Onde elettromagnetiche

$$f = \frac{v_p}{\lambda} \Rightarrow f = \frac{3 \cdot 10^8}{\lambda}$$

$$\lambda = \frac{3 \cdot 10^8}{f} \Rightarrow \lambda\,[m] = \frac{300}{f\,[Mhz]}$$

Segnale trasmesso $s(t) = a \cdot \sin(\omega t)$

Segnale ricevuto $r(t) = b \cdot \sin(\omega t - \varphi)$

$$\varphi = 2\pi \left(\frac{l}{\lambda} \right) =$$

$$= 2\pi \left[int \left(\frac{l}{\lambda} \right) + mod \left(\frac{l}{\lambda} \right) \right]$$

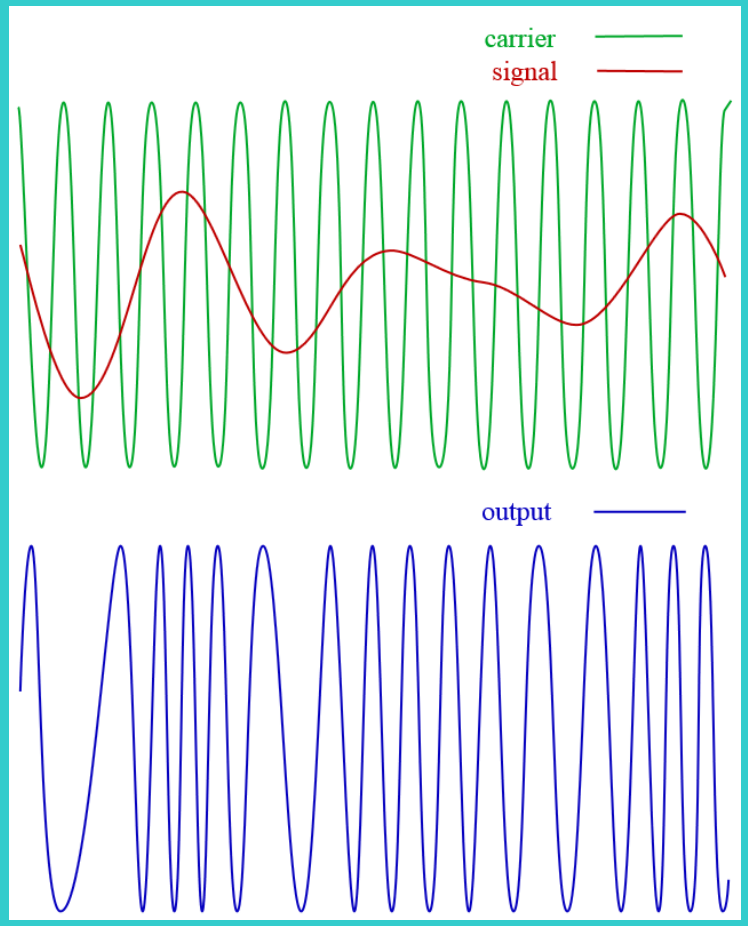
dove l è la distanza tra i punti

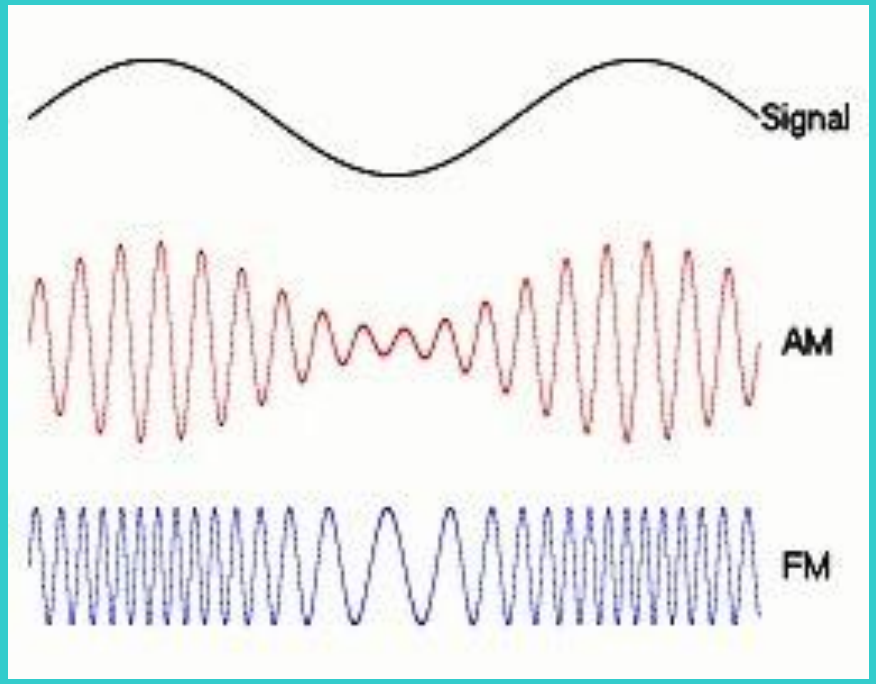
Riducendosi a 0-2π $\varphi = 2\pi \, mod \left(\frac{l}{\lambda} \right)$

$$l = \lambda \left(N + \frac{\varphi}{2\pi} \right)$$

N difficile da misurare senza ambiguità

Modulazione onde elettromagnetiche

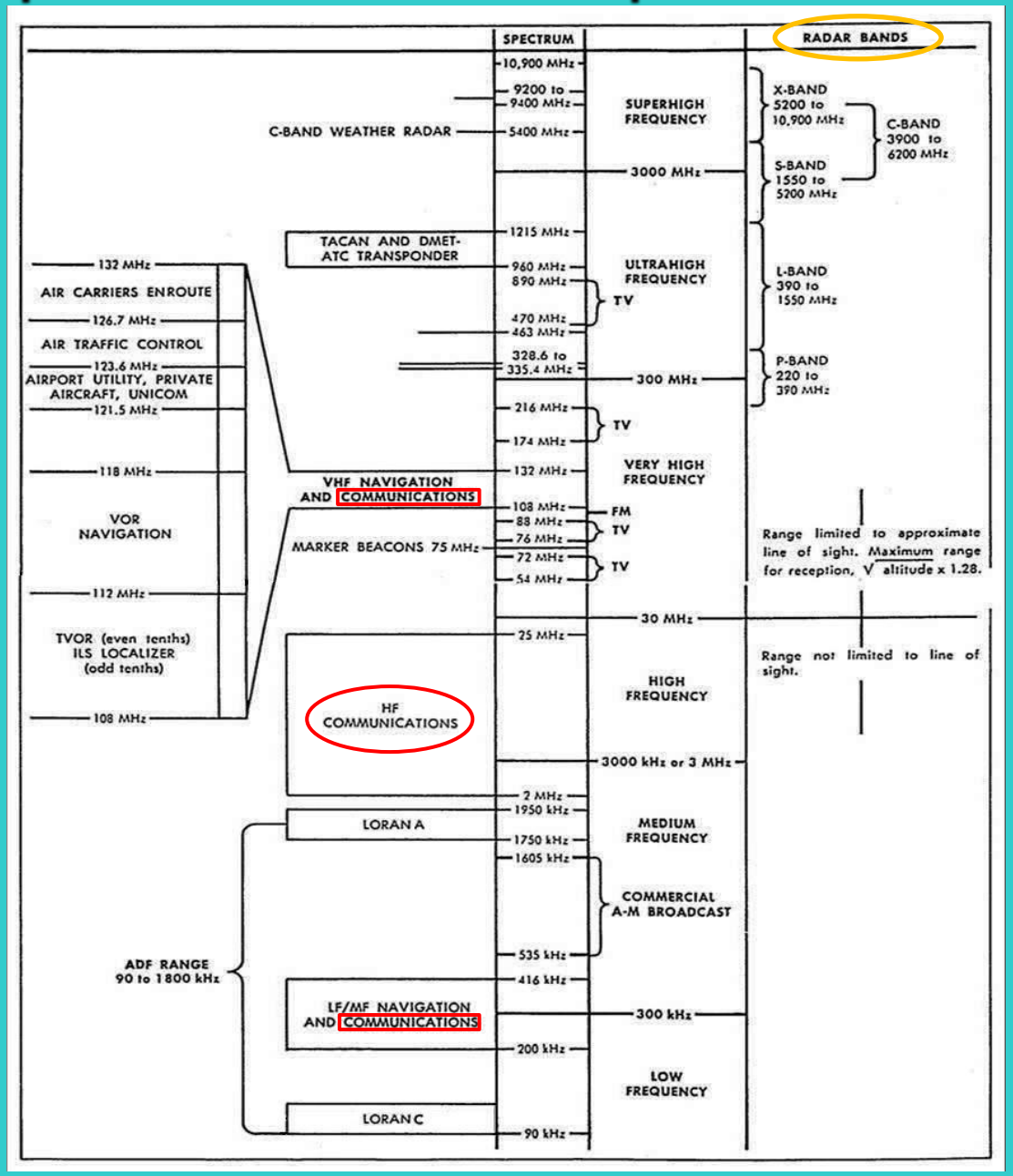




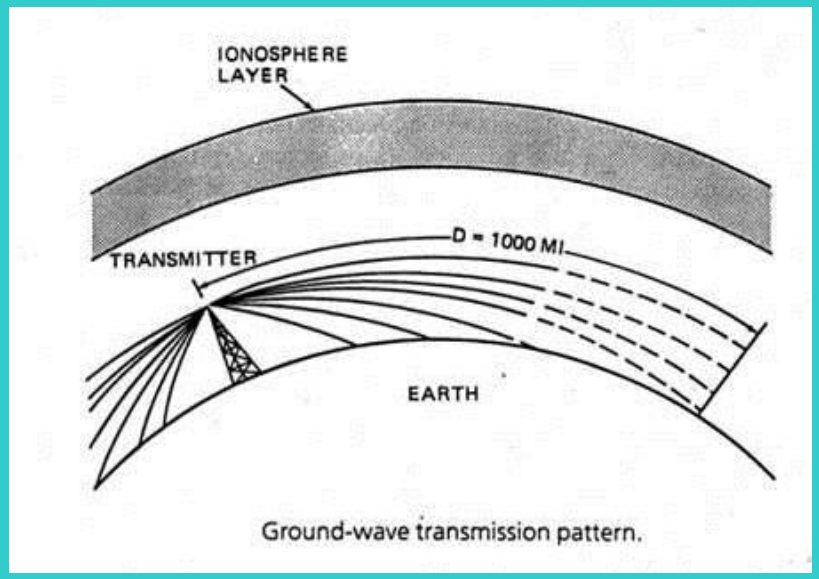
Spettro delle frequenze

Utilizzate per

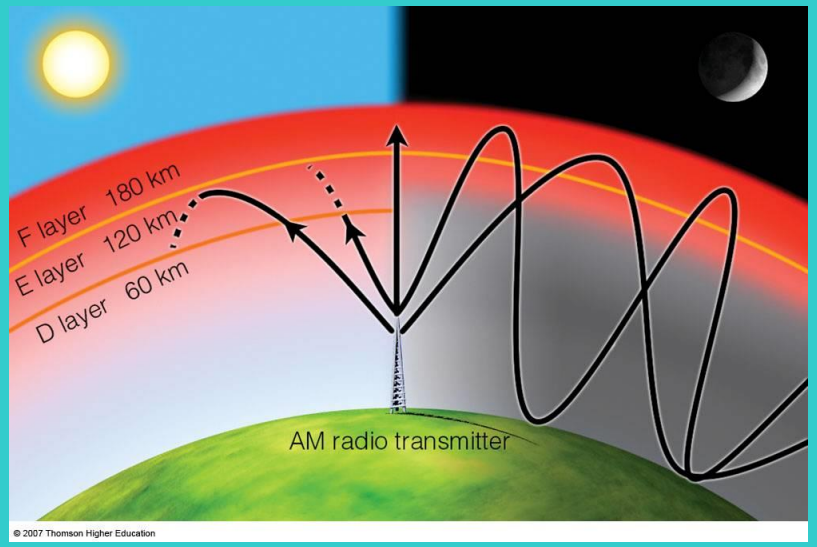
- Comunicazioni
- Radioaiuti
- Radar

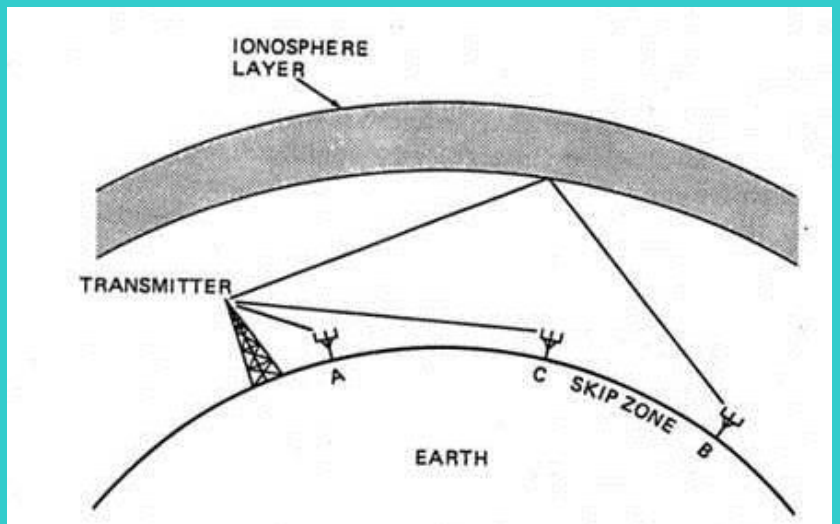


Modalità di propagazione

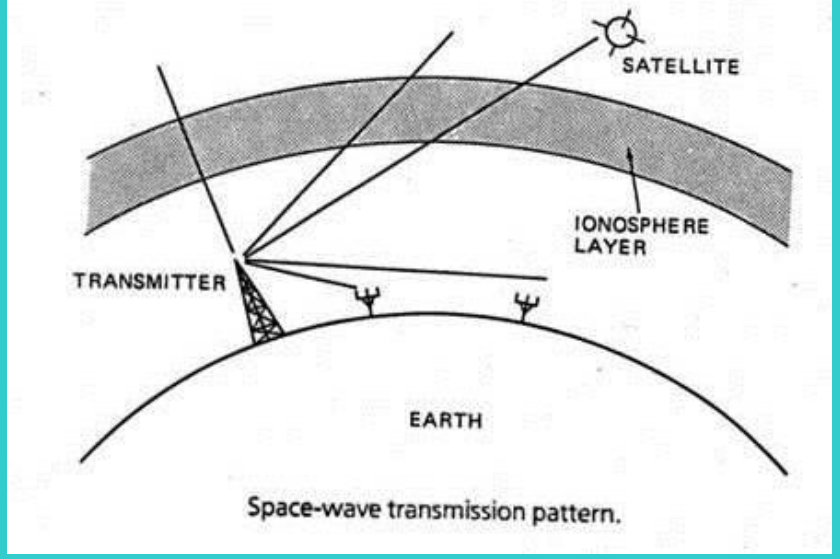


Ground-wave transmission pattern.





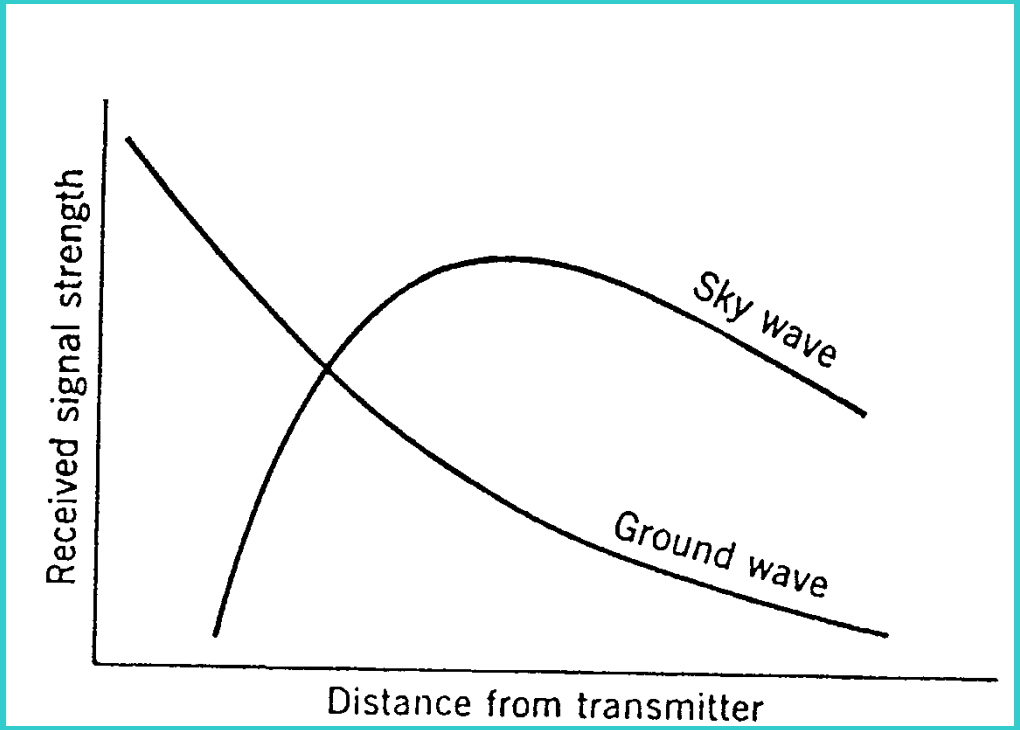
Sky-wave transmission pattern.



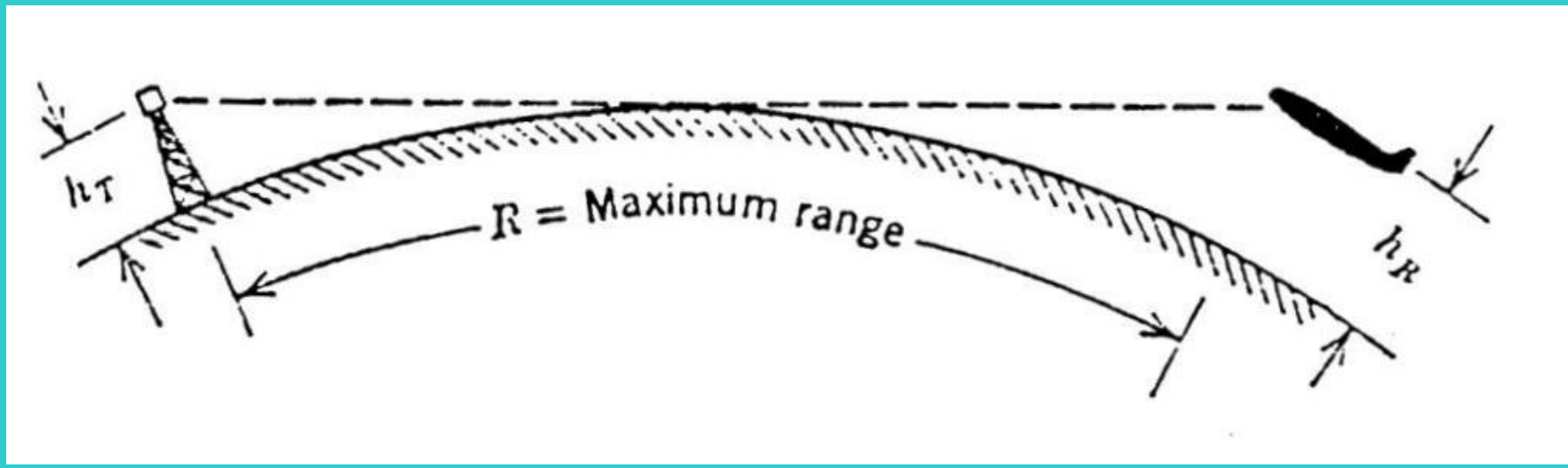
Space-wave transmission pattern.

Superamento della curvatura terrestre

Ambiguità del percorso e quindi ambiguità della distanza tra stazione trasmittente e stazione ricevente.



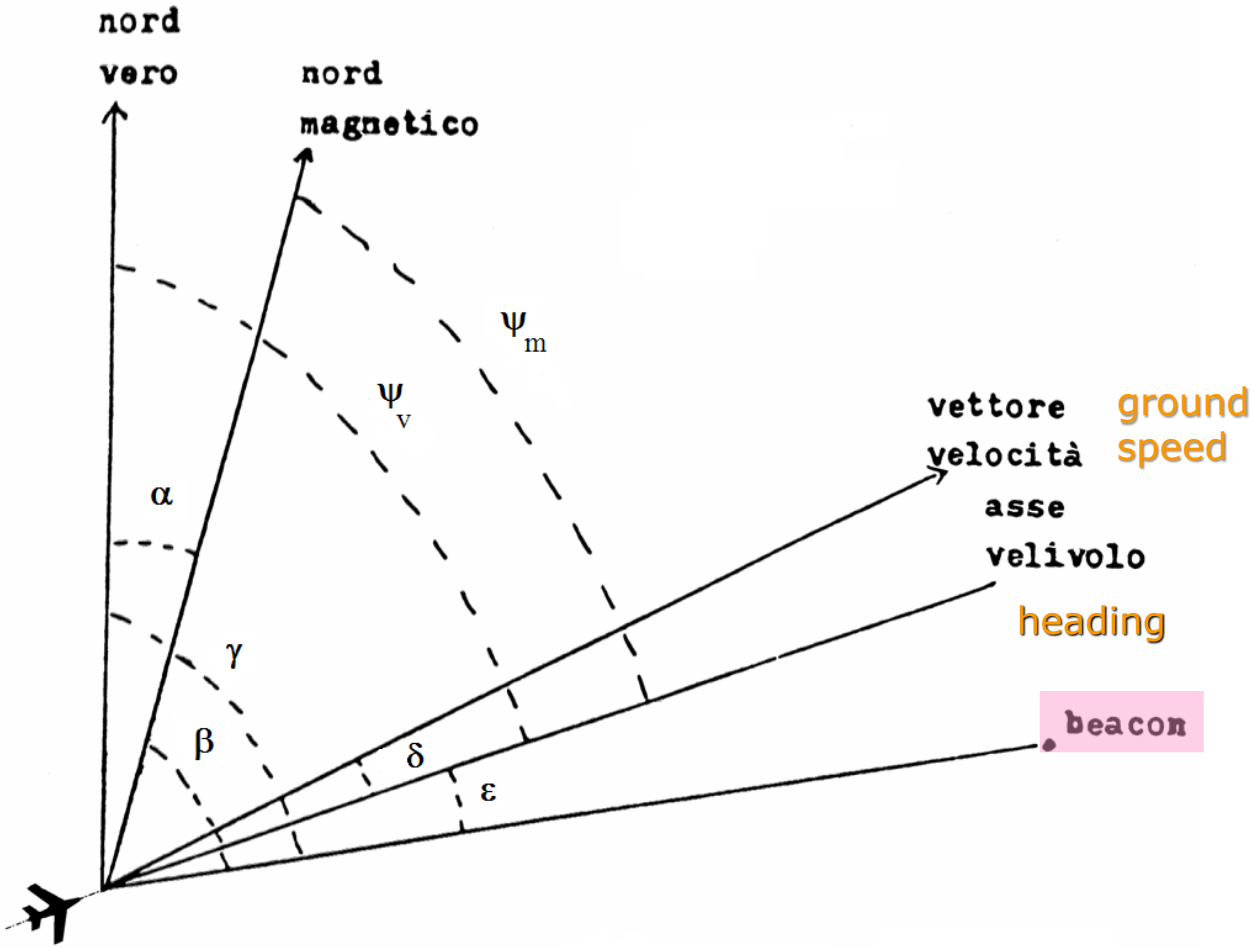
Propagazione rettilinea



$$\mathbf{R} = 1.2\sqrt{\mathbf{h_T}} + 1.2\sqrt{\mathbf{h_R}}$$

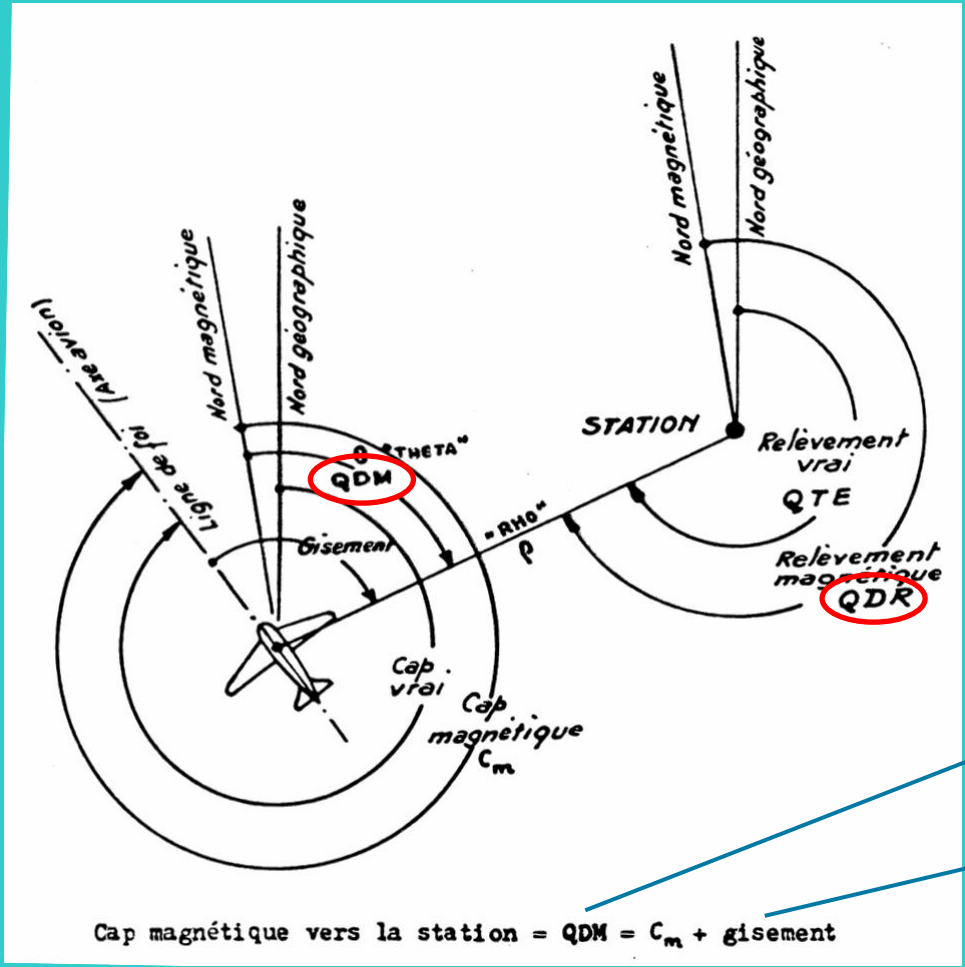
dove **R** è la distanza massima espressa in miglia nautiche mentre $\mathbf{h_T}$ e $\mathbf{h_R}$ sono le quote in piedi

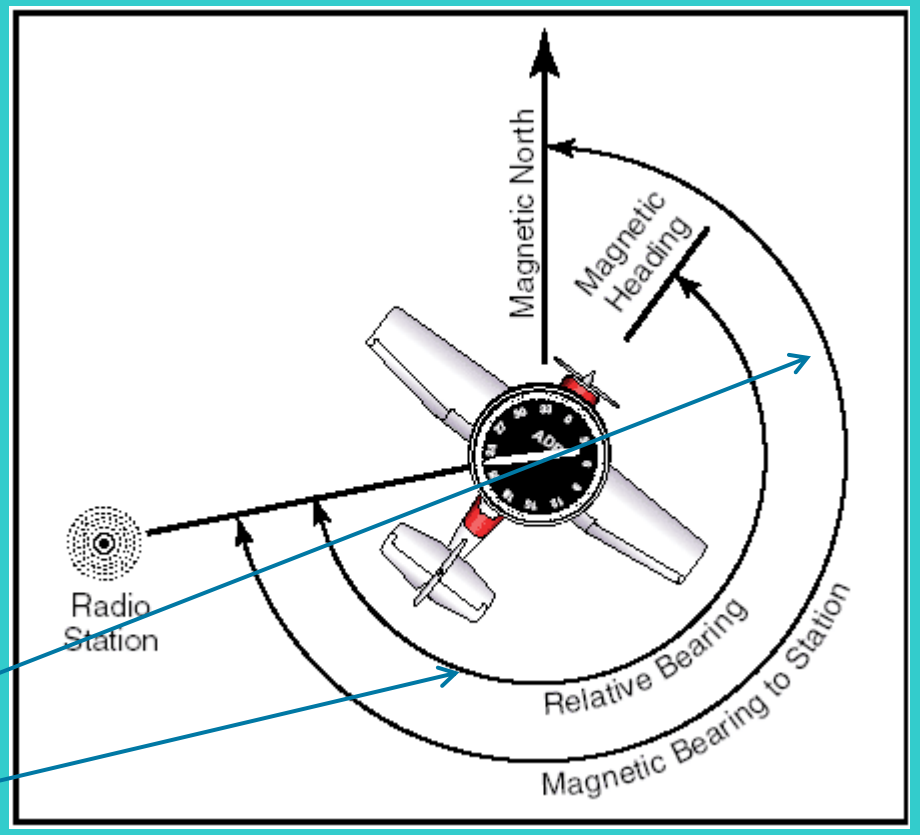
Rilevamenti



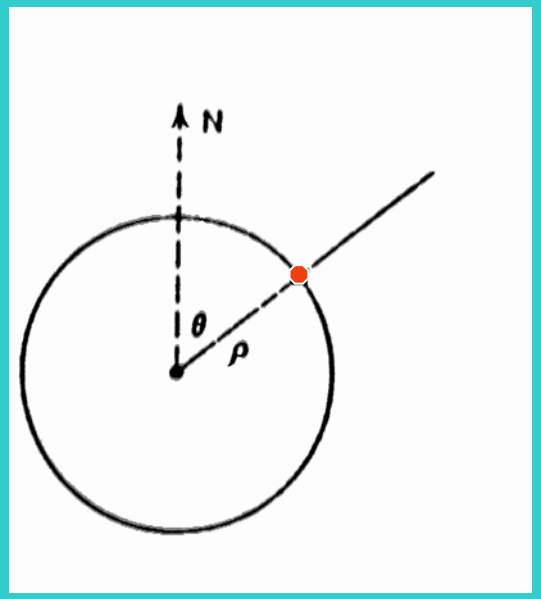
α = variazione magnetica
β = bearing magnetico
γ = bearing vero
δ = angolo di drift
ε = bearing relativo o rilevamento polare
ψ_v = prua vera
ψ_m = prua magnetica

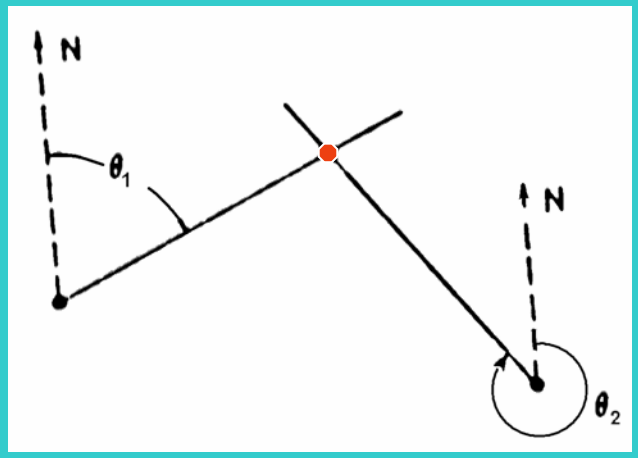
Rilevamenti



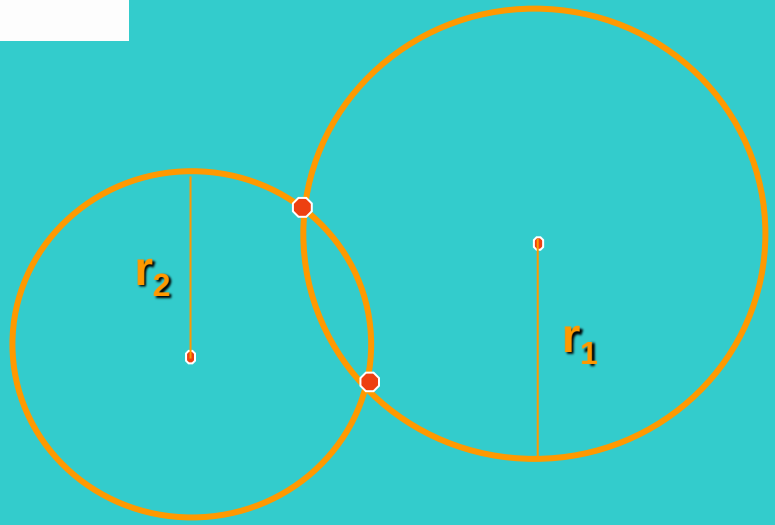


Determinazione del punto come intersezione di linee





LOP
Line Of Position



ADF Automatic Direction Finder

Not Directional Beacon NDB: stazione al suolo che trasmette sulle frequenze da 90 a 1800 kHz (200 a 415 kHz) in maniera indistinta su tutto l'orizzonte

Automatic Direction Finder ADF: apparato di bordo

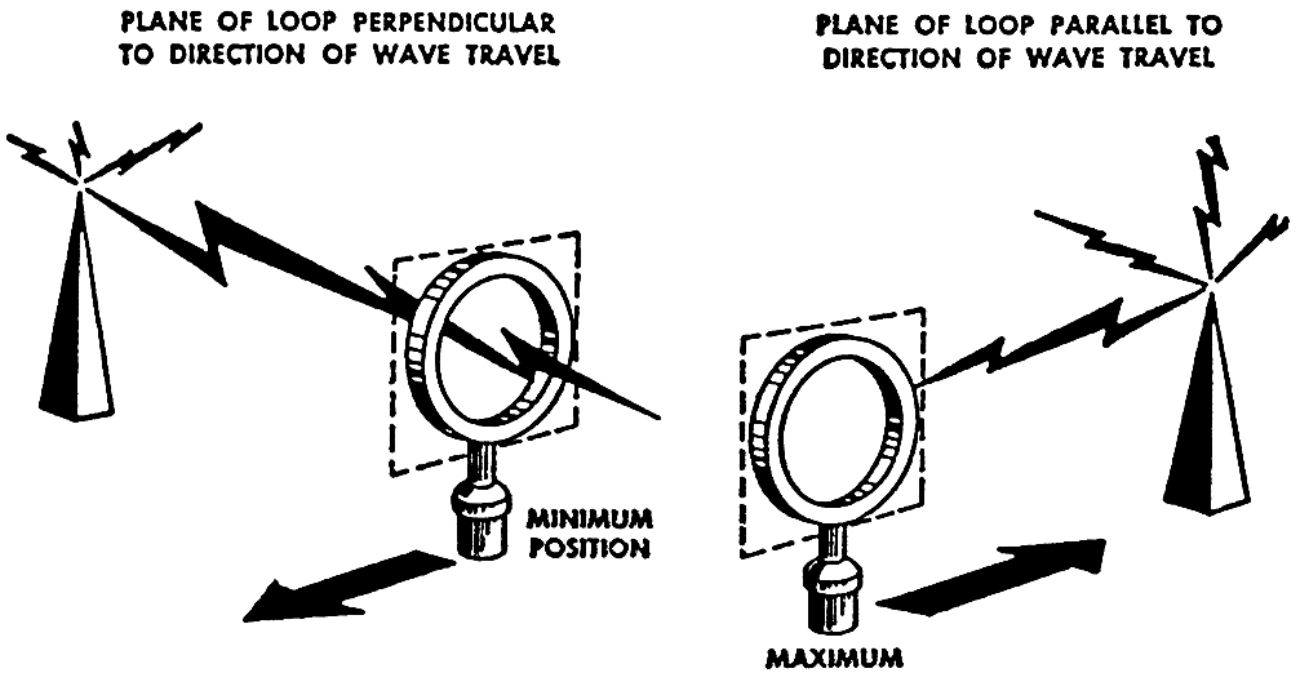
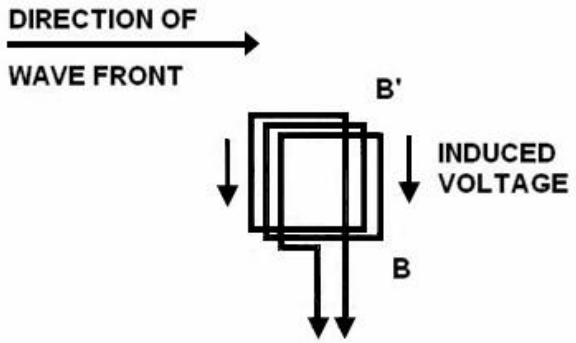
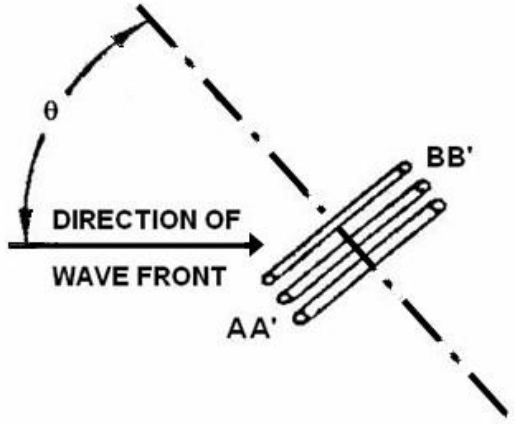


Figure 5.40. Minimum and maximum positions of loop antenna. The minimum (null) position is the loop's position during ADF operation. The modern ADF loop antenna is totally solid state with no moving parts. Electrically, it functions in the same manner as the earlier rotatable type loop shown above.

Loop antenna

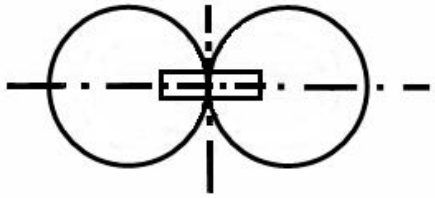


(A) Loop in line with the wavefront



(B) Loop at an angle with the wavefront

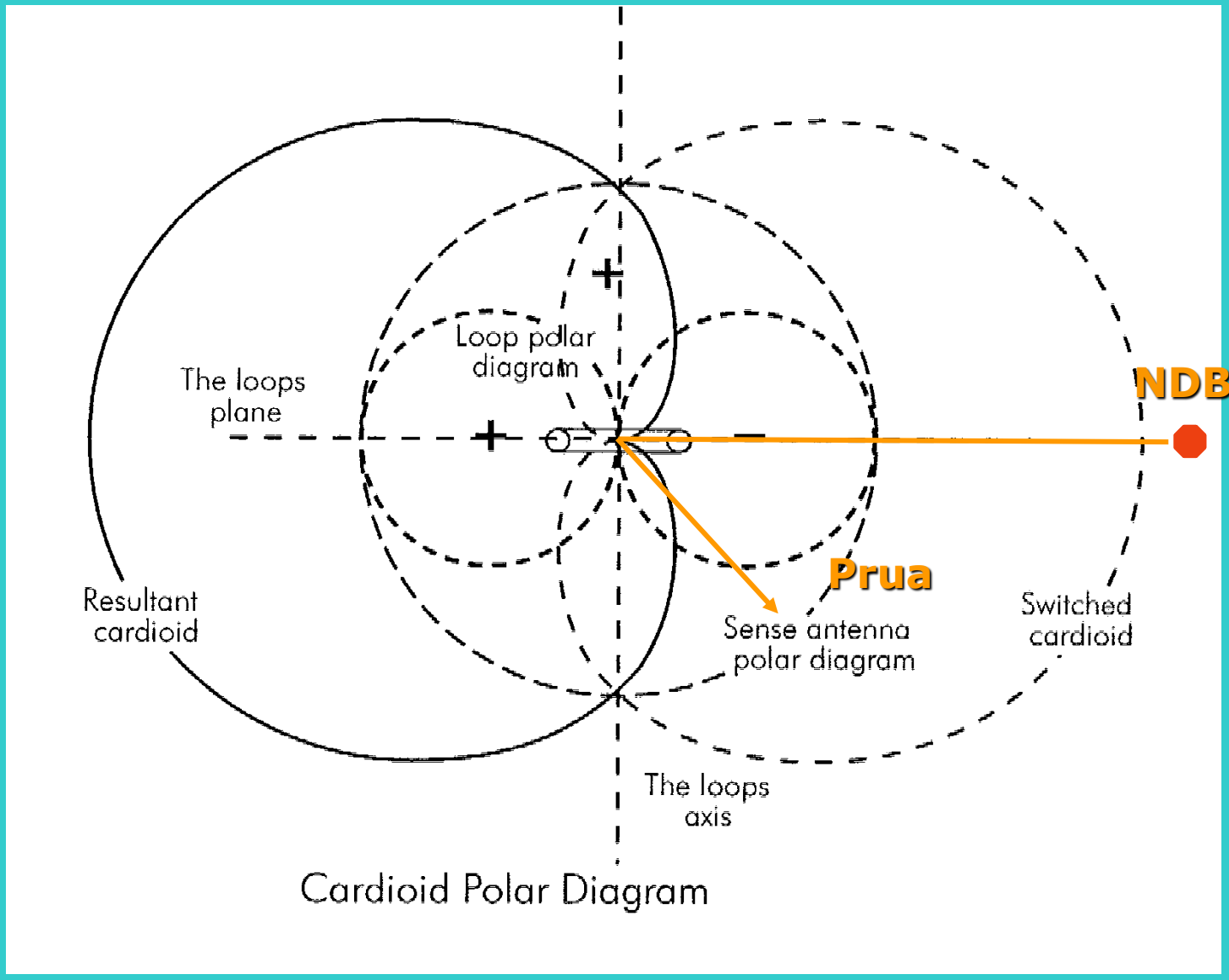
(C) Directional pattern of a loop antenna



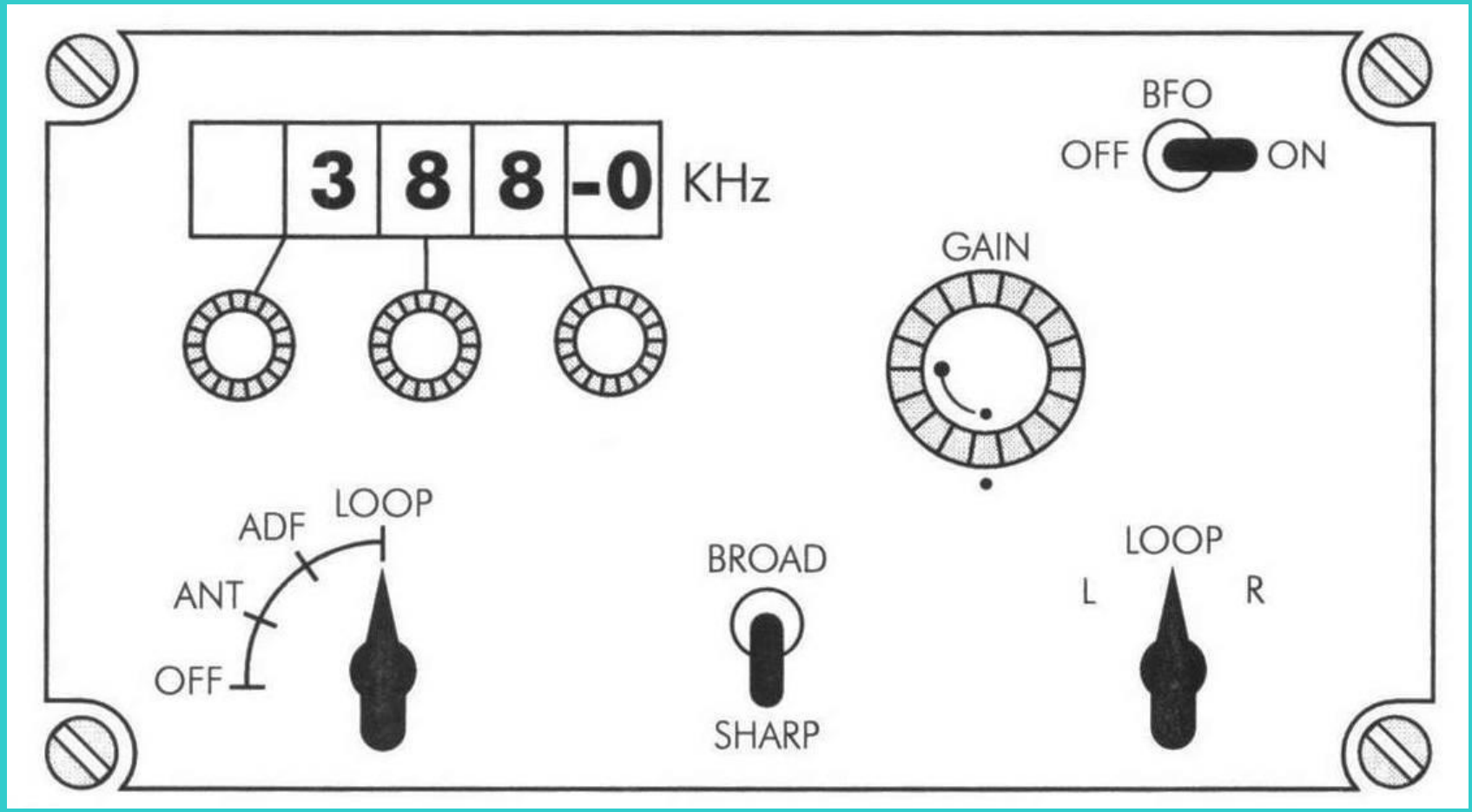
Loop and sense antenna

Henri Busignies gives the first model of his automatic direction finder to the Smithsonian. His device, developed in 1936, was an outgrowth of his earlier radio compass.

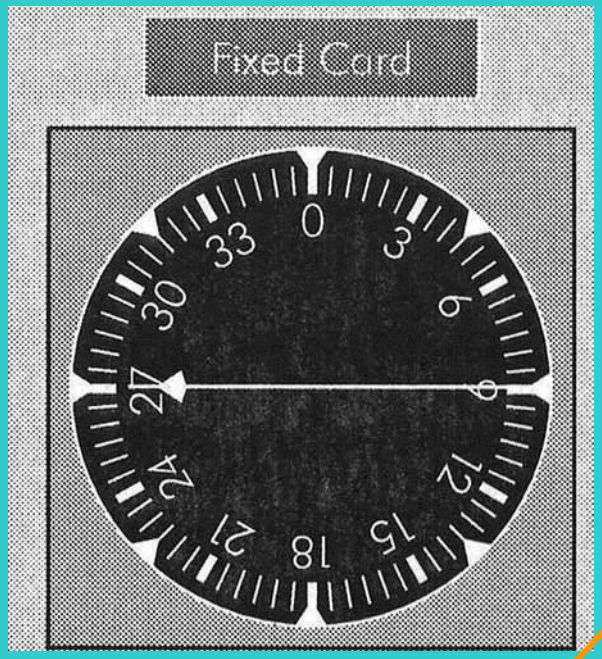
Cardioide

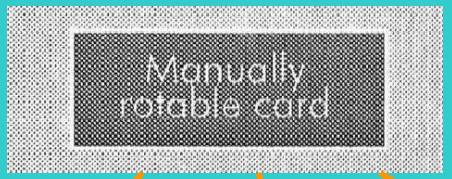

Loop polar diagram
The loops plane
NDB
Prua
Resultant cardioid
Sense antenna polar diagram
Switched cardioid
The loops axis
Cardioid Polar Diagram

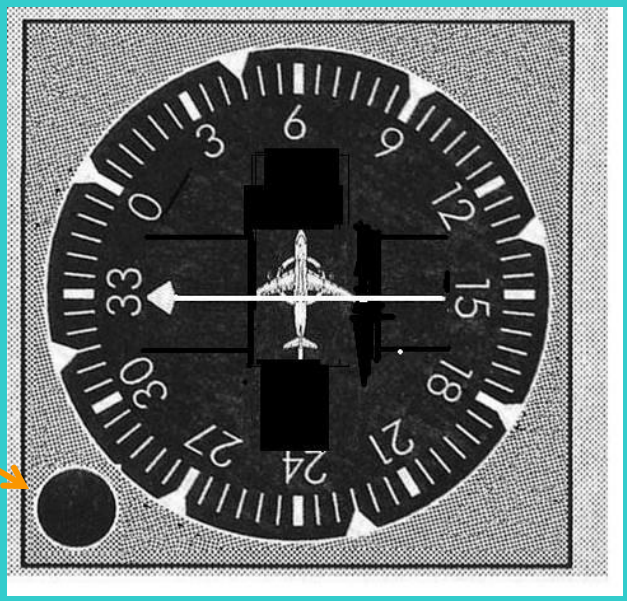
Quadretto di selezione

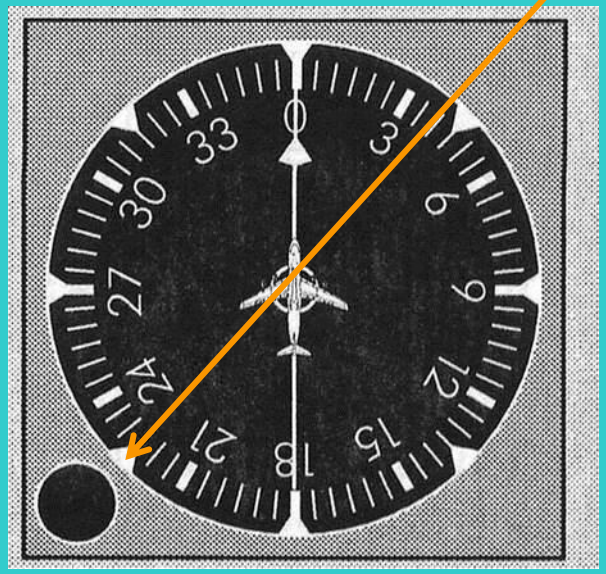


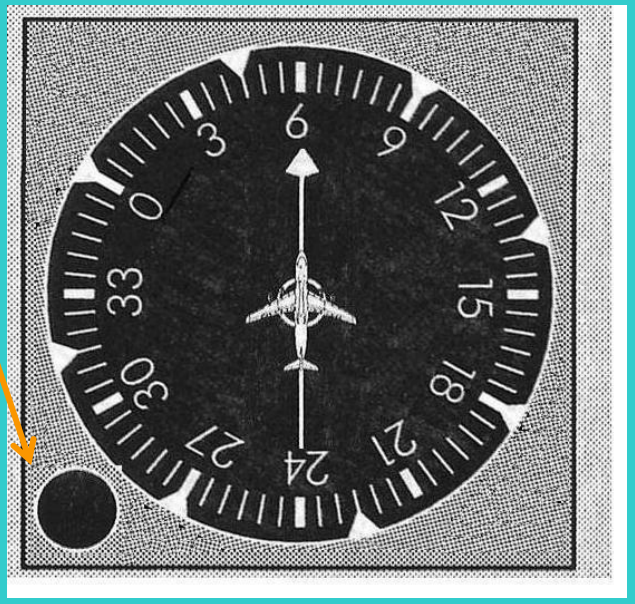
Quadranti



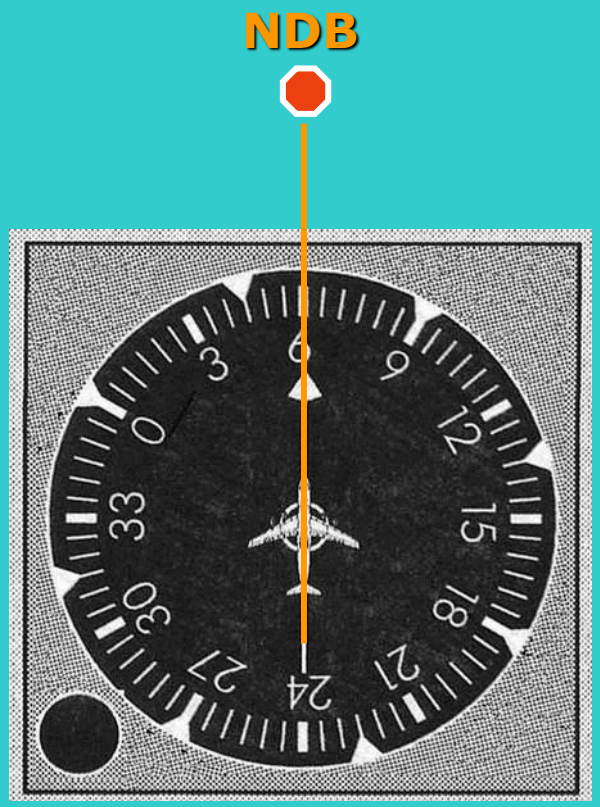




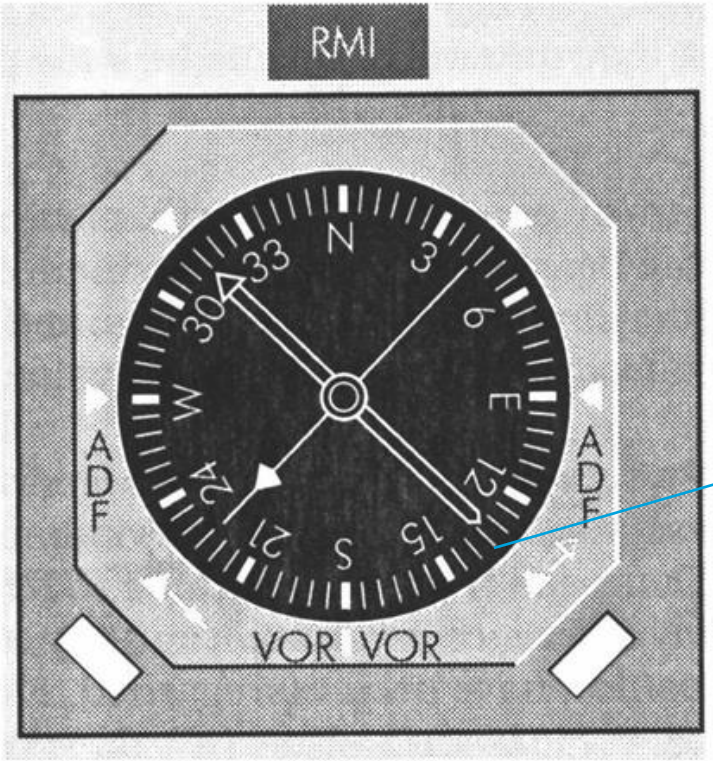




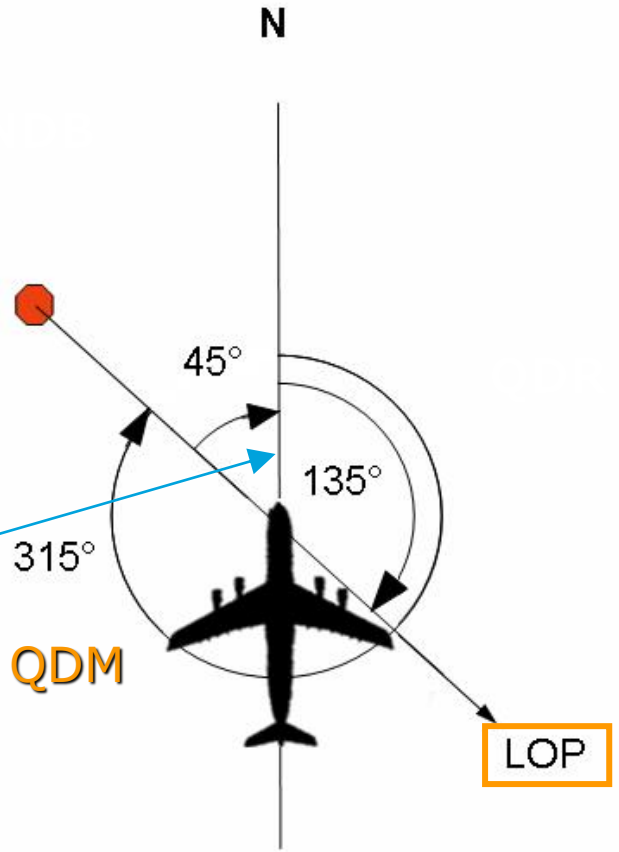
Homing



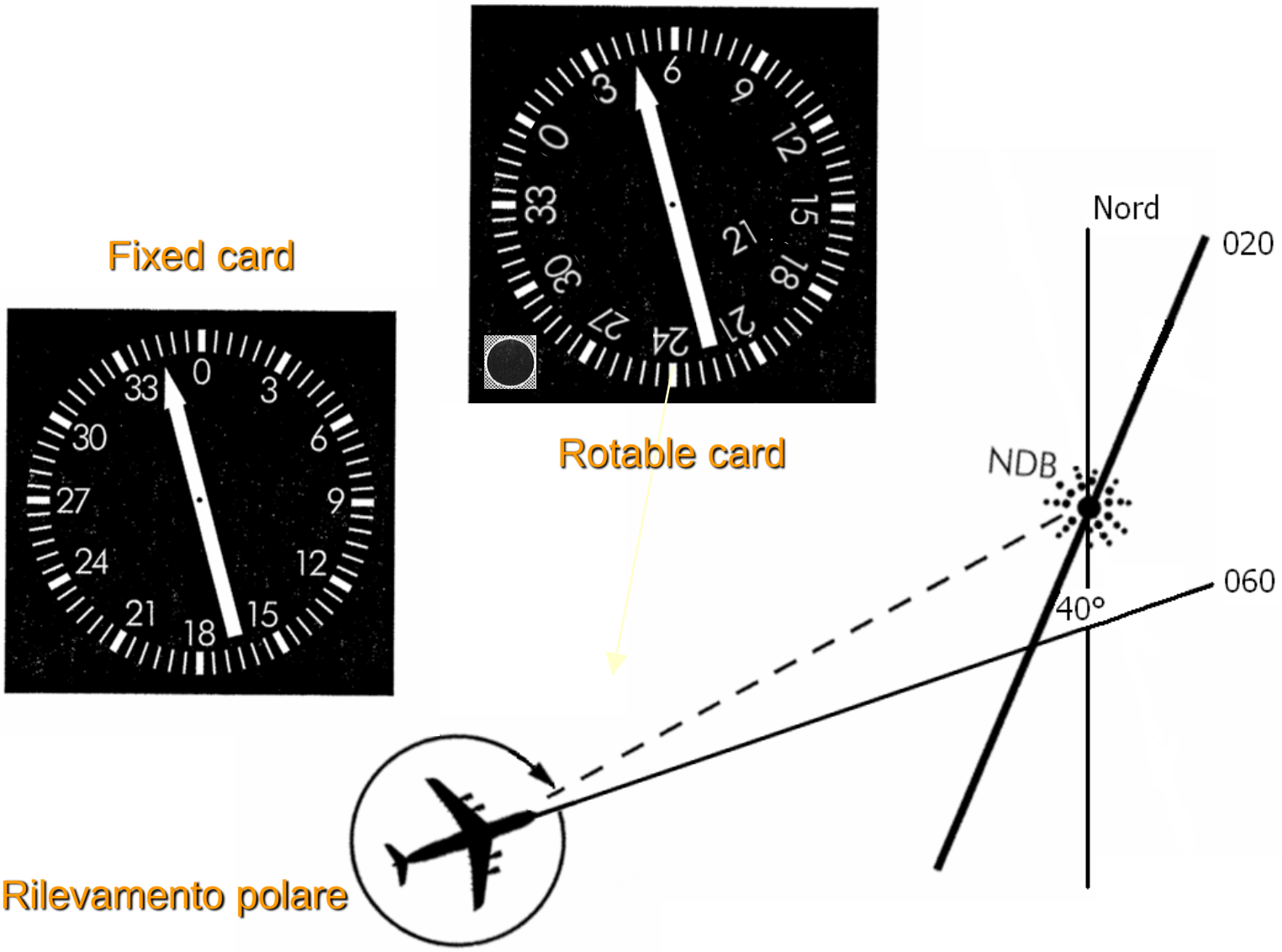
LOP Line Of Position



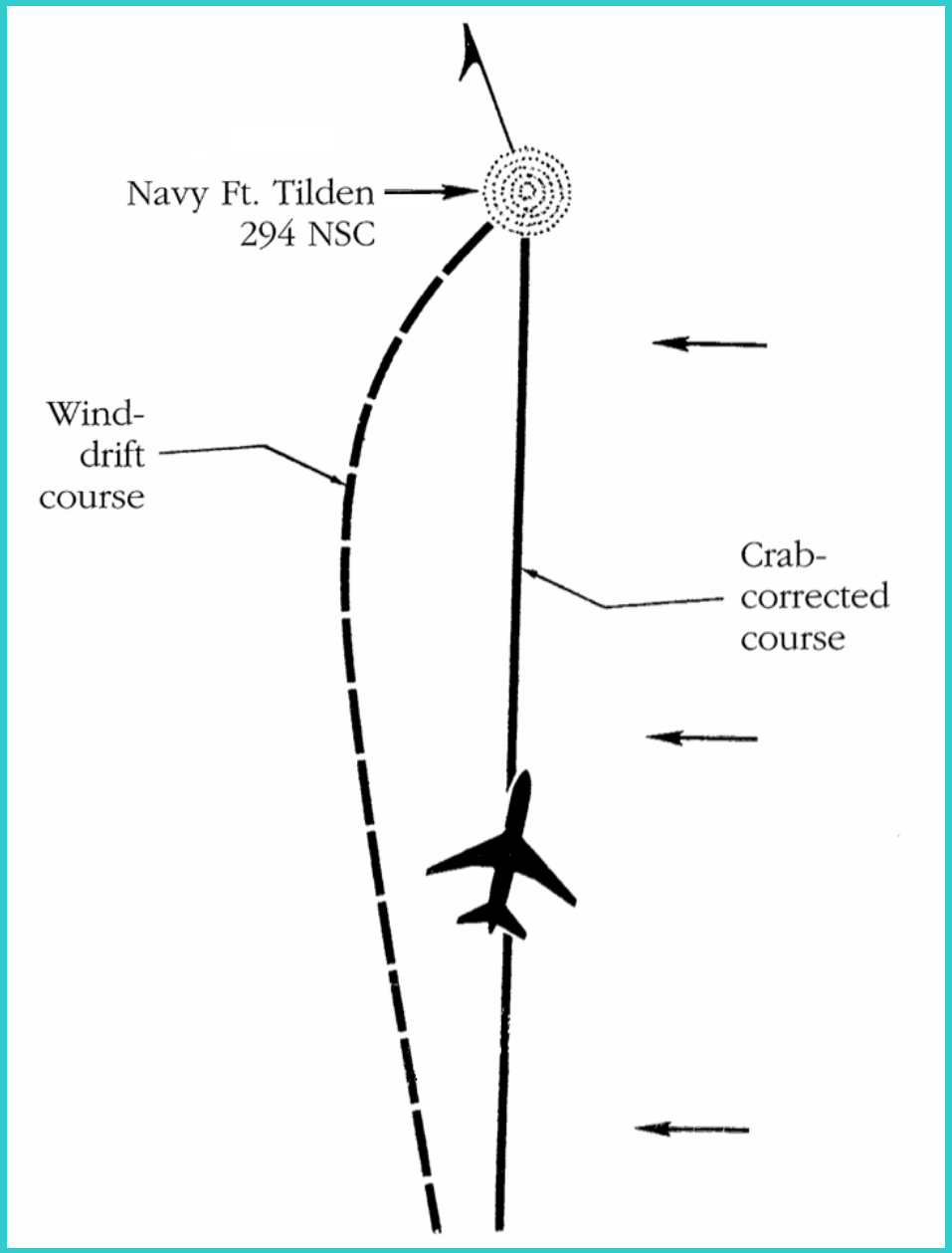
RMI Radio Magnetic Indicator



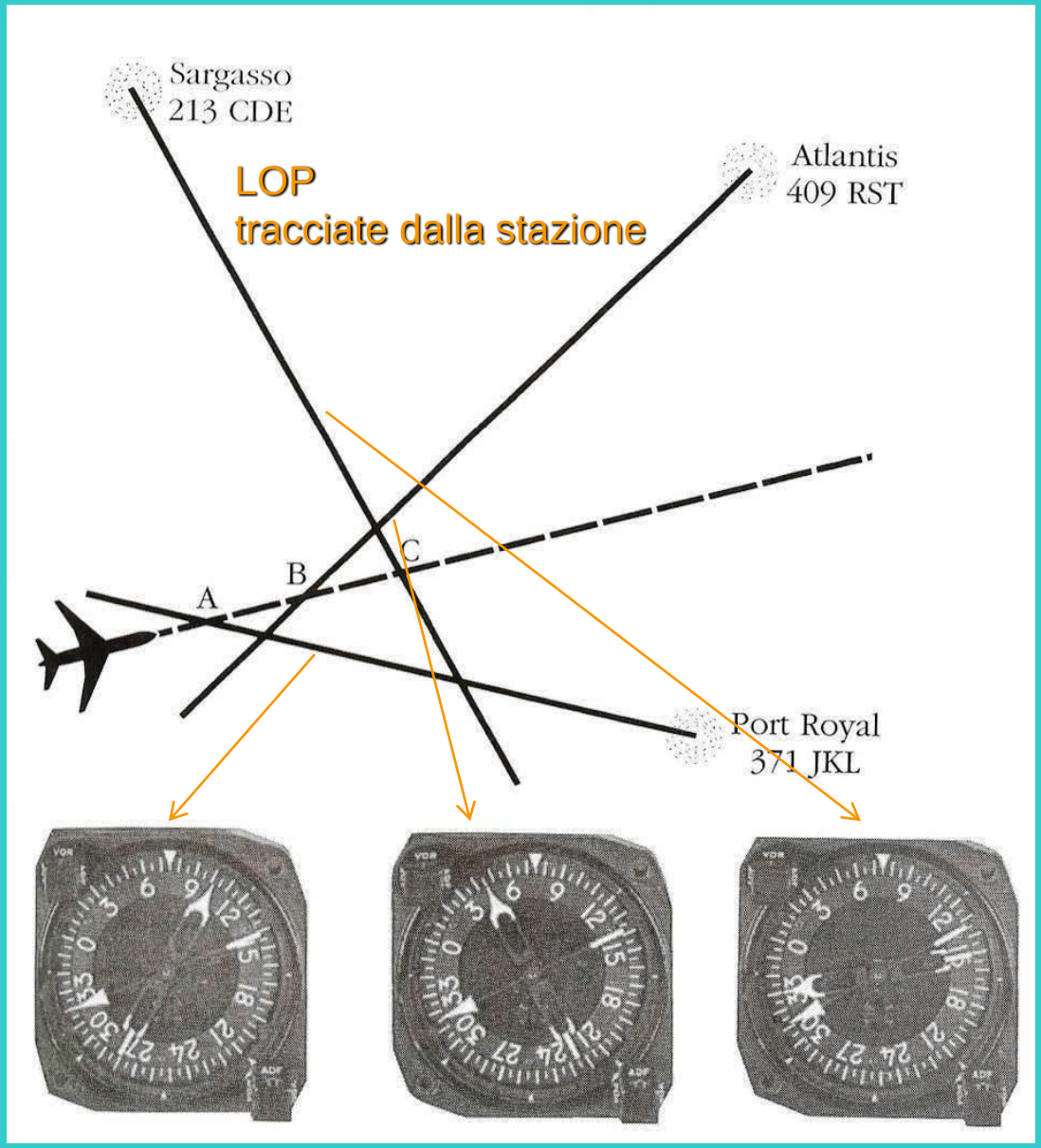
Rilevamento polare - Rilpo



Avvicinamento in presenza di vento laterale



Rilevazione del punto



A Port Royal B Atlantis C Sargasso

Rappresentazione EFIS