default ±5.0 NM scale.

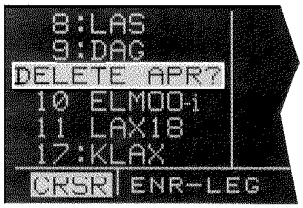

Figure 6-12

6.1.4 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 6.1.1. This example will show how the KLN 90B sequences through an approach and what type of annunciations and scale factor changes can be expected. The KLN 90B 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 6-13) 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 section 6.1.1.

2. When you are within 30 NM of the airport, the KLN 90B will automatically 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 90B is using the correct barometric pressure. If the barometric information is not correct, then the integrity monitoring provided by the KLN 90B will not be as good as it could be. Press [ALT] to bring up the ALT page and verify that the barometric pressure is correct.

NOTE: *If the KLN 90B is interfaced with a compatible air data computer that provides the correct barometric pressure to the KLN 90B, then the previous message is not displayed and it is not necessary to update the barometric pressure.*

At this time the KLN 90B 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.

3. As you approach ELMOO, the KLN 90B will provide waypoint alerting on the external annunciator as well as on the screen of the KLN 90B. Once you pass ELMOO, the KLN 90B will automatically sequence to the next waypoint in the approach, LAX18.

4. This may be a good time to select the Super NAV 5 page. This page is especially useful for getting a feeling of where you are in the approach (figure 6-14).

5. As the aircraft approaches the LAX18 waypoint, the KLN 90B will again provide waypoint alerting. As the aircraft passes LAX18 and sequences to FITON, the KLN

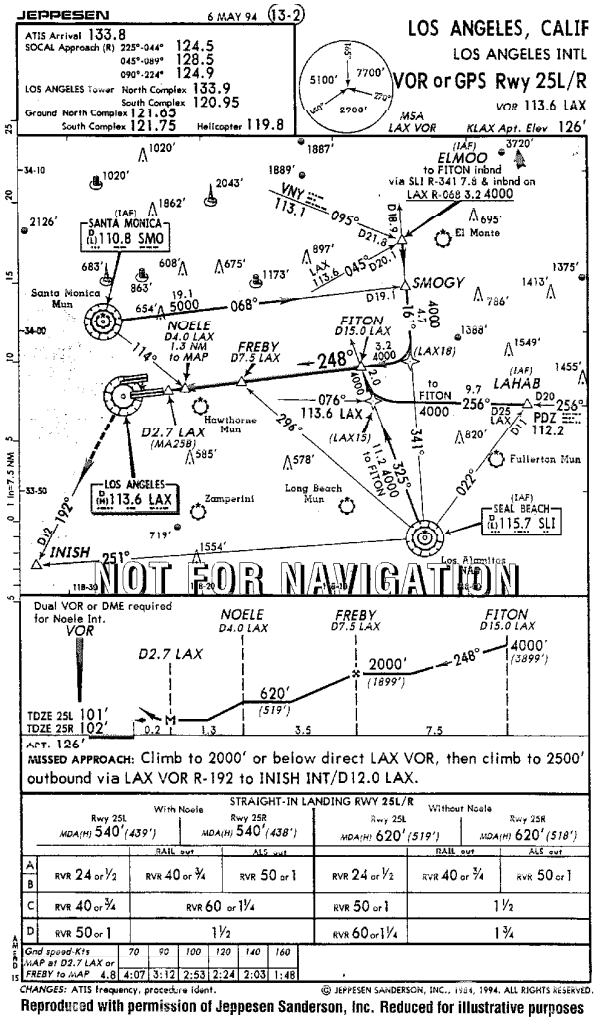

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Figure 6-13

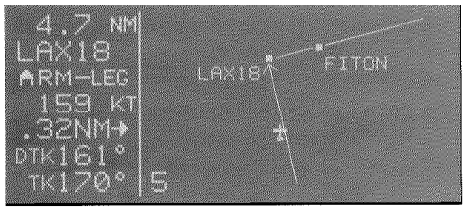

Figure 6-14

90B 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°.

NOTE: *If the KLN 90B is interfaced to EFIS or a suitable mechanical HSI through the optional KA 90 adapter, then the external course pointer will be driven to the correct value when leg sequencing occurs.*

6. As the aircraft approaches the FAF (FREBY) it is a good idea to check over the status of the KLN 90B. Look at the external indicators to verify that LEG sequencing is selected. Remember, the KLN 90B will not transition to the approach active mode if the OBS mode is selected. If the KLN 90B 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, the Final Approach Fix, the KLN 90B will make a prediction to see if integrity will be available at the FAF and at the MAP. If the prediction indicates that integrity monitoring will be available, and RAIM is currently available, the KLN 90B will change the GPS APR annunciator to read ACTV and the status line will indicate APR (figure 6-15). At this time the KLN 90B 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 database. 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 90B will again provide waypoint alerting as you approach MA25B. This is shown on the Super NAV 5 page by a flashing active waypoint identifier. If the AUTO scale factor was chosen for the Super NAV 5 page then the airport diagram will be visible when the aircraft is within 5 NM of the airport. More detail is shown as the aircraft gets to within 1 NM of the airport (figure 6-16).

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 90B will not automatically sequence past the missed approach point. This is shown on the Super NAV 5 page by not showing any lines connecting waypoints that are past the MAP. To perform the published missed approach procedure, press [D→] 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 90B will sequence to the next waypoint 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.*

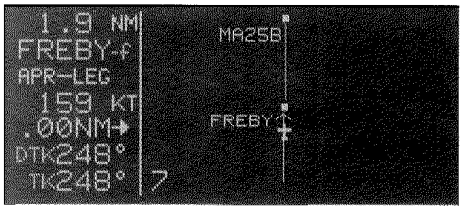

Figure 6-15

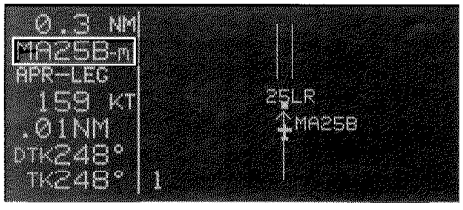

Figure 6-16

6.1.5 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 6-17 for the procedure. For this example assume that the aircraft is 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 6.1.1. In this case there is only one IAF so the KLN 90B 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 90B will ask to add the airport and the approach to FPL 0 (figure 6-18).

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 Super NAV 5 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 6-19), press [D→] and then [ENT] to initiate a direct to operation to the TXO VOR.

3. At a distance of 4 NM to the TXO VOR, the KLN 90B 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 database so it is not possible for the KLN 90B to know if a course reversal is required or not; as a result, the KLN 90B will always give this message whenever a waypoint could be used for a course reversal. The KLN 90B 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 90B 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 90B 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.*

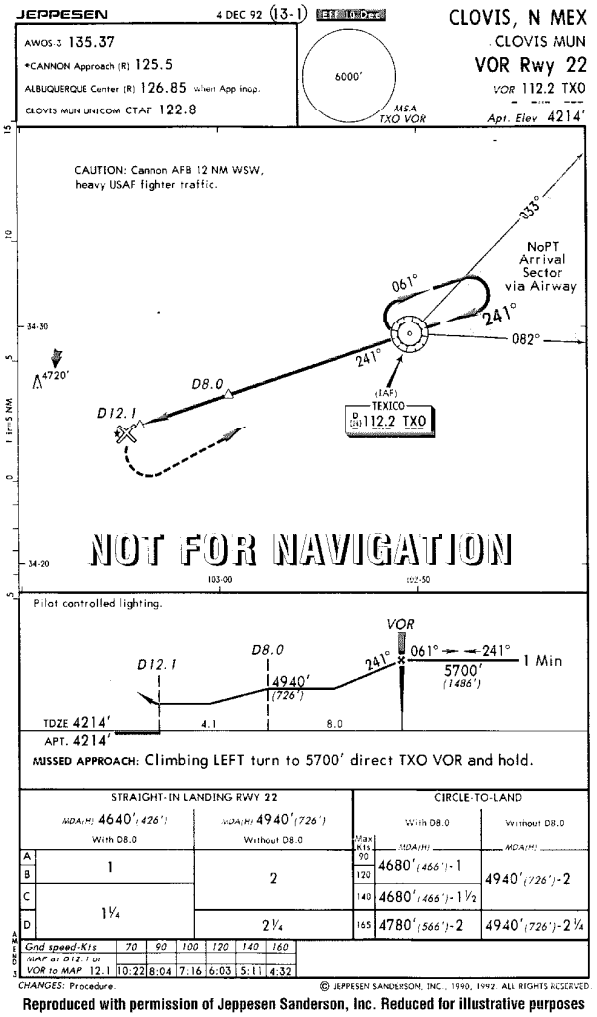

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Figure 6-17

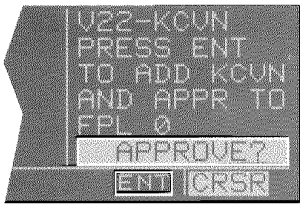

Figure 6-18

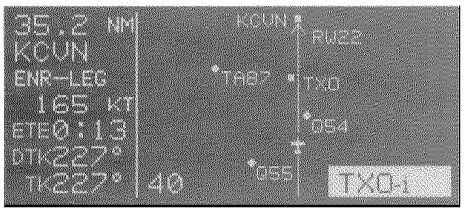

Figure 6-19

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 90B 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 90B to change to the approach active mode.*

6. When the aircraft is 2 NM from the FAF, the KLN 90B will verify that the proper integrity is available. If integrity monitoring is available for the approach, then the KLN 90B will change to the Approach Active mode. This will be annunciated on the external approach status annunciator as well as on the KLN 90B. The CDI scale factor will also start to change from ±1.0 NM to ±0.3 NM.

7. Upon reaching TXO, the KLN 90B will automatically sequence to RW22, the missed approach point.

8. The fix at 8 DME from TXO along the final approach course is not included in the waypoints that come from the database. Since the distance that the KLN 90B is giving you is distance TO the MAP, you will need to mentally figure out when the aircraft has reached this point. 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 [D→] 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 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.*

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 90B 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 90B 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 the approach active mode becomes the active mode.*

6.1.6 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 90B.

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 6.1.5.

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 example, the inbound course is 241°. It is now possible to watch your progress on the Super NAV 5 page and anticipate when you will be given new headings to fly (figure 6-20).

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 90B to change to the approach active mode.*

5. The rest of this approach would be flown using the same steps as presented in section 6.1.5.

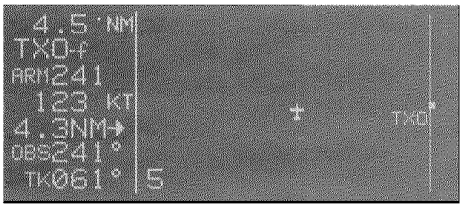

Figure 6-20

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6.1.7 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 6-21). The airport identifier for this airport is KLOU.

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 6.1.1.

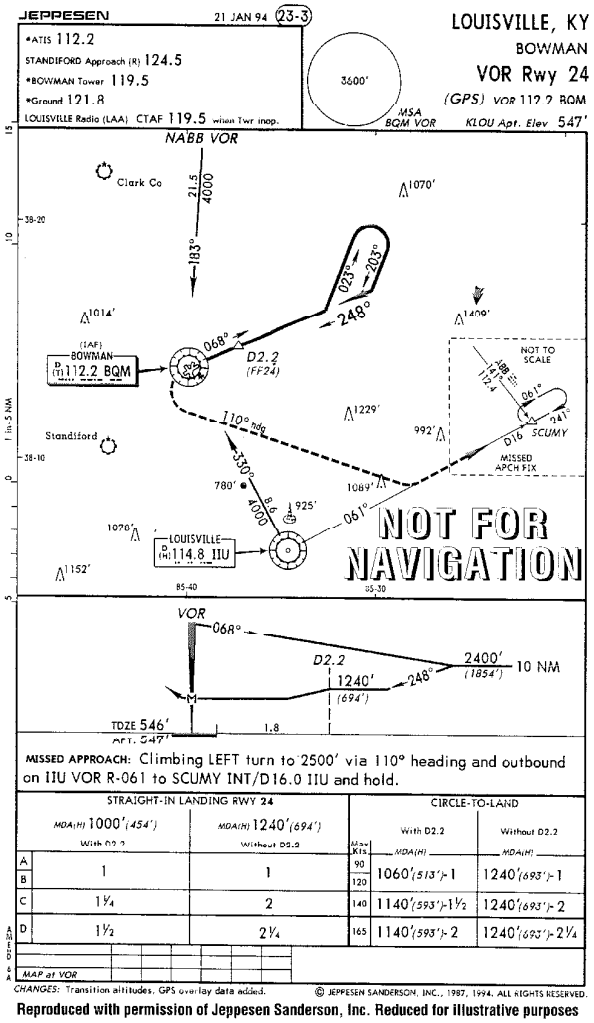
2. When the distance from the present position to the destination airport reaches 30 NM, the KLN 90B will automatically arm the approach mode. The CDI scale factor will transition to ±1.0 NM and the KLN 90B will provide more sensitive integrity monitoring.You also press [ALT] to update the barometric information.

3. When the aircraft is 4 NM from the BQM VOR, the KLN 90B will give a message reminding you to select the OBS mode. The OBS mode is required for the procedure turn. In this case, don't select the OBS mode until after the KLN 90B has sequenced past BQM-i and made FF24-f the active waypoint. (This will keep you from having to manually activate FF24-f while in the OBS mode.) After passing BQM, select the outbound course of 068° on the external CDI or HSI.

4. 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 heading portion of the procedure turn, change the selected course to the inbound course of 248° on the external CDI or HSI.

5. 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 90B to change to the approach active mode.*



Reproduced with permission of Jeppesen Sanderson, Inc. Reduced for illustrative purposes

Figure 6-21

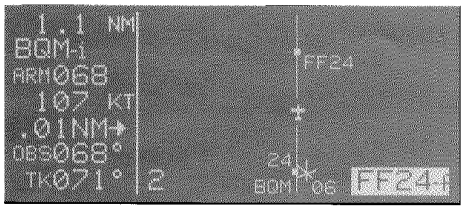


Figure 6-22

6. When the aircraft is 2 NM from the FAF, the KLN 90B will verify that the proper GPS integrity is available. If integrity monitoring is available for the approach, then the KLN 90B will change to the Approach Active mode. This will be annunciated on the external approach status annunciator as well as on the KLN 90B. The CDI scale factor will also start to change from ±1.0 NM to ±0.3 NM.

7. 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 Super NAV 5 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 and the runway diagram becomes visible on the map.

The following steps are followed if a missed approach is required.

8. 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 90B it will be necessary to put the KLN 90B into the OBS mode and make SCUMY the active waypoint. Change the selected course on the external CDI or HSI to 061°.

9. 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.

6.1.8 Example Approach: DME Arc

DME arc procedures with the KLN 90B are completely different from using traditional VOR and DME equipment. Don't worry though because DME arc procedures using the KLN 90B are also easier than using traditional equipment. This is because the KLN 90B provides left/right guidance around the arc. No more having to watch distance in one place and radial in another!

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. 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 90B. 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 6-23. Assume that the aircraft is approaching from the North.

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 90B presents the IAF selection page (figure 6-24).

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 database identifiers for the ends of the arc. D040L means **D**ME arc point, **040** is the radial 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 90B knows that this point is associated with a DME arc. Once an arc waypoint is chosen, the KLN 90B 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 the approach into the flight plan (figure 6-25). This waypoint is named using the same convention discussed earlier.

NOTE: *If the present radial from the reference VOR is outside of the defined arc, then the KLN 90B will default to the beginning of the arc.*

CAUTION: The KLN 90B does not take into account the geometry of the active flight plan when determining the arc intercept point. This point is defined

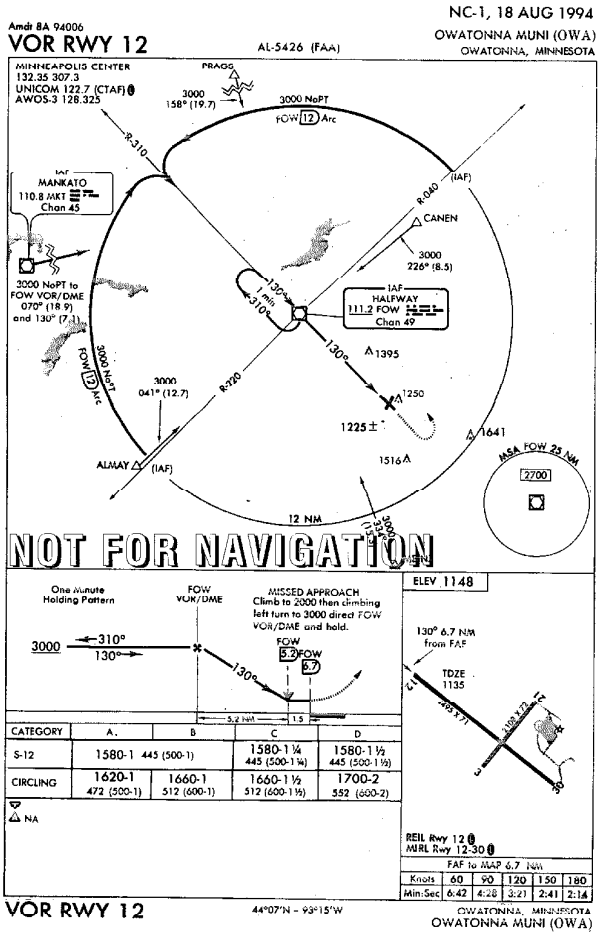


Figure 6-23

Figure 6-24

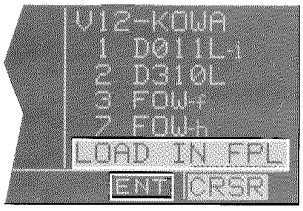


Figure 6-25

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 **LOAD IN FPL**, press [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 90B may give the message:

REDUNDANT WPTS IN FPL
EDIT ENROUTE WPTS
AS NECESSARY

Examine the flight plan and, if practical, observe the Super NAV 5 page to make sure that the sequence of waypoints does not have any unnecessary legs in it.

6. The KLN 90B will now provide guidance to the arc intercept point. The Super NAV 5 page displays the entire arc on the screen. The portion 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 intercept point and the end of the arc is drawn with the normal solid line (figure 6-26).

7. In some cases ATC may provide radar vectors to the arc. The KLN 90B 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 Super NAV 5 page or from the FPL 0 page. The dashed line displayed on the Super NAV 5 page will help you to determine if ATC is giving you correct vectors.

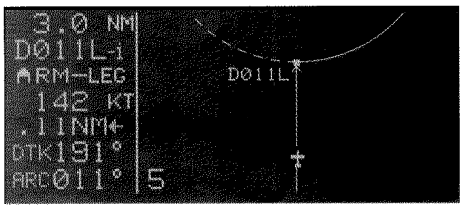


Figure 6-26

- From the Super NAV 5 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 left 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 6-27). 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.
- If [ENT] was pressed, then the KLN 90B will calculate an arc intercept point based on the present track of the aircraft over the ground.

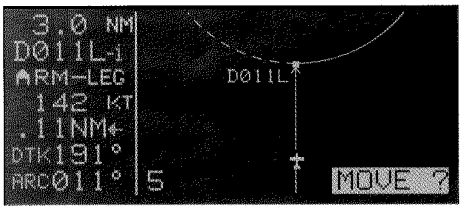


Figure 6-27

NOTE: *If the present track does not intercept the arc, then the KLN 90B will display* ***NO INTRCPT*** *in the scratch pad area of the screen.*

8. When the aircraft approaches the arc the KLN 90B will provide waypoint alerting and turn anticipation to join the arc.

9. Once established on the arc the KLN 90B 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 Super NAV 5 will automatically display DTK on the sixth 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 database. To help you determine your position relative to these step-down points along the arc, the KLN 90B will display a new value on the bottom line of the display on the Super NAV 5 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. It is not possible to select any other type of information to display on this line like you normally can. The arc radial is forced into this position when the aircraft is 30 NM from the arc. The arc display is shown in figures 6-26 or in figure 6-27. 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 90B 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 90B 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 6-28), and the runway environment is in sight, it is possible to descend for a landing.

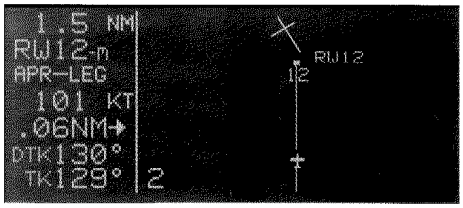


Figure 6-28

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. Since the KLN 90B will not automatically sequence past the MAP, the KLN 90B will provide the correct guidance for the climb.

16. Once 2000 feet has been reached press [D→], 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 getting 4 NM from FOW, the KLN 90B 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 90B 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 the approach active mode becomes the active mode.*

6.1.9 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 90B. In some cases the KLN 90B 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 90B will not go into the approach active mode and will present the following message:

RAIM NOT AVAILABLE
APR MODE INHIBITED
PREDICT RAIM ON STA 5

In these cases you will not be able to finish the approach because there is insufficient integrity monitoring. The STA 5 (Status 5) page provides a means for you to predict when RAIM will be available.

To perform a RAIM prediction on the STA 5 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 90B 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 use the following procedure.

1. Turn the left outer and inner knobs to select the STA 5 page.

2. Press the left CRSR. The cursor will be over the DEST field.

3. Enter the desired waypoint identifier by using the left inner and outer knobs just like you do for any other waypoint entry.

4. Once the desired waypoint identifier is entered press ENT (figure 6-29). Press ENT again if the waypoint information is correct.

5. The cursor will now be over the ETA field. Use the left inner knob to enter the desired hour. Note that the current time zone is displayed below the ETA field. Use the left 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 STA 5 page will be as shown in figure 6-30.

7. Once the RAIM calculation is complete, the STA 5 page will indicate the results of the test. This is done graphically in a bar graph format. The center of the bar graph represents the ETA that you entered in step 5. Each bar represents 5 minutes of time. The RAIM calculation is good for ±15 minutes of the ETA. Bars that are above the line indicate that RAIM is available and bars below the line indicate when RAIM is not available.

An example is shown in figure 6-31. Notice in the figure that the first four bars are below the line and the other three are above the line. This means that RAIM is not available at the ETA, nor during the 15 minutes prior to the ETA. RAIM is predicted to be available five minutes after the ETA and the next 10 minutes. By showing the times when RAIM will be available it is possible for you to alter your ETA to ensure that there will not be any RAIM problems.

Even more rare will be the case when the KLN 90B 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 90B will FLAG the navigation solution and a missed approach will have to be flown. The KLN 90B 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.

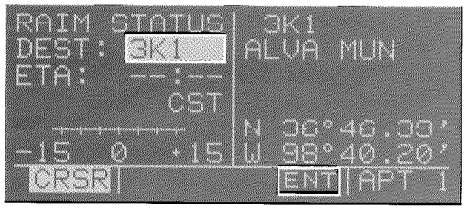


Figure 6-29

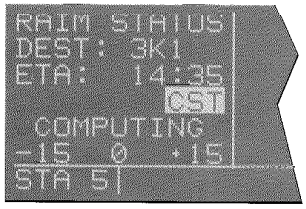


Figure 6-30

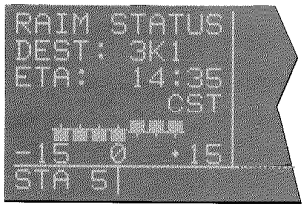


Figure 6-31

6.2 SID/STAR PROCEDURES

The database in the KLN 90B also contains the pilot NAV SIDs (Standard Instrument Departures) and STARs (Standard Terminal Arrival Routes) for the primary database coverage area (see Chapter 2 for database coverage areas). SID/STAR procedures stored in the database can only be considered accurate as long as the database is current. Even though the database contains SID and STAR procedures, there is a lot of information that is not included in the database. 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 90B 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 90B 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 90B. These procedures are not included in the database and therefore the waypoints that make up these procedures would have to be entered manually. It is good preflight practice ensure that the KLN 90B 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.

6.2.1 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.

1. Select KSFO on one of the airport pages (figure 6-32). 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).

2. If not already displayed, rotate the right inner knob until the APT 7 page appears as in figure 6-33. This will allow the selection of SID procedures.

3. Turn the right cursor on by pressing the right CRSR, and rotate the right outer knob until the flashing cursor is over **PORTE9** (figure 6-34). With the cursor over **PORTE9**, press ENT.

4. The KLN 90B will now ask which runway that you will be using. For this example select **RW01B** (figure 6-35) and press ENT.

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 6-36) and press ENT.

6. The KLN 90B 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 **LOAD IN FPL** to load the SID into the active flight plan (figure 6-37).

7. The KLN 90B will then add the SID procedure after the airport reference point in the active flight plan (figure 6-38). If the airport reference point is not included in the active flight plan, then the KLN 90B will ask to add this waypoint to the active flight plan.

Section 6.2.4 gives the actions required to fly this SID.

Figure 6-32

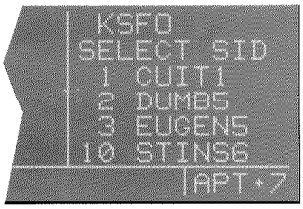


Figure 6-33

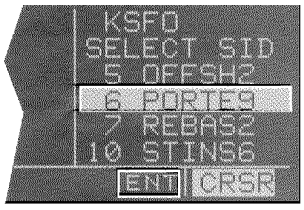


Figure 6-34

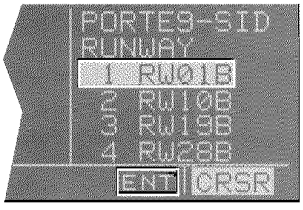


Figure 6-35

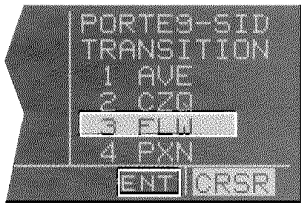


Figure 6-36

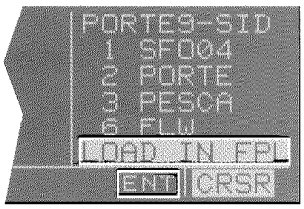


Figure 6-37

6.2.2 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).

Use the following procedure to select a STAR:

1. Select KDFW on one of the airport pages (figure 6-39). 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).

2. Turn to the APT 7 page for KDFW. Make sure that the words **SELECT STAR** are displayed near the top of the screen.

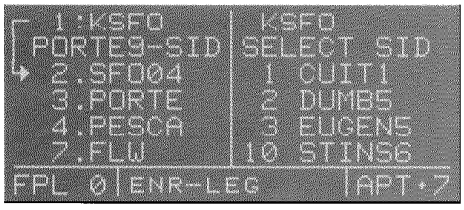


Figure 6-38

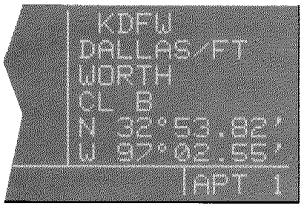


Figure 6-39

3. Turn the right cursor on by pressing the right CRSR, and, if necessary, rotate the right outer knob until the flashing cursor is over the desired STAR. With the cursor over AQN4 (figure 6-40), press ENT.

4. The KLN 90B will now ask which transition you want to use. For this example select **INK** (figure 6-41) and press ENT.

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 90B skips this step.

6. The KLN 90B now presents a list of waypoints that make up the STAR (figure 6-42). Review these waypoints if desired and then press ENT to load the STAR into the active flight plan.

7. The KLN 90B will then add the STAR procedure before the airport reference point in the active flight plan (figure 6-43). If the airport reference point is not included in the active flight plan, then the KLN 90B will ask to add this waypoint to the active flight plan.

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.*

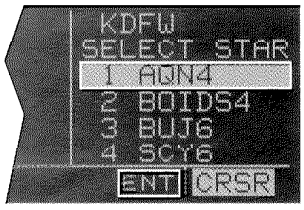


Figure 6-40

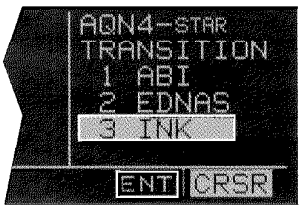


Figure 6-41

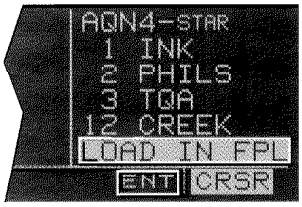


Figure 6-42

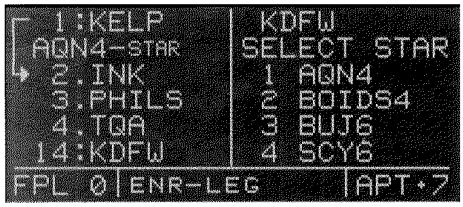


Figure 6-43

6.2.3 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 published 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 use the following steps:

1. Use the left knobs to select the FPL 0 page on the left side of the screen.

2. Turn the left cursor on by pressing the left CRSR. Rotate the left outer knob as necessary to position the cursor over the waypoint identifier which you desire to follow the waypoint being added.

3. Use the left 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 use the following steps:

1. Use the left knobs to select the FPL 0 page on the left side of the screen.

2. Rotate the left 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 database.*

To change or delete an entire SID or STAR procedure from the active flight plan use the following steps:

1. Use the left knobs to select the FPL 0 page on the left side of the screen.

2. Turn the left cursor on by pressing the left [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.*

6.2.4 Example of a SID Procedure

To illustrate the use of the KLN 90B with a SID, the Porte Nine departure loaded into the flight plan in section 6.2.1 will be used. 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 6-44):

1. Load the SID as described in section 6.2.1.

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 90B 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 Super NAV 5 page or from the FPL 0 page. In either case, once PORTE is highlighted in reverse video, press [D] to bring up the direct to page.

4. Press [ENT] to confirm PORTE as the direct to waypoint.

5. Change the selected course to the new value of 135°. This setup will take the aircraft to the PORTE intersection as directed by the SID.

6. Before reaching PORTE, change back to the Leg mode to enable automatic waypoint sequencing. Once the aircraft reaches PORTE the KLN 90B will automatically sequence to the next waypoint, PESCA.

7. After passing PESCA, the procedure calls for a 090° heading until intercepting the OSI R-116. Once established on the 116° radial proceed to the WAGES intersection. To do this with the KLN 90B, 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.

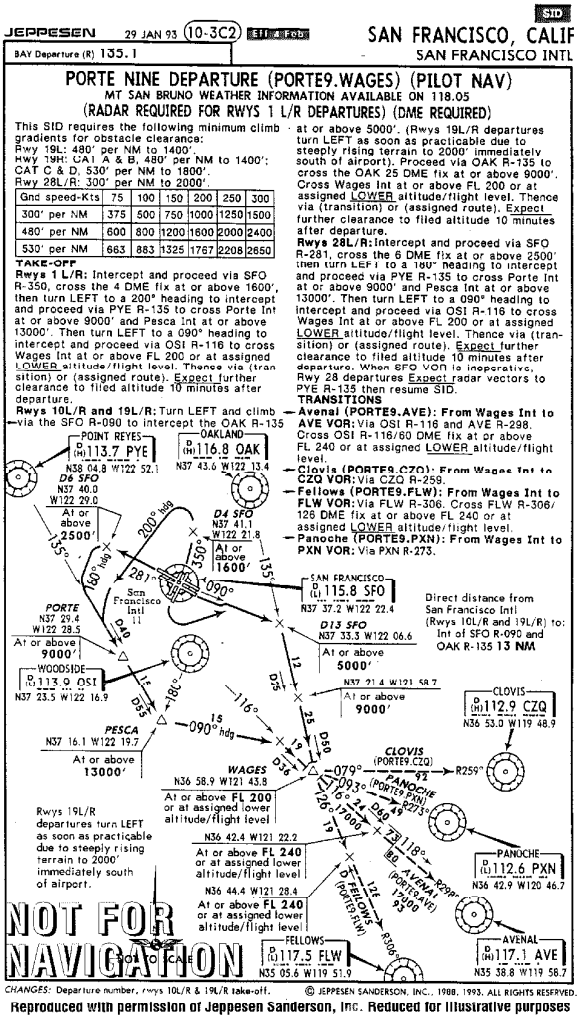


Figure 6-44

6.2.5 Example of a STAR Procedure

To illustrate the use of the KLN 90B 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 6.2.4.

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 90B and refer to the chart for this STAR (figure 6-45):

1. Load the STAR into the flight plan as described in section 6.2.2.

2. This STAR is very simple and the KLN 90B 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 database in the KLN 90B 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.*

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 left cursor and rotate the left 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 left inner and outer knobs and [ENT] as necessary.

8. The rest of the STAR can now be flown.

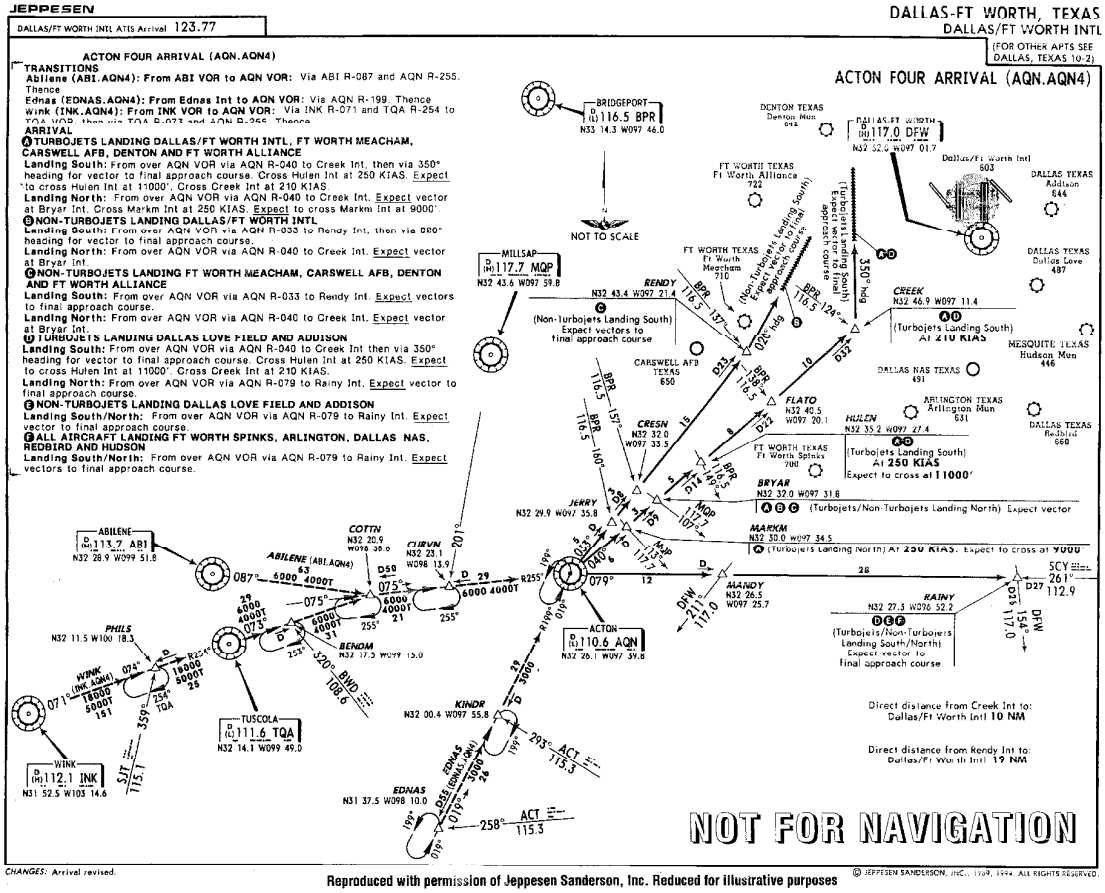


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Figure 6-45

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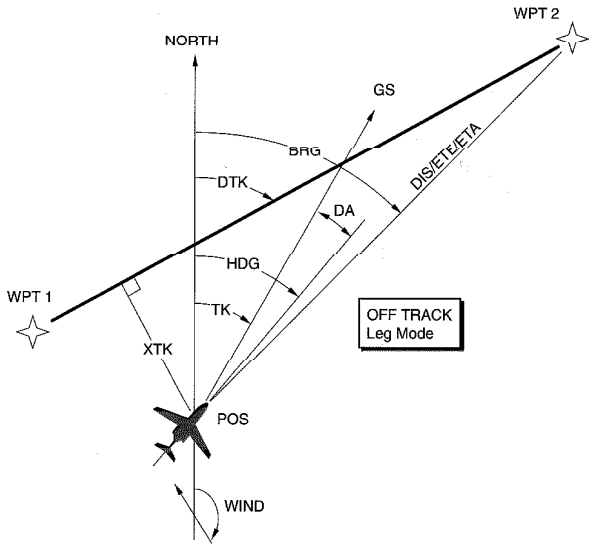
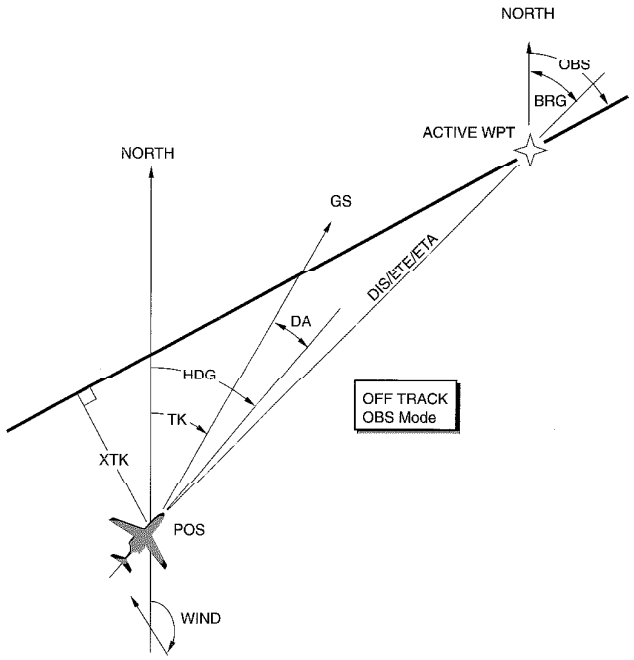
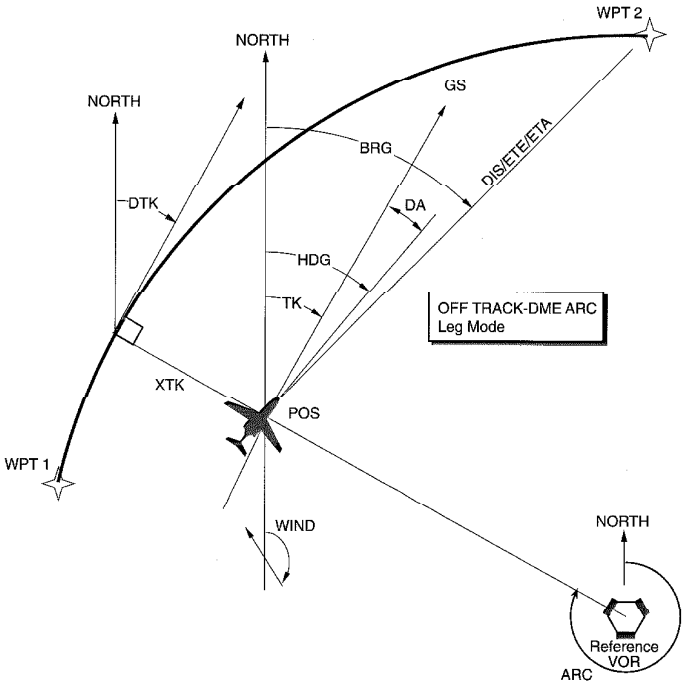
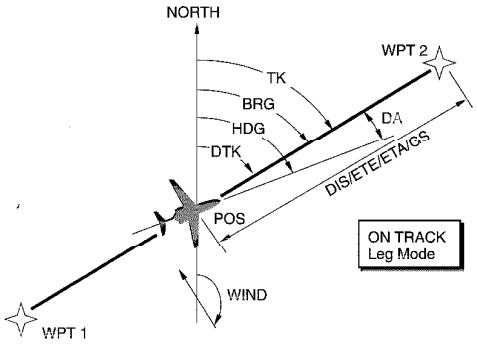
APPENDIX A - NAVIGATIONAL TERMS

BRG - Bearing to waypoint (degrees)
DA - Drift Angle (degrees) - not displayed on KLN 90B
DIS - Distance to waypoint (nm)
DTK - Desired Track (degrees)
OBS - Selected Course
GS - Groundspeed (nm/hr)
HDG - Heading (degrees)
POS - Present position
TK - Actual Track (degrees)
WPT - Waypoint
XTK - Cross Track Error Correction (nm) displayed as "FLY L 2.3 nm"
ETE - Estimated Time Enroute (hrs:min)
ETA - Estimated Time of Arrival
ARC - Radial from reference VOR when executing an approach procedure with a DME arc









APPENDIX B - MESSAGE PAGE MESSAGES

The following is a list of the messages that can appear on the Message page. When the message prompt appears, press **MSG** to view the message page. See section 3.5 for an explanation of the Message page.

ACTV ANNUNCIATOR FAIL - This message appears when there is a failure of the KLN 90B ACTV annunciator drive circuitry. To determine if the approach mode is active you will need to look at the status line of the KLN 90B because the annunciator will not be working if this message has been given. Service the KLN 90B as soon as possible.

ADJ NAV IND CRS TO 123° - (Adjust Navigation Indicator Course to 123°) When this message appears, the pilot should select the suggested course on the HSI or CDI. When the KLN 90B is in the Leg mode, this message occurs at the beginning of turn anticipation (prior to reaching the active waypoint) if the upcoming course change is greater than 5°. See section 4.2.2.

This message will also appear in installations where the KLN 90B is interfaced with an HSI such that the KLN 90B has the capability of reading the selected course from the HSI. In the Leg mode it will appear whenever the difference between the HSI's selected course and the KLN 90B's desired track (**DTK**) is greater than five degrees.

ADJ NAV IND CRS - (Adjust Navigation Indicator Course) This message will appear in installations where the KLN 90B is interfaced with EFIS or with a mechanical HSI through the optional KA 90 adapter. This message appears when the difference between the HSI's selected course and the KLN 90B's selected course (**OBS**) is greater than 0.5°. This usually happens only when the external indicator is not slewed to a new value defined by the KLN 90B. Check the interface between the KLN 90B and the external indicator to determine the problem.

AIRSPACE ALERT - This message appears when the estimated time to enter a special use airspace is approximately 10 minutes or when the distance from an area of special use airspace is less than two nautical miles. See section 3.10.

ALTITUDE FAIL - This message appears if the altitude input to the KLN 90B fails. The altitude related features of the KLN 90B will be disabled. There also may be more RAIM related messages since altitude is not available to help in the integrity calculations. Have the installation checked as soon as practical to determine the cause of the problem.

APT ELEVATION UNKNOWN - (Airport Elevation Unknown) This message appears if the elevation of the airport which would otherwise be used for the height above airport alert is unknown.

ARINC 429 AIR DATA FAIL - This message appears if the KLN 90B is interfaced with an air data system having ARINC 429 outputs and the outputs are not being received correctly by the KLN 90B.

ARINC 429 OUTPUT FAIL - This message appears when the ARINC 429 output fails an internal test. Anything depending on the KLN 90B's ARINC 429 output, such as the EHI 40/50 electronic HSI and some navigation graphics displays, should not be used.

ARM ANNUNCIATOR FAIL - This message appears when there is a failure of the KLN 90B ARM annunciator drive circuitry. To determine if the approach mode is armed you will need to look at the status line of the KLN 90B because the annunciator will not be working if this message has been given. Service the KLN 90B as soon as possible.

ARM GPS APPROACH - If the approach ARM mode has been disarmed then the KLN 90B will remind you to ARM the approach mode when the aircraft is 3 NM from the Final Approach Fix. Arm the approach mode if it is desired to use the KLN 90B for conducting an approach.

BAD SATELLITE GEOMETRY AND RAIM NOT AVAILABLE - This message appears only when the unit 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 STA 2 PAGE - This message will occur after receiving a notice 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.

BATTERY LOW: SERVICE REQUIRED TO PREVENT LOSS OF USER DATA - This message appears when the KLN 90B's internal battery is low and needs replacing at an authorized Bendix/King service center. The battery should be replaced within a week to prevent the loss of all user-defined data including waypoints, airport remarks, flight plans, etc. Typical battery life is approximately three to five years.

CHECK 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 90B and the ACTV annunciator. To determine if the approach mode is active you will need to look at the status line of the KLN 90B because the annunciator will not be working if this message has been given. Have the installation checked to determine the problem.

CHECK 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 90B and the ARM annunciator. To determine if the approach mode is armed you will need to look at the status line of the KLN 90B because the annunciator will not be working if this message has been given. Have the installation checked to determine the problem.

CHECK MSG ANNUNCIATOR - (Check Message 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 90B and the MSG annunciator. To determine if message alerting is being given you will need to look at the KLN 90B because the annunciator will not be working if this message has been given. Have the installation checked to determine the problem.

CHECK WPT ANNUNCIATOR - (Check Waypoint 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 90B and the WPT annunciator. To determine if waypoint alerting is being given you will need to look at the KLN 90B because the annunciator will not be working if this message has been given. Have the installation checked to determine the problem.

DATA BASE CHECKSUM ERR - (Data Base Checksum Error) This message appears if the data base fails an internal test when the KLN 90B is turned on. The most likely cause of the message is a failed data base cartridge.

DATA BASE OUT OF DATE 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.

EEPROM FAILURE: IC_____ EXTERNAL D-BAR INVALID - This message appears in the event a specific internal test fails. The blanks will contain the designator of one of the electrical components. Record the data before turning the unit off in order to assist maintenance personnel. Do not use an external HSI or CDI while it is driven by the KLN 90B. The rest of the KLN 90B is still usable including the internal CDI; however, the page displays may not be centered on the screen.

IF REQUIRED SELECT OBS - This message appears when the aircraft is 4 NM from a waypoint which could be used as the basis for either a procedure turn or a holding pattern and the unit is in the LEG mode. Select the OBS mode when flying procedure truns or holding patterns. This message is advisory only. If no procedure turn is required then no action is required.

INSIDE SPC USE AIRSPACE
[name and type of special use airspace]
[ATC responsible] [Vertical boundaries] - (Inside Special Use Airspace) This message appears when the aircraft's present position is inside an area of special use airspace. See section 3.10.

MAGNETIC VAR INVALID ALL 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 5.12.

MSG ANNUNCIATOR FAIL - (Message Annunciator Failure) This message appears when there is a failure of the KLN 90B MSG annunciator drive circuitry. To determine if message alerting is being given you will need to look at the KLN 90B because the annunciator will not be working if this message has been given. Service the KLN 90B as soon as possible.

NAV SUPER FLAG FAILURE - This message appears when an internal test fails for a specific NAV flag output. The KLN 90B is still usable, but anything connected to the super flag (such as some HSIs and autopilots) should not be used with the KLN 90B.

NO RCVR DATA - (No Receiver Data) This message appears when the KLN 90B fails a specific internal test for the GPS receiver. This failure will prevent the unit from providing any navigation capability.

NO RS-232 DATA - This message appears when no input is received on the RS-232 input (such as from a fuel management or air data system).

OBS WPT > 200NM (OBS Waypoint Greater Than 200 NM) This message appears when the KLN 90B is in the OBS mode and the distance to the active waypoint is more than 200 nautical miles. The system will perform normally; however, at this distance the D-Bar will be extremely sensitive to changes in selected course.

OTHER WAYPOINTS DELETED - This message appears when the message "WAYPOINT _____ DELETED" would be effective for more than ten waypoints.

POSITION DIFFERS FROM
LAST POSITION BY > 2NM - (Position Differs From Last Position By Greater Than 2 NM) This message appears when the GPS sensor first reaches the NAV mode if the new position differs from the position when power was turned off by more than two nautical miles.

POSITION OF
WPT HAS
CHANGED - (Position of Waypoint 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 database. This message is displayed on the left side of the screen while the waypoint page corresponding to the waypoint which changed is displayed on the right side of the screen.

POSITIONS OF OTHER
WAYPOINTS HAVE CHANGED - This message appears when the above message "POSITION OF WPT 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 baro informantion 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 unit is in the approach mode. By pressing the GPS APR button, the unit will be able to restore navigation information so that you can conduct a missed approach based on navigation information provided by the KLN 90B.

RAIM NOT AVAILABLE
APR MODE INHIBITED
PREDICT RAIM ON STA 5 - This message appears when integrity monitoring (RAIM) is predicted to not be available at either the FAF or the MAP. The KLN 90B will not allow the unit to go into the approach active mode until conditions improve. Turn to the STA 5 (Status 5) page to perform a RAIM prediction. The STA 5 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 90B (see section 6.1.9 for how to perform a RAIM prediction).

RAIM POSITION ERROR
CROSS CHECK POSITION - This message means that the unit 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.

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.

RCVR HARDWARE ERROR:_____- (Receiver Hardware Error) This message appears when the KLN 90B fails a specific internal test for the GPS receiver. The blank will contain a numerical value which may provide assistance to maintenance personnel.

RECYCLE POWER TO USE
CORRECT DATA BASE DATA - This message appears when the date entered on the Self-Test 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 90B 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 or SID/STAR procedure in the flight plan and the KLN 90B determines that some waypoints 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 or SID/STAR sections of the flight plan.

RS-232 DATA 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.

RS-232 OUTPUT ERROR - This message appears when the RS 232 output fails an internal test. Anything connected to the RS 232 output bus, such as some moving map displays and ELTs (for position reporting), will not be fully functional. Do not use moving map displays that depend on the KLN 90B's RS 232 output if this message is displayed.

SATELLITE COVERAGE
INADEQUATE FOR NAV - This message appears when the received GPS signals are not adequate for navigation. Occasions when this message will be displayed include when there are an insufficient number of satellites (including altitude input) or when the satellite geometry is inadequate for accurately determining position within 3.8 nautical miles.

SET FUEL ON BOARD
ON OTH 5 IF NECESSARY - This message appears when the KLN 90B determines that it is interfaced with a compatible Shadin fuel flow computer that allows the KLN 90B to set the fuel on board. The pilot should turn to the OTH 5 page to enter the current fuel on board for proper fuel computations (see section 5.10).

SYSTEM TIME UPDATED
TO GPS TIME - The message appears when the KLN 90B system time is automatically updated to GPS time by more than 10 minutes.

USER DATA LOST - This message appears when the unit determines that the internal memory backup battery is dead or that some other internal failure has occurred which has caused all user-entered data including waypoints, flight plans, airport remarks, etc., to be lost.

VNV ALERT- (Vertical Navigation Alert) This message appears when a VNAV operation has been programmed on the NAV 4 page and the estimated time to start the climb or descent is approximately 90 seconds. This message serves as notification to select the NAV 4 page so that the VNAV operation may be executed. This message does not appear if the NAV 4 page is already being displayed. VNAV status can also be displayed on the Super NAV 5 page.

WAYPOINT _____ 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.

WPT ANNUNCIATOR FAIL - (Waypoint Annunciator Failure) This message appears when there is a failure of the KLN 90B WPT annunciator drive circuitry. To determine if waypoint alerting is being given you will need to look at the KLN 90B because the annunciator will not be working if this message has been given. Service the KLN 90B as soon as possible.

NO INTRCEPT - (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 NDB WPTS - (No NDB Waypoints) Appears when the NDB type pages have been selected if the KLN 90B doesn't contain a data base cartridge and there are no user-defined NDB waypoints.

NO SUCH WPT - (No Such Waypoint) Appears when there is no waypoint in the data base corresponding to the entered identifier on the Reference Waypoint page.

NO SUP WPTS - (No Supplemental Waypoints) Appears when the SUP type pages have been selected if the KLN 90B doesn't contain a data base cartridge and there are no user-defined supplemental waypoints.

NO VOR WPTS - (No VOR Waypoints) Appears when the VOR type pages have been selected if the KLN 90B doesn't contain a data base cartridge and there are no user-defined VOR waypoints.

OUTDATED DB - (Outdated Database) Appears whenever the pilot attempts to select an approach from the database when the database has expired.

RMKS FULL - (Remarks Full) Appears when an attempt is made to create a user-entered airport remark on the APT 5 page if 100 user-entered airport remarks already exist. In order to create additional airport remarks, some existing remarks must be deleted on the OTH 4 page as described in section 3.11.6.

RWY MISSING - (Runway Missing) Appears when the Airport 3 (APT 3) page runway diagram shows some, but not all, of the runways at the selected airport. This occurs if the data base contains runway threshold position data for only some of the runways at the selected airport.

USED IN FPL - (Used In Flight Plan) Appears when you try to delete a user-defined waypoint on the OTH 3 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 250 waypoints. In order to create additional user-defined waypoints, it will first be necessary to delete existing user-defined waypoints on the OTH 3 page.

APPENDIX C - STATUS LINE MESSAGES

Status line messages are short operational messages that are displayed in the lower center segment of the screen. (See section 3.3 and figure 3-37). The following are the status line messages that may appear.

ACTIVE WPT - (Active Waypoint) Appears when you try to delete a user-defined waypoint on the OTH 3 page if the waypoint is the active waypoint (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→ CRS XXX° - (Direct To course XXX°) Appears when the KLN 90B is in the OBS mode and is interfaced with an external indicator which the KLN 90B cannot change the selected course and the pilot performs a Direct-To operation. Since the KLN 90B cannot change the selected course to the direct-to course, the KLN 90B 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 have selected 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.

ENT LAT/LON - (Enter Latitude and Longitude) Appears when a user-defined waypoint is being created, to remind you to enter the location of the waypoint.

FPL FULL - (Flight Plan Full) Appears when an attempt is made to add a new waypoint to a flight plan which already contains 30 waypoints and the first waypoint is part of the active leg. Change the active waypoint or delete another waypoint before adding any more waypoints.

IN ACT LIST - (In Active List) Appears when a user-defined VOR waypoint is the active waypoint if you try to change the stored magnetic variation of this VOR. If you need to change the magnetic variation of this waypoint, you must first make another waypoint active.

INVALID ADD - Appears when an attempt is made to add a new waypoint into the approach. Approach procedures must be flown as they are retrieved from the database.

INVALID 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.

INVALID ENT - (Invalid Enter) Appears when you have attempted to enter data which is not a valid entry. For example, trying to enter a date of 30 FEB 92.

INVALID REF - (Invalid Reference) Appears when you attempt to create a reference waypoint on the Reference Waypoint page if the waypoint you have chosen to use as the reference is not a valid choice. The waypoint is not a valid choice if it is impossible to draw a perpendicular line from the waypoint you have entered to one of the legs of the flight plan. A waypoint is also invalid for use as a reference if the letters A through Z cannot be appended to the waypoint identifier to create a unique identifier. See section 5.5.

INVALID VNV - (Invalid Vertical Navigation) Appears when a waypoint identifier has been entered on the NAV 4 page if the waypoint identifier is not valid for use in a VNAV operation. For the Enroute-Leg mode, the waypoint must be the active waypoint or a waypoint positioned in the active flight plan ahead of the aircraft's location. In the Enroute-OBS mode, the waypoint must be the active waypoint.

NO ACTV 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 operation must be accomplished.

NO APPROACH - 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 APT WPTS - (No Airport Waypoints) Appears when the APT type pages have been selected if the KLN 90B doesn't contain a data base cartridge and there are no user-defined airport waypoints.

NO INT WPTS - (No Intersection Waypoints) Appears when the INT type pages have been selected if the KLN 90B doesn't contain a data base cartridge and there are no user-defined intersection waypoints.

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
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
NW	Northwest Territory
ON	Ontario
PE	Prince Edward Island
PQ	Quebec
SK	Saskatchewan
YK	Yukon

COUNTRY ABBREVIATIONS

ABBREVIATION	COUNTRY
AFG	Afghanistan
AGO	Angola
AIA	Anguilla I.
ALB	Albania
ANT	Antarctica/Netherlands Antilles/Aruba
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 and Herzegovia
BRA	Brazil
BRB	Barbados
BRN	Brunei
BWA	Botswana
CAF	Central African Republic
CAN	Canada
CHE	Switzerland
CHL	Chile/Easter I.
CHN	China
CIV	Ivory Coast

Country Abbreviations - Continued

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
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
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	Liby/SPA Jamahiriya
LCA	St. Lucia
LKA	Sri Lanka
LSO	Lesotho
LUX	Luxembourg
MAC	Macau
MAR	Morocco
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 I.
MUS	Mauritius
MWI	Malawi
MYR	Myanmar
MYS	Malaysia
NAM	Nambia
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 I.
PRY	Paraguay

Country Abbreviations - Continued

PYF	French Polynesia/ Society I./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
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	U.S.A. including Baker Islands
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

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC/FIR) ABBREVIATIONS (Used on CTR 2 Page)

ABBREVIATION	ARTCC
ABQ	Albuquerque
ACC	Accra
ADD	Addis Ababa
ADE	Adelaide
ADN	Aden
AKM	Akmola
AKT	Aktyubinsk
ALG	Algiers
ALM	Alma-Ata
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
AUC	Auckland Oceanic
AUC	Auckland
BAG	Baghdad
BAH	Bahrain
BAK	Baku
BAL	Bali
BAN	Bangkok
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

Air Route Traffic Control Center (ARTCC/FIR) Abbreviations - Continued

BRL	Berlin
BRN	Barnaul
BRR	Barranquilla
BRS	Brasilia
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	Capetown
CAS	Casablanca
CHA	Chaybukha
CHE	Chelyabinsk
CHI	Chicago
CHO	Chokurdakh
CHR	Chersky
CHT	Chita
CHU	Chulman
CLE	Cleveland
COC	Cocos Island
COL	Colombo
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	Kikson
DOR	Kornod
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
GUY	Guayaquil
HAN	Hanoi
HAR	Harare
HAV	Havana
HK	Hong Kong
HNR	Honiara
HOC	Hochiminh
HON	Honolulu
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
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
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

Air Route Traffic Control Center (ARTCC/FIR) Abbreviations - Continued

LUS	Lusaka	OSK	Okhotsk
LVO	Lvov	OSL	Oslo
MAD	Madrid	PA	Punta Arenas
MAG	Magadan	PAN	Panama
MAI	Maiquetia	PAP	Port Au Prince
MAL	Male	PAR	Paris
MAN	Manila	PE	Port Elizabeth
MAR	Marcoille	PEC	Pechora
MAU	Mauritius	PEM	Perm
MAZ	Mazatlan	PEN	Penza
MAZ	Mazatlan Oceanic	PER	Perth
MDR	Madras	PET	Petersburg
MEL	Melbourne	PEV	Pevek
MEM	Memphis	PHN	Phnom Penh
MEN	Mendoza	PIA	Piarco
MER	Merida	PM	Port Moresby
MEX	Mexico	PMT	Puerto Montt
MGD	Magdagachi	PRA	Prague
MIA	Miami	PRM	Paramaribo
MIA	Miami Oceanic	PTR	Petropavlovsk-Kam
MIL	Milan	PV	Porto Velho
MIN	Minneapolis	PYO	Pyongyang
MIR	Mirny	REC	Recife
MLM	Malmo	RES	Resistencia
MLT	Malta	REY	Reykjavik
MNC	Monction Northern	RIG	Riga
MNC	Monction Southern	RIV	Rivadavia
MNS	Manaus	RMS	Reims
MNT	Monterrey	ROB	Roberts
MOG	Mogadishu	ROC	Rochambeau
MON	Montreal	ROM	Rome
MOS	Moscow	ROS	Rostov
MRM	Murmansk	ROV	Rovaniemi
MS	Mys Shmidta	SAI	Sainshand
MSK	Minsk	SAL	Sal Oceanic
MTV	Montevideo	SAM	Samara
MUN	Munich	SAN	Santiago
MUR	Muren	SCO	Scottish
MUS	Musca	SDO	Santo Domingo
NAD	Nadi Oceanic	SEA	Seattle
NAH	Naha	SEM	Semipalatinsk
NAI	Nairobi	SEY	Seychelles
NAS	Nassaut	SHA	Shanghai
NDJ	N'Djamena	SHE	Shenyang
NIC	Nicosia	SHN	Shannon
NIK	Nikolaevsk-Na-Amure	SHW	Shanwick Oceanic
NMY	Niamey	SIM	Simferopol
NOR	Norilsk	SIN	Singapore
NOV	Novosibirsk	SJU	San Juan Oceanic
NUK	Nukus	SLC	Salt Lake City
NY	New York	SLK	Salekhard
NY	New York Oceanic	SM	Santa Maria Oceanic
NZE	New Zeland	SMR	Samarkand
OAK	Oakland	SOF	Sofia
OAK	Oakland Oceanic	SON	Sondrestrom
ODE	Odessa	STA	Stavanger
OKH	Okha	STO	Stockholm
OMS	Omsk	SUK	Sukhuml
ORN	Orenburg	SUN	Sundsvall

Air Route Traffic Control Center (ARTCC/FIR) Abbreviations - Continued

SUR	Surgut
SWI	Switzerland
SYD	Sydney
SYK	Syktyvkar
SYM	Seymchan
TAE	Taegu
TAH	Tahiti Oceanic
TAI	Taipei
TAL	Tallinn
TAM	Tampere
TAS	Tashkent
TAZ	Tashavz
TBI	Tbilisi
TEH	Tehran
TEL	Tel Aviv
TIK	Tiksi
TIL	Tilichiki
TIR	Tirana
TOK	Tokyo
TOR	Toronto
TRI	Tripoli
TRO	Trondheim
TUN	Tunis
TUR	Turukhansk
TYU	Tyumen
UFA	Ufa
UJU	Ujung Bandang
ULA	Ulaanbaatar
UND	Underhaan
URA	Uralsk
URU	Urumqi
VAN	Vancouver
VAR	Varna
VEL	Velikiye Luki
VIE	Vienna
VIL	Vilnius
VLA	Vladivostok
VNT	Vientiane
VLO	Vologda
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
ZAI	Zaire
ZHK	Zhezkazgan
ZUR	Zurich
ZYR	Zyryanka

OTHER ABBREVIATIONS USED ON KLN 90B PAGES

80	80 octane fuel
100	100 octane fuel
100LL	100 octane low lead fuel
A	Airport waypoint
AAS	Aeronautical advisory service
ABV	Above
ACQ	Acquisition
ACT	Active flight plan waypoints
ADJ	Adjust
AKD	Alaska Daylight Time
AKS	Alaska Standard Time
ALRT	Alert area
ALT	Altitude
ANNUN	Annunciators
APPR	Approach
APR	Approach
APT	Airport
ARM	Approach Arm Mode
ARVL	Arrival (freq)
ATD	Atlantic Daylight Time
ATF	Aerodrome traffic frequency
ATS	Atlantic Standard Time
AWOS	Automatic weather observing station
B	Bad
B	Both
BARO	Barometer (altimeter setting)
BEL	Below
BRG	Bearing
C	Centigrade
CAL	Calculator
CAL	Calibration
CAS	Calibrated airspeed
CAUT	Caution area
CDI	Course Deviation Indicator
CDT	Central Daylight Time
CL B	Class B airspace
CL C	Class C airspace
CLR	Clearance delivery
CLY	Clay
CONV	Conversion
CORD UNIV	Coordinated Universal Time
CRS	Course
CRSR	Cursor
CST	Central Standard Time
CTA	Control area (outside USA)
CTAF	Common traffic advisory frequency
CTR	Center (Air Route Traffic Control Center)
D	DME capable
D/T	Distance/Time
DB	Database
DEGRD	Degraded navigation
DEN	Density Altitude
DEP	Departure

Other Abbreviations Used on KLN 90B Pages - Continued

DEST	Destination
DEV	Deviation (on external course devation indicator)
DIR	Director (freq)
DIS	Distance
DNGR	Danger area
DTK	Desired track
DUP	Duplicate
E	East
EDT	Eastern Daylight Time
ELE	Elevation
ELEV	Elevation
ELV	Airport elevation
ENDUR	Endurance
ENG	Engine
ENR	En route
ENT	Enter
ESA	Minimum en route safe altitude
EST	Eastern Standard Time
ETA	Estimated time of arrival
ETE	Estimated time en route
F	Fahrenheit
FAF	Final Approach Fix
FAILR	Failure of receiver
FF	Fuel Flow
FLT	Flight time
FOB	Fuel on board
FP	Flight plan
FPL	Flight plan
FPM	Feet per minute
FR	From
F REQ	Fuel required
FSS	Flight service station
G	GPS based approach procedure
GAL	Gallon
GDT	Greenland Daylight Time
GPS	Global Positioning System
GPS CRS	External Leg/OBS switch
GRND	Ground control
GRV	Gravel
GS	Groundspeed
GST	Greenland Standard Time
H	High altitude VOR
H	High pressure oxygen
HAD	Hawaii Daylight Time
HAS	Hawaii Standard Time
HB	High pressure bottled oxygen
HDG	Heading
HDWND	Headwind
HRD	Hard surface
HSI	Horizontal Situation Indicator
HT	Height
I	Intersection waypoint
IAF	Initial Approach Fix
IDENT	Identifier
IMP	Imperial gallon
INACTV	Inactive
IND	Indicated altitude
INIT	Initialization
INT	Intersection
INVRT	Invert
KG	Kilogram
KT	Knots
L	Left
L	Liters
L	Low altitude VOR
L	Low pressure oxygen
L	Runway lighting sunset to sun rise
L FOB	Landing fuel on board
LB	Low pressure bottled oxygen
LB	Pounds
LDG	Landing
LEN	Length
LPC	Runway lighting is pilot controlled
LPT	Runway lighting is part time or on request
MACH	Mach number
MAHP	Missed Approach Holding Point
MAP	Missed Approach Point
MAT	Steel matting
MB	Millibars
MCOM	Multicom
MDT	Mountain Daylight Time
MF	Mandatory frequency
MOA	Military operation area
MOD	Mode
MOGAS	Automotive fuel
MPH	Miles per hour
MSA	Minimum safe altitude
MSG	Message
MST	Mountain Standard Time
N	NDB overlay approach procedure
N	NDB waypoint
N	North
NAV	Navigation
NAV A	Navigation with altitude aiding
NAV D	Navigation with data collection
NM	Nautical miles
NR	Nearest
OBS	Omni bearing selection
ORS	Operational Revision Status
OTH	Other
P.POS	Present position
PCL	Pilot controlled lighting
PDT	Pacific Daylight Time
POS	Position
POSN	Position
PRES	Present
PROH	Prohibited area
PRS	Pressure altitude
PST	Pacific Standard Time
PTAX	Pre-taxi clearance
PWR	Power
R	Right

Other Abbreviations Used on KLN 90B Pages - Continued

R	RNAV overlay approach procedure
(R)	Radar environment to approach & departure
RAD	Radial
RAIM	Receiver Autonomous Integrity Monitoring
RAMP	Ramp/taxi control (freq)
RCVR	Receiver
RDR	Radar (freq)
REF	Reference
REQD	Required fuel
RES	Reserve fuel
REST	Restricted area
RMI	Radio magnetic indicator
RMKS	Remarks
RW	Runway
S	South
S	Supplemental waypoint
SAT	Static air temperature
SDT	Samoa Daylight Time
SEL	Selected altitude
SEQ	Sequence
SET	Setup
SFT	Soft surface
SHL	Shale
SID	Standard Instrument Departure
SND	Sand
SNR	Signal-to-noise-ratio
SNW	Snow
SPC USE	Special Use (airspace)
SRCH	Search the sky
SST	Samoa Standard Time
STA	Status
STAR	Standard Terminal Arrival Route
STN	Station
SUP	Supplemental
SV	Space vehicle
SW	Software
T	Terminal VOR
T	Terminal waypoint
t	Relative to true North
TAS	True airspeed
TAT	Total air temperature
TEMP	Temperature
TK	Actual track
TLWND	Tailwind
TMA	Terminal area (outside USA)
TRAN	Transition
TRF	Turf
TRI	Trip
TRNG	Training area
TRSA	Terminal Radar Service Area
TWR	Tower
U	Undefined class of VOR
UNIC	Unicom
UNK	Unknown
UTC	Coordinated Universal Time (Zulu)
V	VNAV status (on Super NAV 5)
V	VOR approach overlay procedure
V	VOR waypoint
VERT	Vertical
VNV	Vertical navigation (VNAV)
W	Weak
W	West
WARN	Warning area
WPT	Waypoint
WRN	Warn
XTK	Cross track error correction
Z	Zulu time