

**EWCA, Inc. Course EW-1500**  
**Topical Outline**

**Each lecture is two hours of instruction**

**Lecture Group I** – Early Warning and Target Acquisition Radar Basics – 6 lectures

Topics include: Electromagnetic Wave Radiation Condition, Frequency, Period, Wavelength, Phase, Phase Shift, Phase Front, Plane Waves, Electric Field Component, Polarization, Magnetic Field Component, Free Space Impedance, Poynting Vector, Power Spatial Density, Superposition, Antenna Basics, Antenna Patterns, Basic Radar Principles, Types of Search Radars, The Radar Power Equation, Radar Cross Section (RCS) Definition and Characteristics, Scatter Mechanisms, Target RCS Reduction, Clutter RCS Radar System Block Diagram, Transmitter, TR/ATR Switch, Circulator, Waveguides, Coaxial Cables, Connectors, Couplers, Transmission Modes, Characteristic Impedance, Matched Loads, Reflection Coefficients, Voltage Standing Wave Ratio (VSWR), Antennas as Impedance Transformers, Transmit Antenna, Receive Antenna, Local Oscillator, Mixer, IF Amplifier, Detector, Displays, Detecting Signals in Noise, Probability Density Functions, Setting Detection Thresholds, Constant False Alarm Rate (CFAR), Probability of False Alarm, Probability of Detection, Extracting Target Information – Range and Doppler, Resolution

**Lecture Group II** – Target Tracking Radars – 6 lectures

Topics Include: Automatic Gain Control, Range Tracker Block Diagram, Classical Split Gate Range Tracking, Balanced and Biased Range Gate Tracking, Range Tracking Simulation Results and Error Analysis, Methods of Range Ambiguity Resolution, Methods of Range Estimation in Highly Ambiguous Waveform Modes, Classical and Optimal Tracking Filters, Target Spectra and JEM, Doppler Split Gate Tracking, Doppler Acquisition/Re-acquisition, Doppler Tracking Simulation Results and Error Analysis. Classical and Optimal Tracking Filters, Target Spectra and JEM, Doppler Split Gate Tracking, Doppler Acquisition/Re-acquisition, Doppler Tracking Simulation Results and Error Analysis. Coordinated Range Rate-Doppler Tracking, Classical Range and Doppler ECCMs, Track-While-Scan Systems, Sources of Track-While-Scan Angle Error Conical Scan Tracking, Sources of Conical Scan Tracking Error, Monopulse Tracking, Two-Channel Monopulse, Three-Channel Monopulse, Sources of Monopulse Angle Tracking Error, Inherent ECCM characteristic of Monopulse Trackers

**Lecture Group III** – Weapon Systems – 4 lectures

Topics Include: General Weapon System Functions: Detect, Identify, Acquire, Track, Guide, Intercept, Multi-Spectral Subsystems, Guidance Mode Requirements, Guidance Modes: Ballistic, Lead Angle Command Guidance, Command-to-Line-of-Sight, Beam Rider, Semi-Active, Passive, Data-Link, Track Via Missile/ Seeker Aided Ground Guidance, Example Command Guided Surface-to-Air Missile Threat Weapon System, Example Coherent Semi-Active Surface-to-Air Missile Threat Weapon System, Example Seeker-Aided Ground Guidance Surface-to-Air

Missile Threat Weapon System, Example AAA Threat Weapon System, Example IR Guided Threat Weapon System, Example Airborne Interceptor Threat Weapon System, Definition of Weapon System Success for Selected Specific Weapon Systems. Classes of EW Concepts against Detect, Identify, Acquire, Track, Guide, and Intercept Functions; Example Technique Descriptions Within Selected Classes, Specific Weapon System Susceptibility of Selected Weapon Systems to Selected EW Techniques.

**Lecture Group IV – Missiles – 4 lectures**

Topics Include: Stable Flight, Roll, Pitch, Yaw, Thrust, Center of Gravity, Moments of Inertia, Static Drag, Dynamic Drag, Autopilot Functions, Example Flight Profiles, Command Guidance Methods, Command Guidance Receiver System, Semi-Active Guidance System and Proportional Navigation, RF Seeker Antenna, Radome Design Considerations and Parasitic Coupling, Missile Seeker Receiver, Doppler Tracker, Angle Tracker, Semi-Active RF Seeker ECCM, Active RF Seeker System, Onboard Signal Processing, Range/Doppler Matrix, Angle Tracking, Active RF Seeker ECCM,

**Competitive Design Project Reviews – PDR, CDR, and Final Review**