

# Pilot's Guide

## KFC 250

Bendix/King Flight Control System



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## Introduction to the KFC 250 Flight Control System

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The KFC 250 Flight Director/Autopilot is a complete 3-axis integrated system with large, 4-inch electric (or 3-inch vacuum/electric) Flight Command and Pictorial Navigation Indicators.

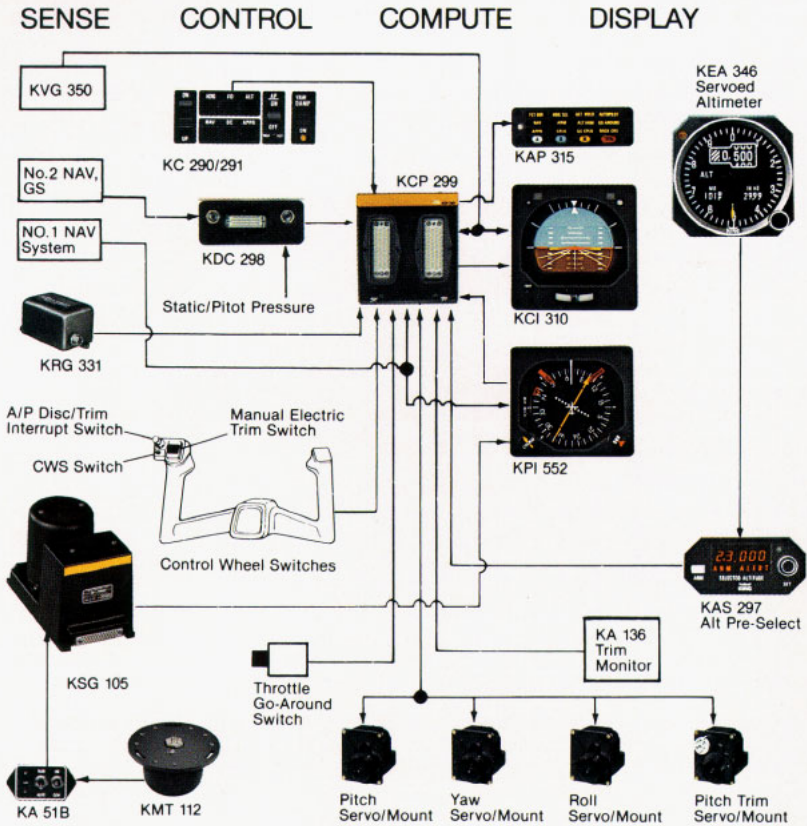
An all solid-state Flight Computer provides computed Flight Director commands along with complete 3-axis Autopilot control. The system provides all standard operating modes plus altitude preselect capability.

This system is designed specifically to bring the advantages of advanced technology to single pilot instrument flying in turboprops and cabin class twins.

King Radio also offers a Flight Director only version, named the KFD 250 which offers virtually the same performance as the 4" KFC 250 system without servo control of the aircraft control surfaces. Presentation of the flight sequences shown in this handbook can be used as a guide for the KFD 250 by ignoring comments regarding autopilot operation.



**IMPORTANT:** This Pilot's Guide provides a general description of the various operational characteristics of the KFC 250 Flight Control System. However, operation of the system should not be attempted without first reviewing your FAA approved Aircraft Flight Supplement Manual for complete system familiarization and limitations.



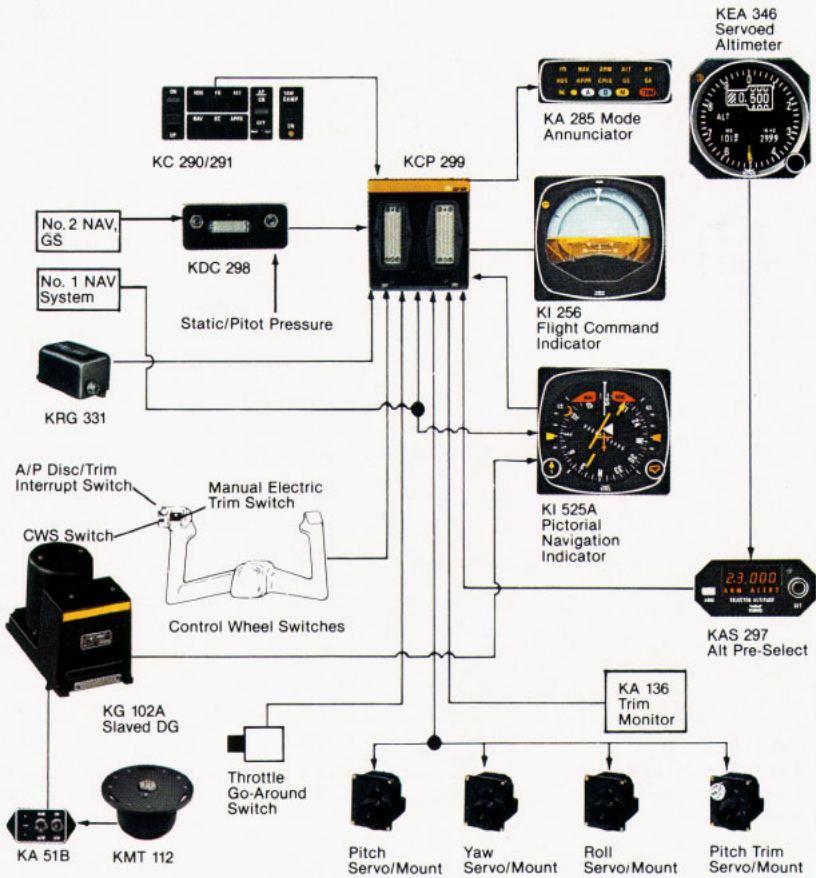
## KFC 250 System Integration

The system diagrams show the components of the KFC 250 Integrated Flight Control System and their relationships.

The system is functionally divided into four parts: Sense, control, compute and display. All sensor information (pitch and roll reference; slaved compass; RNAV/VOR/LOC/GS; DME; marker receiver; and air data) is fed into the KCP 299 Flight Computer.

The Flight Computer computes pitch and roll steering commands. These two commands are routed to the KCI 310 or KI 256 Flight Command Indicator where they are displayed on the V-bar as visual steering commands. These steering commands are also fed to the Autopilot computation circuits contained in the Flight Computer where the steering commands and aircraft yaw rate information

SENSE CONTROL COMPUTE DISPLAY



are combined to generate the aileron, elevator trim, and rudder drive commands for the Autopilot.

Using the same pitch and roll commands provides totally consistent Flight Director steering command and Autopilot control. There is no disagreement in computation. The Autopilot simply converts the pitch and roll steering commands from the Flight Computer,

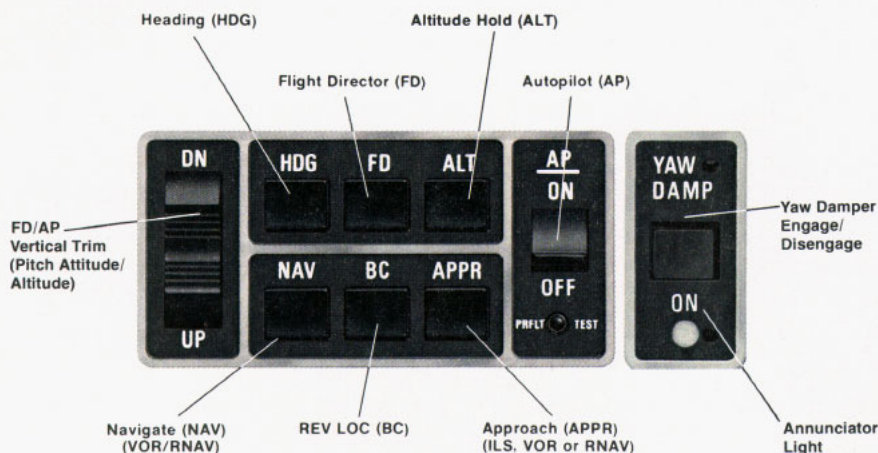
displayed on the V-bar in the FCI, into the required elevator and aileron position commands.

Full integration of Flight Director and Autopilot allows the pilot to delegate the manual effort of flying the aircraft to the Autopilot while monitoring its activity with the Flight Director.

# KING KFC 250 Flight Control System Specifications

<b>KFC 250</b>		Current Drain	Weight	
			(lbs)	(Kgs)
(Common components)				
KC 290	Mode Controller		.50	.22
KC 291	Yaw Controller		.10	.04
KCP 299	Flight Computer		5.90	2.67
KDC 298	Air Data		1.70	.77
KA 136	Trim Monitor		.50	.22
KS 27X (4)	Servo/Mount		13.40	6.07
KRG 331	Yaw Rate Sensor		.76	.34
KAS 297	Altitude Selector		1.20	.54
KEA 346	Servoed Altimeter		2.90	1.31
		10.45 A 28 VDC		
		4.5 VA 26 VAC	26.96	12.18
<b>4-Inch</b>				
KCI 310	Flight Command Indicator		5.00	2.27
KPI 552	Pictorial Navigation Indicator		4.80	2.18
KAP 315	Mode Annunciator		1.40	.63
KVG 350	Vertical Gyro		6.00	2.72
KCS 305	Slaved D.G.		5.60	2.54
		11.95 A 28 VDC		
		43.6 VA 26 VAC		
Total 4-Inch		95 VA max 115 VAC	49.76	22.52
<b>3-Inch</b>				
KI 256	Flight Command Indicator		3.30	1.50
KI 525A	Pictorial Navigation Indicator		4.00	1.82
KA 285	Mode Annunciator		.50	.20
KG 102A/ KMT 112/ KA 51B	Slaved D.G. System		5.50	2.50
		13.85 A 28 VDC		
		4.5 VA 26 VAC	40.26	18.20

# Flight Director System Modes of Operation



## Flight Director Guidance and Command to Autopilot

- Basic Attitude Reference Mode** — Activated with "power on" but with no modes selected. The Flight Command indicator and Pictorial NAV indicator will display existing attitude and heading. The Command V-bar is retracted out of view until a Flight Director/Autopilot mode has been selected.
- Flight Director (FD)** — Command V-bar will call for wings level. The pitch attitude of the aircraft will remain the same as at the time of mode selection.
- Heading (HDG)** — Select desired heading on PNI, then select the HDG mode and the system will command the necessary bank to turn to and maintain the selected heading.
- NAV (VOR/RNAV)** — Set desired course on PNI and select NAV mode. The system's all-angle NAV Course Capture feature gives the pilot complete freedom to select any intercept angle in response to ATC vectors, using HDG mode. The NAV mode will be "armed," and at the capture point HDG will automatically disconnect and the system will "couple" and command the necessary bank to capture and track a selected VOR or RNAV course without overshooting.

- Approach (APPR) (ILS or VOR)** ————— Set the inbound front approach course on the PNI and select Approach mode. The system's all-angle Approach Course Capture feature allows the pilot to select any intercept angle in response to ATC vectors, as in the NAV mode. The Approach mode will be "armed," and at the appropriate capture point the system will "couple" and command the necessary bank and pitch to capture and track LOC and Glideslope beams for precision approaches . . . or bank command to capture and track VOR courses for non-precision approaches.
- Back Course (BC)** ————— With back course selected in Approach mode, the system when capturing will command the bank necessary to capture and track a reverse LOC course . . . Glideslope is locked out. The inbound front approach course is always set on the PNI to enable you to make course corrections toward the needle rather than away from the needle on the PNI.
- Go Around (GA)** ————— Push the "Go Around" button and the system will command wings level and nose up to a preset missed approach climb attitude.
- Altitude Hold (ALT)** ————— Pitch command to maintain engaged altitude.
- Vertical Trim** ————— Provides capability to adjust or slew the Altitude up or down without disengaging and then reengaging ALT Hold. If Altitude Hold is not engaged, the Vertical Trim knob will adjust the pitch attitude up or down.
- Altitude Preselect** ————— Permits preselection of a desired altitude and automatic capture upon reaching that altitude.
- Autopilot (AP)** ————— Control surfaces respond to all selected Flight Director mode commands in both pitch and roll axis plus automatic pitch trim. A full time yaw damper is in operation any time the Autopilot is engaged. Separate Autopilot servos and capstans make it easy to remove and service the control surface servos without de-rigging the surface control cables.
- Control Wheel Steering** ————— Allows manual flight maneuvering without the need to disengage and reengage the Autopilot. With the CWS switch depressed, the system pitch axis is synchronized with the airplane and the Autopilot servos disengage, so the pilot can hand fly the airplane (in the existing mode with Autopilot engaged) without removing his hand from the control wheel.
- Yaw Damp Engage** ————— System senses motion around the yaw axis and automatically moves the rudder to oppose yaw.



# KFC 250 System Panel Checklist:

1. THE KAP 315 ANNUNCIATOR PANEL provides the pilot with continuous information on system operating status. It shows modes in operation, as well as modes "armed" prior to capture. It also displays Marker Beacon lights and a Trim Fault warning.



2. THE KPI 552 PICTORIAL NAVIGATION INDICATOR displays slaved gyro magnetic heading information. By positioning the "Heading Bug" on the PNI with the "heading select" knob, the pilot selects the desired aircraft heading. For VOR/LOC/RNAV course selection, the "course select" knob is used. Glideslope deviation is shown on the left side of the instrument face when a valid Glideslope signal is received. TO/FROM indications and appropriate warning flags are also displayed on this indicator.

A KPI 553A PNI with built in DME display and RMI pointer is available as an option (see picture on page 11).



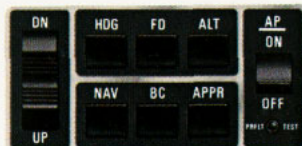
3. THE KCI 310 FLIGHT COMMAND INDICATOR displays the following information:

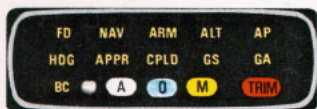
- Pitch and roll attitude
- Pitch and roll commands
- Decision Height (DH)
- RNAV Annunciation (RNV)
- Skid/Slip on inclinometer

Separate wiring from the remote vertical gyro to the attitude indicator and strict separation of attitude and command bar power circuits assure the pilot of attitude reference even in the event of a Flight Computer failure.

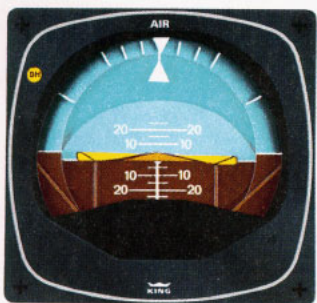


4. THE KC 290 MODE CONTROLLER provides pushbutton selection of all Flight Director/Autopilot modes, plus Vertical Trim. This trim switch allows the pilot to adjust the aircraft's altitude or pitch attitude without disturbing the selected Flight Director mode or disengaging the Autopilot. The Autopilot engage switch engages all three axis of the Autopilot. The compact KC 290 unit can be easily installed in panel or pedestal mount configurations.





1A. THE KA 285 ANNUNCIATOR PANEL provides the same functions as the KAP 315 with the exception of the ALT ARM light.



2A. THE KI 256 3-INCH VACUUM/ELECTRIC FLIGHT COMMAND INDICATOR displays the following information:

- Pitch and roll attitude
- Pitch and roll commands
- Decision height (DH)



3A. THE KI 525A PICTORIAL NAVIGATION INDICATOR displays slaved gyro magnetic heading information and operates similarly to the KPI 552.



5. THE OPTIONAL KC 291 YAW MODE CONTROLLER can be installed alongside the KC 290 Mode Controller. In this configuration the yaw axis is wired so that it automatically engages when the Autopilot is engaged. Disengagement of the yaw damper is accomplished by using the control wheel mounted disengage switch or the KC 291 engage/disengage switch.

The Yaw Damper only is engaged or disengaged using the KC 291. The Yaw Damper engage status is annunciated on the KC 291.

Some airplanes are certified with the yaw damper on at all times when the autopilot is engaged. (Refer to Flight Manual Supplement to determine your type of installation.)



6. KEA 346 SERVOED ALTIMETER provides barometric corrected altitude information to the KAS 297 Altitude Selector and encoding for an ATC transponder.



7. THE KAS 297 ALTITUDE SELECTOR permits the pilot to preselect a desired altitude in climb or descent. The system provides automatic capture and hold upon reaching that altitude. Altitude alerting is also provided as required by FAR 91.51.



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## Operating the KFC 250 System

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There are twelve (12) modes of operation that are provided by the KFC 250 system to offer the pilot Flight Director/Autopilot commands in response to his selection of desired modes on the Mode Controller.

Most of these modes are activated by pushbutton switches on the Mode Controller. These pushbuttons operate with alternate action. The first depression of the pushbutton activates a mode; the second depression cancels it, if it has not already been automatically inactivated. Annunciation of the mode selected appears on the annunciator panel.

Any operating mode not compatible with a newly-selected mode will be automatically cancelled in favor of the pilot's latest selection. This lets the pilot advance along his

flight sequence without the inconvenience of having to manually cancel modes. For example, if in NAV CPLD mode, selection of Heading will automatically cancel NAV.

### THE BASIC MODE OF SYSTEM OPERATION

The system will be in the Basic Attitude Reference or "Gyro" mode with engines running and aircraft "power on," but no modes selected (Annunciator Panel blank). This provides indication of aircraft heading on the Pictorial Navigation Indicator, and roll and pitch attitude on the Flight Command indicator. The FCI Command V-bar is biased out of view.



## System Safety Is Assured By Integrity Monitors

The KFC 250 monitors the validity of the system sensors and the Flight Computer to alert the pilot when the system cannot respond correctly to command signals.

"Invalid" signals provide visual warning by means of the flags and annunciators. "Invalid" signals are also routed to the KFC 250 switching logic to "lock out" modes which will not operate reliably.

Most failures in the slaved compass system would be annunciated by a compass flag and the system would not allow selection of the Heading, NAV or APPR modes.

The illustrations above show the KFC 250 Flight Director cockpit displays with all warning flags in view.

**Flight Command indicator warnings:** Flight Director (FD) Command V-bar will bias out of view whenever the FD mode is not selected, and when FD internal power is inadequate. Attitude and computer flags will also be in view.

**The Pictorial Navigation Indicator warnings:** A compass flag indicates that the compass card is not displaying proper heading. A NAV flag indicates that a valid NAV Signal is not being received.

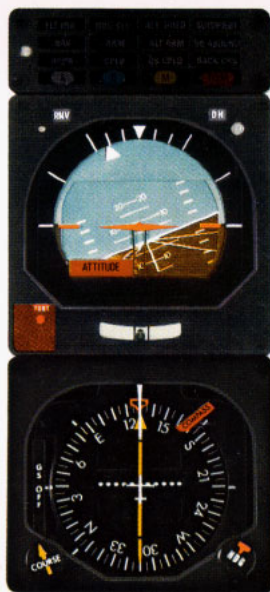
When an ILS channel is selected on the NAV receiver and a valid Glideslope signal is received, the Glideslope pointer will appear. Glideslope coupling usually occurs at Outer Marker, when the Glideslope is intercepted (glideslope pointers centered) and APPR CPLD. If, after GS coupling, the GS pointer disappears, the system will flash the GS Annunciator and go from GS coupled to Pitch Attitude Hold. If the GS pointer reappears, the system will revert back to GS coupled. The NAV warning flag indicates an invalid Localizer but has no effect on Glideslope operation.

In the Approach mode, in an aircraft equipped with dual LOC and GS receivers, Approach monitoring is provided if both systems are tuned to the LOC frequency. If the deviations of No. 2 LOC or GS differs greater than a preset amount the appropriate annunciator light (APPR or GS) will flash.

**The Trim warning light** in the Annunciator Panel will light when a monitored Auto or Manual electric trim failure occurs or when the trim breaker is pulled. It will also flash 4 to 6 times when the TEST switch on the Mode Controller is depressed.



1.



2.



## Preflight Test Determines, Before Takeoff, that the System is Operating Normally.

With power on, all circuit breakers in, and engine running, allow 3 minutes for the gyros to come up to speed.

Make sure you are in slaved gyro mode by confirming the status on the KA 51B Slaving Meter and compare the compass card on the KPI 552 or KI 525A with your magnetic compass.

With no modes engaged, depress the Preflight Test button on the Mode Controller. All modes will be annunciated on the Annunciator Panel, including the 3 Marker lights, and the red Autotrim light will flash. At least four and not more than six flashes must be observed to indicate proper operation of the Autotrim monitor feature. The KCI 310 computer flag will also come into view. (Figure 1)

For attitude indicator test, push the test button on the KCI 310 front panel. The attitude and compass flags will appear and the pictorial horizon will display a climbing right turn. (Figure 2)

The KI 256 FCI does not have a computer or attitude flag or attitude test since the gyro is air driven.

The pilot first engages the Flight Director to activate the Command V-bar. Then he

engages the Autopilot. The Autopilot will not engage when the Flight Director is not operating.

Now depress the CWS switch, center the display on the Flight Command Indicator and release the CWS switch. Then apply force to the controls to determine if the Autopilot can be overpowered.

**CAUTION:** Operation of the Autopilot on the ground may cause the autotrim to run because of back force generated by elevator downsprings or pilot induced forces.

Some aircraft have preflight test sequences required in addition to the general procedures described here. See the FAA approved Aircraft Flight Manual Supplement for your particular aircraft for details.

**IMPORTANT:** This pilot Guide provides a general description of the various operational characteristics of the KFC 250 Flight Control System. **However, operation of the system should not be attempted without first reviewing your FAA Approved Aircraft Flight Supplement Manual for complete system familiarization and limitation.**

## FLIGHT DIRECTOR Mode (FD)

The Flight Director mode is activated by depressing the "FD" button on the Mode Controller.

The FCI Command V-bar will appear and provide the pilot with steering commands to maintain wings level and the pitch attitude that existed at the time of Flight Director engagement.

If pitch or roll attitude are changed, recycling the FD button will synchronize the Command V-bar to the new situation.

If a change only in the commanded pitch attitude is desired, the Control Wheel Steering (CWS) button installed on the pilot's control wheel allows the pilot to synchronize the Command V-bar (in the FD mode with Autopilot disengaged) without removing his hand from the control wheel.

The Flight Director can also be activated by direct selection of any specific mode, which will activate the Command V-bar. Such selection will annunciate both FD and the appropriate mode.

The Vertical Trim switch on the Mode Controller may also be used to adjust the selected pitch attitude up or down at approx. 1 degree/second.

**Special note: The FD mode must be activated before the Autopilot can be engaged.**

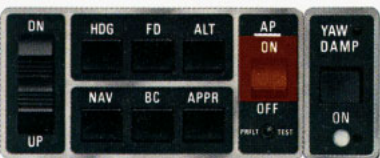
## AUTOPILOT Engagement

The AUTOPILOT is engaged by moving the solenoid-held AP toggle switch on the Mode Controller to the ON position. Note that the AP and the YAW DAMP (YD) switches are wired so that the YAW DAMP mode is automatically engaged with the AP switch.

The Autopilot, together with the Yaw Damper, provides three-axis stabilization, automatic turn coordination and automatic elevator trim as well as automatic response to all selected Flight Director commands.

**CAUTION:** When the autopilot is engaged, manual application of a force to the pitch axis of the control wheel for a period of 3 seconds or more will result in the autotrim system operating in the direction to create a force opposing the pilot. This opposing mistrim force will continue to increase as long as the pilot applies a force to the control wheel and will ultimately overpower the autopilot. If the autopilot is disengaged under these conditions, the pilot may be required to exert control forces in excess of 50 pounds to maintain the desired aircraft attitude. The pilot will have to maintain this control force while he manually retrimms the aircraft.

**CAUTION:** Prior to Autopilot engagement, the pilot should make sure the V-bar commands are satisfied. This will prevent any rapid changes in the aircraft's flight path when the Autopilot is engaged.



## HEADING SELECT/PRESELECT Mode (HDG SEL)

Select a desired heading by positioning the heading "bug" on the PNI. This is done with the HDG knob on the PNI.

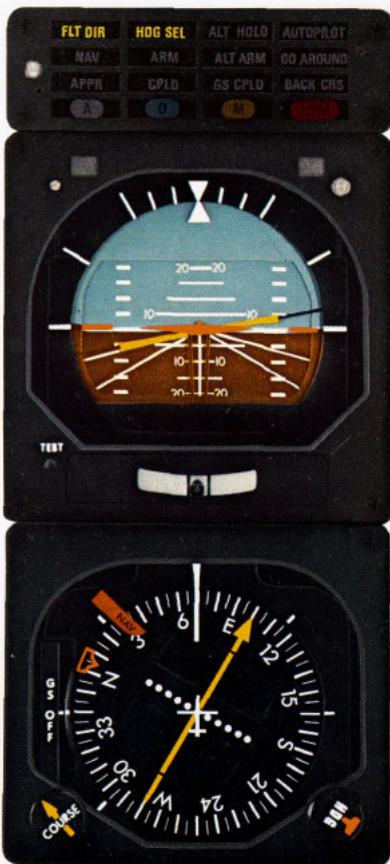
Depress the HDG button on the Mode Controller to activate the HDG SEL mode. "HDG SEL" will light on the Annunciator Panel and a computed, visually displayed bank command is shown on the FCI. Following this bank command, the aircraft will bank and roll out on the desired preselected heading.

The Command V-bar on the FCI will deflect in the direction of the shortest turn to satisfy the commanded turn to the preselected heading. The aircraft may be manually banked to realign the V-bar and satisfy the command or, if the Autopilot is engaged, the aircraft will automatically bank, turn to, roll out and hold the preselected heading. As the aircraft approaches the selected heading the V-bar will command a rollout to wings level.

With the HDG SEL mode in operation, subsequent changes made in the heading "bug" position on the PNI will immediately cause the V-bar on the FCI to call for a turn to the new heading.

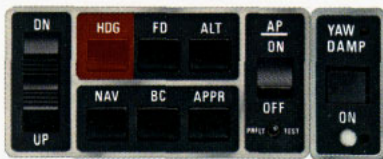
The HDG SEL mode is cancelled when NAV or APPR coupling occurs, or whenever the FD or HDG mode buttons are depressed.

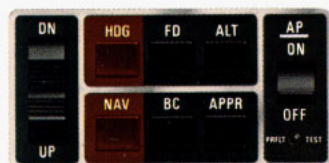
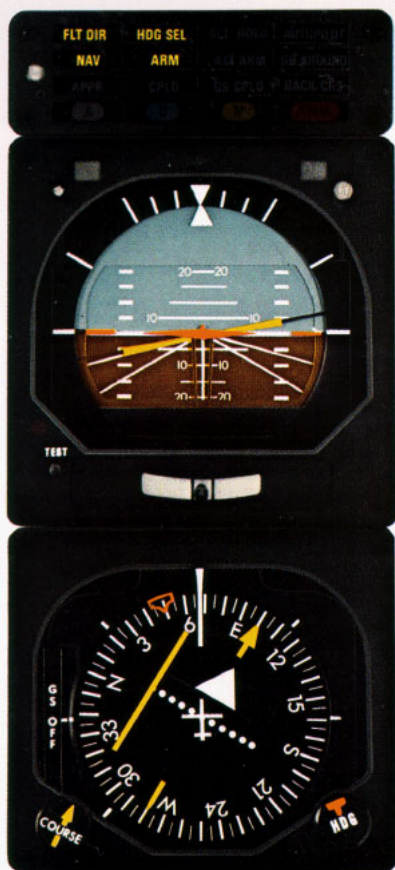
**CAUTION:** An invalid heading source (compass flag in view) will automatically disengage the autopilot. The autopilot may then be re-engaged, however, only the vertical modes will be useable.



## YAW DAMP Mode

The KC 291 Yaw Mode Controller is installed beside the KC 290 Mode Controller and the yaw axis is wired so that it automatically engages when the Autopilot is engaged. Disengagement of the Yaw Damper is accomplished by using the alternate action switch (pushbutton) on the KC 291. The Yaw Damper may be engaged alone with or without any Flight Director mode. It usually provides a more stable aircraft whether control surfaces are operated manually or by the Autopilot. The Yaw Damper engage status is annunciated on the KC 291 Yaw Mode Controller.





## NAVIGATION (NAV ARM and NAV CPLD) Mode

The NAV mode provides visual bank commands on the Flight Command Indicator and deviation guidance on the PNI to intercept and track a VOR course or an RNAV course.

Operation of the NAV mode requires the pilot to:

1. Tune the frequency of the selected VOR (or VORTAC) station. For RNAV operation, set in waypoint distance and bearing from the VORTAC station.
2. Set the PNI course pointer on the desired course.
3. Establish angle of intercept by setting heading "bug" and activate "HDG" mode.
4. Depress the NAV button on the Mode Controller.

When the "NAV" button on the Mode Controller is depressed, "NAV/ARM" will be lighted on the Annunciator Panel and the automatic capture circuit is armed. Heading select, if operating, is retained until capture occurs.

The VOR or RNAV "course-capture" point is variable to prevent overshoot and depends on angle of intercept and the rate the course deviation is changing. Upon capture, a bank command will be displayed on the FCI; the HDG, if on, will be cancelled and "NAV/CPLD" will be lighted on the Annunciator Panel.

The pilot can manually bank the aircraft to satisfy the command display which will call for a rollout to level flight when on course centerline to track the course. Crosswind compensation is provided in the "track" state.

If the NAV mode is selected with the aircraft level within  $\pm 4^\circ$  of bank and within three dots of course deviation, NAV/ARM will be bypassed and NAV/CPLD will engage directly.

If the Autopilot is engaged, the aircraft will bank to satisfy the command display and rollout on course automatically.

Upon station (or waypoint) passage, an outbound course other than the inbound reciprocal can be selected by resetting the NAV course arrow on the PNI. This will cause an immediate V-bar deflection on the FCI directing a turn to the new course.

The NAV mode is cancelled by depressing the NAV button, or selecting HDG (when in NAV coupled) or APPR modes, or pushing FD to "OFF".

**CAUTION:** The NAV mode of operation will continue to provide airplane control without a valid VOR/LOC signal (NAV flag in view).



## APPROACH (APPR/ARM, APPR/CPLD and GS CPLD) Mode

The APPR mode provides visual roll and pitch commands on the FCI V-bar to capture and track precision ILS (LOC and Glideslope) beams, or non-precision VOR radials. Lateral and vertical deviation can be monitored on the PNI.

Operation of the APPR mode requires the pilot to:

1. Set the NAV receiver frequency.
2. Set the PNI course pointer to the inbound runway heading or the front course in case of ILS precision approach. Do this even on back course approach.
3. Set the HDG SEL "bug" on the PNI to the desired intercept angle and activate "HDG" mode.
4. Depress the "APPR" button on the mode controller.

The automatic APPR capture function will be immediately armed. "APPR/ARM" will be lighted on the Mode Annunciator Panel.

In APPR/ARM mode, prior to capture, the heading select mode is retained in order to allow the pilot to adjust heading to Approach Control vectoring instructions.

The LOC beam or VOR "capture" point will vary, depending on angle of intercept and rate of change of deviation indication. Upon capture, a bank command will be introduced on the FCI, the existing heading mode will be cancelled and "APPR/CPLD" will be lighted on the Annunciator Panel.

The pilot may manually bank the aircraft to satisfy the command display, which will command a rollout to level flight when the aircraft is on course. Automatic crosswind compensation will provide precise tracking. VOR/LOC deviation is shown on the PNI, and actual crab angle will be shown by offset of the course arrow from the lubber line.

Throughout APPR mode operation, LOC and Glideslope deviation or VOR deviation are displayed in the PNI.

If the Autopilot is engaged during operation in the APPR mode, automatic steering response will follow the command display on the FCI.

The Glideslope mode is armed for automatic capture if LOC front course capture has occurred. Automatic Glideslope capture occurs as the aircraft passes through the glide path from above or below.

Upon interception of the Glideslope, capture occurs and "GS CPLD" is lighted on the Annunciator Panel. A smooth capture pitch command is displayed by the Command V-bar. The pilot (or Autopilot) controls the aircraft to satisfy the Command V-bar.

Upon GS capture, the ALT HOLD mode (if active) is cancelled. However, ALT HOLD may be manually reselected to maintain altitude upon reaching MDA if visual contact is not established.



During VOR or RNAV approaches, Glideslope capture will not occur because the NAV receiver is channeled to a VOR station, not an ILS, and this locks out the Glideslope function.

APPR/CPLD mode is cancelled by selection of HDG, NAV, or Go-Around modes ... or pushing FD or APPR to "Off".

**CAUTION:** The APPR mode of operation will continue to provide airplane control without a valid VOR/LOC signal (NAV flag in view).



### BACK COURSE (BACK CRS) Mode

Whenever a LOC or ILS frequency is selected, the BC mode may be activated by depressing the BC button on the Mode Controller, **after** selecting APPR. When in BC mode and Localizer capture occurs, the system will turn and track outbound on the front course or inbound on the back course. The BC mode reverses the LOC deviation signal and course datum to permit the FCI steering command display to operate on a fly-to rather than a fly-from basis on the reverse course. "BACK CRS" is lighted on the Annunciator Panel.

Operation on BC is identical to front course operation including setting the PNI Course Pointer to the front course heading, except that automatic Glideslope capture is "locked out" by the switching circuitry. Localizer deviation on PNI will have the proper sensing if the front inbound Localizer course was set on the PNI.



### GO-AROUND Mode

The Go-Around mode is primarily designed to assist the pilot in establishing the proper pitch attitude under missed approach conditions. The Go-Around switch is located on the throttle lever for pilot convenience when applying climb-out power.

Depression of the Go-Around switch during an approach cancels all Flight Director modes and disengages the Autopilot, if it is engaged.\* A wings-level and pitch-up command is displayed by the FCI and "GO AROUND" is lighted on the Annunciator Panel. The magnitude of the pitch-up command is adjustable to match Flight Manual criteria for each aircraft model.

The Go-Around mode may also be used on takeoff for climb-out attitude guidance. When used for takeoff, the Go-Around mode may be followed with HDG for continuous heading control during departure. NAV and APPR modes may also be armed for automatic capture and guidance during the departure sequence.

Go-Around may be cancelled by use of Vertical Trim, Altitude Hold mode, Control Wheel Steering mode or by turning off the Flight Director.

*\*Some airplanes are certified with the Autopilot remaining engaged when GA is selected. (Refer to Flight Manual Supplement to determine your type of installation.)*



### ALTITUDE SELECT (ALT ARM) Mode

This mode allows the pilot to select an altitude and, upon approaching that selected altitude, obtain an automatic visual pitch command on the FCI to capture and hold the pre-selected altitude. To operate in this mode the pilot must:

1. Set the desired altitude into the "selected altitude" window of the KAS 297 Altitude Selector.

2. Establish a climb or descent as appropriate.

3. Depress the ARM button on the Altitude Selector. This may be done at any time during the climb or descent before the selected altitude has been attained. "ALT ARM" will light on the Annunciator Panel and on the Altitude Selector.

4. The Altitude "ALERT" annunciator in the KAS 297 will illuminate (and in most systems a two second aural tone will sound) 1,000 ft. prior to reaching selected altitude and will cancel at 300 ft. prior. An aural tone will sound upon reaching altitude.

As the aircraft approaches the selected altitude, an "adaptive" pitch rate command will automatically guide the pilot through it at a low rate. As the aircraft reaches the selected altitude, ALT HOLD will automatically engage, "ALT HOLD" will light on the Annunciator Panel and "ALT ARM" will disappear. The command bars on the FCI will call for level flight at the selected altitude. If autopilot is engaged, the system will perform the required maneuvers.

ALT ARM is disengaged by depressing the ALT ARM button, by engaging ALT HOLD, by GS capture, or selecting FLT DIR to OFF.

#### ALTITUDE HOLD (ALT HOLD) Mode

This mode will cause a computed visual pitch command on the FCI command bars to hold the aircraft at the pressure altitude existing at the time it was activated.

The mode is activated either automatically by the ALT ARM function, or manually by depressing the ALT button on the Mode Controller.

If the autopilot is engaged, it will automatically hold the aircraft at that altitude.

The Vertical Trim switch may be used to adjust the selected altitude up or down at a constant rate of approximately 600 fpm without disengaging the mode. This enables the pilot to conveniently adjust the aircraft altitude to match resetting of the altimeter, or to make short descent segments during a nonprecision approach.

The ALT HOLD mode is cancelled by automatic Glideslope capture or selection of ALT ARM, or GO-AROUND modes, or selection of FLT DIR to OFF.

#### CONTROL WHEEL STEERING (CWS) Mode

When the Autopilot is engaged, Control Wheel Steering provides the pilot with the capability for natural and convenient manual maneuvering of the aircraft without the need to disengage and reengage the Autopilot, or reselect any modes of operation.

The CWS mode is engaged by continuous pressure on the CWS button, preferably located on the left-hand horn of the control wheel. Operation of the CWS button causes immediate release of Autopilot servos and

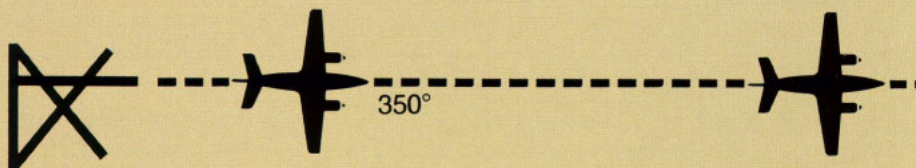
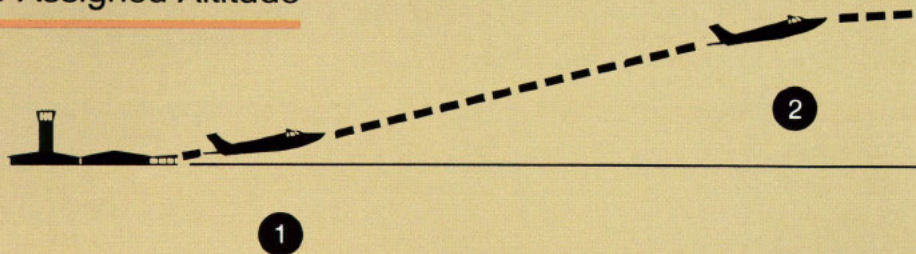


allows the pilot to assume manual control, while Autopilot control functions and Pitch Command and Altitude Hold modes are placed in a synchronization state.

This means that these modes remain in continuous synchronization with the pilot's aircraft maneuvers so that, upon release of the CWS mode button, the Autopilot will smoothly reassume control of the aircraft to the original lateral command and existing vertical command.

Since all engaged modes remain coupled (in synchronization) during operation of the CWS mode, their annunciator lights will continue to show on the Annunciator Panel. The CWS mode is not separately annunciator.

## Takeoff and Climb to Assigned Altitude



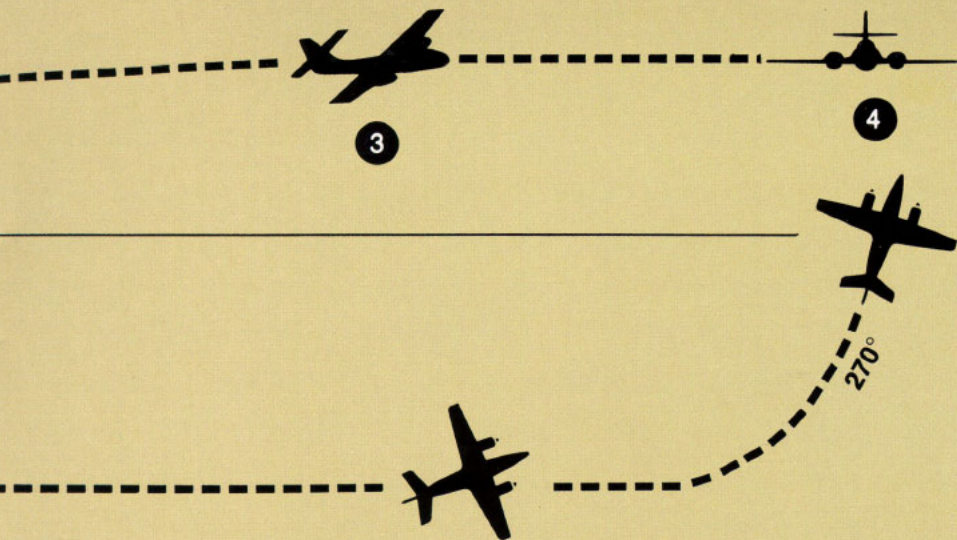
1. The FD has been engaged. Takeoff is in the GO-AROUND mode, activated by depressing the GO-AROUND button located on the throttle. "GO-AROUND" is lighted in the annunciator panel. Wings are commanded level and the nose up to the GO-AROUND angle. Takeoff is on runway 35 as shown on the PNI.



2. The aircraft is well off the ground and climbing.

The heading "bug" on the PNI is turned to a desired heading and HDG mode has been pushed on.

The Flight Director has responded with the Command V-bar calling for a left turn to the 270° heading and takeoff pitch attitude. The aircraft has not yet responded to the heading command but will as soon as the Autopilot is engaged.



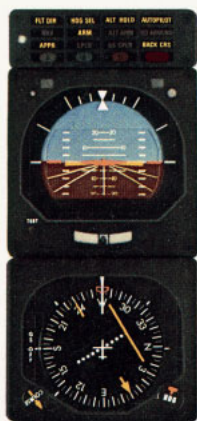
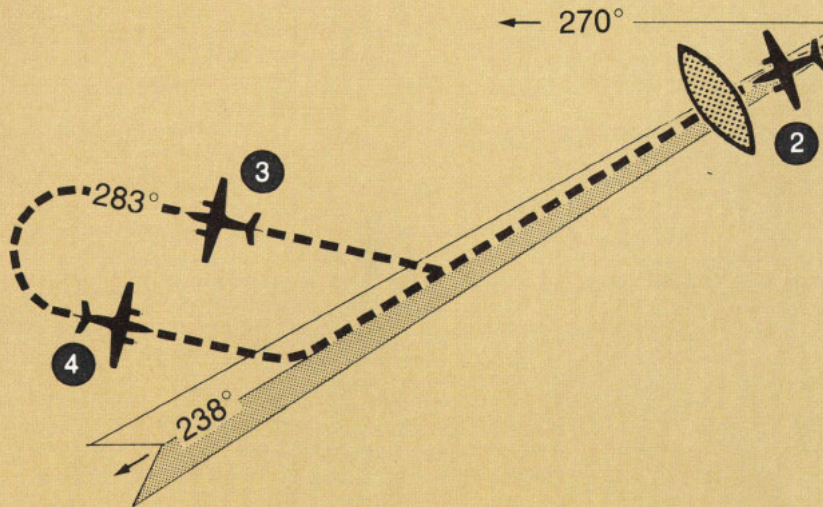
**3.** With the Autopilot engaged, the aircraft is responding to the FCI commands with a left bank. Takeoff climb attitude continues. Desired altitude may now be selected and armed on the KAS 297 altitude selector. Altitude alerting will be provided as you approach your selected altitude.



**4.** Desired altitude has been reached, ALT HOLD mode has been automatically engaged and the aircraft has returned to level flight. The 270° heading has been acquired.

# Outbound on Front Course for Procedure Turn to ILS Approach

360°

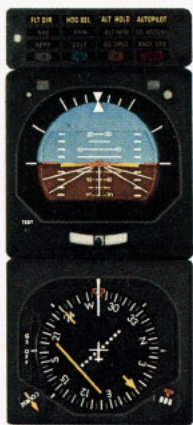
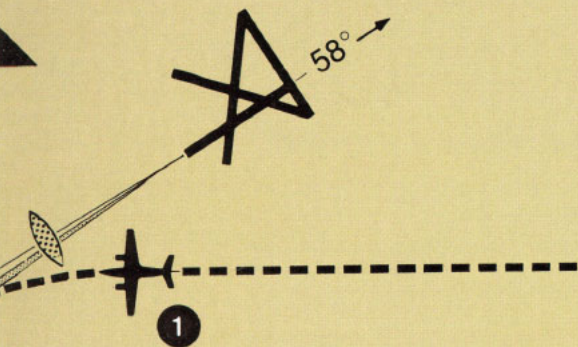


1. In HDG SEL and ALT Hold mode on a LOC channel, the aircraft is heading 270° toward the Localizer. The front inbound localizer course of 58° is selected. APPR mode and "BC" have been selected. The back course (BC) mode is selected to go outbound on the front course. The capture point is now being computed, based on closure rate.



2. When the computed capture point is reached, the APPR CPLD mode is automatically activated and a left turn outbound on the localizer is commanded by the FCI, and is satisfied by the Autopilot.

Note that the left-right deviations of the bar give "fly-to" indications just as on the front course inbound.



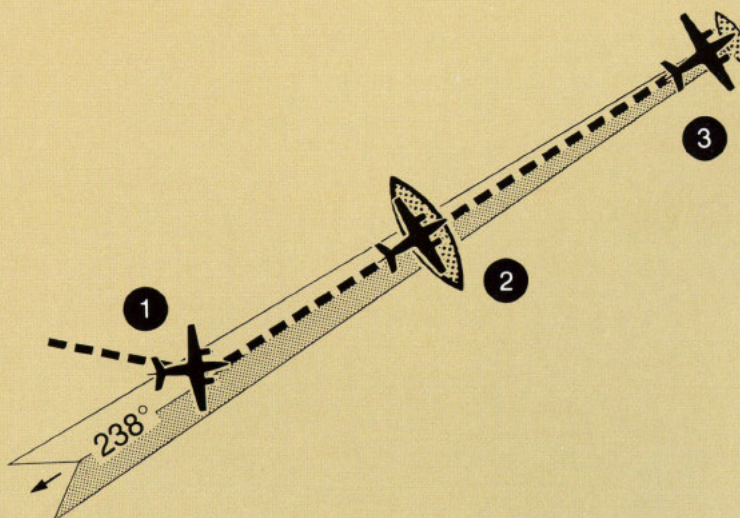
**3.** Prior to procedure turn you will return to HDG mode in order to select your outbound heading. Approach Coupled mode will automatically cancel.

During the procedure turn outbound, the deviation bar shows pictorially that the aircraft is flying away from the Localizer centerline at a 45° angle on a selected heading of 283°.



**4.** Now you have reset the heading select bug to 103° and made a 180° turn to this heading. This 103° heading will intercept the front course. The PNI clearly pictures the course you are to intercept and the angle of interception. APPR ARM mode has been selected so that automatic capture of the Localizer will occur.

## Front course ILS approach with missed approach and Go-Around

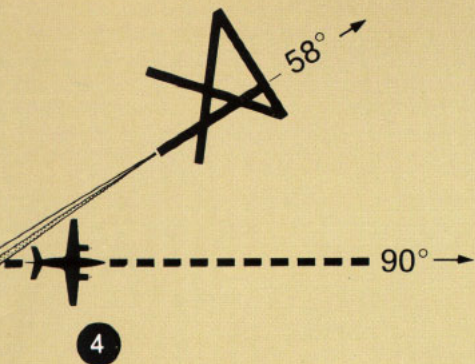


1. Continuing the maneuver on preceding page, APPR coupling occurs and the Glideslope mode is automatically armed. The Command V-bar will command a turn to the LOC course and the PNI shows your position in relation to the LOC course.

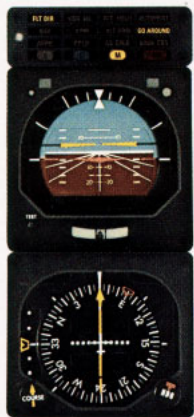


2. The Autopilot (or pilot) is following the Command V-bar on the FCI which commands the necessary heading to maintain on centerline of the Localizer. At the Outer Marker the Glideslope pointer is approximately at midpoint, Altitude Hold is automatically disengaged and Glideslope capture occurs when the airplane passes through beam center. The V-bar will command a descent on the Glideslope and on Localizer.





4



3. At the Middle Marker a missed approach is executed by pressing the Go-Around button on the throttle as you increase power. This disengages the Autopilot and the FCI commands the correct nose-up attitude and wings level. At the discretion of the pilot, the Autopilot may be reengaged to complete the missed approach. Some airplanes are certified with autopilot remaining engaged when GA selected.



4. The heading "bug" has been previously set to the missed approach heading, 90°. Activating the HDG mode will cause the Command V-bar in the FCI to command a turn to that heading. Pitch-up attitude may be adjusted from the Go-Around angle by using CWS or the Vertical Trim control on the Autopilot controller, either of which terminates "GA" mode.

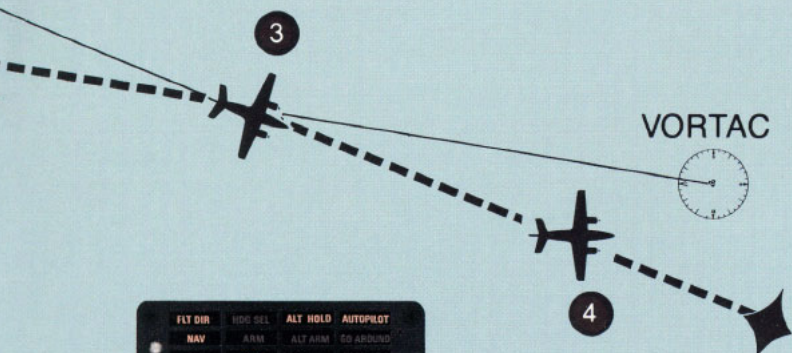
## RNAV capture.



1. The aircraft is flying an OMNI airway in HDG mode on a heading of 80°.

2. A waypoint has been established and the RNAV computer is in ENROUTE mode. A 112° course to the waypoint has been selected and NAV mode pushed "on". HDG and NAV/ARM modes are activated for automatic capture of the 112° course to the waypoint. The capture rate is now being computed based on beam rate. The airplane must be headed toward the selected course in order for NAV/CPLD to occur.

360°



3. Capture sequence starts when NAV/CPLD mode is automatically engaged, cancelling the NAV/ARM and HDG modes. The Command V-bar will call for a right bank which is being satisfied by the Autopilot.



4. The aircraft has completed its turn to the 112° course. A wind correction produces an aircraft heading of 105°, displaying a 7° "crab" angle to maintain the 112° course.

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