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**FAA APPROVED**

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

MOONEY MODELS

M20C, M20J, M20K, M20L, M20M

WITH

KING KNS-80 RNAV SYSTEM

Reg. No. \_\_\_\_\_

Ser. No. \_\_\_\_\_

This supplement must be attached to the applicable Airplane Flight Manual when the King KNS-80 RNAV System has been installed by Mooney Aircraft Corporation. The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures and performance information not contained in the supplement, consult the basic Airplane Flight Manual.

FAA APPROVED: \_\_\_\_\_



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Original Issue Date: 12 - 21 - 78

Revision D: 7 - 29 - 89

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## LOG OF REVISIONS

Revision Number	Revision Pages	Description of Revisions	FAA Approved	Date
D	ALL PAGES	1) Add M20M Model	<i>A A Compton</i>	7-28-89

The revised portions of affected pages are indicated by vertical black lines in the margin.

## **SECTION I - GENERAL**

The KNS-80 system contains one VOR/DME receiver combination when in the RNAV mode and has the capability for autopilot coupled operations. KNS-80 Area Navigation Computer includes a four waypoint memory for data storage and annunciation of conventional operating modes when selected. The system will retain its waypoint storage memory from its own battery power with the aircraft battery switch off.

### **1.1 HORIZONTAL SITUATION OR COURSE DEVIATION INDICATOR**

1. COURSE SELECTOR Control - Used to set the magnetic course to the waypoint in either RNAV ENR or APR mode.

Sets the magnetic course to the VOR ground station in VOR and VOR PAR mode.

2. VERTICAL DEVIATION BAR - Represents deviation from the selected magnetic course. Pointer moves left or right of the center line as airplane deviates from the selected magnetic course. Course width is 20 degrees in VOR mode, 10 nautical miles in RNAV ENR mode and 2-1/2 nautical miles in RNAV APR mode.

3. HORIZONTAL DEVIATION BAR \* - When the KNS 80 is tuned to an ILS frequency the horizontal deviation bar represents the deviation from the suggested glidepath. If the airplane is above the glidepath, the horizontal bar is displaced downward. If below the glidepath the horizontal bar is displaced upward.

4. TO/FROM POINTER - Indicates whether the selected magnetic course is TO or FROM the destination. The pointer reverses direction as the destination is passed.

5. WARNING FLAG - Shows if the Course Deviation data is unreliable. A black background appears if the Course Deviation data is reliable. If the data is not reliable, the TO/FROM flag disappears from view, and a red NAV flag appears.

6. LIGHTING - The CDI lighting is controlled by an instrument lighting rheostat which controls all instrument panel lighting.

\* Not applicable to systems without a glideslope.

## **SECTION II - LIMITATIONS**

1. The KNS 80 in the RNAV mode is limited to VFR operations only unless accuracy certified per AC 90-45A for IFR operations. (Placard installed below right end of instrument cluster if not IFR approved) IFR approaches must be conducted in accordance with approved instrument approach procedures.

2. IFR approaches must be conducted in accordance with FAA approved instrument approach procedures.

3. IFR Enroute use of the RNAV must be conducted in accordance with FAA approved RNAV routes or with a flight plan filed with and accepted by the applicable A.T.C. facility.

4. A/P coupled R/N approaches are prohibited. (Placard installed just above artificial horizon.) Limitation applies to KNS 80 S/N 3865 and prior only.

Coupled approaches are permissible with approved autopilot installations.

5. VOR PAR mode prohibited during approach operation.

6. VOR/DME stations used for RNAV and VOR PAR operations must be co-located.

**SECTION III - EMERGENCY PROCEDURES**

NO CHANGE

**SECTION IV - NORMAL PROCEDURES**

**4.1 KNS 80 OPERATION**

**4.1.1 GENERAL**

The KNS 80 can be operated in any of 3 basic modes:

(a) VOR, (b) RNAV or (c) ILS.

To change from one mode to another, the appropriate pushbutton switch is pressed, except that the ILS mode is entered automatically whenever an ILS frequency is channeled in the USE waypoint. The display will annunciate the mode lighting a message above the pushbutton. In addition to the standard VOR and RNAV enroute (RNV ENR) modes, the KNS 80 has a constant course width or parallel VOR mode (VOR PAR) and an RNAV approach mode (RNV APR). To place the unit in either of these secondary modes the VOR pushbutton or the RNAV pushbutton, as the case may be, is pushed a second time. Repetitive pushing of the VOR button will cause the system to alternate between the VOR and VOR PAR modes, while repetitive pushing of RNAV button causes the system to alternate between RNV ENR and RNV APR modes.

A description of the RNAV and VOR modes is as follows:

1. VOR

This is the conventional VOR/DME mode. The NM, KT- and MIN displays are DME outputs and the CDI is displaying conventional cross track deviation information (i.e., +/-10 degrees full scale).

2. VOR PAR

This is like the above mode except that the CDI is now displaying constant course width information with a full scale deflection of +/- 5 NM. In this mode, a DME "unlock" will cause a CDI flag. Rechanneling the VOR with the HOLD button depressed will also cause a CDI flag. It is recommended that the VOR mode be used instead of VOR PAR for approaches since in this mode the course indication is more accurate at distances less than 28 nautical miles.

**WARNING**

**VOR PAR information can be displayed during ILS or RNAV approaches but use is prohibited.**

3. RNV ENR

This RNAV mode has a CDI sensitivity of +/- 5 NM full scale. The NM, KT and MIN displays as well as the CDI are now with respect to the waypoint as defined by the data stored in the USE waypoint location.

4. RNV APR

This is like the above except that the CDI sensitivity is +/- 1.25 NM full scale.

**CAUTION**

**Autopilot approach steering is too sensitive for coupled approach operation and is prohibited.**

All waypoint information, station frequency, waypoint distance, and waypoint radial is entered with the increment/decrement rotary switch on the right side of the panel

and displayed in the right hand readout. The small knob affects the lower significant digits while the large knob changes the most significant digits. The tenth's position of waypoint radial and distance can be changed by pulling the small knob to the out position. The type of data being displayed is indicated by the illuminated messages (FRQ, RAD, DST) located directly below the displayed data.

Frequency, radial, or distance information for a waypoint can be displayed sequentially by pressing the "DATA" pushbutton. The increment/decrement switch changes only the information being displayed.

The KNS 80 can store frequency, radial, and distance information for up to 4 waypoints. The waypoint number of the data being displayed is located above the message DPS. The DSP waypoint number is changed by pressing DSP button. The number of the waypoint being used for navigation is indicated by the displayed waypoint, the DSP waypoint number blinks. Pressing the USE button causes the waypoint in use to match the displayed waypoint.

Normally, the DME is tuned to the station paired with the VOR frequency. The tuning of the DME may be frozen by depressing the HOLD button. Subsequent rechanneling of the NAV receiver will cause the HLD light to come on. The DME will "hold" the frequency it was tuned to at the time the button was depressed.

## 4.2 DETAILED FUNCTION DESCRIPTION

### 4.2.1 SYSTEM MODES

VOR, VOR PAR, RNV ENR and RNV APR are selected modes and have equal precedence. If an ILS frequency is placed in the active data, the system will automatically go to the ILS mode. When switched out of an ILS frequency the system will revert back to the mode in which it was at the time the ILS frequency was selected.

### 4.2.2 DISPLAYS

#### 4.2.2.1 - NM DISPLAY

##### 1. VOR and VOR PAR modes

Displays DME distance.  
0 to 99.9 NM in 0.1 NM steps, 100 to 200 NM in 1 NM steps.  
Displays dashes whenever DME goes into search.

##### 2. RNV APR and RNV ENR Modes

Displays RNAV distance to waypoint.  
0 to 99.9 NM in 0.1 NM steps, 100 to 400 NM in 1 NM steps.  
Displays dashes if DME is in search, if VOR flags, or if the VOR is rechanneled with the HOLD button depressed.

#### 4.2.2.2 - KT DISPLAY

##### 1. VOR and VOR PAR modes

Displays ground speed to the DME ground station.  
0 to 999 knots in 1 knot steps.  
Update rate is once per second.  
Displays dashes whenever DME goes into search.

##### 2. RNV APR and RNV ENR Modes

Displays ground speed to the active waypoint.  
0 to 999 knots in 1 knot steps.  
Update rate is once per second.

Displays dashes whenever DME goes into search, if VOR flags or if the VOR is rechanneled with the HOLD button depressed.

#### 4.2.2.3 - MIN DISPLAY

##### 1. VOR and VOR PAR Modes

Displays time to DME ground station.  
0 to 99 minutes in 1 minute steps.  
Displays dashes whenever DME goes into search or when calculated value exceeds 99 minutes.

##### 2. RNV APR and RNV ENR Modes

Displays time to the active waypoint.  
0 to 99 minutes in 1 minute steps.  
Displays dashes if DME is in search, if VOR flags, if the VOR is rechanneled with the HOLD button depressed, or if calculated value exceeds 99 minutes.

#### 4.2.2.4 - FRQ. RAD. DST DISPLAY

##### 1. FRQ Mode

Displays frequency from 108.00 to 117.95 MHz.  
1 MHz digit overflows into (or underflows from) 10 MHz digit.  
Roll over from 117 to 108 or vice versa.  
Least significant digit displays only zero or five.

##### 2. RAD Mode

Displays ground station radial on which the waypoint is located from 0.0 to 359.9 degrees.  
10 degree digit overflows into (or underflows from) 100 degree digit.

##### 3. DST Mode

Displays the distance offset of the waypoint from the ground station over range of 0.0 to 199.9 NM.  
10 NM digit overflows into (or underflows from) 100 NM digit.  
The two most significant digits roll over from 190 to 0 NM and vice versa.

#### 4.2.2.5 - USE DISPLAY

Displays waypoint number of data actually being used by system.  
In VOR MODES only the frequency has meaning.  
Range 1 to 4.  
When changed always takes on new value equal to DSP value.

#### 4.2.2.6 - DSP DISPLAY

Displays waypoint number of data being displayed.  
Range 1 to 4.  
When changed, increments by 1.  
Rolls over from 4 to 1 and blinks when not equal to USE value.

#### 4.2.2.7 - PAR, VOR, ENR, APR, RNV DISPLAYS

System status lights.

#### 4.2.2.8 - HLD DISPLAY

Indicates when the station to which the DME is actually tuned is different than the station to which the VOR is tuned.

#### 4.2.2.9 - DATA DISPLAY

Displays waypoint data.  
The messages FRQ, DST, and RAD tell what is being displayed at any one time.

#### 4.2.2.10 - ILS DISPLAY

Indicates that the frequency in use is an ILS frequency.

#### 4.2.2.11 - COURSE DEVIATION INDICATOR

##### 1. VOR Mode

Full scale sensitivity equals +/- 10 degrees.

##### 2. VOR PAR Mode

Full scale sensitivity equals +/- 5 NM.  
Flagged if VOR or DME data is invalid.  
Flagged if the VOR is rechanneled with the DME HOLD button depressed.

##### 3. RNV ENR Mode

Full scale sensitivity equals +/- 5 NM.  
Flagged if VOR or DME data is invalid.  
Flagged if the VOR is rechanneled with the DME HOLD button depressed.

##### 4. RNV APR Mode

Full scale sensitivity equals +/- 1.25 NM.  
Flagged if VOR or DME data is invalid.  
Flagged if the VOR is rechanneled with the DME HOLD button depressed.

##### 5. ILS Mode

Full scale sensitivity equals 3 to 6 degrees (depending upon ground facility).  
Flagged if localizer or glideslope data is invalid.

### 4.2.3 CONTROLS

#### 4.2.3.1 - VOR BUTTON

Momentary pushbutton.  
When pushed while system is in either RNV mode causes system to go to VOR mode. Otherwise the button causes system to toggle between VOR and VOR PAR modes.

#### 4.2.3.2 - RNAV BUTTON

Momentary pushbutton.  
When pushed while system is in either VOR mode causes system to go to RNV ENR mode. Otherwise the button causes system to toggle between RNV ENR and RNV APR modes.

#### 4.2.3.3 - HOLD BUTTON

Two position pushbutton.

When in depressed position, inhibits DME from channeling to a new station when the VOR frequency is changed. Pushing the button again releases the button and channels the DME to the station paired with the VOR station.

#### 4.2.3.4 - USE BUTTON

Momentary pushbutton.

Causes active waypoint to take on same value as displayed waypoint and data display to go to FRQ mode.

#### 4.2.3.5 - DSP BUTTON

Momentary pushbutton.

Causes displayed waypoint to increment by 1 and data display to go to frequency mode.

#### 4.2.3.6 - DATA BUTTON

Momentary pushbutton.

Causes waypoint data display to change from FRQ to RAD to DST and back to FRQ.

#### 4.2.3.7 - OFF/PULL ID CONTROL

1. Rotate counterclockwise to switch off power to the KNS 80.
2. Rotate clockwise to increase audio level.
3. Pull switch out to hear VOR Ident.

#### 4.2.3.8 - DATA INPUT CONTROL

Dual concentric knobs. Center knob has "in" and "out" positions.

##### 1. Frequency Data

Outer knob varies 1 MHz digit.

A carryover occurs from the tens to hundreds place.

Rollover occurs from 117 to 108.

Center knob varies frequency in .05 MHz steps regardless of whether the switch is in its in or out position.

##### 2. Radial Data

Outer knob varies 10 degree digit.

A carryover occurs from units to tens to hundreds position.

A rollover to zero occurs at 360 degrees.

Center knob "in" position varies 1 degree digit.

Center knob "out" position varies 0.1 NM digit.

##### 3. Distance Data

Outer knob varies 10 NM digit.

A carryover occurs from the tens to hundreds place.

A rollover to zero occurs at 200 NM.

Center knob "in" position varies 1 NM digit.

Center knob "out" position varies 0.1 NM digit.

#### 4.2.3.9 - COURSE SELECT KNOB

Located in CDI unit.

Selects desired course through the VOR ground station or waypoint.



#### 4.2.4 LIGHTING

Display lighting is automatically controlled by ambient light conditions. Button back-lighting is controlled by an instrument lighting rheostat which controls all instrument panel lighting.

#### 4.3 BATTERY REPLACEMENT

The waypoint memory is kept alive by two silver oxide watch cells located in the lower left hand corner of the front panel. Typical life of the cell is two years although high temperature and humidity conditions can shorten this period. If the battery should become weak, waypoint storage will be lost and the radio will "wake up" tuned to 100.00 MHz in the VOR mode. The cells can be replaced by opening the battery pocket with a thin blade screwdriver. The holder was designed so that the cells can only be inserted with the correct polarity.

#### 4.4 SYSTEM PERFORMANCE GROUND CHECK

The following test can be used to determine if the system is operating properly.

1. Tune the KNS 80 to a VORTAC (VOR/DME) within 25 NM of the airplane.
2. Place the KNS 80 in VOR mode and rotate the OBS until the course deviation needle centers with the TO/FROM flag giving a "from" indication.
3. Place the KNS 80 in RNAV ENR mode.

The system is operating properly if the distance to station is within 1.0 NM and the course deviation needle is within a dot of being centered.