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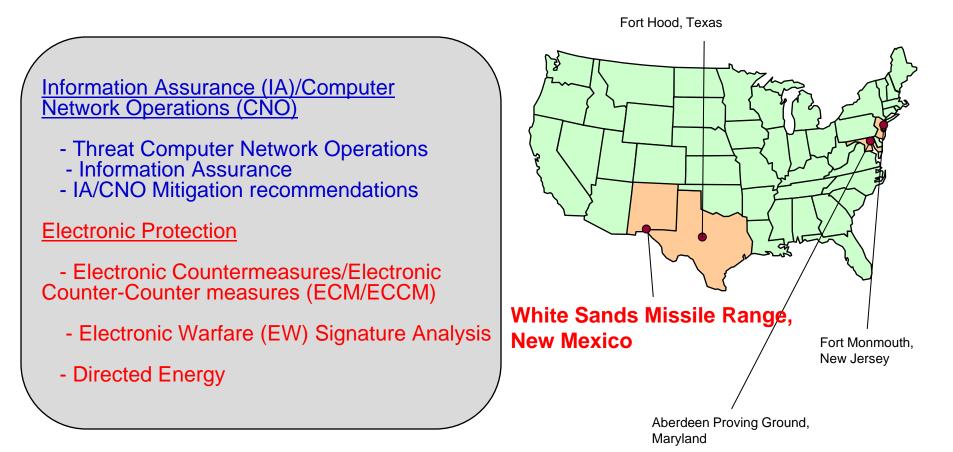
Jose M. Gonzalez Chief Modeling & Simulation Support Branch U. S. Army Research Laboratory Survivability/Lethality Analysis Directorate gonzalez@arl.army.mil Office 575-6798-5309 Cell: 575-635-8853 29 July 2009

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RDECOM



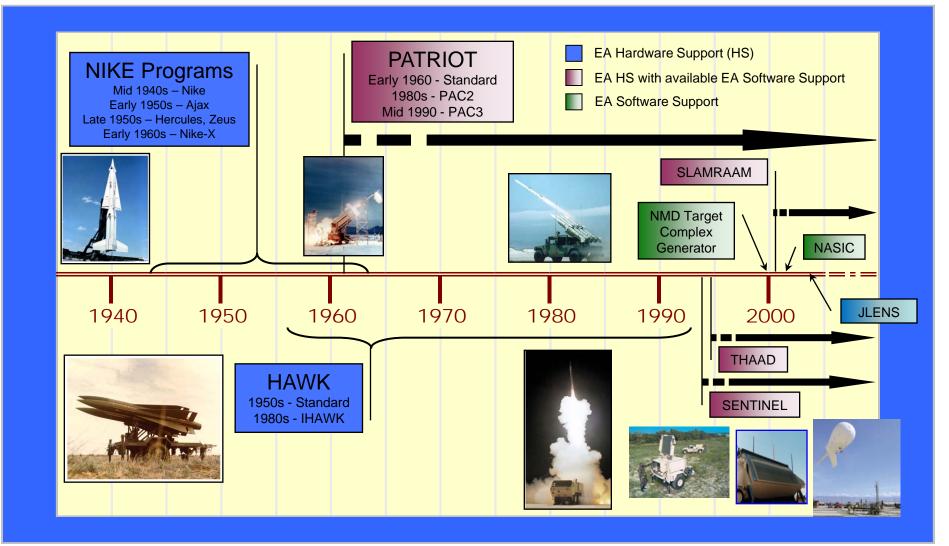


SLAD's support is based on a solid technical foundation of physics, signal processing, engineering, theoretical analysis, modeling & simulation, and experimentation.



UNCLASSIFIED // FOR OFFICIAL USE ONLY Survivability/Lethality Analysis Directorate's Air & Missile Defense Systems Experience





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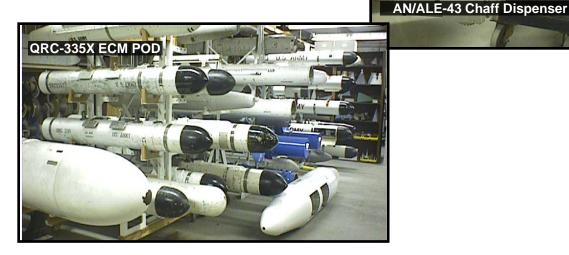


UNCLASSIFIED // FOR OFFICIAL USE ONLY SLAD'S EA Experience



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







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- Installed simulative jammer waveforms in the NMD Target Complex Generator as a proofof-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**
 - FW 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





WARFIGHTER FOCUSED. TECHNOLOGY **UOES** User Operational Evaluation System UNCLASSIFIED // FOR OFFICIAL USE ONLY



EA Modeling Objective



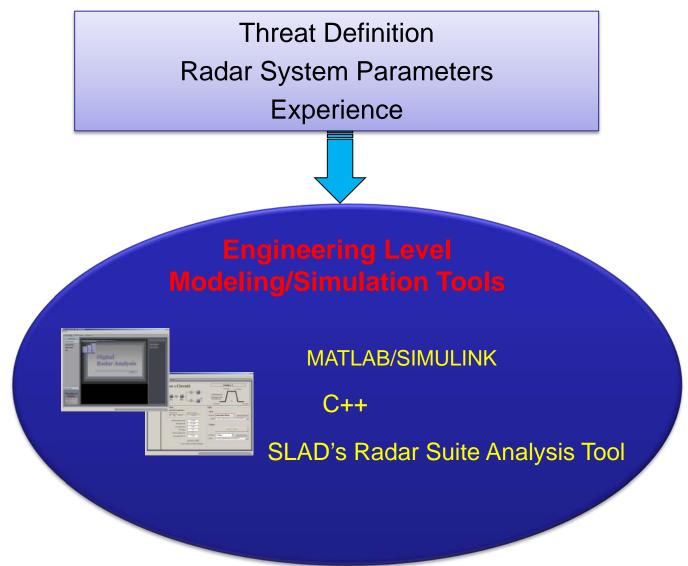
Properly modeled Electronic Attack provides the developer and evaluator with the opportunity to assess system performance in a digital Electronic Attack Environment.

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Electronic Attack





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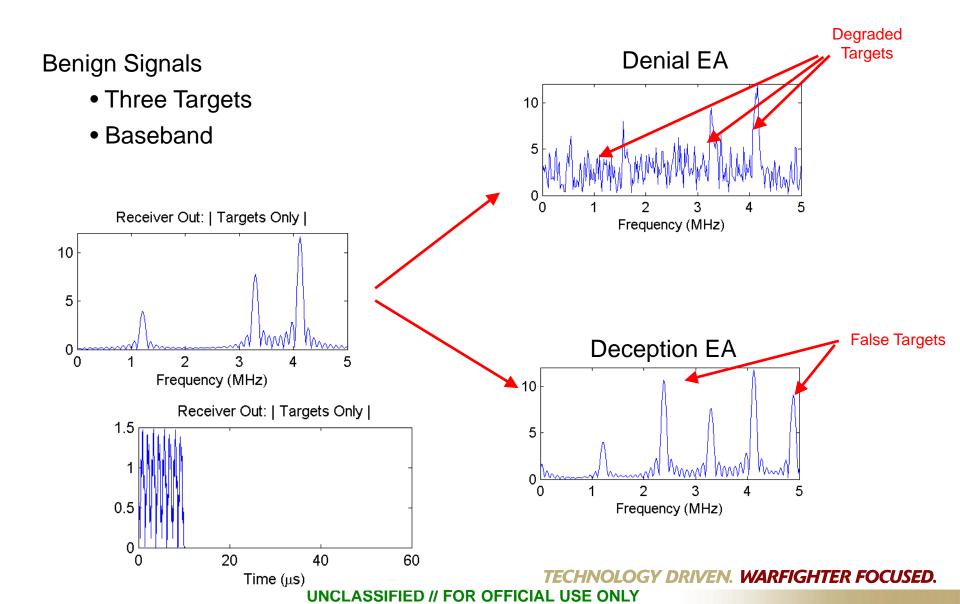
- EA Modeling
 - Denial (Noise): Statistically equivalent noise
 - Deception: False targets
 - Combinations: Denial/Deception
 - Additional Capability
 - Simulate target and EA return signal at the last RF IF stage
 - Analyze radar receiver models requiring high fidelity
 - Model Digital RF Memory Based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



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Stretch Processing + Electronic Attack





In-house modeling and _ 🗆 🗙 [Non-Commercial] - ARL RADAR Suite Eile Help Waveform Builder RADAR Structures Data Viewer analysis tool Waveform Info General Waveforms CM Waveforms Waveform data is in ChirpTargets Load Var 0.016496 Scale Continuous Waveforms Structure data is in C:/Program Files/ARL_DigitalRadar/data_Waveforms/ChirpTargets/ 0.2 Apply Scalar Plot WF 01 WF 02 WF 03 **WF 04** GaussianNoise Load Var 0.955781 Scale WF 05 C:/Program Files/ARL_DigitalRadar/data_Waveforms/GaussianNoise 1.0 Apply Scalar Plot WF 06 [Non-Commercial] - ARL RADAR Suite lotted GaussianNoise **WF 07** Ele Help C:/Program Files/ARL_DigitalRadar\data_Structures/Pass2 WF 08 Select Data Directory: Default 2 Pass 111 WF 09 CM 2 Load Var Scaler Waveform Builder RADAR Structures Data Verwer 1.0 WF 10 Apply Scalar Plot RADAR Stuctures Pass 2 Circuit Timeline Statistics & Histogram 1 Pass Repeater Waveform: Average = 257.315 WF 50 2 Pass Post Process Data Variance = 42887.3 Critical Parameters WF 51 Scale, Sum, and Execute Thinned I 1 Pass HT Skew = 4.62278 Reset Nyquist I Kurtosis = 34,2384 2 Pass HT 16384 Plot Waveform Composite Waveforms N Matched Fiter Target/CM Sum Gaune Check Hatogram dT 7.4e-010 Nyquet Q Load Previous Waveforms Save Waveform Themed Q Target Save As CM1 [GeneralParameters] n=16384 dt=7.4e-010 CM2 • poly much rando be a moral thread fc=1e+008 Detail 2500 · 2000 · 1500 -500 man man mark have man mark have

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Radar Suite Analysis Tool

RDECON

Chirp Target summed with White Wideband Gaussian Noise

Detail Resolution: Ful - Cear Makers Toggle Grid DetaiPlot Help

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UNCLASSIFIED // FOR OFFICIAL USE ONLY Ongoing Efforts



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



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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

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