

Ballistic Missile Defense System



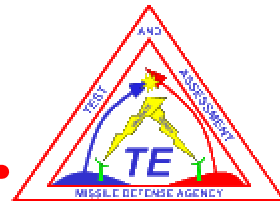
Modeling & Simulation

Crash Konwin
Program Manager
MDA TEM Support
NDIA SBA Conference
25 – 27 June 2002



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Agenda



- **BMDS Capability-Based Acquisition**
- **Core Model & Simulation Program Overview**
- **Missile Defense System Exerciser (MDSE)**
- **Wargame 2000 (WK2K)**
- **Extended Air Defense Test Bed (EADTB)**
- **Summary**



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Mission Defined



***“To Protect Our Own People, Our Allies And Friends,
We Must Develop And We Must Deploy Effective
Missile Defenses.”***

**President George W. Bush
27FEB01**

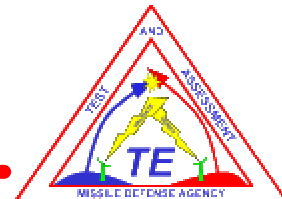
***“Establish a Single Program to Develop an Integrated
System Under a Newly Titled Missile Defense
Agency.”***

**Donald H. Rumsfeld
Secretary of Defense
02JAN02**

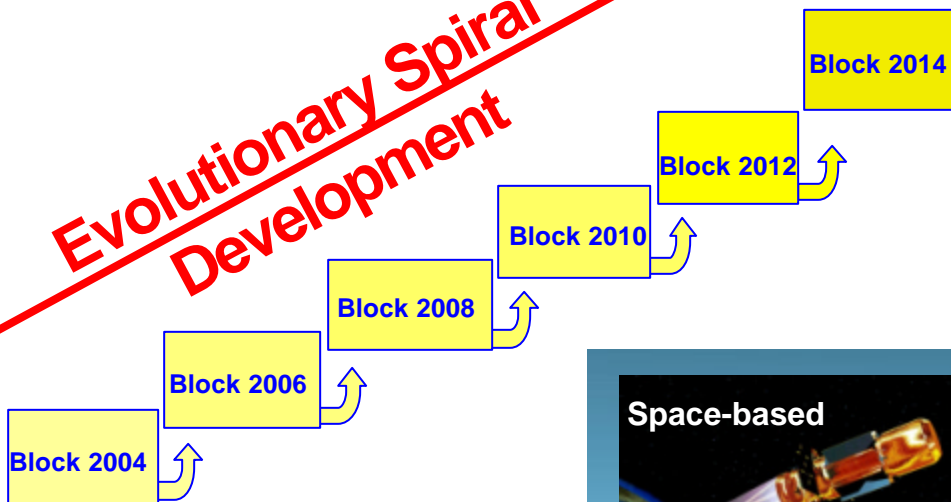


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MDA Paradigm



Evolutionary Spiral Development



Capability Based Acquisition

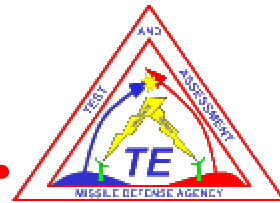
Layered Defense





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Fundamentals of Capability-Based Acquisition



- **Plan – System Definition**

- Define Problem
- Define Program Baseline (Synthesize Technical, Program And Operational)

- **Design, Develop And Integrate**

- Execute To Capability Specifications, BMD Funding And Schedules
- Upgraded/New Equipment And Operations

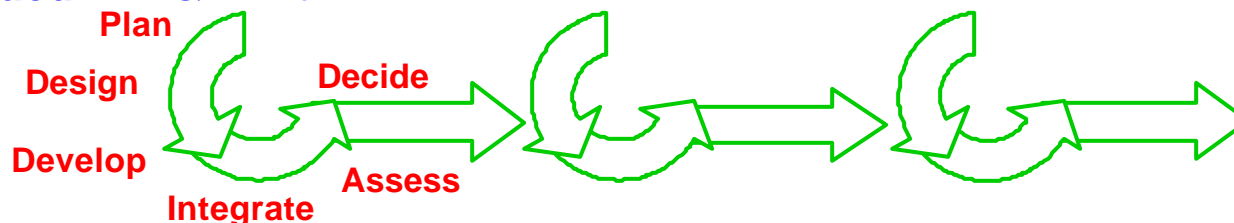
- **Assess BMDS Capability**

- External Environments
- Program Baselines
- Potential For Changes To BMDS

- **Decide**

- Transition To Services (Production, Programmatics, Operations)
- Continued RDT&E Within MDA

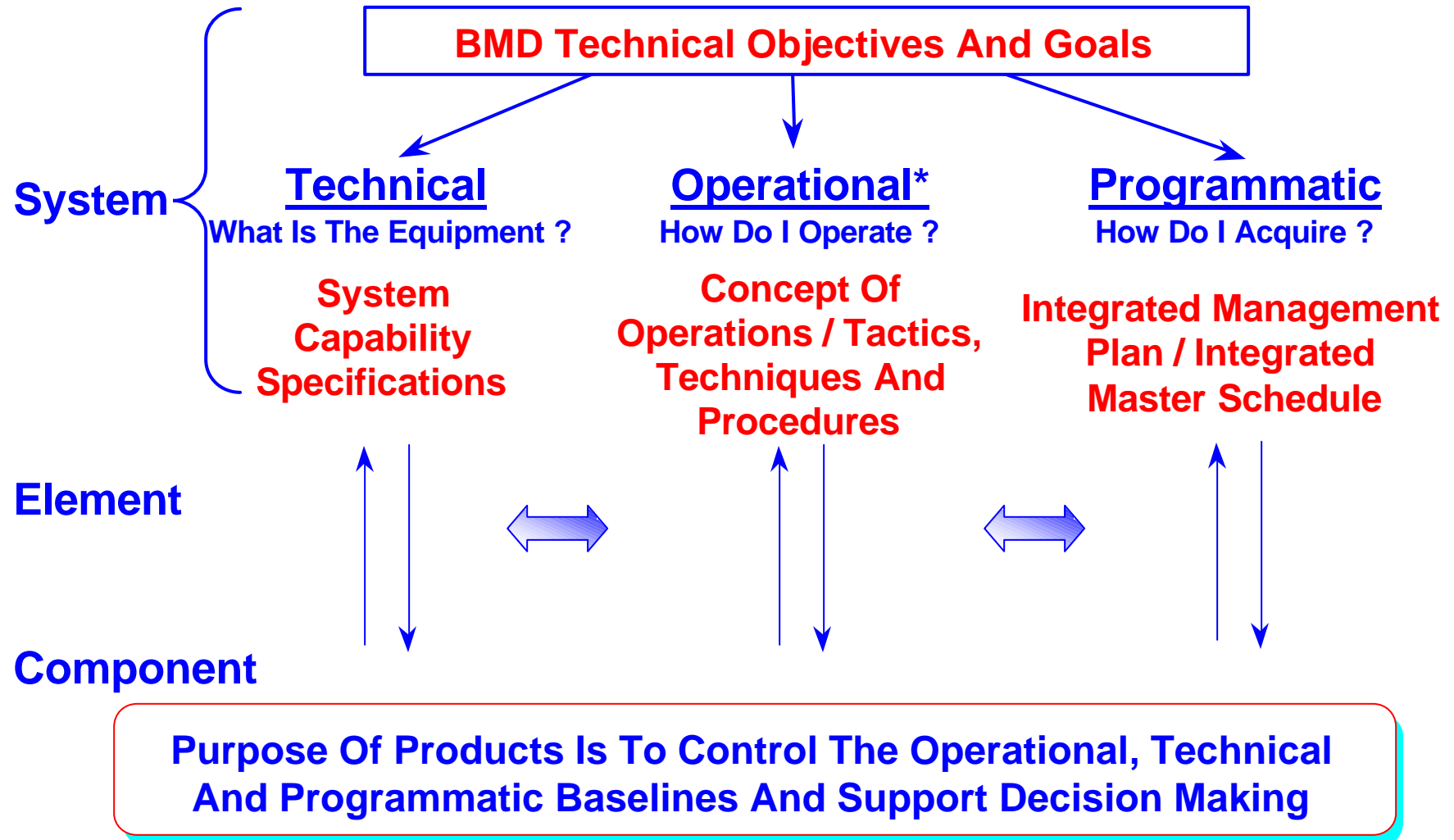
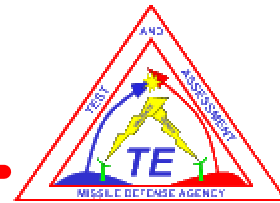
- **Government And Industry Working As A Single Team**
- **Embodies Disciplined Engineering And Decision Making**
- **Always Buying And Evolving What Is Executable**





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Hierarchy of BMD Capability-Based Products

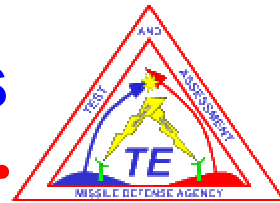


* Warfighter Product In Collaboration With MDA

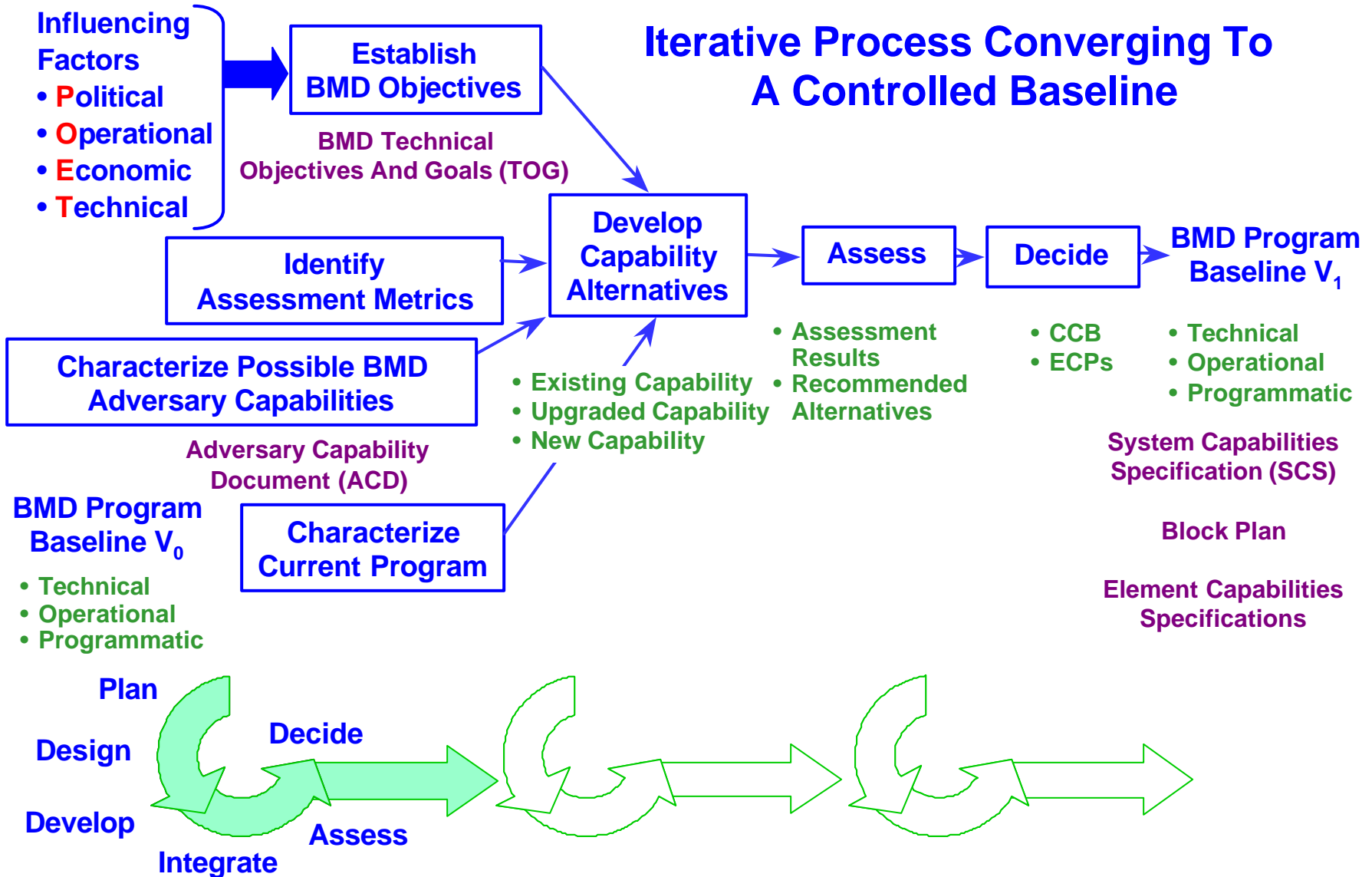


Capability-Based Acquisition Process

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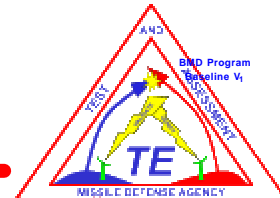
Iterative Process Converging To A Controlled Baseline



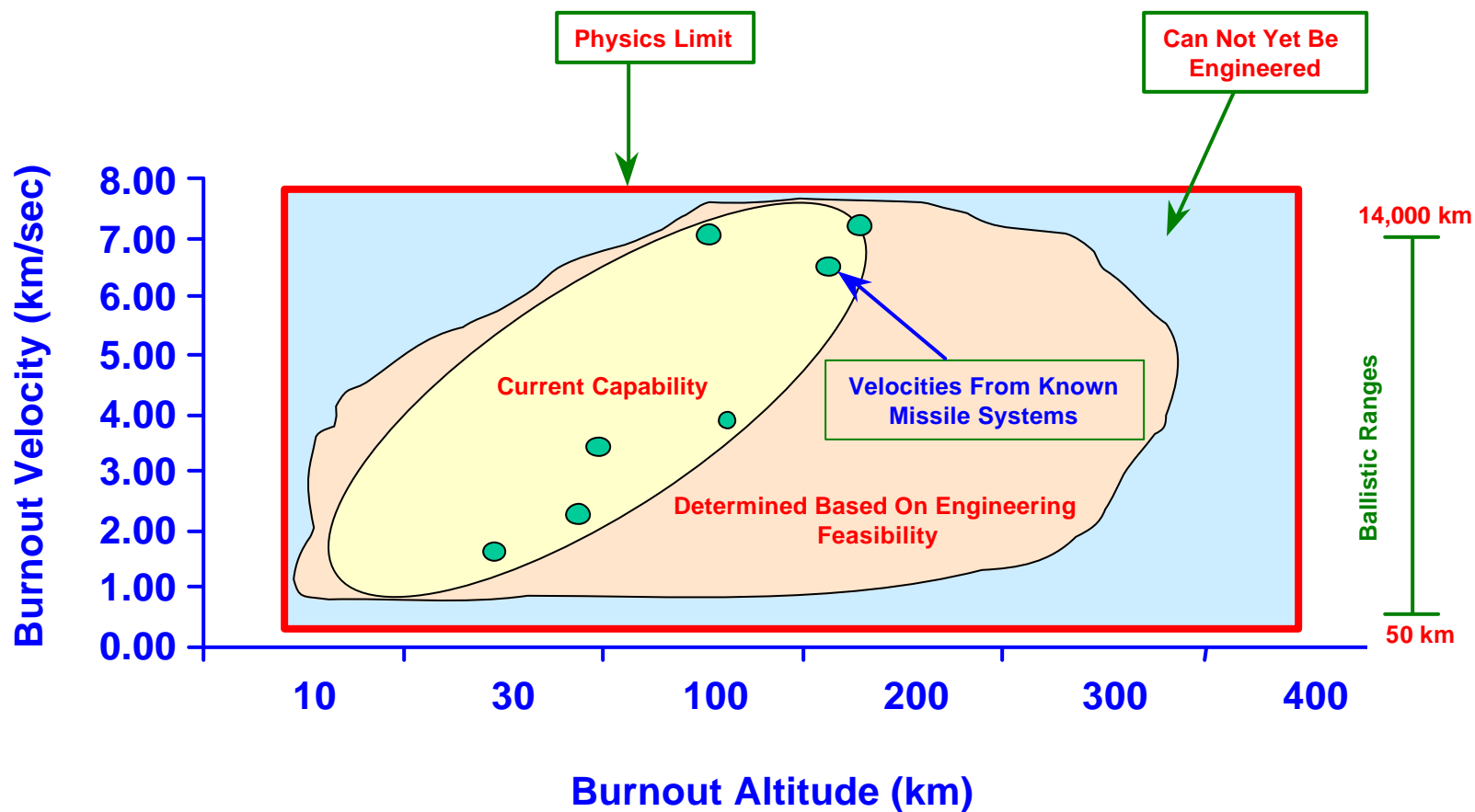


ADVERSARY CAPABILITY EXAMPLE

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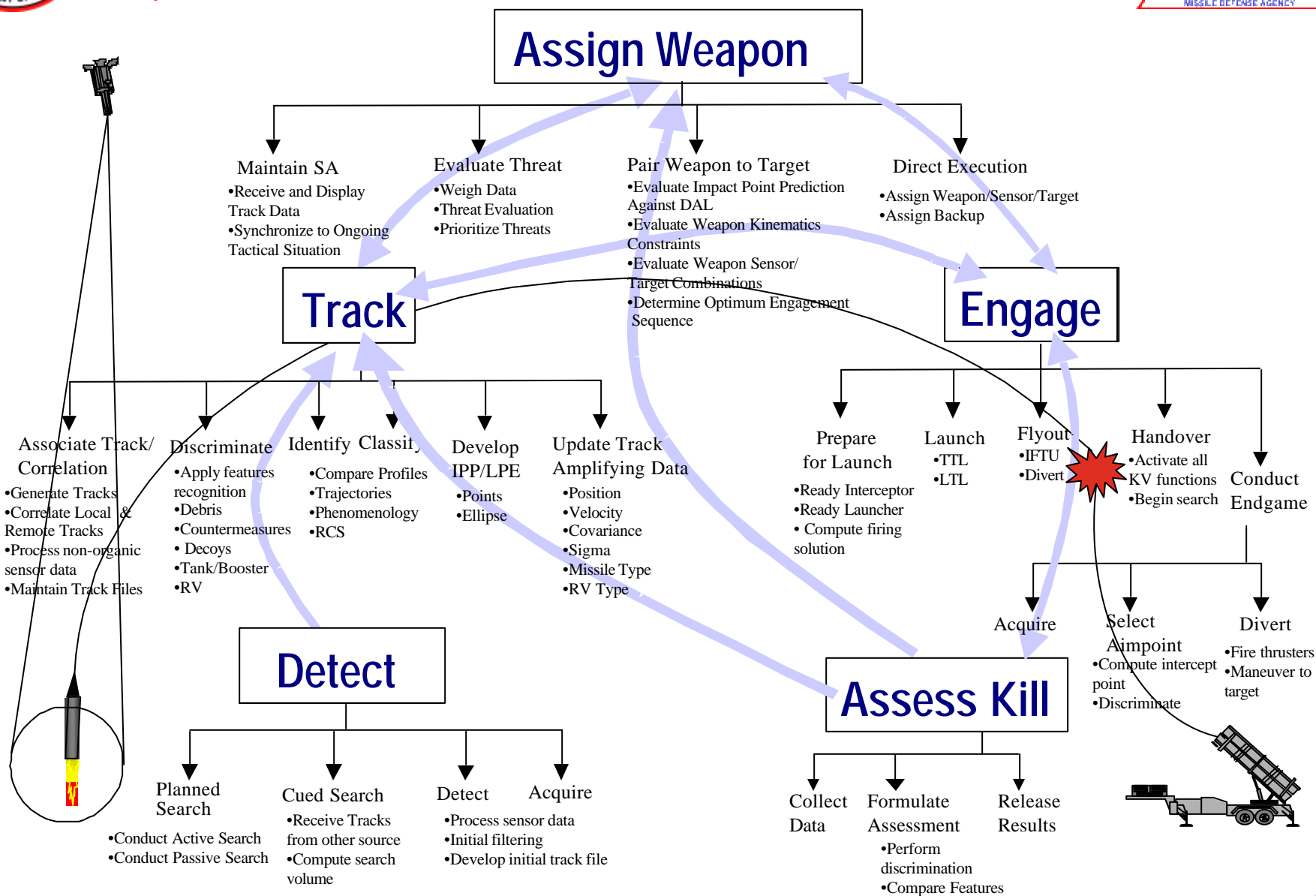
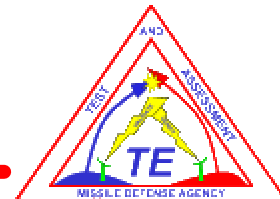
Physics-Based Burnout Velocity Space





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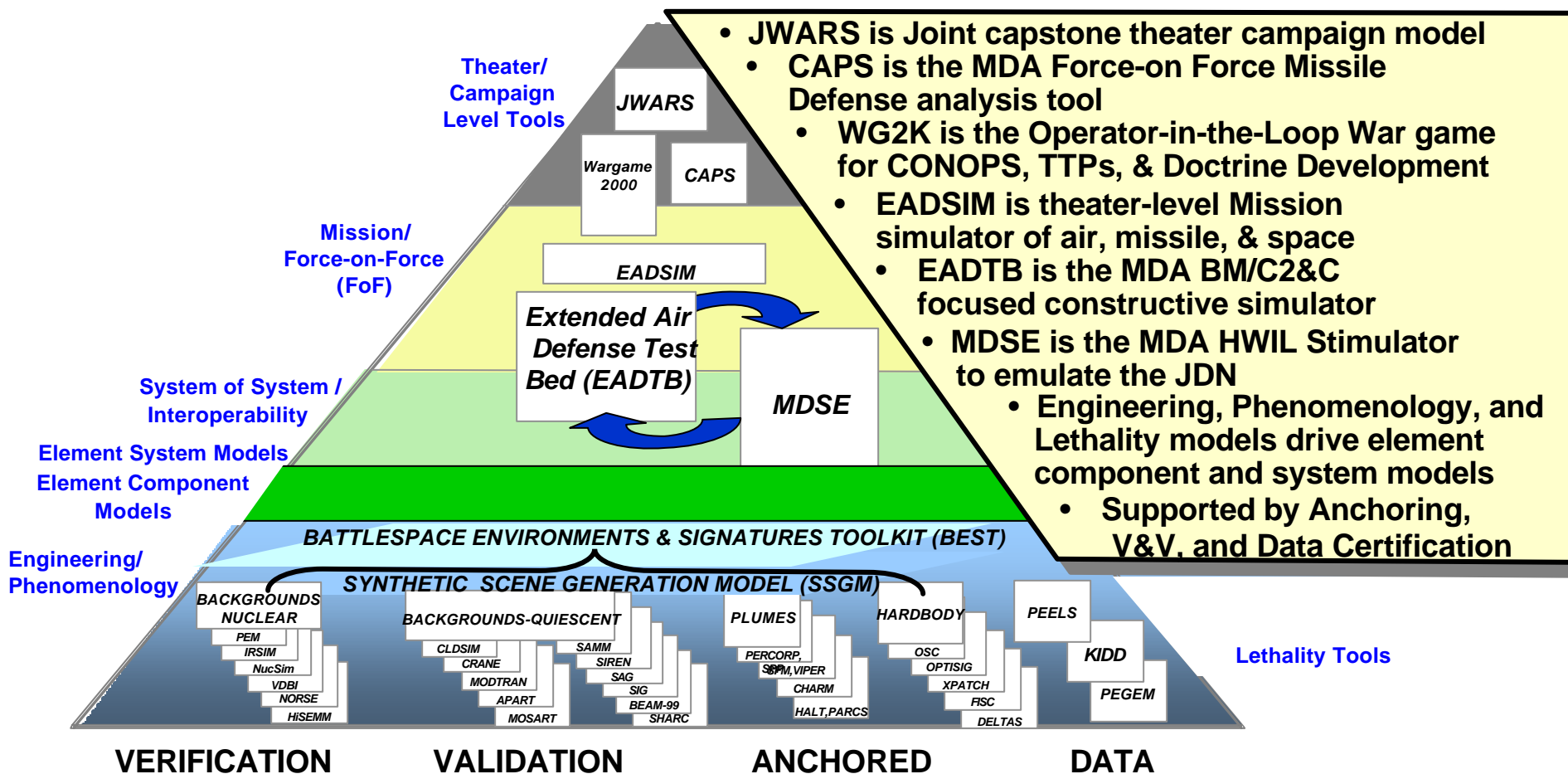
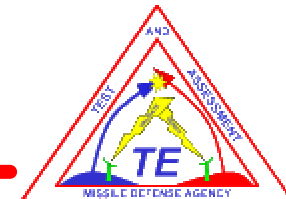
BMDS Kill Chain Functions





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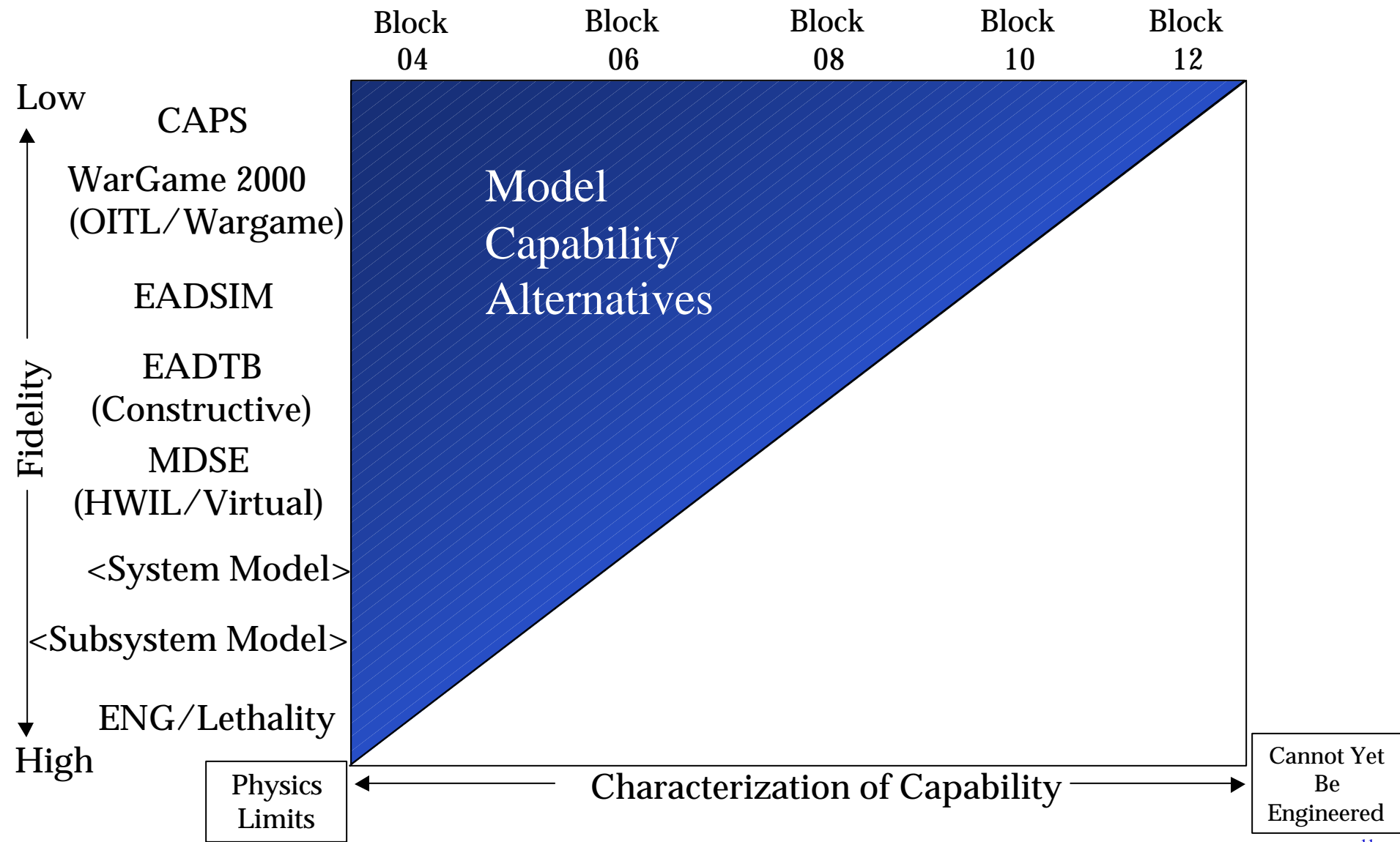
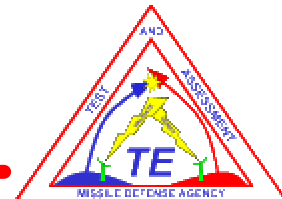
MDA Core M&S Baseline





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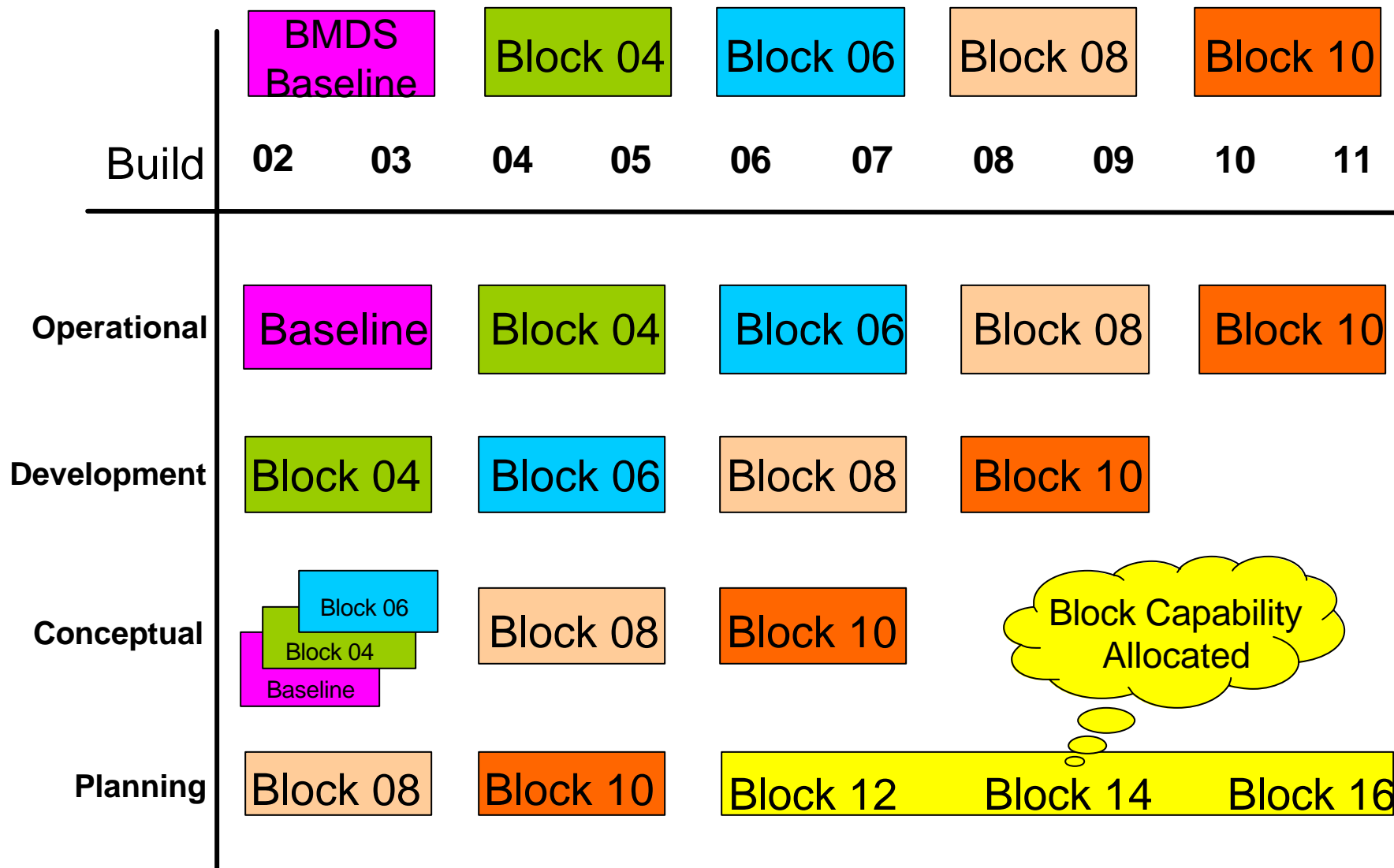
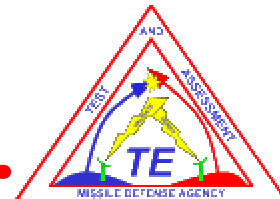
M&S Characterization by Block





Evolutionary Capabilities-Based M&S

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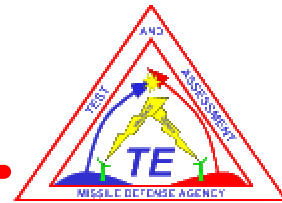


MISSILE DEFENSE SYSTEM EXERCISER (MDSE)



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MDSE IS ...

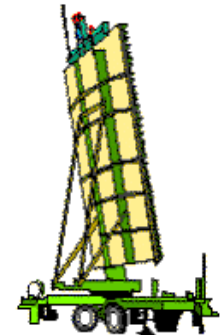
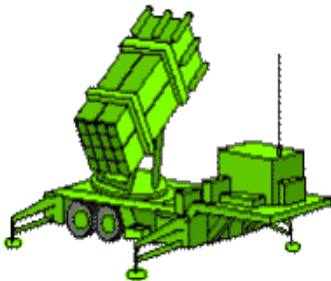


**... A Computer-Based Developmental
Hardware-in-the Loop (HWIL)
Test Tool**

**Sensors
Tactical Processors
BMC2 and COMMS**

**... For BMDS Capability
Assessment**

... Focused on BMDS



**... by Stimulating Tactical
Hardware and Software**

... Emulating the JDN

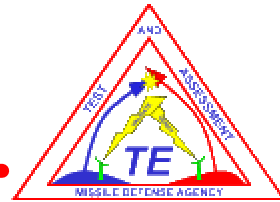
**Real Time, Dynamic, Interactive
Geographically Distributed Architecture
Centrally Controlled
Validated and Verified**

**... In Realistic Simulated
Environments**



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MDSE Uses



- **MDSE Is a Hardware-in-the-Loop Tool**

- ❖ Major MDA-Sponsored HWILT
- ❖ Focused HWILTS To Provide:
 - ❖ Data Registration
 - ❖ Lost Track/Drop Track
 - ❖ Track Characterization

MDSE continues to evolve and undergo continuous validation as the BMDS continues to evolve.

- **ATEC: Employ MDSE for PATRIOT IOT&E Interoperability Demonstration**

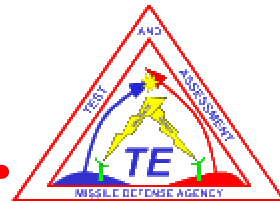
- **MDSE Has Fostered Numerous Integration/Interoperability Efforts**

- Arrow/US Interoperability (Allied Interoperability)
- Task Force Exerciser (Army Integration/ Interoperability)
- Roving Sands (MDSE Drivers Used for Training and Readiness)



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MDSE Future



- **MDSE Is The MDA Hardware-in-the-Loop Tool**
- **Enhancements in MDSE's Fidelity (e.g., Radars)**
- **Expansion of MDSE Elements By Block**
- **Planned Improvement in to Element Drivers**

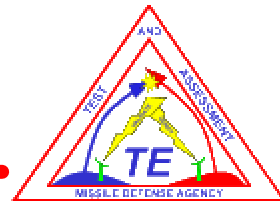


Wargame 2000 (WG2K)



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CONOPS, Doctrine, TT&P



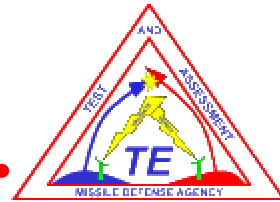
- **Vision** - Examine/develop/model CONOPS, doctrine, tactics techniques & procedures (TT&P)
- **Example questions to answer**
 - How do I use the system(s) to fight the war?
 - Who is in charge of what?
 - Who talks to whom?
 - What information is need at each level of control?
 - What are the impacts to the individual warfighter?
- **This means** - Model implementation well enough to illuminate differences in the C2 plan, communications plan, deployment plan, intel plan, airspace control plan

Derived requirement - Focus design on logical behaviors of elements and their interactions



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Human-in-Control



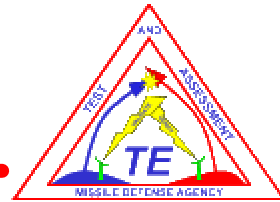
- **Vision - Conduct Human-in-Control Experiments**
- **Example Questions to Answer**
 - What Did the Warfighter Know?
 - When Did He Know It?
 - What Did He Do?
 - When Did He Do It?
 - What Impact Did It Have on the War?
- **This Means That Element Representations Must Include Imperfect Errored Performance With Counter & Counter/Counter Measures Modeled**

Derived Requirement - Execute in Real Time With Information Displays to Support Multiple Levels of Command and Control



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Fog-of-War



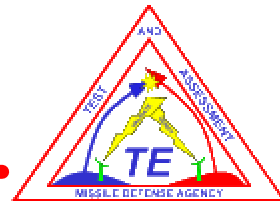
- **Vision** - Represent the Confusion Caused by “Fog-of-War”
- **Example Questions to Answer**
 - How Bad Can the Picture Get Before the Human Can No Longer Fight the Battle?
 - What Happens If Certain Information Is Incorrect, Unclear, or Late?
 - What Happens When Perception Does Not Meet Reality?

Derived Requirement - Provide Physics Based Medium to High Fidelity System Element Representations So That Fog-of-War Errors Have an Effect



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WG2K Future



- **The MDA OITL Tool!**
- **WG2000 is a real-time or faster, variable fidelity, tool for exploring C2 aspects of the BMD problem**
- **Explore and assess BMDS military utility**
- **Develop operator response data for use in constructive models or HWIL testing**
- **Requires formal validation and credible/Service accepted data sets to provide confidence in results for near-term BMDS block capabilities**

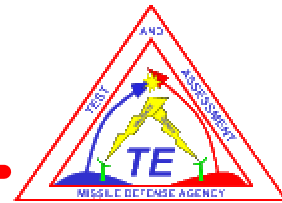


Extended Air Defense Test Bed (EADTB)

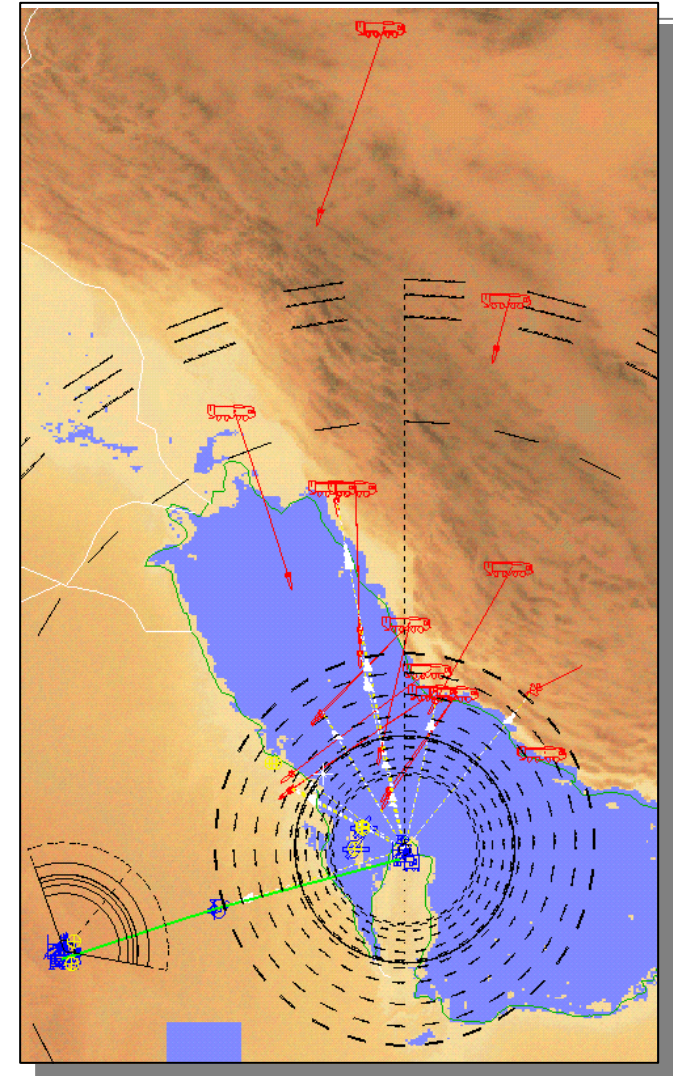


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EADTB Description



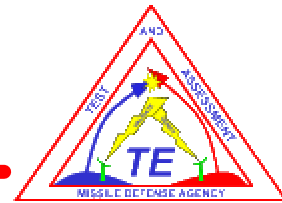
- **An event stepped constructive simulation**
 - Perception-Based - Model entities act on information they perceive, just as the real world systems do
 - Entity performance is data driven
 - Experiment logic is “ruleset” driven
 - Model algorithms are special purpose; configured by input data
- **BMC2 & C Focused - Explicitly models TADIL-J Traffic to the message content level**



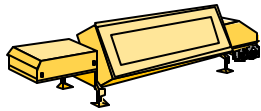


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EADTB Capability by Functionality



Sensors



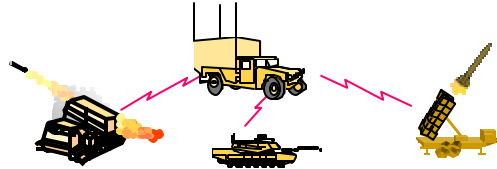
- Multi-mode Operation With Dynamic Mode Definition and Switching, Resource Management
- Propagation Effects, Volume and Surface Clutter (With Doppler), and Jamming
- 6-, 7-, and 9-state Kalman Filters, Abg Filters
- Detailed/Aspect-Dependent Target Characterization

Weapons



- Explicit Fly Out
- 3 DOF Dynamics With Dynamic Guidance
- Warhead Detonation
- Sensor on Missile

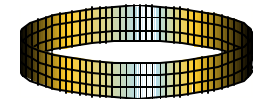
Command and Control



- Perception Based, Sensor and Message Driven With Errors, Lost Messages, Delays
- User Defined Rule Set

Visualization of
Battlefield/ Warfighter
Perception
Variable Detail and
Scope

Communications



- Explicit Message Contents
- Loading/Queuing/Processing Delays
- Networks/gateways
- Plot or Track Dissemination
- Damage Mechanisms & Jamming
- Error Rates
- Dynamic Routing Delays
- Loading/queuing/jamming
- Broadcast, Multi-cast, Point-to-point

Environments

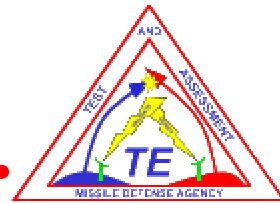


- Multi-Resolution Terrain (DTED) and Features (DFAD)
- Multi-Resolution Weather



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EADTB Future



- **Validated, perception-based model capable of characterizing SoS/FoS interoperability**
- **Airborne Laser, Ground-Based Mid-course, Sea-Based Mid-Course**
- **Debris, counter-measures, ACD Threat Space**



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SUMMARY



- **Capability-Based Acquisition Is A Structured And Disciplined Process**
 - Iterative Process Converges To Establish Expectations
 - Block Capability is Deliverable
 - Baseline Is Controlled
- **M&S Motivation**
 - Get Ahead And Stay Ahead Of The BMDS Block Capability Development
 - Flexible Strategy
 - Place Simulated Capabilities “In Play” Sooner
- **Capability-Based Acquisition Is Flexible – M&S Tool Development Must Be Just As Flexible**
 - Insert New Ideas And Capabilities
 - Support Decisions To Accelerate, Continue, Modify, Or Truncate Block Capability Development Activities

