



Distribution authorized to U.S. Government agencies and their contractors; critical technology (July 2009). Other request for this document shall be referred to Director, U.S. Army Research Laboratory, ATTN: AMSRD-ARL-SL-ES, Survivability/Lethality Analysis Directorate, Information and Electronic protection Division, White Sands Missile Range, NM 88002-5513

## Modeling Electronic Attack (U)



**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

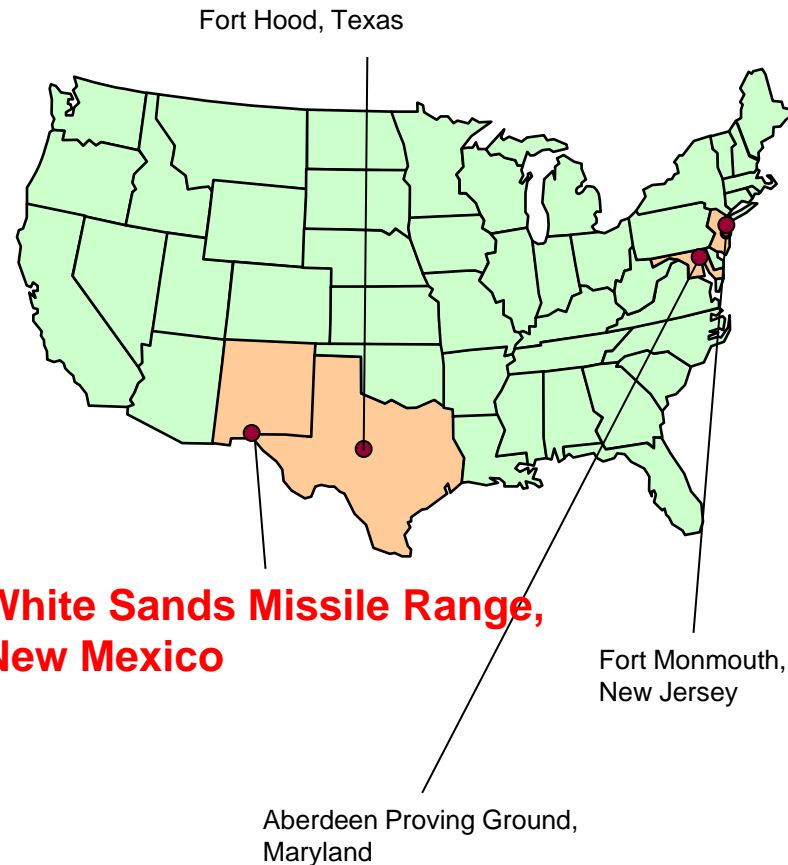
Jose M. Gonzalez  
Chief Modeling & Simulation Support Branch  
U. S. Army Research Laboratory  
Survivability/Lethality Analysis Directorate  
[gonzalez@arl.army.mil](mailto:gonzalez@arl.army.mil)  
Office 575-6798-5309  
Cell: 575-635-8853  
29 July 2009

## Information Assurance (IA)/Computer Network Operations (CNO)

- Threat Computer Network Operations
- Information Assurance
- IA/CNO Mitigation recommendations

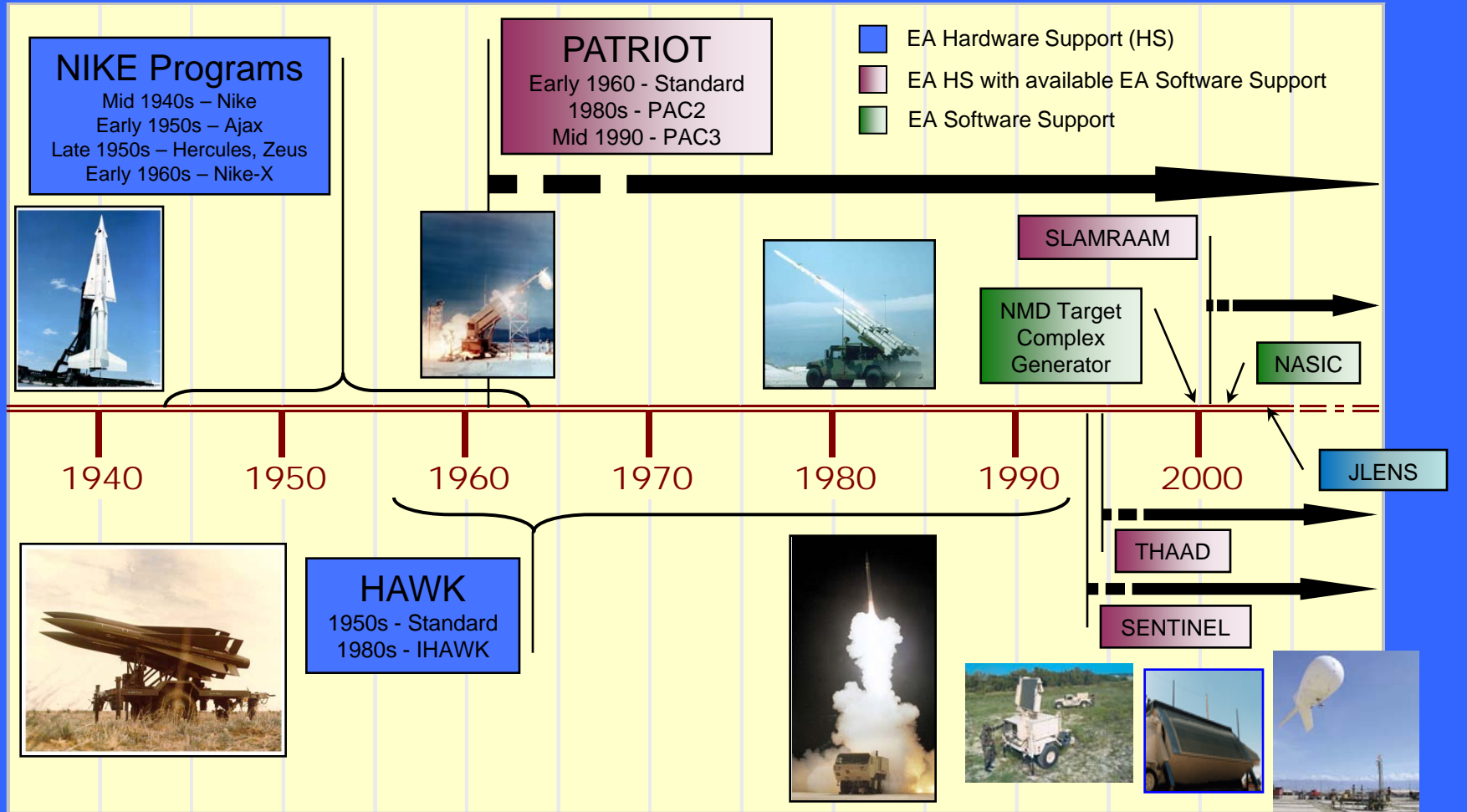
## Electronic Protection

- Electronic Countermeasures/Electronic Counter-Counter measures (ECM/ECCM)
- Electronic Warfare (EW) Signature Analysis
- Directed Energy

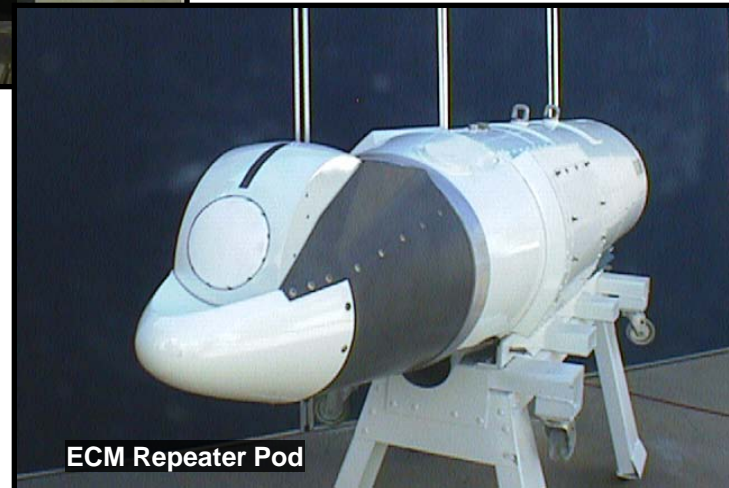


SLAD's support is based on a solid technical foundation of physics, signal processing, engineering, theoretical analysis, modeling & simulation, and experimentation.

# Survivability/Lethality Analysis Directorate's Air & Missile Defense Systems Experience



- 40 plus years
  - Developing and building hardware jammers
  - Analyzing countermeasure effects on radar systems



# Support to MDA Elements

- Installed simulative jammer waveforms in the NMD Target Complex Generator as a proof-of-principle at the ARC in Huntsville, AL.
- Provided engineering analysis to MDA/System Engineering Black Team on THAAD, Aegis, SBX, and AN/TPY-2 (FBX-T) on system topics and on notional events involving ECM techniques and ECCM solutions.
- Provided simulated targets using RTJS during THAAD UOES
- Supported MDA with the ACD and threat risk assessments using communications EW and CNO expertise

ACD Adversary Capability Document  
 ARC Advanced Research Center  
 CNO Computer Network Operations  
 EW Electronic Warfare  
 ECM Electronic Countermeasure  
 ECCM Electronic Counter-Countermeasure  
 NMD National Missile Defense  
 MDA Missile Defense Agency  
 RTJS Radar Target/Jammer Simulator  
 THAAD Terminal High Altitude Area Defense  
 UOES User Operational Evaluation System



**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

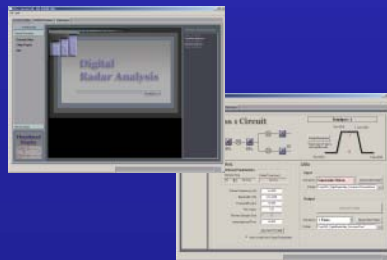
Properly modeled Electronic Attack provides the developer and evaluator with the opportunity to assess system performance in a digital Electronic Attack Environment.

# Electronic Attack

Threat Definition  
Radar System Parameters  
Experience



**Engineering Level  
Modeling/Simulation Tools**



MATLAB/SIMULINK

C++

SLAD's Radar Suite Analysis Tool

# Electronic Attack

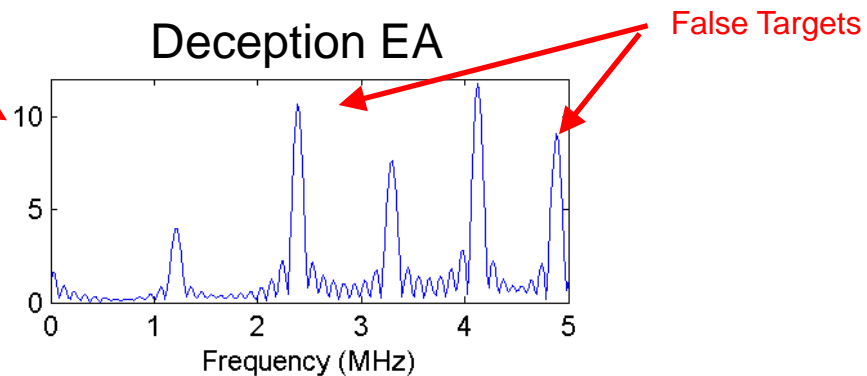
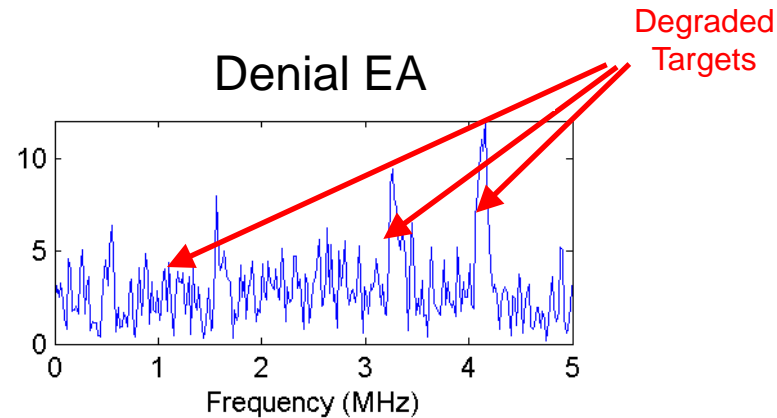
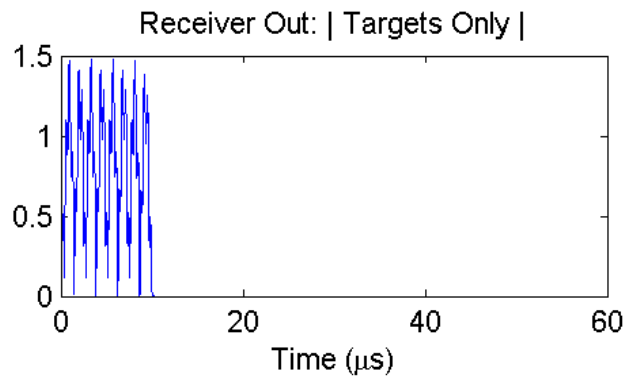
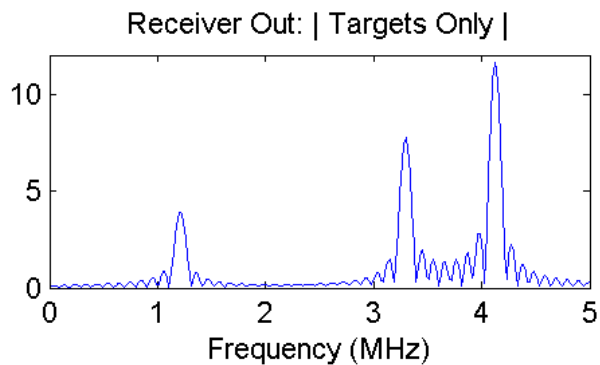
- EA Modeling
  - Denial (Noise): Statistically equivalent noise
  - Deception: False targets
  - Combinations: Denial/Deception
- Additional Capability
  - Simulate target and EA return signal at the last RF IF stage
  - Analyze radar receiver models requiring high fidelity
  - Model Digital RF Memory Based EA (ongoing)



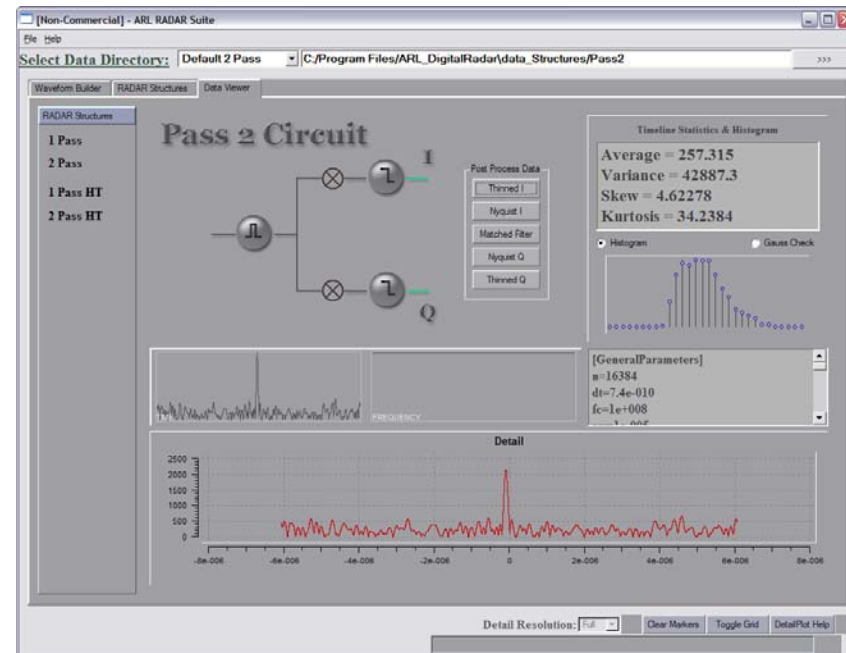
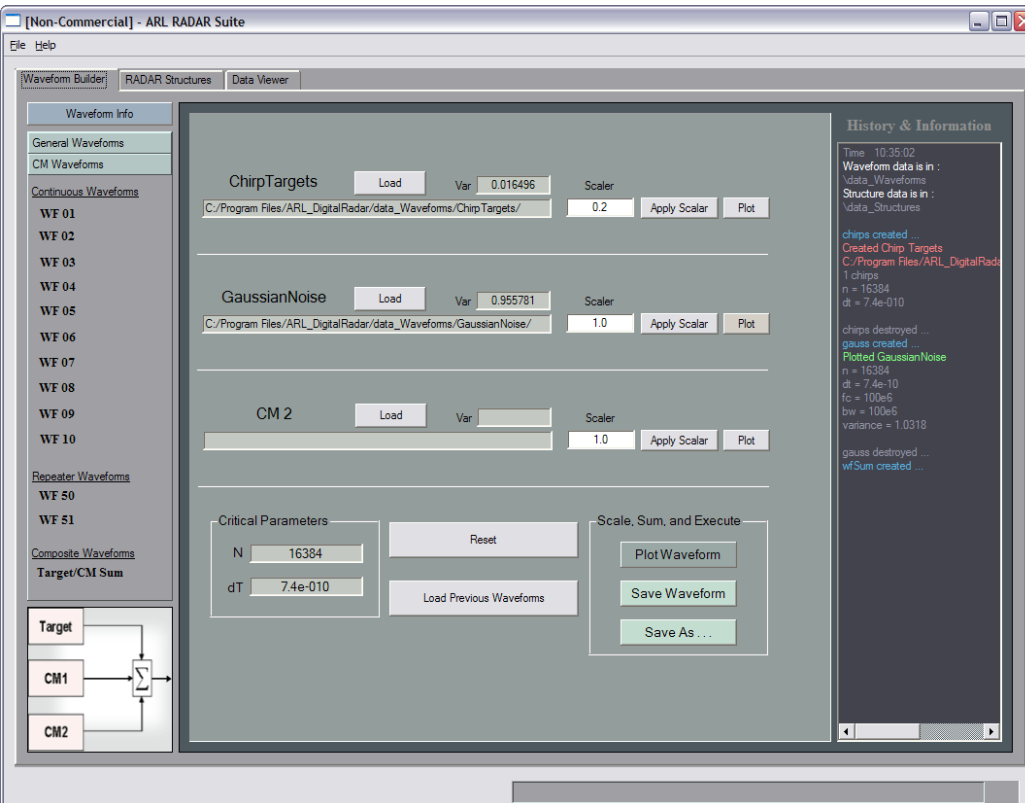
# Stretch Processing + Electronic Attack

## Benign Signals

- Three Targets
- Baseband



## In-house modeling and analysis tool



Chirp Target summed with White Wideband Gaussian Noise

## SENTINEL/ SLAMRAAM

Analysis of Radar in EA environment

## JLENS

Analysis of Radar in EA environment with the goal to support Simulation-over-Live Stimulator

## THAAD

Operational Test Agency THAAD Limited User Test

## MDA Advanced Systems

Collaboration with Northrop/Grumman

SLAD can provide the following:

- Performance analysis of the front-end radar receiver in benign and ECM environments.
- Customization of digital EA waveform to radar parameters and threat-representative electronic jamming conditions.
- Efficient EA integration for use in simulation
  - Simulation-over-Live
  - All Digital Simulation
  - Real-time & non real-time Hardware-in-the-Loop

Mr. Jose M. Gonzalez  
Chief, Modeling & Simulation Support Branch  
RDRL-SLE-S  
White Sands Missile Range, NM 88002

NIPR: [gonzalez@arl.army.mil](mailto:gonzalez@arl.army.mil)

SIPR: jose.marcos.gonzalez@arl.army.smil.mil

Office: 575-678-5309

Cell: 575-635-8853