



The Evolution of Analytical Modeling & Simulation

Shephard's Electronic Warfare 2007
by John Bednarz - Tactical Technologies Inc.



5/16/2007



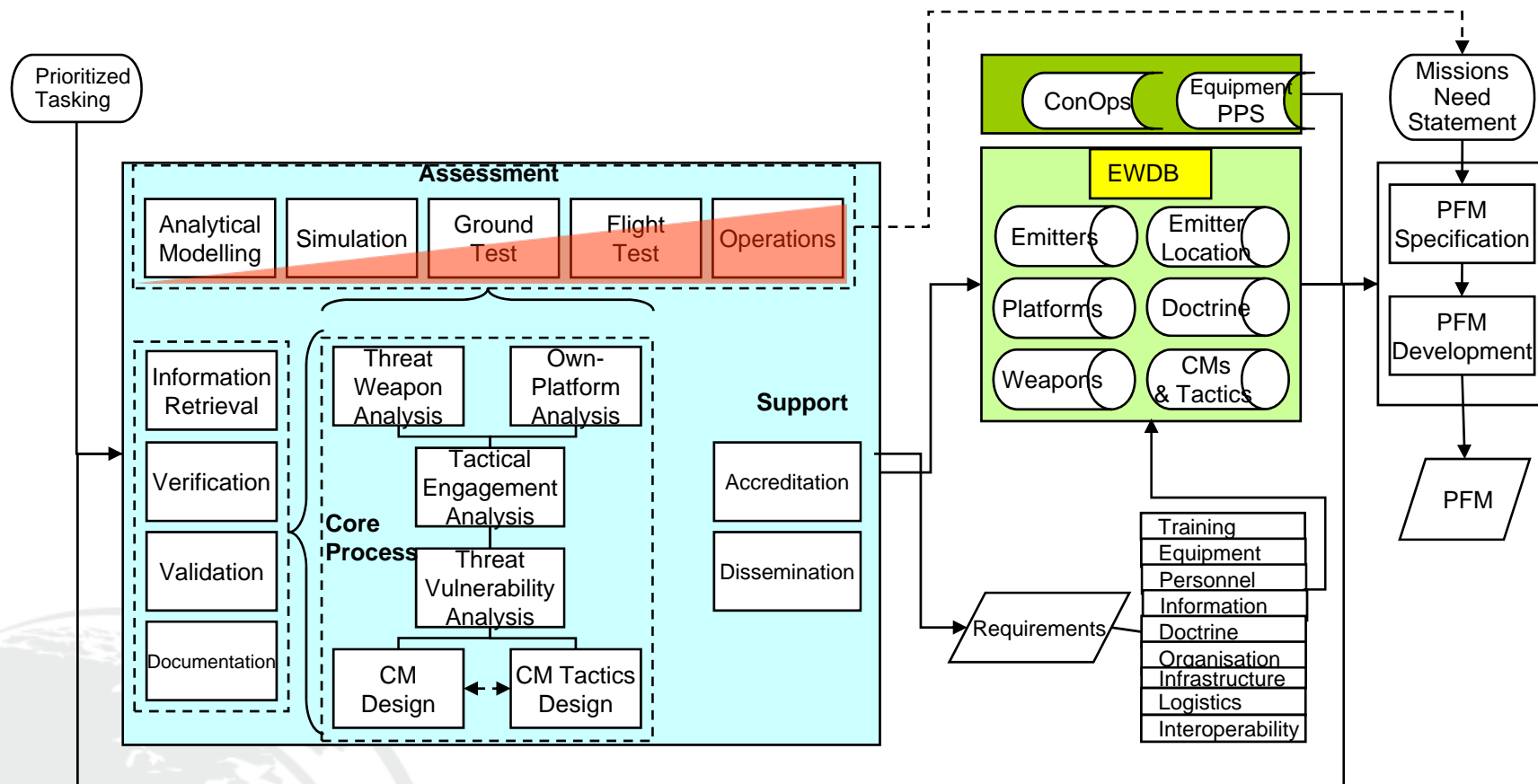
Introduction

EW engineers, researchers & the military can use physics-based models and engagement simulations to analyze and evaluate weapon systems and to develop and optimize countermeasure effectiveness.

Tactical Technologies Inc (TTI) has been developing this class of modeling and simulation based analytical tools for over ten years and supports an EW user community in over 20 countries.

The objective of this presentation is to share some of the insights derived from developing, evolving and supporting this technology.

Countermeasure Development Process



c/o David Tuffnell - MASS Consultants Limited, Lincoln, UK

Countermeasure Readiness Model

CRL 9	Actual CM Tactics qualified e.g. through reliability demonstration in operations	Test, qualification and operation
CRL 8	Actual CM Tactics completed and qualified through operational test and evaluation	
CRL 7	Actual CM (Tactics) prototype demonstrated in an operationally relevant environment	Demonstration, equipment checks
CRL 6	Actual CM validation in laboratory environment	
CRL 5	Actual CM (Tactics) prototype demonstrated in a laboratory environment	Research to prove feasibility
CRL 4	Generic CM validation in laboratory environment	
CRL 3	Analytical & experimental CM critical function and characteristic proof-of-concept	Basic research
CRL 2	CM concept and application formulated	
CRL 1	Basic CM principles observed & reported	

Flight Test

Ground Test

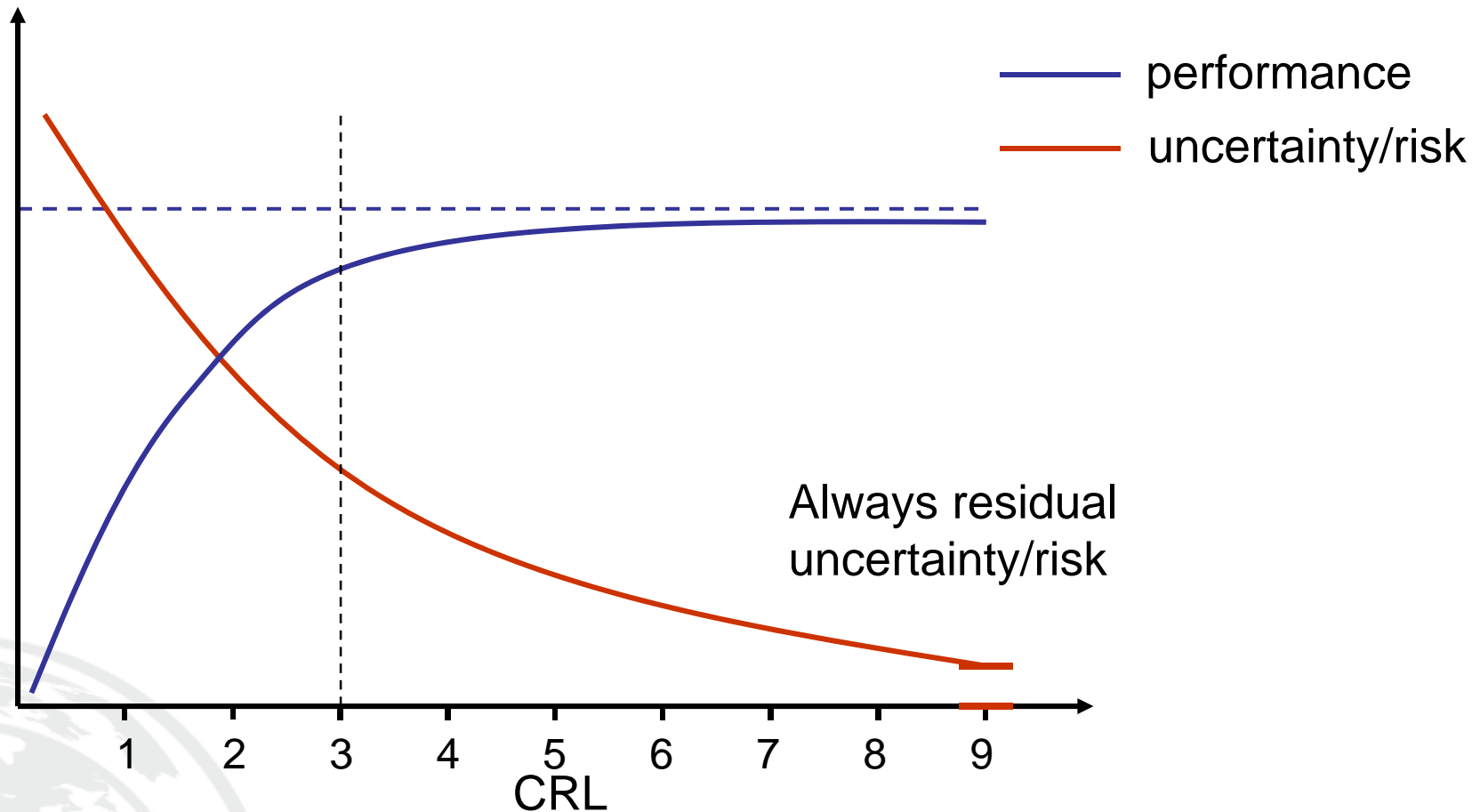
Modelling & Simulation



c/o David Tuffnell - MASS Consultants Limited, Lincoln, UK

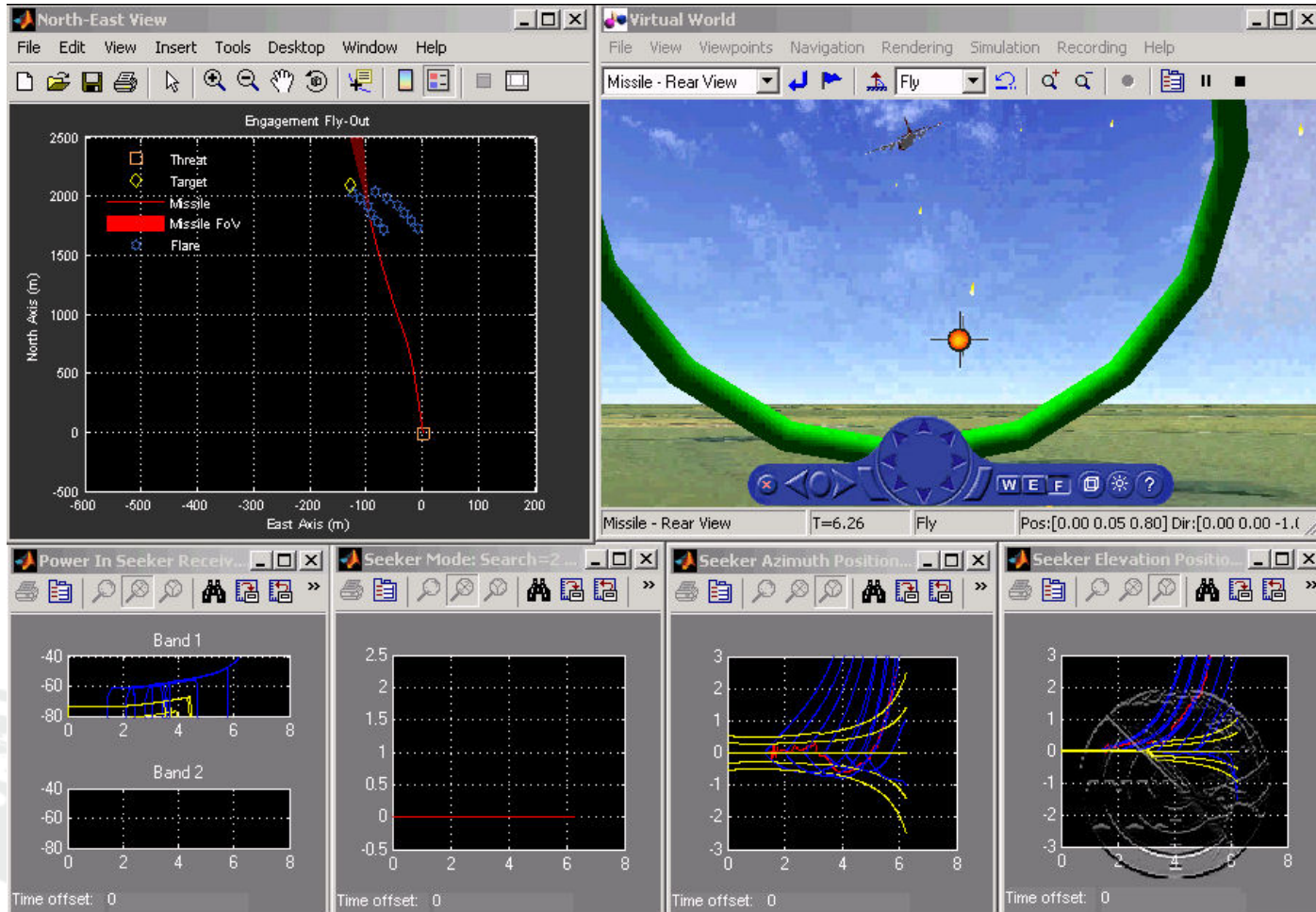


CM Readiness versus Performance



c/o David Tuffnell - MASS Consultants Limited, Lincoln, UK

Analytical Modeling & Simulation Tools





TTI's Starting Point

- EW & CM experience
- Not a Software Shop
- Windows[®] on standard PC's
- Open source physics-based material - unclassified
- MATLAB[®] and Simulink[®] infrastructure
 - a Mathematical modeling & simulation language
 - COTS with international support
 - Open, Hierarchical Structure
 - Easy To Program, Verify, Validate and Modify...
 - Usable by EW engineers



Customer Needs & Wants

NEED to understand CM effectiveness

- Develop EW knowledge
- Insight into EW & CM engagement physics
- Appreciate effectiveness of delivered or developed CM

WANT to develop EW knowledge

- Open & verifiable capability
- Accessible affordable analytical tools
- Unclassified foundation in physics
- Re-usable across their requirements

A common solution for CM development



Solution Concepts

Commercial-Off-The-Shelf

Off-the-shelf availability
Self sustained evolution
3rd party support

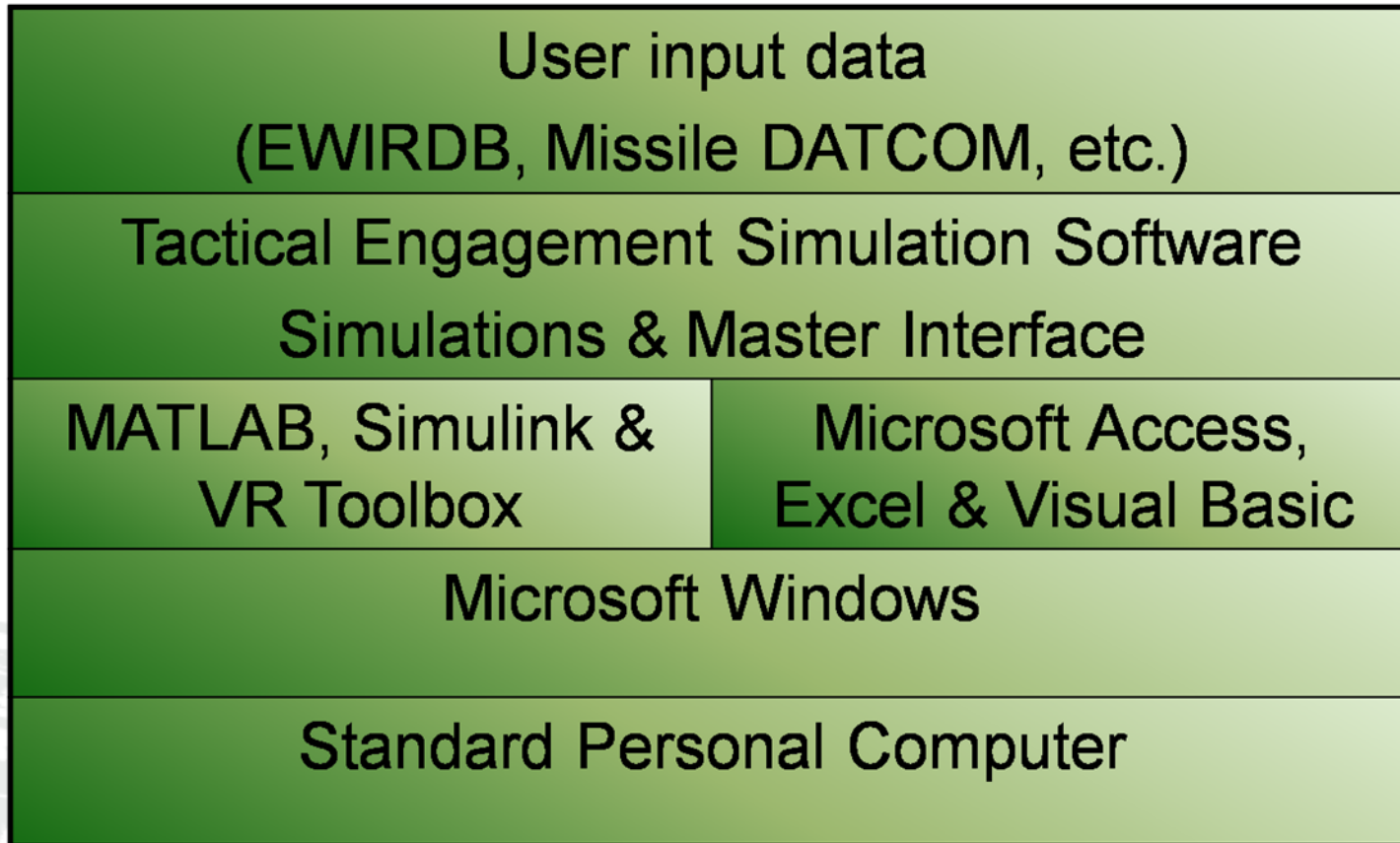
Openness

EWIRDB data
Unclassified OS physics
Software Source Code
Validation & verification
Freedom of Use

Modularity

System-of-systems
Replace/Modify
Integrate to other resources
Extensible custom usage

Commercial Off-the-Shelf

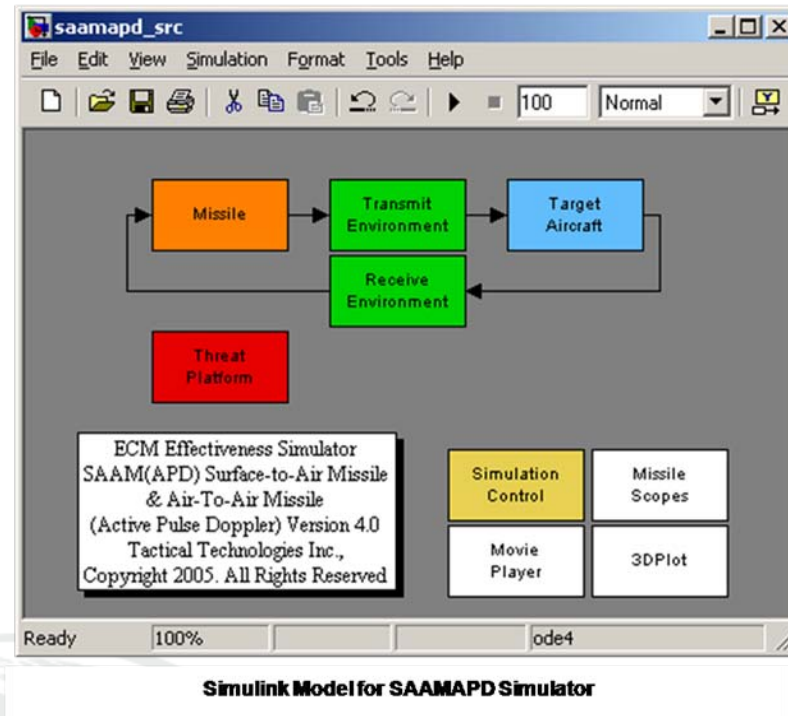




Openness

Level	Openness
Usage	EWIRDB Parameter Set & Units, Missile DATCOM data, etc
Cost	Low Cost Compiled System Models (Semi-Compiled)
IP	Complete Source Code Version
Documentation	Software Description Documents cw technical references to all source materials
Custom	Complete Custom Support

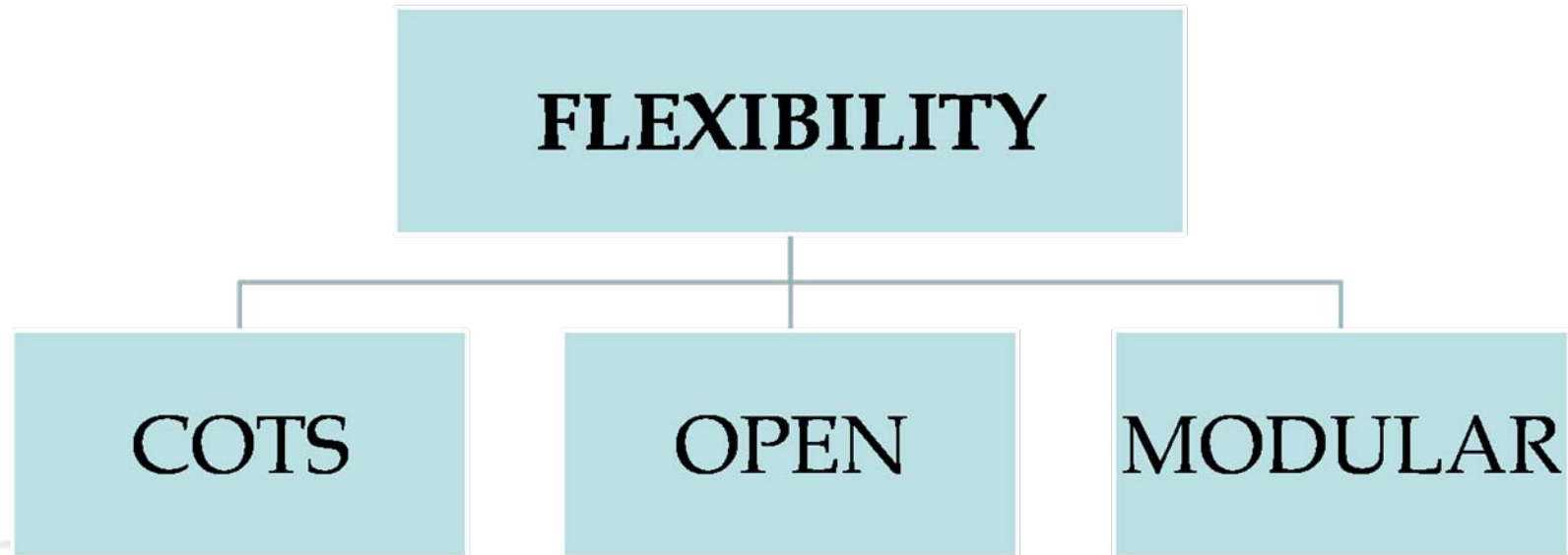
Modularity



- Simulation architecture
- Systems-of-systems
- Threat-environment-target
 - Threat: Sensor, Guidance, Auto-Pilot, Airframe
 - Target: Signature, Maneuvers & Self Protection Systems
 - Environment

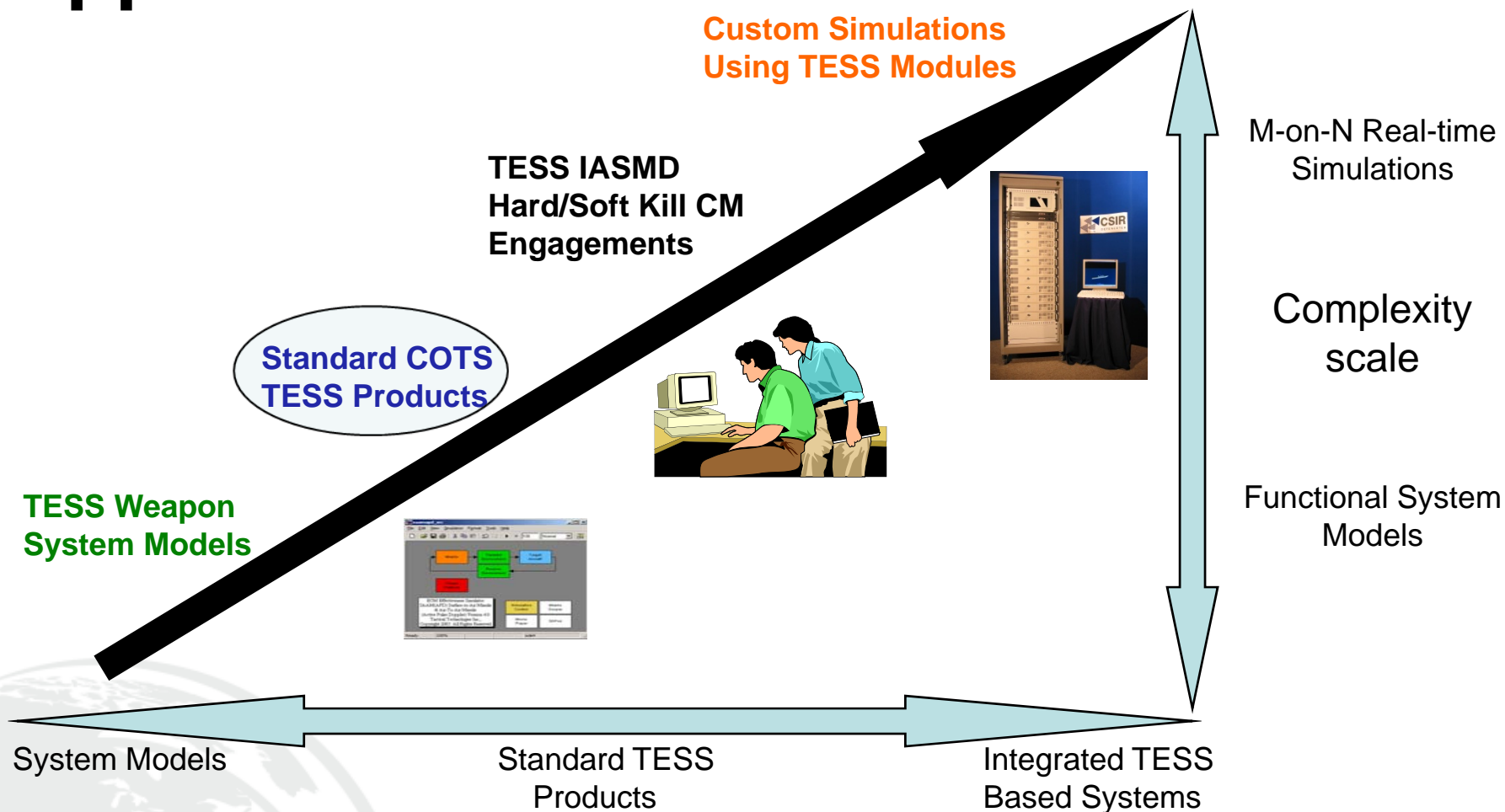


Resultant Effect





Applications





SUMMARY

- TTI's experience in developing and evolving analytical modeling and simulation for CM analysis
 - designed to contribute out-of-the-box with unclassified open source physics
 - COTS, OPEN & MODULAR solution to EW modeling and simulation
 - support broad range of user requirements
 - And can evolve and migrate to support simulation requirements across the EW laboratory and test range as a common infrastructure