Department of Transportation
FEDERAL AVIATION ADMINISTRATION
IFR PILOT EXAM-O-GRAM* NO. 14

VOR QUIZ

A thorough understanding of all information provided by the VOR receiver will be helpful in taking the Instrument Pilot Written Examination, and will save pilots time, work, and worry in flight. The questions and explanations that follow concern the basic problems and a few of the refinements of VOR receiver operation. Awareness of the points brought out in these explanations will help you obtain maximum utilization of this fine aid to air navigation.

1. Does the CDI (Course Deviation Indicator) relate the selected course and the aircraft heading?

   No, the CDI relates selected course and aircraft location. The illustration below represents a VOR station and the surrounding area. The course selector setting is always represented by an imaginary line (in this case, 030°) extended through the station; the aircraft is located on, or to either side of this line.
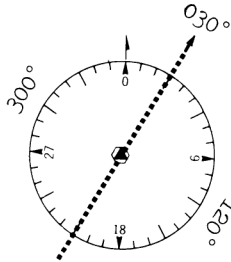
   The problem of interpreting the CDI may be confusing if aircraft heading and selected course are not the same. However, the true relationship is readily seen by mentally (or actually) turning the aircraft to the heading shown on the course selector.

2. How can pilots avoid "reverse sensing"?

   By keeping the course selector setting and the aircraft heading in approximate agreement. Only by this procedure will the CDI be deflected in the direction of the selected course. If the course selector and aircraft heading are approximately opposite, it is as though the pilot has done an "about face," and what was to his right is now to his left. He must now read the CDI in "reverse."

   NOTE: When flying an ILS localizer course, it is not always possible to avoid "reverse sensing." When the VOR receiver is tuned to an ILS frequency, the course selector becomes useless, and the CDI automatically senses to the inbound front course bearing. When the aircraft is headed in the opposite direction of the inbound front course bearing, the pilot must read the CDI in "reverse."

3. In the diagram above, assume that the aircraft is located somewhere along the 120° - 300° line, which is perpendicular to the course selector setting. Would the receiver indicate TO or FROM?

   Neither, there can be no TO-FROM resolution along a line through the station, perpendicular to the course selector setting. The area of no reliable TO-FROM indication may extend 20° on each side (40° total) of this perpendicular line. The indication could be: a red flag, OFF, a partial or intermittent TO-FROM, or no indication at all.

4. What angular deviation from a VOR course is represented by 1/2 scale deflection of the CDI?

5°. The CDI is normally calibrated to indicate a full scale right or left deflection (from center) at 10° from the selected course. This information is useful when approaching an intersection or intercepting a radial. The needle will start movement toward the center at a position 10° from the radial set on the course selector. The rate of movement can be interpreted as an indication of distance from the station, and is a clue to the lead required for an interception turn.

If approximate distance to the VOR station is known, this angular sensitivity provides information on approximate distance off course. Based on the formula - 1 degree equals 1 mile in 60 miles - an aircraft which is 30 miles out, and shows a 1/2 scale (5°) CDI needle deflection, would be 2 1/2 miles from course centerline.

NOTE: Remember that the CDI is 4 times as sensitive when used in ILS localizer function, and the needle will move 4 times as fast, requiring the pilot to plan and act accordingly. A one-half scale deflection of the CDI represents approximately 1 1/4° from the localizer centerline.

5. What degree of accuracy can be expected in VOR navigation?

This depends on pilot technique and systems accuracy. The following table shows an example of accumulated system errors, and the approximate effect at 30 miles distance from the station:

VOR radial error	1° = .5 mi.		(NOTE: In many cases system
Airborne receiver error	4° = 2.0 mi.		errors will have a cancel-
	5° = 2.5 mi. off course		ing effect.)

Any error in pilot technique could be added to the total of the above system errors. The need for proper adjustment of the VOR receiver, and precise navigation by the pilot, is evident.