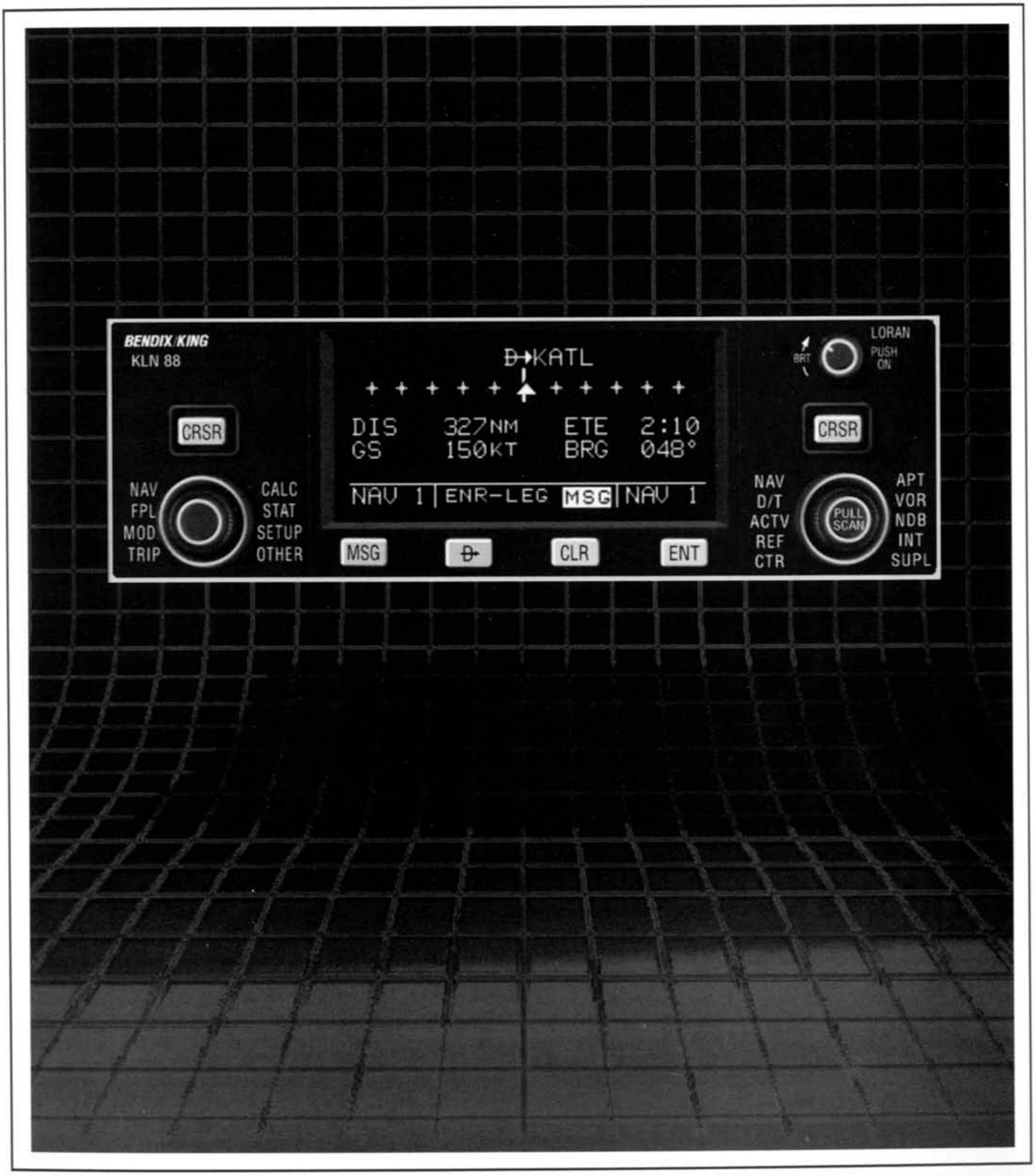
Pilot's Guide

KLN 88

Bendix/King Multi-chain
Loran Navigation System



ORS 01, 03, and 04

KLN 88 PILOT'S GUIDE

006-08458-0000

for KLN 88s with

OPERATIONAL REVISION STATUS ORS 01, 03, and 04

Note: KLN 88 units having ORS 03 and 04 are able to utilize the North Central U.S. chain (8290), the South Central U.S. chain (9610), and the Zulu station of the Great Lakes chain (8970). KLN 88s having ORS 01 are not able to utilize these chains/stations without modification. See page 4-3 for how to determine the unit's ORS level. Before a KLN 88 is eligible for IFR certification in Alaska or Canada it must have ORS level 04.

APRIL, 1992

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INTRODUCTION

The KLN 88 is an extremely sophisticated and capable navigational device. 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 88'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 88 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 Loran user. 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 88, 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! In fact, the FAA's Advisory Circular concerning approval of Loran-C, AC 20-121A, states "Aircraft employing Loran-C for IFR navigation should also be equipped with an alternate means of navigation".

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 88 that you forget to fly the airplane. 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 4-4 where the white border around the characters* ***APPROVE****? 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 88 is to operate, the following operational preview is presented. This operational preview assumes the KLN 88 has been properly installed, the unit was previously operational in the same general geographical location, and that no peripheral equipment interfaced with the KLN 88 (such as external HSIs, CDIs, autopilots, RMIs, fuel flow systems, moving map displays, 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. The Self Test page is recognizable because it shows the date and time on the right side. If the date and time are incorrect, refer to section 4.2 of this Pilot's Guide. The bottom left side of the Self Test page must display **TEST OK**. Press [ENT] to approve the Self Test page. (Note: If the KLN 88 is being used in the optional KCC 88 take-home case, a Take-Home Warning page is displayed before the Self Test page and must be acknowledged by pressing [ENT].)

3. A Data Base page is now displayed showing the date the data base expires or the date it expired. Press [ENT] to acknowledge the information displayed on this page.

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 [⊕] button. A page with the words **DIRECT TO** is now displayed on the left. In step 6 you will enter the identifier of the destination airport. The identifier will have a "K" prefix for a U.S. airport (or a "C" prefix for a Canadian airport) if the identifier is all letters. For example, LAX becomes KLAX. If the identifier contains any numbers there is no prefix. For example, TX04 is entered as TX04.

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.

PRECIPITATION-STATIC CONSIDERATIONS

Loran systems operate with relatively low signal-to-noise ratios and have only a short period of time to identify and use each signal. *Therefore, noise sources that will cause no interference or momentary interference with other avionics systems may cause a complete loss of the Loran signal, resulting in a Nav Flag from the Loran system.* The types of noise of most concern to Loran operation are precipitation-static (p-static) interference and alternating current noise sources. P-static interference is the result of three effects:

1. Corona discharges from aircraft extremities. This effect is the result of an electrical charge generated on the aircraft while it is passing through electrical fields associated with thunderstorms or a frictional charge generated on the aircraft as it passes through charging particles such as snow, rain, sand, or dust.

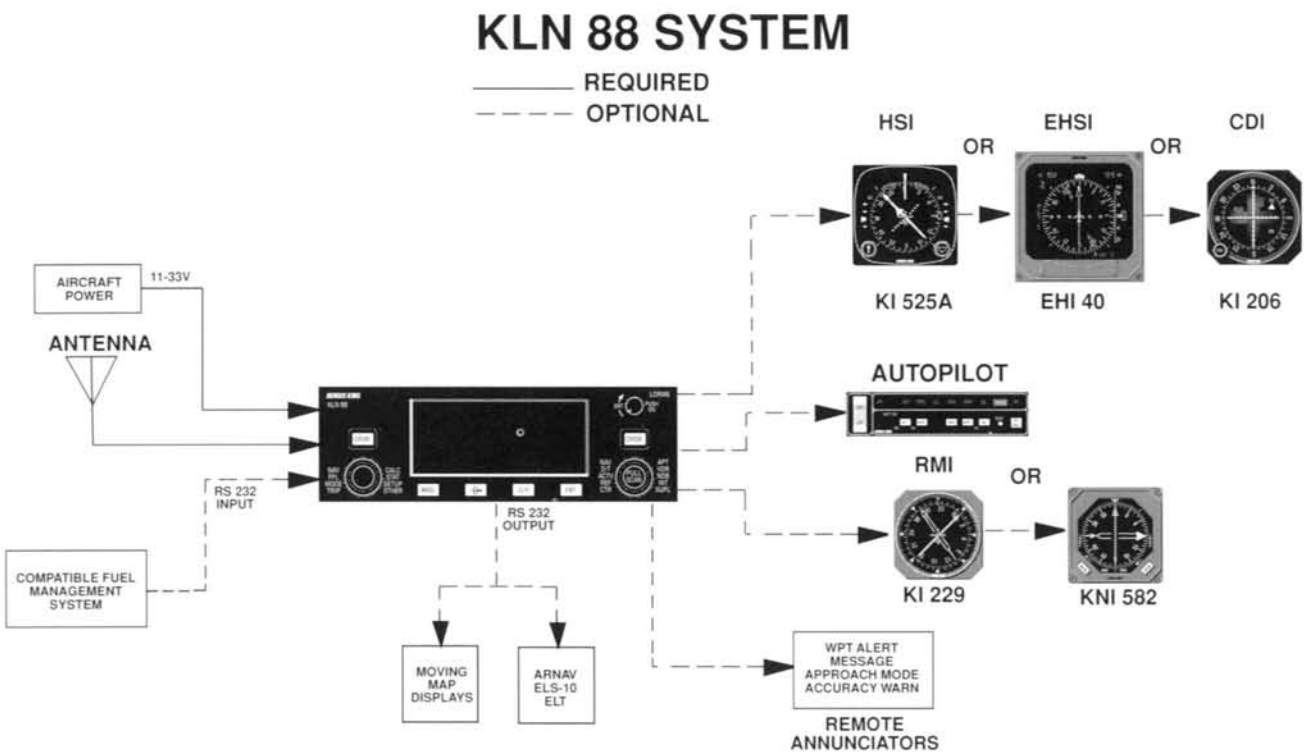
2. Streamer discharges from nonmetallic surfaces as a result of frictional charging of the surface. When the breakdown potential of the air is reached, a discharge will occur between either two unequally charged surfaces or from a charged surface to a grounded surface.

3. Sparkover discharges from metallic surfaces that are electrically isolated from the rest of the airframe. The isolated surface will develop a frictional charge that will discharge itself to the rest of the airframe when the electrical potential of the air is reached.

The effects of p-static and alternating current noise may be minimized, but not entirely eliminated, by selecting an optimum antenna location, by the proper use of static dischargers on the aircraft, by ensuring proper bonding of all aircraft control surfaces and access doors, by proper bonding and shielding of all alternating current noise sources, and using proper installation practices for routing of equipment cables.

CHAPTER 1 - KLN 88 SYSTEM COMPONENTS

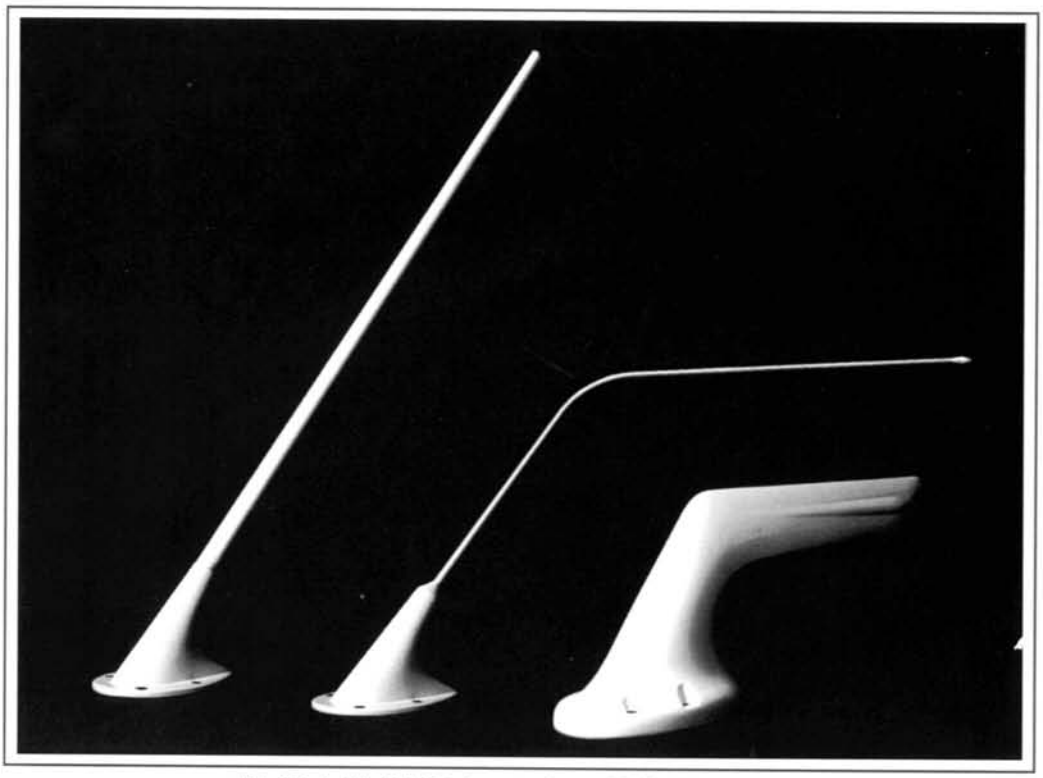
A basic KLN 88 system consists of a panel mounted KLN 88 navigation sensor/navigation computer, a data base cartridge, and an antenna. Additional system components may be added or interfaced to the KLN 88 which increase its features and capabilities. Some of these optional components include an external course deviation indicator (CDI) or HSI, RMI, fuel management system, ARNAV ELS-10 emergency locator transmitter (ELT), autopilot, and external annunciators.



The KLN 88 panel mounted unit contains the Loran-C 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 data base 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 data base is designed to be easily updated by the user by removing the obsolete cartridge and replacing it with a current one.

Three Loran antennas are available for use with the KLN 88. The standard antenna is the KA 83 straight whip. Optional antennas are the KA 84 bent whip which is used in installations where ground clearance is a consideration and the high speed KA 85. All three contain an antenna coupler mounted in the base of the antenna.



KA 83 (left), KA 84 (center), and KA 85 antennas

The KLN 88 has analog outputs to drive the left-right deviation bar of most mechanical CDI's and HSI's. In addition, it has digital outputs to automatically drive the course pointer and display flight plan waypoints on the Bendix/King EHI 40 electronic HSI.

The Bendix/King KI 229 and KNI 582 RMIs may be interfaced to the KLN 88 to provide a display of magnetic bearing to the waypoint.

The NAV mode of the Bendix/King KFC 150, KAP 150, KAP 100, KFC 200, KAP 200, KFC 250, KFC 300, and KFC 400 Flight Control Systems may be coupled to the KLN 88. Many other autopilots may also be coupled to the KLN 88. Actual autopilot performance and capability when coupled to the KLN 88 may vary significantly from one autopilot model to another.

Certain Digiflo™ and Miniflo™ fuel management systems manufactured by Shadin Co. Inc. and certain fuel computers manufactured by ARNAV Systems, Inc. interface with the KLN 88. These interfaces allow the pilot to view fuel related parameters calculated by the KLN 88 such as how much fuel will be remaining when the aircraft lands at the destination.

The KLN 88 will interface directly to the ARNAV Systems, Inc. ELS-10 emergency locator transmitter system. The latitude and longitude of the aircraft's present position is continuously sent from the KLN 88 to the ELS-10. Upon activation, the ELS-10 uses these latitude and longitude coordinates to make a synthesized voice transmission of the aircraft's location. Certain "Nav Map" systems, such as the Eventide Argus 5000, may also be interfaced to the KLN 88.

Some installations may require remote annunciators to be mounted in the aircraft panel in order to indicate the status of certain KLN 88 functions. Specifically, the KLN 88 has outputs to provide annunciation for waypoint alert, message, approach mode, and accuracy warning.

Also available is the KCC 88 take-home case. The KCC 88 contains a power supply which plugs into a standard 115 volt or 230 volt electrical wall outlet and a mounting rack housed in an attractive briefcase. It allows a user to operate the KLN 88 from the comfort of his home, office, or motel room. It can be used to perform flight planning or as an excellent means of learning to use the KLN 88.

KCC 88 Take - Home Case

CHAPTER 2 - DATA BASE

One reason the KLN 88 is such a powerful navigation system is because of its extensive data base. A data base is an area of electronic memory used to store a large catalog of navigational and aeronautical information.

2.1 FUNCTIONS OF THE DATA BASE

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

The second function of the data base is that it serves as a very convenient means to store and easily access 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 88!

2.2 DATA BASE COVERAGE AREA

The KLN 88 data base contains information for North America. More precisely, the data base coverage area is for the geographical regions which the International Civil Aviation Organization (ICAO) refers to as Canada, the United States, and Latin America. These regions are shown in figure 2-1. There are portions of this area which do not provide Loran coverage. The KLN 88 Loran coverage area chart is shown in figure 4-1.

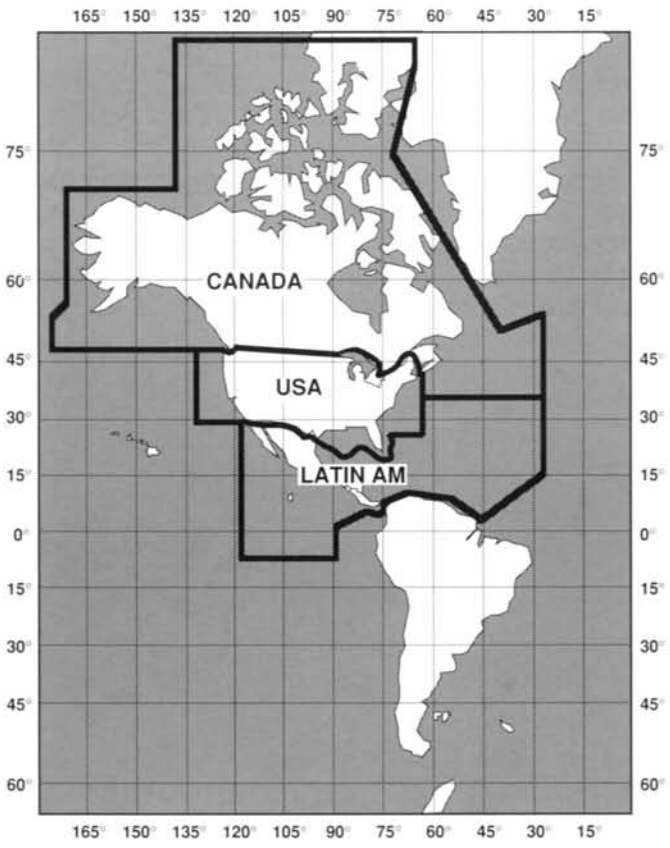


Figure 2-1. KLN 88 Data Base Geographical Region

2.3 USE OF ICAO IDENTIFIERS

Waypoints are stored in the KLN 88 data base 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, Denver and Los Angeles VOR's have the familiar ICAO identifiers DEN and LAX, respectively.

Please note that one area of potential confusion is airport ICAO identifiers. Many airport identifiers 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 ICAO identifier for Denver Stapleton International airport is KDEN, not DEN. 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".

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 3LA, 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.

2.4 UPDATING THE DATA BASE

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

The data base is housed in a cartridge which plugs directly into the back of the KLN 88. It is designed so that the user may easily keep the data base current by removing the old data base cartridge and inserting a current cartridge.

Every 28 days, Bendix/King receives new NavData information from Jeppesen Sanderson for the North American data base region. This information is processed and downloaded onto the data base cartridges. Bendix/King makes these data base cartridge updates available to you in a choice of a one year subscription or on a random basis as you require. In either case, an updated cartridge is sent to you and the obsolete cartridge must be returned to Bendix/King. The one year subscription includes 13 updates (one every 28 days).

Bendix/King sends the update cartridge to subscribers so that it arrives several days prior to the next effective date. The new cartridge may be installed in the KLN 88 any time prior to the effective date and the KLN 88 will use the previous data up to the effective date and automatically begin using the new data on the effective date. Depending upon the date a random update is ordered, users who choose to update their data bases on a random basis could receive an update cartridge any time during the 28 day effectivity period.

In order to get maximum utilization from the KLN 88, Bendix/King highly encourages you to update the data base 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 data base information is only assured if it is used before the end of the effectivity period. Use of out of date data base information is done entirely at the user's own risk.

To update the KLN 88 cartridge it is necessary to remove the KLN 88 from the aircraft's instrument panel. The KLN 88 and the mounting rack have been designed to provide for easy removal. Follow these steps to update the data base cartridge.

1. Insert the KLN 88 insertion/removal tool (supplied with unit) in the small hole located on the right side of the front of the unit (figure 2-2). A standard 3/32 inch Allen wrench may also be used.

Figure 2-2

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 88 should now be loose from the rack. Pull the unit out the 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 data base cartridge by pulling it straight out the back of the KLN 88 (figure 2-3).

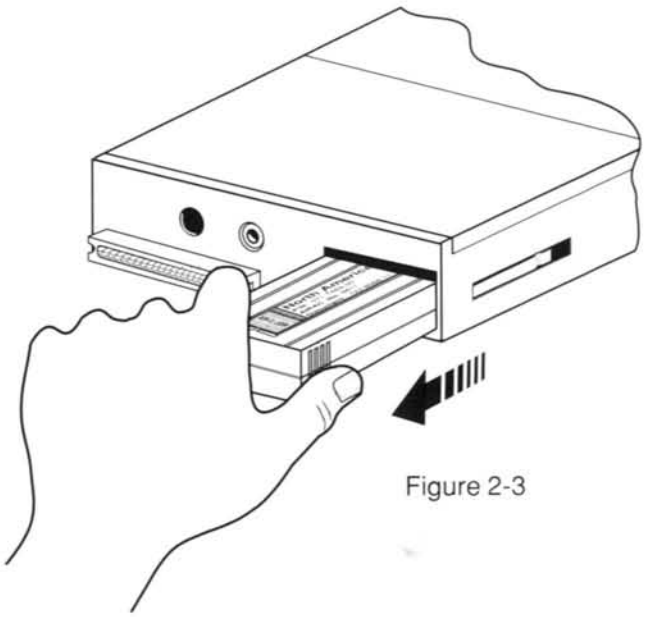


Figure 2-3

5. Remove the new data base cartridge from its shipping container. Note that the label on the cartridge indicates which side is up and which end to insert into the KLN 88. 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 88 (figure 2-4).

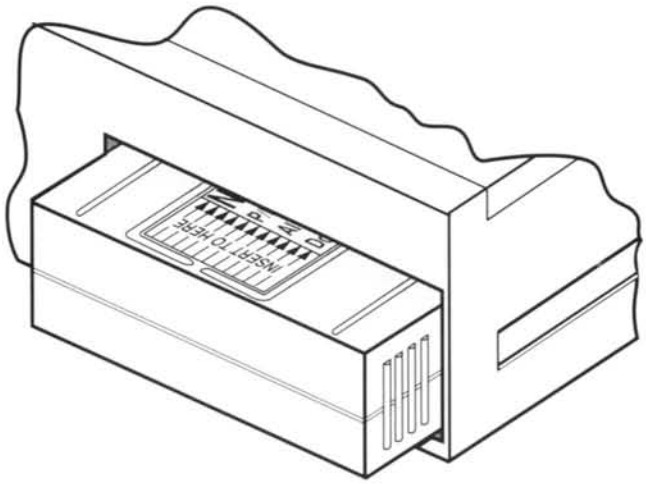


Figure 2-4

6. Make sure that the front lug of the locking mechanism is in the up position (figure 2-2). Insert the KLN 88 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 88 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. Insert the old cartridge and the new packing list into the container which had been used to ship the new cartridge. Peel off the protective backing from the adhesive on the side flap on the container. Press the flap against the adhesive to seal the container.

9. Mail immediately. The container already has a return shipping label back to Bendix/King. No postage is required if mailed from within the U.S. Please return the old cartridge promptly. 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 DATA BASE

In addition to the published data base 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 6.4 describes how you may create a user-defined waypoint.

2.6 INTERNAL MEMORY BACKUP BATTERY

The KLN 88 contains an internal lithium battery that is used to "keep-alive" the user-defined data base as well as flight plans and user-defined Loran approaches. 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.*

CHAPTER 3 - KCC 88 TAKE-HOME CASE

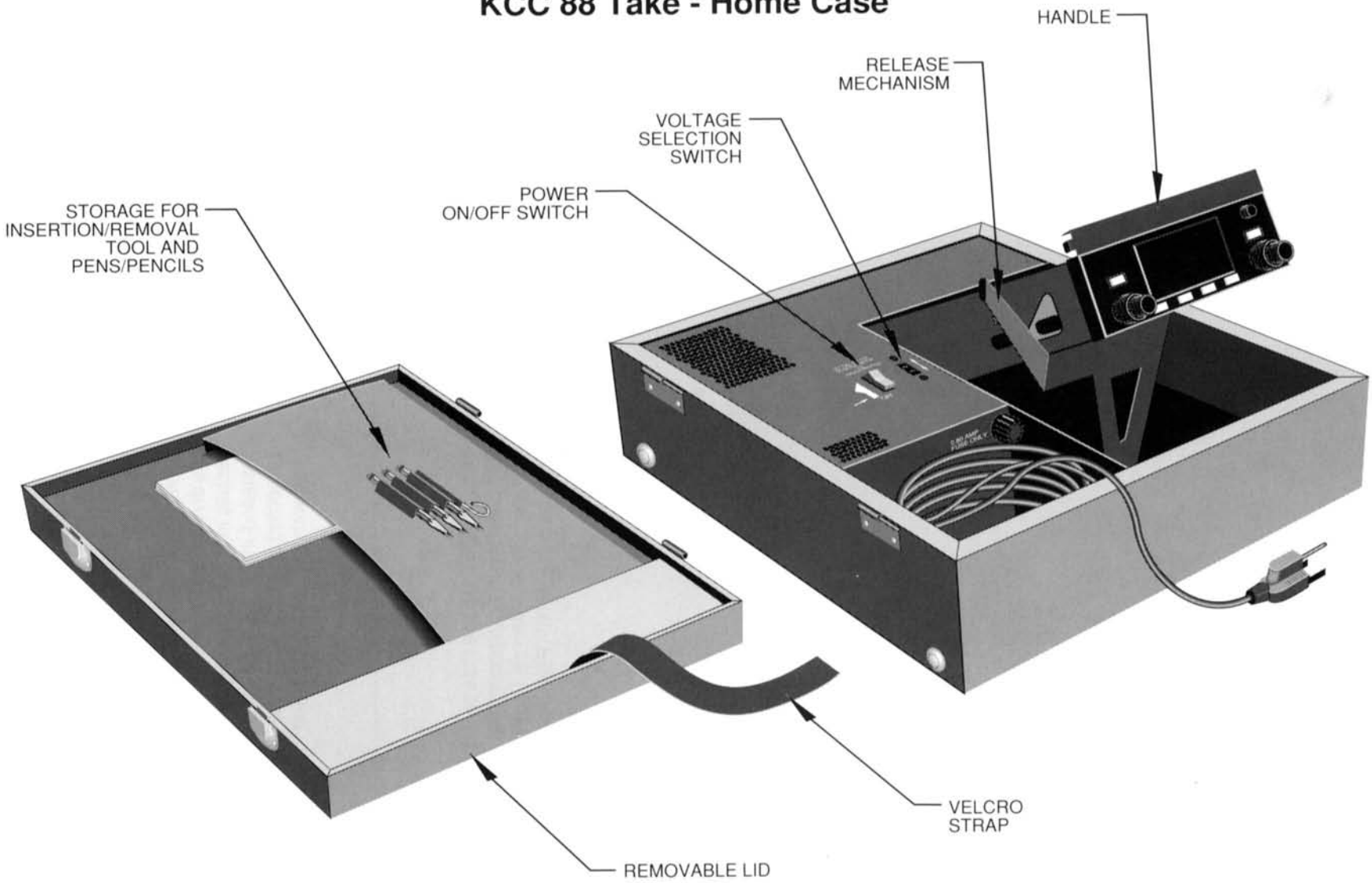
3.1 DESCRIPTION

The optional KCC 88 is a specially designed case containing a power supply, cooling fan, and rack for the KLN 88 Loran. The KCC 88 provides an excellent means of allowing the KLN 88 to be utilized from the comfort of your home or office for detailed flight planning of future trips. Estimates of time enroute, distance, minimum altitudes, and fuel requirements may be easily determined. It also provides an ideal way of learning to use the KLN 88, since the division of attention required inside of an aircraft cockpit results in a poor learning environment. In addition, when installed in the KCC 88 take-home case, the KLN 88 is protected against a moderate degree of the abuse associated with transporting the unit to and from the aircraft.

3.2 THE TAKE-HOME MODE

When the KLN 88 is used in the KCC 88 case, it is automatically put into the take-home mode. When the KLN 88 is in the take-home mode, it performs as if it is receiving adequate Loran signals to determine its position. It displays the latitude and longitude of its last known position or of whatever position it is initialized to on the Setup 1 (**SET 1**) page (see section 4.6,"INITIALIZATION"). Trip planning may be accomplished with the unit in the take-home mode using the six Trip Planning pages as described in section 6.1, "TRIP PLANNING".

KCC 88 Take - Home Case



3.3 SETTING UP THE KCC 88

1. After opening the case, the lid may be removed.

2. Lift up on the handle located on the top of the rack to raise the rack to the desired viewing angle.

3. The KLN 88 is inserted and removed from the KCC 88 rack in the same manner as described in section 2.4, "UPDATING THE DATA BASE".

4. Check the voltage selection switch located to the right of the red ON/OFF power switch to make sure it is in the appropriate position. The selection choices are 115 or 230 volts. 115 volts is the common voltage used in the United States.

5. Plug the power cord into a suitable electrical receptacle.

6. Press the KCC 88's red power switch to the ON position. Do not cover the vent holes on top of the case. A fan pulls air from the outside of the case to provide cooling to the KLN 88.

7. Refer to the instructions beginning in section 4.2, "TURN-ON AND SELF-TEST", for KLN 88 operation.

8. When use is completed, turn-off the KLN 88 with the power/brightness switch located on the unit. If you have initialized the unit on the SET 1 page at a location other than the location of the aircraft, it is a good idea to re-initialize the unit back to the aircraft's position before you turn-off the KLN 88 . This will save you the effort of possibly having to initialize the unit when it is put back into the aircraft.

9. Press the KCC 88's red power switch to the OFF position.

10. The rack may be lowered back into the case by pulling up slightly on the handle of the rack and then pulling forward on the release mechanism located on the left side of the rack.

NOTE: *The KCC 88 contains a microswitch that automatically turns the power supply off if the KLN 88 rack is lowered into the case while the red power switch is left in the ON position.*

11. The KLN 88 Pilot's Guide, aeronautical charts, or other pilot aids may be stored in the pouch located in the KCC 88 lid. The lid also has slots to provide storage for pens, pencils, and the insertion/removal tool. The Abbreviated Operator's Manual may be stored on top of the KLN 88 rack.

CHAPTER 4 - LEVEL 1 OPERATION

This is the first of three chapters specifically dealing with operating the KLN 88. In this chapter you will learn the basic operation of the front panel controls and then how to perform Direct To navigation (navigating from your present position direct to your desired location).

4.1 COVERAGE AREA

The KLN 88 VFR operational area is depicted in figure 4-1. Note that this area is slightly different than the data base coverage area shown in figure 2-1. If your KLN 88 is approved for IFR use, the areas approved for IFR flight are stated in the aircraft's KLN 88 Flight Manual Supplement.

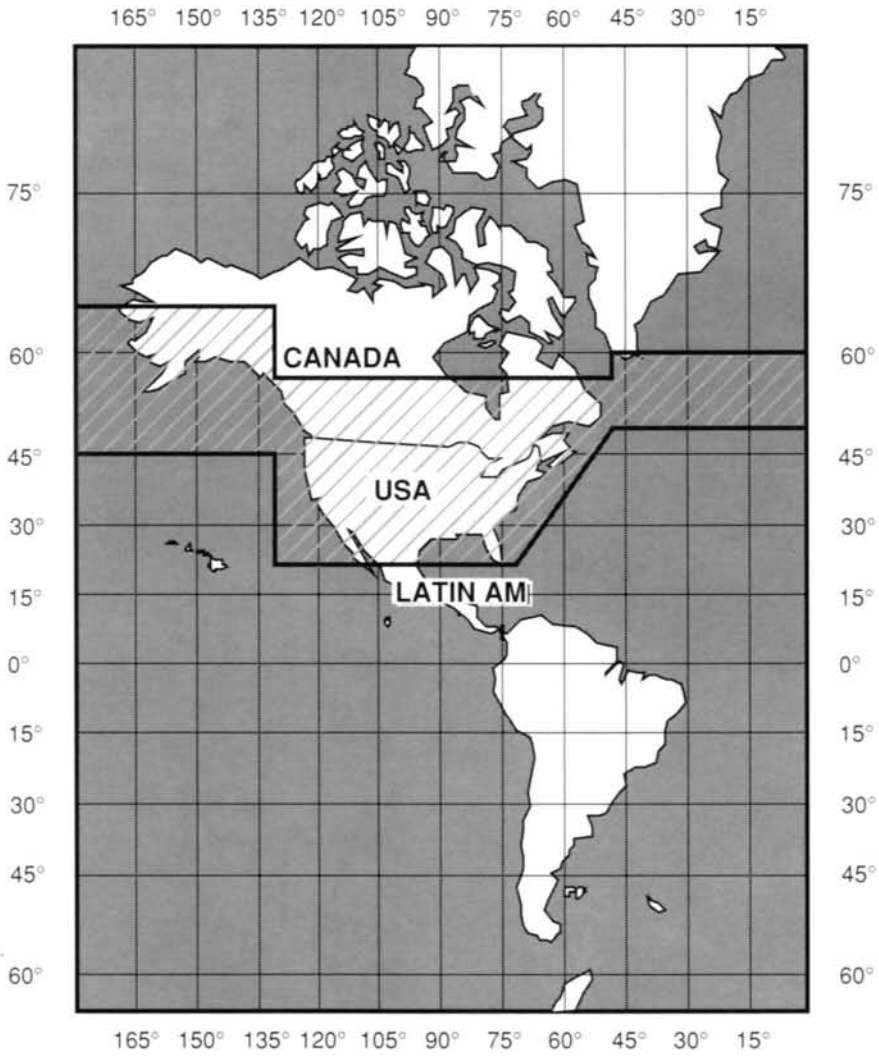


Figure 4-1 KLN 88 Navigation Coverage Area

KLN 88 CONTROLS

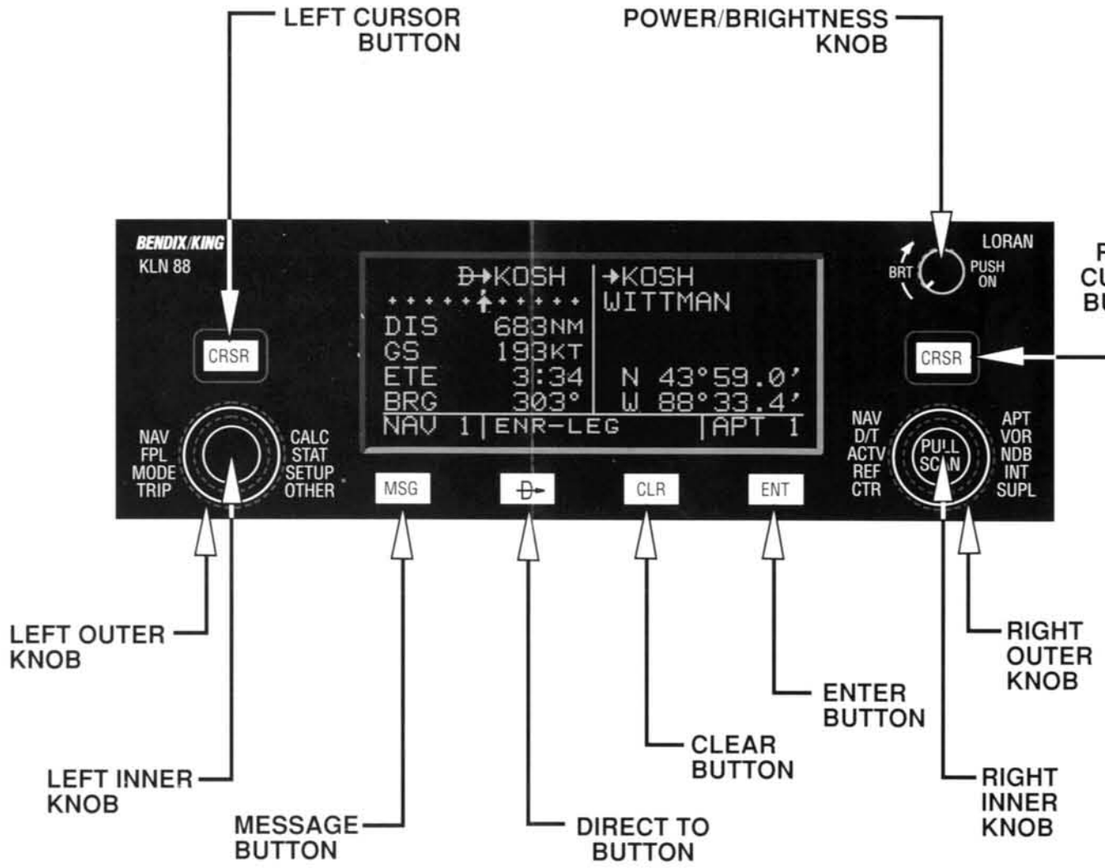


FIGURE 4-2

4.2 TURN-ON AND SELF TEST

Enough of the preliminaries. Let's get started into actually turning the KLN 88 on and using it! Figure 4-2 will fold out and allow you to use it as a reference as you read this chapter, especially if you don't have a KLN 88 immediately at hand. The steps below take a lot of words to explain, but you will find that in actual use you will accomplish these steps in a just a few moments.

NOTE: *When power is applied to the KLN 88 it always "wakes up" in the Enroute-Leg mode. Only the Enroute-Leg mode is described in this chapter. In this mode the KLN 88 performs great circle navigation (the shortest distance between two points located on the earth's surface). The course deviation output displayed on the unit's internal course deviation indicator (CDI) and provided to an external HSI or CDI is five nautical miles left and right, full scale sensitivity. The other three modes of the unit (Enroute-OBS, Approach-Leg, and Approach-OBS) are described in section 6.10 of this Pilot's Guide.*

1. Turn-on the KLN 88 by pressing the power/brightness knob to the "in" position. The power/brightness knob is located on the upper right side of the unit. It takes just a few seconds for the screen to warm up.

2. The Turn-On page will be displayed for a few seconds (figure 4-3). During this time the KLN 88 performs an extensive internal test. The **ORS** (Operational Revision Status) level number in the upper right corner of the display should match the ORS level indicated on the first page of this Pilot's Guide (page before Table of Contents). If desired, you may program four lines of personalized information which is displayed each time the Turn-On page is in view. The procedure for doing this is described in section 6.8.

   When the internal test is complete, the Turn-On page will automatically be replaced by the Self Test page (figure 4-4). The white borders around **APPROVE?** and **ENT** in figure 4-4 indicate that the characters are flashing. Note: if the KLN 88 is operating in a KCC 88 take-home case, the Take-Home Warning page (figure 4-5) is displayed first and must be acknowledged by pressing [ENT]. See chapter 3 for more information on the KCC 88 and the Take-Home mode.

3. Adjust the display brightness to the desired level by rotating the power/brightness knob. Clockwise rotation increases brightness and counterclockwise rotation decreases brightness.

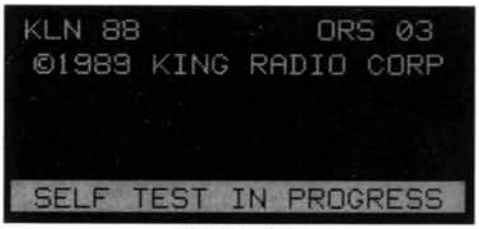


Figure 4-3

Figure 4-4

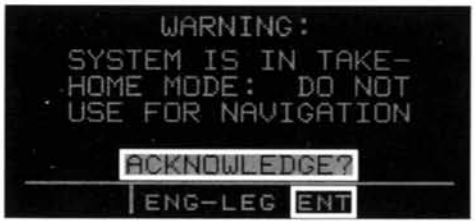


Figure 4-5

4. Verify that the data displayed on the left side of the Self Test page is the same as is being displayed on the appropriate equipment in the aircraft which is interfaced to the KLN 88. If the KLN 88 is not connected to any other equipment in the aircraft, you may skip to step 5.

   If the KLN 88 is interfaced with a NAV indicator such as an HSI or a course deviation indicator (CDI), the D-bar (deviation bar) should be indicating a half scale deviation to the right. The TO/FROM indicator should be showing FROM.

   The **OBS IN** field will display dashes in most installations. However, if the KLN 88 is interfaced with a Bendix/King EHI 40 EHSI or is interfaced with a NAV indicator such that the KLN 88 can "read" the selected course from the NAV indicator, then the **OBS IN** field should display the same course as on the NAV indicator.

   The **OBS OUT** field always displays 315 degrees and is only applicable when the KLN 88 is interfaced with a Bendix/King EHI 40 EHSI or with an HSI which has a driven course pointer capable of being driven by the KLN 88. This type of HSI is normally found only in some jets and turboprops. If one of these two types of NAV indicators is interfaced to the KLN 88, the course pointer on the NAV indicator should be driven to 315 degrees and both the **OBS IN** and **OBS OUT** fields should be displaying 315 degrees.

   The **RMI** field always displays 130 degrees. If the KLN 88 is connected to a compatible RMI in the aircraft, the RMI should indicate a bearing to the station of 130 degrees.

   The distance field (**DIS**) always displays 34.5 NM (nautical miles). If the KLN 88 is interfaced to a compatible indicator that displays DME distance, the indicator should be displaying 34.5 nautical miles.

   If any of the above checks fail, do not use the associated equipment with the KLN 88.

5. Verify that **TEST OK** is displayed on the bottom left side of the Self Test page. If **TEST FAIL** is displayed, recycle power to the KLN 88. If the Self Test page still displays **TEST FAIL**, the KLN 88 requires repair and should not be used for navigation.

***NOTE**: If the KLN 88 is installed utilizing a remote approach offset switch (used primarily for offshore helicopter approaches),* **APR OFST R** *is displayed in place of* **TEST OK** *to warn that the switch is in the right offset position.* **APR OFST L** *is displayed to warn that the switch is in the left offset position. In either case the approach offset switch should be moved to the position that deselects the offset.*

6. Verify that the date displayed on the right side of the Self Test page is correct. The KLN 88 has an internal battery powered calendar/clock, so the date and time normally don't require setting. The battery has a life of approximately 3 years.

   If the date is incorrect, rotate the right outer knob counter-clockwise until the cursor is over the entire date field (figure 4-6). Rotate the right inner knob until the correct day of the month is displayed (figure 4-7). Then, rotate the right outer knob one step clockwise to place the flashing part of the cursor over the month field (figure 4-8). Rotate the right inner knob to display the correct month (figure 4-9). Rotate the right outer knob one step clockwise again and use the right inner knob to select the first digit of the correct year (figure 4-10). Next, rotate the right outer knob one more step clockwise and then use the right inner knob to select the second digit of the year (figure 4-11). When the date is correct, press [ENT].

7. Verify that the time displayed on the right side of the Self Test page is correct. If it is necessary to reset the time, use the right outer knob to position the cursor over the time zone field (figure 4-12). Use the right inner knob to select the desired time zone (figure 4-13). The following are the time zones which the KLN 88 is capable of displaying:

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

Figure 4-6

Figure 4-7

Figure 4-8

Figure 4-9

Figure 4-10

Figure 4-11

Figure 4-12

Figure 4-13

You will be able to change the time zone any time you desire on several other pages, so don't worry if you're not sure which time zone to choose. UTC - Coordinated Universal Time (also called "Zulu") is always a safe choice if your areas of flying include more than one time zone, or you may prefer the local time zone where most of your flying is done.

Once you have selected the desired time zone, turn the right outer knob one step counterclockwise to position the cursor over the entire time field (figure 4-14). Use the right inner knob to select the correct hour (figure 4-15). Since 24 hour time is used, be sure to add 12 if the time is after 1:00 P.M. (2:30 P.M. becomes 14:30). Now turn the right outer knob one step clockwise to position the flashing part of the cursor over the first minute's position (figure 4-16). Turn the right inner knob to select the desired value. Turning the right outer knob one more step clockwise positions the flashing part of the cursor over the second minute's position, and the right inner knob is now used to finalize the time selection (figure 4-17). When the correct time has been entered, press [ENT] to start the clock running.

Figure 4-14

Figure 4-15

Figure 4-16

Figure 4-17

Figure 4-18

8. Turn the right outer knob clockwise to position the cursor over **APPROVE?** if it is not there already (figure 4-18). Press [ENT] to approve the Self Test page.

9. The Data Base page will now be displayed with the cursor over **ACKNOWLEDGE?**. If the data base is current, line three will show the date when the data base expires (figure 4-19).

   If the data base is out of date, line three shows the date that it expired (figure 4-20). The KLN 88 will still function with an out of date data base; however, you must exercise extreme caution and always verify that the data base information is correct before using information from an out of date data base.

   Press [ENT] to acknowledge the information on the Data Base page.

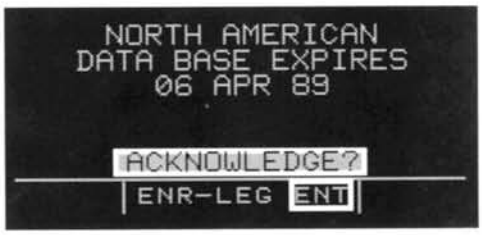


Figure 4-19

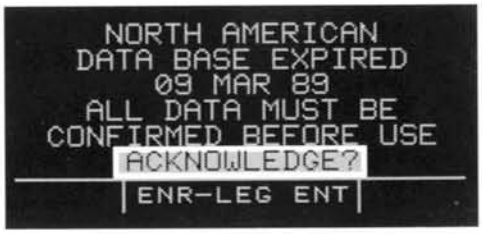


Figure 4-20

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

The NAV 2 page (present position) is now automatically displayed on the left side of the screen and the waypoint page for the waypoint which was active when the KLN 88 was last turned off will be displayed on the right side (figure 4-21). If the last active waypoint was an airport, the APT 4 page (airport communications) will be displayed. Isn't that convenient! Almost always, the waypoint which was active when you last removed power from the KLN 88 is the airport where you landed. Therefore, when you get ready to depart, the airport communication frequencies for that airport will automatically be displayed for you!

Figure 4-21

When the NAV 2 page first appears, it is quite likely that the present position will be dashed. It takes the KLN 88 several minutes to acquire the Loran stations and to make its initial calculation of your position. When the KLN 88 reaches a NAV ready status and is able to navigate, the NAV 2 page will display your present position in two ways (figure 4-22). The bottom of the page will display the aircraft's latitude and longitude. Above the latitude/longitude position is the present position expressed as the distance and radial from a nearby VOR. The VOR displayed on the NAV 2 page is the nearest low or high altitude class VOR. Terminal class VORs are not used because many charts do not depict a compass rose around them and verifying the displayed radial would be difficult. Verify that the present position shown on the NAV 2 page is correct.

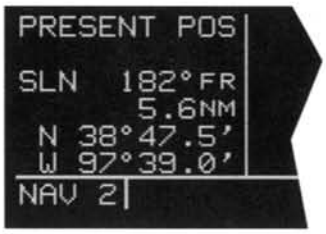


Figure 4-22

4.3 DISPLAY FORMAT

The KLN 88 uses a Cathode Ray Tube (CRT) display. The display screen is divided into segments. These segments are formed by horizontal and vertical lines on the screen. Most of the time there are five segments as shown in figure 4-23. There are occasionally times when there are only four segments (figure 4-24) or one large segment (figure 4-25).

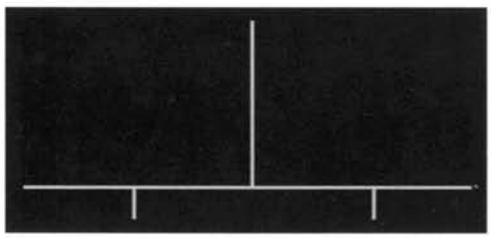


Figure 4-23

Aeronautical information (also called "data") is presented on the screen in the form of "pages". A page is a presentation of specific data in an organized format. Various page "types" are used to display related kinds of data. For example, one page type is NAV (navigation). NAV pages show information such as distance, groundspeed, bearing, course, and other data relating to navigation. Another page type is APT (airport). APT pages contain information pertinent to a specific airport such as name, location, elevation, runways, and communication frequencies. There are numerous page types used to display the KLN 88's vast capabilities.

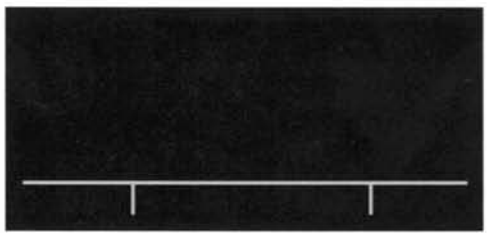


Figure 4-24

Figure 4-25

Normally, when the screen is divided into five segments, the KLN 88 displays two pages at one time. These pages are presented in the upper left and upper right segments of the screen. In figure 4-26 the upper left segment (A) is showing a Navigation page and the upper right segment (B) is showing an Airport page. The lower left segment (C) indicates which specific page is being displayed on the left side. **NAV 2** indicates that the Navigation 2 page is being presented on the left side of the screen. An Airport 4 page is being shown in the upper right segment of the display (B) and is identified as such with the **APT 4** characters in the lower right segment (D). The page identification includes a number appended to the page type when there is more than one page for a page type, such as in the two examples of pages shown in figure 4-26. There is no number displayed in the page identifier if there is only one page for a particular page type. The **VOR** page identification in figure 4-27 shows that there is only one VOR page.

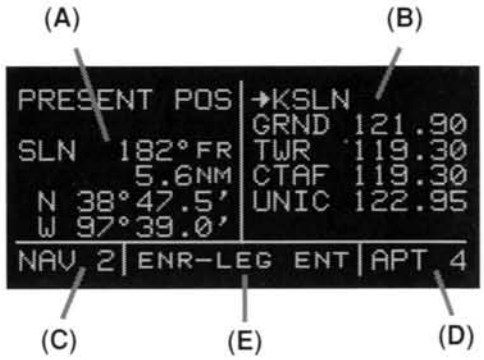


Figure 4-26

Figure 4-27

You might think of the page types as the chapters in a book and the page numbers as the pages within a chapter. Just as a chapter in a book may have from one to many pages, a KLN 88 page type may have from one to 10 pages associated with it. There are, for example, 10 Flight Plan pages (FPL 0, FPL 1, FPL 2, ..., FPL 9) in the Flight Plan type and six Airport pages (APT 1, APT 2, ..., APT 6) in the Airport type. There is one VOR page in the VOR type.

Figure 4-28 shows another example of an Airport 4 page. As you have previously seen, the Airport 4 page is always used to show airport communication frequencies. Notice the "+" sign in the **APT+4** identification. Whenever a "+" sign is part of a page identifier there will be one or more additional pages, all having the same page number, used to present all of the required information. That is, all of the information associated with a particular page number doesn't fit on the page being viewed. In this case the "+" sign indicates that there are two or more APT 4 pages. Figure 4-29 shows the second APT 4 page for **KMKC** (Kansas City Downtown airport).

Figure 4-28

Figure 4-29

The lower center segment (E) of the display (figure 4-26) is used to present four different kinds of information. The first seven spaces of this segment indicate the mode in which the KLN 88 is operating. In figure 4-26, **ENR-LEG** designates the unit is in the Enroute-Leg mode of operation. The Enroute-Leg mode is the normal mode of operation. This mode, as well as the other three modes of operation are discussed in section 6.10.

The last three spaces of segment (E) are usually blank but may contain the characters **MSG** or **ENT.** The characters **MSG** in figure 4-30 indicate that there is a message to be viewed on the Message page - accomplished by pressing MSG. The characters ENT will flash in these spaces when it is necessary to press ENT to complete various kinds of operations (figure 4-31).

Segment (E) is also used as an area for displaying short operational messages to the user called "status line messages". These messages are displayed for approximately five seconds, then this segment returns to its previous display. An example of a status line message is shown in figure 4-32. A complete listing of status line messages is contained in appendix C of this Pilot's Guide.

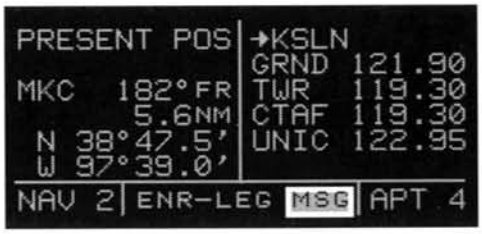


Figure 4-30

Figure 4-31

4.4 BASIC OPERATION OF PANEL CONTROLS

Remember that figure 4-2 is on a fold-out page that you may want to refer to as you read this chapter.

The KLN 88 has five knobs and six buttons which are used to perform all operations. In general, the two concentric knobs and the cursor button (CRSR) located on the left side of the unit are used to select pages and enter data on the left side of the screen. Likewise, the two concentric knobs and the cursor button on the right side of the unit are used to select pages and enter data on the right side of the screen.

Figure 4-32

The cursor is an area of inverse video (dark characters on a light backround) on the screen. Many pages allow you to add, delete, or change data on the screen by first pressing the appropriate CRSR button (left CRSR for left side of screen and right CRSR for right side) to turn the cursor function on and bring the cursor on the screen. The appropriate knobs are then used to enter the data. When a cursor is on the screen, the page name normally shown in the lower left and right segments is replaced with a **CRSR** annunciation in inverse video (figure 4-33). The cursor is over the identifier **TUL**. Not all pages allow you to make data entry and therefore pressing the CRSR button while these pages are displayed will have no effect.

Figure 4-33

There are times when the cursor is flashing. Figure 4-31 shows an example of how a white border is used in this Pilot's Guide to depict a flashing cursor (over **APPROVE?**). In addition, figure 4-31 shows an example of how a white border around normal text in this Pilot's Guide is used to depict normal characters flashing. The letters **ENT** are flashing but are not in inverse video.

4.4.1 Page Selection

It's now time for learning to select a desired page.

NOTE: *The cursor function, which is controlled by the left and right CRSR (cursor) buttons, is not used in selecting pages and the CRSR buttons should not be pressed at this time. If* ***CRSR*** *is annunciated in the lower left or right segments of the display, press the left or right CRSR button (as appropriate) to turn the cursor function off.*

The left outer knob is rotated to select one of eight page types for the left side of the screen. These eight page types are the following:

Page Annunciation	Knob Annunciation	Page Name	Page Numbers
TRI	TRIP	Trip Planning	0 - 6
MOD	MODE	Mode	1 - 4
FPL	FPL	Flight Plan	0 - 9
NAV	NAV	Navigation	1 - 5
CAL	CALC	Calculator	1 - 7
STA	STAT	Status	1 - 2
SET	SETUP	Setup	1 - 8
OTH	OTHER	Other	0 - 5 *

* 0 - 9 with fuel management system interface

Remember that the page type for the left side is always annunciated in the lower left segment of the screen. The first three letters of the page type are always used for annunciation on the screen —**TRI** for TRIP, **MOD** for Mode, **SET** for SETUP, etc. Rotating the left outer knob clockwise selects the page type in the top-to-bottom order shown above. Rotating the left outer knob counterclockwise selects the page type in the opposite order. The page type selection wraps around from OTHER to TRIP; that is, the knob has is no mechanical stops.

Once you have selected the desired page type using the left outer knob, you may select the page number by rotating the left inner knob. Let's use an example to make sure you understand. You are presently viewing the NAV 2 page on the left page. You wish to view the CAL 5 page. Rotating the left outer knob one step clockwise will display the CAL page that you last viewed - we'll say the Calculator 1 page. Turning the left inner knob four steps clockwise or three steps counterclockwise will bring you to the CAL 5 page. Got it?

You've probably already figured out that the right side of the unit operates in a similar manner to the left side. There are, however, a couple of differences. First, the page types are different for the right side except for NAV. The Navigation pages are identical on both sides of the screen. Just as on the left side, only the first three letters of the page type are used for annunciation on the screen. The page types for the right side are the following:

Page Annunciation	Knob Annunciation	Page Name	Page Numbers
CTR	CTR	Center Wpt.	1 - 2
REF	REF	Reference Wpt.	None
ACT	ACTV	Active Wpt.	**
D/T	D/T	Distance/Time	1 - 4
NAV	NAV	Navigation	1 - 5
APT	APT	Airport Wpt.	1 - 6
VOR	VOR	VOR Wpt.	None
NDB	NDB	NDB Wpt.	None
INT	INT	Intersection Wpt.	None
SUP	SUPL	Supplemental Wpt.	None

** Varies with the type of waypoints in the active flight plan

The second difference from the left side is that the right inner knob has both an "in" and an "out" position. With the knob pushed "in" it works exactly like the inner knob on the left side. Make sure the right inner knob is pushed "in" for now. Later in this chapter we'll discuss how the right inner knob in the "out" position performs a waypoint scan function.

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

4.4.2 Data Entry

Now that you've learned how to select the desired page, you're ready to learn the means of entering data. It is necessary to enter data, for example, in order to specify a Direct To waypoint of your choice. The general procedure for entering a waypoint identifier is described below. You need not perform these steps now since they will be described again shortly.

1. If the cursor is not positioned on the screen location where you desire to enter the waypoint identifier (figure 4-34), press CRSR (left CRSR for left page or right CRSR for right page) to turn on the cursor function (figure 4-35).

2. If required, rotate the outer knob (left outer knob for left page or right outer knob for right page) to position the cursor in the desired location (figure 4-36).

3. Rotate the appropriate inner knob to select the first character of the waypoint identifier (figure 4-37).

4. Turn the appropriate outer knob one step clockwise to move the cursor to the second character position (figure 4-38).

5. Rotate the inner knob to select the second character (figure 4-39).

6. Use the outer and inner knobs in this manner until the complete waypoint identifier is displayed (figure 4-40). Note that you may not have to enter the last characters of the identifier because each time you enter a character, the KLN 88 offers you the first identifier in the data base beginning with the characters you have entered.

7. If **ENT** is flashing in the lower middle segment of the display, then press ENT. This will display a waypoint page on the right side of the screen for the waypoint identifier you just entered (figure 4-41).

8. Verify the waypoint information displayed, and then press ENT again to approve the waypoint page. The right side will return to the page previously displayed (figure 4-42).

Figure 4-34

Figure 4-35

Figure 4-36

Figure 4-37

Figure 4-38

Figure 4-39

Figure 4-40

Figure 4-41

Figure 4-42

4.4.3 Alternative Waypoint Data Entry Method

There is another method of data entry for waypoints which you will sometimes find convenient. This method applies when there is a page on the left side of the screen with the cursor over a field where a waypoint is enterable. You may fill the waypoint field on the left side by first selecting the desired waypoint page on the right side (figure 4-43). When [ENT] is pressed, the waypoint field on the left will contain the flashing identifier of the waypoint that is displayed on the right side (figure 4-44). To finalize the selection, [ENT] is pressed again (figure 4-45).

Figure 4-43

Figure 4-44

Figure 4-45

4.4.4 The Duplicate Waypoint Page

There are some waypoints in the data base whose identifiers are not unique. That is, more than one waypoint has the same identifier. When a waypoint identifier has been entered which is not unique to a single waypoint, a Duplicate Waypoint page appears on the left side. The Duplicate Waypoint page is used to select which of the waypoints having the same identifier is actually desired. The waypoint identifier is displayed on the top left of the page. To the right of the identifier is the number of waypoints in the data base having the identifier. Below the identifier is a list of the waypoint types (APT, VOR, NDB, INT, SUP) and the associated countries which use the identifier. To see an example of a Duplicate Waypoint page perform the following steps:

1. Press [⊕]

2. Turn the left inner knob to select the letter "**D**" as a waypoint identifier (figure 4-46).

3. Press [ENT]. The Duplicate Waypoint page will be displayed on the left side (figure 4-47). At the time on this writing, there were three waypoints in the data base having the identifier "D". These three are shown on the page. One is an NDB located in Canada, one is an NDB located in Cuba, and one is an NDB located in the United States. They are listed with the waypoint closest to the present position first and the waypoint farthest last (third in this case). The cursor will be over the first waypoint type listed. If another selection is desired, rotate the left outer knob to move the cursor over the appropriate choice.

4. Press [ENT] to view the waypoint page for the selected waypoint (figure 4-48).

5. Press [ENT] to approve the waypoint page.

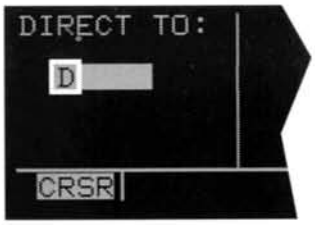


Figure 4-46

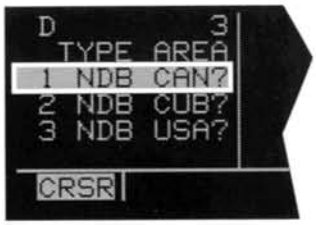


Figure 4-47

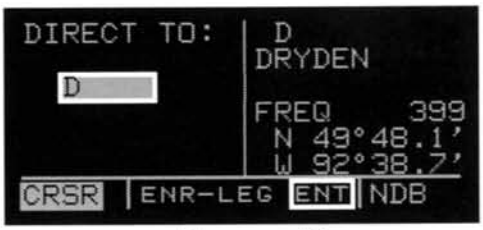


Figure 4-48

4.5 MESSAGE PAGE

Whenever the KLN 88 determines that there is a situation that requires your attention, the MSG prompt begins flashing in inverse video at the bottom of the display just to the right of the mode of operation (figure 4-49). A remote message annunciator may also be installed in the aircraft instrument panel. You should view the message at your earliest opportunity because the unit may be alerting you to some condition of immediate concern to its condition or to your flight. To view the message, press [MSG]. The MSG page, which takes the whole width of the display, will appear and show the new message (figure 4-50). Appendix B of this Pilot's Guide contains a listing of all of the Message page messages and their meanings. It is possible that several messages are displayed at one time on the Message page. The newest message appears first and the rest in reverse chronological order.

Figure 4-49

Figure 4-50

After reading the message, press [MSG] again to return to the pages which were previously in view. If all of the messages can not be displayed on one Message page, repeated presses of [MSG] will show the other messages before returning to the pages which were previously being viewed. Whenever a message condition exists which requires a specific action by you, the message prompt will remain on but not flashing.

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4.6 INITIALIZATION

Since the KLN 88 stores its position in memory when power to the unit is removed, it is seldom necessary to aid the unit in reaching a NAV ready condition. However, if you turn the KLN 88 on more than 60 nautical miles from where it was last turned off it may need to be "initialized". All this means is that you must tell the unit approximately where it is so that it may start looking for the right combination of Loran stations to start using. Also, under certain rare conditions, the KLN 88 may determine that it has calculated ambiguous positions and needs to be initialized. This means that the unit can not distinguish between two possible locations. The KLN 88 will notify you of this with a message on the Message page that states:

LORAN POSN AMBIGUITY
ENTER POSN ON SET 1 PG

To initialize the unit:

1. Select the Setup 1 page (**SET 1**) by first turning the left outer knob to display a **SET** type page. Next, turn the left inner knob until the **SET 1** page is selected (figure 4-51).

2. Press the left CRSR to bring the cursor on the page over the WPT field (figure 4-52).

3. Use the left inner knob to enter the first character of the identifier for the airport where you are presently located or the identifier of a navaid or other airport which is close to you. Any waypoint in the data base which is within 60 miles is acceptable, but the closer the better. Remember, if you are entering an airport identifier that is all letters (no numbers), then it will begin with a "K" prefix in the Contiguous U.S., a "P" in Alaska, or a "C" in Canada. If there are numbers in the identifier then a prefix is not used.

4. Rotate the left outer knob one step clockwise to move the flashing portion of the cursor to the second position and then use the left inner knob to enter the second character of the identifier.

Figure 4-51

Figure 4-52

5. Complete entering the rest of the identifier using the left knobs in the same manner as in step 4 (figure 4-53).

6. Press [ENT] to view the waypoint page on the right side.

7. Press [ENT] again to confirm the waypoint page.

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

8. Use the left outer knob to position the cursor over **CONFIRM?,** if it is not there already (figure 4-54).

9. Press [ENT].

10. Use the left knobs to select the NAV 2 page. When the KLN 88 reaches the NAV ready status and is therefore able to navigate, the NAV 2 page will display the present position. Verify that the latitude and longitude or the VOR, radial, and distance display of present position are correct.

Figure 4-53

Figure 4-54

4.7 SELECTING WAYPOINTS

There are five types of waypoints: airports, VORs, NDBs, intersections, and supplemental. Waypoints in the published data base (those in the cartridge) fall into one of the first four types. Remember that you can create up to 250 of your own waypoints which you may designate as one of the first four types or you may designate it as a supplemental waypoint which simply means that it is a miscellaneous waypoint that doesn't fit into one of the other categories.

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

4.7.1 Selecting Waypoints By Identifier

The most direct way of selecting a specific waypoint is to simply enter the waypoint's identifier directly on the appropriate waypoint page type (APT, for example). Let's use San Antonio International airport whose identifier is **KSAT** as an example to illustrate how this is done.

1. Rotate the right outer knob to select the airport type pages (APT). Rotate the right inner knob to select the APT 1 page if it is not already in view (figure 4-55). (Actually, the airport identifier can be entered on any of the six Airport pages but we'll use the APT 1 since it displays the airport name.)

2. Press the right CRSR to bring the cursor on the screen over the first character in the airport identifier (figure 4-56). The right inner knob should be pushed to the "in" position.

3. Turn the right inner knob to select a "K" (figure 4-57). You may turn the knob either clockwise or counterclockwise, the letters and numbers wrap around with a blank character separating the "9" and the "A". Go ahead and experiment a little bit.

4. Rotate the right outer knob one step clockwise to position the cursor over the second character in the airport identifier (figure 4-58).

5. Use the right inner knob to select the second character, "S" (figure 4-59).

6. Use the right outer and right inner knobs in the same manner as above to select the "A" and the "T" (figure 4-60). You are now viewing the APT 1 page for KSAT.

7. Press the right CRSR to remove the cursor from the right page. The APT 2, APT 3, APT 4, APT 5, and APT 6 pages may be viewed by rotating the right inner knob.

Did you notice that as you entered the "K" in step 3 that the second and third characters also changed? That is because every time you enter a character (in this case the "K"), the KLN 88 searches its data base to offer the first waypoint in the data base which begins with the characters you have already entered. Since the KLN 88 considers numbers lower in order than letters, **K00** is the first airport identifier in the data base beginning with a "K". Let's do one more example to show how this data base search can save you time and effort.

Figure 4-55

Figure 4-56

Figure 4-57

Figure 4-58

Figure 4-59

Figure 4-60

For the second example let's select Bible Grove VOR whose identifier is **BIB**.

1. Make sure you have turned the right cursor off from the previous example. Now rotate the right outer knob to display a VOR type page (figure 4-61).

2. Press the right CRSR to bring the cursor on the screen over the first character in the VOR identifier (figure 4-62).

3. Enter a "B" with the right inner knob (figure 4-63).

4. Use the right outer knob to position the cursor over the second character and use the right inner knob to select the "I" (figure 4-64). Surprise! When you entered the "I", the KLN 88 searched its data base for the first VOR identifier beginning with "BI" and found **BIB**. You didn't have to enter the last character. Many times you will only have to enter several characters of the waypoint identifier and the KLN 88 will furnish the rest.

5. Press the right CRSR when you are done entering data so you can view other pages.

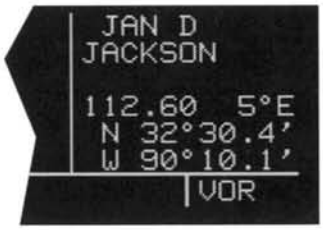

Figure 4-61

Figure 4-62

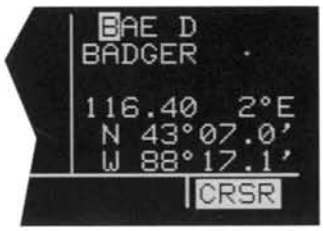

Figure 4-63

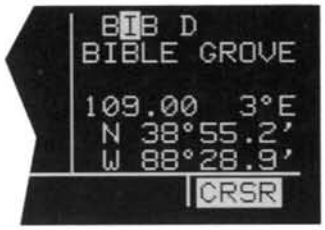

Figure 4-64

4.7.2 Selecting Waypoints By Scanning

To select waypoints using the scanning method:

1. Select the desired waypoint type (**APT**, **VOR**, **NDB**, **INT**, or **SUP**) on the right side by using the right outer knob.

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

3. Turn the right inner knob clockwise to scan through the waypoints in alphabetical order, or counterclockwise to scan in reverse alphabetical order. Remember that numbers are considered lower in order than letters. Thus, the airport identifier **K98** comes before **KAAF**.

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

4.7.3 "Nearest" And "Complete" Waypoint Scan Lists

There are actually two waypoint scan lists for airports, VORs, and NDBs. These two lists are the "complete" list and the "nearest" list. The complete list contains all of the waypoints in the data base for a waypoint type (all the airports for example). The nearest list consists of the nine nearest waypoints to your present position. Therefore, if you are in the nearest airport list, it will contain the nine nearest airports relative to your location. There is no "nearest" list for intersections (INT) and supplemental waypoints (SUP).

The nearest list is positioned in front of the complete list. That is, you must scan backwards (turn the knob counterclockwise) through the complete list to reach the nearest list. You will know when you have reached the nearest list because the top right portion of the waypoint page will flash the relative position of the waypoint to your position. "**NR 1**" indicates nearest (figure 4-65) while "**NR 9**" indicates the ninth nearest (figure 4-66). As you scan clockwise "NR 1, NR 2, NR 3, ...,NR 9", the next scan position is the beginning of the complete list. The nearest list can only be reached scanning backwards. It does not wrap around after the last waypoint in the complete list.

Figure 4-65

Figure 4-66

Waypoint pages displayed in the nearest list do not contain a latitude and longitude position as they do in the complete list. Instead, the bearing and distance to the waypoint are displayed.

The nine airports in the nearest list are the nine airports which meet the criteria selected on the Setup 3 page (**SET 3**). The SET 3 page allows you to specify what criteria you want an airport to meet before it is considered for the nearest airport list. To specify the airport criteria:

Figure 4-67

Figure 4-68

1. Select the SET 3 page on the left side (figure 4-67).

2. Press the left CRSR to turn on the left cursor function. The cursor will appear over the minimum runway length field.

3. Use the left inner knob to select the minimum length runway desired for the airport to qualify for the nearest airport list (figure 4-68). Values between 1000 feet and 5000 feet in 100 foot increments may be selected.

4. Rotate the left outer knob one step clockwise to position the cursor over the runway surface criteria (figure 4-69).

Figure 4-69

5. Turn the left inner knob to select either **HRD SFT** or to select **HRD**. If **HRD SFT** is chosen, then both hard and soft surface runways meeting the required runway length will be included in the nearest airport list. If **HRD** is chosen, then only hard surface runways will be included. Hard surface runways include concrete and asphalt. Soft surface runways include turf, gravel, clay, sand, and dirt.

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

4.7.3.1 Nearest Airports In An Emergency

In the event of an emergency, a special procedure exists to very quickly get to the beginning of the nearest airport list:

1. Press [MSG].

2. Press [ENT]. The waypoint page for the nearest airport is now displayed on the right side. The right inner knob may now be used in the normal manner to scan the other nearest airports (knob in the "out" position) or to view all six airport pages for a specific airport (knob in the "in" position).

4.7.4 Selecting Waypoints By Name Or City

When you know the identifier of the desired waypoint you will use one of the two methods just described to select it. However, what if you know the name but you don't know the identifier of your desired waypoint? You're in luck because the KLN 88 will allow you to enter the first few characters of the name to help you find it in the data base. We will use a couple of examples to illustrate how this is done. For VORs and NDBs you may use the navaid name. For airports, you may use the airport name on the APT 1 page or the city name (where the airport is located) on the APT 2 page.

In this first example we want to view the information in the KLN 88 data base for Napoleon VOR (located just East of Kansas City) but we don't remember the identifier for it.

1. Turn the right outer knob to the VOR waypoint type. The VOR waypoint in view is not important.

2. Press the right CRSR. Make sure the right inner knob is pushed to the "in" position.

3. Rotate the right outer knob clockwise until the cursor is over the first character in the VOR name which is being displayed (figure 4-70).

4. Turn the right inner knob to display the first character of the waypoint name, "N" in this case (figure 4-71).

5. Turn the right outer knob one step clockwise and then use the right inner knob to enter the second character, "A" (figure 4-72).

6. Use the right outer knob and right inner knob to select the third character, "P" (figure 4-73). Up pops Napoleon and its identifier, **ANX**!

   In this example, three characters were all it took to find our desired waypoint. In some cases it may take more characters and in others it may take fewer.

7. Press the right CRSR to turn off the cursor function so you can view other pages.

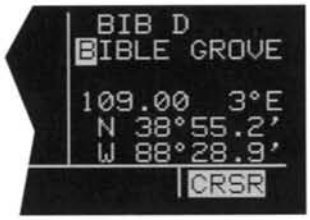

Figure 4-70

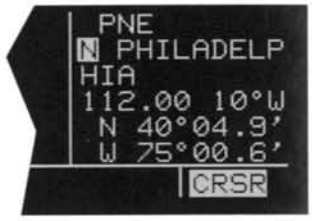

Figure 4-71

Figure 4-72

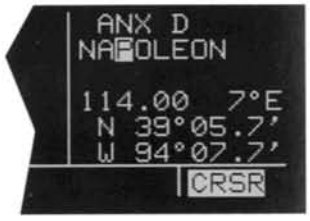

Figure 4-73

We will now use another example to show how we may enter a few characters and then scan through all the waypoints in the data base beginning with those characters. Let's use this method to find Stapleton International airport located in Denver, CO.

1. Use the right outer knob to select the airport type waypoints. If the APT 1 page is not displayed, use the right inner knob to select the APT 1 page. The airport displayed at this time is not important.

2. Press the right CRSR to bring the cursor on the display.

3. Rotate the right outer knob to locate the cursor over the first character in the airport name (figure 4-74).

4. Turn the right inner knob to display an "S".

5. Use the right outer and inner knobs to enter a "T" in the second character position and an "A" in the third character position.

6. Rotate the right outer knob one step clockwise to locate the cursor over the fourth character position (figure 4-75).

   You will now scan through all the airport names beginning with "STA".

7. Pull the right inner knob to the "out" position (figure 4-76).

8. Turn the right inner knob (in the "out" position) to scan through all the airport names beginning with "STA".

   There are about thirty of them. Not too good you say. We can make it a lot easier to find Stapleton if we enter another character.

9. Push the right inner knob back to the "in" position.

10. Use the right inner knob to select a "P" in the fourth character position.

11. Rotate the right outer knob one more step clockwise to position the cursor over the fifth character.

12. Pull the right inner knob to the "out" position (figure 4-77). Once again rotate the knob to scan through all the airport names beginning with "STAP". How about that! Now there are just a couple names and Stapleton International is easy to find, **KDEN** (figure 4-78).

To verify that this is the airport located in Denver, push the right inner knob to the "in" position and press the right CRSR to turn off the cursor function. Select the APT 2 page for **KDEN** to verify that **KDEN** is in Denver (figure 4-79).

NOTE: *This same method may be used on the APT 2 page with the name of the city where the airport is located.*

Figure 4-74

Figure 4-75

Figure 4-76

Figure 4-77

Figure 4-78

Figure 4-79

There are a few changes made to names in order to accommodate the KLN 88 display and to make the names easier to find.

1. Names which are too long to fit on the display are abbreviated. The first six characters are usually exactly correct, but the following are exceptions:
   North, Northern, East, Eastern, etc. - uses N, E
   Southeast, Northwest, etc. - uses SE, NW
   Point - uses PT
   Port - uses PT
   Fort - uses FT
   Saint - uses ST
   General - uses GEN
   Person's name - uses initials unless very well known (Will Rogers World airport)
   Delete "City Of" (City Of Colorado Springs Municipal)
   Delete "Greater" (Greater Buffalo Intl)
   Delete "The" (The Hartsfield Atlanta Intl)

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

3. Delete most punctuation such as periods and apostrophes.

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

5. Abbreviations for Regional are REGL and REG.

4.8 DIRECT TO OPERATION.

The [-D-] button is used to initiate Direct To operation (navigation from your present position direct to your destination). When [-D-] is pressed, the Direct To page will be displayed on the left side with a flashing cursor over a waypoint identifier (figure 4-80). The waypoint identifier which appears on the Direct To page is chosen by the KLN 88 according to the following rules:

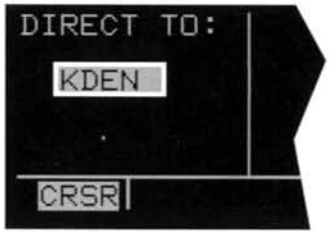

Figure 4-80

1. If the Flight Plan 0 page is displayed on the left side and the cursor is over one of the waypoint identifiers in Flight Plan 0 when [-D-] is pressed, then that waypoint identifier will appear on the Direct To page. (You will appreciate this feature when you learn to use flight plans in chapter 5).

If condition number 1 isn't occurring, then:

2. If there is any waypoint page (APT 1-6 page, VOR page, NDB page, INT page, SUP page, or ACT page) in view on the right side when [-D-] is pressed, then the Direct To page will contain the identifier for the waypoint page being viewed on the right side.

If neither condition number 1 nor number 2 above is occurring, then :

3. When [-D-] is pressed, the waypoint identifier for the current active waypoint will be displayed.

4. If there is no active waypoint when [-D-] is pressed, then the Direct To page displays blanks. In order for there not to be an active waypoint, there is no Direct To waypoint and there are no waypoints in Flight Plan 0.

All right, rules are rules, you say. But how do I perform Direct To navigation? Since you won't learn flight plan operation until later, let's see how to apply rules 2 and 3 at this time to proceed Direct To our desired destination, Oshkosh, Wisconsin. The identifier for Wittman field in Oshkosh is **KOSH**.

4.8.1 Direct To -Procedure 1

1. Press [D→]. The Direct To page is displayed on the left side (figure 4-80). The cursor will already be on the left page. A waypoint identifier may or may not be displayed, it doesn't matter at this point.

2. Rotate the left inner knob to select the first character of the desired waypoint's identifier (figure 4-81). Remember to enter the "K", "C", or "P" prefix for certain airports, if required (see section 2.3,"USE OF ICAO IDENTIFIERS").

3. Turn the left outer knob one step clockwise to move the flashing portion of the cursor over the second character position (figure 4-82).

4. Rotate the left inner knob to select the second character of the identifier (figure 4-83).

5. Use the left outer and inner knobs as in the previous steps until the desired identifier is completely displayed (figure 4-84).

6. Press [ENT] to display the waypoint page on the right side for the selected waypoint (figure 4-85). Note: if an incorrect identifier has been entered, you may immediately start using the left inner knob to re-enter the correct identifier.

7. Press [ENT] again to approve the displayed waypoint page. The right side will display the NAV 1 page and the left side will return to the page which was displayed prior to pressing [D→] (figure 4-86). The selected waypoint is now the active Direct To waypoint.

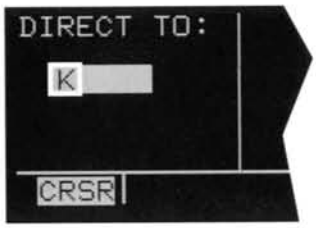

Figure 4-81

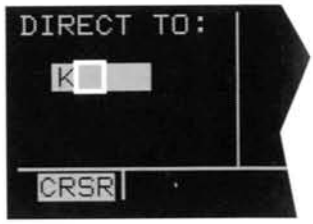

Figure 4-82

Figure 4-83

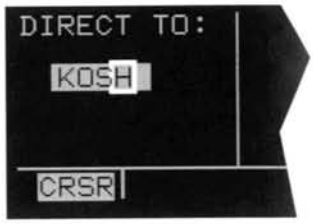

Figure 4-84

Figure 4-85

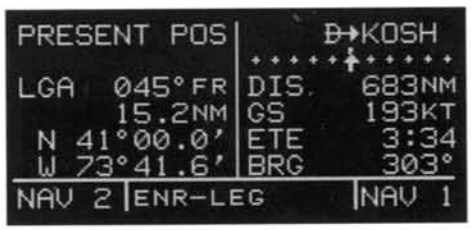

Figure 4-86

4.8.2 Direct To - Procedure 2

1. Select the desired waypoint page on the right side (figure 4-87) using one of the three procedures explained in section 4.7, "SELECTING WAYPOINTS".

2. Press [D→]. The Direct To page is displayed on the left side and it contains the desired waypoint identifier (figure 4-88).

3. Press [ENT] to approve the waypoint page displayed on the right side. The right side will now display the NAV 1 page, and the left side will return to the page which was displayed prior to pressing [D→] (figure 4-89). The selected waypoint is now the active Direct To waypoint.

Figure 4-87

Figure 4-88

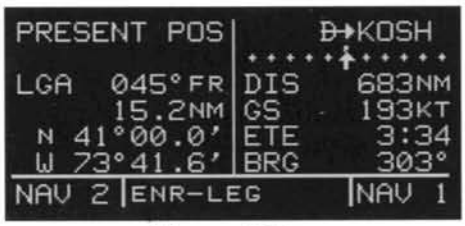

Figure 4-89

4.8.3 To Recenter The D-Bar

If you get off course and wish to recenter the left/right deviation bar (D-Bar) to proceed direct to the same waypoint:

1. Select a non-waypoint page (**NAV**, **D/T**, **REF**, or **CTR**) or the active waypoint page on the right side.

2. Press [D→]. The Direct To page is displayed on the left, containing the active waypoint identifier.

3. Press [ENT].

4.8.4 To Proceed Direct To Another Waypoint:

You may proceed Direct To another waypoint other than the active one by using Direct To procedure 1 or 2 at any time.

4.8.5 Cancelling Direct To Operation

The primary reason for wanting to cancel Direct To operation is to return to flight plan operation which is described later in section 5.2, "OPERATING FROM THE ACTIVE FLIGHT PLAN". To cancel Direct To operation:

1. Press [D→]

2. Press [CLR]

3. Press [ENT]

4.8.6 Waypoint Alerting For Direct To Operation

Approximately 36 seconds prior to reaching a Direct To waypoint, the arrow preceding the waypoint identifier on the waypoint page for the active waypoint will begin flashing. This arrow will also be flashing on any Navigation page or Distance/Time (**D/T**) page displaying the active waypoint identifier. 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.

4.9 THE NAVIGATION PAGES

As you would expect, the NAV (navigation) pages contain information relating specifically to the KLN 88's navigation capabilities. The KLN 88 has five NAV pages. Unlike any other pages, these pages may be selected and viewed on both the left and right sides of the screen. The procedure for selecting specific pages, including the NAV pages, was described in section 4.4.1, "Page Selection". This section will cover all NAV pages except for the NAV 4 page (Vertical Navigation) which is explained in section 6.2.

4.9.1 The Navigation 1 Page (NAV 1)

A NAV 1 page is shown in figure 4-90. A NAV 1 page displays the following information:

- The active navigation leg. For Direct To operation this consists of the Direct To symbol, D→, followed by the active Direct To waypoint identifier (figure 4-90). For the leg of a flight plan this consists of the "from" waypoint identifier and the active "to" waypoint identifier (figure 4-91). An arrow (→) precedes the active waypoint identifier.

- A course deviation indicator (CDI) that displays left and right deviation from the desired track. A vertical bar operates like a navigation deviation needle on a conventional CDI or HSI. An on-course indication is displayed when the vertical deviation bar is centered on the triangle in the middle of the CDI. In the enroute modes each dot represents one nautical mile deviation from the desired track. Therefore, the CDI shows course deviation five nautical miles left and right of course. A vertical deviation bar positioned two dots to the right of the center triangle indicates the aircraft is two nautical miles to the left of course (figure 4-92). In the approach modes each dot represents one-fourth nautical mile. The center triangle also serves as the CDI's TO/FROM indicator and operates in the same manner as a conventional CDI TO/FROM indicator; an "up" triangle indicates "to" the active waypoint while a "down" triangle (figure 4-93) indicates "from" the active waypoint. The word "FLAG" is displayed over the CDI when the Loran is not usable for navigation.

- Distance (**DIS**) to the active waypoint.

- Groundspeed (**GS**)

- Estimated time enroute (**ETE**)

- Bearing (**BRG**) to the active waypoint.

Figure 4-90

Figure 4-91

Figure 4-92

Figure 4-93

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4.9.2 The Super NAV 1 Page

When the NAV 1 page is selected on both the left and right sides at the same time, the Super NAV 1 page is displayed (figure 4-94). The Super NAV 1 page contains exactly the same information as the standard NAV 1 page but spreads the data out across the entire screen making it even easier to view.

Figure 4-94

4.9.3 The Navigation 2 Page (NAV 2)

The NAV 2 page in figure 4-95 displays the aircraft's present position in two formats. The first format is in terms of the distance and radial from a nearby VOR. (Although terminal VORs are in the data base, they are not used on this page since many aeronautical charts do not display a compass rose around them for orientation purposes). The second format is in latitude and longitude.

Figure 4-95

4.9.4 The Navigation 3 Page (NAV 3)

The NAV 3 page, such as shown in figure 4-96, displays the following supplementary navigation information:

- Desired track (**DTK**) - The great circle course between two waypoints. Any CDI or HSI driven by the KLN 88, including the CDI displayed on the NAV 1 page, is referenced to this DTK. You may wish to view the navigation terminology diagram in Appendix A at this time if your are unfamiliar with terms like desired track and actual track.

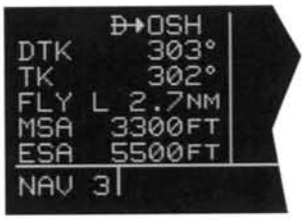

Figure 4-96

***NOTE**: If the KLN 88 is in the Enroute-OBS or Approach-OBS mode, the selected course (**OBS**) is displayed instead of the desired track on the NAV 3 page (figure 4-97).*

- Actual track (**TK**) - The aircraft's present track over the ground.

Figure 4-97

- Cross track error correction - This is a text means of indicating how far and which direction to get back on course. It is consistent with the vertical deviation bar displayed on the NAV 1 page. "**FLY L 2.7 NM**" means fly left 2.7 nautical miles to get on course.

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

  *The minimum safe altitude (**MSA**) provides "reference point" clearance within these one degree latitude by one degree longitude sectors. Jeppesen defines reference point as "a natural (Peak, Knoll, Hill, etc.) or man-made (Tower, Stack, Tank, Building, etc.) object". Jeppesen states the following about the Grid Minimum Off-Route altitude: "Grid MORA values clear all reference points by 1000 feet in areas where the highest reference points are 5000 feet MSL or lower. MORA values clear all reference points by 2000 feet in areas where the highest reference points are 5001 feet MSL or higher". The KLN 88 displays dashes for areas outside the data base coverage area or for areas where the Grid MORA is not defined.*

- Minimum Enroute Safe Altitude (**ESA**). *IMPORTANT: When the KLN 88 is in either the Enroute-Leg or the Approach-Leg mode, the minimum enroute safe altitude is the highest MSA sector altitude from the present position to the active waypoint, then to the destination waypoint along the active flight plan. See figure 4-98. When the KLN 88 is in either the Enroute-OBS or the Approach-OBS mode, the minimum enroute safe altitude is the highest MSA sector altitude from the present position to the active waypoint.*

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

MINIMUM ENROUTE SAFE ALTITUDE (ESA)

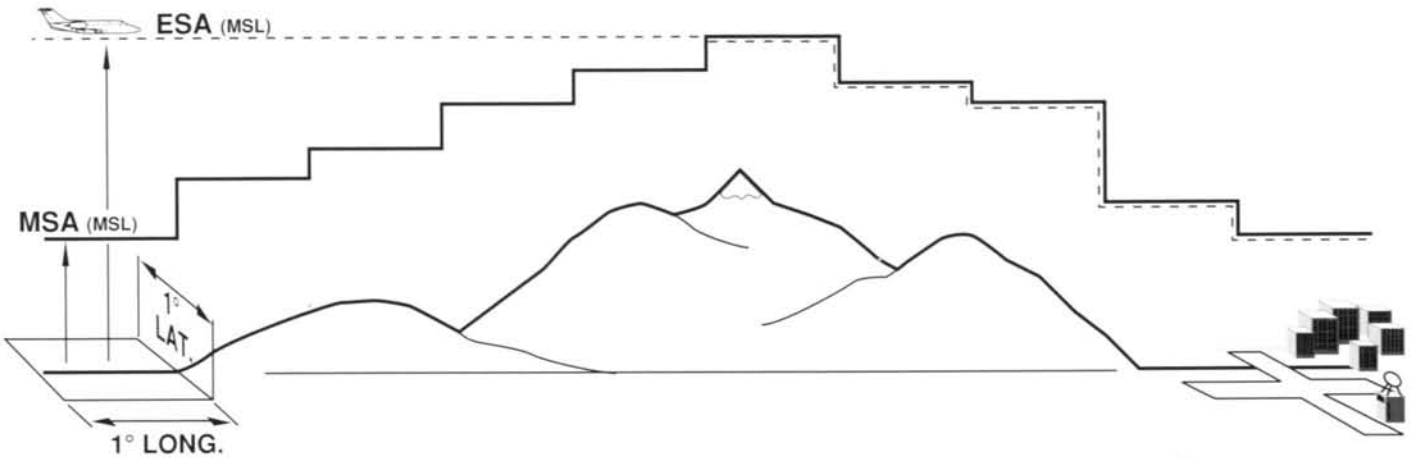

Figure 4-98

4.9.5 The Navigation 4 Page (NAV 4)

The NAV 4 page (figure 4-99) is used exclusively for advisory vertical navigation (VNAV). Its operation is described in section 6.2.

4.9.6 The Navigation 5 Page (NAV 5)

The NAV 5 page provides a navigation graphics presentation. It is useful in providing you with proper orientation of the navigation situation. One of three map orientation formats may be selected for use on the NAV 5 page: a True North up display (figure 4-100), a desired track up display (figure 4-101), or an actual track up display (figure 4-102). When the North up display is selected, viewing the NAV 5 page is like looking at a navigation chart with North at the top. When the desired track up display is selected, viewing the NAV 5 page is like looking at a chart that is turned so that your course line is pointing up. When the actual track up display is selected, viewing the NAV 5 page is like looking at a chart that is turned so that the direction the aircraft is tracking over the ground is pointing up.

Figure 4-99

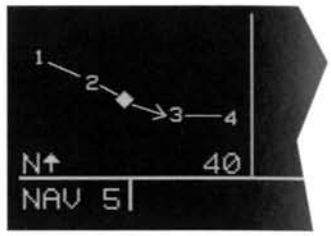

Figure 4-100

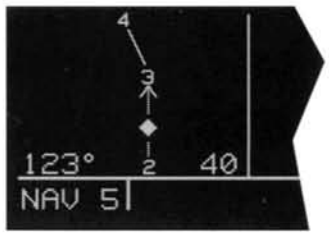

Figure 4-101

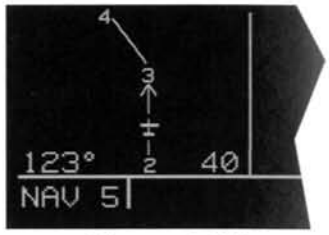

Figure 4-102

In chapter 5 of this Pilot's Guide you will learn to use flight plan operation where the NAV 5 page really becomes useful. When navigating using flight plan operation, the active flight plan (FPL 0) waypoints are displayed using the number associated with the waypoint as it appears on the FPL 0 page (figure 4-103). Thus, the position of the third waypoint in FPL 0 is indicated by a **3** on the NAV 5 page. Lines connect the flight plan waypoints. An arrow points to the active waypoint and shows the current flight plan leg.

Figure 4-103

When operating Direct To a waypoint which is not in the active flight plan, the Direct To waypoint is indicated on the NAV 5 page by an * (figure 4-104).

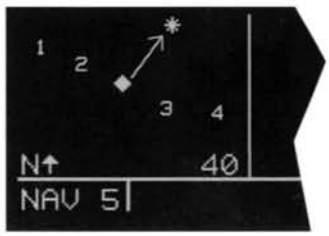

Figure 4-104

In both the North up format and the desired track up format, the aircraft's position is depicted by a diamond. The diamond always stays in the same position on the screen. The map graphics move on the screen to display the correct orientation. In the North up format, the lower left corner of the NAV 5 page shows an N↑ . In the desired track up format, the lower left corner of the NAV 5 page shows a number such as **123**. The number displayed in front of the degree symbol is the desired track for the current leg.

In the actual track up format, an aircraft symbol replaces the diamond to depict the aircraft's position. The groundspeed of the aircraft must be at least 30 knots in order for the aircraft symbol to appear, allowing use of the NAV 5 page. The lower left corner of the NAV 5 page shows a number similar to the desired track up format. However, the number displayed in front of the degree symbol is the direction the aircraft is actually tracking over the ground. In a no wind condition, this is also the aircraft's heading.

WARNING: The KLN 88 calculates the aircraft's actual track from changes in position. Therefore, in the actual track up format it is typical for the NAV 5 page to have a delay from the time a heading change is made until the new actual track is calculated and the correct map orientation is displayed. The length of this delay typically ranges from 20 seconds to several minutes depending on the quality of the Loran signals. THIS IS NOT A HEADING UP DISPLAY.

The range scale is displayed in the lower right corner of the NAV 5 page. The range scale indicates the distance from the aircraft's position (the diamond or aircraft symbol) to the top of the screen. Range scale selections from 5 NM to 1000 NM may be made by pressing the appropriate CRSR (left CRSR if NAV 5 page is on left side and vice versa) and turning the appropriate inner knob. For example, figure 4-105 illustrates the results of changing the range scale of the map in figure 4-100 from 40 nautical miles to 15 nautical miles.

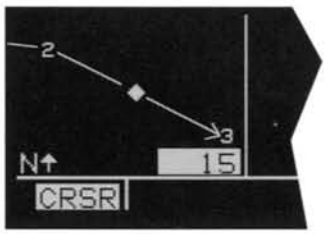

Figure 4-105

When the NAV 5 page is displayed on the left side of the screen and any selected waypoint page is displayed on the right side, the location of the selected waypoint is indicated by a "+" on the NAV 5 page (figure 4-106). Of course, the display scale must be chosen which allows the selected waypoint to be displayed.

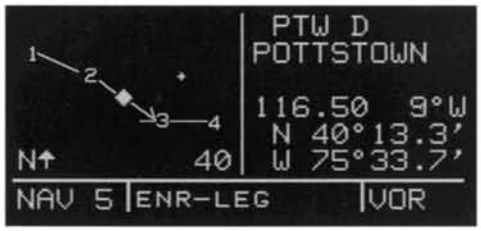

Figure 4-106

To change the NAV 5 page map orientation, select the Setup 5 page (**SET 5**) on the left side. Then:

1. Press the left CRSR (figure 4-107).

2. Rotate the left inner knob to alternate the text from **NORTH UP**, to **DTK UP** (desired track up), to **TRACK UP** (actual track up). Select the desired format.

3. Press the left CRSR to turn off the left cursor function and then use the left knobs to return to the desired page.

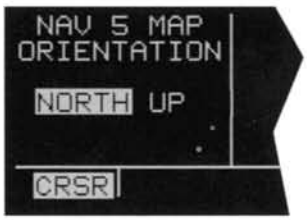

Figure 4-107

4.9.7 The Super NAV 5 Page

When the NAV 5 page is selected on both the left and right sides at the same time, the Super NAV 5 page is displayed (figure 4-108). As you can see, the Super NAV 5 page has a unique format unlike any other KLN 88 page. This is done so that you get the maximum amount of screen dedicated to graphics display. There are no page display indicators in the lower left and right segments of the display to tell you the Super NAV 5 page is being displayed. However, you will soon learn to recognize the Super NAV 5 page from its unique format. The mode annunciation, which normally appears in the lower center segment of the screen, is now located on the far left side. The message prompt is now located in the lower left corner of the graphics display.

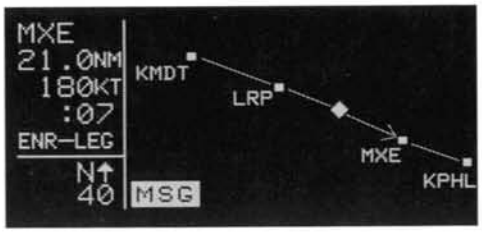

Figure 4-108

Surprise! The Super NAV 5 page shows alphanumeric waypoint identifiers on the graphics display to make orientation even easier for you. In addition, the left side of the Super NAV 5 page shows the following information:

- The active waypoint identifier
- Distance to the active waypoint
- Groundspeed
- Estimated time enroute
- Mode of operation
- Map orientation
- Range scale

Like the standard NAV 5 page, map orientation may be either North up, desired track up, or actual track up. The left CRSR and left inner knob are used to change the range scale.

CAUTION: The NAV 5 and Super NAV 5 pages do not provide any functions other than orientation. They do not display weather, terrain, restricted airspace, or any other data. Be careful when using the desired track up display or the actual track up display to not think that this is a heading up display. The desired track up display orientation is most useful when the aircraft's heading is approximately the same as the desired track.

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4.10 SPECIAL USE AIRSPACE ALERT

The KLN 88 data base contains the location of areas of special use airspace. These areas include Prohibited Areas, Restricted Areas, Warning Areas, Alert Areas, Military Operations Areas (MOAs), Terminal Control Areas (TCAs), Airport Radar Service Areas (ARSAs), and Terminal Radar Service Areas (TRSAs). The outer lateral boundaries for each of these areas are stored without reference to any altitude restriction criteria.

The KLN 88 will normally alert you prior to entering one of these areas with a message prompt. When the Message page is viewed it will display **AIRSPACE ALERT** and will also display the name and type of the special use airspace (figure 4-109). If the special use airspace is a TCA, ARSA, or TRSA, the message page will also instruct you to see the Airport 4 page (airport communications) for the primary airport so that the correct communications frequency may be determined (figure 4-110).

Figure 4-109

Figure 4-110

The message prompt for a special use airspace alert will occur when the aircraft's position is at a point such that a projection of the aircraft's existing track over the ground is approximately 10 minutes from penetrating the outer boundary of one of these areas. It will also occur if the aircraft is within approximately two nautical miles of one of these areas even if the aircraft's projected track over the ground won't actually penetrate the special use airspace (figure 4-111). If one of the special use areas is penetrated, another message will state: **INSIDE SPC USE AIRSPACE**.

The special use airspace alert feature may be disabled (or enabled) on the Setup 8 page (figure 4-112). After displaying the Setup 8 page (**SET 8**) on the left side, press the left CRSR to turn on the left cursor function. The left inner knob is used to display **AIRSPACE ALERT ENABLE** or **AIRSPACE ALERT DISABLE**. After the desired selection has been made, press the left CRSR to turn off the cursor function.

Figure 4-112

CAUTION: It is the pilot's responsibility to avoid those areas of special use airspace where ATC clearance to penetrate is required but has not been obtained. The KLN 88's special use airspace alert is only a tool to assist the pilot but should never be relied upon as the sole means of avoiding these areas.

SPECIAL USE AIRSPACE ALERT

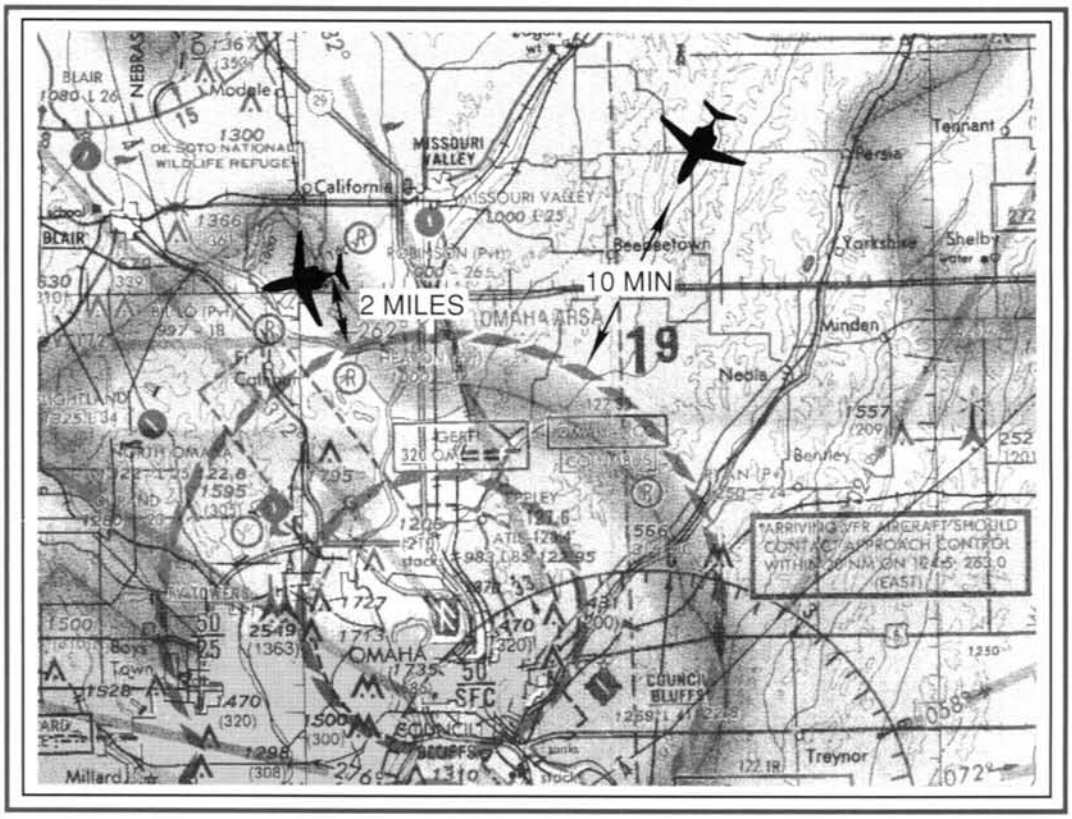

Figure 4-111

4.11 VIEWING THE WAYPOINT PAGES

You learned in section 4.7, "SELECTING WAYPOINTS", the different means of selecting the desired waypoint. You will now see what information may be displayed for each of the waypoint types (airport, VOR, NDB, intersection, and supplemental).

4.11.1 Airport Pages

There are six airport pages (APT 1, APT 2, ...,APT 6) for every airport in the published data base (those stored in the cartridge). The data base contains public use and military airports which have a runway at least 1000 feet in length. We will use Denver's Stapleton airport to illustrate what is contained on the first five airport pages.

4.11.2 The Airport 1 Page (APT 1)

See figure 4-113.

Figure 4-113

- Airport identifier. An arrow precedes the identifier if it is the active waypoint.

- Airport name.

- If the airport underlies the outer boundary of a TCA (Terminal Control Area), an ARSA (Airport Radar Service Area), or a TRSA (Terminal Radar Service Area) the letters **TCA**, **ARSA**, or **TRSA**, respectively, will appear on the left side of this line. Note that there is no altitude information applied to this criteria.

  In addition, if the airport is a military airport the letters **MILTRY** will appear on the right side of this line.

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

4.11.3 The Airport 2 Page (APT 2)

See figure 4-114.

Figure 4-114

- Airport identifier. An arrow precedes the identifier if it is the active waypoint.

- The city where the airport is located.

- The state if the airport is located in the United States, the Province if located in Canada, or the country outside the United States and Canada. A listing of the abbreviations used for States, Provinces, and countries is contained in Appendix D.

- Airport elevation. The elevation is rounded to the nearest 10 feet.

- Time in relationship to UTC (Zulu). **Z-07**, for example, indicates standard time is seven hours behind UTC time. If the airport is located in an area which observes daylight savings time, the information in parentheses shows the daylight savings time in relationship to UTC.

- Instrument approach information.

  ILS - airport has an ILS approach.
  MLS - airport has a MLS approach.
  ILS/MLS - airport has an ILS and MLS approach
  NP APR - airport has a nonprecision approach and no ILS or MLS.
  NO APR - airport does not have an instrument approach.

- The symbol **(R)** designates that the airport is serviced by an Approach/Departure control facility having radar capability. If you are on an instrument flight plan, you know whether to expect vectors to the final approach course or whether you will have to do your own transition. If you are VFR, you know whether or not the Approach/Departure control is capable of providing separation advisories.

4.11.4 The Airport 3 Page (APT 3)

See figure 4-115.

Figure 4-115

The function of the APT 3 page is to display runway information for the selected airport. Runway designation, lighting, and type of surface for up to five runways are displayed. The runways are displayed in order of length, beginning with the longest. Since only two runways can be displayed at a time, additional APT 3 pages are used to display the other runways when the airport has more than two runways. Remember that a "+" inserted between the page type and the number (**APT+3** in this case) is used to indicate that there is more than one Airport 3 page.

- Airport identifier. An arrow precedes the identifier if it is the active waypoint.

- Runway number designation for both ends of the runway.

- Runway lighting availability:
  L - runway lighting sunset to sunrise
  LPC - runway lighting is pilot controlled
  LPT - runway lighting is part-time or on-request
  Blank indicates no runway lighting

- Runway length in feet.

- Runway surface:
  HRD - hard surface
  TRF - turf
  GRV - gravel
  CLY - clay
  SND - sand
  DRT - dirt
  UNK - unknown

In the event that there is no runway information for an airport, the following message is displayed on the APT 3 page:

RUNWAY DATA NOT AVAILABLE

4.11.5 The Airport 4 Page (APT 4)

See figure 4-116.

The APT 4 page is used to display communication frequencies for the selected airport.

- Airport identifier. An arrow precedes the identifier if it is the active waypoint.

- Frequencies for:
  - ATIS - automatic terminal information service
  - PTAX - pre-taxi clearance
  - CLR - clearance delivery
  - GRND - ground control
  - TWR - tower
  - UNIC - unicom
  - MCOM - multicom
  - CTAF - common traffic advisory frequency
  - MF - mandatory frequency
  - ATF - aerodrome traffic frequency
  - TCA - terminal control area (VFR frequency)
  - ARSA - airport radar service area (VFR frequency)
  - TRSA - terminal radar service area (VFR frequency)
  - APR - approach control
  - DEP - departure control
  - AAS - aeronautical advisory service

Airports which have numerous communication frequencies will have multiple Airport 4 pages indicated by **APT+4**.

Part-time operation, such as for a control tower, is indicated with an * to the left of a frequency.

The frequencies associated with TCA, ARSA, and TRSA are VFR frequencies. Airports which have one of these categories of frequencies also have APR and DEP which are IFR frequencies.

Where required, APR, DEP, TCA, ARSA, and TRSA frequencies are sectorized. That is, a frequency may be used only within a certain range of radials from a designated reference location. The format for displaying the sectorization is to show the frequency first, followed by the identifier of the associated reference point, followed next by the associated range of radials, and followed lastly by any associated altitude restrictions. For example, the VFR TCA frequency 126.90 MHz is used between the 211 degree radial and the 89 degree radial from **KDEN** (figure 4-117). In another example, figure 4-118 shows that for **KLAX** (Los Angeles International airport) the TCA frequency 125.20 MHz is used between 250 degrees and 335 degrees from **KLAX** at altitudes at and below 7000 feet.

Figure 4-116

Figure 4-117

Figure 4-118

***NOTE**: When an altitude restriction is shown on the Airport 4 page, the abbreviation* **BEL** *means at and below the specified altitude. Likewise, the abbreviation* **ABV** *means at and above the specified altitude. Thus,* **ABV 4000 FT** *means at and above 4000 feet and* **BEL 3999 FT** *means at and below 3999 feet.*

In a few cases, APR, DEP, TCA, ARSA, and TRSA frequencies are sectorized such that the restriction cannot be displayed on a single page. When this occurs the following message is displayed on the APT 4 page:

TEXT OF FREQUENCY USAGE NOT DISPLAYED

There may also be some airports in the data base for which no communications information is available. The following message is then displayed on the **APT 4** page:

COMM FREQ DATA NOT AVAILABLE

4.11.6 The Airport 5 Page (APT 5)

The Airport 5 page is used to store and display user-entered remarks. These remarks might include information on lodging, dining, airport services, or anything else you desire to record for later use. Up to 100 airports may contain these remarks. A remark may contain up to three lines of eleven characters each. Letters, numbers, hyphens, and spaces may be used in the remark. To enter a remark:

- Select the APT 5 page for the desired airport (figure 4-119).
- Press the right CRSR.
- Rotate the right outer knob until the cursor fills the entire third line of the screen (figure 4-120).
- Use the right inner knob to select the first character of the remark.
- Use the right outer knob to move the flashing portion of the cursor to the second cursor position, and then use the right inner knob to select the second character.
- Use the right outer and inner knobs to select the rest of the first line of the remark (figure 4-121).
- Press ENT to approve the first line. The cursor will move to the next line (figure 4-122).
- Use the above procedure to select the characters for the second and third lines of the remark. Press ENT to individually approve each line of the remark.
- Press the right CRSR to turn the right cursor function off (figure 4-123).

Figure 4-119

Figure 4-120

Figure 4-121

Figure 4-122

Figure- 4-123

The Other 4 page (**OTH 4**) includes a listing of all airports whose APT 5 pages contain remarks (figure 4-124). To delete a previously entered airport remark, select the Other 4 page, position the left cursor over the desired airport identifier, press [CLR], and then press [ENT]. If there are more than five airports with remarks, you will have to use the left outer knob to scroll down the list on the Other 4 page to find the desired airport identifier.

Figure 4-124

4.11.7 The Airport 6 Page (APT 6)

The APT 6 page is used exclusively for Loran approaches. The procedure for using the KLN 88 for shooting published Loran approaches is explained in section 6.11. The fictitious approach shown in figure 4-125 will be used to illustrate what information is contained on the APT 6 page.

Figure 4-125

- Airport identifier. An arrow precedes the identifier if it is the active waypoint.
- Approach identifier. For example, RW 18 indicates the approach is for runway 18.
- The Group Repetition Interval (GRI) of the Loran chain used for the approach.
- The two secondary station designations (W, X, Y, Z, etc.) used with the master station for the approach. To the right of each secondary station designation is the Additional Secondary Factor (ASF). The ASF is a correction factor used to increase the accuracy of the Loran's position calculation.
- The waypoints used in the Loran approach.

4.11.8 The VOR Page

The VOR page shown in figure 4-126 for Blue Ridge VOR is used to illustrate the contents of a VOR page.

Figure 4-126

- VOR identifier. An arrow precedes the identifier if it is the active waypoint.
- The letter **D** appears following the VOR identifier if the VOR has DME capability.
- The name of the VOR.
- The VOR frequency (MHz).
- The published magnetic variation of the VOR.
- The latitude and longitude of the VOR.

4.11.9 The NDB Page

The NDB page shown in figure 4-127 for Lawrence NDB is used to illustrate the contents of an NDB page.

- NDB identifier. An arrow precedes the identifier if it is the active waypoint.
- The name of the NDB.
- The NBD frequency (kHz)
- The latitude and longitude of the NDB.

Figure 4-127

***NOTE**: NDBs which are combined with outer markers (usually called outer compass locators) are <u>not</u> stored with NDBs. Instead, they are stored with intersections and are found on the intersection (INT) pages.*

4.11.10 The Intersection Page (INT)

The Intersection pages contain low altitude, high altitude, approach, and SID/STAR intersections <u>as well as outer markers and outer compass locators</u>. The Intersection page for KENZY outer compass locator (figure 4-128) is used as an example of what is displayed for Intersection pages:

- The intersection, outer marker, or outer compass locator name.
- The location of the intersection, outer marker, or outer compass locator expressed in terms of a radial and distance from a nearby VOR. The KLN 88 chooses the closest VOR.
- The latitude and longitude of the intersection, outer marker, or outer compass locator.

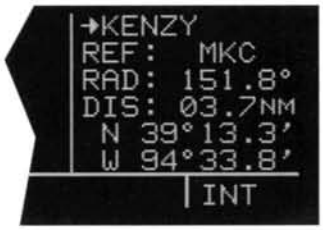

Figure 4-128

You may also enter the identifier of another nearby waypoint in the **REF** field, and the page will compute and display the radial and distance from the nearby waypoint to the intersection. This information is not stored with the Intersection page and is lost when leaving the page. To calculate the radial and distance from a nearby waypoint:

1. Display the desired Intersection page.
2. Press the right CRSR to turn on the right cursor function.
3. Rotate the right outer knob until the cursor is positioned over the identifier adjacent to **REF** (figure 4-129).
4. Use the right inner and outer knobs to select the desired identifier (figure 4-130).
5. Press ENT to display the waypoint page for the identifier just entered.
6. Press ENT to approve the waypoint page. The Intersection page is displayed with the computed radial and distance (figure 4-131).
7. Press the right CRSR to turn off the right cursor function.

Figure 4-129

Figure 4-130

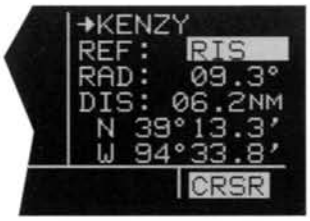

Figure 4-131

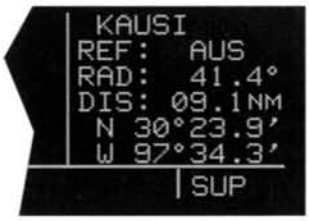

Figure 4-132

4.11.11 The Supplemental Waypoint Page (SUP)

Supplemental waypoints are user-defined waypoints that have not been defined specifically as an airport, VOR, NDB, or intersection. They also include ARTCC "Center" waypoints and "Reference" waypoints which you will learn to create later in chapter 6 of this Pilot's Guide. Figure 4-132 shows an example of a typical Supplemental Waypoint page. The following information is displayed on a Supplemental waypoint page:

- The name or identifier of the supplemental waypoint.
- The position of the supplemental waypoint expressed in terms of a radial and distance from a nearby VOR.
- The latitude and longitude of the supplemental waypoint.

In addition, you may enter the identifier of another nearby waypoint in the **REF** field and the page will compute and display the radial and distance from the nearby waypoint to the supplemental waypoint. The procedure for doing this is identical to that just explained above for an intersection waypoint. This radial and distance information is not stored with the Supplemental Waypoint page and is lost when leaving the page.

4.12 FREQUENCIES FOR NEAREST FLIGHT SERVICE STATIONS

The KLN 88 stores in its data base the locations of Flight Service Stations (FSS) and their remote communications sites. In addition, the KLN 88 determines which two of these FSS points of communication are closest to your present location. What a convenience for you! Next time you want to file a flight plan from the air or contact a FSS for some other reason, you can easily use the KLN 88 to determine a suitable FSS and the appropriate frequency.

Select the Other 1 page (**OTH 1**) on the left side to view two of the nearest points of communication with Flight Service Stations. There will normally be two OTH 1 pages, one for each of the two points of contact. The name of the FSS is at the top of the page . There can be from one to four frequencies included for a point of contact (figure 4-133). Remember that in the U.S. the frequency 122.00 MHz is used for "Flight Watch" and the frequency 123.60 MHz is used for Aeronautical Advisory Service. As you know, it is often possible to communicate with a FSS by transmitting on 122.10 MHz and listening on the VOR frequency. In cases like this, the OTH 1 page displays the frequencies to use for transmit and receive and also the VOR name through which you are communicating (figure 4-134).

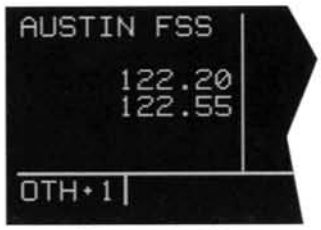

Figure 4-133

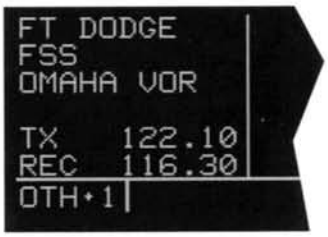

Figure 4-134

4.13 FREQUENCIES FOR AIR ROUTE TRAFFIC CONTROL CENTERS (ARTCC)

The KLN 88 also stores in its data base the low altitude boundaries of each of the ARTCC "Centers". The KLN 88 determines the proper Center to contact and the appropriate frequencies to use for the aircraft's present position. The Other 2 page (**OTH 2**) is used to display this information to you (figure 4-135). Next time you wish to obtain VFR flight following or communicate with Center for any reason, you have an quick way to get a frequency for establishing contact! Appendix D contains a listing of Center abbreviations used on the OTH 2 page.

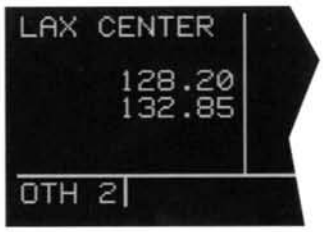

Figure 4-135

4.14 VIEWING AND SETTING THE DATE AND TIME

The KLN 88 contains an internal battery powered calendar/clock that should seldom require resetting. You will normally check to make sure the KLN 88 is set to the correct date and time shortly after you turn the unit on while you verify the Self Test page. You can, however, also check the date and time on the Setup 2 page (**SET 2**) anytime you desire and make any required corrections. Although you have not been exposed to them yet, there are several pages where it is important to have the correct time and date set. Also, there are several internal functions of the unit, such as magnetic variation and proper use of data base information, that depend on having the proper date and time set.

To set the date:.

1. Select the SET 2 page on the left side (figure 4-136).
2. Press the left CRSR to turn on the left cursor function. The cursor will be over the entire date (figure 4-137).
3. Rotate the left inner knob to select the correct day of the month (figure 4-138).
4. Turn the left outer knob one step clockwise to position the flashing part of the cursor over the month field (middle three dashes).
5. Rotate the left inner knob to select the correct month (figure 4-139).
6. Turn the left outer knob one step clockwise to position the flashing part of the cursor over the first position of the year field (second dash from right).
7. Use the left inner knob to select the correct ten's digit of the year (figure 4-140).
8. Turn the left outer knob one step clockwise to position the flashing part of the cursor over the remaining position in the year field.
9. Use the left inner knob to complete the year.
10. Press ENT to start the KLN 88 using the new date (figure 4-141).

Figure 4-136

Figure 4-137

Figure 4-138

Figure 4-139

Figure 4-140

Figure 4-141

To set the time:

1. Select the SET 2 page on the left side.
2. Press the left CRSR to turn on the left cursor function if it is not on already.
3. Use the left outer knob to position the cursor over the time zone (figure 4-142).
4. Use the left inner knob to change the time zone, if desired (figure 4-143). A listing of the time zones and their abbreviations is contained in section 4.2.
5. Turn the left outer knob one step counterclockwise to position the cursor over the entire time (figure 4-144).
6. Rotate the left inner knob to select the correct hour (figure 4-145). Remember, the KLN 88 uses 24 hour time. If it is 1:00 P.M. or later, add 12 hours (for example, 2:30 P.M. becomes 14:30).
7. Turn the left outer knob one step clockwise to position the flashing part of the cursor over the first minute's position, and then use the left inner knob to select the correct value (figure 4-146).
8. Turn the left outer knob one step clockwise again to position the flashing part of the cursor over the remaining minute's position, and then use the left inner knob to complete the time selection.
9. Press ENT to start the clock running (figure 4-147).
10. Press the left CRSR to turn off the left cursor function.

Figure 4-142

Figure 4-143

Figure 4-144

Figure 4-145

Figure 4-146

Figure 4-147

4.15 REMOTE MOUNTED ANNUNCIATORS

The KLN 88 has outputs capable of driving four remote annunciator lights: waypoint alert, message, accuracy warn, and approach mode. Some installations may require a portion or all of these remote annunciators for FAA or other approvals. A typical annunciator is shown in figure 4-148; however, actual annunciation abbreviations and configurations may be different.

Figure 4-148

The remote waypoint alert annunciator is on whenever waypoint alerting is occurring. See sections 4.8.6 and 5.2.2.

The remote message annunciator is on whenever the message prompt is on. See section 4.5.

The remote accuracy warn annunciator is on whenever the KLN 88 determines that its estimated position error is greater than 1.7 nautical miles.

The remote approach mode annunciator is on whenever the KLN 88 is in either the Approach-Leg mode or the Approach-OBS mode.

4.16 SAMPLE TRIP

Just to make sure you are ready to use the KLN 88 for navigation, let's go through a sample trip to illustrate many of the features you have learned to use in this section of the Pilot's Guide. Our trip will be from Adams field (**KLIT**) in Little Rock, Arkansas to Mueller Municipal airport (**KAUS**) in Austin, Texas. The weather is perfect and you decide to make the trip VFR and fly direct to Austin.

4.16.1 Pre-departure

1. Apply power to the KLN 88 by pushing the power/brightness knob to the "in" position.

2. When the screen warms up, adjust the brightness to the desired level by rotating the power/brightness knob.

3. Verify that the information on the Self Test page is correct, including the time and date. Press [ENT] to approve the Self Test page.

4. Read the Data Base page. Acknowledge the Data Base page by pressing [ENT].

5. A blank NAV 2 page is now displayed on the left side on the screen. The APT 4 page for Adams field (**KLIT**), which shows the communications frequencies, is now displayed on the right side of the screen since **KLIT** was the active waypoint when you last removed power from the KLN 88. The APT 4 page indicates that the ATIS frequency is 125.60 MHz, the pre-taxi clearance delivery frequency is 118.95 MHz, the ground control frequency is 121.90 MHz, and the tower frequency is 118.70 MHz. After listening to ATIS, you contact clearance delivery for your clearance out of the Little Rock ARSA. Next, you give ground control a call and receive your taxi clearance.

6. By this time the KLN 88 has reached a NAV ready status. You know this because the NAV 2 page is now showing a valid present position, in this case 4.1 nautical miles on the 316 degree radial from Little Rock (**LIT**) VOR.

7. Press [⊕▸] to bring up the Direct To page on the left side. Use the two left knobs to enter the identifier of Mueller Municipal airport (**KAUS**) by using the left inner knob to select the characters and the left outer knob to move the flashing part of the cursor to the desired cursor location.

8. Press [ENT] to bring up the APT 1 waypoint page for Mueller Municipal airport on the right side.

9. Press [ENT] again to approve the waypoint page. The NAV 1 page is now displayed on the right side of the screen while the NAV 2 page returns to the left side. The NAV 1 page indicates it is 384 nautical miles to Austin and that the bearing is 224 degrees. After take-off, the NAV 1 page will also display groundspeed and estimated time enroute.

10. You now decide to view the Super NAV 1 page. Rotate the left inner knob to select the NAV 1 page.

4.16.2 Enroute

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

2. In order to determine the minimum enroute safe altitude (ESA) for the flight, you view the NAV 3 page. It indicates an ESA of 3600 feet for the trip and minimum safe altitude for your present position of 3400 feet.

3. After departure control has directed "squawk 1200, frequency change approved", you decide it would be a good idea to obtain VFR flight following. To obtain the frequency for Center, select the Other 2 page (**OTH 2**). It indicates that for your position, you should be able to contact Memphis Center on 118.85 MHz.

4. You've only flown about 100 nautical miles, but you begin wondering where you would go if an engine suddenly starting running rough. You decide to use the KLN 88 to determine where the nearest airports are from your present location. To view the nearest airports press [MSG], and then press [ENT]. The nearest airport is Hope Municipal (**M18**) which is eight nautical miles from your position on a bearing to the airport of 11 degrees. You now rotate the right inner knob to view the other APT pages for Hope Municipal. You learn, for example, that it is located in Hope, Arkansas, and has two hard surface runways that are each 5500 feet in length. By pulling the right inner knob to the "out" position, you may now scan clockwise through the remaining eight airports in the nearest airport list.

5. Since it is a good idea to not rely on just one navigation source, you decide to cross check the KLN 88's position against other equipment in the aircraft. The NAV 2 page indicates you are presently located on the Texarkana (**TXK**) VOR 68 degree radial at a distance of 19 nautical miles. By tuning your Navigation Receiver and DME to **TXK**, you are able to confirm that this is the correct position.

4.16.3 Terminal Area

1. About 50 nautical miles from Austin's Mueller airport you start preparing for your arrival. Viewing the APT 4 page for **KAUS** you determine that the ATIS frequency is 119.20 MHz and tower is 121.00 MHz.

2. A few minutes later, the message prompt begins flashing. When you press [MSG], the message page advises: **AIRSPACE ALERT - AUSTIN ARSA - SEE KAUS APT 4 PAGE**. The Special Use Airspace Alert feature has determined that you are within 10 minutes of penetrating the Austin ARSA. When you view the APT 4 page, you see that the ARSA frequencies are sectorized. You determine from the APT 4 page that the proper frequency to use is 124.90 MHz since you are Northeast of Austin and 124.90 MHz is the appropriate frequency to use from 3 degrees to 91 degrees.

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

4. After landing, the KLN 88 is turned off either by pulling the power/brightness switch to the "out" position or with the avionics master switch if one is installed.

CHAPTER 5 - LEVEL 2 OPERATION

This is the second of three chapters specifically dealing with operating the KLN 88. 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 4 about operating the KLN 88, since you can use the Direct To operation to fly anywhere you want to go. However, you would be selling yourself and the KLN 88 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 88 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!

5.1 CREATING AND MODIFYING FLIGHT PLANS

The following rules and considerations apply to KLN 88 flight plans:

- The KLN 88 is capable of storing in its memory nine flight plans plus an active flight plan.
- Each of the flight plans may contain up to 20 waypoints. These waypoints may consist of any combination of published waypoints from the data base or user created waypoints.
- The flight plans are numbered 0 through 9 (FPL 0, FPL 1, FPL 2, ..., FPL 9).
- 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 9. 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 9 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 88 system will be flagged.

5.1.1 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** (Cress 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 5-1).

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 5-2). If all of the flight plan pages contain flight plans, refer to section 5.1.5, "Deleting Flight Plans".

3. Press the left CRSR to turn on the cursor function for the left page (figure 5-3).

***NOTE**: The KLN 88 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. 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 5-4).

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 5-5).

7. Press ENT. A waypoint page for the identifier just entered will be displayed on the right side (figure 5-6). 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 data base, a page allowing creation of a user defined waypoint will appear on the right side. Refer to section 6.4, "USER-DEFINED WAYPOINTS", for instruction on how to define a user created waypoint.

Figure 5-1

Figure 5-2

Figure 5-3

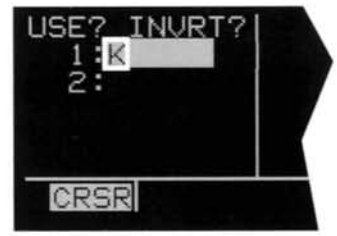

Figure 5-4

Figure 5-5

Figure 5-6

8. Press ENT again to approve the waypoint page being displayed. The cursor will move to the second waypoint position (figure 5-7).

9. Use the same procedure to enter the rest of the waypoints in the flight plan (figure 5-8). If the flight plan consists of five or more waypoints, the waypoints will automatically scroll as necessary to allow entry of the next waypoint.

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 5-9). 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.

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

Figure 5-7

Figure 5-8

Figure 5-9

5.1.2 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 5-10).

3. Press the left CRSR to enable the left cursor function. The cursor will appear over **USE?** (figure 5-11). 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?**.

4. Press ENT to activate the flight plan in the order shown (figure 5-12). 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 5-13).

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 5-10

Figure 5-11

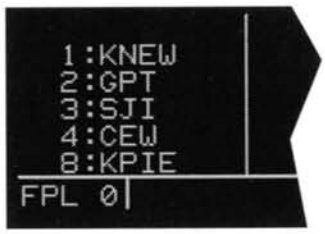

Figure 5-12

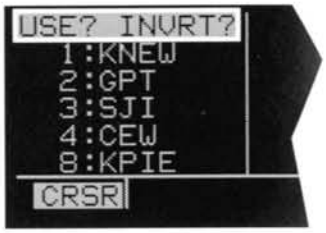

Figure 5-13

5.1.3 Adding A Waypoint To A Flight Plan

A waypoint may be added to any flight plan containing fewer than 20 waypoints. To add a waypoint to a flight plan:

1. Press the left CRSR to enable the left cursor function if it is not on already (figure 5-14).

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 5-15).

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 5-16).

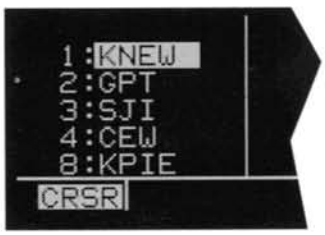

Figure 5-14

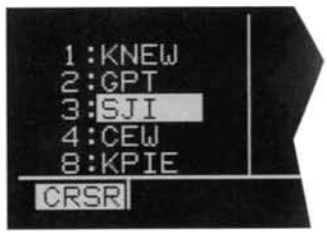

Figure 5-15

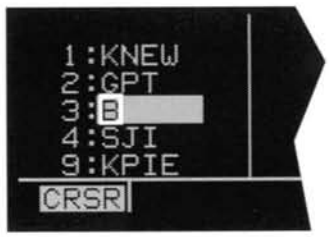

Figure 5-16

4. Use the left outer and inner knobs in the normal manner to complete entering the waypoint identifier (figure 5-17).

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 5-18).

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

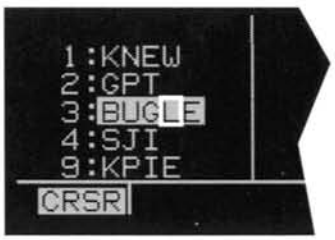

Figure 5-17

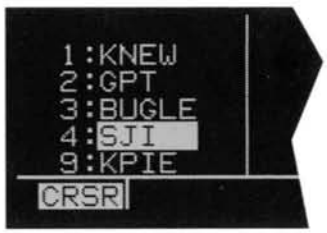

Figure 5-18

5.1.4 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 5-19).

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 5-20). 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 5-21).

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

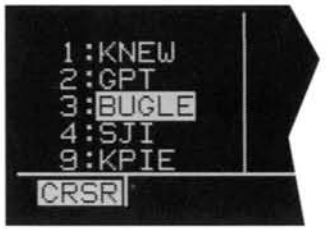

Figure 5-19

Figure 5-20

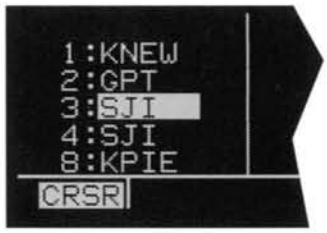

Figure 5-21

5.1.5 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 9) which is to be cleared (figure 5-22).

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 5-23). 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 5-24).

Figure 5-22

Figure 5-23

Figure 5-24

5.1.6 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 5-25). If none exist, use the procedure described in section 5.1.5, "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 5-26).

3. Rotate the left outer knob one step counterclockwise to position the cursor over **LOAD FPL 0?** (figure 5-27).

4. Press ENT to load the active flight plan into this numbered flight plan (figure 5-28).

Figure 5-25

Figure 5-26

Figure 5-27

Figure 5-28

5.2 OPERATING FROM THE ACTIVE FLIGHT PLAN

5.2.1 General Procedures

Everything you have learned in this Pilot's Guide thus far is applicable to using the KLN 88 for flight plan operation. The following rules and considerations apply to flight plan operation while the KLN 88 is in the Enroute-Leg mode:

- Although any of the KLN 88 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 5.2.5, "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 4.9.6 and 4.9.7).

- 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 5-29, **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 5-29. The ↳ symbol is not displayed unless the KLN 88 is actually receiving navigation signals suitable for navigation. (Note: if the unit is in the KCC 88 take-home case, 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 D→ symbol (figure 5-30) instead of a "from" waypoint (figure 5-31), then Direct To navigation is occurring. If it is desired to cancel the Direct To operation and operate from the active flight plan; press [D→], then press [CLR], then press [ENT].

Figure 5-29

Figure 5-30

Figure 5-31

- 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 5-32).

Figure 5-32

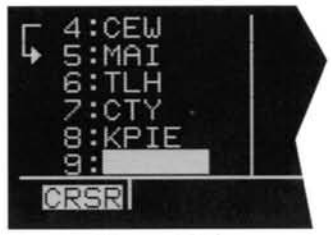

Figure 5-33

- 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 5-33).

5.2.2 Turn Anticipation And Waypoint Alerting

Prior to reaching a waypoint in the active flight plan, the KLN 88 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 5-34. 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 88 automatically sequences to the next leg after passing the midpoint in the transition segment.

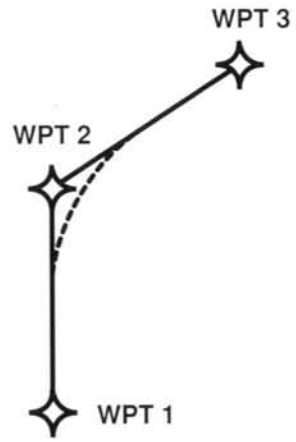

Figure 5-34

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 5-35). This is called "waypoint alerting". If an external waypoint alert annunciator is mounted in the aircraft, this annunciator will begin flashing at the same time.

Figure 5-35

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 desired track (**DTK**) displayed on the NAV 3 page changes to the value for the next leg. The beginning of turn anticipation is also indicated when the external waypoint alert annunciator stops flashing and goes on steady. Turn anticipation becomes inactive when transition to the next leg has been made.

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 5-36). 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.

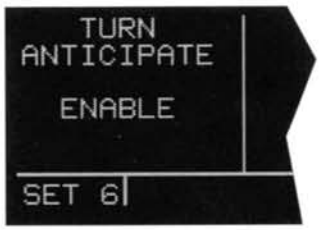

Figure 5-36

5.2.3 Viewing The Waypoint Pages For The Active Flight Plan Waypoints

The waypoint page(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 5-37). 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

Figure 5-37

identifier designates the type of waypoint: **A** = airport, **V** = VOR, **N** = NDB, **I** = intersection, or **S** = supplemental. 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 5-38). For airport waypoints, the right inner knob may be pushed back to the "in" position and rotated to display any of the six airport pages (figure 5-39). Pulling the knob back out will allow further scanning of the waypoint pages in the active flight plan.

Figure 5-38

Figure 5-39

5.2.4 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 88 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 4.8.

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 5-40).

3. Press D→. The waypoint page for the selected waypoint in FPL 0 will be displayed on the right side (figure 5-41).

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 5-42). The ↳ symbol is not displayed since there is no "from" waypoint in the flight plan.

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.

Figure 5-40

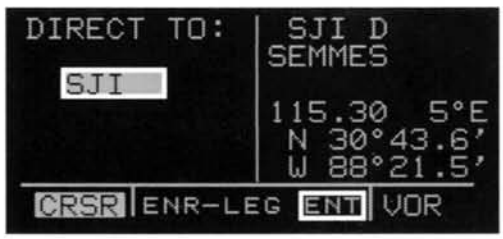

Figure 5-41

Figure 5-42

5.2.5 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.

5.2.6 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 5-43). 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 5-44).

If a numbered flight plan page (FPL 1 through FPL 9) 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 5-45).

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 5-46).

Figure 5-43

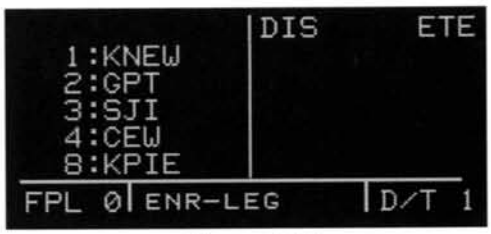

Figure 5-44

Figure 5-45

Figure 5-46

5.2.7 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 5-47). 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 5-48). Changing the time zone on the D/T 2 page changes the time zone on other pages where time is displayed.

If a numbered flight plan page other than FPL 0 is displayed on the left side, no estimated times of arrival are displayed (figure 5-49).

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 5-50).

5.2.8 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 5-51). 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 your are unfamiliar with this term.

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 5-52). Note that this is different than for the D/T 1 and D/T 2 pages.

Figure 5-47

Figure 5-48

Figure 5-49

Figure 5-50

Figure 5-51

Figure 5-52

5.2.9 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 5-53). The information displayed on the D/T 4 page is the following:

Figure 5-53

Figure 5-54

- 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 5-54). If the SET 4 page displays **RUN WHEN GS > 30 KT**, 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 88. 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 at any time.

- **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 **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.

5.3 SAMPLE TRIP

Let's use a sample trip to illustrate some of the KLN 88's flight plan features you learned to use in this section of the Pilot's Guide. The flight will be from Lakefront airport in New Orleans, LA. **(KNEW)** to St. Petersburg/Clearwater, FL. International airport **(KPIE)**. You decide to fly mostly an inland route rather than following the coast to avoid the many restricted areas and MOAs and also to avoid thunderstorms which are occurring off the coast around Panama City (figure 5-55). The pages viewed in this scenario assume that the KLN 88 is driving an external HSI or CDI. If your KLN 88 installation is not interfaced with an external HSI or CDI, then your page selection would have more emphasis on the NAV 1 and Super NAV 1 pages than presented here.

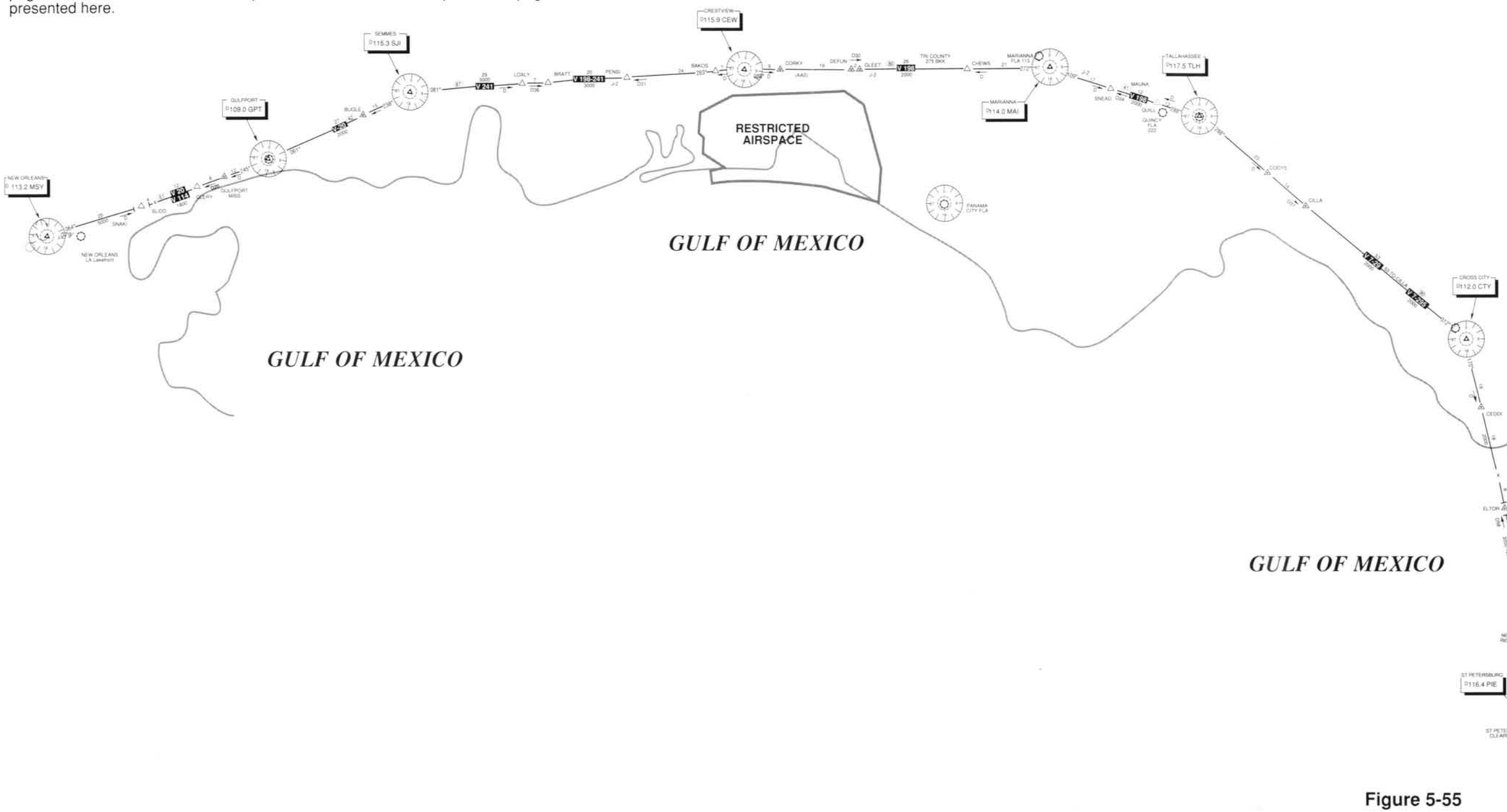

Figure 5-55
(Not For Navigation)

5.3.1 Pre-departure

1. After turn-on and approval of the Self Test and Data Base 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 5.1.1. 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** (Cress City VOR), to **KPIE**.

3. The flight plan is now activated (made FPL 0) as described in section 5.1.2.

4. Until the KLN 88 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 5-56).

5. Shortly, the KLN 88 reaches a NAV ready status (figure 5-57). 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 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 5-58).

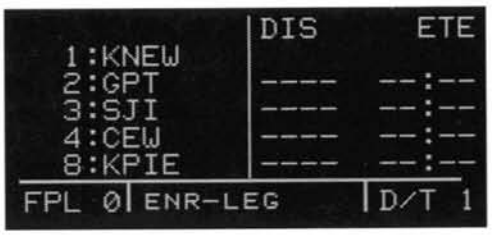

Figure 5-56

Figure 5-57

Figure 5-58

5.3.2 Enroute

1. After departure from runway 18R at Lakefront airport, you receive radar vectors out of the New Orleans TCA. 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 5-59). (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 5-60). 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.

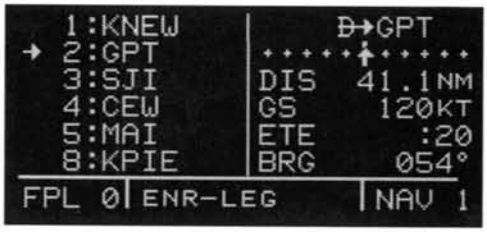

Figure 5-59

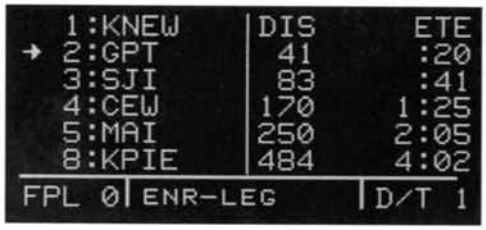

Figure 5-60

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 5-61

3. As you pass abeam GPT, the leg orientation automatically changes to the second leg (figure 5-61).

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 5-62). 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 5-63).

Figure 5-62

Figure 5-63

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

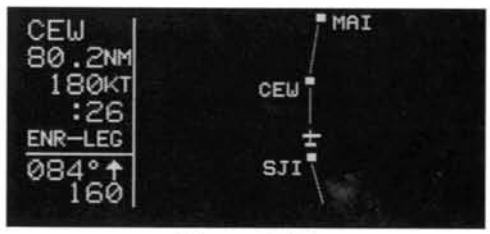

Figure 5-64

6. When you are 20 NM West of **MAI**, you decide to proceed direct to Cross City VOR (**CTY**). To do this, you place the cursor over **CTY** on the FPL 0 page (figure 5-65). Next, you press [D→] to view the waypoint page for **CTY**, and then press [ENT] (figure 5-66). You reselect the D/T 1 page on the right side (figure 5-67).

7. 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 5.1.3 (figure 5-68).

8. To prepare yourself for the arrival into St. Petersburg/ Clearwater International airport, you familiarize yourself with the data base 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 six airport pages.

9. 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 5.1.4.

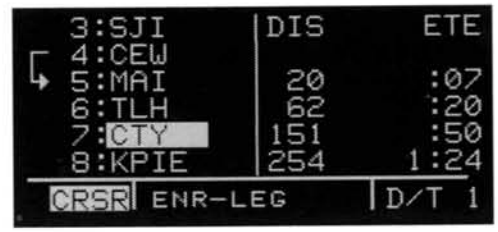

Figure 5-65

Figure 5-66

Figure 5-67

Figure 5-68

CHAPTER 6 - LEVEL 3 OPERATION

This is the third of three chapters specifically dealing with operating the KLN 88. In this chapter you will learn to use many of the supplementary features of the KLN 88. These include such things as the Advisory VNAV, the Trip Planning pages, the Calculator pages, Loran Approaches, and other features that you may find very beneficial and convenient to use in your flying.

6.1 TRIP PLANNING

There are seven Trip Planning pages (**TRI**) that can be displayed on the left side of the screen. The KLN 88 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 ten flight plans (FPL 0, FPL 1, FPL 2, ..., FPL 9) 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 88 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.

6.1.1 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 88 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 6-1).
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 6-2).
4. Rotate the left outer knob clockwise to position the cursor over the first two digits of the wind direction (figure 6-3).
5. Turn the left inner knob to select the first two digits of the wind direction (figure 6-4).
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 wind 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 6-5).
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 wind 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 6-1

Figure 6-2

Figure 6-3

Figure 6-4

Figure 6-5

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6.1.2 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 88 must either be receiving Loran signals sufficient to be in the NAV ready status or the KLN 88 must be in the take-home mode provided by operation in the optional KCC 88 take-home case.

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 88 is in the KCC 88 take-home case, use the SET 1 page to enter your present position. See section 4.6, "INITIALIZATION", 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 6-6).
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 6-7).
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 6-8).

Figure 6-6

Figure 6-7

Figure 6-8

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.

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 6-9).

9. Use the left inner and outer knobs to enter the amount of reserve fuel (**RES**) desired when you reach the selected waypoint (figure 6-10). 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 6-11). 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 6-9

Figure 6-10

Figure 6-11

6.1.3 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 88 does not have to be receiving Loran 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 6-12).

2. Press the left CRSR to turn on the left cursor function. The cursor will be located over the "from" waypoint identifier (figure 6-13).

3. Use the left inner and outer knobs to enter the identifier of the "from" waypoint (figure 6-14).

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 6-15).

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 6-16).

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 inputs 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 6-17). 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 indicated by **TRI+4**.

Figure 6-12

Figure 6-13

Figure 6-14

Figure 6-15

Figure 6-16

Figure 6-17

6.1.4 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 9). The KLN 88 does not have to be receiving Loran 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 6-18).

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 6-19). 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 20 waypoints which creates 19 flight plan legs.

Figure 6-18

Figure 6-19

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 inputs 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 6-20). 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 6-20

6.2 ADVISORY VNAV OPERATION

The KLN 88'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 88 will alert you of when to start the descent, and display the advisory altitudes to fly throughout the descent.

6.2.1 VNAV For Direct To Operation

The Navigation 4 (**NAV 4**) page is used to program the KLN 88 for vertical navigation. The following example will be used to illustrate how to use the VNAV feature. You are using the KLN 88 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 6-21). You desire to use the VNAV to provide vertical guidance to Dubuque's traffic pattern altitude of 1900 feet MSL.

Figure 6-21

1. Select the NAV 4 page on either side of the screen (figure 6-22). The identifier for the active waypoint will automatically be displayed on the page. Prior to programming a VNAV operation, the top of the page will display that the VNAV is inactive (**VNAV INACTV**).

Figure 6-22

2. Press the appropriate CRSR button to turn on the cursor function.

3. Enter your present altitude in the "from" (**FR**) fields (figure 6-23). 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 6-23

4. Use the outer knob to move the cursor to the "to" altitude fields, and then use the inner and outer knobs to enter the desired altitude (figure 6-24).

Figure 6-24

5. Use the outer knob to move the cursor to the offset fields 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 6-25).

Figure 6-25

Notice that the bottom of the NAV 4 page now displays an angle and the top of the page displays your present altitude. If you want to start your descent now using the displayed descent angle, just start a rate of descent so that the altitude displayed on your altimeter matches the advisory altitude at the top of the page. This advisory altitude will count down in 100 foot increments at a rate so that you arrive at your programmed location (two nm before **KDBQ**) at the desired altitude of 1900 feet.

Normally, however, you will probably want 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 6.3.4. After a little experience using the VNAV feature, you will soon learn what angles to use for your normal speeds and rates of descent.

Figure 6-26

6. Use the outer knob to move the cursor to the angle field, and then enter the desired descent angle (figure 6-26). 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.

7. Press the CRSR to turn off the cursor function. Return to any desired page for now. 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 6-27

8. When the countdown reaches 0:00, the time will be replaced with an advisory altitude (figure 6-27). Begin your rate of descent so that the altitude displayed on your altimeter matches the advisory altitude.

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.*

6.2.2 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.

6.3 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 rely on you to make manual inputs of data, they do not receive inputs from any sensors in the aircraft.

6.3.1 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 6-28).

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 6-29).

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 6-30). The pressure altitude is now displayed (**PRS**).

NOTE: *The SET 7 page (figure 6-31) 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.*

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 6-32). 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.

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

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

Figure 6-28

Figure 6-29

Figure 6-30

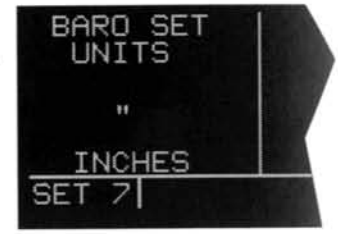

Figure 6-31

Figure 6-32

6.3.2 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 6-33).

Figure 6-33

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 6-34). 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.

Figure 6-34

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 6-35). 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.

Figure 6-35

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

6.3.3 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 6-36).

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 6-37). 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.

Figure 6-36

Figure 6-37

6.3.4 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 6-38).

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 6-39).

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 6-40). 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.

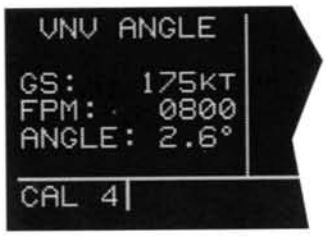

Figure 6-38

Figure 6-39

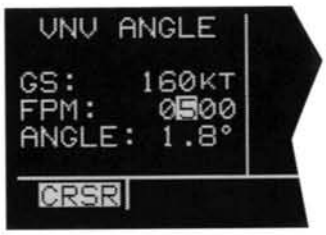

Figure 6-40

6.3.5 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:

1. Display the CAL 5 page on the left side (figure 6-41).

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 6-42).

   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.

   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 6-43).

   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.

Figure 6-41

Figure 6-42

Figure 6-43

6.3.6 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 4.2. For example, if it 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 6-44). The first time the CAL 6 page is viewed after the KLN 88 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 6-45).

4. Turn the left inner knob to select the desired time zone (figure 6-46).

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 6-47). 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 6-44

Figure 6-45

Figure 6-46

Figure 6-47

6.3.7 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 data base. It can do this for any date you desire from January 1, 1988 until December 31, 2087. Amazing you say! Yes, but its true! To use the CAL 7 page:

1. Select the CAL 7 page on the left side (figure 6-48). The first time the CAL 7 page is selected after the KLN 88 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 6-49).

4. If desired, select another date using the left inner and outer knobs. You must press ENT to enter the date (figure 6-50).

5. If desired, select another time zone. The sunrise and sunset times for the selected waypoint, date, and time zone are now displayed (figure 6-51).

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

Figure 6-48

Figure 6-49

Figure 6-50

Figure 6-51

6.4 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 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 data base.

6.4.1 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), remarks, and Loran approach can also be stored. Communication frequencies can not be stored. 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 6-52).

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 6-53).

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 6-54).

Figure 6-52

Figure 6-53

Figure 6-54

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 6-55). 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 tenths of a minute by using the right outer knob to position the cursor and the right inner knob to select the desired numbers (figure 6-56). 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 6-57).

9. Turn the right inner knob one step clockwise to display the APT 2 page (figure 6-58). 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 inner knob to select each individual digit and 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 6-59).

10. Turn the right inner knob one step clockwise to display the APT 3 page (figure 6-60). 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 6-61).

11. Airport remarks may be stored on the APT 5 page using the procedure described in section 4.11.6, "The Airport 5 Page (**APT 5**)". See section 6.12,"USER-DEFINED LORAN APPROACHES", for information on storing user-defined Loran approaches on the APT 6 page.

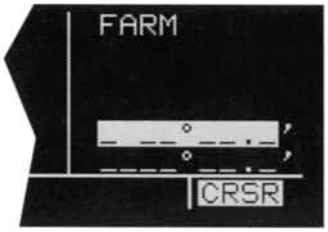

Figure 6-55

Figure 6-56

Figure 6-57

Figure 6-58

Figure 6-59

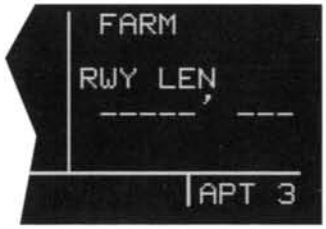

Figure 6-60

Figure 6-61

6.4.2 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 6-62). 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 6-63).

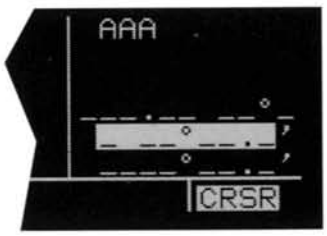

Figure 6-62

Figure 6-63

6.4.3 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 6-64). 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 6-65).

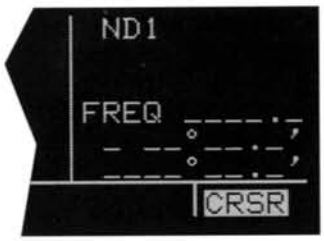

Figure 6-64

Figure 6-65

6.4.4 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 6-66).

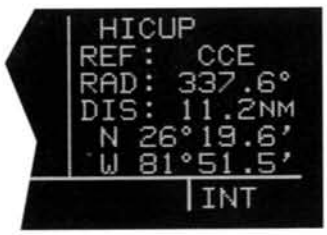

Figure 6-66

2. Use the right CRSR and the right inner and outer knobs in the manner previously described in section 6.4.1, "Creating An Airport User Waypoint", to select the waypoint identifier (figure 6-67).

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 6-68).

4. Turn the right outer knob counterclockwise to position the cursor over the dashes to the right of **REF** (figure 6-69).

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 6-70).

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 6-71).

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 6-72).

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 6-73).

12. Press ENT. The latitude and longitude is calculated and displayed. The user waypoint is now defined (figure 6-74).

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 6-75). The original reference waypoint may be re-entered at any time.*

Figure 6-67

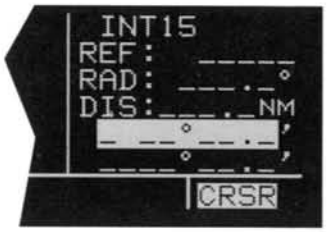

Figure 6-68

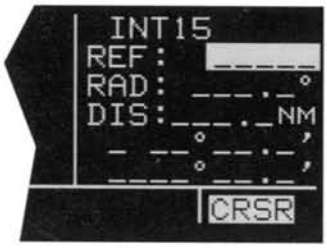

Figure 6-69

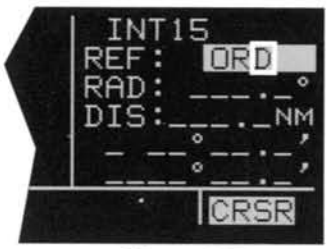

Figure 6-70

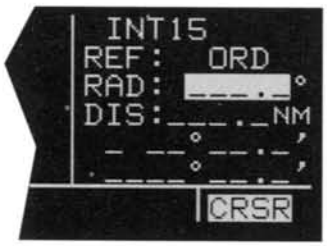

Figure 6-71

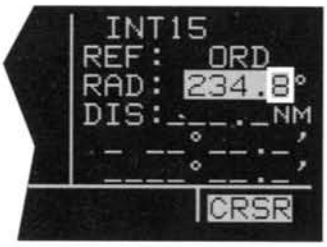

Figure 6-72

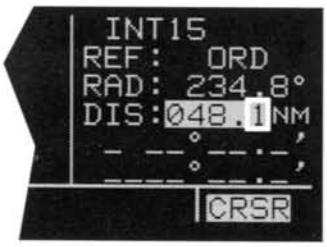

Figure 6-73

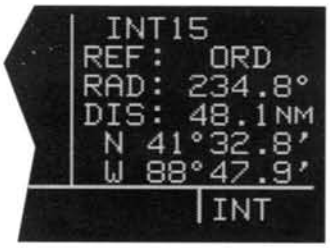

Figure 6-74

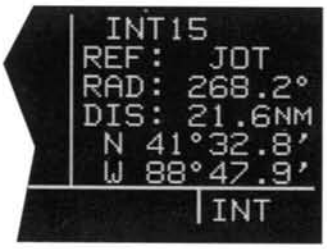

Figure 6-75

6.4.5 Deleting User-Defined Waypoints

A listing of all user-defined waypoints is contained on the Other 3 page (**OTH 3**). See figure 6-76. The user-defined waypoints are listed by category; airports are first, VORs are second, NDBs are third, Intersections (INT) are fourth, and Supplemental waypoints (SUP) are last. Within each category, the waypoints are alphabetized by identifier. To the right of the identifier is the type waypoint defined (APT, VOR, NDB, INT, or SUP) 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:

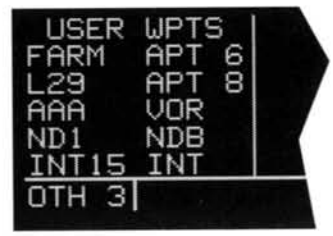

Figure 6-76

Figure 6-77

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 6-77). If more than five user-defined waypoints exist, it is necessary to use the left outer knob to scroll though the complete list. A waypoint contained in a flight plan can not be deleted without first either deleting the waypoint from the flight plan or deleting the entire flight plan.

3. Press CLR (figure 6-78). The waypoint page for the waypoint to be deleted appears on the right side.

4. Press ENT (figure 6-79).

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

Figure 6-78

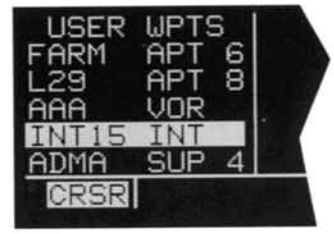

Figure 6-79

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6.5 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.

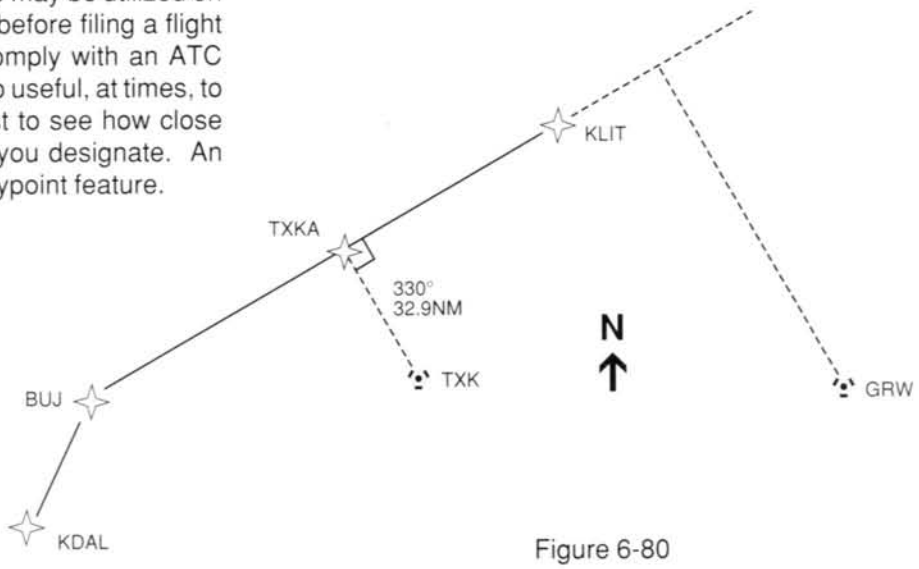

Figure 6-80

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 TCA. 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**.

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 6-81.

2. Display the desired flight plan on the left side (figure 6-82). The Reference Waypoint feature may be used on the active flight plan or on any of the nine numbered flight plans that contain at least two waypoints.

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

Figure 6-81

Figure 6-82

4. Use the right inner and outer knobs to enter the identifier of the desired waypoint (figure 6-83).

Figure 6-83

NOTE: *The waypoint which is used to create the Reference Waypoint may be in the published or user data base. 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 6-80 shows that* **TXK** *is an acceptable waypoint to use in creating a Reference Waypoint. Figure 6-80 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 6-84). 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 6-84

The KLN 88 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 6-85).

Figure 6-85

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 88 is turned off.

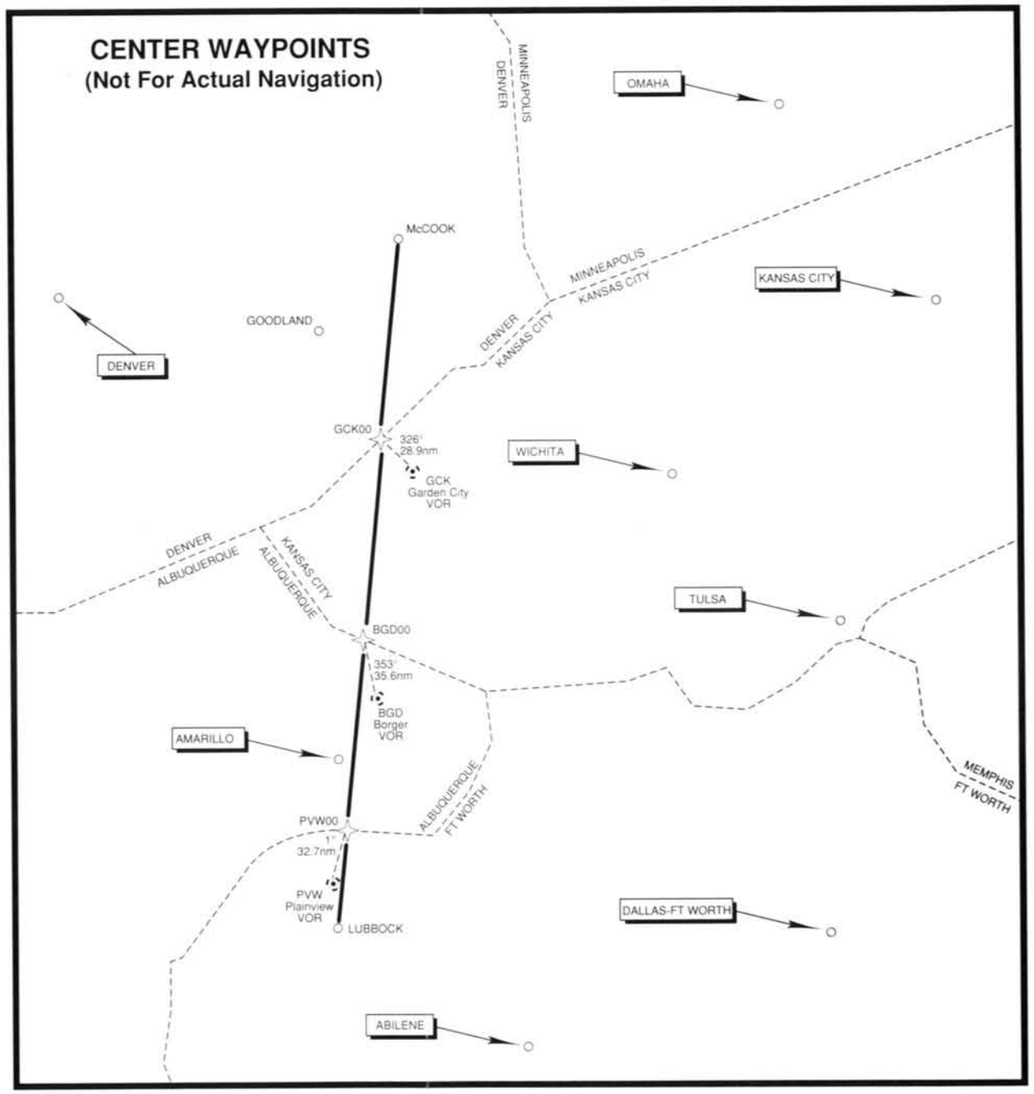
CENTER WAYPOINTS
(Not For Actual Navigation)
MINNEAPOLIS
DENVER
OMAHA
McCOOK
MINNEAPOLIS
KANSAS CITY
KANSAS CITY
GOODLAND
DENVER
DENVER
KANSAS CITY
GCK00
326°
28.9nm
GCK
Garden City
VOR
WICHITA
DENVER
ALBUQUERQUE
KANSAS CITY
ALBUQUERQUE
TULSA
BGD00
353°
35.6nm
BGD
Borger
VOR
AMARILLO
MEMPHIS
FT WORTH
ALBUQUERQUE
FT WORTH
PVW00
1°
32.7nm
PVW
Plainview
VOR
LUBBOCK
DALLAS-FT WORTH
ABILENE

Figure 6-86

6.6 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). Center Waypoints are waypoints at locations where a flight plan intersects the ARTCC "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 data base.

An example will illustrate the Center Waypoint feature. You are planning a flight from Lubbock, Texas International airport (**KLBB**) to Mc Cook, Nebraska Municipal airport (**KMCK**) as shown in figure 6-86. A flight plan is initially created with just these two waypoints (figure 6-87). In order to give ATC more waypoints for your intended direct routing, you decide to utilize the Center Waypoint feature.

6.6.1 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 6-88.

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 nine numbered flight plans (figure 6-89).

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 6-90).

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.

Figure 6-87

Figure 6-88

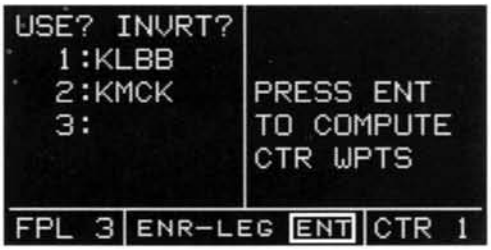

Figure 6-89

Figure 6-90

An example of a CTR 2 page is shown in figure 6-91. The top line contains the identifier of the Center Waypoint. The KLN 88 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, then **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**.

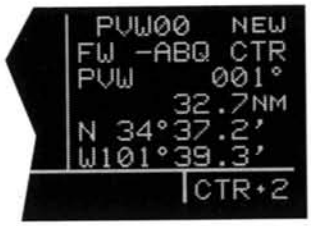

Figure 6-91

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 6-86. A listing of the Center abbreviations is contained in Appendix D.

The third and forth 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 6-92). The Center Waypoints are inserted into the flight plan in the correct order.

Figure 6-92

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 20, then no Center Waypoints are displayed and the CTR 1 page will display the statement "**NOT ENOUGH ROOM IN FPL**".

6.6.2 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 6-89 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 6-93). Center 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. Center Waypoints that are no longer part of a flight plan are deleted from the list of user-defined waypoints when the KLN 88 is turned off.

6.6.3 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 Mc Cook by extending your flight to Omaha (figure 6-94). When you use the CTR 1 page to compute Center Waypoints, the CTR 1 page will now be as shown in figure 6-95. The newly computed Center Waypoint is identified as "NEW" on the CTR 2 page (figure 6-96) while the existing Center Waypoints no longer contain the "NEW" label.

Figure 6-93

Figure 6-94

Figure 6-95

Figure 6-96

6.7 THE OTHER 0 (OTH 0) PAGE

The OTH 0 page is an index to aid you in remembering what is contained on each of the OTH pages. There are two formats for the OTH 0 page, depending on whether or not the KLN 88 system is interfaced with a fuel management system. Without an interface to a fuel management system, there are five OTH pages and the OTH 0 page appears as shown in figure 6-97. With an interface to a fuel management system, there are nine OTH pages and the OTH 0 page appears as shown in figure 6-98. The OTH 0 page indicates the following:

OTH 1: Flight Service Station Frequencies (see section 4.12)
OTH 2: ARTCC ("Center") frequencies (see section 4.13)
OTH 3: User-defined waypoints (see section 6.4.5)
OTH 4: User-entered airport remarks (see section 4.11.6)
OTH 5: User-defined Loran approaches (see section 6.12)
OTH 6-9: Fuel management (see section 6.13)

Figure 6-97

Figure 6-98

6.8 PROGRAMMING THE TURN-ON PAGE

You may personalize your KLN 88 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 88. The example in figure 6-99 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 6-99

1. Turn the KLN 88 off if it is on.

2. Turn-on the unit . As soon as you see the Turn On page, press the left CRSR (figure 6-100). 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 88 is being used in the optional KCC 88 take-home case).

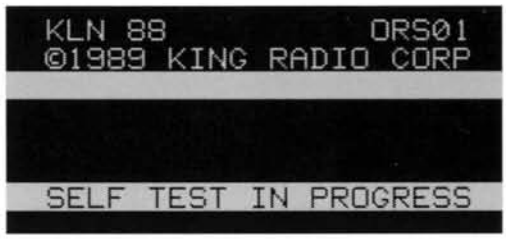

Figure 6-100

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?

6.9 THE LORAN STATUS PAGES

6.9.1 Determining The Status Of The Loran Stations

The Status 1 (**STA 1**) and Status 2 (**STA 2**) pages may be viewed at any time to determine the status of the Loran receiver. This includes which Loran stations are being tracked, which stations are actually being used for navigation, the signal-to-noise ratio for each of these stations, and the estimated position error.

The Loran receiver in the KLN 88 is capable of using up to eight Loran stations in four Loran chains to determine its position. A valid position may be determined using as few as three stations in one Loran chain or two stations in each of two Loran chains. This ability to utilize stations from more than one chain at a time is called "multi-chain" operation and is what allows the KLN 88 to navigate over such a vast area.

Figures 6-101 and 6-102 show a representative example of a set of STA 1 pages. Three chains are simultaneously being tracked and used to determine position. There will be two STA 1 pages if more than four stations are being tracked as in this example. The fact that there are two Status 1 pages is indicated in the page identification segment by **STA+1**. The following information is displayed on a STA 1 page:

- Normally, the Loran receiver is in the multi-chain mode (**MULTI-CHAIN**) which allows the receiver to automatically choose the best combination of stations and chains to use for navigation. The other mode of the Loran receiver is manual triad (**MAN TRIAD**) where a combination of three stations within one chain are specified and used for navigation. The receiver is always reset to the multi-chain mode each time the KLN 88 is turned on. It will remain in the multi-chain mode unless you manually put it in the manual triad mode. The two means of selecting manual triad are 1) from the STA 1 page as described in section 6.9.2, "Manual Triad Operation", and 2) by putting the KLN 88 in one of the two approach modes as described in section 6.10.2,"Selecting The Approach-Leg or The Approach-OBS Mode".

- The Group Repetition Interval (**GRI**) is the identifier of the Loran chain. Appendix E contains a Loran station listing. The KLN 88 is capable of using the following Loran chains:

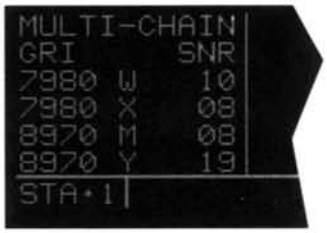

Figure 6-101

Figure 6-102

5930 - Canadian East Coast
7930 - Labrador Sea
7970 - Norwegian Sea
* **8290** - North Central U.S.
8970 - Great Lakes
* **9610** - South Central U.S.
9990 - North Pacific
5990 - Canadian West Coast
7960 - Gulf of Alaska
7980 - Southeast U.S.
9940 - U.S. West Coast
9980 - Iceland

* ORS 03 and 04 units only

- The abbreviations for each of the secondary Loran stations being tracked. An * to the right of the station indicates that this station is being tracked but is not presently being used for determining position. The letter "**B**" displayed to the right of of a secondary station annunciates a "blink" condition. A blink condition means the secondary station is transmitting a signal that indicates its information may be inaccurate or missing. Loran chains include one master station and may contain two, three, or four secondary stations. The following abbreviations are used for the stations in a Loran chain:

  M - Master
  V - Victor
  W - Whiskey
  X - X-Ray
  Y - Yankee
  Z - Zulu

- Signal-to-noise-ratio (**SNR**), which is a ratio of the Loran signal level to the level of the backround noise. Generally, the receiver is able to use a signal if the SNR is greater in value than minus 8. It is important to note, however, that the geometrical relationship of the Loran stations and the aircraft also affects a station's usability.

SNR	Usability
20 and up	Excellent
08 to 19	Good
-08 to 07	Fair
-09 and less	Poor

A representative STA 2 page is shown in figure 6-103. The STA 2 page displays the system's estimate of the position error expressed in nautical miles.

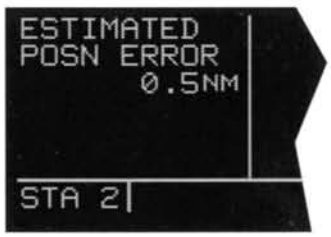

Figure 6-103

6.9.2 Manual Triad Operation

In manual triad operation, you must specify the chain and stations to be used by the Loran sensor to determine position. Three stations within one chain must be selected in order to utilize manual triad operation. To put the Loran sensor into manual triad operation:

1. Select the STA 1 page on the left side.
2. Press the left CRSR to turn on the left cursor function. The cursor will be over **MULTI-CHAIN** (figure 6-104).
3. Turn the left inner knob one step clockwise to select **MAN TRIAD** (figure 6-105).
4. Turn the left outer knob one step clockwise to position the cursor over the GRI position (figure 6-106).
5. Rotate the left inner knob to scan through the list of GRIs until the desired one is displayed (figure 6-107).
6. Turn the left outer knob one step clockwise to move the cursor over the first station position (figure 6-108).
7. Rotate the left inner knob to scan through the list of available stations for the selected GRI. Display the desired first station (figure 6-109).
8. Use the left outer and inner knobs in the same manner to select the second and third stations (figure 6-110).
9. Use the left outer knob to position the cursor over **APPROVE?**.
10. Press ENT to activate manual triad operation. When the KLN 88 reaches a NAV ready status, the STA 1 page will appear similar to figure 6-111.

The Loran sensor is restored to multi-chain operation by pressing the left CRSR to bring the cursor over **MAN TRIAD**, and turning the left inner knob to display **MULTI-CHAIN**. No further approval is necessary. Press the left CRSR to turn off the left cursor function.

CAUTION: Manual triad operation should only be used when the operator is knowledgeable about what station triad to select. Choosing inappropriate stations can reduce the accuracy of the position.

In the Approach-Leg and Approach-OBS modes, the Loran sensor is always in the manual triad mode, but there are no cursor fields on the page. The GRI and station selections for these modes are stored as part of the Loran approach.

NOTE: *Manual triad operation is not functional in Alaska or Canada for ORS 04 units.*

Figure 6-104

Figure 6-105

Figure 6-106

Figure 6-107

Figure 6-108

Figure 6-109

Figure 6-110

Figure 6-111

6.10 MODES OF OPERATION

The KLN 88 has four modes of operation: Enroute-Leg, Enroute-OBS, Approach-Leg, and Approach-OBS. When the KLN 88 is turned on, it always "wakes up" in the Enroute-Leg mode. The Enroute-Leg mode is the normal mode for enroute flying.

The mode is annunciated in the lower center segment of the screen (figure 6-112). 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 6-113). The following abbreviations are used for mode annunciation.

Mode	Annunciation
Enroute-Leg	**ENR-LEG**
Enroute-OBS	**ENR:274**
Approach-Leg	**APR-LEG**
Approach-OBS	**APR:274**

For both of the OBS modes, the number included in the annunciation is the selected magnetic course. The course may be changed on the NAV 3 page (or on the MOD 2 or MOD 4 pages) to any desired value.

If a remote Approach mode annunciator is installed in the aircraft, it will be illuminated whenever either of the two Approach modes is selected.

Mode selection is accomplished on the Mode (**MOD**) type pages. There are four Mode pages, one corresponding to each of the four modes.

Page	Mode
MOD 1	Enroute-Leg
MOD 2	Enroute-OBS
MOD 3	Approach-Leg
MOD 4	Approach-OBS

Figure 6-112

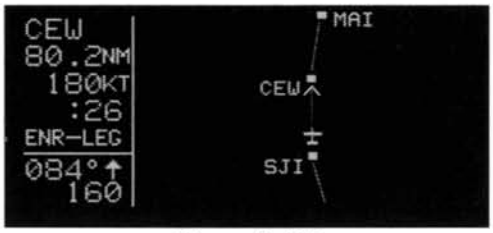

Figure 6-113

6.10.1 Selecting The Enroute-Leg Mode Or The Enroute-OBS Mode

Use the following procedure to change to either the Enroute-Leg mode or the Enroute-OBS mode:

1. Select the MOD type pages on the left side. The MOD page corresponding to the active mode will be displayed (figure 6-114).

2. Rotate the left inner knob to select the MOD page for the desired mode: MOD 1 to select Enroute-Leg or MOD 2 to select Enroute-OBS (figure 6-115).

3. Press [ENT] (figure 6-116). The mode change is complete and you may return to any desired page.

Figure 6-114

Figure 6-115

Figure 6-116

6.10.2 Selecting The Approach-Leg Or The Approach-OBS Mode

In order to put the KLN 88 in an Approach mode, it is necessary to specify an airport having a Loran approach. The airport specified dictates parameters for the Loran receiver to use - including the chain (GRI), the stations, and the additional secondary factors (ASFs). Use the following procedure to change to either the Approach-Leg mode or the Approach-OBS mode.

1. Select the MOD type pages on the left side. The MOD page corresponding to the active mode will be displayed.

2. Rotate the left inner knob to select the MOD page for the desired mode: MOD 3 to select Approach-Leg (figure 6-117) or MOD 4 to select Approach-OBS.

The data entry field adjacent to **APT** will contain a flashing airport identifier if at least one of the following conditions exist.

(a) If there is at least one waypoint that is part of a Loran approach and this waypoint is located in the active flight plan from the current active waypoint to the end of the flight plan, then the MOD 3 or MOD 4 page will contain the identifier of the airport associated with this approach waypoint. This waypoint must have been entered into the active flight plan by transferring the waypoint from an APT 6 page using the procedure described later in section 6.11.1, "Loading Loran Approach Waypoints Into The Active Flight Plan".

(b) If there is an airport with a Loran approach in the active flight plan from the current active waypoint to the end of the flight plan, then the MOD 3 or MOD 4 page will contain the identifier of this airport.

Figure 6-117

(c) If the Direct To waypoint is not in the active flight plan but the Direct To waypoint is an airport having a Loran approach, then the MOD 3 or MOD 4 page will contain the identifier of this airport.

(d) If conditions (a) and (b) both exist, then the MOD 3 or MOD 4 page will contain the identifier associated with whichever condition exists first in the flight plan.

If none of the above four conditions exist, the data entry field adjacent to **APT** will be blank.

3. If the data entry field adjacent to **APT** doesn't contain the identifier for the airport where the Loran approach is to be made, then press the left CRSR and use the left inner and outer knobs to enter the desired airport identifier.

4. Press ENT. The airport identifier will be flashing on the left side. The right side will display the APT 6 page for the selected airport (figure 6-118). This APT 6 page shows the chain, stations, and ASFs, but does not show the waypoints associated with the approach. (This is because there could be several approaches for this airport).

Figure 6-118

5. Press ENT to initiate selection of the desired Approach mode. If the KLN 88 was previously in an Enroute mode, the mode annunciation for the selected Approach mode will begin flashing in the lower center segment of the display (figure 6-119). The flashing indicates:

Figure 6-119

(a) The KLN 88 is not yet fully in an Approach mode since it is still utilizing Loran stationsfrom the Enroute mode.

(b) The rest of the characteristics for the selected Approach mode are now active (see section 6.10.5, "The Approach-Leg Mode" and section 6.10.6, "The Approach-OBS Mode"). Any desired page may be displayed during and after this mode transition.

This Enroute mode to Approach mode transition (while the mode annunciation is flashing) will last from a few seconds up to two minutes, but typically will be less than 30 seconds. When the Approach mode annunciation stops flashing, the KLN 88 is fully in an Approach mode. The KLN 88 will flag in an Approach mode anytime the unit is not receiving adequate signals from the required Loran stations.

CAUTION: The purpose of this transition phase from an Enroute mode to an Approach mode is to allow the KLN 88 to continue to provide a navigation funtion while it is in the process of switching from the Loran stations used in the Enroute mode to those specified for use in the Approach mode. The KLN 88 must be fully in an Approach mode when shooting a Loran approach, so plan ahead to ensure the mode trasition is complete. The Approach mode selection should be initiated at least five to ten minutes prior to beginning the approach.

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6.10.3 The Enroute-Leg Mode

The following are characteristics of the Enroute-Leg mode:

1. The Loran receiver is normally in multi-chain operation and is free to choose Loran chains (GRIs) and stations. The exception is if you have manually put the Loran receiver in manual triad operation on the STA 1 page as described in section 6.9.2.

2. The course deviation indicator (CDI) sensitivity is plus and minus five nautical miles, full scale. This applies to the CDI on the NAV 1 page as well as any external CDIs or HSIs interfaced to the KLN 88. If the CDI or HSI has five dots left and right of the center position, then each dot represents one nautical mile of deviation.

3. 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. 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 88 will be substantially shorter and the desired track will probably change only a few degrees.

4. 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.

5. Turn anticipation may be utilized in flight plan operation as described in section 5.2.2.

6. 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 4.9.4.

7. The KLN 88 determines and uses its own ASFs (additional secondary factors). ASFs are correction factors which are applied to the Loran sensor's position calculation in order to increase accuracy.

6.10.4 The Enroute-OBS Mode

The following are characteristics of the Enroute-OBS mode. Items 1, 2, and 7 are the same as for the Enroute-Leg mode.

1. The Loran receiver is normally in multi-chain operation and is free to choose Loran chains (GRIs) and stations. The exception is if you have manually put the Loran receiver in manual triad operation on the STA 1 page as described in section 6.9.2.

2. The course deviation indicator (CDI) sensitivity is plus and minus five nautical miles, full scale. This applies to the CDI on the NAV 1 page as well as any external CDIs or HSIs interfaced to the KLN 88. If the CDI or HSI has five dots left and right of the center position, then each dot represents one nautical mile of deviation.

3. The course is defined by the active waypoint and the selected magnetic course. A course "to" or "from" the active waypoint may be selected.

4. The course selection is made on the NAV 3 or Mode 2 (**MOD 2**) pages. To change the selected course on either of these pages:

   a. Select either the NAV 3 or MOD 2 page (figure 6-120).

   b. Press the appropriate CRSR to turn on the cursor function.

   c. Turn the appropriate inner knob to select the desired course (figure 6-121).

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

If the KLN 88 is interfaced with a compatible electronic HSI, such as the Bendix/King EHI 40, course selection may also be made directly with the HSI's course select knob.

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

6. 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 4.9.4. Other waypoints in the active flight plan do not affect the ESA.

7. The KLN 88 determines and uses its own ASFs (additional secondary factors). ASFs are correction factors which are applied to the Loran sensor's position calculation in order to increase accuracy.

8. When the active waypoint is a VOR, the published magnetic variation for the VOR is utilized rather than the calculated magnetic variation.

Figure 6-120

Figure 6-121

6.10.5 The Approach-Leg Mode

The following are characteristics of the Approach-Leg mode. Items 3, 4, 5, and 6 below are characteristics common to the Enroute-Leg mode.

1. The Loran chain and stations, as well as the ASFs, used by the Loran receiver are only those specified in a particular Loran approach. The receiver is always in manual triad operation.

2. The course deviation indicator (CDI) sensitivity is plus and minus 1.25 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 88. If the CDI or HSI has five dots left and right of the center position, then each dot represents one-fourth nautical mile of deviation.

3. Navigation is provided along the great circle path between two waypoints.

4. Automatic waypoint sequencing is provided during flight plan operation.

5. Turn anticipation may be utilized in flight plan operation as described in section 5.2.2.

6. 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 4.9.4.

7. Once in the Approach-Leg mode, no Loran approach parameters can be modified or defined. This means you can not modify the data or create a new approach on any APT 6 page while in this mode. Approach information can only be modified or defined in one of the two Enroute modes.

6.10.6 The Approach-OBS Mode

The following are characteristics of the Approach-OBS mode. Items 3, 4, 5, 6, and 7 below are characteristics common to the Enroute-OBS mode. Items 1, 2, and 8 below are characteristics common to the Approach-Leg mode.

1. The Loran chain and stations, as well as the ASFs, used by the Loran receiver are only those specified in a particular Loran approach. The receiver is always in manual triad operation.

2. The course deviation indicator (CDI) sensitivity is plus and minus 1.25 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 88. If the CDI or HSI has five dots left and right of the center position, then each dot represents one-fourth nautical mile of deviation.

3. The course is defined by the active waypoint and the selected magnetic course. A course "to" or "from" the active waypoint may be selected.

4. The course selection is made on the NAV 3 or Mode 4 (**MOD 4**) pages in the same manner as for the Enroute-OBS mode. To change the selected course on either of these pages:

   a. Select either the NAV 3 or MOD 4 page.

   b. Press the appropriate CRSR to turn on the cursor function.

   c. Turn the appropriate inner knob to select the course.

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

If the KLN 88 is interfaced with a compatible electronic HSI, such as the Bendix/King EHI 40, course selection may also be made directly with the HSI's course select knob.

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

6. 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 4.9.4. Other waypoints in the active flight plan do not affect the ESA.

7. When the active waypoint is a VOR, the published magnetic variation for the VOR is utilized rather than the calculated magnetic variation.

8. Once in the Approach-OBS mode, no Loran approach parameters can be modified or defined. This means you can not modify the data or create a new approach on any APT 6 page while in this mode. Approach information can only be modified or defined in one of the two Enroute modes.

6.10.7 Switching From One Of The OBS Modes To One Of The Leg Modes

The following mode transition occurs if the KLN 88 is in either the Enroute-OBS mode or Approach-OBS mode and the mode is switched to either Enroute-Leg or Approach-Leg:

1. The waypoint that was active while in the OBS mode remains the active waypoint when one of the Leg modes is activated. The system does not attempt to orient itself on a leg of 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.

3. With the exception of #2 above, the characteristics of normal Direct To operation apply.

6.10.8 Activating A Waypoint While In One Of The OBS Modes

While in either the Enroute-OBS or the Approach-OBS mode, you may activate another waypoint by using the normal Direct To method or by using the following method. This second method activates another waypoint without changing the selected course (**OBS**). This feature may be useful when shooting a Loran approach. In this example the KLN 88 is operating in the Approach-OBS mode (figure 6-122).

1. Press [D→] (figure 6-123). The rules described in section 4.8, "DIRECT TO OPERATION", dictate which waypoint identifier will be initially displayed on the Direct To page.

2. Press [D→] a second time. The annunciation **DIRECT TO** changes to **ACTIVATE** (figure 6-124). The right side still displays the appropriate waypoint page. Repeated presses of [D→] alternates between **DIRECT TO** and **ACTIVATE**. Make sure **ACTIVATE** is displayed.

3. Press [ENT] to approve the waypoint page and activate the waypoint (figure 6-125). The selected course does not change, therefore this method does not center the D-Bar like a Direct To operation.

Figure 6-122

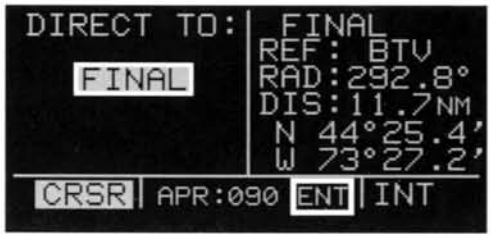


Figure 6-123

Figure 6-124

Figure 6-125

Loran approaches are designed around the KLN 88's flight plan operation. The specific approach parameters for public-use Loran approaches are stored in the data base and include the chain (GRI), stations, additional secondary factors (ASFs), and the waypoints. The general procedure is to 1) view and approve the specific Loran approach parameters by displaying the appropriate APT 6 page for the desired airport, 2) load the approach waypoints into the flight plan, and 3) put the KLN 88 into an approach mode. The keys to safely executing a Loran approach are advance planning and familiarity with the procedures.

There are two approach modes, Approach-Leg and Approach-OBS. There may be times when one of these modes may be appropriate for the entire approach, or times when it may be desirable to initiate the approach in the Approach-OBS mode and then switch to the Approach-Leg mode at the appropriate time.

CAUTION: The examples shown in this section of the Pilot's Guide are intended to demonstrate the concepts that may be required in order to shoot a Loran approach. If your KLN 88 installation is approved for IFR flight, check your aircraft's Flight Manual Supplement to see if the KLN 88 is approved for Loran approaches. Like any other type of instrument approach, Loran approaches have certain unique characteristics that require careful understanding in order to be safely executed. Practice shooting Loran approaches in good VFR conditions until you feel comfortable with the procedures before ever attempting in IFR conditions.

6.11.1 Loading Loran Approach Waypoints Into The Active Flight Plan

It is generally a good idea to load the Loran approach waypoints into the active flight plan just as soon as you think there is a possibility the Loran approach may be required. Including the waypoints in the flight plan does not mean you have to utilize them. It is far easier to bypass the approach waypoints or delete them from the flight plan than to scramble at the last minute to add them to the flight plan. To load Loran approach waypoints into the flight plan:

1. Display the active flight plan (FPL 0) on the left side and the APT 6 page for the specific Loran approach you wish to shoot on the right side (figure 6-126). Verify that the waypoints shown on the APT 6 page are correct. If there are more than six waypoints in the approach, it is necessary to press the right CRSR and then use the right outer knob to scroll through the first six waypoints to see the final one or two waypoints.

2. Press the left CRSR and rotate the left outer knob to position the cursor over the airport identifier where the approach is to be executed (figure 6-127).

3. Press ENT. The approach waypoints will appear in the flight plan in front of the airport identifier (figure 6-128). The waypoints will be flashing in inverse video at this time. Verify that the waypoints are correct and in proper sequence.

4. Press ENT a second time to load the waypoints into the flight plan (figure 6-129).

5. It is a good idea to verify the position of each of the approach waypoints at this time by selecting the ACT type waypoints on the right side and scanning through the flight plan waypoints with the right inner knob in the "out" position.

6. Press the left CRSR to turn off the left cursor function. You may return to displaying any desired pages at this time.

NOTE: *Waypoints loaded into the flight plan in the above manner are automatically deleted from the flight plan when power is removed from the unit.*

Figure 6-126

Figure 6-127

Figure 6-128

Figure 6-129

6.11.2 Sample Loran Approaches

Three examples will be used to demonstrate the procedural concepts required for shooting Loran approaches. The fictitious runway 9 Loran approach to Home Municipal airport (KHOM) used in these examples consists of three waypoints: INITT, the initial approach fix (IAF); FINAL, the final approach fix (FAF); and MMAPP, the missed approach point (MAP).

Figure 6-131

6.11.3 Direct To The IAF - No Procedure Turn

In figure 6-130 (position A) you have just passed BEGIN intersection and are cleared direct to INITT. The chart indicates "NoPT" so no procedure turn is used from BEGIN. The approach waypoints for this approach have previously been added to the active flight plan using the procedure described in section 6.11.1 (figure 6-131).

Figure 6-132

Position A: Put the KLN 88 in the Approach-Leg mode:

1. Select the MOD 3 page on the left side (figure 6-132). KHOM is flashing in the APT field as described in section 6.10.2.

Figure 6-133

2. Press [ENT]. An abbreviated APT 6 page for KHOM is displayed on the right side (figure 6-133). Verify that the displayed chain, stations, and ASFs are correct for the approach.

Figure 6-134

3. Press [ENT] to approve the approach parameters and initiate activation of the Approach-Leg mode (figure 6-134). The lower middle segment of the screen shows that the system is in the Approach-Leg mode. The mode annunciation may flash for a few seconds to indicate a transition period from an Enroute mode to an Approach mode (see section 6.10.2, "Selecting The Approach-Leg Or The Approach-OBS Mode"). Any desired pages may be displayed at this time (figure 6-135).

Figure 6-135

DIRECT TO THE INITIAL APPROACH FIX (IAF)- NO PROCEDURE TURN
(Not For Actual Navigation)

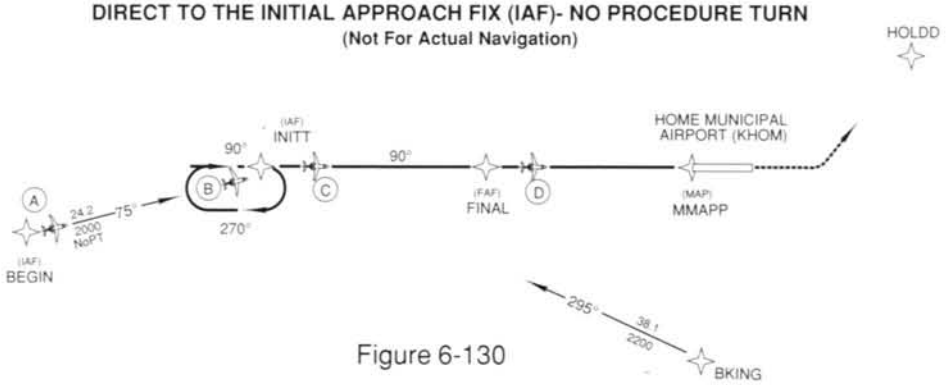


Figure 6-130

Position B: Normal waypoint alerting and turn anticipation occur.

Position C: Leg sequencing has occurred and the aircraft is established on the leg between INITT and FINAL (figure 6-136).

Position D: Leg sequencing has occurred and the aircraft is established on the leg between FINAL and MMAPP (figure 6-137).

Figure 6-136

Figure 6-137

6.11.4 Direct To The IAF - Course Reversal

In figure 6-138 (position A) you have just passed BKING intersection and are cleared direct to INITT. A holding pattern course reversal is required coming from BKING. The approach waypoints for this approach have previously been added to the active flight plan using the procedure described in section 6.11.1 (figure 6-139).

Position A: Put the KLN 88 in the Approach-OBS mode:

1. Select the MOD 4 page on the left side (figure 6-140). KHOM is flashing in the APT field as described section 6.10.2.

2. Press [ENT]. An abbreviated APT 6 page for KHOM is displayed on the right side (figure 6-141). Verify that the displayed chain, stations, and ASFs are correct for the approach.

3. Press [ENT] to approve the approach parameters and initiate activation of the Approach-OBS mode (figure 6-142). The lower middle segment of the screen (except for Super NAV 5 page) shows that the system is in the Approach-OBS mode. The mode annunciation may flash for a few seconds to indicate a transition period from an Enroute mode to an Approach mode (see section 6.10.2, "Selecting The Approach-Leg Or The Approach-OBS Mode"). The selected course (295 degrees) is automatically chosen by the KLN 88 so that the D-Bar and TO/FROM flag remain in the same position when switching from the Enroute-Leg mode to the Approach-OBS mode. Any desired pages may displayed at this time (figure 6-143).

Figure 6-139

Figure 6-140

Figure 6-141

Figure 6-142

Figure 6-143

DIRECT TO THE INITIAL APPROACH FIX (IAF)- COURSE REVERSAL
(Not For Actual Navigation)

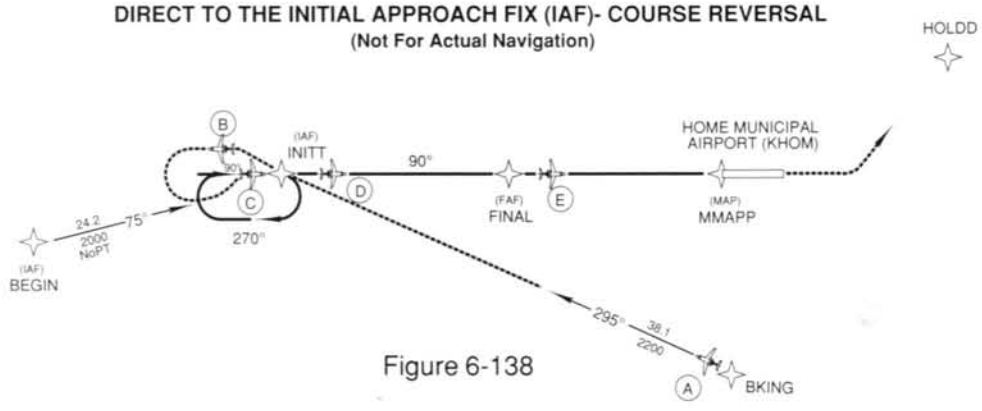


Figure 6-138

Position B: After crossing INITT, enter 90 degrees as the selected course:

1. Select the NAV 3 or MOD 4 page on the left side (figure 6-144).

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

3. Rotate the left inner knob to select 90 degrees (figure 6-145). The external HSI or CDI should also be set to 90 degrees.

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

Position C: Follow the proper Air Traffic Control procedure for making the required course reversal in the holding pattern or procedure turn. When established on the final approach course the D-Bar will be centered (figure 6-146). If you are required to hold at INITT, you are all set up.

Position D: Outbound from INITT you may activate the next waypoint, FINAL.

1. Position the cursor over FINAL (figure 6-147).

2. Press ⊣D⊢ once to bring up the Direct To page and then press ⊣D⊢ a second time to change the **DIRECT TO** annunciation to **ACTIVATE** (figure 6-148). This function is explained in section 6.10.8.

3. Press ENT to make FINAL the active waypoint. Activating FINAL in this manner keeps the selected course the same, 90 degrees (figure 6-149).

Position E: Outbound from FINAL you may activate the next waypoint, MMAPP. To activate MMAPP, use the same procedure for activating a waypoint as described for Position D.

NOTE: *As an alternate method, the KLN 88 may be put in the Approach-Leg mode at position C or later to obtain automatic waypoint sequencing.*

Figure 6-144

Figure 6-145

Figure 6-146

Figure 6-147

Figure 6-148

Figure 6-149

6.11.5 Radar Vectors To The Final Approach Course

In figure 6-150 you have just passed BKING intersection and are on the flight plan leg between BKING and INITT. The approach waypoints for this approach have previously been added to the active flight plan using the procedure described in section 6.11.1 (figure 6-151). The approach control has radar capability and will provide radar vectors to the final approach course.

Figure 6-151

Position A: Put the KLN 88 in the Approach-OBS mode as described in the previous example (figure 6-152).

Figure 6-152

Position B: As soon as you begin receiving vectors to fly, select the final approach course (90 degrees) on the NAV 3 or MOD 4 page (figure 6-153). The procedure is as described for position B in the previous example.

If the vectors are to intercept the final approach course outside of INITT, you are all set up. If the vectors are to intercept the final approach course outside of FINAL, activate FINAL (figure 6-154 - the procedure is as described for position D in the previous example). The selected course is still 90 degrees.

Figure 6-153

Position C: Just prior to intercepting the final approach course (figure 6-155).

Position D: Established on the final approach course (figure 6-156).

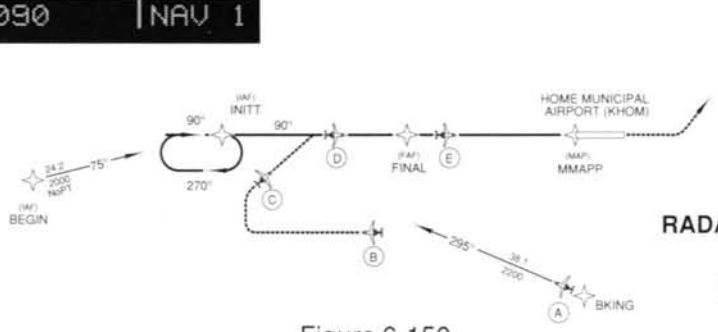
Position E: Outbound from FINAL you may activate the next waypoint, MMAPP.

NOTE: *As an alternate method, the KLN 88 may be put in the Approach-Leg mode at position D or later to obtain automatic waypoint sequencing.*

Figure 6-154

Figure 6-155

Figure 6-156



RADAR VECTORS TO THE FINAL APPROACH COURSE
(Not For Actual Navigation)

Figure 6-150

6.11.6 Additional Notes Concerning Loran Approaches

1. Some approaches may define the final approach fix (FAF) as an un-named position a specific distance from the MAP instead of a named position. This is commonly done on RNAV approaches. In these cases it is not necessary to put a waypoint in the flight plan for the FAF. When the MAP is the active waypoint, the FAF is identified as a point along the final approach course at the specified distance from the MAP. The general procedural concepts previously described are still applicable with only minor modifications.

2. You may wish to manually enter the missed approach holding fix into the flight plan. Caution is advised, however, since the missed approach instructions for the approach may not be from the MAP direct to this holding fix. In many instances it is necessary to climb to a designated altitude and/or follow a designated route to the missed approach holding fix.

3. Remember to change the selected course on an external HSI in order to keep the "orientation picture" correct whenever the desired track (DTK) or selected course (OBS) is changed. It will probably also be required to have the correct DTK or selected course on the external HSI or CDI for proper operation of an autopilot in the Approach mode that is coupled to the KLN 88.

4. Practice flying Loran approaches in good VFR conditions until you feel comfortable with the procedures. You may wish to experiment to determine what page combinations work best for you.

6.11.7 Modifying ASFs For Published Loran Approaches

The published ASFs may be manually changed by the pilot for up to 250 airports in the published data base. Note that this is not a standard procedure since the ASF correction factors are stored the the data base. The ASFs are changed directly on the APT 6 page by using the right outer knob to position the cursor over the ASF to be changed, and then using the right inner knob to select the desired ASF. Turning the right inner knob scrolls through the list of possible ASF values from 0.0 to 19.9. The published value appears at the end of the list (after 19.9). When an ASF has been changed to a value other than what is stored in the data base, a flashing * appears to the immediate left of the displayed ASF value. If the data base is later updated, user-entered values for ASFs will be replaced by published values.

The Other 5 page (**OTH 5**) contains a listing of Loran approaches having user-modified ASFs. This listing of approaches having user-modified ASFs is located after the listing of user-defined approaches on the OTH 5 page. To view the user-modified ASF approaches on the OTH 5 page, press the left CRSR and use the left outer knob to scroll through the listing of user-defined approaches. At the end of the listing of user-defined approaches are two lines which read:

XXX ASF
MODS AVAIL

where "XXX" is filled in with the number of airports remaining where modifications may be made to approach ASFs. For example, if ASF changes have been made for approaches at four airports, "XXX" would be 246.

6.11.8 Approach Offset

FAA Advisory Circular No. 90-80A, "Approval Of Offshore Helicopter Approaches", defines an Offshore Standard Approach Procedure (OSAP) which requires the selection of a one-half nautical mile left and right offset. The KLN 88 has this capability with the installation of a remote mounted switch and associated annunciators. When the external switch is placed in the left offset position, the D-Bar (both for external HSI/CDIs and for the internal CDI) provides guidance one-half nautical mile to the left of the primary course. When the switch is placed in the right offset position, the D-Bar provides guidance one-half nautical mile to the right of the primary course.

6.12 USER-DEFINED LORAN APPROACHES

The KLN 88 is capable of storing up to 30 user-defined Loran approaches. These approaches may be defined either for airports in the published data base or for user defined airports (see section 6.4.1, "Creating An Airport User Waypoint"). Once a user -defined Loran approach has been created, it is utilized in the same manner as a published Loran approach.

WARNING: Published FAA Loran approaches are contained in the KLN 88's data base. As official changes are made to published Loran approaches, they will be included in revisions to the data base. The approved method of using Loran approaches is to use approach information contained in an up to date (non-expired) KLN 88 data base. The capability for user-defined Loran approaches exists for certain operators (such as offshore helicopter operators) having specific approval from the appropriate government authorities to generate and utilize their own Loran approaches. User-defined approaches may be easily identified by the * that exists to the right of the airport identifier on the APT 6 page.

6.12.1 Creating A User-Defined Loran Approach

A Loran approach is defined on an APT 6 page. A Loran approach can not be defined or modified while the KLN 88 is in either the Approach-Leg mode or the Approach-OBS mode.

NOTE: *The minimum requirements for a Loran approach are that it contain an airport identifier, an approach designation (example, "**RW18**" or "**A**"), the Loran chain (GRI) used for the approach, two secondary stations used for the approach, Additional Secondary Factor (ASF) corrections for each of the two secondary stations, and one waypoint.*

Each approach may contain up to eight waypoints. An airport may contain up to eight approaches. All approaches at a given airport will have the same GRI, secondaries, and ASFs. Therefore, changing the GRI, secondaries, and/or ASFs for one approach at a given airport, changes the GRI, secondaries, and/or ASFs for any other approach at that same airport. To create a user-defined approach:

1. Display the APT 6 page on the right side for the desired airport (figure 6-157).

NOTE: *If one to seven approaches already exist for this airport, there will be an APT 6 page available that contains the GRI, secondaries, and ASFs, but does not contain the approach designation or approach waypoints (figure 6-158). Only the approach designation and approach waypoints need be entered in this case.*

Figure 6-157

Figure 6-158

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

3. Use the right outer knob to move the cursor to the first approach designation position (figure 6-159).

If the approach is for a specific runway, turn the right inner knob to select the desired runway number (figure 6-160). If the runway also has an alpha character in the designation (for example L for left, R for right, or C for center), then turn the right outer knob to move the cursor over the second approach designation position. Use the right inner knob to select the desired alpha character (figure 6-161).

If the approach is not for a specific runway, turn the right outer knob to move the cursor over the second approach designation, and then use the right inner knob to select the desired alpha character (figure 6-162).

NOTE: *Every approach must contain a designation.*

4. Turn the right outer knob clockwise to move the cursor to the GRI position, and then use the right inner knob to select the desired GRI (figure 6-163).

5. Rotate the right outer knob one step clockwise to move the cursor to the first secondary station position, and then use the right inner knob to select the desired secondary station (figure 6-164).

6. Rotate the right outer knob one step clockwise to move the cursor to the first ASF position, and then use the right inner knob to enter the ASF correction for the first secondary station (figure 6-165).

7. Use the right outer and inner knobs in the same manner as in steps 5 and 6, and enter the second secondary station and its associated ASF (figure 6-166).

8. Use the right outer knob to move the cursor to the first waypoint position, and then use the right inner and outer knobs to select the identifier for the first waypoint in the approach (figure 6-167). The waypoints used in defining a Loran approach must already exist in the published or user data base.

Figure 6-159

Figure 6-160

Figure 6-161

Figure 6-162

Figure 6-163

Figure 6-164

Figure 6-165

Figure 6-166

Figure 6-167

9. Press [ENT] to view the waypoint page for the waypoint identifier just entered. Press [ENT] once again to approve the waypoint page. The cursor will be over the second waypoint position (figure 6-168).

10. Use the right inner and outer knobs to enter the identifiers for the rest of the waypoints used in the approach (figure 6-169). The [ENT] must be pressed twice for each waypoint entered, once to view the waypoint page and once the approve the waypoint page. Up to eight waypoints may be entered. After six waypoint identifiers have been entered, the waypoints automatically scroll since only six may be viewed at one time.

NOTE: *When an APT 6 page containing more than six waypoints is first viewed, only the first six waypoints are displayed. To see the remaining waypoints, press the right [CRSR] and turn the right outer knob clockwise to manually scroll through the complete waypoint list.*

11. Press the right [CRSR] to turn off the right cursor function.

12. When the complete approach has been defined, visually check to make absolutely sure that all the information is correct before selecting another page. After leaving the page, return to the page to confirm that the information is stored as you desire.

NOTE: *If the data base is updated with a new data base cartridge, user-entered values for GRI, secondaries, and ASFs will be replaced by published values, where available. When this occurs a message stating "***USER APPROACH DATA REPLACED***" is displayed on the Message page.*

Figure 6-168

Figure 6-169

6.12.2 Deleting a User-Defined Loran Approach

The Other 5 (**OTH 5**) page contains an alphabetical listing of waypoint identifiers for airports having user-defined Loran approaches. When the page is first viewed, it displays the number of approaches which may still be defined (figure 6-170). If there are more than three user-defined approaches, it is necessary to scroll down the waypoint list to see the remaining approaches. Scrolling is performed by pressing the left [CRSR] and rotating the left outer knob. To delete a user-defined Loran approach, position the cursor over the approach to be deleted, press [CLR], and then press [ENT].

Figure 6-170

6.13 THE FUEL MANAGEMENT PAGES

Certain models of fuel management computers manufactured by Shadin Company and ARNAV Systems, Inc. may be interfaced with the KLN 88. The primary benefit of having the KLN 88 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 88. The KLN 88 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 88's 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 6, OTH 7, OTH 8, and OTH 9 pages are used to display fuel management information for KLN 88's interfaced with compatible fuel management computers. If there is no fuel management computer interface, these pages are not displayed.

6.13.1 The Other 6 Page (OTH 6)

The OTH 6 page displays the following information (figure 6-171):

Figure 6-171

- 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

- The fuel presently on board (**FOB**).

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

- The landing fuel on board (**L FOB**), which 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.

6.13.2 The Other 7 Page (OTH 7)

The OTH 7 page displays the following information (figure 6-172):

- 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 6 or the OTH 7 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 6 page. Changing the reserve on one of the two pages also changes it on the other page.

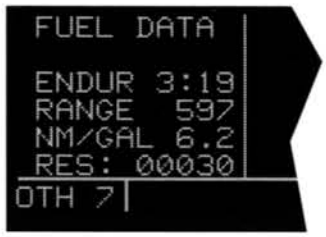


Figure 6-172

6.13.3 The Other 8 Page (OTH 8)

The OTH 8 page displays rate of fuel flow. It has two formats depending on whether the aircraft is a twin engine (figure 6-173) or a single engine (figure 6-174).

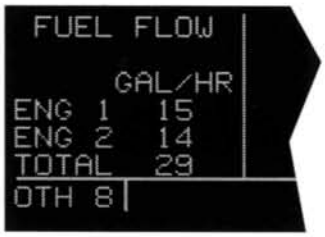


Figure 6-173

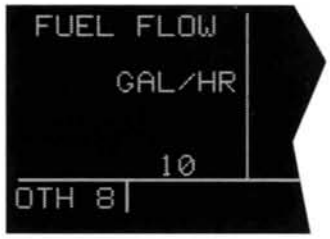


Figure 6-174

6.13.4 The Other 9 Page (OTH 9)

The OTH 9 page displays the amount of fuel used. This page is usable only if the KLN 88 is interfaced to the Shadin fuel management computer. If interfaced with the ARNAV fuel management computer, this page displays dashes. There are two formats for the page, depending on whether the aircraft is a twin engine (figure 6-175) or single engine (figure 6-176).

Figure 6-175

Figure 6-176

6.14 OPERATION WITHOUT A DATA BASE CARTRIDGE

The KLN 88 is designed so that a data base 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 data base cartridge should only be used for VFR flight, not for IFR.*

Without a data base cartridge inserted, the Data Base page appears as in figure 6-177. All published waypoints (those that originated from the data base 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.

The KLN 88 is unable to calculate magnetic variation without the data base cartridge. Therefore, a magnetic variation must be manually inserted on the Data Base 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 6-178). With the cursor positioned over **ACKNOWLEDGE?**, press [ENT] to approve the Data Base page. The magnetic variation can only be entered on the Data Base page. Therefore, the unit must be turned off and back on to change the magnetic variation.

The active flight plan is the only flight plan available when there is no data base cartridge. There is no way to gain access to flight plans one through nine. Functions not requiring the published data base 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 data base 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.

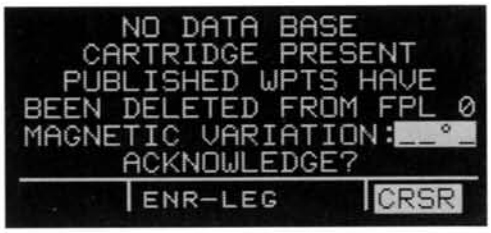


Figure 6-177

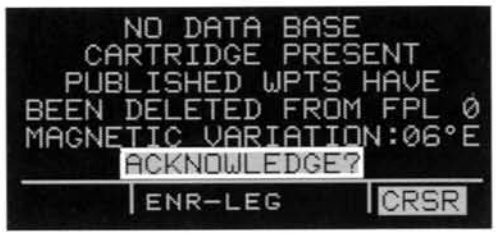
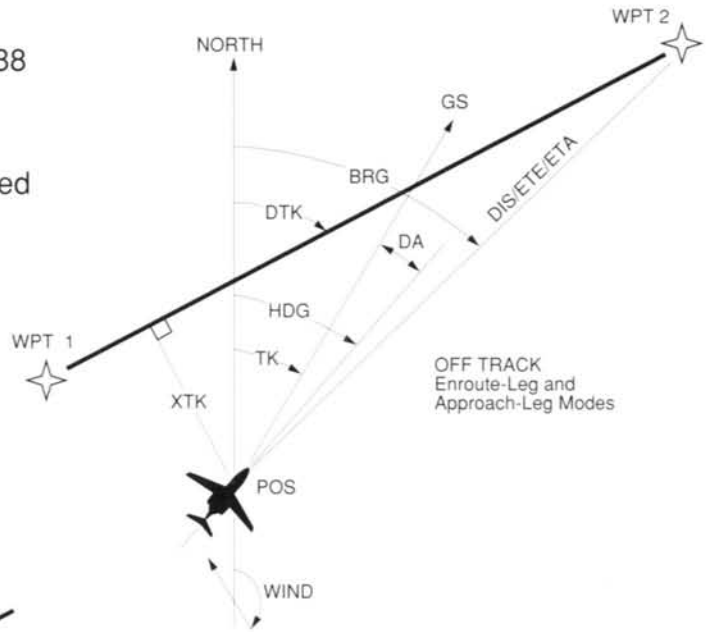
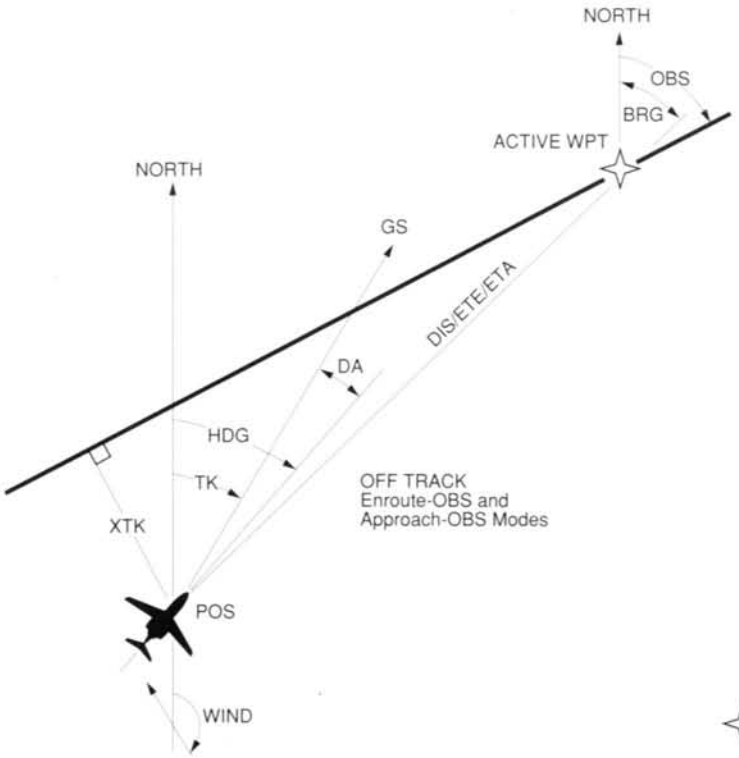


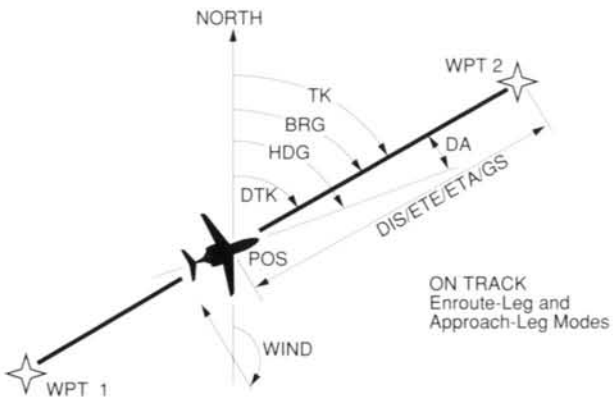
Figure 6-178

APPENDIX A - NAVIGATIONAL TERMS

BRG - Bearing to waypoint (degrees)
DA - Drift Angle (degrees)-not displayed on KLN 88
DIS - Distance to waypoint (nm)
DTK - Desired Track (degrees)
OBS - Selected Course
GS - Groundspeed (nm/hr)
HDG - Heading (degrees)-not displayed on KLN 88
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







APPENDIX B - MESSAGE PAGE MESSAGES

The following is a listing of the messages that can appear on the Message page. When the message prompt appears, press MSG to view the message page. See section 4.5 for an explanation of the Message page.

ACCURACY WARNING
POSITION ERROR > 1.7NM - (Accuracy Warning, Position Error Greater Than 1.7 NM) This message appears when the system's estimated position error exceeds 1.7 nautical miles.

ADJ NAV INDICATOR CRS - (Adjust Navigation Indicator Course) When this message appears, the pilot should view the desired track (**DTK**) or selected course (**OBS**) on the NAV 3 page and then select this course on the HSI. This message is applicable only for KLN 88s which are interfaced with an HSI such that the KLN 88 has the capability of reading the selected course from the HSI. For these installations, this message appears in the Enroute-Leg or Approach-Leg mode when the difference between the HSI's selected course and the KLN 88's desired track is greater than five degrees. In the Enroute-OBS or Approach-OBS mode, this message appears when the difference between the HSI's selected course and the KLN 88's selected course (**OBS**) is greater than 0.5 degrees.

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 4.10.

APPROACH PARAMETERS FOR ____ SELECTED - This message appears if the aircraft is within five nautical miles of an active waypoint which was entered into the active flight plan as part of an approach, or if the active leg is between two such waypoints, and the KLN 88 is in an approach mode but the approved approach parameters are different than those for the approach which the active waypoint is in. The blank space is filled in with the identifier of the airport for which approach parameters were approved.

ARINC 429 OUTPUT FAIL - This message appears when the ARINC 429 output fails an internal test. Anything depending on the KLN 88's ARINC 429 output, such as the EHI 40 electronic HSI and some navigation graphics displays, should not be used.

BATTERY LOW: SERVICE REQUIRED TO PREVENT LOSS OF USER DATA - This message appears when the KLN 88'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, approaches, airport remarks, flight plans, etc. Typical battery life is approximately three to five years.

DATA BASE CHECKSUM ERR - (Data Base Checksum Error) This message appears if the data base fails an internal test when the KLN 88 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.

DATA FOR OTHER USER APPROACHES REPLACED - This message appears when the message "USER LORAN APPROACH DATA REPLACED" would be effective for more than ten waypoints.

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 88. The rest of the KLN 88 is still usable including the internal CDI; however, the page displays may not be centered on the screen.

ELT 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 88's RS 232 output if this message is displayed.

FUEL SENSOR DATA ERROR - This message appears when the KLN 88 detects an error in the received fuel management computer data. If the message persists, service to the fuel management computer or to the KLN 88 is required.

INSIDE SPC USE AIRSPACE
{name and type of special use airspace}
{ATC responsible} - (Inside Special Use Airspace) This message appears when the aircraft's present position is inside an area of special use airspace. See Section 4.10.

LORAN POSN AMBIGUITY
ENTER POSN ON SET 1 PG - (Loran Position Ambiguity, Enter Position ON SET 1 Page) This message appears when the Loran receiver needs a confirmed position to resolve a position ambiguity. Enter the aircraft's position on the SET 1 page, position the cursor over the **CONFIRM?** field, and press [ENT] .

NAV SUPER FLAG FAILURE - This message appears when an internal test fails for a specific nav flag output. The KLN 88 is still usable, but anything connected to the super flag (such as some HSIs and autopilots) should not be used with the KLN 88.

NO FUEL SENSOR DATA - This message will appear when no input is received from the fuel management computer. This message is only applicable to systems interfaced to a fuel management computer.

NOT FOR IFR USE IN THIS AREA OF CANADA-ALASKA - The aircraft is in an area of Canada or Alaska where the KLN 88 is not IFR certifiable. This message is applicable to ORS 04 units only.

OBS WPT > 200NM - (OBS Waypoint Greater Than 200 NM) This message appears when the KLN 88 is in either the Enroute-OBS mode or the Approach-OBS mode if 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 Loran 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, a waypoint used in a Loran approach, 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.

RCVR HARDWARE ERROR:___ - (Receiver Hardware Error) This message appears when the KLN 88 fails a specific internal test for the Loran receiver. The blank will contain a numerical value which may provide assistance to maintenance personel.

RCVR INTERFACE ERROR - (Receiver Interface Error) This message appears when the KLN 88 fails a specific internal test for the Loran receiver. This failure will prevent the unit from providing any navigation ability.

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 88 off and back on so that the correct data base data is utilized.

SIGNALS INADEQUATE
FOR IFR USE - This message appears when the Loran Station's signal-to-noise ratios (SNRS) drop below the level required for IFR use.

STEEP TURN AHEAD - This message appears approximately 60 seconds before the start of a turn which requires a bank angle in excess of 20 degrees in order to stay on the course turn anticipation. See section 5.2.2.

SYSTEM IN ENROUTE MODE - This message appears if the aircraft is within five nautical miles of an active waypoint which was entered into the active flight plan as part of an approach, or if the active flight plan leg is between two such waypoints, and the system is in either the Enroute-Leg mode or the Enroute OBS mode.

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, approaches, etc., to be lost.

USER DEFINED APPROACH IN FLIGHT PLAN - This message appears when a user-defined Loran approach is inserted into a flight plan.

USER LORAN APPROACH DATA REPLACED - This message appears when a new data base contains a Loran approach with different GRI, secondaries, or ASFs than those entered for a previously defined user Loran approach at the same airport. This message is displayed on the left side of the screen and the APT 6 page corresponding to the first user-defined Loran approach for that airport is displayed on the right side of the screen.

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.

WAYPOINT _____ DELETED - This message appears when a waypoint used in a flight plan, a waypoint used in a Loran approach, 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 or approaches in which it was used.

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 4.3 and figure 4-32). The following are the status lines 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.

APR FULL - (Approach Full) Appears when you attempt to add a waypoint to a user-defined Loran approach if the approach already contains eight waypoints.

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.

ILLEGAL STN - (Illegal Station) Appears when you attempt to approve manual triad mode on the STA 1 page if any two of the selected stations are the same.

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 for this waypoint, you must first make another waypoint active.

INVALID APR - (Invalid Approach) Appears when you enter an airport identifier on the MOD 3 or MOD 4 page if the Loran approach for the airport contains the same two secondary stations.

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 89.

INVALID GRI - (Invalid Group Repetition Interval) Appears when you attempt to enter a Loran secondary station on an APT 6 page if no GRI has previouly been selected.

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 6.5.

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 and Approach-Leg modes, 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 and Approach-OBS modes, the waypoint must be the active waypoint.

INVALID WPT - (Invalid Waypoint) Appears when you try to fill a non-flashing cursor field on the MOD 3 or MOD 4 page by displaying a non-airport waypoint page on the right side of the screen and pressing [ENT]. The cursor field on the MOD 3 and MOD 4 pages can only be filled with the identifier of an airport which has a defined Loran approach.

NO ACTV WPT - (No Active Waypoint) Appears when you attempt to activate the Enroute-OBS or Approach-OBS modes 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 - (No Approach) Appears when you enter an airport identifier on the MOD 3 or MOD 4 page if no Loran approach exists for the airport.

NO APT WPTS - (No Airport Waypoints) Appears when the APT type pages have been selected if the KLN 88 doesn't contain a data base cartridge and there are no user-defined airport waypoints.

NO GRI DATA - (No Group Repitition Interval Data) Appears when an attempt is made to enter a GRI on the APT 6 page if the RNAV computer and the Loran sensor are not communicating. This usually would indicate an internal failure of the KLN 88 and that the unit is in need of repair.

NO INT WPTS - (No Intersection Waypoints) Appears when the INT type pages have been selected if the KLN 88 doesn't contain a data base cartridge and there are no user-defined intersection waypoints.

NO MORE APR - (No More Approaches) Appears when an attempt is made to create more than 30 user-defined Loran approaches. The KLN 88 is capable of storing up to 30 user-defined Loran approaches. If it is necessary to create another Loran approach, it will first be necessary to delete an existing Loran approach on the OTH 5 page.

NO NDB WPTS - (NO NDB Waypoints) Appears when the NDB type pages have been selected if the KLN 88 doesn't contain a data base cartridge and there are no user-defined NDB waypoints.

NO SUCH APT - (No Such Airport) Appears when you enter an identifier on the MOD 3 or MOD 4 page if the identifier does not correspond to an airport in the data base. The identifier entered on the MOD 3 or MOD 4 page must be for an airport in the data base (published or user) which has a defined approach.

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 88 doesn't contain a data base cartridge and there are no user-defined supplemental waypoints.

NOT FOR IFR USE IN THIS AREA OF CANADA-ALASKA - The aircraft is in an area of Canada or Alaska where the KLN 88 is not IFR certifiable. This message is applicable to ORS 04 units only.

NO VOR WPTS - (No VOR Waypoints) Appears when the VOR type pages have been selected if the KLN 88 doesn't contain a data base cartridge and there are no user-defined VOR waypoints.

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 4.11.6..

USED IN APR - (Used In Approach) Appears when you try to delete a user defined waypoint on the OTH 3 page if the waypoint is used in a Loran approach. Either this waypoint must be deleted from the Loran approach on the APT 6 page or the Loran approach must be deleted on the OTH 5 page before this waypoint can be deleted from the user-defined waypoint list.

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 attemp 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 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

ABBREVIATION	STATE
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	Oregan
PA	Pennsylvania
RI	Rhode Island
SC	South Carolina
SD	South Dakota
TN	Tennessee
TX	Texas
UT	Utah
VA	Virginia
VT	Vermont
WA	Washington
W I	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

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

COUNTRY ABBREVIATIONS

ABBREVIATION	COUNTRY
ANT	Netherlands Antilles
ATG	Antigua/Barbuda
BHS	Bahamas
BLZ	Belize
BMU	Bermuda
BRB	Barbados
CAN	Canada
COL	San Andres
CRI	Costa Rica
CUB	Cuba
CYM	Cayman Island
DMA	Dominica
GLP	Guadeloupa
GRD	Grenada
GTM	Guatemala
HND	Honduras
HTI	Haiti

ABBREVIATION	COUNTRY
JAM	Jamaica
KNA	Anguilla I
LCA	St Lucia & St Kitts-Nevis
MEX	Mexico
MSR	Monserrat I
MTQ	Martinique
NIC	Nicaragua
PAN	Panama
PRI	Puerto Rico
SLV	El Salvador
SPM	St Pierre and Miquelon
TCA	Caicos & Turk Islands
TTO	Trinidad and Tabago
USA	United States
VCT	St Vincent I
VGB	Virgin Island (U.K.)
VIR	Virgin Island (U.S.)

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

ABBREVIATION	ARTCC/FIR
ABQ	Albuquerque
ANC	Anchorage
ATL	Atlanta
BER	Bermuda
BOS	Boston
CAM	Central America
CHI	Chicago
CLE	Cleveland
CUR	Curacao
DEN	Denver
EDM	Edmonton
FW	Fort Worth
GAN	Gander
HAV	Havana
HOU	Houston
IND	Indianapolis
JAX	Jacksonville
KC	Kansas City
KIN	Kingston
LAX	Los Angeles
MAZ	Mazatlan
MEM	Memphis

ABBREVIATION	ARTCC/FIR
MER	Merida
MEX	Mexico
MIA	Miami
MIN	Minneapolis
MNC	Moncton
MNT	Monterrey
MON	Montreal
NAS	Nassau
NY	New York
OAK	Oakland
PAN	Panama
PAP	Port Au Prince
PIA	Piarco
SDO	Santo Domingo
SEA	Seattle
SJU	San Juan
SLC	Salt Lake City
TOR	Toronto
VAN	Vancouver
WAS	Washington
WIN	Winnipeg

OTHER ABBREVIATIONS USED ON KLN 88 PAGES

A	Airport waypoint
AAS	Aeronautical advisory service
ACT	Active flight plan waypoints
ADJ	Adjust
ATF	Aerodrome traffic frequency
AKD	Alaska Daylight Time
AKS	Alaska Standard Time
APT	Airport
APR	Approach
ASF	Additional secondary factor
ATD	Atlantic Daylight Time
ATS	Atlantic Standard Time
BARO	Barometer (altimeter setting)
BRG	Bearing
C	Centigrade
CAL	Calculator
CAS	Calibrated airspeed
CDT	Central Daylight Time
CLR	Clearance delivery
CLY	Clay
CONV	Conversion
CORD UNIV	Coordinated Universal Time
CRS	Course
CRSR	Cursor
CST	Central Standard Time
CTAF	Common traffic advisory frequency
CTR	Center (Air Route Traffic Control Center)
D	DME capable
DB	Data base
DEP	Departure
DEV	Deviation (on external course deviation indicator)
DIS	Distance
D/T	Distance/Time
DTK	Desired track
DUP	Duplicate
E	East
EDT	Eastern Daylight Time
ELV	Airport elevation
ENDUR	Endurance
ENG	Engine
ENR	En route
ENT	Enter
ETA	Estimated time of arrival
ETE	Estimated time en route
ESA	Minimum en route safe altitude
EST	Eastern Standard Time
F	Fahrenheit
FF	Fuel flow
FLT	Flight time
FOB	Fuel on board
FPL	Flight plan
FPM	Feet per minute
FR	From
F REQ	Fuel required
FSS	Flight service station
GAL	Gallon
GRI	Group repetition interval
GRND	Ground control
GRV	Gravel
GS	Groundspeed
GDT	Greenland Daylight Time
GST	Greenland Standard Time
HAD	Hawaii Daylight Time
HAS	Hawaii Standard Time
HDG	Heading
HDWND	Headwind
HRD	Hard surface
I	Intersection waypoint
IDENT	Identifier
IMP	Imperial gallon
IND	Indicated altitude
INT	Intersection
INVRT	Invert
KG	Kilograms
KT	Knots
L	Left
L	Runway lighting sunset to sunrise
L	Liters
LB	Pounds
LEN	Length
L FOB	Landing fuel on board
LPC	Runway lighting is pilot controlled
LPT	Runway lighting is part time or on request
MB	Millibars
MCOM	Multicom
MDT	Mountain Daylight Time
MF	Mandatory frequency
MOD	Mode
MPH	Miles per hour
MSA	Minimum safe altitude
MSG	Message
MST	Mountain Standard Time
N	North
N	NDB waypoint
NAV	Navigation
NM	Nautical miles
NR	Nearest
OBS	Omni bearing selection
ORS	Operational Revision Status
OTH	Other
PDT	Pacific Daylight Time
PST	Pacific Standard Time
POS	Position

P.POS	Present position
PRS	Pressure altitude
PRES	Present
PTAX	Pre-taxi clearance
(R)	Radar environment for approach & departure
RAD	Radial
RCVR	Receiver
REF	Reference
REQD	Required fuel
RES	Reserve fuel
RMKS	Remarks
RW	Runway
S	South
S	Supplemental waypoint
SET	Setup
SFT	Soft surface
SND	Sand
SNR	Signal-to-noise-ratio
SPC USE	Special Use (airspace)
STA	Status
SUP	Supplemental
SDT	Samoa Daylight Time
SST	Samoa Standard Time
STN	Station
t	Relative to true North
TAS	True airspeed
TEMP	Temperature
TK	Actual track
TLWND	Tailwind
TRF	Turf
TRI	Trip
TWR	Tower
UNIC	Unicom
UNK	Unknown
UTC	Coordinated Universal Time (Zulu)
V	VOR waypoint
VNV	Vertical navigation (VNAV)
W	West
WPT	Waypoint
WRN	Warn
Z	Zulu time

APPENDIX E - LORAN STATION LISTING

GRI	CHAIN	STATION	FUNCTION	LOCATION
5930	Canadian East Coast	Caribou, ME	Master	N46°48.5' W67°55.6'
		Nantucket, MA	X-ray	N41°15.2' W69°58.7'
		Cape Race, NF	Yankee	N46°46.5' W53°10.5'
		Fox Harbour, NF	Zulu	N52°22.6' W55°42.5'
5990	Canadian West Coast	Williams Lake, BC	Master	N51°58.0' W122°22.0'
		Shoal Cove, AK	X-ray	N55°26.4' W131°15.3'
		George, WA	Yankee	N47°03.8' W119°44.7'
		Port Hardy, BC	Zulu	N50°36.5' W127°21.5'
7930	Labrador Sea	Fox Harbour, NF	Master	N52°22.6' W55°42.5'
		Cape Race, NF	Whiskey	N46°46.5' W53°10.5'
		Angissoq, Greenland	X-ray	N59°59.3' W45°10.5'
7960	Gulf of Alaska	Tok, AK	Master	N63°19.7' W142°48.5'
		Narrow Cape, AK	X-ray	N57°26.3' W152°22.2'
		Shoal Cove, AK	Yankee	N55°26.4' W131°15.3'
		Port Clarence, AK	Zulu	N65°14.7' W166°53.2'
7970	Norwegian Sea	Ejde, Denmark	Master	N62°18.0' W07°04.5'
		Sylt, Germany	Whiskey	N54°48.5' E08°17.6'
		Bo, Norway	X-ray	N68°38.1' E14°27.8'
		Sandur, Iceland	Yankee	N64°54.5' W23°55.4'
		Jan Mayen, Norway	Zulu	N70°54.9' W08°44.0'
7980	Southeast U.S.	Malone, FL	Master	N30°59.7' W85°10.2'
		Grangeville, LA	Whiskey	N30°43.6' W90°49.7'
		Raymondville, TX	X-ray	N26°31.9' W97°50.0'
		Jupiter, FL	Yankee	N27°02.0' W80°06.9'
		Carolina Beach, NC	Zulu	N34°03.8' W77°54.8'
* 8290	North Central U.S.	Havre, MT	Master	N48°44.6' W109°58.9'
		Baudette, MN	Whiskey	N48°36.8' W94°33.3'
		Gillette, WY	X-ray	N44°00.2' W105°37.4'
		Williams Lake, BC	Yankee	N51°58.0' W122°22.0'
8970	Great Lakes	Dana, IN	Master	N39°51.1' W87°29.2'
		Malone, FL	Whiskey	N30°59.7' W85°10.2'
		Seneca, NY	X-ray	N42°42.9' W76°49.6'
		Baudette, MN	Yankee	N48°36.8' W94°33.3'
		* Boise City, OK	Zulu	N36°30.3' W102°54.0'

* ORS 03 and 04 units only

GRI	CHAIN	STATION	FUNCTION	LOCATION
*9610	South Central U.S.	Boise City, OK	Master	N36°30.3' W102°54.0'
		Gillette, WY	Victor	N44°00.2' W105°37.4'
		Searchlight, NV	Whiskey	N35°19.3' W114°48.3'
		Las Cruces, NM	X-ray	N32°04.3' W106°52.1'
		Raymondville, TX	Yankee	N26°31.9' W 97°50.0'
		Grangeville, LA	Zulu	N30°43.6' W90°49.7'
9940	U.S. West Coast	Fallon, NV	Master	N39°33.1' W118°49.9'
		George, WA	Whiskey	N47°03.8' W119°44.7'
		Middletown, CA	X-ray	N38°47.0' W122°29.8'
		Searchlight, NV	Yankee	N35°19.3' W114°48.3'
9960	Northeast U.S.	Seneca, NY	Master	N42°42.9' W76°49.6'
		Caribou, ME	Whiskey	N46°48.5' W67°55.6'
		Nantucket, MA	X-ray	N41°15.2' W69°58.7'
		Carolina Beach, NC	Yankee	N34°03.8' W77°54.8'
		Dana, IN	Zulu	N39°51.1' W87°29.2'
9980	Iceland	Sandur, Iceland	Master	N64°54.5' W23°55.4'
		Angissoq, Greenland	Whiskey	N59°59.3' W45°10.5'
		Ejde, Denmark	X-ray	N62°18.0' W07°04.5'
9990	North Pacific	St. Paul, AK	Master	N57°09.2' W170°15.1'
		Attu, AK	X-ray	N52°49.7' E173°10.8'
		Port Clarence, AK	Yankee	N65°14.7' W166°53.2'
		Narrow Cape, AK	Zulu	N57°26.3' W155°22.2'

* ORS 03 and 04 units only

APPENDIX F - SECONDS TO DECIMAL MINUTES

The KLN 88 utilizes latitude and longitude expressed in degrees, minutes, and tenths of a minute. You may occasionally see a document expressing latitude and longitude in degrees, minutes, and seconds. You may use this table to convert seconds to tenths of a minute. A small rounding error does occur in this conversion.

SECONDS	TENTHS OF MINUTE	SECONDS	TENTHS OF MINUTE
00	.0	30	.5
01	.0	31	.5
02	.0	32	.5
03	.1	33	.6
04	.1	34	.6
05	.1	35	.6
06	.1	36	.6
07	.1	37	.6
08	.1	38	.6
09	.2	39	.7
10	.2	40	.7
11	.2	41	.7
12	.2	42	.7
13	.2	43	.7
14	.2	44	.7
15	.3	45	.8
16	.3	46	.8
17	.3	47	.8
18	.3	48	.8
19	.3	49	.8
20	.3	50	.8
21	.4	51	.9
22	.4	52	.9
23	.4	53	.9
24	.4	54	.9
25	.4	55	.9
26	.4	56	.9
27	.5	57	1.0
28	.5	58	1.0
29	.5	59	1.0

For Example:

35 deg, 46 min, 24 seconds becomes 35 deg, 46.4 min
32 deg, 15 min, 58 seconds becomes 32 deg, 16.0 min

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4/92 006-08458-0000 7.5K PRINTED IN THE U.S.A.

Allied Signal Aerospace