

**EW-2000**  
**Topical Outline**

**Each lecture is two hours of instruction**

**Lecture Group One** – 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, 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 Two** – Missile Functions and Implementing Subsystems – 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, Passive IR Guidance System, Single-Detector IR Guidance System, Aperture Optics, Detector, Video Signal Processor, Angle Tracker, Rosette Scan, Sequential Detector Signals, Scene Over Time Generation, Focal Plane Arrays, IR ECCM, Multi-Spectral Detectors

**Lecture Group Three** – 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

**Lecture Group Four** – Weapon System Potential Susceptibility to Multiple Classes of EW Concepts – 2 lectures

Topics include: 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 Five** – EW Systems Overview – 1 lecture

Topics include: High-Level Systems Requirements – Threat Systems and Their Operational Modes, Classes of EW System Functions, General Tradeoffs Between On-Board and Off-Board Self-Protection EW Systems, Open Loop and Closed Loop On-Board Self Protection Systems, Support EW Systems, Stand-alone EW Systems, Federated EW Systems, Integrated EW Systems, System of Systems – the emerging role of data links in EW

**Lecture Group Six** – Radar Warning Receivers, 4 lectures

Topics include: Microwave EW Receiver Systems Overview, Crystal Video Subsystems, Super Heterodyne Subsystems, Instantaneous Frequency Measurement Subsystems, Channelized Receiver Subsystems, Compressive Receiver Subsystems, The AN/ALR-69 RWR Hardware and Software Functions, The AN/ALR-56C RWR Hardware and Software Functions, The AN/ALR-56M Hardware and Software Functions

**Lecture Group Seven** – ECM Systems and Techniques – 6 lectures

Topics Include: Noise ECM Subsystems and Technique Descriptions, Repeater ECM Subsystems and Technique Descriptions, Transponder ECM Subsystems and Technique Descriptions, Digital RF Memory Subsystems and Technique Descriptions, Dual Coherent Source ECM

Subsystems and Techniques, The AN/ALQ-131 ECM System Hardware and Software Functions, The AN/ALQ-131, Block II ECM System Hardware and Software Functions, The AN/ALQ-184 ECM System Hardware and Software Functions, The AN/ALQ-161 ECM System Hardware and Software Functions, The AN/ALQ-172 ECM Hardware and Software Functions

**Lecture Group Eight** – Towed Decoys 4 lectures

Topics include: Towed Decoy Basic Functions, Towed Reflector, Towed Antenna, Towed Repeater, Fiber Optic Towed Transmitter, Antenna Patterns, Repeater Gain, Transmitter Power, Tow Line Length, Retraction, Release Response Time, The AN/ALE-50 Decoy Subsystem, The AN/ALE-55 Subsystem

**Lecture Group Nine** – Chaff, Flare, and Expendable Decoys – 4 lectures

Topics Include: Chaff Radar Cross Section, Bloom Rate, Dispense Patterns and Timing, Single and Multi-Frequency Chaff Packets, Chaff and Flare Dispensers, Flare Aerodynamics, Flare Irradiance, Irradiance Patterns, Dispense Methods, Timing, Spectral Issues, Expendable Decoy Transmit Power, Activate Mechanisms, Antenna Patterns, Frequency Response, Expendable Decoy Aerodynamics, Battery Issues, The AN/ALE-40 Chaff and Flare Dispenser, The AN/ALE-47 Chaff and Flare Dispenser

**Lecture Group Ten** -- EW Test and Evaluation – 3 lectures

Topics Include: AF Test Process, Test Environments, Concepts Development, Computer Aided Test and Evaluation, Hardware-In-The-Loop, Installed System Test Facility, Open Air Range, Test Results Correlation, Test Plan, Test Objectives, Data Requirements, Instrumentation Requirements, Data Collection, Analysis, Measures of Performance, Extrapolation of Test Results to the Operational Environment

**Lecture Group Eleven** – Review and Reinforce – 2 lectures

Topics Include: Review of specific topics as requested by students.