PILOT'S GUIDE

KFC 300 FLIGHT CONTROL SYSTEM

KING

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KFC 300 Flight Control System Certifications.

Beechcraft:	Super King Air 200 King Air A100 King Air E90
Cessna:	Citation 421B Golden Eagle
Dassault-Breguet:	Falcon 10
Piper:	Cheyenne PA 31T
Mitsubishi:	MU2J
Rockwell:	Sabre 75A Commander 690A

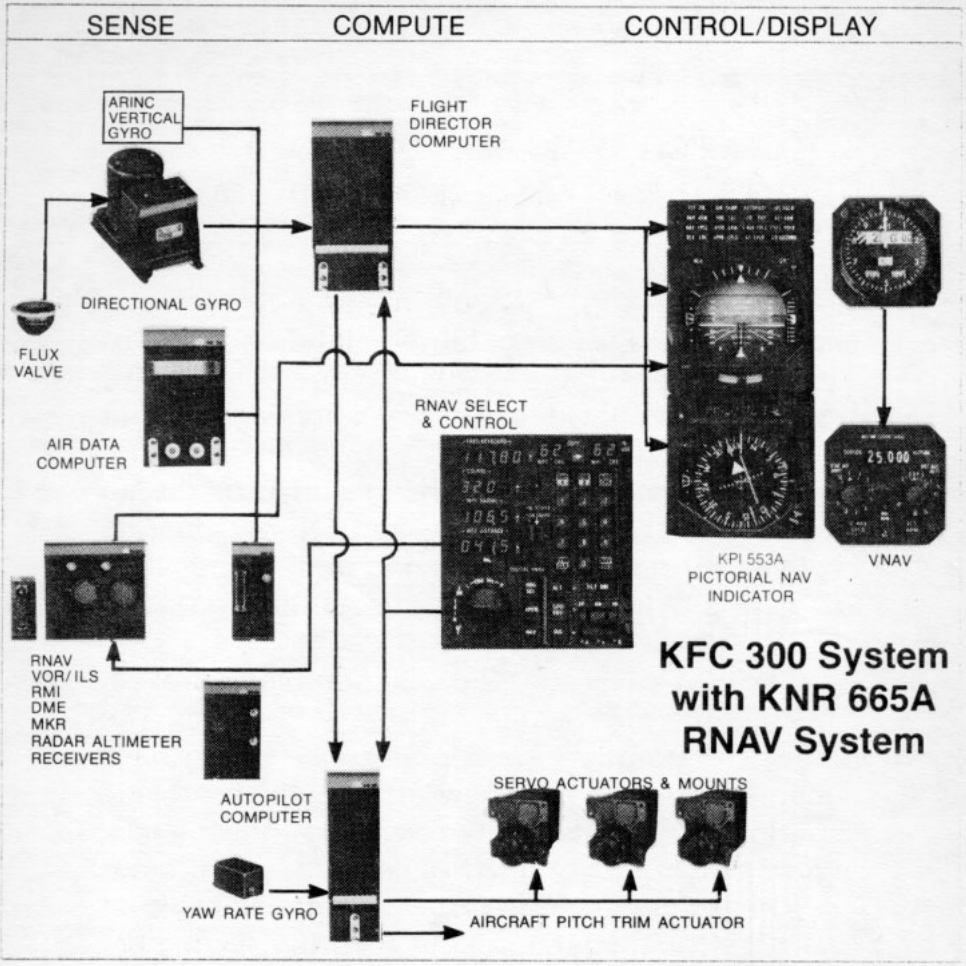
Introduction to the KFC 300 Flight Control System

The new King KFC 300 integrated Automatic Flight Control System is the outstanding result of a decision to assemble a highly competent, creative engineering staff with extensive experience in both avionics and flight systems for commercial and military applications, to develop and produce an advanced Flight Control system. New, separate facilities for engineering, testing and manufacturing were provided and a very substantial corporate investment committed.

The design of the KFC 300 combines proven, conventional approaches with new concepts. The modes of operation include all those which have become standard, plus new modes which provide superior navigational utility, operating convenience, flight safety and workload relief to the flight crew.

These unique modes provide capabilities never available in commercial flight control systems before the KFC 300.

Notice:
This manual contains general information on the KFC 300 Flight Control System. Specific FAA approved information on procedures and limitations for a particular aircraft are contained in the Aircraft Flight Manual supplement. Be sure to familiarize yourself with this specific information prior to any flight operation of the KFC 300 Flight Control System.



KFC 300 System Integration

The system diagram above shows the components of the KFC 300 integrated Flight Control System and their relationships.

The system is functionally divided into four parts: sense, compute, display and control. All sensor information (pitch and roll reference; slaved compass; RNAV/VOR/LOC/GS; DME; marker receiver; radar altimeter; and air data computer) is fed into the KCP 320 Flight Director Computer.

The Flight Director Computer computes roll and pitch steering commands. These two commands are routed to both the KCI 310 Flight Command Indicator, where they are displayed on the "V-Bars" as visual guidance commands, and to the KAC 325 Autopilot Computer where the steering commands and aircraft yaw rate information are combined to generate the aileron, elevator and rudder drive commands for the Autopilot.

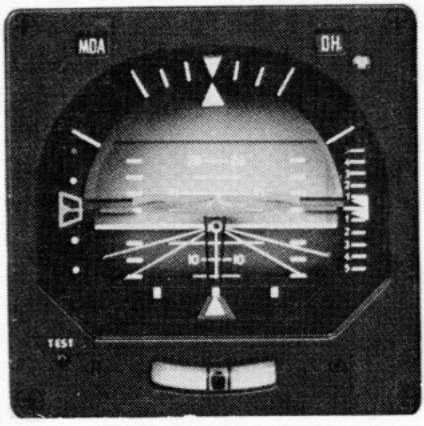
Using the same pitch and roll commands provides totally consistent Flight Director steering command and autopilot control. There is no disagreement in computation. The autopilot simply converts the pitch and roll steering commands from the Flight Director computer, displayed on the "V-Bars" in the FCI, into the required elevator and aileron position commands.

Full integration of Flight Director and Autopilot allows the flight crew to delegate the manual effort to the autopilot while monitoring its activity with the Flight Director.

Modes of Operation Flight Director System:

Mode	Guidance Display Provided on FCI and PNI
ATTITUDE REFERENCE	(Power on, no modes selected) Existing Roll, Pitch Attitude and Heading Command bars are out of view
FLT DIR (Flight Director)	Pitch Attitude and Heading Hold Commands appear on command bars. System maintains heading that exists at time of Flight Director Mode selection.
HDG SEL (Heading Select/Preselect)	Roll Command to Heading selected on Heading Marker in PNI
NAV ARM (VOR and RNAV)	Standby mode for automatic capture of selected course
NAV CPLD (VOR and RNAV)	Active Roll Command to capture and track selected OMNI and RNAV course
APPR ARM (ILS, VOR & RNAV)	Standby mode for automatic capture of Approach path
APPR CPLD (ILS, VOR & RNAV)	Roll and Pitch Commands to Capture and Track LOC for precision approaches. Roll Commands for VOR and RNAV non-precision approaches
GS CPLD	Capture and Track of Glideslope beam
REV LOC	Roll Command to capture and track reverse LOC course, automatically selected with APPR ARM if intercept angle is greater than 90°. After APPR CPLD, roll command to track reverse LOC course
GO AROUND	Pitch and Roll Command to Missed Approach Climb Attitude and wings level
VNAV CPLD (VNAV, RNAV vertical guidance)	Pitch Command to Capture and Track computed Vertical Flight Path, and Capture Altitude selected in VNAV computer window
ALT ARM (Altitude Select/Preselect)	Standby mode for automatic altitude capture
ALT HOLD	Pitch Command to Hold Altitude
IAS HOLD	Pitch Command to Hold Airspeed
MACH or SPD PRF (Mach Hold or Speed Profile)	Pitch Command to Hold Mach No. or preset Speed Schedule
YAW DAMP	Stability Augmentation in Yaw Axis
AUTOPILOT	Control Response to all Selected Flight Director Modes Plus: • 3-Axis rate stabilization • Automatic turn coordination • Automatic Pitch Trim

KFC 300 System Panel checklist:



1. The KCI 310 Flight Command Indicator displays the following information:

Pitch and roll attitude
Pitch and roll commands
LOC deviation
Glideslope deviation
VNAV flight path angle or deviation
Minimum Descent Altitude (MDA)
Decision Height (DH)
Skid/Slip on Inclinometer

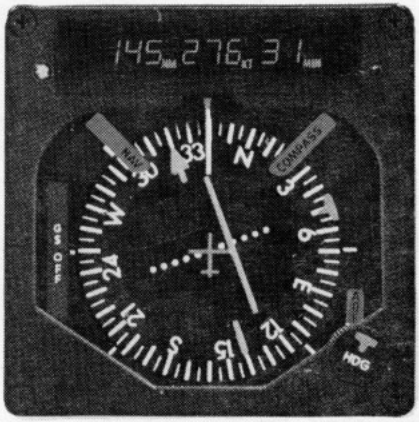
Separate wiring from remote vertical gyro to attitude indicator and strict separation of attitude and command bar power circuits assure the pilot of attitude reference even in the event of a Flight Director Computer failure.

2. The KAP 315 Annunciator Panel annunciates all vertical and lateral Flight Director/Autopilot system modes, including all "armed" modes prior to capture. Simply stated, it tells the pilot when his selected mode has been received and accepted by the system and if an "armed" mode capture has been initiated.

3. The KPI 553A Pictorial Navigation Indicator displays the following information:

- Aircraft magnetic heading
- Selected heading
- Selected VOR/LOC/RNAV course
- To-From course indication
- Course or LOC deviation
- RMI or ADF bearing
- Glideslope deviation
- Distance, groundspeed and time-to-station
- Radar altitude readout from 990 ft. to touchdown

Note: KPI 552, without distance/speed/time/altitude displays may be substituted for KPI 553A.

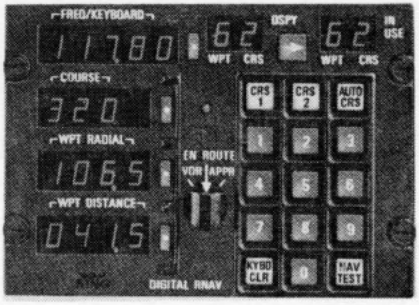


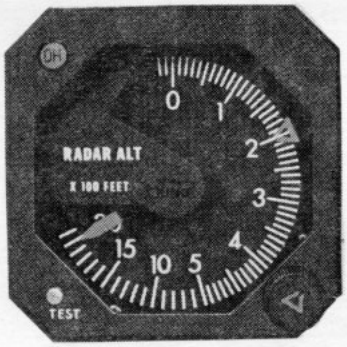
4. The KVN 395 Vertical Navigation Computer provides:

- Vertical navigation track computation
- Altitude selection
- Altitude alerting
- Slant range correction for DME and RNAV distance display
- Waypoint (along track) distance bias
- Vertical path angle and deviation are displayed to the pilot on the right side of the Flight Command Indicator.

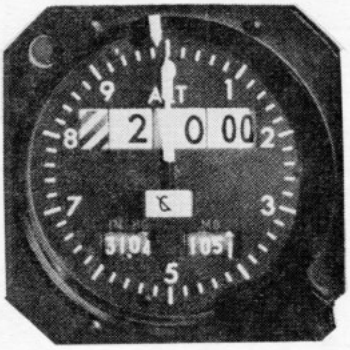
MDA switch may be actuated on all approaches to annunciate MDA.

5. The KNR 665A RNAV Computer (KCU 565A Control/Display shown) provides the KVN 395 VNAV Computer with distance to waypoint information when in the RNAV Enroute or Approach modes. It provides RNAV/VOR deviation signals to the Flight Control System and LOC/GS deviation whenever an ILS channel is selected. The desired VOR/LOC/RNAV course is selected on the KCU 565A.



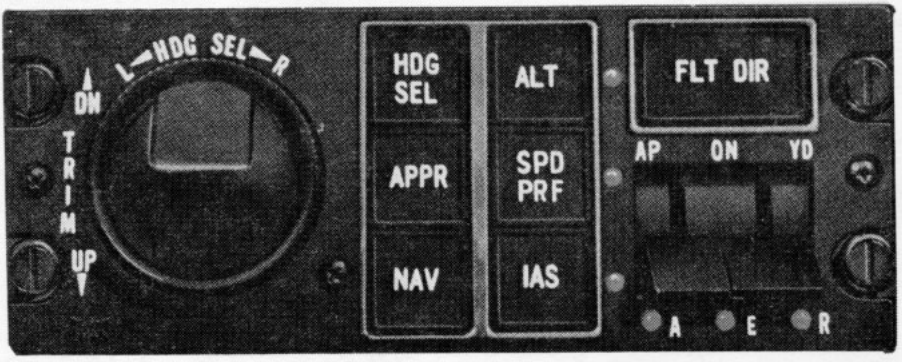


6. The KRA 405 Radar Altimeter (optional) schedules Glideslope gain for smooth tracking of the Glideslope beam from the Outer Marker to touchdown during an ILS approach. The altitude is displayed in 10 ft. increments on the KPI 553A from 990 ft. to touchdown. The Marker Beacon Receiver actuates a Glideslope gain reduction at the Middle Marker if a radar altimeter is not installed, or automatically operates as a backup if the radar altimeter should fail.

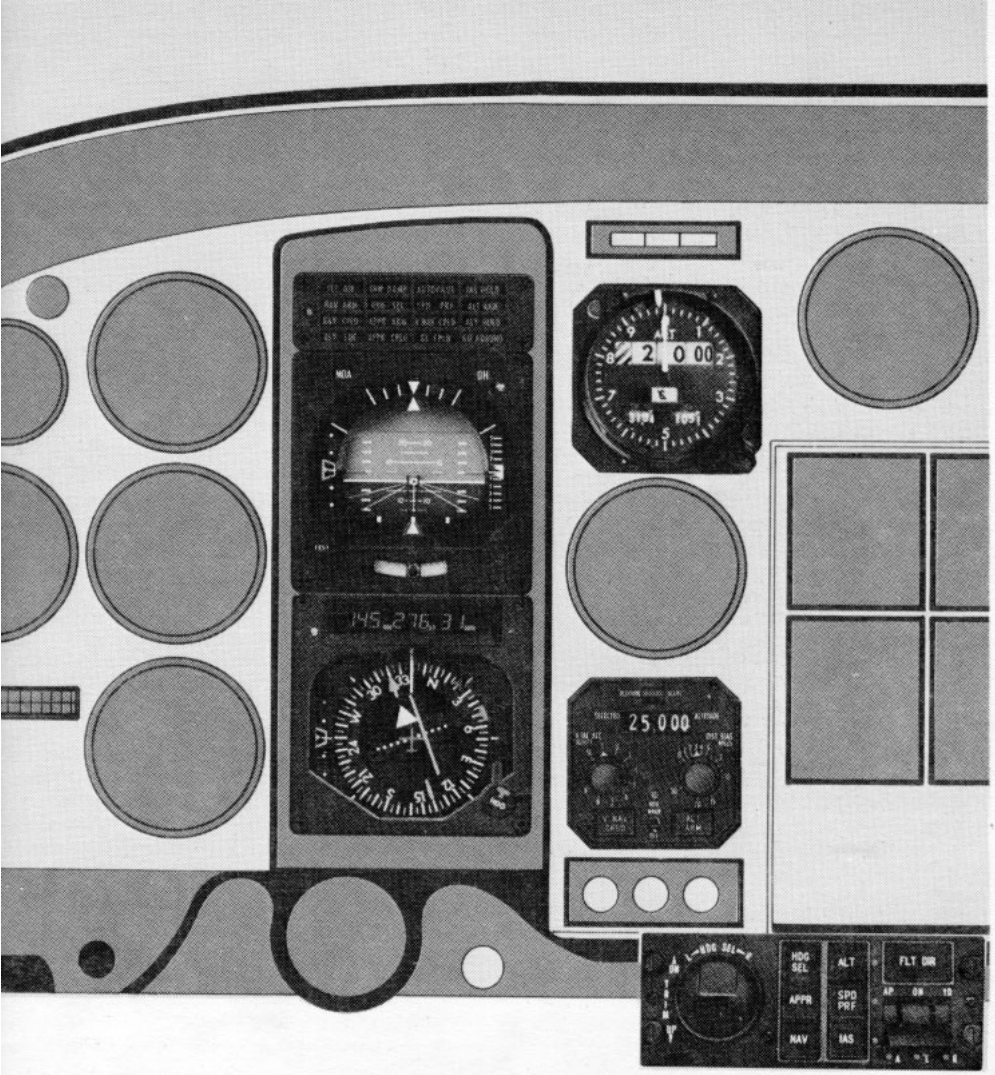


7. Servoed Altimeter provides corrected altitude information to the KVN 395 VNAV Computer and encoding for an ATC transponder.

8. The KA 35A Marker Beacon lights



The KMC 340 Mode Controller contains seven pushbutton switches for turning on the Flight Director and selection of FD modes; solenoid-held switches for autopilot and yaw damper; a knob to proportionally slew (rotate) the heading "bug" in the Pictorial Navigation Indicator; and a vertical trim rocker switch. It also displays six warning lights that alert the pilot to a failure in the Air Data Unit, or individual servo disengagement by the servo monitor system.



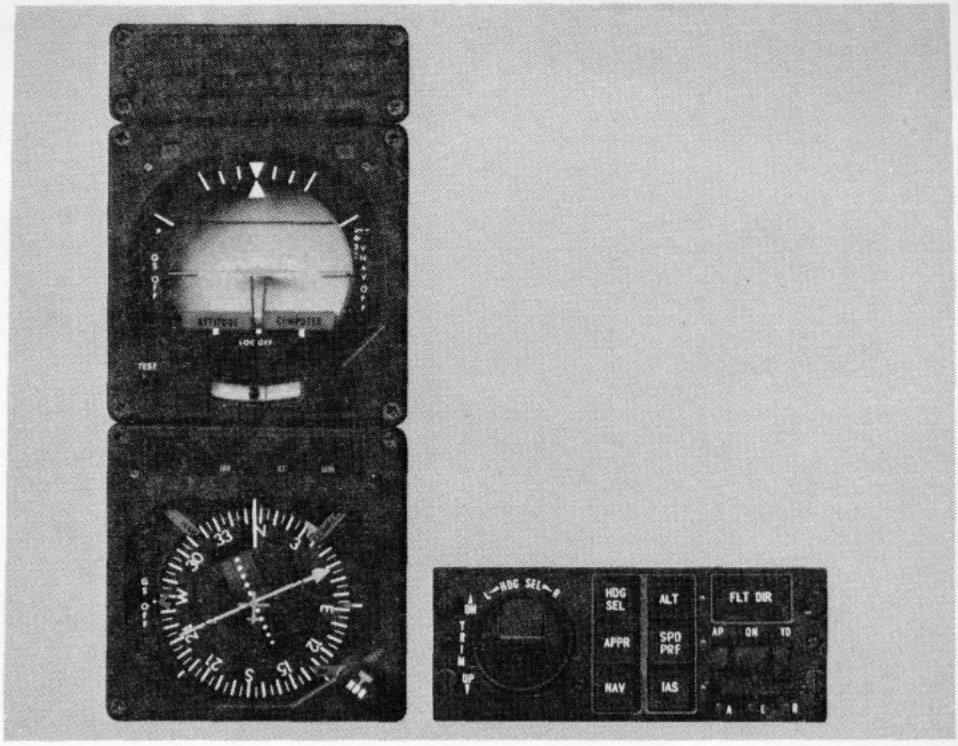
Operating the KFC 300 System

There are sixteen (16) modes of operation that are provided by the KFC 300 system to offer the pilot automatically computed guidance in response to his manual programming of a flight plan sequence.

Most of these modes are activated by lighted pushbutton switches on the Mode Controller and VNAV Computer. 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.

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 shutting off modes.

The Basic Attitude Reference or "Gyro" Mode is energized with aircraft "power on," but no modes selected (Annunciator Panel blank). It provides indication of aircraft heading on the Pictorial Navigation Indicator, and roll and pitch attitude and sideslip on the Flight Command Indicator. The FCI command bars are biased out of sight.



System safety is assured by integrity monitors.

The KFC 300 extensively monitors the validity of the system sensors, the Flight Director and Autopilot Computers and the servo actuator control loops to alert the pilot when information is faulty and when the system is not responding correctly to command signals.

"Invalid" signals provide both visual warning by means of the flags and annunciators, and "inhibit" signals which are routed to the KFC 300 switching logic to "lock out" modes which will not operate reliably. This not only warns the pilot, but also makes it impossible to engage the system in a mode which has invalid information. For example, if a Flight Computer, Autopilot Computer or Vertical Gyro failure exists, no modes can be selected and the Autopilot cannot be engaged.

A NAV Flag prior to the selection of NAV ARM will prevent the selection of NAV ARM. The NAV Flag must be out of view for 7.5 seconds prior to NAV CAPTURE to achieve CAPTURE. The system will remain in NAV ARM or NAV CAPTURE if NAV Flag should occur in either respective mode. A NAV Flag prior to the selection of APP ARM will prevent selection of APP ARM. A NAV Flag following APP ARM will terminate APP ARM. The NAV Flag will also prevent APP CPLD and also terminates APP CPLD.

A Glideslope Flag prevents GS CPLD. Following GS CPLD a GS Flag will terminate GS CPLD and the system will revert to PAH.

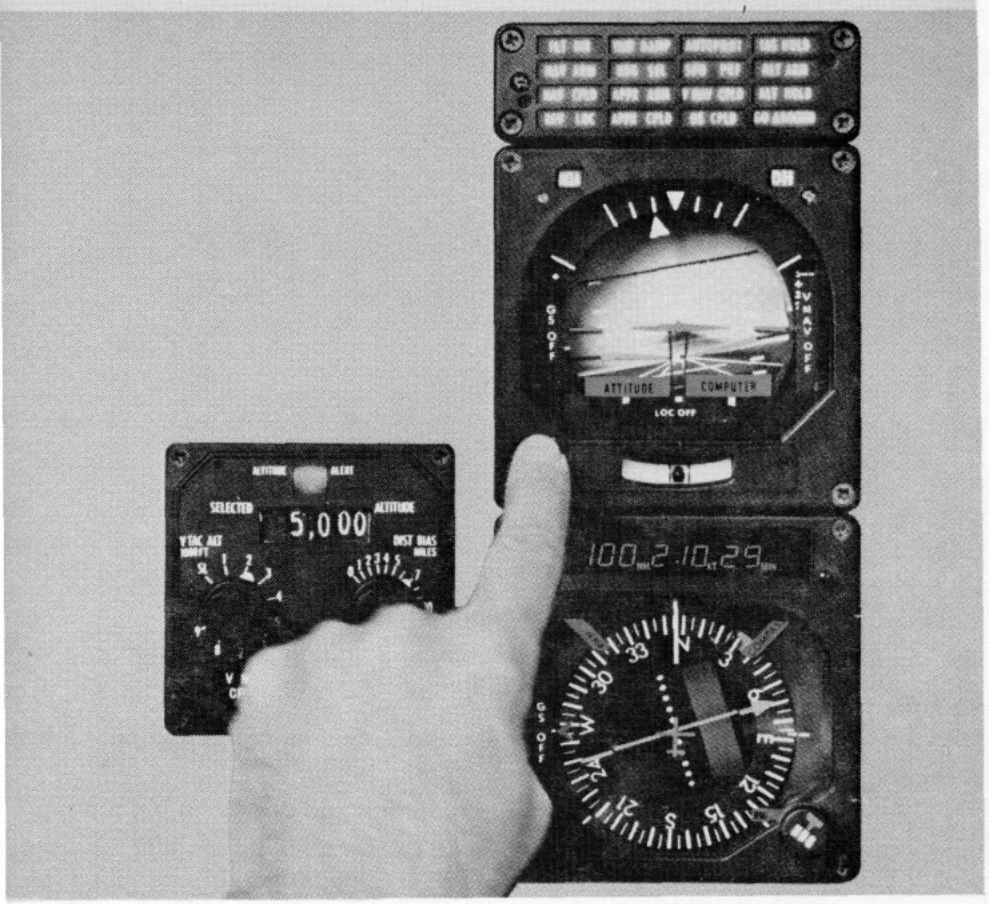
The illustrations above show the KFC 300 Flight Director instruments and their surrounding cockpit displays with all warning flags in view. In addition, the annunciator lights on the Mode Controller are lighted.

Flight Command Indicator warnings: attitude and computer flags, and glideslope, localizer and VNAV shutters obscure displays when information is invalid.

The Pictorial Navigation Indicator warnings: NAV, and compass flags, and glideslope shutter.

In addition the Servoed Altimeter, and the Radar Altimeter are flagged.

The Mode Controller warning lights show failure in the aileron, elevator or rudder servos (horizontally) and altitude, Mach (or Speed Profile) and IAS sensors (vertically).



Preflight test determines, before takeoff, that the system is operating normally.

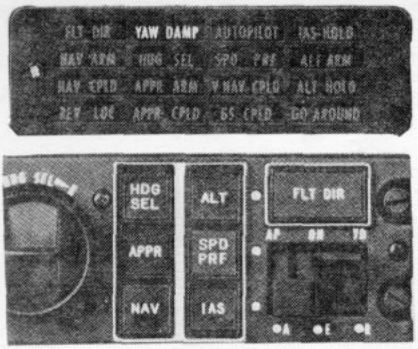
With power on, the pilot first engages the Flight Director to bring the "V-bars" into view. Then he engages the Autopilot and Yaw Damper. The Autopilot will not engage when the Flight Director is not operative.

The pilot then presses the preflight test button on the Flight Command Indicator as shown in this photo. This assures him that the mode switching logic and warning lights are operational, and inserts test signals.

The Flight Command Indicator displays a simulated climbing right turn of 10° pitch up and 10° right roll on the attitude display. Initially, the command bars remain centered with the symbolic reference airplane.

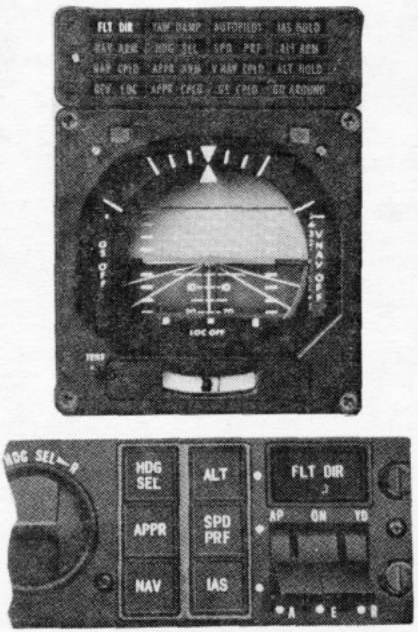
Seconds after the test button was actuated, an abrupt 10° pitch down command, 20° roll left command, and 6⅔° left heading error are then fed into the Flight Computer. This action trips all three Servo actuator monitors. The Autopilot and Yaw Damper will disengage to demonstrate proper computer monitor operation. Correct Flight Computer response brings the command bars into exact alignment with the previously offset horizon display, as shown in the illustration above.

Normal responses in the self-test cycle indicate that the system will operate correctly in flight.



YAW DAMP Mode

The YAW DAMP mode is selected by using the solenoid-held toggle switch on the Mode Controller. YAW DAMP may be used with or without any Flight Director mode. It usually provides a more stable aircraft whether control surfaces are operated manually or with autopilot engaged.



FLIGHT DIRECTOR (FLT DIR) Mode

The FLIGHT DIRECTOR mode is activated by depressing the "FLT DIR" button on the Mode Controller.

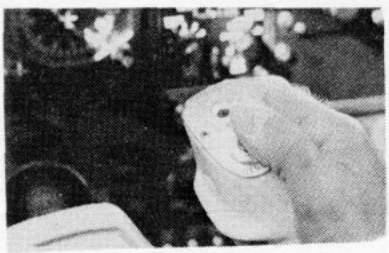
The FCI command bars will be brought into view to provide the pilot with steering commands to maintain the pitch attitude and aircraft heading that existed at the time of FLT DIR engagement.

If pitch attitude and/or heading are changed, recycling the FLT DIR button will synchronize the command bars to the new situation.

The "SYNC" button on the pilot's control wheel permits the pilot to activate the FLT DIR mode and synchronize the command bars without removing his hand from the control wheel.

The Flight Director can also be activated by direct selection of any specific mode, which brings command bars into view and illuminates both FLT DIR and the appropriate annunciator.

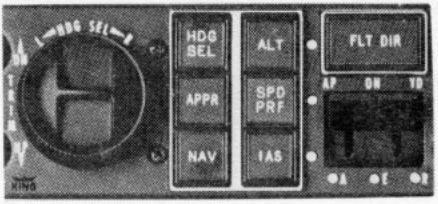
Special note: The FLT DIR mode must be selected before the autopilot can be engaged.



The AUTOPILOT Mode

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 interlocked mechanically so that the YAW DAMP switch 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: Overpowering the Autopilot in the pitch axis in flight for periods of 3 seconds or more will result in the autotrim system operating in the direction to oppose the pilot and will, therefore, cause an increase in the pitch overpower forces, and if Autopilot is disengaged, will result in a pitch transient control force. Operation of the Autopilot on the ground may cause the autotrim to run because of backforce generated by elevator downsprings or pilot induced forces.

HEADING SELECT/PRESELECT (HDG SEL) Mode

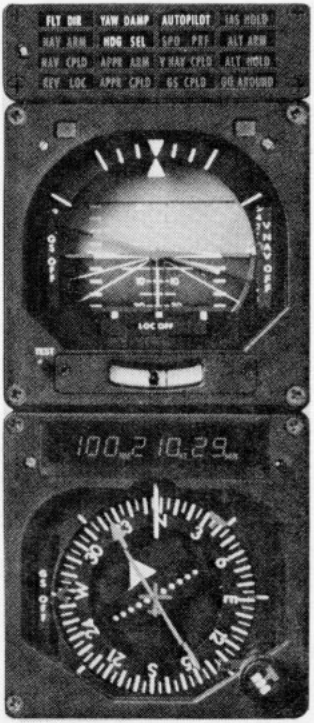
The HDG SEL button on the Mode Controller is depressed to activate the HDG SEL mode. "HDG SEL" will light on the annunciator panel and a computed, visually displayed bank command is shown on the FCI to turn and hold the desired preselected heading.

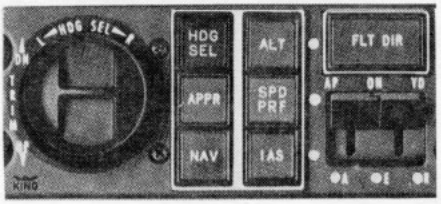
A desired heading can be preselected or adjusted by positioning the heading "bug" on the PNI. This may be done with the HDG SEL knob on the Mode Controller or the HDG knob on the PNI.

The steering command bars 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 satisfy the command or, if the autopilot is engaged, the aircraft will automatically bank turn to, rollout and hold the preselected heading. As the selected heading is achieved, the command bars will command a rollout to hold that heading.

With the HDG SEL mode in operation, subsequent changes made in the heading "bug" position on the PNI will immediately cause the command bars on the FCI to call for a turn to the new heading, unless the HDG SEL button on the Mode Controller has been depressed again to cancel the HDG SEL mode.

The HDG SEL mode is cancelled when NAV or APPR coupling occurs, or when FLT DIR mode button is pushed to OFF.





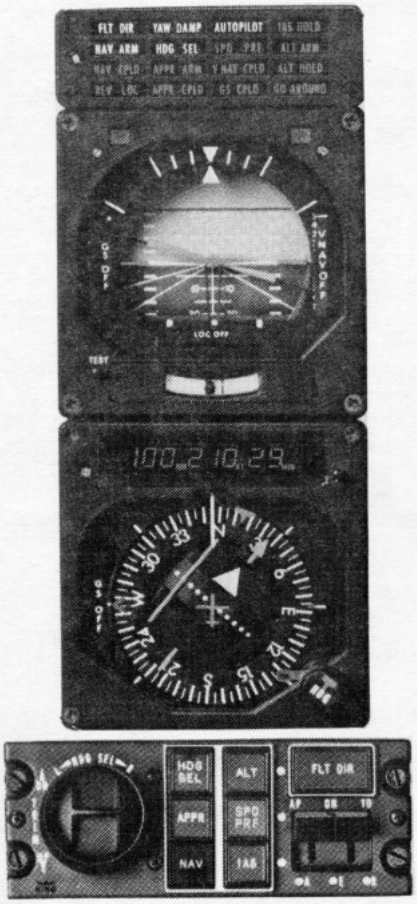
NAVIGATION (NAV ARM and NAV CPLD) Mode

The NAV mode provides visual bank commands on the Flight Command Indicator 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 distance and radial from the VORTAC station to the selected waypoint.

2. Set the PNI course pointer on the desired course. (If you have a King KNR 665A Digital RNAV system, you may preselect complete information for 10 waypoints. Steps 1 and 2 will be accomplished with the KCU 565A keyboard.)



3. Establish angle of intercept by setting heading "bug" and engaging HDG SEL 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, provided a valid VOR or VORTAC signal is being received. Heading hold and heading select, if operating, are retained until capture occurs.

The VOR or RNAV "course-capture" point is variable to prevent overshoot and depends on distance, angle of intercept and speed of capture. Upon capture, a bank command will be introduced on the FCI, the HDG SEL, 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 bars which will call for a rollout to wings level when on course. Crosswind compensation is provided as necessary to track course.

If the NAV mode is selected with the wings level within ±4° 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 can be selected by resetting the NAV course arrow on the PNI, or a preselected course can be called up by simply pressing the CRS 2 button on the KCU 565A Digital control and display for the KNR 665A RNAV system when it is installed. This will cause an immediate command 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 SEL or APPR modes, or pushing FLT DIR to OFF.

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

The APPR mode provides visual bank and pitch commands on the FCI to capture and track precision ILS (LOC and Glideslope) beams, or non-precision VOR or RNAV courses.

Operation of the APPR mode requires capture and track of precision ILS (LOC and Glideslope) beams, or non-precision VOR or RNAV radials.

Operation of the APPR mode requires the pilot to:

1. Set the NAV receiver frequency.

2. Set the PNI course pointer "bug" to the runway heading or approach front course. If you have a KNR 665A RNAV system installed, all you do is select the preselected waypoint number on the keyboard of the KCU 565A (this may be a waypoint at the end of the runway or an ILS frequency), then just press the CRS 1 button on the KCU 565A.

3. Set the HDG SEL "bug" to the desired intercept angle and engage HDG SEL mode.

4. Depress the button on the APPR mode controller.

The automatic APPR capture function will be immediately armed (provided NAV receiver and/or RNAV computer signals are valid). "APPR ARM" will be lighted on the Mode Annunciator Panel.

In APPR ARM mode, prior to capture, the heading hold mode is retained and HDG SEL is retained or may be selected to allow the pilot to adjust heading to Approach Control vectoring instructions.

The LOC beam or VOR/RNAV "capture" point will vary depending on IAS, angle of intercept and rate of closure. 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 bars, which will command a rollout to wings level when the aircraft is on course. Automatic crosswind compensation will provide precise tracking. RNAV/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 a precision approach, LOC and Glideslope deviation are displayed on both the FCI and 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 when LOC front course capture has occurred. Automatic Glideslope capture occurs as the aircraft approaches the beam from above or below.

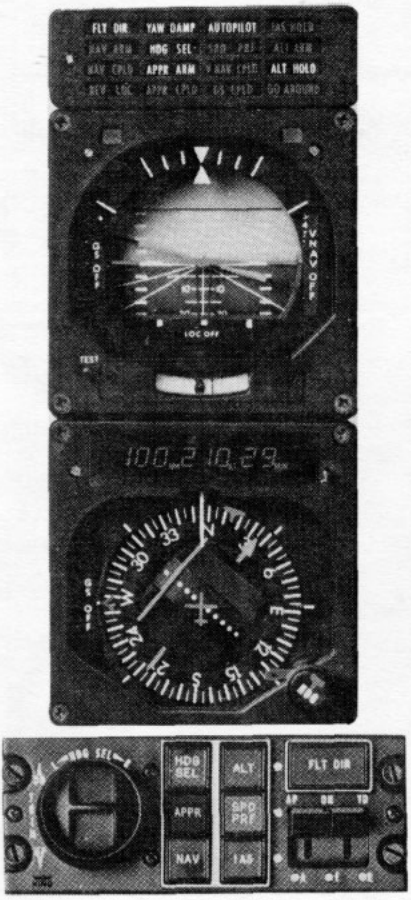
Upon capture of the Glideslope beam, "GS CPLD" is lighted on the Annunciator Panel and a smooth capture command is displayed by the command bars. The pilot (or autopilot) controls the aircraft to satisfy the command bars.

At 1250 feet, if a radar altimeter is installed, all data in upper right window of KPI 553A PNI is wiped clean and dashes are shown until descent to 990 feet . . . then radar altitude is displayed and counts down in 10 ft. increments to touchdown.

Upon GS capture, the ALT HOLD and IAS (or MACH) HOLD modes (if active) are cancelled. However, ALT HOLD may be manually reselected to maintain altitude upon descent to MDA or DH if visual contact is not established.

During VOR or RNAV approaches Glideslope capture will not occur because the absence of LOC frequency locks out this function.

APPR CPLD mode is cancelled by selection of HDG SEL, NAV, or GO-AROUND modes . . . or pushing FLT DIR or APPR to OFF.



ILS Approach Monitor

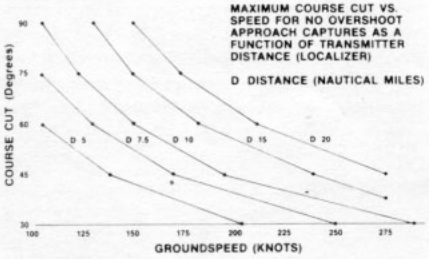
A unique ILS Approach Monitor compares the No. 2 LOC and GS deviations to pre-set values when No. 2 is tuned to a LOC frequency. If the pre-set values are exceeded the APPR CPLD and GS CPLD mode lights will flash intermittently. The Approach Monitor warns the pilot that he is not flying the Approach path within limits. Both APPR CPLD and GS CPLD flash during the capture maneuver until the airplane is on the proper flight path.

BACK COURSE (REV LOC) Mode

Whenever a LOC frequency is selected and the aircraft intercepts the LOC course at an angle greater than 90° from the inbound front course, the REV LOC mode is automatically activated. The LOC receiver signals are reversed to permit the FCI steering command display to operate on a fly-to rather than a fly-from basis on the reverse course. "REV LOC" is automatically lighted on the Annunciator Panel.

When capturing, the system will command flying outbound on the front course or inbound on the back course.

Operation on REV LOC is identical to front course operation, except that automatic Glideslope capture is "locked out" by the switching circuitry.



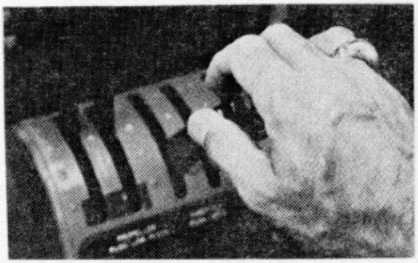
GO-AROUND Mode

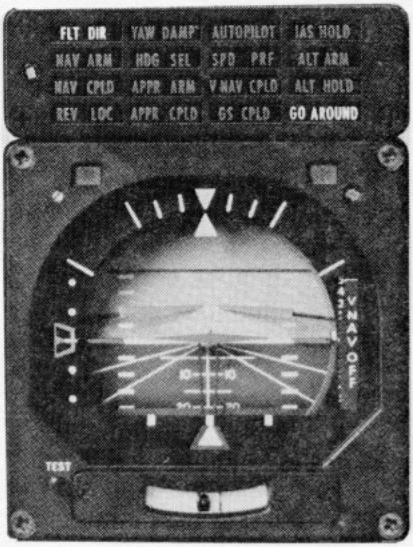
The go-around mode is primarily designed to assist the pilot in establishing the proper pitch attitude under missed-approach conditions. The go-around switch is located on the left throttle lever for pilot convenience when applying climb-out power.

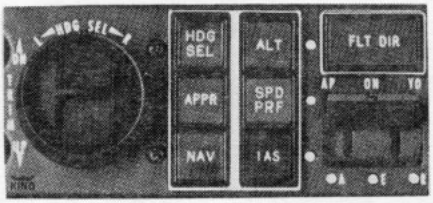
Depression of the go-around switch during an approach cancels all Flight Director modes and disengages the autopilot, if it is engaged. A wings-level and nose-up command is displayed by the FCI and "GO AROUND" is lighted on the Annunciator Panel. The magnitude of the nose-up command is adjustable to 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 SEL for continuous heading control during departure. ALT, NAV and APPR modes may also be armed for automatic capture and guidance during the departure sequence.

The GA MODE is disengaged by selection of ALT, IAS, MACH/SPD PRF, V'NAV, ALT CAPT, VERTICAL TRIM, CYCLE FLIGHT DIRECTOR OFF SWITCH, or PITCH SYNCH. The Autopilot can be engaged with the GA mode active.







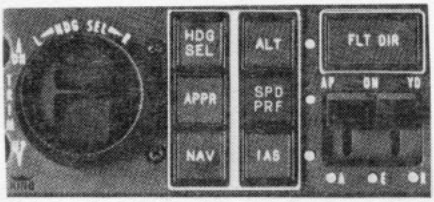
The IAS HOLD Mode

The IAS HOLD mode is selected by depressing the IAS button on the Mode Controller. "IAS HOLD" will be lighted on the Mode Annunciator Panel and the pitch command bars will be activated on the FCI to call for pitch maneuvers necessary to maintain a constant indicated airspeed. The reference airspeed will be the indicated airspeed at the time of IAS HOLD engagement, and is independent of power setting.

If the autopilot is engaged, airspeed will be automatically maintained, and loss or gain of altitude will depend on power settings.

The reference airspeed may be adjusted at a rate of two knots per second by use of the Vertical Trim switch on the Mode Controller.

The IAS HOLD mode is cancelled by selection of GO-AROUND, VNAV CPLD, ALT HOLD, SPEED PROFILE (or MACH) HOLD, Glideslope capture, or FLT DIR to OFF.



SPEED PROFILE (SPD PRF) Mode

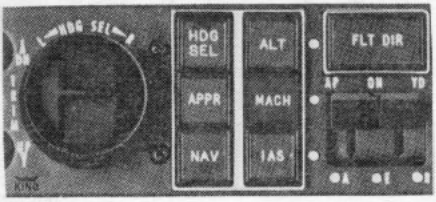
The SPEED PROFILE mode for turboprops and low performance jet aircraft is used primarily in climb or descent.

The pilot engages SPEED PROFILE at the speed appropriate to his altitude at the time of engagement. Or he adjusts to the appropriate speed for his altitude with the vertical trim switch after engagement.

The reference airspeed may be adjusted at a rate of two knots per second by use of the Vertical Trim switch on the Mode Controller.

Engagement will cause "SPD PRF" to be lighted on the Annunciator Panel and activate the command bars on the FCI to call for pitch maneuvers necessary to maintain the airspeed appropriate for each altitude entered.

If the autopilot is engaged, the airspeed will be automatically maintained through the prescribed speed for each altitude entered.



MACH HOLD (MACH HLD) Mode

The MACH HOLD mode for jet aircraft is selected by depressing the MACH button on the Mode Controller. "MACH HLD" will be lighted on the Mode Annunciator Panel and the pitch command bars will be activated on the FCI to call for pitch maneuvers necessary to maintain constant Mach number.

The reference Mach number will be that at the time of MACH HOLD engagement, and is independent of power setting. It may be adjusted at a rate of .003 Mach/second by use of the Vertical Trim switch on the Mode Controller.

If the Autopilot is engaged, the Mach number will be automatically maintained, and loss or gain of altitude will depend on power settings.

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 VNAV computer.
2. Establish a climb or descent as appropriate.
3. Depress the ALT ARM button on the VNAV computer. This may be done at any time during the climb or descent before the selected altitude has been attained.

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.

Pitch control during climb or descent may be maintained in the Pitch Attitude, IAS, or MACH (SPD PRF) modes. Climb or descent speed in IAS, MACH (SPD PRF) modes may be adjusted with the Vertical Trim switch on the Mode Controller. Climb or descent to altitude may also be made in the VNAV mode.

ALT ARM is disengaged by depressing the ALT ARM button, by engaging ALT HOLD, by GS capture, by selecting a new altitude on this VNAV computer, or selecting FLT DIR to OFF.

ALTITUDE HOLD (ALT HOLD) Mode

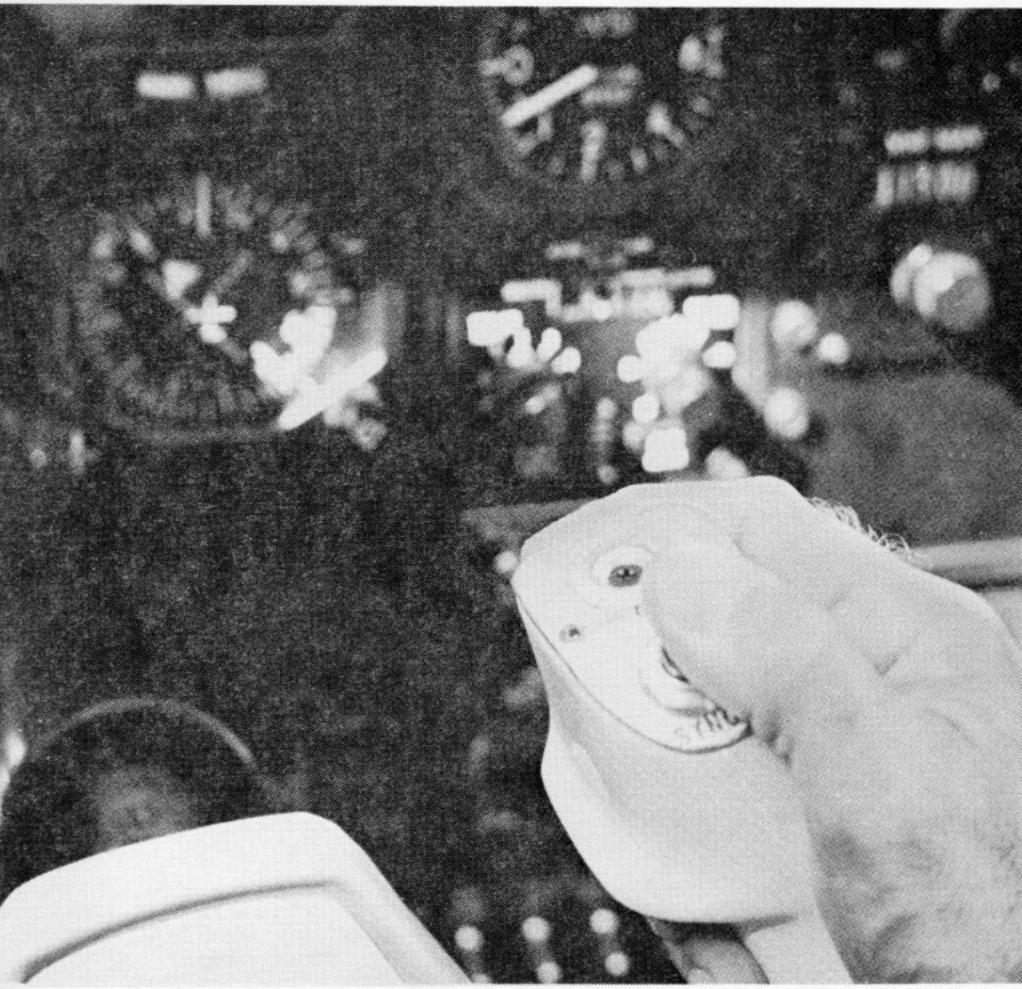
This mode will cause a computed visual pitch command on the FCI command bars to hold the aircraft at the pressure altitude existing at the time it was activated.

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 500 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 IAS, SPEED PROFILE (or MACH), ALT ARM, VNAV CPLD, or GO-AROUND modes, or selection of FLT DIR to OFF.



CONTROL WHEEL STEERING mode

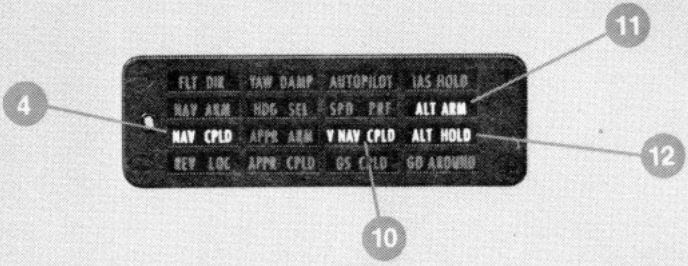
Control Wheel steering provides the pilot with the capability for natural and convenient manual maneuvering of the aircraft without the need to disengage and reengage the autopilot, or reselect any modes of operation.

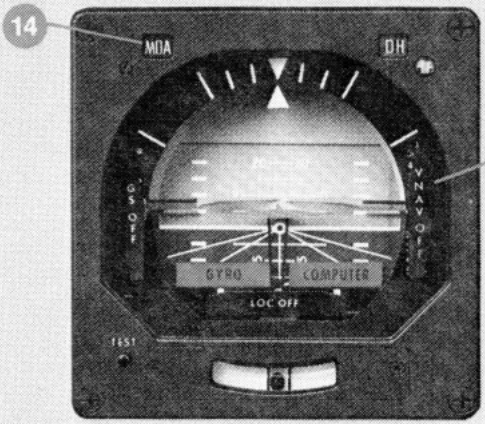
The CWS mode is engaged by continuous pressure on the CWS button, preferably located on the left-hand horn of the control wheel. Operation of the CWS button causes immediate release of Autopilot servos and allows the pilot to assume manual control, while Autopilot control functions and all engaged modes, except HDG SEL, NAV, and APPR are placed in a synchronization state.

This means that all modes except HDG SEL remain in continuous synchronization with the pilot's aircraft maneuvers so that, upon release of the CWS mode button, all previously engaged modes will smoothly reassume control of the aircraft unless decoupled or reprogrammed by the pilot.

When in NAV or APPR after the CWS button is released, the aircraft will resume a path toward the selected radio reference. If in ALT HLD, IAS, SPD PRF, the Flight Director will command the new reference which was present upon release of CWS switch.

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 annunciated. The CWS and SYNC are controlled from the same button.


FLT DIR
YAW DAMP
AUTOPILOT
IAS HOLD
NAV ARM
HDG SEL
SPD PRF
ALT ARM
NAV CPLD
APPR ARM
V NAV CPLD
ALT HOLD
REV LOC
APPR CPLD
GS CPLD
GO AROUND
4
10
11
12


MDA
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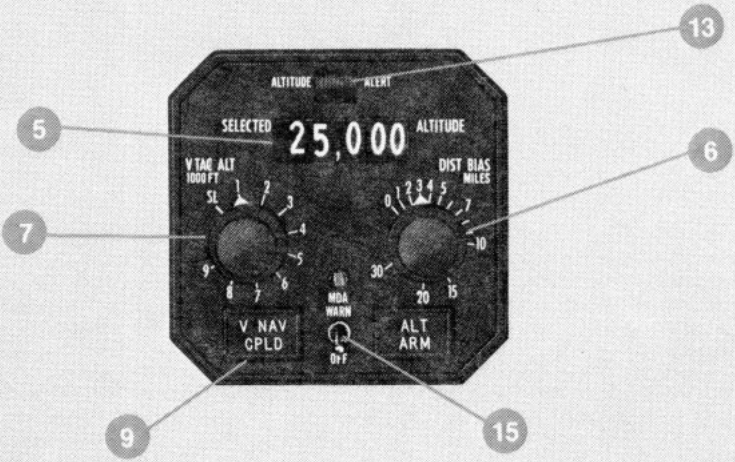
GS OFF
V NAV OFF
GYRO
COMPUTER
LOC OFF
TEST
14
8


ALTITUDE
ALERT
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ALTITUDE
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1000 FT
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OFF
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15

VERTICAL NAVIGATION (VNAV CPLD) Mode

The VNAV mode provides computed pitch commands on the Flight Command Indicator to capture and maintain a vertical track angle, in ascent or descent, to a predetermined altitude with respect to an RNAV waypoint (which can be over a VORTAC). To operate in this mode, the pilot must:

1. Tune a receivable VORTAC frequency.

2. Establish an RNAV waypoint with his RNAV computer and select RNAV mode.

3. Establish his course to the waypoint. (Steps 1, 2 & 3 are accomplished with keyboard when KNR 665A is used.)

4. Have system in NAV CPLD or HDG SEL mode.

5. Set the desired altitude over the waypoint into the VNAV computer.

6. Set along-track bias from 0-30 nm if he wants to reach desired altitude before waypoint.

7. Set the approximate VORTAC station elevation with the left outer concentric knob on the VNAV computer to obtain slant range correction. This adjustment should not be made while VNAV is coupled.

The Vertical Track Angle (VTA) will then be displayed on the right-hand display scale **8** of the FCI in degrees up to a maximum of 5°. As the aircraft flies toward the waypoint at a constant altitude, the VTA will slowly increase. When the desired Vertical Track Angle is indicated on the display scale, the pilot engages VNAV guidance by depressing the VNAV CPLD button **9** on the VNAV computer.

"VNAV CPLD" will be lighted on the Annunciator Panel, **10** the VTA indicated on the display scale becomes the reference flight path angle and the display scale pointer reverts to display of altitude deviation in feet (± 250 ft. full scale) from the selected vertical flight path.

The FCI command bars will deflect to command the pitch up or pitch down maneuver to acquire and hold the flight path.

Engagement of VNAV CPLD mode also automatically activates the ALT ARM **11** function to capture the selected 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, VNAV CPLD will automatically disengage and ALT HOLD will automatically engage, "ALT HOLD" **12** 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 the autopilot is engaged, capture and holding of the Vertical Track Angle and subsequent capture and holding of the desired altitude will be automatic. Adjustment of power will have no effect on the VTA, but will affect the indicated airspeed and vertical speed.

Waypoint distance bias is provided to permit the pilot to acquire a desired altitude at a point up to 30 nm short of the waypoint. For instance, the waypoint could be established at a runway threshold with the desired MPA altitude selected and the waypoint distance biased 1 to 2 miles short to position the aircraft for a straight-in approach. Waypoint bias adjustment should not be made while VNAV is coupled. Power is controlled by the pilot during ascent or descent.

Additional characteristics of VNAV CPLD Mode

Altitude alerting as required by FAR 91.51 for jet aircraft is included in the VNAV computer. Selection of altitude in the window also sets up the alerter. The outer warning band is 1000 to 500 feet above and below the selected altitude and the inner band 500 feet above and below. These band limits are adjustable at installation.

Flight through the outer bands causes the Altitude Alert warning **13** to light on the VNAV computer and on the altimeter. An aural warning also is sounded in the audio system when entering either of the outer bands or flying through the selected altitudes.

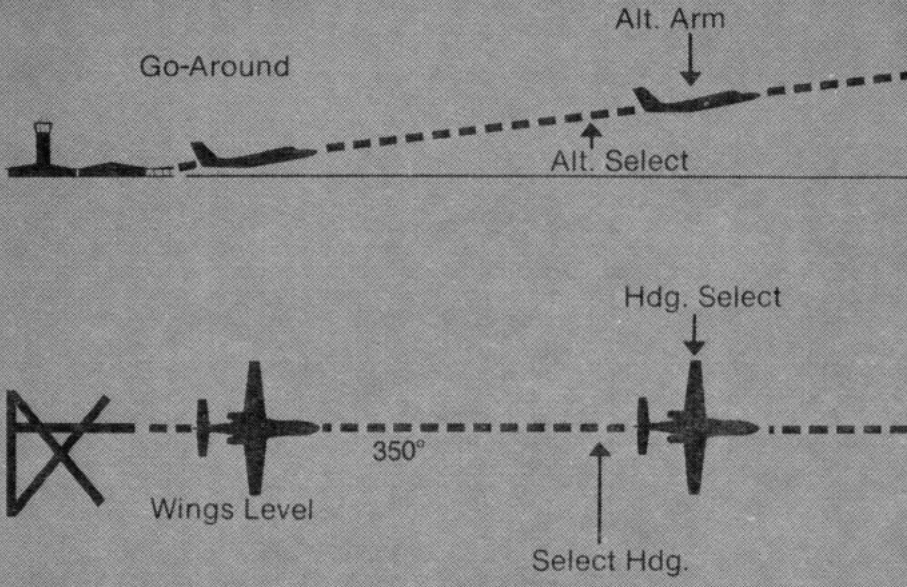
Minimum Descent altitude warning for nonprecision approaches is provided by an MDA annunciator light **14** on the FCI and by an aural warning. The MDA light on the FCI is armed with a toggle switch on the VNAV computer and the desired selected MDA is in the VNAV computer **15**

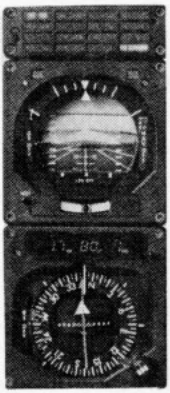
Further safety is assured with the Autopilot engaged by the altitude capture function which automatically captures the selected altitude.

The VNAV CPLD mode is deactivated by selection of any other vertical mode, or by pushing VNAV CPLD or FLT DIR to OFF.

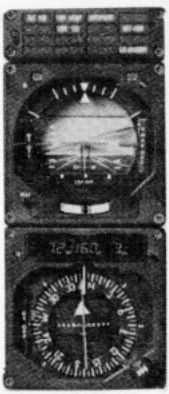
Note: The DME distance is corrected for slant range correction by setting the approximate elevation of the VORTAC on the VNAV computer (7)

Takeoff and climb to selected altitude



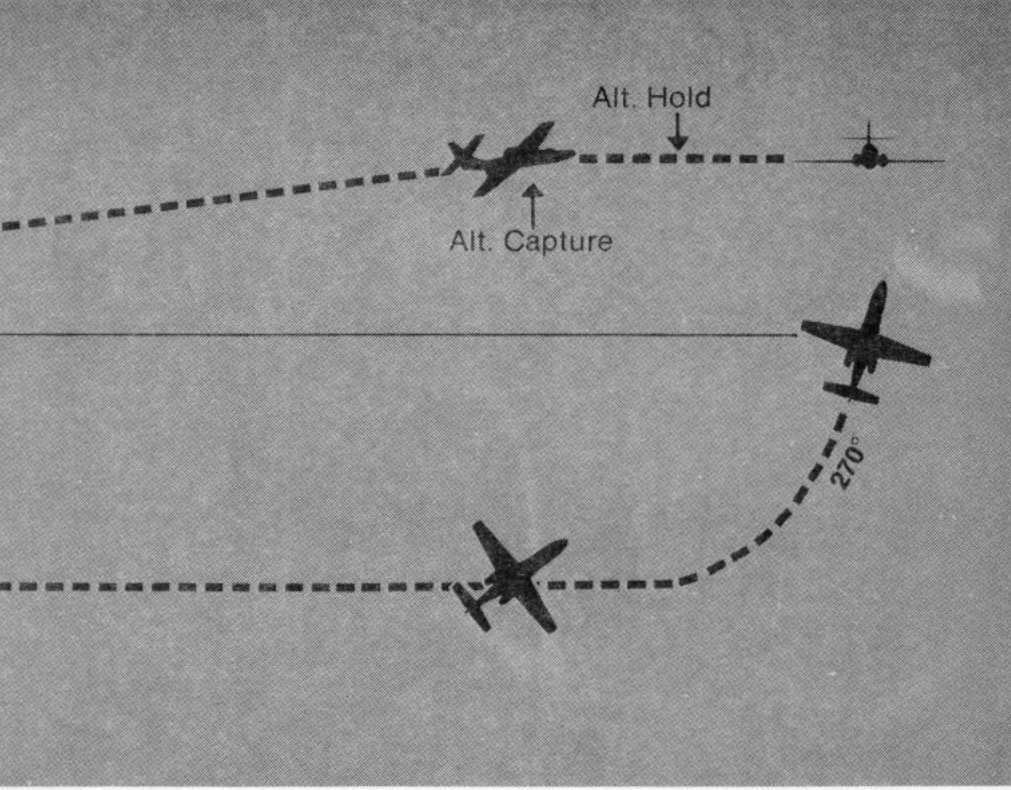


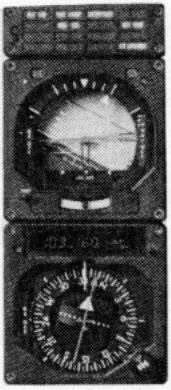
1. Takeoff is in the GO-AROUND mode, activated by depressing the GO-AROUND button located on the left throttle. "GO-AROUND" is lighted on the annunciator panel and the GO-AROUND pitch and roll command is indicated by the command bars on the FCI. Wings are commanded level and nose up. Takeoff is on runway 35 as shown on the PNI.



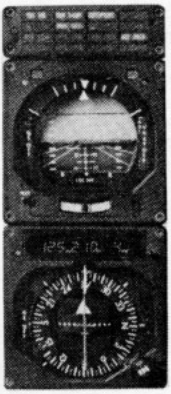
2. The aircraft is well off the ground and climbing. The YAW DAMP and AUTO-PILOT modes have been engaged; a desired altitude has been selected in the window of the VNAV computer. Using the HDG SEL knob on the Mode Controller, the heading bug on the PNI is slewed to a desired heading. HDG SEL and ALT ARM modes have been pushed on.

The Flight Director has responded with the command bars calling for a left turn to the 270° heading and takeoff pitch attitude. The aircraft has not yet responded.



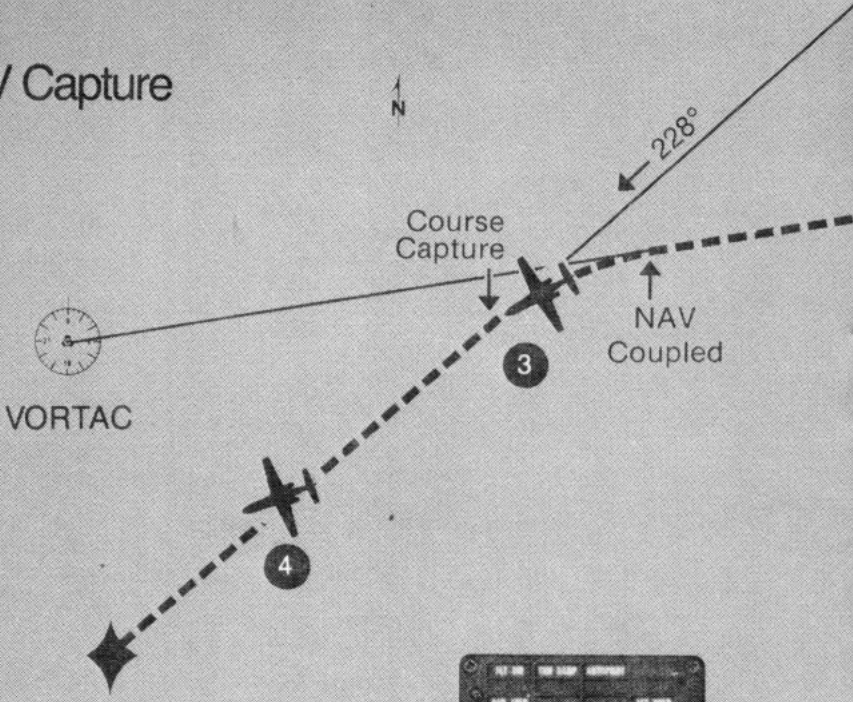


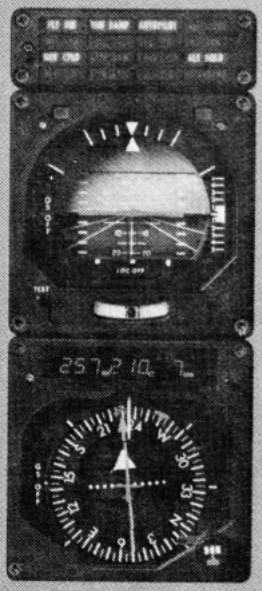
3. The aircraft is now responding to the FCI commands with a 28° left bank. Take-off climb continues.

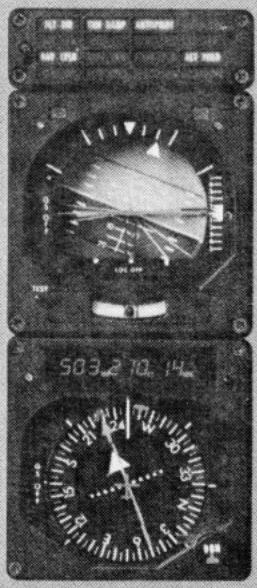


4. Desired altitude has been captured, ALT HOLD mode has automatically engaged and the aircraft has returned to level flight. The 270° heading has been acquired.

RNAV Capture

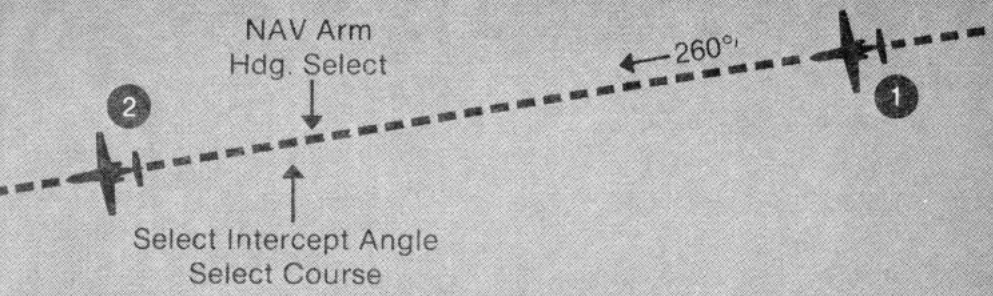


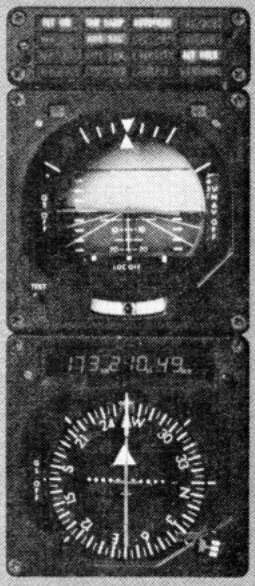




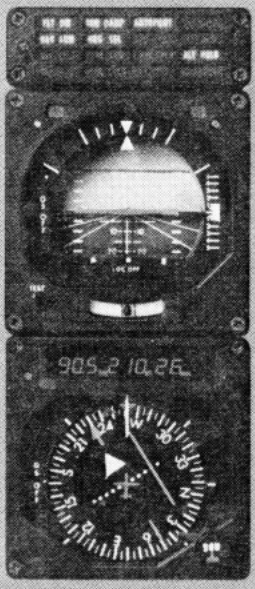
3. Capture sequence starts when NAV CPLD mode automatically engages, cancelling the NAV ARM and HDG SEL modes. Command bars on the FCI call for a left bank which is being satisfied by the autopilot.

4. The aircraft has completed its turn to the 228° course. A wind correction produces an aircraft heading of 235°, displaying a 7° "crab" angle to maintain the 228° course.



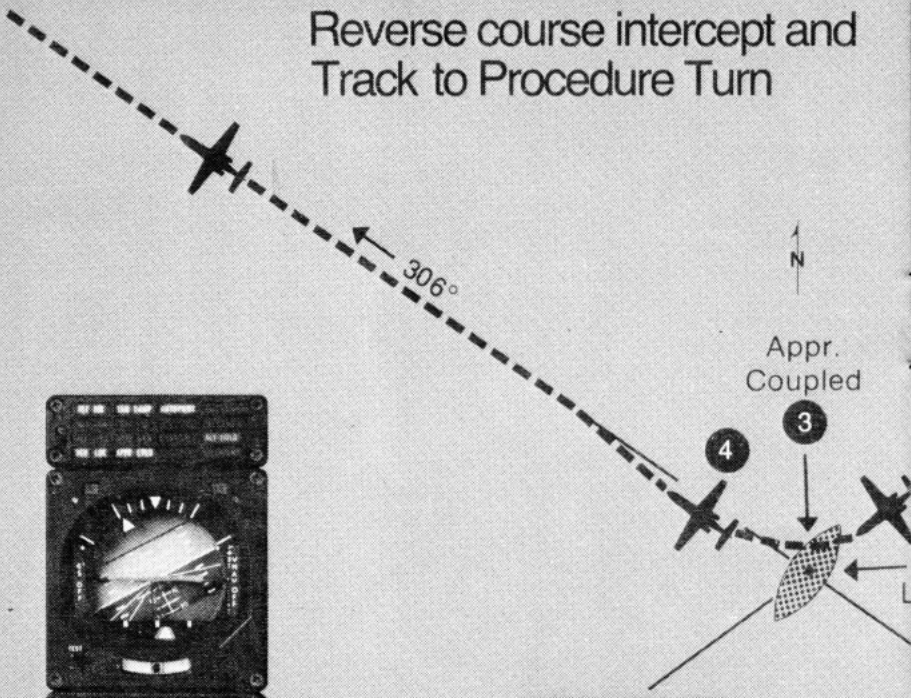


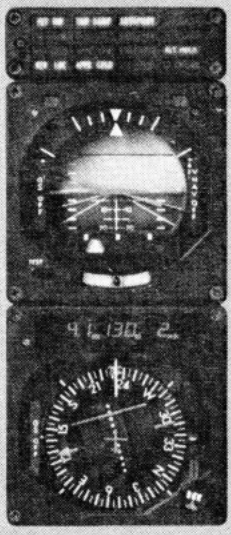
1. The aircraft is flying an OMNI airway in the HDG SEL mode, on a heading of 260°.



2. A waypoint has been established and the RNAV computer is in ENROUTE mode. A 228° course to the waypoint has been selected and NAV mode pushed "on"; HDG SEL and NAV ARM modes are activated for automatic capture of and turn to the 228° course to the waypoint.

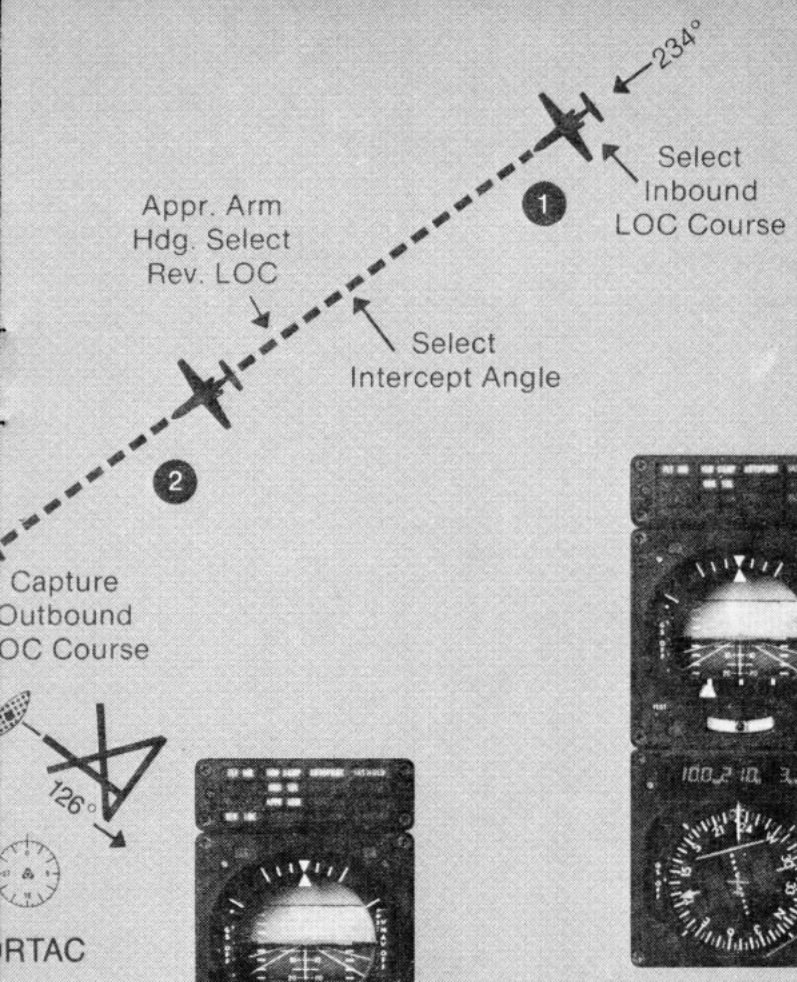
Reverse course intercept and Track to Procedure Turn



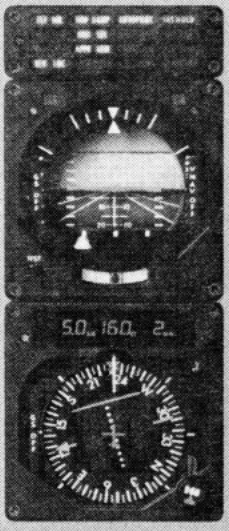


4. The aircraft banks right, to bank limit, satisfying the command on the FCI. The aircraft will continue to follow the FCI commands to center up with the localizer and roll out on a precise outbound course.

3. Just prior to reaching the outer marker the APPR CPLD mode is automatically activated and a right turn outbound on the localizer is commanded by the FCI.

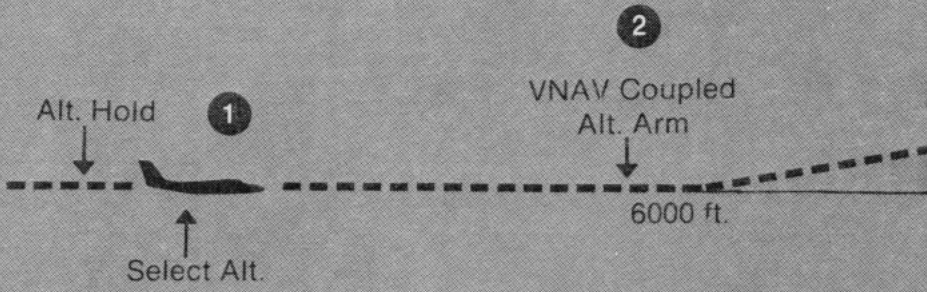


1. In HDG SEL mode on a LOC channel, the aircraft is heading 234° in ALT HOLD. A front course localizer of 126° is selected and the Outer Marker is directly ahead of the aircraft as noted by the green ADF pointer in the HSI.

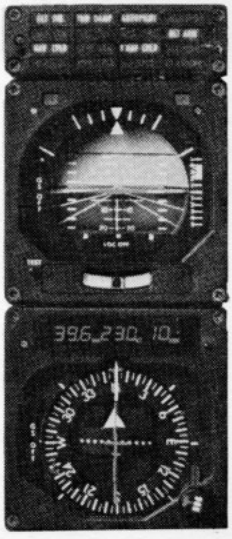


2. APPR mode has been selected and "APPR ARM" and "HDG SEL" are annunciated. Because the intercept angle to the front course is greater than 90° the automatic reverse course detection circuit has activated the REV LOC mode. This tells the pilot that when the system captures the Localizer, it will turn outbound.

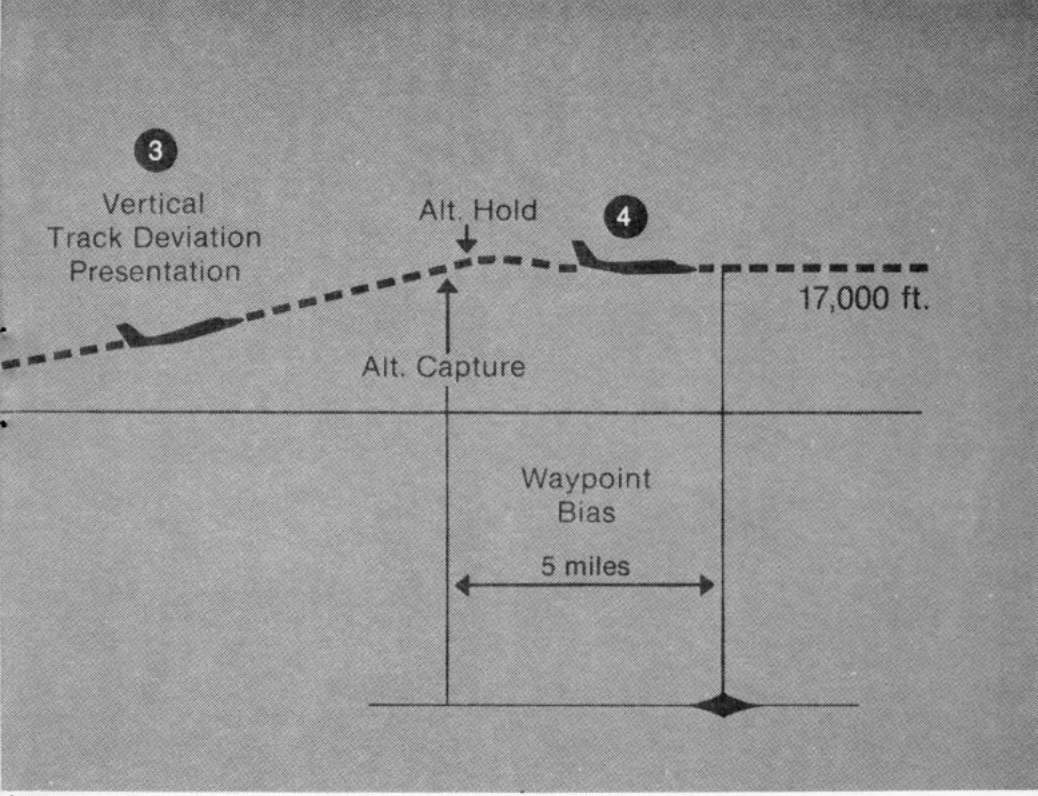
Climb and capture selected altitude over waypoint.

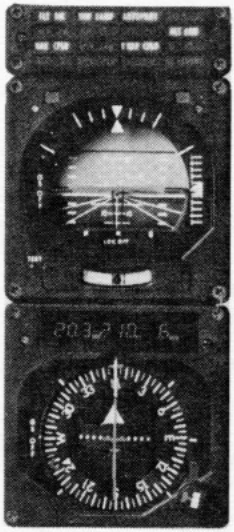


1. The aircraft is on an airway, coupled in RNAV mode and ALT HOLD at 6,000 ft. A waypoint has been selected on the RNAV computer and an assigned altitude of 17,000 feet over the waypoint (biased 5 nm, at pilot's choice back toward the aircraft) has been selected on the VNAV computer.

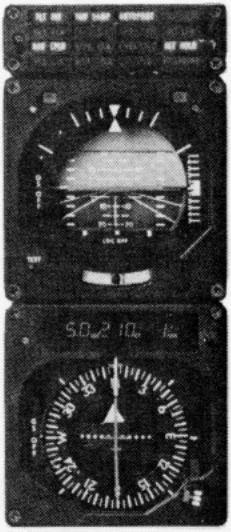


2. The Vertical Track Angle is displayed on the right side of the FCI. When a vertical track angle of 3° is reached, the pilot selects VNAV CPLD mode. The FCI now commands a climb to make good the chosen 3° vertical track and the VTA display will indicate any deviation from that track (±250 ft. full scale).

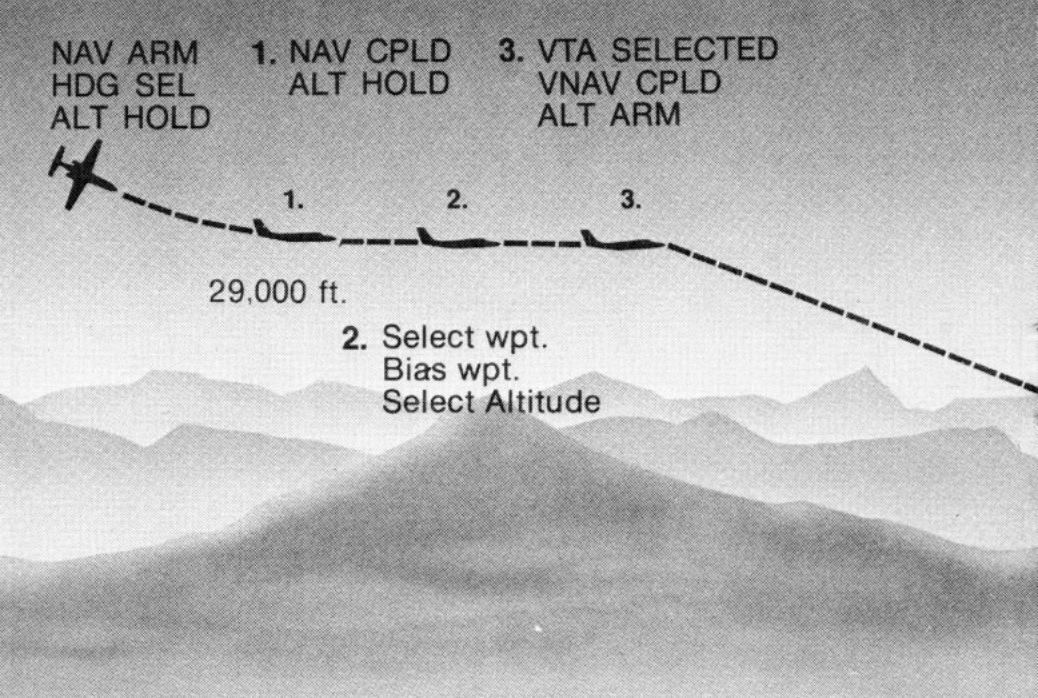




3. The autopilot complies with the FCI commands and the aircraft is climbing at a vertical track angle of 3°. Deviation from the vertical track is shown in feet above or below (±250 ft. full scale).



4. Altitude capture is at 17,000 feet, 5 nm from the waypoint (biased 5 nm) and the ALT HOLD mode is automatically activated. VNAV CPLD and ALT ARM are cancelled as the aircraft smoothly intercepts and maintains 17,000 feet.



Descent from enroute altitude to pre-determined TCA entry point and approach to ILS.

Flying at his assigned altitude of 29,000 feet, the pilot is on a heading of 150° in Heading Select mode to intercept a 90° Omni Airway course.

His RNAV is set on Enroute mode with zero-distance offset in the RNAV computer.

The Flight Director is ON and the Autopilot is coupled. He selects NAV on the Mode Controller and "NAV ARM" is displayed on the annunciator panel. The system will continue to fly in the Heading Select mode until capture occurs.

1. As the 90° course is approached, NAV ARM and HDG SEL modes automatically disengage and NAV CPLD engages. The Flight Director and Autopilot command a smooth left-turn interception to the selected course.

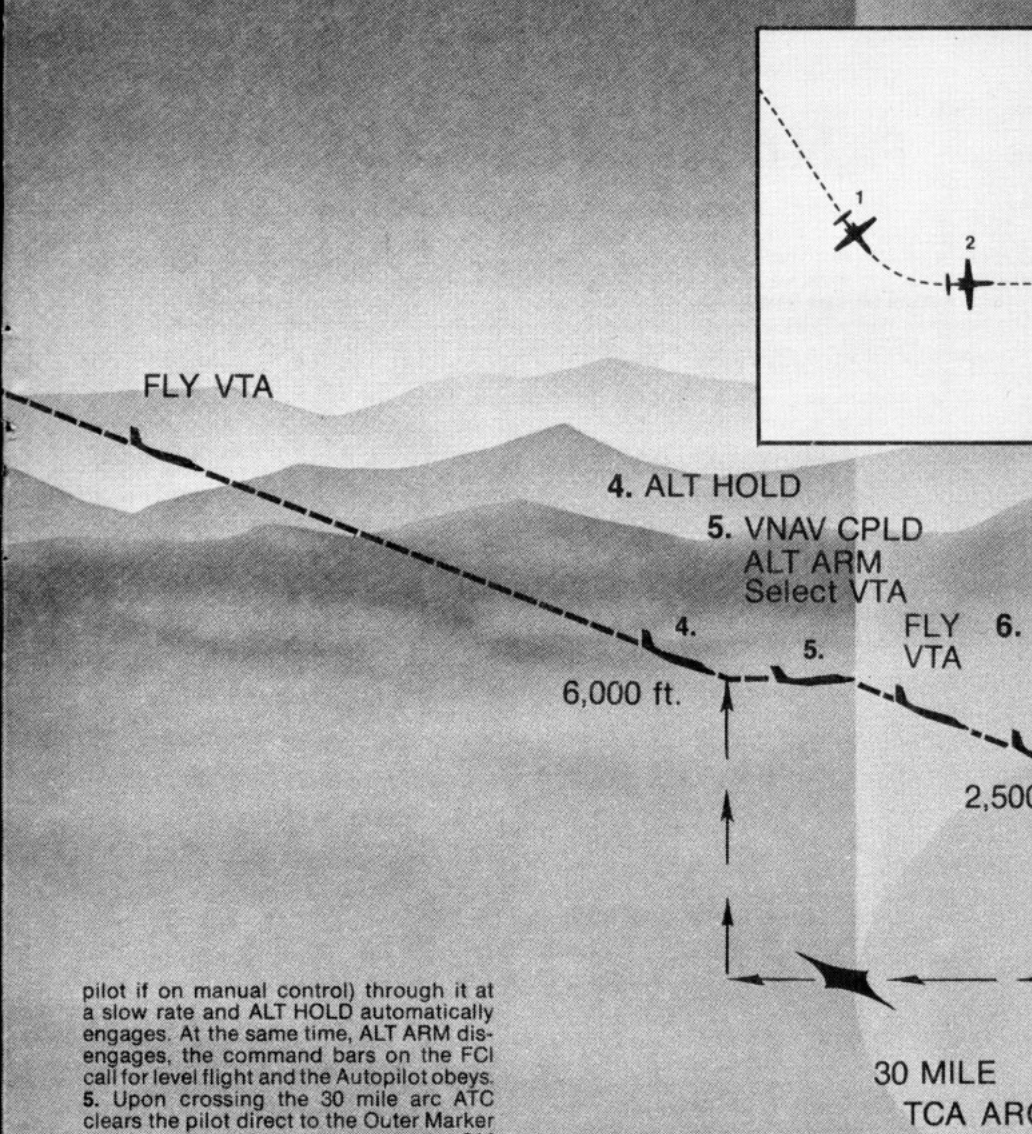
ATC now clears the pilot to cross the 30 mile arc of the TCA at 6000 feet.

2. This is easily programmed by moving the TCA VORTAC (to which he is tuned) toward him 30 miles by setting a WPT DISTANCE of 30 miles and a WPT RADIAL of 270° (the reciprocal of his 90° course) in the RNAV computer. He now has a waypoint set up at the 30 mile TCA arc and on his course to the VORTAC.

He now decides that he wants to reach his assigned 6000 ft. altitude a comfortable 3 miles before crossing the 30 mile arc. To accomplish this, he sets 6000 ft. in the VNAV window and biases the waypoint back 3 miles using the bias control knob on the VNAV computer.

3. When the Vertical Track Angle (VTA) display on the right side of the Flight Command Indicator displays the degree of the angle of descent the pilot desires, he pushes VNAV CPLD on the VNAV computer. The command bars on the FCI now command the Autopilot down a vertical path to reach 6000 feet at a point 33 miles from the TCA VORTAC. When VNAV CPLD was selected, ALT ARM was automatically engaged.

4. As the aircraft approaches the selected 6000 feet altitude over the biased waypoint, an "adaptive" pitch rate command automatically guides the Autopilot (or



pilot if on manual control) through it at a slow rate and ALT HOLD automatically engages. At the same time, ALT ARM disengages, the command bars on the FCI call for level flight and the Autopilot obeys.

5. Upon crossing the 30 mile arc ATC clears the pilot direct to the Outer Marker and instructs a descent to cross the OM at 2500 feet, the final approach altitude.

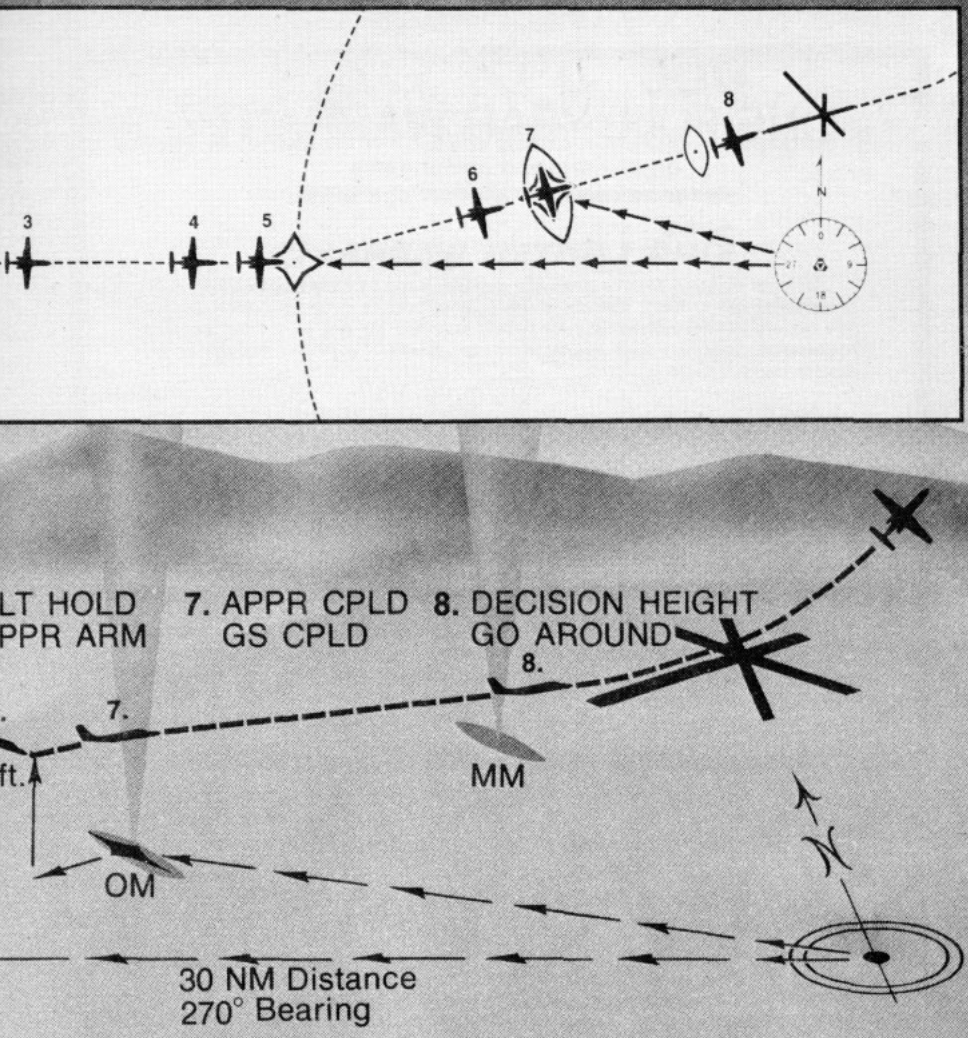
Using the coordinates on the approach chart, the pilot places a waypoint directly over the Outer Marker. Now, by selecting 2500 feet and pushing the VNAV CPLD button on his VNAV computer he can be assured of a smooth descent to and capture of 2500 feet over the OM. Or he may want to bias the waypoint back a few miles from the OM to allow for bleeding off speed and preparing for his approach. The pilot decides to do this and biases the waypoint back from the OM 4 miles, using the bias knob on the VNAV.

6. Upon reaching 2,500 feet, ALT HOLD again automatically engages, and the pilot channels his NAV receiver to the Localizer frequency and sets the inbound front course on his PNI. He then depresses the APPR button on the Mode Selector to arm and capture the Localizer.

7. When the Localizer is captured, the APPR CPLD mode is annunciated and the Glideslope capture mode is automatically armed.

LOC and Glideslope deviation are displayed on both the FCI and the PNI.

As the Glideslope is captured, GS CPLD mode is activated and the aircraft is commanded to descend on the glide path. The Autopilot responds to the V-bar commands on the FCI and ALT HOLD is



automatically cancelled.

At 1250 feet radar altitude, all data in the upper right window of the KPI 553 disappears and is replaced by dashes until the aircraft reaches 990 feet radar altitude. At this point, radar altitude is displayed in the window and counts down in 10 foot increments to touchdown.

8. Decision Height (DH) of 200 ft. is set in the Radar Altimeter. DH warning is provided by the DH annunciator light on the FCI. If, at Decision Height, the approach cannot be continued and "Go Around" is desired, the pilot presses the GO AROUND button on the throttle lever as he increases power. "GO AROUND" is lighted on the Annunciator Panel.

All Flight Director modes are instantly cancelled and the Autopilot is disengaged. A wings-level and nose-up command is displayed by the FCI command bars and the pilot takes over to climb out. The Autopilot can be reengaged in GO AROUND if desired.

ONE FULL YEAR WARRANTY

on **all** parts and components...
plus a warranty on labor for one full year!

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KING KFC 300

Flight Control System Specifications

Component Weight, Size and Requirements

	Weight Lbs. (Kg.)	Size Inches (cm.) Width	Height	Depth
Flight Director Components				
KCI 310 Flight Command Indicator	5.0 (2.04)	4.25 (10.80)	4.25 (10.80)	7.37 (18.72)
KAP 315 Annunciator Panel	1.4 (0.63)	4.25 (10.80)	1.37 (3.48)	2.75 (6.99)
KCP 320 Flight Computer	8.2 (3.72)	ARINC 3/8 ATR Short		
KMC 340 Mode Controller	1.6 (0.73)	5.75 (14.61)	2.25 (5.72)	6.4 (16.26)
KDC 380 Air Data Computer	6.9 (3.12)	ARINC 3/8 ATR Short		
KVN 395 Vertical Nav. Computer	3.1 (1.41)	3.25 (8.26)	3.25 (8.26)	10.07 (25.45)
*KPI 553A Pictorial Nav. Indicator	5.5 (2.50)	4.26 (10.82)	4.26 (10.82)	10.02 (25.45)
		(4.45)	(13.34)	(30.48)
Total Flight Director	31.2 (14.15)			
Autopilot Components				
KAC 325 Autopilot Computer	5.7 (2.58)	ARINC 1/4 ATR Short		
KRG 330 Rate Gyro	0.9 (0.41)	2.8 (7.11)	2.0 (5.08)	1.8 (4.57)
KSA 370/KSM 375 Servo actuator & mount (3)	18.0 (8.16)	4.5 (11.43)	4.75 (12.07)	6.15 (15.62)
Total Autopilot	24.6 (11.16)			
Total	55.8 (25.31)			

Vertical Gyro—to be purchased from appropriate supplier: VG 206, any ARINC VG 6.0 (2.7)

Grand Total 61.8 (28.04)

Servoed Altimater Options

Smiths WL 1003AM/MS/12 (AND OTHERS)	4.0 lbs.
IDC 518-16007-235 (AND OTHERS)	4.5 lbs.

COMPASS SYSTEM

KCS 305 Directional Gyro	5.4 (2.45)	115 vac 20 va

Remote-mounted equipment:

Flight Computer	TEMP: −54° to +71°C Operate
Autopilot Computer	−62° to +71°C Storage
Air Data Computer	ALTITUDE: 45,000 ft.
TSO: C9c/C52a	
ENV. CAT. RTCA DO-138,	AAOAAAEXXXXX
Servo Actuators	AAJAAAEXXXXX

Panel-mounted equipment:

Flight Command Indicator	TEMP: −15° to +71°C Operate
Pictorial Navigation Indicator	−54° to +71°C Storage
Annunciator Panel	
Vertical NAV Computer	ALTITUDE: 15,000 ft.
TSO: C9c/C52a	
ENV. CAT. RTCA DO-138,	GAKAAAXXXXXX
Mode Controller	GAJAAAXXXXXX

*KPI 552 (5.5 lbs.) may be substituted for KPI 553A.

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