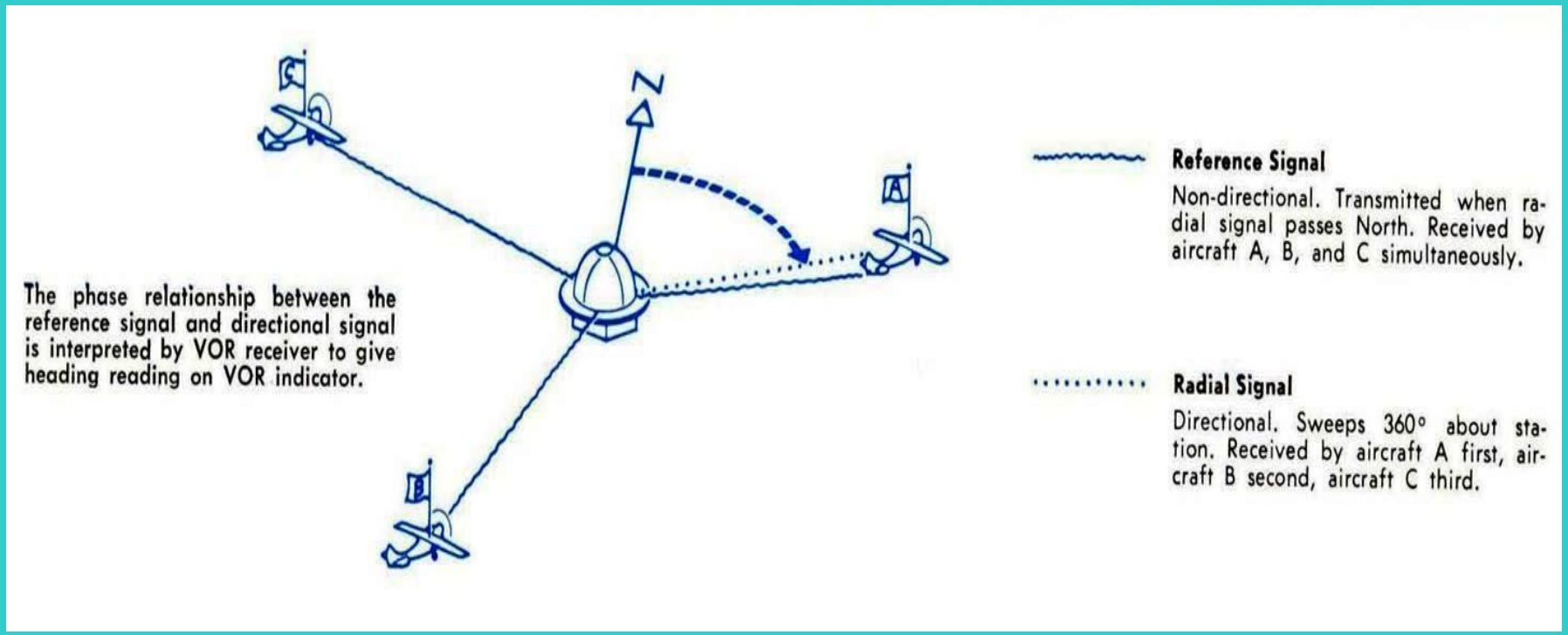
VOR Very High Frequency Omni Range

108 – 117,99 Mhz

TABLE 5.2. Line-of-Sight Distances for VHF Reception.

Aircraft Altitude (ft.)	*Approximate Transmission Range (nautical miles)*	*Aircraft Altitude (ft.)*	*Approximate Transmission Range (nautical miles)*
100	12	4,000	70
200	15	5,000	80
400	25	8,500	100
600	30	10,000	115
800	35	12,500	125
1,000	40	15,000	135
2,000	50	17,500	145
3,000	65	20,000	160



Sfasamento dei segnali

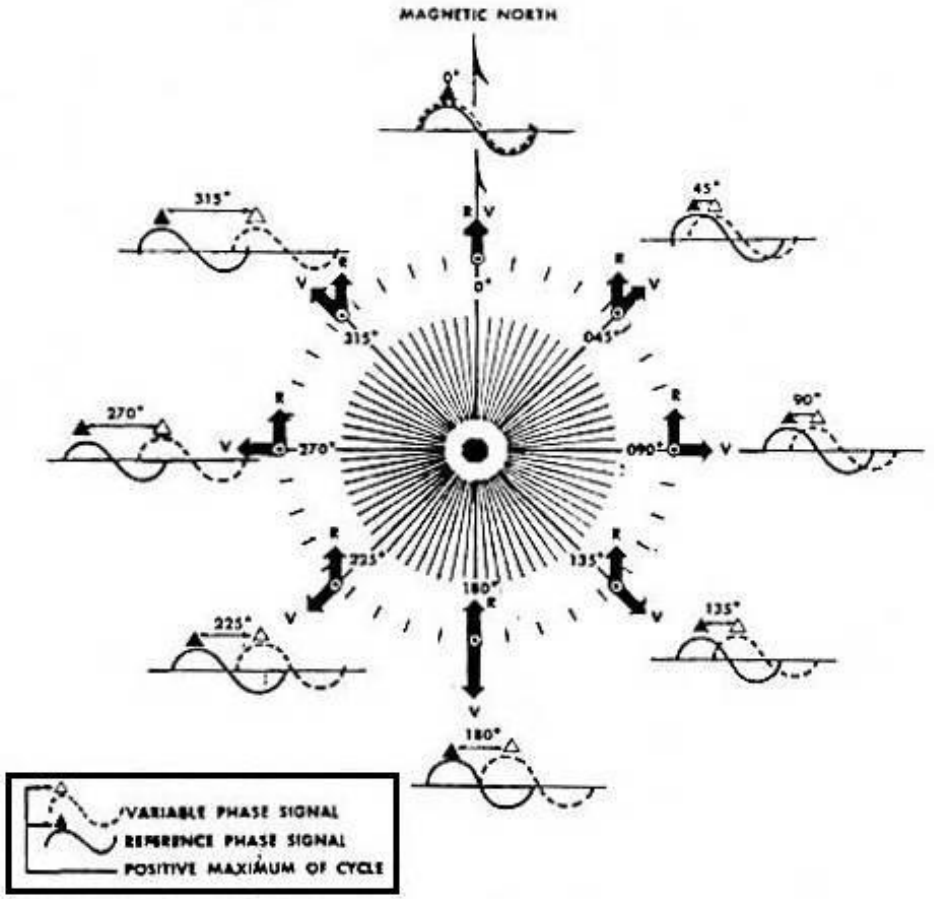
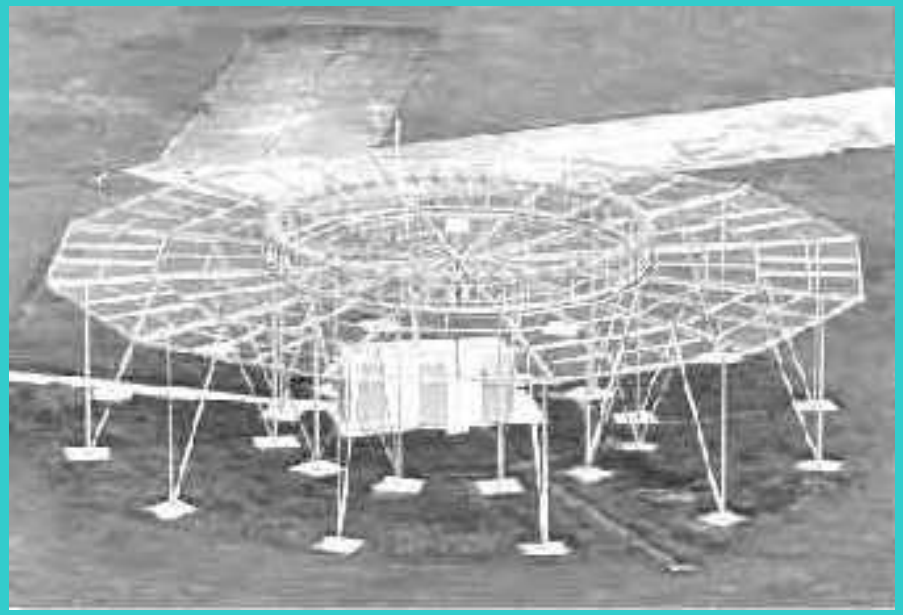
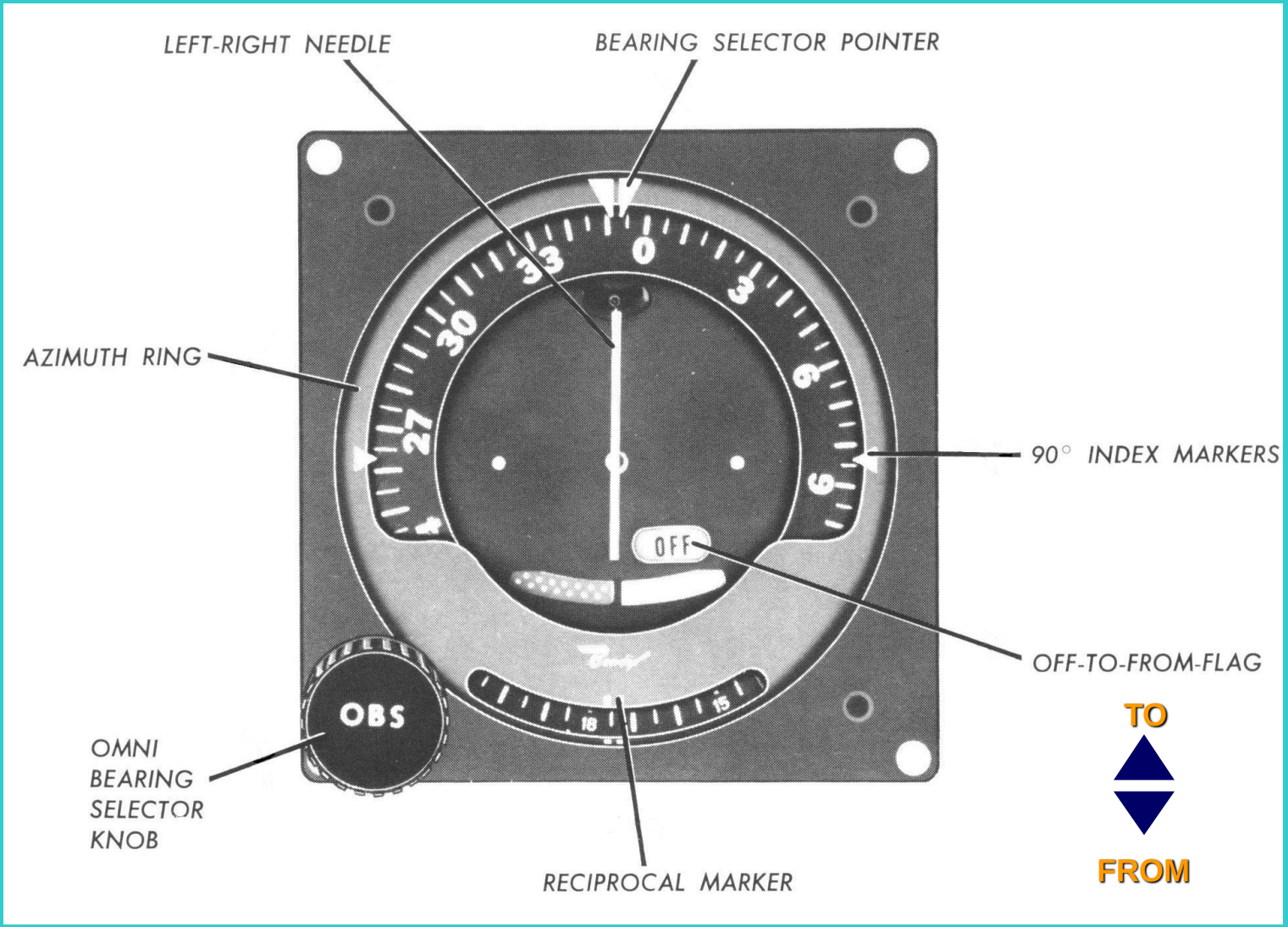


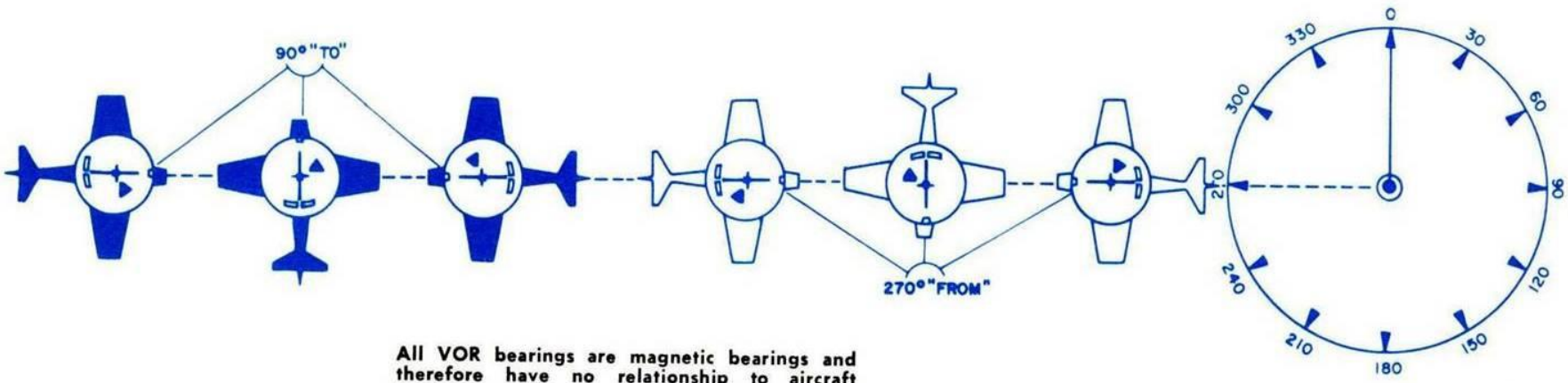
Figure 5.32. VOR phase angle relationship. Signals are in phase at magnetic north and vary elsewhere around the station. *(Courtesy of US Air Force.)*

Radiofaro VOR

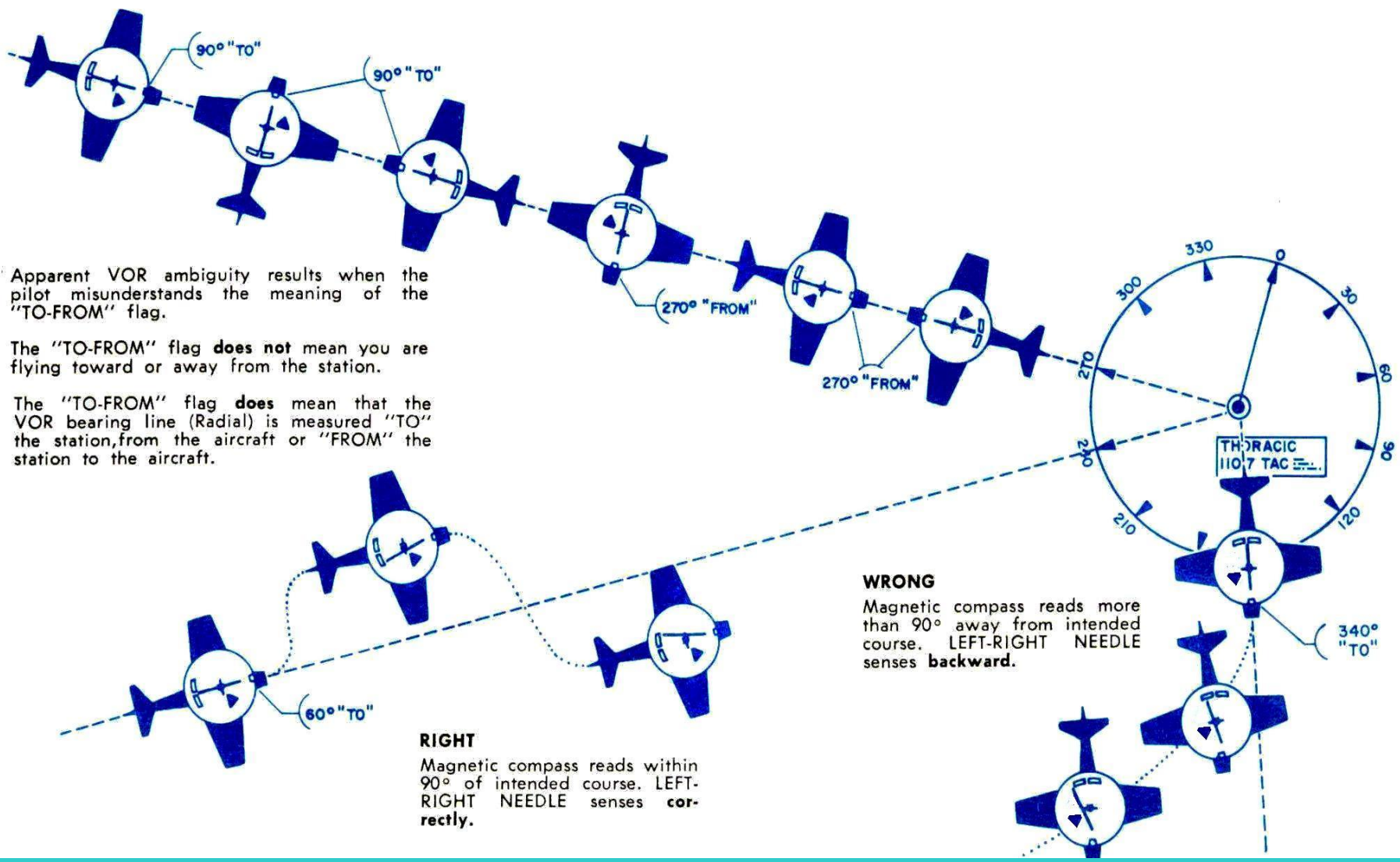


CDI Course Deviation Indicator





All VOR bearings are magnetic bearings and therefore have no relationship to aircraft headings.



Apparent VOR ambiguity results when the pilot misunderstands the meaning of the "TO-FROM" flag.

The "TO-FROM" flag **does not** mean you are flying toward or away from the station.

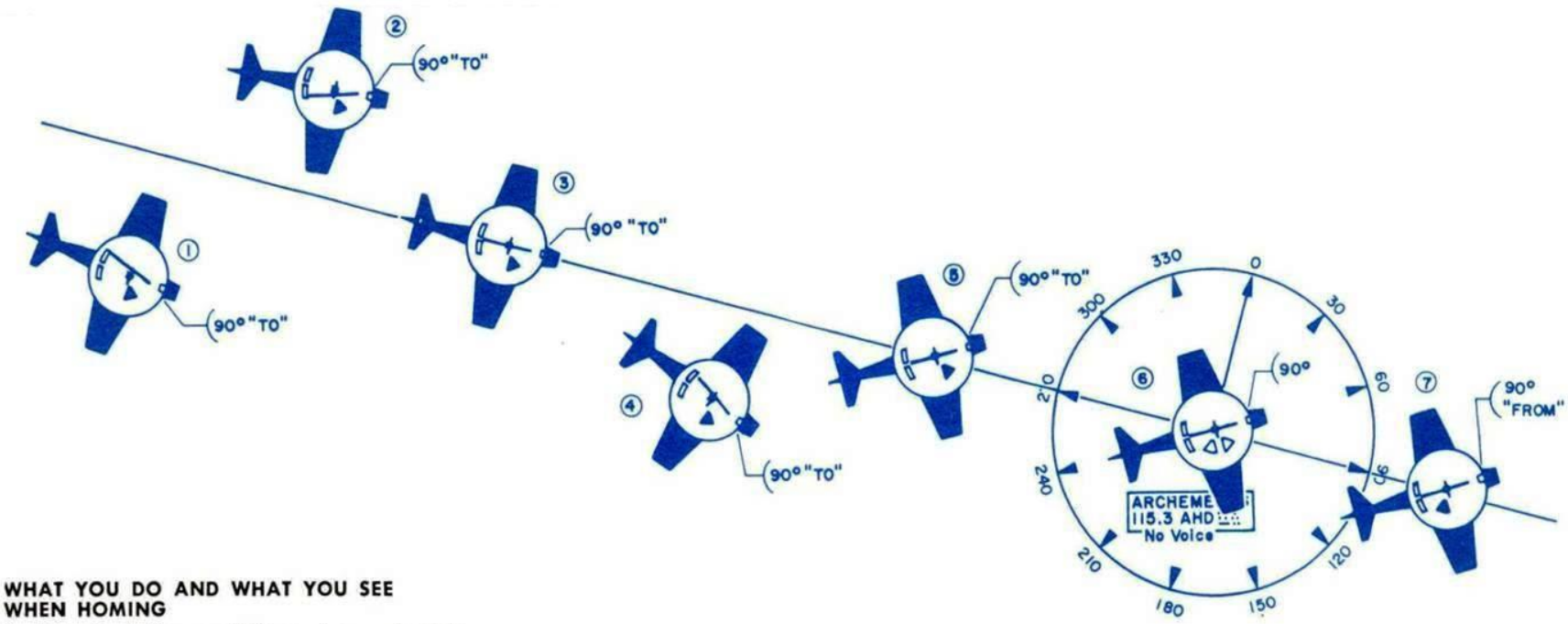
The "TO-FROM" flag **does** mean that the VOR bearing line (Radial) is measured "TO" the station, from the aircraft or "FROM" the station to the aircraft.

WRONG

Magnetic compass reads more than 90° away from intended course. LEFT-RIGHT NEEDLE senses **backward.**

RIGHT

Magnetic compass reads within 90° of intended course. LEFT-RIGHT NEEDLE senses **correctly.**



WHAT YOU DO AND WHAT YOU SEE WHEN HOMING

1. Tune in station on VHF receiver and rotate the BEARING SELECTOR KNOB until the desired course appears under the HEADING INDEX POINTER. TO-FROM FLAG will read "TO". LEFT-RIGHT NEEDLE will show how much aircraft is off course and direction to turn in order to get on course.

2. When left of course, the RIGHT-LEFT NEEDLE orders right turn to get on course.

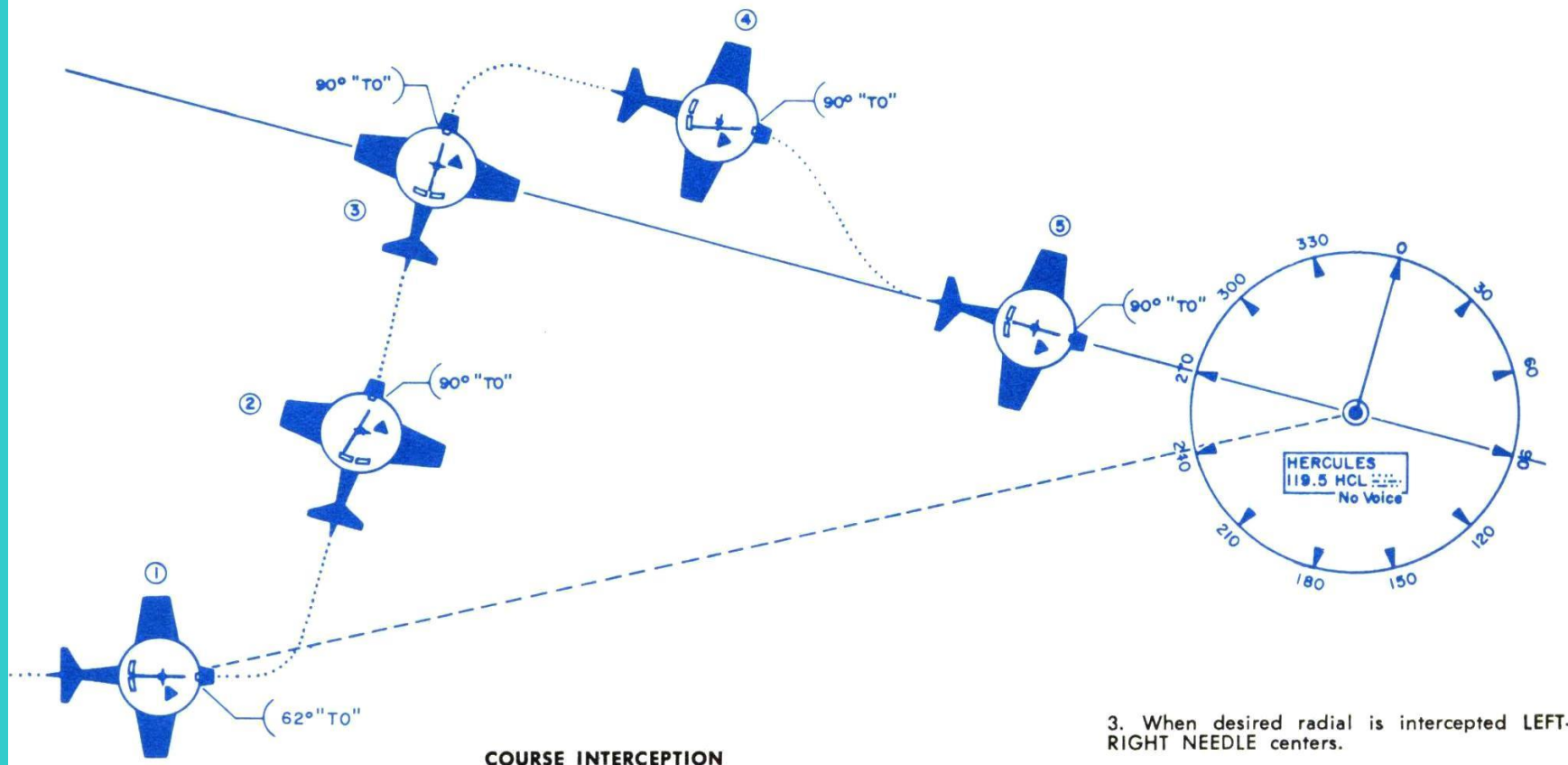
3. When on course, the LEFT-RIGHT NEEDLE is centered.

4. When off course due to wind drift, LEFT-RIGHT NEEDLE shows left turn required to return to course line.

5. When on course, crabbing, to compensate for wind drift, fly to hold LEFT-RIGHT NEEDLE centered and aircraft will remain on course.

6. When on course, passing over the station, the TO-FROM FLAG varies, then disappears when aircraft is over the station.

7. When on course, after passing the station, TO-FROM FLAG shows "FROM".



COURSE INTERCEPTION

1. VOR station is tuned in and LEFT-RIGHT NEEDLE centered to determine direction to desired radial.

2. Course line followed to achieve intercept route **must be magnetic compass oriented.** DO NOT FLY NEEDLE UNTIL STEP 4.

3. When desired radial is intercepted LEFT-RIGHT NEEDLE centers.

4. Aircraft has crossed desired radial. Start magnetic compass oriented turn in direction of new course. After turn LEFT-RIGHT NEEDLE shows turn direction required to get on course. O.K. to fly needle from now on.

5. On course, LEFT-RIGHT NEEDLE centered.

Quadretto di un VOR

Above Genave Alpha 200B NAV/ COMM

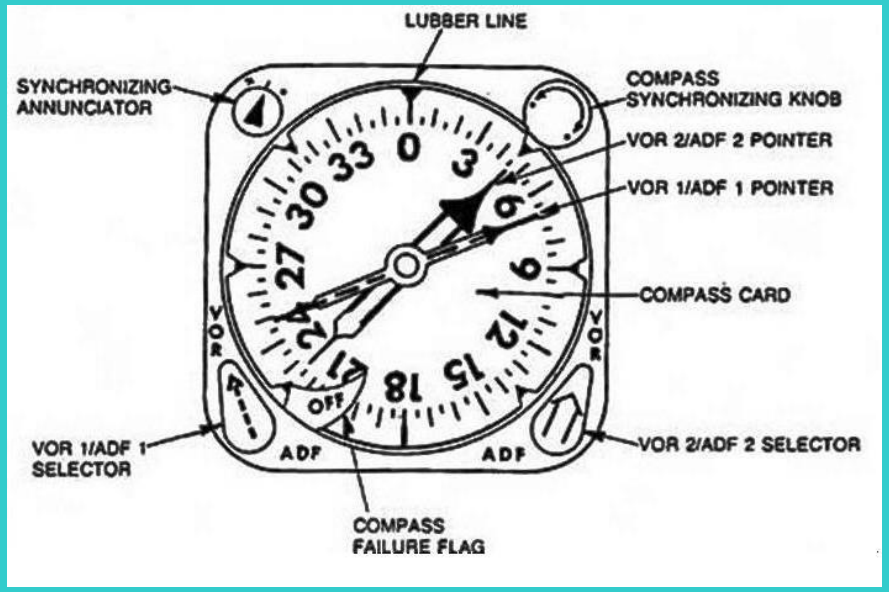
Below Bendix electronic course deviation indicator

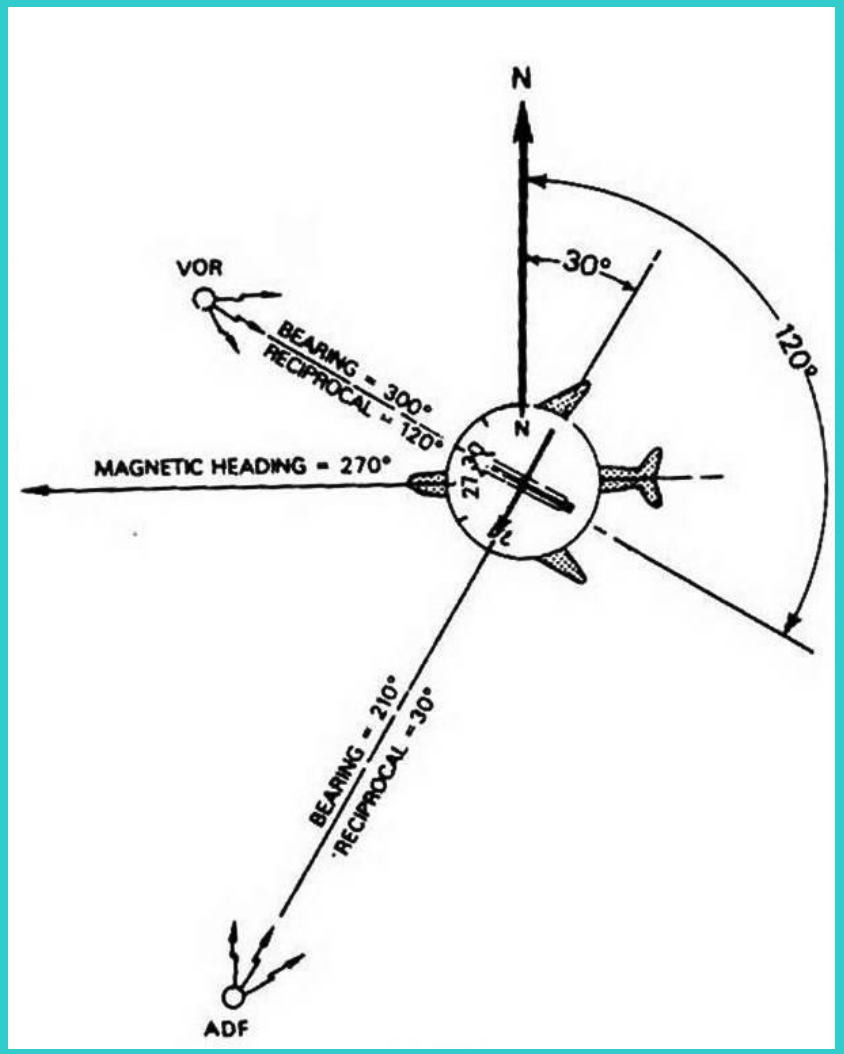
ow Davtron 902A VOR indicator

Below Collins IND-350 VOR/LOC indicator

Below Narco NAV 122 self-contained VOR/ILS

RMI Radio Magnetic Indicator



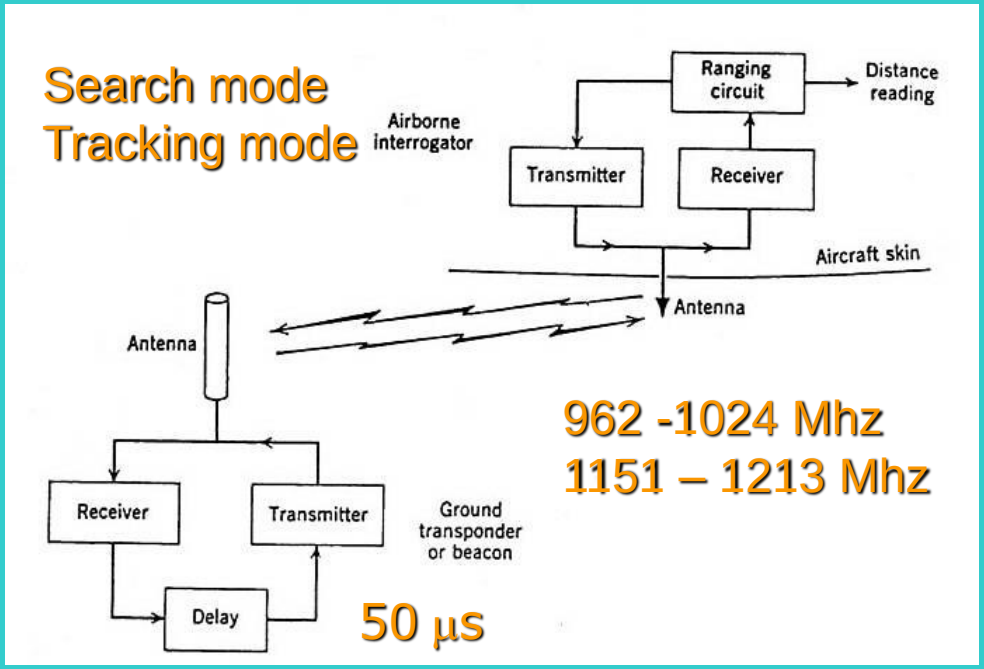


DME Distance Measuring Equipment

1025 -1150 Mhz

Aircraft Interrogator

Una coppia di impulsi separati
da 12 μs e che durano 7,5 μs,
da 5 a 50 al secondo



Gestisce almeno 50 aerei

Si può avere la distanza, la velocità al suolo, il tempo alla stazione

Tactical Air Navigation
TACAN – VORTAC - VOR/DME

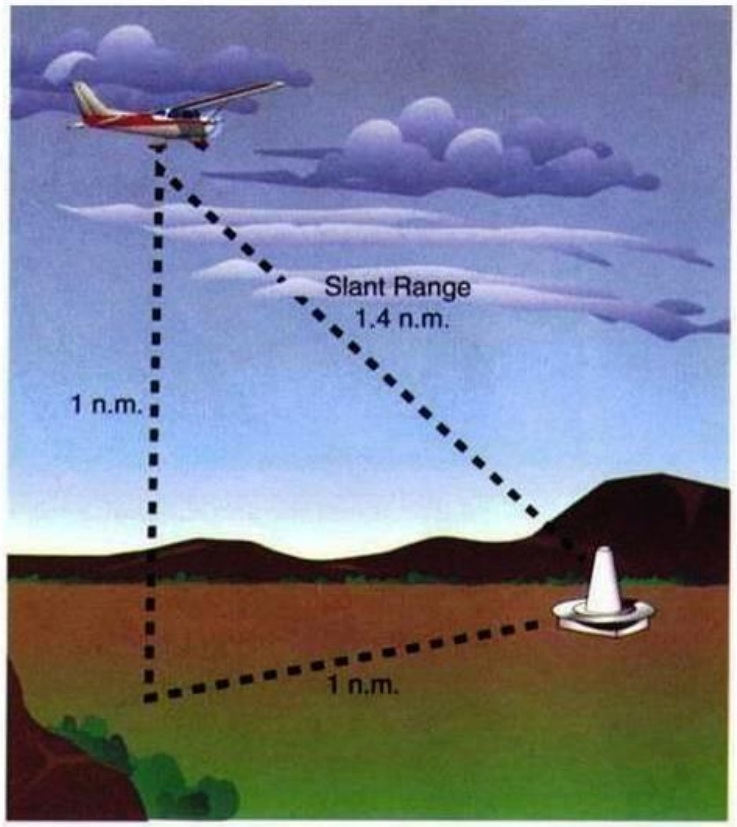
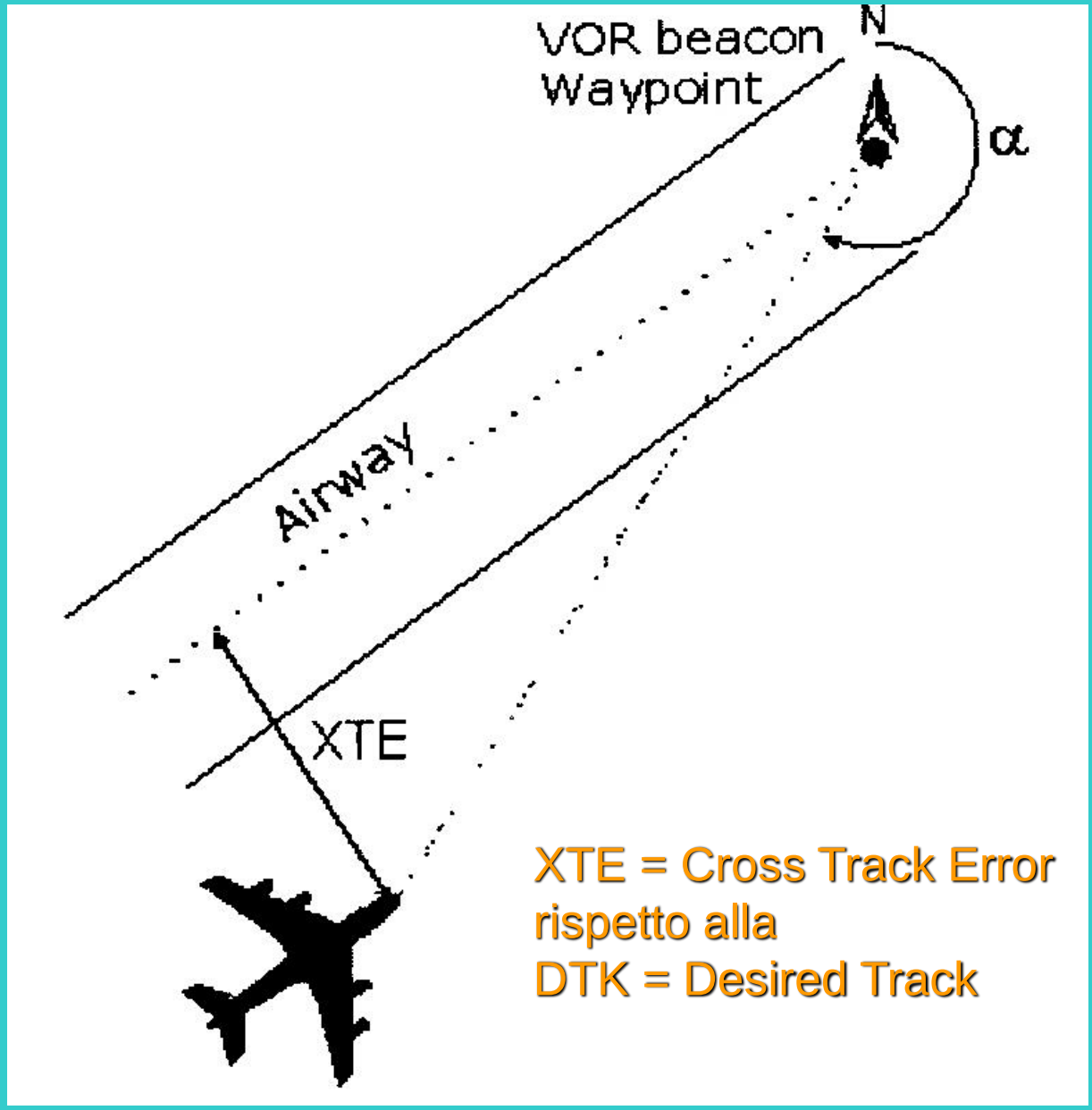


Figure 2-70. If you are flying at an altitude of 1 nautical mile at a horizontal distance of 1 nautical mile from the station, your DME will indicate a distance of 1.4 nautical mile. Slant range error is negligible if the aircraft is 1 mile or more from the ground facility for every 1,000 feet of altitude above the station.

TACAN

- Versione militare del VOR
- Opera in UHF (960-1250 MHz)
- Maggiore precisione
- Il DME, sempre presente, è identico a quello civile
- Spesso co-locato con un VOR (VORTAC)


VOR beacon
Waypoint
N
α
Airway
XTE
XTE = Cross Track Error
rispetto alla
DTK = Desired Track

Accuratezza

L'accuratezza del sistema dipende da quattro fattori principali

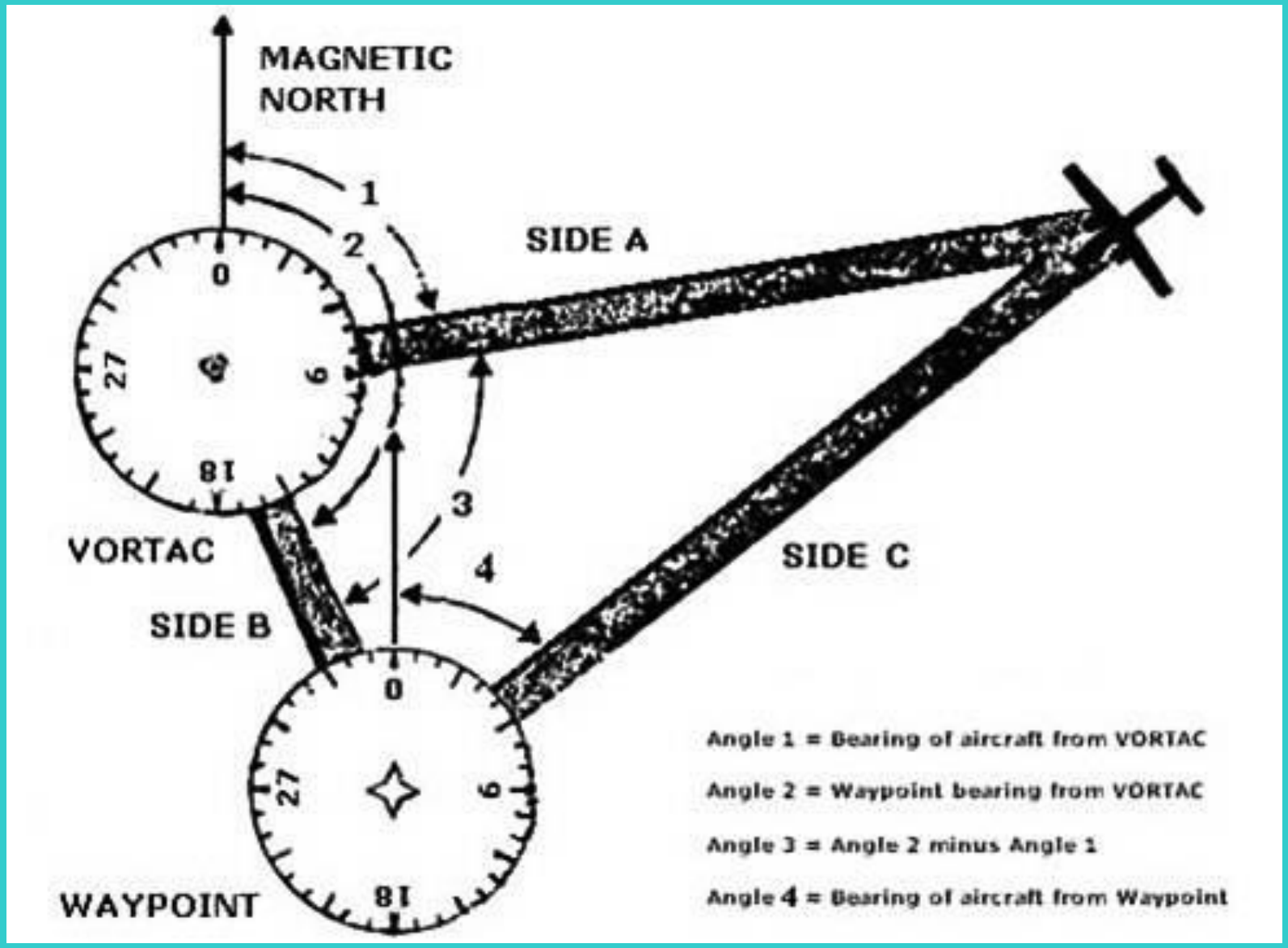
- La localizzazione del radiofaro: ± 1°;
- La propagazione influenzata dal terreno. Sommato al precedente l'errore (ground errors E_g) non deve superare ± 3°;
- Il ricevitore di bordo (airborne equipment error E_a) che va da ± 1° a ± 3° in dipendenza dell'apparato;
- Le tecniche di pilotaggio (pilotage error E_g). Tipicamente ± 2,5°.

Complessivamente

$$\mathbf{E} = \pm\sqrt{\mathbf{E_g^2} + \mathbf{E_a^2} + \mathbf{E_p^2}}$$ RMS(root mean square)

Generalmente l'errore è contenuto in ± 5°.

RNAV Randon NAVigation Navigazione d'area



RNAV Randon NAVigation Navigazione d'area