

DA 40 AFM  
DA 40 F AFM



Supplement A14  
GPS, KLN 94 IFR

**SUPPLEMENT A14  
TO THE AIRPLANE FLIGHT MANUAL  
DA 40, DA 40 F  
GPS KLN 94  
IFR OPERATION  
BENDIX/KING**

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## **1. GENERAL**

This Supplement supplies the information necessary for the efficient operation of the airplane when the GPS KLN 94 in IFR configuration is installed. The information contained within this supplement is to be used in conjunction with the complete AFM.

This Supplement is a permanent part of this AFM and must remain in this AFM at all times when the GPS KLN 94 in IFR configuration is installed.

Refer to Section 7.14 for BRNAV operation in the European region.

## **2. LIMITATIONS**

- A. The KLN 94 GPS Pilot's Guide must be immediately available to the flight crew whenever navigation is predicated on the use of the system. The Operational Revision Status (ORS) of the Pilot's Guide must match the ORS level annunciated on the Self Test page.
- B. Navigation is prohibited within 60 n.m. of the north and south poles (i.e., at greater than 89° north and south latitudes).
- C. IFR Navigation is restricted as follows:
  - 1. The system must utilize ORS level 01 or later FAA approved revision.
  - 2. The data on the self test page must be verified prior to use.
  - 3. IFR en route and terminal navigation is prohibited unless the pilot verifies the currency of the aeronautical data base or verifies each selected waypoint for accuracy by reference to current approved data.
  - 4. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the KLN 94 data base. The KLN 94 aeronautical data base must incorporate the current update cycle.

- (a) The KLN 94 Quick Reference must be immediately available to the flight crew during instrument approach operations.
  - (b) Instrument approaches must be conducted in the approach mode, and RAIM must be available at the Final Approach Fix.
  - (c) APR ACTV mode must be annunciated at the Final Approach Fix.
  - (d) Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, and MLS approaches are not authorized.
  - (e) When an alternate airport (or airfield) is required by the applicable operating rules, it must be served by an approach based on other than GPS or Loran-C navigation.
  - (f) The KLN 94 can only be used for approach guidance if the reference coordinate datum system for the instrument approach is WGS-84 or NAD-83. (All approaches in the KLN 94 data base use the WGS-84 or the NAD-83 geodetic datums.)
5. For BRNAV operations in the European region:
- (a) With 23 (24 if the altitude input to the KLN 94 is not available) or more satellites projected to be operational for the flight, the airplane can depart without further action.
  - (b) With 22 (23 if the altitude input to the KLN 94 is not available) or fewer satellites projected to be operational for the flight, the availability of the GPS integrity (RAIM) should be confirmed for the intended flight (route and time). This should be obtained from a prediction program run outside the airplane. The prediction program must comply with the criteria of appendix 1 of AC90-96. In the event of a predicted continuous loss of RAIM of more than 5 minutes for any part of the intended flight, the flight should be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

6. The airplane must have other approved navigation equipment appropriate to the route of flight installed and operational.
7. 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.

### **3. EMERGENCY PROCEDURES**

- If the KLN 94 GPS information is not available or invalid, utilize remaining operational navigation equipment as required.
- If a 'RAIM NOT AVAILABLE' message is displayed while conducting an instrument approach, terminate the approach. Execute a missed approach if required.
- If a 'RAIM NOT AVAILABLE' message is displayed in the en route or terminal phase of flight, continue to navigate using the KLN 94 or revert to an alternate means of navigation appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using another IFR approved navigation system.
- Refer to the KLN 94 Pilot's Guide, Appendices B and C, for appropriate pilot actions to be accomplished in response to annunciated messages.

### **4A. NORMAL OPERATING PROCEDURES**

#### **OPERATION**

Normal operating procedures are outlined in the KLN 94 GPS Pilot's Guide. A KLN 94 Quick Reference containing an approach sequence, operating tips and approach related messages is intended for cockpit use by the pilot familiar with KLN 94 operations when conducting instrument approaches.

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## **SYSTEM ANNUNCIATORS / SWITCHES / CONTROLS**

- HSI NAV presentation (NAV/GPS) switch annunciator - May be used to select data for presentation on the pilot's HSI; either NAV data from the number one navigation receiver or GPS data from the KLN 94 GPS. Presentation on the HSI is also required for autopilot coupling.
- Message (MSG) annunciator - Will flash (along with a large 'M' on the right side of the KLN 94 screen) to alert the pilot of a situation that requires attention. Press the MSG button on the KLN 94 GPS to view the message. If a message condition exists which requires a specific action by the pilot, the message annunciator will remain on but will not flash. (Appendix B of the KLN 94 Pilot's Guide contains a list of all of the message page messages and their meanings).
- Waypoint (WPT) annunciator - Prior to reaching a waypoint in the active flight plan, the KLN 94 GPS will provide navigation along a curved path segment to ensure a smooth transition between two adjacent legs in the flight plan. This feature is called turn anticipation. Approximately 20 seconds prior to the beginning of turn anticipation the WPT annunciator (along with a large 'WPT' on the right side of the KLN 94 screen) will flash, going solid upon initialization of the turn, and extinguishing upon turn completion.


### **WARNING**

Turn anticipation is automatically disabled for FAF waypoints and those used exclusively in PD/STARS where overflight is required. For waypoints shared between PD/STARS and published en route segments (requiring overflight in the PD/STARS), proper selection on the presented waypoint page is necessary to provide adequate route protection on the PD/STARS.

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- HSI course control knob - Provides analog course input to the KLN 94 in OBS when the NAV/GPS switch/annunciator is in GPS. When the NAV/GPS switch annunciation is in NAV, GPS course selection in OBS mode is digital through the use of the controls and display at the KLN 94. The HSI course control knob must also be set to provide proper course datum to the autopilot if coupled to the KLN 94 in LEG or OBS.

### NOTE

Manual HSI course centering in OBS using the control knob can be difficult, especially at long distances. Centering the D-Bar can best be accomplished by pressing  and then manually setting the HSI pointer to the course value prescribed in the KLN 94 displayed message.

- GPS remote approach (GPS APR ARM/ACTV) switch/annunciator - Used to manually select or deselect approach ARM (or deselect approach ACTV). The remote switch annunciator also annunciates the stage of approach operation; either armed (ARM) or activated (ACTV). Sequential button pushes if in ACTV would first result in approach ARM and then approach ARM canceled. Subsequent button pushes will cycle between the armed state (if an approach is in the flight plan) and approach arm canceled. Approach ACTV cannot be selected manually.

### PILOT'S DISPLAY

Left/right steering information is presented on the pilot's HSI as a function of the NAV/GPS switch position .

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## **AUTOPILOT COUPLED OPERATION**

The KLN 94 may be coupled to the autopilot by first selecting GPS on the NAV/GPS switch. Manual selection of the desired track on the pilot's HSI course pointer is required to provide course datum to the autopilot. (Frequent manual course pointer changes may be necessary, such as in the case of flying a DME arc.) The autopilot approach mode (APR) should be used when conducting a coupled GPS approach.

## **APPROACH MODE SEQUENCING AND RAIM PREDICTION**

### **WARNING**

Familiarity with the en route operation of the KLN 94 does not constitute proficiency in approach operation. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the KLN 94.

### **NOTE**

The special use airspace alert will automatically be disabled prior to flying an instrument approach to reduce the potential for message congestion.

- Prior to arrival, select a STAR if appropriate from the APT 7 page. Select an approach and an initial approach fix (IAF) from the APT 8 page. The most efficient means of getting to these pages is initiated by pressing the PROC button on the KLN 94.
  - Press PROC button.
  - Select Approach, Arrival, or Departure.
  - Select the Airport from the list or enter the desired Airport identifier.
  - The APT 7 or APT 8 page will be displayed as appropriate.

### NOTE

To delete or replace a DP, STAR or approach, select FPL 0 page. Place the cursor over the name of the name of the procedure, press ENT to change it, or CLR then ENT to delete it.

- En route, check for RAIM availability at the destination airport ETA on the AUX 3 page.

### NOTE

RAIM must be available at the FAF in order to fly an instrument approach. Be prepared to terminate the approach upon loss of RAIM.

- At or within 30 nm from the airport:
  - Verify automatic annunciation of APR ARM.
  - Note automatic d-bar scaling change from  $\pm 5.0$  nm to  $\pm 1.0$  nm over the next 30 seconds.
  - Update the KLN 94 altimeter baro setting as required.
  - Internally the KLN 94 will transition from en route to terminal integrity monitoring.
- Select NAV 4 page to fly the approach procedure.
  - If there is a need to fly a procedure turn or holding pattern, fly in OBS until inbound to the FAF.

## NOTE

OBS navigation is TO-FROM (like a VOR) without waypoint sequencing.

- If receiving radar vectors, choose VECTORS as the IAF, activate vectors when the first vector for the approach is received, and leave the unit in LEG mode.
- NoPT routes including DME arc's are flown in LEG. LEG is mandatory from the FAF to the MAP.

## WARNING

Flying final outbound from an off-airport vortac on an overlay approach; be aware of the DME distance increasing on final approach, and the GPS distance-to-waypoint decreasing, and not matching the numbers on the approach plate.

- At or before 2 nm from the FAF inbound:
  - Select the FAF as the active waypoint, if not accomplished already.
  - Select LEG operation.
- Approaching the FAF inbound (within 2 nm):
  - Verify APR ACTV.
  - Note automatic dbar scaling change from  $\pm 1.0$  nm to  $\pm 0.3$  nm over the 2 nm inbound to the FAF.
  - Internally the KLN 94 will transition from terminal to approach integrity monitoring.
- Crossing the FAF and APR ACTV is not annunciated:
  - Do not descend.

- Execute the missed approach.
- Missed Approach:
  - Climb.
  - Navigate to the MAP (in APR ARM if APR ACTV is not available),

### NOTE

There is no automatic LEG sequencing at the MAP.

- After climbing in accordance with the published missed approach procedure, press D6, verify or change the desired holding fix and press ENT.

### NOTE

- The aeronautical data base must be up to date for an instrument approach operation.
- Only one approach can be in the flight plan at a time.
- Checking RAIM prediction for your approach while en route using the AUX 3 page is recommended. A self check occurs automatically within 2 nm of the FAF. APR ACTV is inhibited without RAIM.
- Data cannot be altered, added to or deleted from the approach procedures contained in the data base. (DME arc intercepts may be relocated along the arc through the NAV 4 or the FPL 0 pages).

- Some approach waypoints do not appear on the approach plates (including in some instances the FAF).
- Waypoint suffixes in the flight plan:
  - i - IAF
  - f - FAF
  - m - MAP
  - h - missed approach holding fix
- The DME arc IAF (arc intercept waypoint) will be
  - a) on your present position radial off the arc VOR when you load the IAF into the flight plan, or
  - b) the beginning of the arc if currently on a radial beyond the arc limit. To adjust the arc intercept to be compatible with a current radar vector, bring up the arc IAF waypoint in the NAV 4 page scanning field or under the cursor on the FPL 0 page, press CLR, then ENT. Fly the arc in LEG. Adjust the HSI or CDI course pointer with reference to the desired track value on the NAV 4 page (it will flash to remind you). Left/right dbar information is relative to the arc. Displayed distance is not along the arc but direct to the active waypoint. (The ARC radial is also displayed in the lower right corner of the NAV 4 page).
- The DME arc IAF identifier may be unfamiliar.

Example: D098G where 098 stands for the 098° radial off the referenced VOR, and G is the seventh letter in the alphabet indicating a 7 DME arc.

- APR ARM to APR ACTV is automatic, provided that:
  - You are in APR ARM (normally automatic).
  - You are in LEG mode.
  - The FAF is the active waypoint.
  - Within 2 nm of the FAF,
  - Outside of the FAF,
  - Inbound to the FAF.
  - RAIM is available.
- Direct-To operation between the FAF and MAP cancels APR ACTV. Fly the missed approach in APR ARM.
- Flagged navigation inside the FAF may automatically bring up the message page stating:

PRESS PROC BUTTON NOW FOR NAVIGATION

Pressing the PROC button may usually restore navigation (not guaranteed) by changing from APR ACTV to APR ARM. Fly the missed approach.

- The instrument approach using the KLN 94 may be essentially automatic starting 30 nm out (with a



manual baro setting update) or it may require judicious selection of the OBS and LEG modes.

## **4B. ABNORMAL OPERATING PROCEDURES**

No change.

## **5. PERFORMANCE**

No change.

## **6. MASS AND BALANCE**

Upon removal or installation of the GPS the change of the empty mass and corresponding center of gravity of the airplane must be recorded according to Chapter 6 of the Airplane Flight Manual.

## **7. DESCRIPTION OF THE AIRPLANE AND ITS SYSTEMS**

### **7.14 AVIONICS**

#### **GENERAL**

The KLN 94 GPS panel mounted unit contains the GPS sensor, the navigation computer, a color LCD, and all controls required to operate the unit. It also houses the data base card which plugs directly into the front of the unit.

The data base card is an electronic memory containing information on airports,

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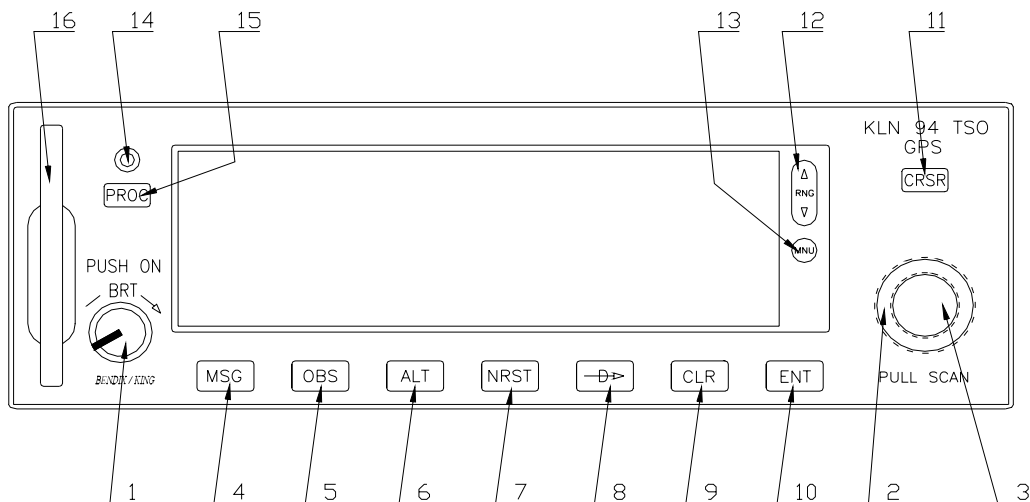
navaids, intersections, DPs, STARs, instrument approaches, special use airspace, land data (roads, bodies of water, cities, obstacles, railroad tracks), and other items of value to the pilot.

Every 28 days, Bendix/King receives new aeronautical data base information from Jeppesen Sanderson for the North American data base region. (The land date is updated on a less frequent basis.) This information is processed and downloaded onto the data base cards. Bendix/King makes these data base card updates available to KLN 94 GPS users.

Provided the KLN 94 GPS navigation system is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications of:

- \* VFR/IFR en route oceanic and remote, en route domestic, terminal, and instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB-DME, RNAV) operation within the U.S. National Airspace System, North Atlantic Minimum Navigation Performance Specifications (MNPS) Airspace and latitudes bounded by 74° North and 60° South using the WGS-84 (or NAD 83) coordinate reference datum in accordance with the criteria of AC 20-138, AC 91-49, and AC 120-33. Navigation data is based upon use of only the global positioning system (GPS) operated by the United States.
- \* VFR/IFR en route, terminal and non-precision instrument approach operation in accordance with AC 20-138 and BRNAV (Basic Area Navigation) operation in accordance with the criteria of AC 90-96 in the European region. (Reference ICAO Doc 7030 Regional supplementary Procedures, JAA Technical Guidance Leaflet AMJ 20X2, Leaflet 2, Rev. 1 and Eurocontrol RNAV Standard Doc 003-93 Area Navigation Equipment Operational Requirements and Functional Requirements (RNAV).)

## OPERATING CONTROLS



1. On/Off/Brightness knob - Used to turn the unit on and off and adjust display brightness.
2. Right outer knob - When the cursor is off, used to select the page type (e.g., APT, NAV, FPL, etc.). When the cursor is on, used to move the cursor from one position to another on the display.
3. Right inner knob - When the cursor is off, used to select the specific page number for a page type (e.g., APT 1, APT 2, APT 3, etc.). When the cursor is on, used to select alphanumeric or other applicable data for the field the cursor is on.
4. Message button - Used to view messages.
5. OBS button - Used to select between LEG mode and OBS modes.
6. Altitude button - Used to select the two Altitude pages where baro settings are made and VNAV operation is set up.
7. Nearest button - Used to bring up a menu of nearest functions (Airports, VORs, NDBs, Intersections, etc.) that may be selected.

8. Direct To button - Used to initiate Direct To operation.
9. Clear button - Used to delete data from a data field. Also used to back up to a previous step in some instances such as selecting approaches/STARs/DPs
10. Enter button - Used to approve or acknowledge data.
11. Cursor button - Used to turn the cursor on and off.
12. Range button - Used to change the map scale if the map page (Nav 4) page is being displayed. Used to select the map page if it is not already on the map page.
13. Menu button - Used to display the map menu if the map page (Nav 4) page is being displayed. The map menu is used to initiate changing what is displayed on the map as well as select the map orientation. Used to select the map page if it is not already on the map page.
14. Data loader jack - Used when updating the Aeronautical database from a computer.
15. Procedure button - Used to initiate the loading of approaches, arrival procedures, and departure procedures. Also used to activate vector-to-final (VTF) for approaches when an approach with 'Vectors' has been loaded into the active flight plan.
16. Data card - Contains the KLN 94 database.

## OPERATION

### NOTE

Detailed operating procedures are outlined in the KLN 94 GPS Pilot's Guide.

### TURN ON AND INITIALIZE THE KLN 94

1. Turn on the KLN 94 by pushing in the On/Off/Brightness knob. For the first few seconds a single color Power-On page is displayed at a fixed brightness. When the screen changes to full color, rotate the knob to adjust display brightness to the desired level. After an additional few seconds, the operational revision status (ORS) level number is displayed on the Power-On page. The ORS level displayed should match the ORS level indicated on the cover of the Pilot's Guide.

### NOTE

If the temperature is very cold when the KLN 94 is turned on, a Warm Up screen is displayed after the Power-On screen. Line 4 will display the approximate time the Warm Up screen will be displayed prior to automatically changing to the Power-On screen. The CLR button may be pressed to bypass the Warm Up screen but the display may be extremely sluggish until it warms up.

When an extensive internal test is complete, the Power-On page will automatically be replaced by the Self Test page.

## NOTE

If the KLN 94 is operating in the Take-Home Mode, the Take Home Warning Page is displayed first and must be acknowledged by pressing **ENT**.

2. Use the right inner knob to enter the current altimeter setting into the 'Baro' field and then press the **ENT** button.
3. If the KLN 94 has passed the internal self test, the bottom of the Self Test page will display **Pass**. If instead **Fail** is displayed, recycle power to the KLN 94. If the Self Test page still displays **Fail**, the KLN 94 requires repair.
4. Use the right outer knob to position the cursor over **Ok?** if it is not already there. When you are ready to approve the Self-test page, press the **ENT** button.
5. The next page displayed will be the Initialization page. Verify that the date displayed in the top left corner of the Initialization page is correct. If the date is incorrect, rotate the right outer knob counterclockwise until the cursor is over entire date field. Rotate the right inner knob until the correct day of the month is displayed. Then, move the cursor to the month field by rotating the outer knob one click clockwise and change the month as necessary. Use the same methods to select the correct year. When the date is correct, press **ENT**.
6. Verify that the time displayed in the upper right corner of the Initialization page is correct to within ten minutes of the actual time. Once the KLN 94 receives the first satellite, it will automatically be very accurately updated by the satellite to the correct time. However, you are responsible for assuring the desired time zone is selected on the KLN 94. If it is necessary to reset the time, position the cursor over the time zone field and select the desired time

zone.

Once you have selected the desired time zone, position the cursor over the entire time field and select the correct hour with the right inner knob. Now move the cursor to the tens of minutes position and select the desired value, and repeat this process for the last digit of the time field. When the correct time has been entered, press **ENT** to start the clock running.

7. To aid the GPS receiver in acquiring your position, it helps to have a reasonable idea of where you are, and the Initialization page is where you have the chance to set this initial position. Check to see if the displayed initial position is where you actually are.
8. When all information on the Initialization page is correct, move the cursor to **Ok?** using the right outer knob and press **ENT** to move on.
9. The Database page will now be displayed with the cursor over **Acknowledge?**. Line 1 indicates whether an Americas, Atlantic International, or Pacific International database is being used. If the aeronautical database (airports, nav aids, etc) is current, line 2 will show the date when the aeronautical database expires. If the aeronautical database is out of date, line 2 shows the date that it expired. The KLN 94 will still function with an out-of-date aeronautical database; however, you must exercise extreme caution and always verify that the database information is correct before using information from an out-of-date aeronautical database. Line 4 displays the date that the land database (roads, rivers, etc) was created. The land database has no expiration date and new data is available approximately once a year. Press **ENT** to acknowledge the information on the Database page.

## MESSAGE PAGE

Whenever the KLN 94 wants to get your attention, the message prompt (a large yellow 'M' on the right side of the screen) begins flashing. You should view the message at your earliest opportunity because the unit may be alerting you to some situation of immediate concern to its condition or to your flight. A description of each possible message is included in Appendix B of the GPS KLN 94 Pilot's Guide.

To view a message:

1. Press the **MSG** button. The MSG page will appear and show the new message.

### **NOTE**

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

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

## SCRATCHPAD MESSAGES

The lower left corner of the display can also display short operational messages to the user called 'scratchpad messages'. These messages are displayed for approximately five seconds, then this area returns to a display of the page type and



number. A complete listing of scratchpad messages is available in Appendix C of the GPS KLN 94 Pilot's Guide.

### NEAREST FUNCTIONS

At any time, you can have access to the nearest airports, waypoints, Special Use Airspace (SUA), Flight Service Station (FSS) frequencies, and Center frequencies to your position. The 'nearest' function is activated by pressing the **NRST** button.

When you first press the **NRST** button, a page is displayed asking which nearest function you would like to select.

The choices are:

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

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

### DIRECT TO OPERATION

The **D6** button is used to initiate Direct To operation (navigation from your present

position direct to your destination). When  is pressed, the Direct To Page will be displayed with a flashing cursor over a waypoint identifier. The waypoint identifier which appears on the Direct To Page is chosen by the KLN 94 according to the following rules:

1. If the Flight Plan 0 (FPL 0) Page is displayed on the screen and the cursor is over one of the waypoint identifiers in FPL 0 when  is pressed, then that waypoint identifier will appear on the DIR Page.
2. If the KLN 94 is displaying the NAV 4 Page and the right inner knob is in the 'out' position, then the waypoint highlighted in the lower right hand corner of the NAV 4 map display will be the default waypoint.

OR...

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

If none of the conditions above are occurring, then:

4. When  is pressed, the waypoint identifier for the current active waypoint will be displayed.

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

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

#### FLY DIRECT TO A WAYPOINT

1. Press . The Direct To Page is displayed. The cursor will already be on. A

waypoint identifier may or may not be displayed, it does not matter at this point.

2. Rotate the right inner knob to select the first character of the desired waypoint's identifier.

3. Turn the right outer knob one click clockwise to move the flashing portion of the cursor over the second character position.
4. Rotate the right inner knob to select the second character of the identifier.
5. Use the right outer knob and the inner knobs as in the previous steps until the desired identifier is completely displayed.
6. Press **ENT** to display the waypoint page for the selected waypoint.
7. Press **ENT** again to approve the displayed waypoint page. The screen will change to the NAV 1 Page, and the selected waypoint will now be the active Direct To waypoint.

## **8. AIRPLANE HANDLING, CARE AND MAINTENANCE**

No change.