



412th Test Wing



War-Winning Capabilities ... On Time, On Cost



The Electronic Warfare Test & Evaluation (EW T&E) University – Educating & Training EW T&E Engineers

U.S. AIR FORCE

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Integrity - Service - Excellence



Overview



- **Who we are**
- **Motivation for EW T&E University**
- **EW T&E University**
- **Philosophy**
- **Curriculum**
- **Challenges**
 - **Workforce experience demographics**
 - **Evolving threat environment**
- **Summary**



Who We Are



- **Part of the Air Force Test Center**
 - USAF Center of Excellence for EW DT&E
- **412th EW Group**
 - Provide EW T&E engineering expertise to programs:
 - F-35, F-22, F-16
 - B-2, B-1, B-52
 - KC-46
 - Global Hawk
 - Operate test facilities & resources
 - Benefield Anechoic Facility (BAF)
 - Integration Facility for Avionics Subsystems (IFAST)
 - Digital Integrated Air Defense System (DIADS)
 - Improve and modernize test capabilities
 - Develop and maintain an effective EW T&E workforce

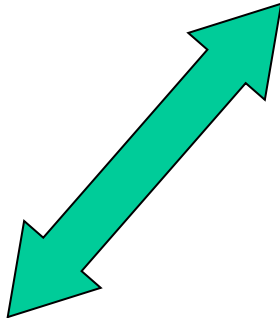


Motivation for EW T&E University

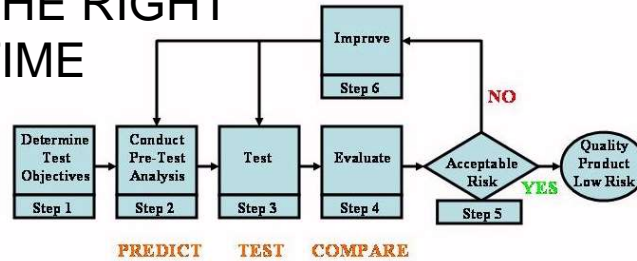


2000 – Went from 35 engineers to 110+ in less than 5 years

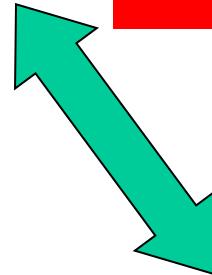
- Reduce Risk
- Demonstrate Performance
- Produce Information



THE RIGHT TIME



Provide testers with the required skills



EW SYSTEMS UNDER TEST (SUT)



THE RIGHT TEST



THE RIGHT PLACE



EW T&E University



- **Technical EW T&E training**
 - Recruiting asset
 - Initial training
 - Continuing education
- **Established in 2000**
 - 204 class offerings
 - 19 unique courses developed
 - 4100+ students
 - Wide USAF & DoD participation
 - Internally funded
- **Onsite Facility**
 - Fully Equipped Classroom
 - 24 station computer network
 - Up to SECRET content



Course Development Philosophy



- **3 – 5 day short course format**
 - Use commercially available courses
 - Develop courses to meet unique needs
- **Engineering level instruction**
- **Outstanding instructors**
 - Excellent academic credentials
 - Significant T&E or relevant experience
 - Good communication skills
- **Practical, hands on focus**
 - Realistic exercises
 - Field trips to T&E facilities and ranges



Guiding Philosophy



Therefore I say: 'Know the enemy and know yourself;
in a hundred battles you will never be in peril.

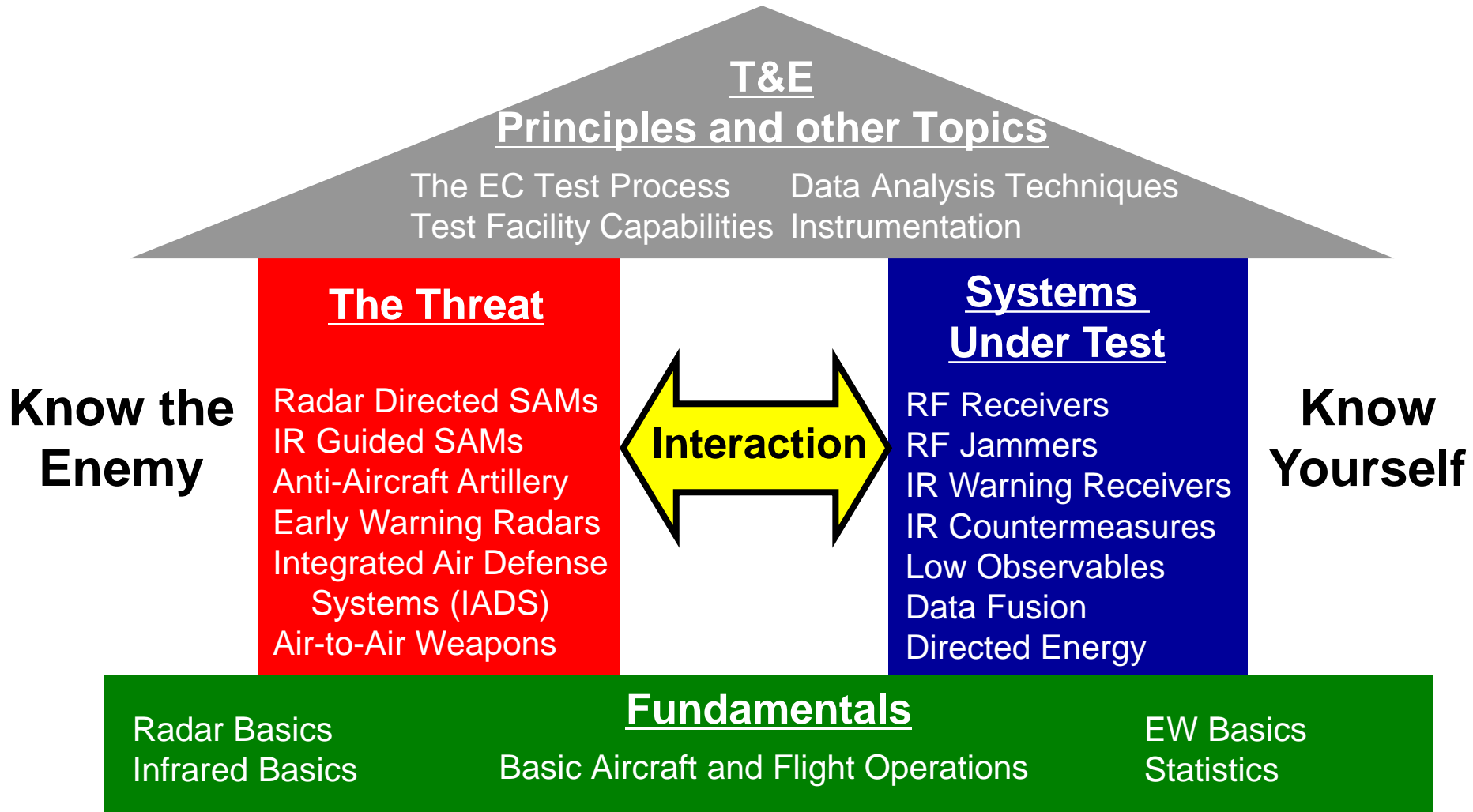
When you are ignorant of the enemy but know yourself,
your chances of winning or losing are equal.

If ignorant of both your enemy and of yourself, you are
certain in every battle to be in peril.'

SUN TZU, c500 BC
THE ART OF WAR
III:31-33

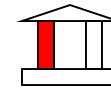


Course Development Philosophy





Threat Systems



- **Explore selected threat systems in detail**

- Operational employment
- Sensor types
- Missile guidance and navigation
- Gun direction
- Operator roles, etc.



- **Visit test ranges & facilities**

- Tour China Lake ECR actual systems & other assets
- Talk with threat system operators

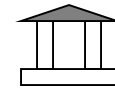


Systems Under Test

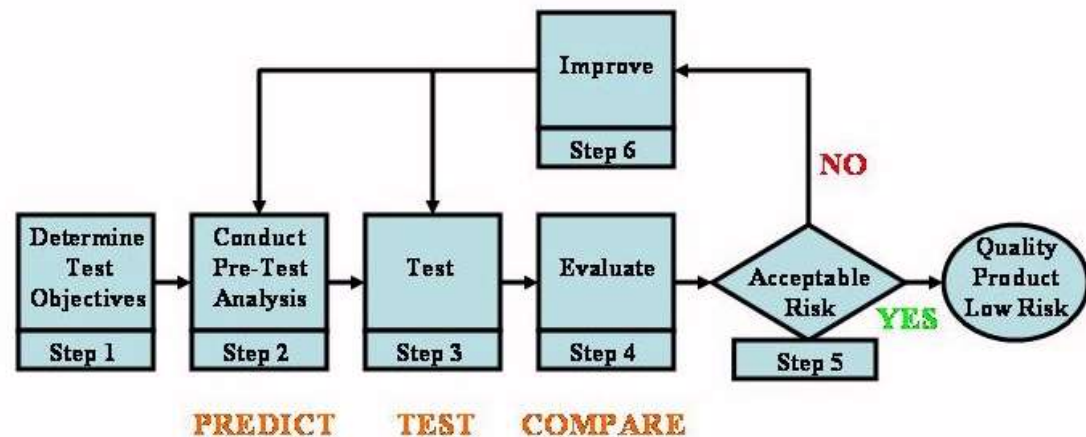


- **Operational roles**
- **Key attributes illustrated with selected systems**
 - Sensor types, e.g. crystal video receiver
 - Countermeasure techniques, e.g. range gate pull off (RGPO)
 - Enabling technologies, e.g. lasers
- **Test programs responsible for detailed system training**
- **Describe T&E resource categories and capabilities**
- **System development & operational considerations**
 - Hardware, software, & sustainment
 - Mission data reprogramming
- **Measures of performance**



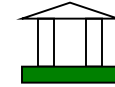


- **Implementation of the EC Test Process**
- **Assess the performance of SUT vs. Threat**
 - Statistical relevance
- **Address the “White Systems”**
 - SUT and victim system instrumentation
- **Other advanced concepts**





Fundamentals



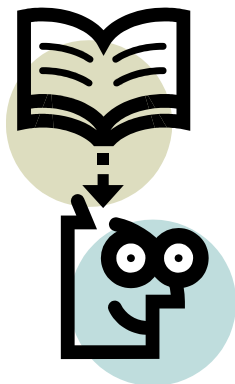
- **Provide a solid technical underpinning**
 - Focus on topics that are generally not taught in a normal university curriculum
 - Provide prerequisites for more advanced classes
- **Assume students have a technical background**
 - New college graduates
 - Engineers changing disciplines
 - Engineers looking for career broadening



Journeyman EW T&E Engineer



- Technical Degree (encourage postgraduate work)
- Acquisition Professional Development Program (APDP) Certification
- General T&E training
 - Test planning, reporting, safety, etc.
- Statistics for test training
- **EW T&E University focused training**
- Miscellaneous DoD/USAF required training
- On-the-job training – Combined Test Force (CTF) experience



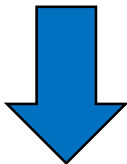


EW T&E University Plan



Phase 1 0 – 1.5 years

Radar Fundamentals
EW Receivers T&E
Introduction to EW
Command Guided SAMs



Get security clearance
& move to a CTF
in 6 – 9 months

Green = Basic
Blue = Intermediate
Orange = Advanced

Phase 2 1.5 – 3 years

Tactical Air Defense Systems
Strategic Air Defense Systems
Integrated Air Defense Systems
MtStat (Data Analysis Software)

Supplement with
commercially available
courses

Continuation > 3 years

Open Air Range Testing
Onboard Electronic Countermeasures
Infrared Directed Threat Systems
Network Centric Warfare (NCW) T&E
EW Data Reduction & Analysis
Modern Air Defense Systems
Surveillance Radars

Sep 15

FY 16

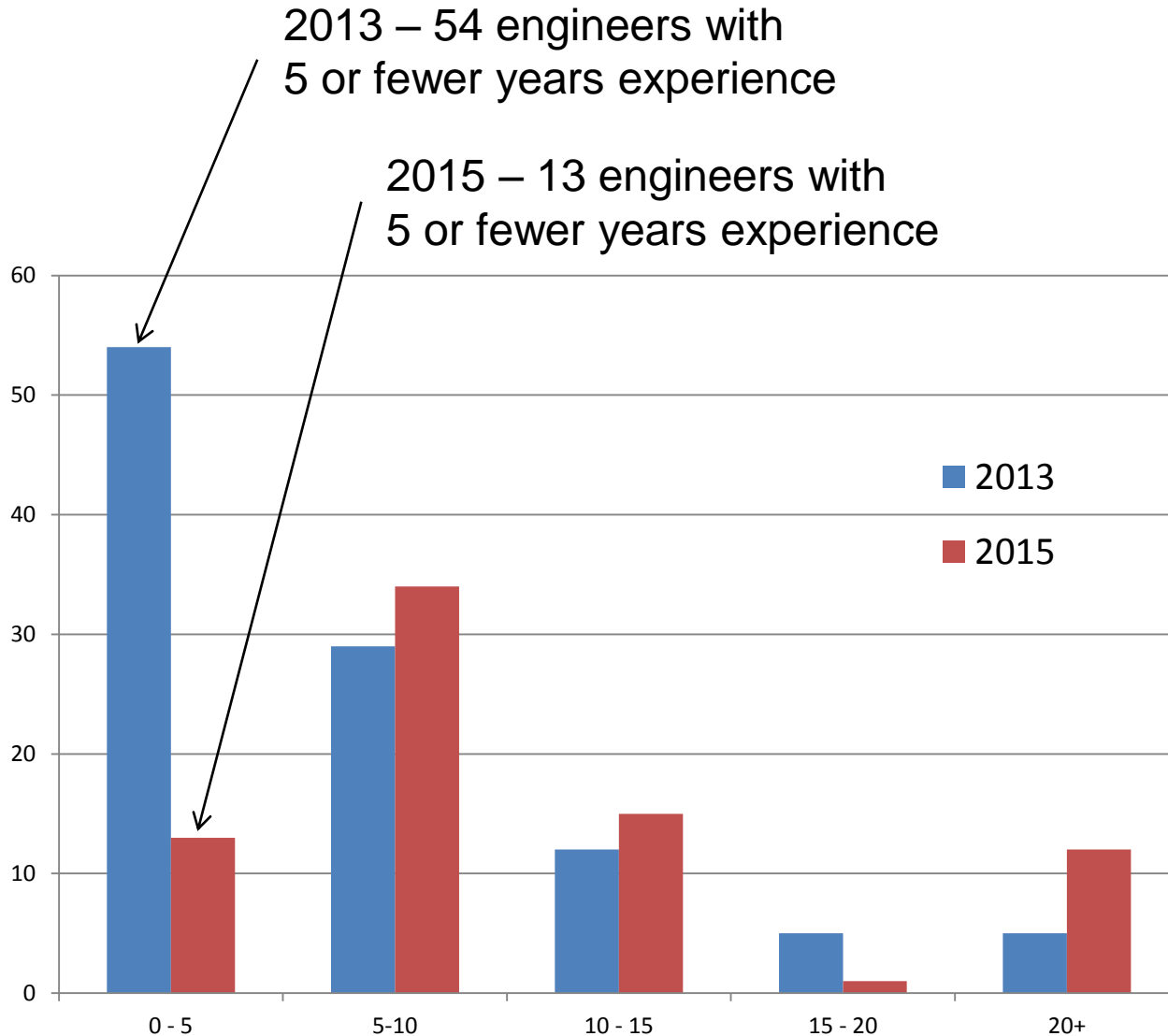
Flyable Storage

High Energy Lasers (HEL) T&E
High Power Microwave (HPM) T&E

Descriptive Statistics
Inferential Statistics



Experience Demographics



Workforce changes
(attrition & hiring)
forces
unpredictable
developments

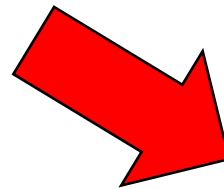
Requires active
management to
teach the right
mix of classes



Threat Evolution



Where we started:
1960 – 2000 technology



General characteristics :

- Passive ESA (PESA)
- Active ESA (AESA)
- Hybrid guidance
- Active missile seekers
- Improved detection capability
- Low probability of intercept (LPI)
- Sensor fusion



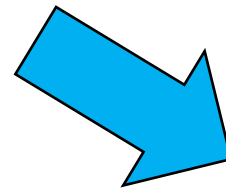
General characteristics:

- Track-while-scan (TWS)
- Conical scan (CONSCAN)
- Monopulse
- Mechanically scanned
- Basic passive electronically scanned array (ESA)
- Command guided
- Semi-active
- Hybrid guidance

The threat today



Countermeasures Evolution



EW systems must adapt to meet mission requirements

The threat and the countermeasures response are increasingly **DIGITAL**

This has potentially significant workforce makeup implications



Short Course Updates



- **Basic courses**
 - **Radar Fundamentals**
 - Introduce AESA concepts
 - Introduce synthetic aperture radar (SAR) concepts
 - Expand electronic protection (EP) discussion
 - Expand LPI discussion
 - **EW Receivers T&E**
 - Emphasize digital receiver concepts
 - Discuss LPI concepts
 - **Introduction to EW**
 - Superficially introduce all of the above
 - **Additional Topics**
 - Supplement as necessary with commercial courses



Short Course Updates (Continued)



- **Threat Courses**
 - **Regularly updated existing courses**
 - **Command Guided SAMs**
 - **Tactical Air Defense Systems**
 - **Strategic Air Defense Systems**
 - **Integrated Air Defense Systems (IADS)**
 - **Developing new courses**
 - **Modern Air Defense Systems (Sep 15)**
 - **Surveillance Radars (late FY 16)**
- **Systems Under Test Courses**
 - **Adapt as necessary**



Summary



- **Outstanding Results**
 - Great knowledge accelerator
 - Very positive feedback
 - Management support
- **Future Challenges**
 - Dynamic workforce demographic
 - Evolving threat
 - Evolving countermeasures



www.edwards.af.mil

- Other links
- EW T&E University