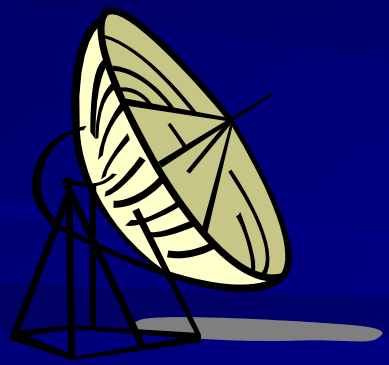


Learning Objectives

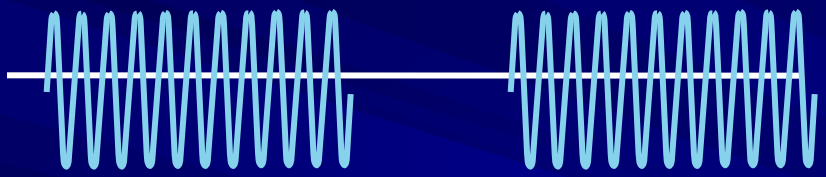
- Comprehend basic operation of a simple pulse radar system and a simple continuous wave radar system
- Know the following terms: pulse width, pulse repetition frequency, carrier frequency, peak power, average power, and duty cycle
- Know the block diagram of a simple pulse radar system

Learning Objectives

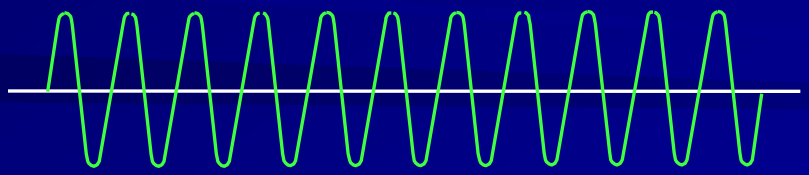
- Comprehend the concept of Doppler frequency shift
- Know the block diagram of a simple continuous wave radar system (amplifiers, power amplifiers, oscillators, and waveguides)
- Comprehend the use of filters in a CW radar system

Two Basic Radar Types

- Pulse Transmission



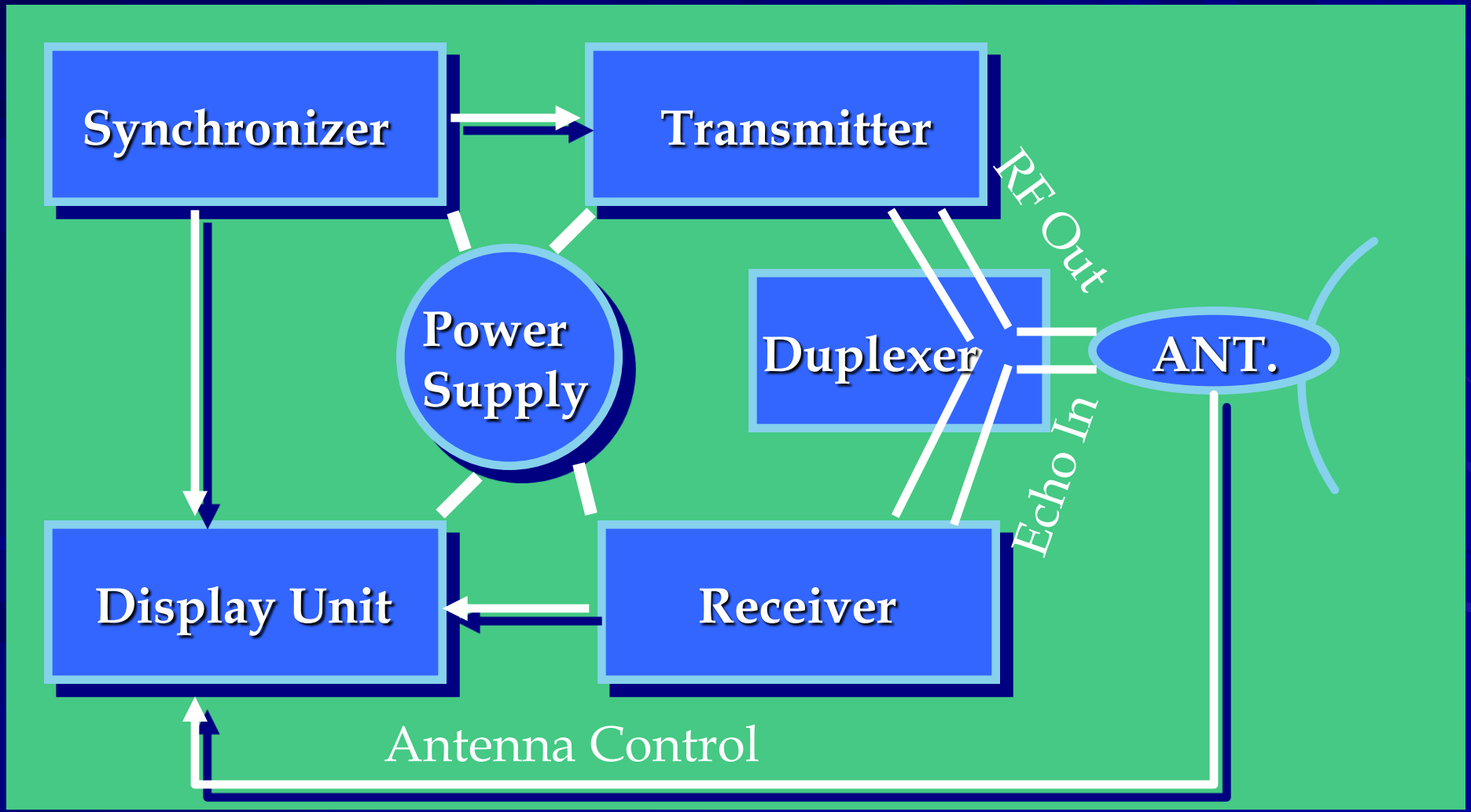
- Continuous Wave



Pulse Transmission

- Pulse Width (PW)
  - Length or duration of a given pulse
- Pulse Repetition Frequency (PRF)
  - **Frequency at which consecutive pulse are transmitted**
- Pulse Repetition Time (PRT=1/PRF)
  - Time from beginning of one pulse to the next
  - Inverse of PRF
- PW determines radar's
  - Minimum detection range
  - Maximum detection range
- PRF determines radar's
  - Maximum detection range

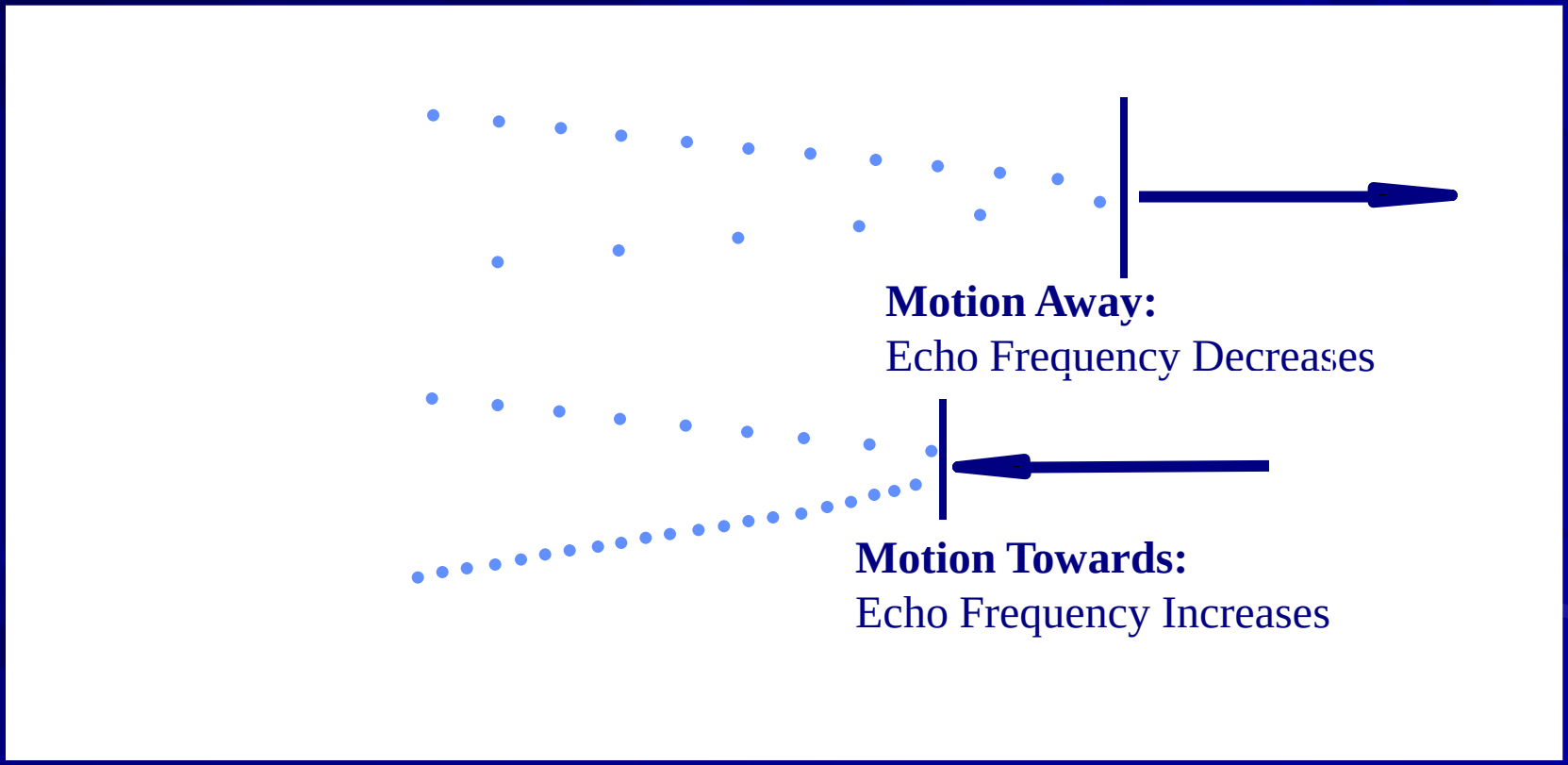
Pulse Radar Components



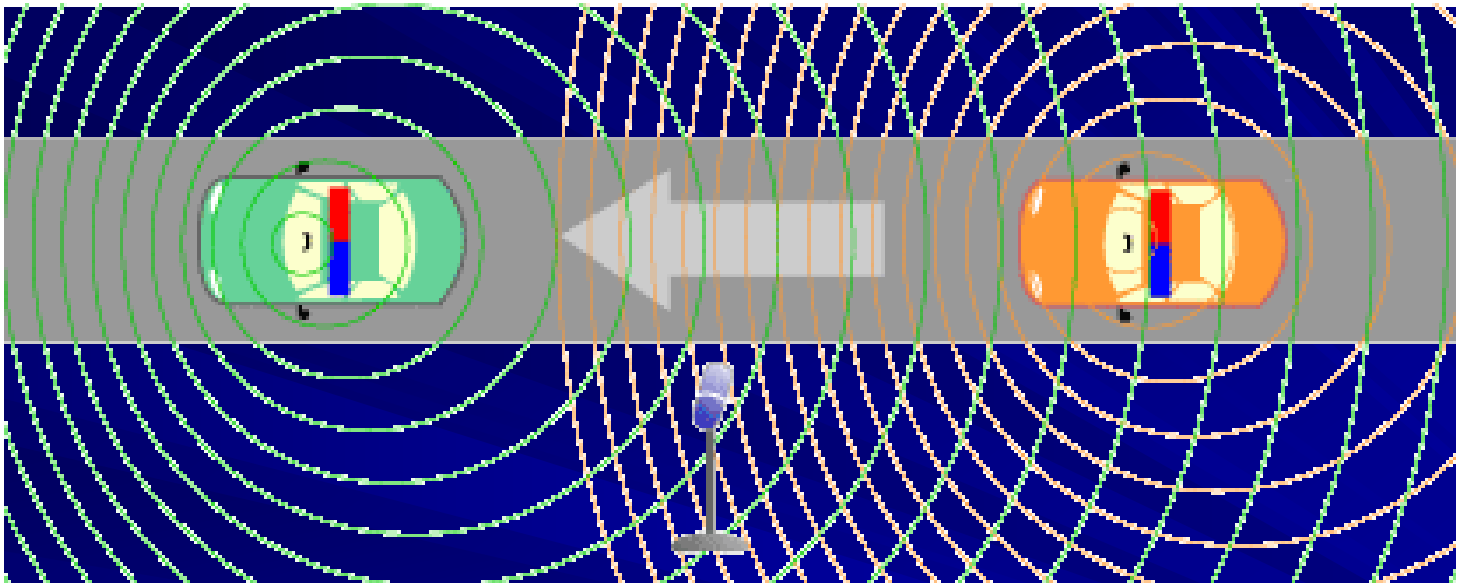
Continuous Wave Radar

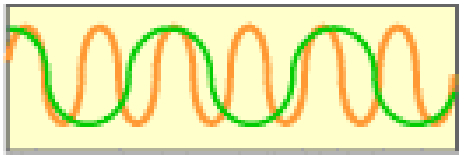
- Continual energy transmission
- Separate transmit/receive antennas
- Relies on “DOPPLER SHIFT”

Doppler Frequency Shifts

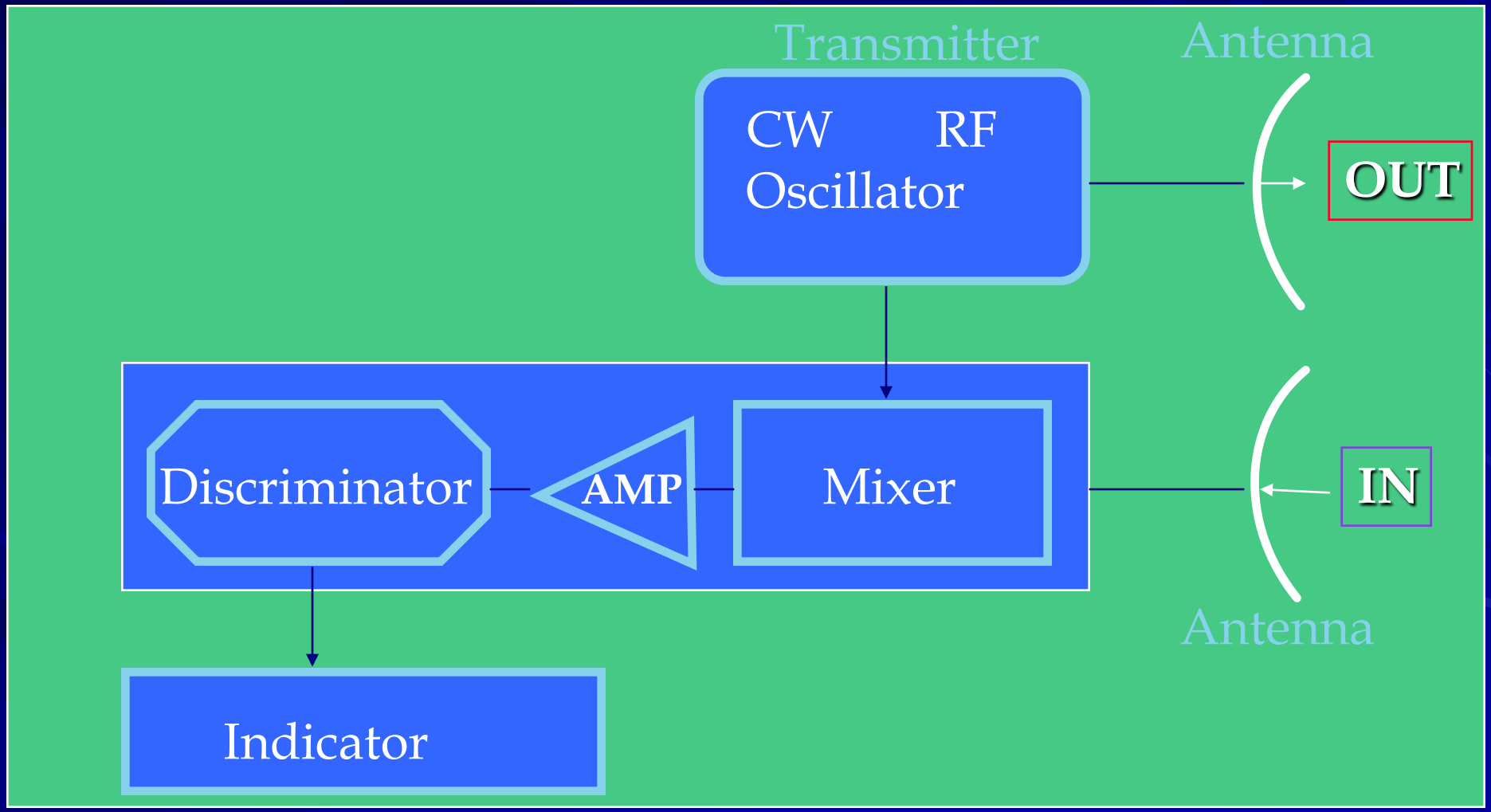


Doppler Effect





Continuous Wave Radar Components



Pulse Vs. Continuous Wave

Pulse Echo

- Single antenna
- Gives range, usually altitude as well
- Susceptible to jamming
- Range determined by PW and PRF

Continuous Wave

- Requires 2 antennae
- Range or Altitude info
- High SNR
- More difficult to jam but easily deceived
- Can be tuned to look for frequencies

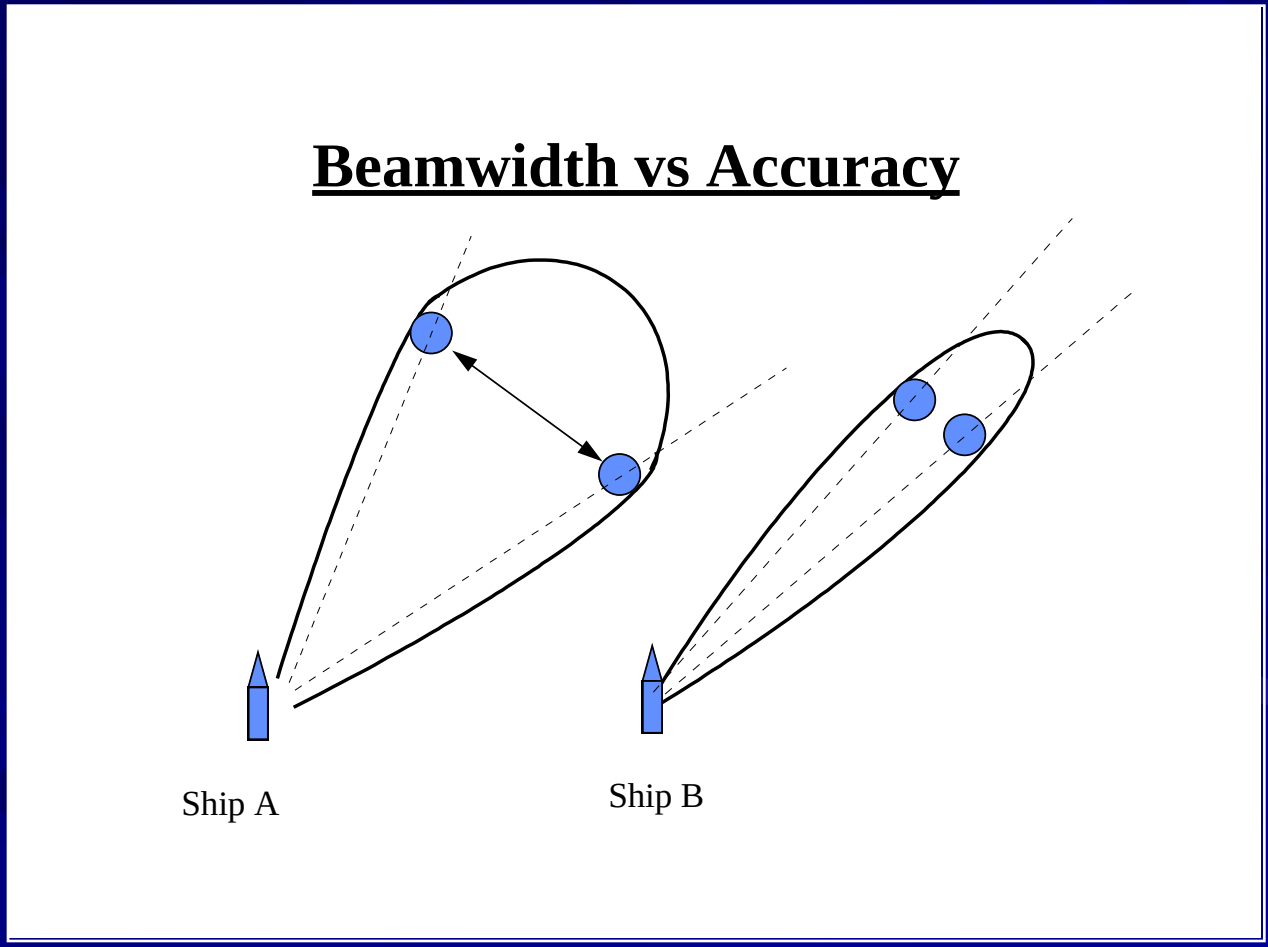
RADAR Wave Modulation

- Amplitude Modulation
  - Vary the amplitude of the carrier sine wave
- Frequency Modulation
  - Vary the frequency of the carrier sine wave
- Pulse-Amplitude Modulation
  - Vary the amplitude of the pulses
- Pulse-Frequency Modulation
  - Vary the Frequency at which the pulses occur

Antennae

- Two basic purposes:
  - Radiates RF energy
  - Provides beam forming and energy focusing
- Must be 1/2 the wave length for maximum wave length employed
- Wide beam pattern for search
- Narrow beam pattern for tracking

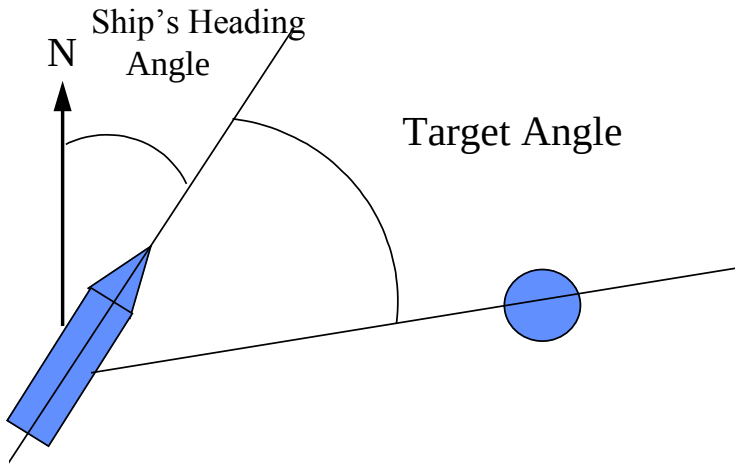
Beamwidth Vs. Accuracy



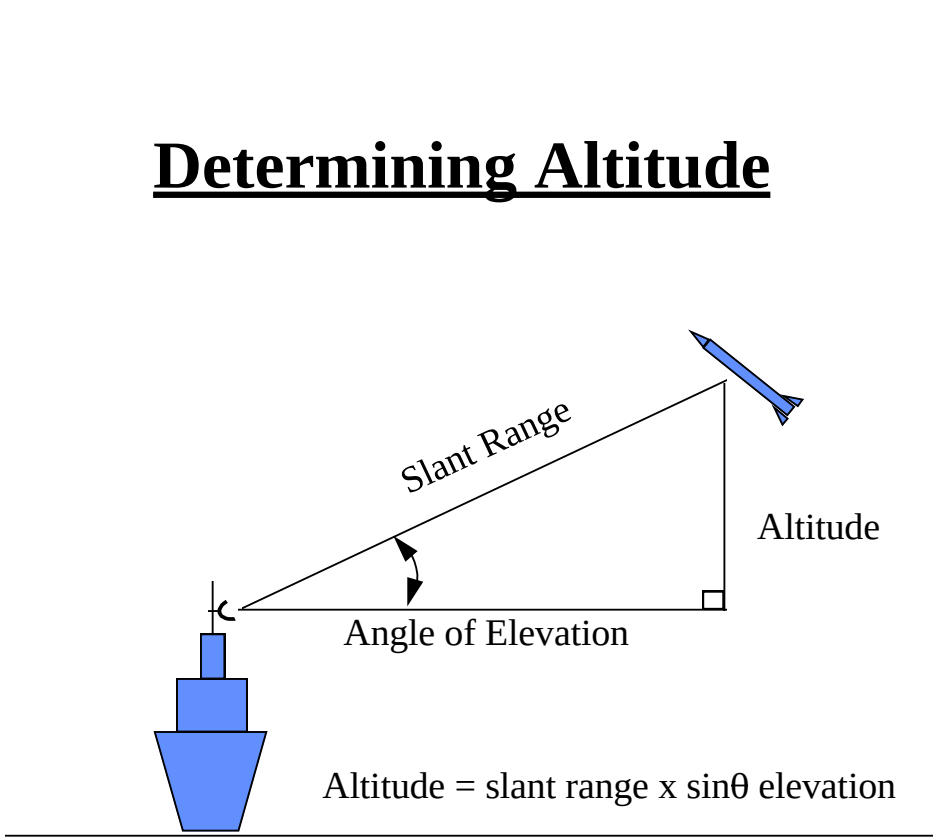
Determining Azimuth Angular Measurement

Azimuth Angular Measurement

Relative Bearing = Angle from ship's heading.
True Bearing = Ship's Heading + Relative Bearing



Determining Altitude

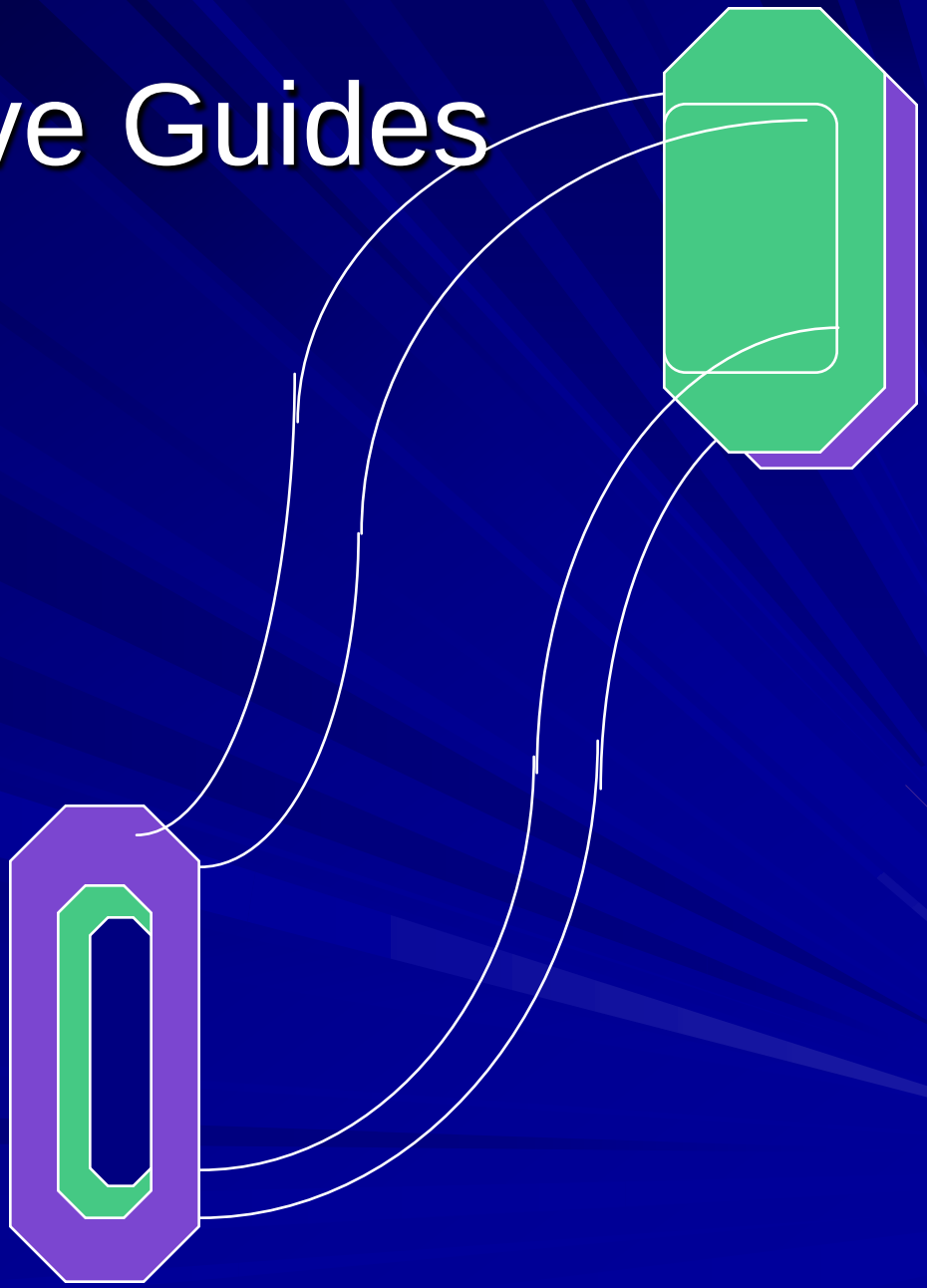


Concentrating Radar Energy Through Beam Formation

- Linear Arrays
  - Uses following principles
    - Wave summation (constructive interference)
    - Wave cancellation (destructive interference)
  - Made up of two or more simple ½ wave antennae
  - Example – Aegis Radar
- Quasi-optical
  - Uses reflectors and “lenses” to shape the beam

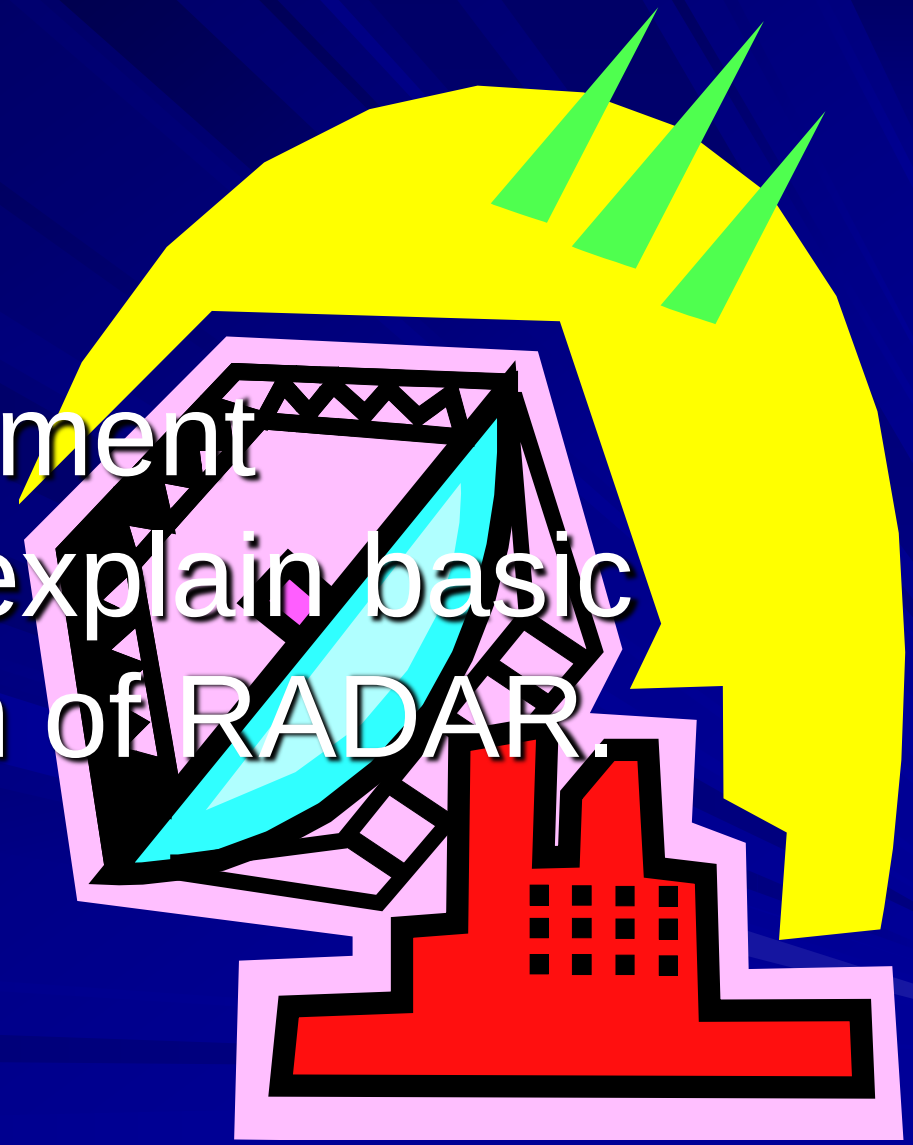
Wave Guides

- Used as a medium for high energy shielding.
- Uses magnetic field to keep energy centered in the wave guide.
- Filled with an inert gas to prevent arcing due to high voltages within the wave guide.



Assignment

Q. Draw and explain basic block diagram of RADAR.



Radar Applications

- Commercial Applications: ATC
- Military Applications
- Surveillance
- Navigation