



Systems 2020

Strategic Initiative Overview

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13th Annual NDIA Systems Engineering Conference
San Diego, CA | October 28, 2010



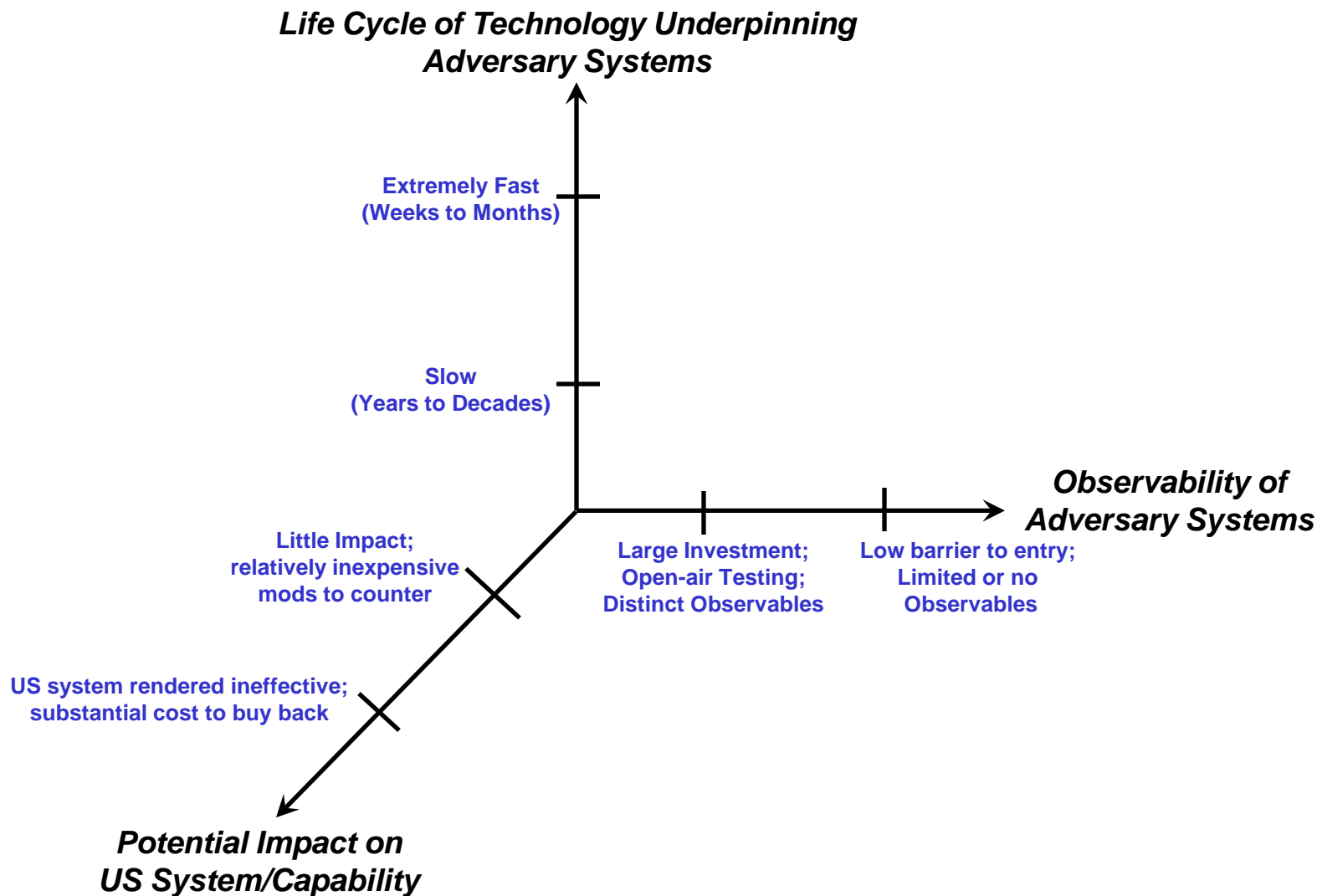
Need for Systems 2020



- **Adversary can use commercial technologies and new tactics to rapidly alter the threat to US forces**
 - Increasing uncertainty in future Defense missions & environments
- **DoD engineering, and business processes not structured for adaptability**
 - Sequential, single step progression from fixed requirements
 - Individually designed, monolithic systems
 - Vulnerabilities from global supply chain
- **New research, tools, pilot efforts needed to determine best methods for building adaptable defense systems**

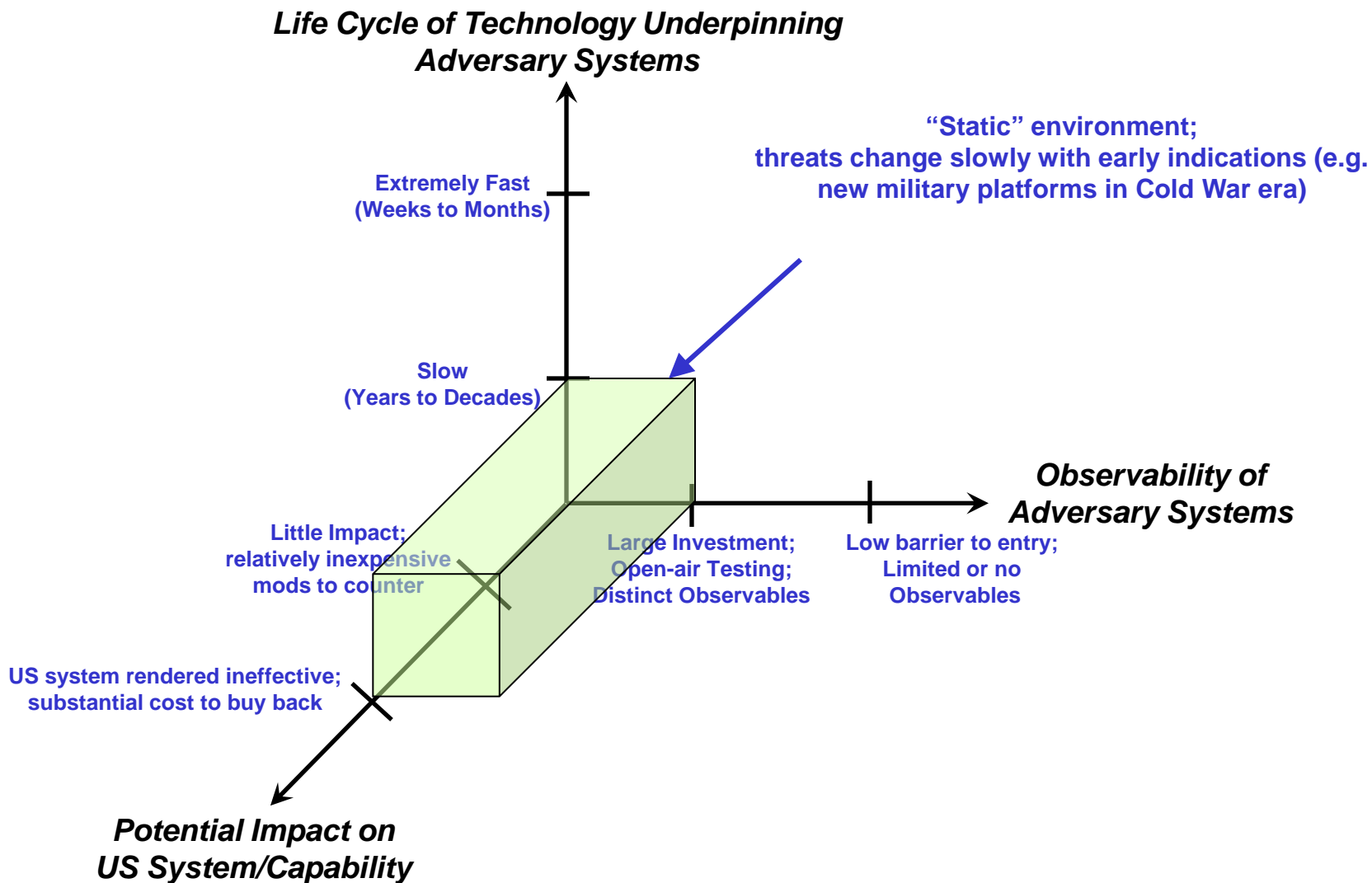


The Urgency of Anticipation, Flexibility and Rapid Adaptability





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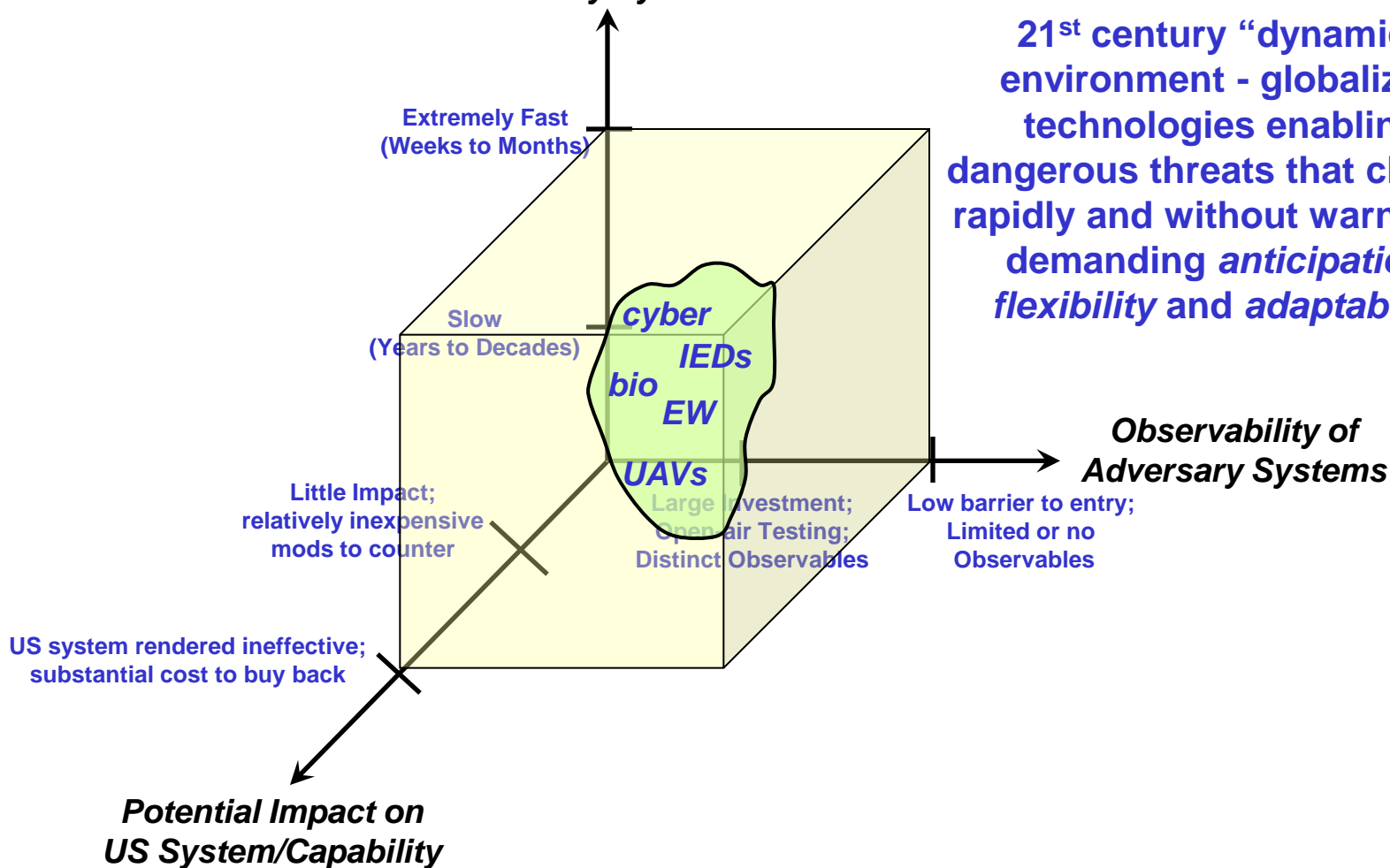




The Urgency of Anticipation, Flexibility and Rapid Adaptability



Life Cycle of Technology Underpinning Adversary Systems





Systems 2020

Designing DoD Systems for Adaptability

**Design
Disciplines**

Platform Based Engineering

Using a common core
platform to develop many
related systems/capabilities

Trusted System Design

Developing trusted systems
from untrusted components

**Design
Framework**

Model Based Engineering

Using modeling and simulation for
rapid, concurrent, integrated system
development and manufacturing

**Adaptable
DoD Systems**

Capability on Demand

Real-time Adaptive Systems
Rapidly Reconfigurable Systems
Pre-planned Disposable Systems



Systems 2020 Scope

- **Systems 2020 technologies could apply to many domains**
 - Platform Based Engineering (PBE), Model Based Engineering (MBE), Trusted Systems Design (TSD) are relevant to microelectronics, software, enduring defense platforms
- **Focus of Systems 2020 is on system engineering disciplines and frameworks to build adaptable defense systems**
- **Significant business process challenges in addition to technical challenges**
 - e.g., Challenging the requirements community to avoid specifying a fixed point solution, enforcing open architectures
 - Primary S-2020 focus is on the technical challenges

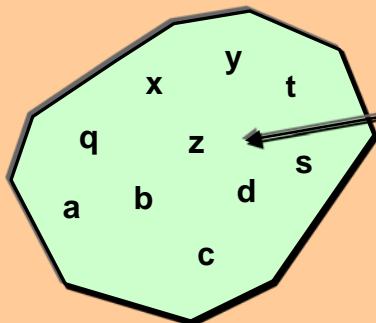
Faster delivery of adaptable systems that are trusted, assured, reliable and interoperable



Platform-Based Engineering and Trusted Systems Design Disciplines

Notional Defense System

Today
Point design
to address
fixed, static
requirements

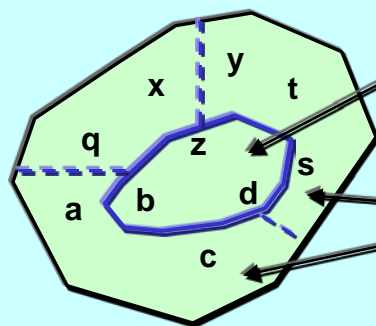


*Monolithic,
Complex, Rigid
Design*

Threat and mission changes
require extensive re-work or start
from scratch

- Expensive, slow to field

PBE
Inherently adaptable
design to address
dynamic, uncertain
requirements



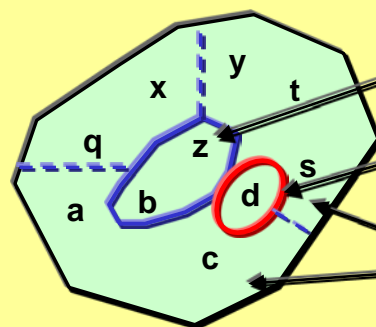
*Enduring
Core
Platform*

*Rapidly
Changeable
Subsystems*

Core platform capable of rapidly
accommodating threat and mission
changes

- Well-defined architectures,
interfaces allow a variety of
systems configurations

PBE + TSD
Inherently adaptable
and robust design
to address
dynamic, uncertain
requirements



*Enduring Core
Platform*

*Trust
Partitioning*

*Rapidly
Changeable
Subsystems*

Additional partitioning of untrusted
components and subsystems

- Allow rapid response to trust
violation

x, y, z, etc – subsystems and/or components



Model Based Engineering Framework Designing for Adaptability



Today
*Model selected
critical subsystems*

*Lots of design –
physical prototypes*

Req & Analysis



Design & Prototype



Operational System



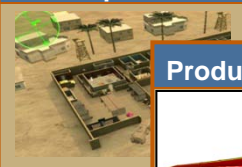
**Early Design
Lock In**

- Design decisions and interactions captured on paper, lost in personnel turnover.
- Lack of iterative concept design environment.
- Manual integration across product design seams.
- Custom manufacturing solutions.

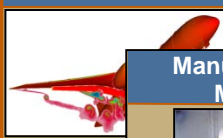
Stage 1
*Segmented Virtual:
Concept Modeling
Product Modeling
Model Driven
Manufacturing*

**Iterative/ Adaptive
Process - Entire
Life Cycle**

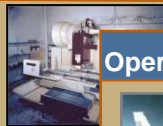
Concept Models



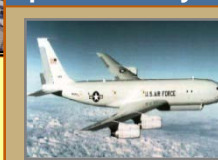
Product Models



Manufacturing
Models



Operational System



- Emergence of open virtual design environment, interoperable tools and design data/artifacts.
- Early analysis of PBE and TSD system trades in concept, product, manufacturing models.

Stage 2
*Fully Integrated
Process Flow:
System Concept,
Design, Build,
Field, Adapt*

**Adaptive
Transparent
Systems**

- Robust end-to-end open multi-scale design environment, tools, data, patterns & virtual/physical verification.
- Support full system PBE & TSD trades, responding to dynamic threats & trust scenarios.

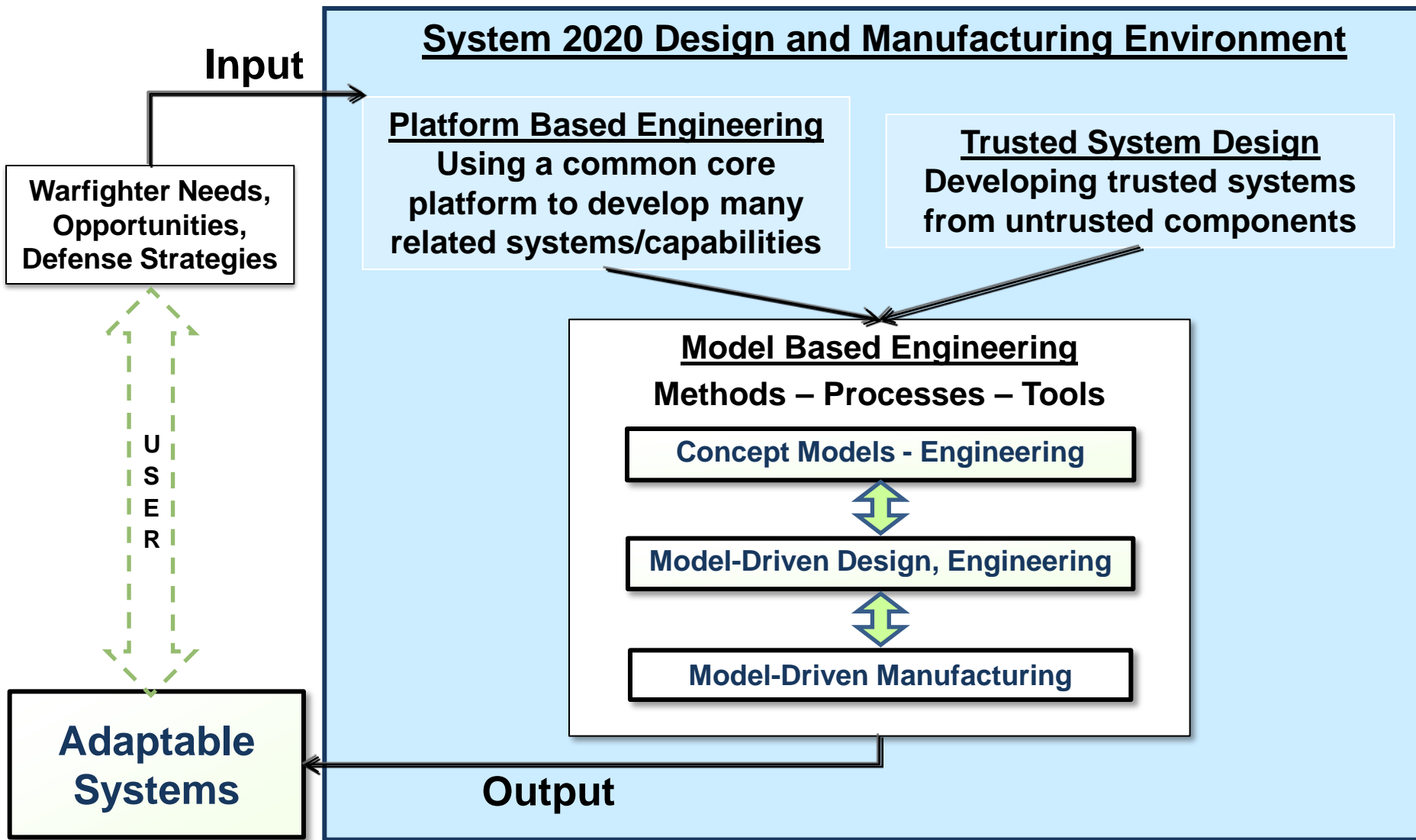


Trusted Systems Design

- **Designing trusted systems using components or subsystems of unknown or suspect trustworthiness**
 - Desire to leverage commercial technologies to provide enhanced warfighting capability, however...
 - Current patchwork of defensive methods are not adequate for using commercial technologies from across the globe
- **Use Platform Based Engineering tools, techniques to design the system to address trust**
 - Suspect components are isolated, not part of the enduring core
- **Research gaps identified in three key areas:**
 - Architectures to make systems less transparent to the attacker
 - Methods, models for implementing trusted system design throughout system lifecycle
 - Trustworthiness assessment tools and methodologies



System 2020 Workflow to Achieve Adaptable Systems





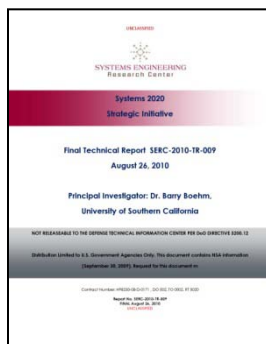
***We are seeking input on key
technical gaps and
opportunities to shape
research projects and pilots***



Systems Engineering Gaps and Critical Needs

Summer 2010 Studies
Identified deficiencies and gaps in systems engineering

**SE Research Center
S-2020 Study**



**Booz Allen Hamilton
S-2020 Study**

**BOOZ ALLEN
HAMILTON
Systems-2020 Study**

Final Report
Booz Allen Hamilton

8/16/2010

Analysis of these reports
categorized gaps into 3 areas

Gaps

Need for a conceptual design environment

Lack of tools to integrate system modeling capabilities across domains

Lack of open, virtual, realistic environment for validation, testing and manufacturing

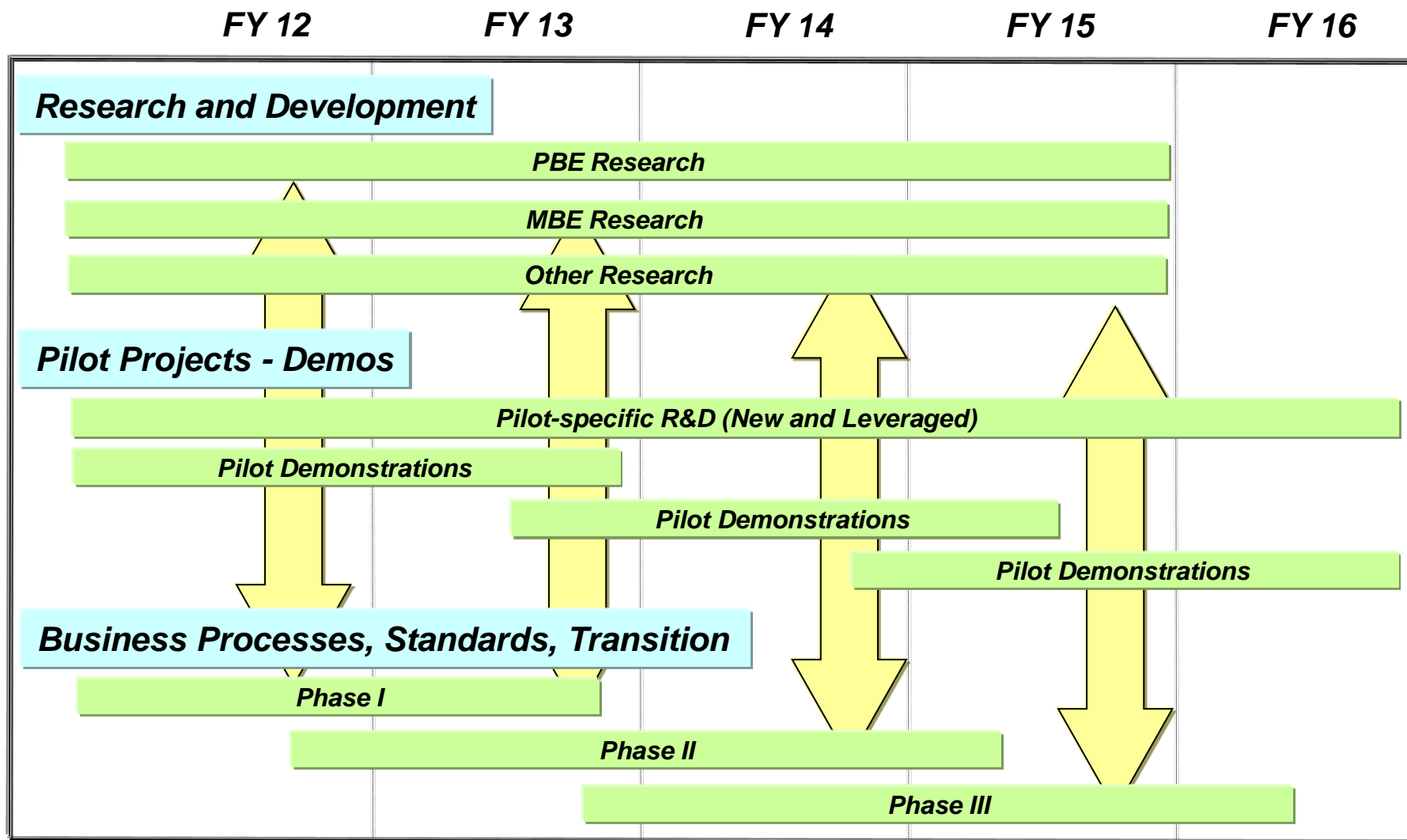
Lead to Critical Needs

An integrated framework for concept, design and analysis of systems

- Accommodates custom and commercial tools based on open architectures and standards
- Common conceptual environment and design tools for seamless interoperability
- Capabilities to verify system integrity, promote modularity and re-use, and design for trust
- Enhanced multi-scale Mod/Sim tools that support cross domain testing



Overview of S-2020 Path Ahead





Summary

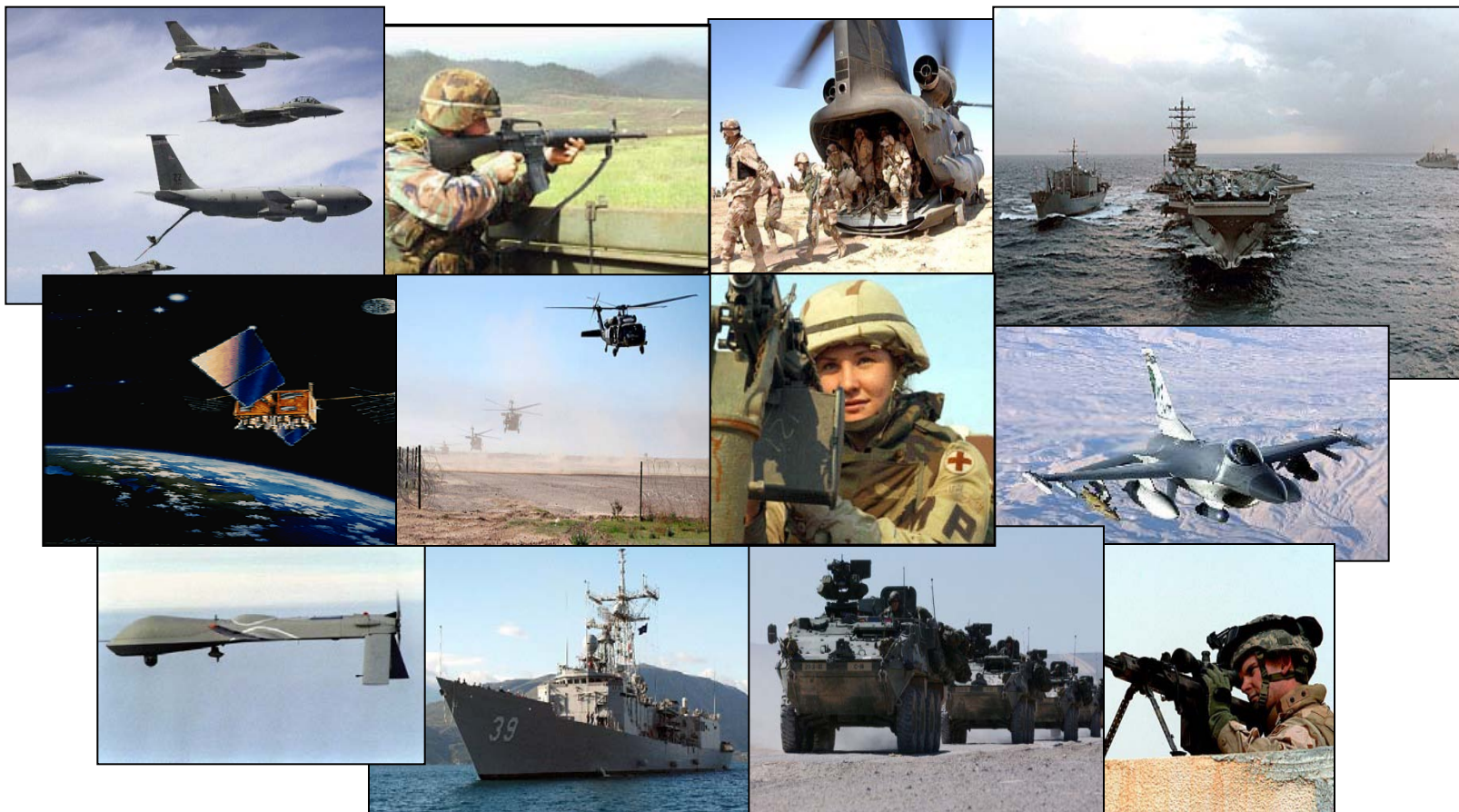


- **DDR&E's Systems 2020 initiative develops the design disciplines and framework to build adaptable Defense systems**
- **Program consists of research, pilot projects and transition efforts to advance key technologies**
 - Platform Based Engineering, Model Based Engineering, Trusted Systems Design
 - Rapidly reconfigurable systems
- **Execution performed through partnership with Services, Government, Industry, Academia**

We look forward to broad community engagement



Systems Engineering: Critical to Program Success



Innovation, Speed, and Agility

<http://www.acq.osd.mil/se>