

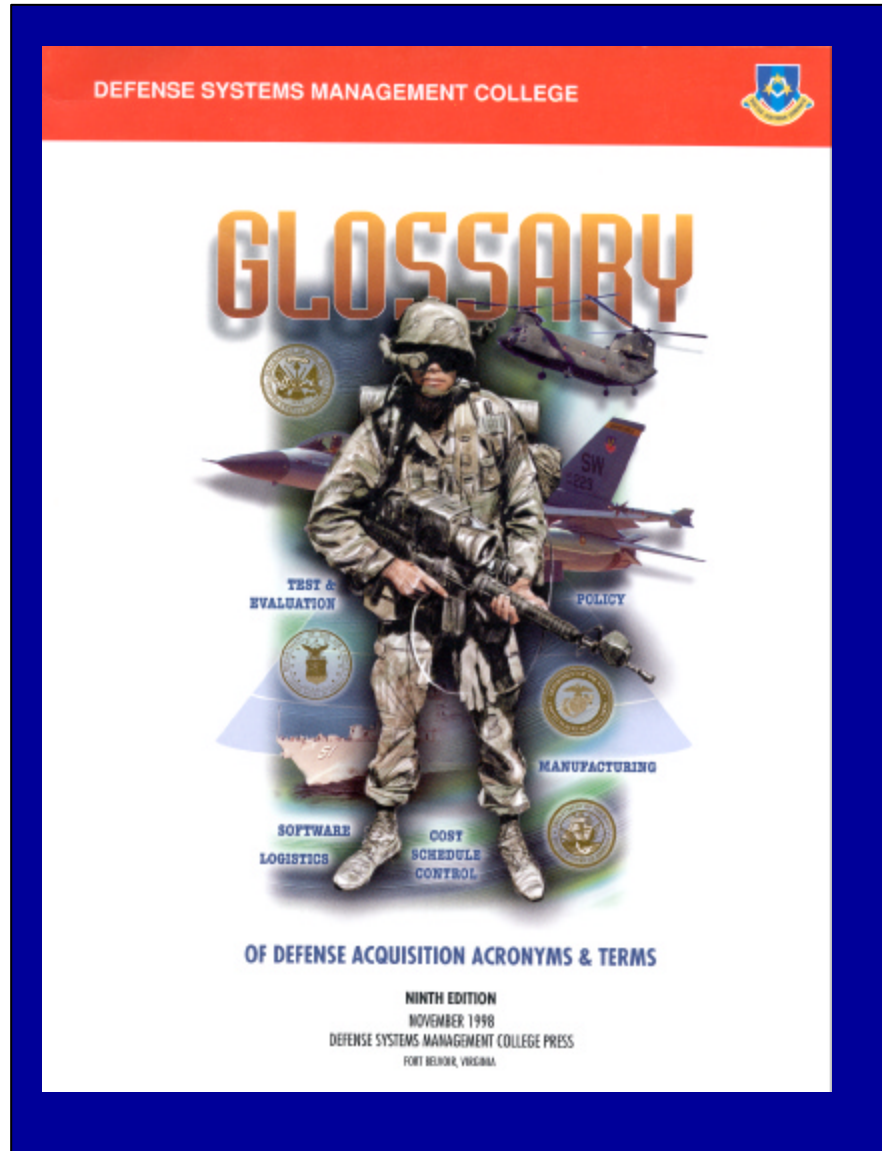
SBA Yesterday & Today:

Current View of SBA in
Advanced Systems Engineering
and
System-of-Systems
Environment

Dr. Judith Dahmann

- **SBA concepts have been a topic of interest for several years**
 - Where are we in implementing these concepts in today's systems acquisitions?
- **Growing emphasis on Network Centric Warfare, Coalition Operation and Systems of Systems**
 - How do SBA concepts support tomorrow's acquisition environments?

Simulation-Based Acquisition Defined



"A concept which envisions greater and more integrated use of modeling and simulation in the acquisition process. DoD and industry would be enabled by robust, collaborative use of simulation technology that is integrated across acquisition programs and phases."

November 1998

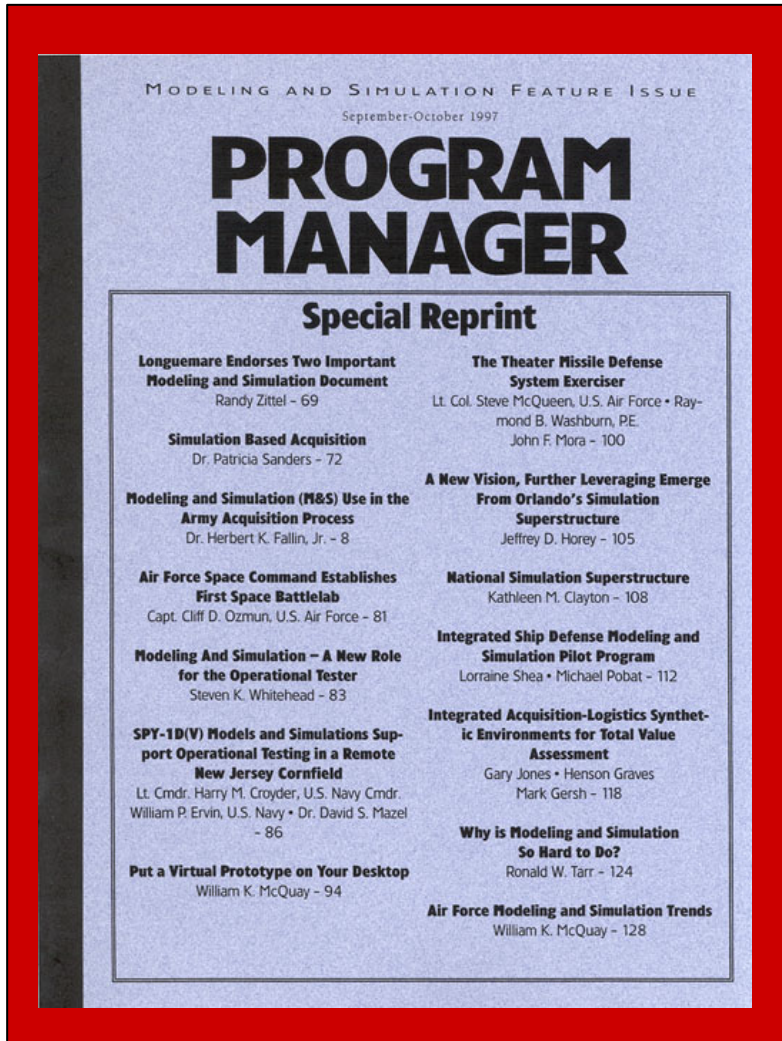
Origins

Need for More Cost Effective Acquisition Process

- **Declining defense budgets and changing force structure**
 - Modernization/Transformation versus Recapitalization
 - 1995 Vice President's National Performance Review (NPR) -- 25% reduction in delivery time for new systems
 - Department of Defense (DoD) stretch of NPR goal to 50% reduction, plus reduction in Total Ownership Costs
- **Cost-performance consideration allow routine use of advanced IT, modeling and simulation tools**
 - Defense Systems Affordability Council recognizes M&S potential

SBA Benefits

Risk Reduction



- Continuous evaluation of system development
- Rapid evaluation of concept design
- **Reduce and delay** need for physical prototype
- **Facilitate** continuous user participation in development process
- **Efficient** development/evaluation of manufacturing plans
- Reuse of system software and hardware in training simulators

M&S Use in the Army Acquisition Process,
Dr Herbert K. Fallin, Jr; 1997

Original Goals

- Substantially **reduce the time, resources and risk** associated with the entire acquisition process
- **Increase the quality, military worth and supportability** of fielded systems, while **reducing** their **total ownership costs throughout the total life cycle**
- Enable Integrated Product and Process Development (IPPD) **across the entire acquisition life cycle.**

1998 SBA Roadmap



A Road Map for Simulation Based Acquisition

Report of The Joint
Simulation Based Acquisition Task Force

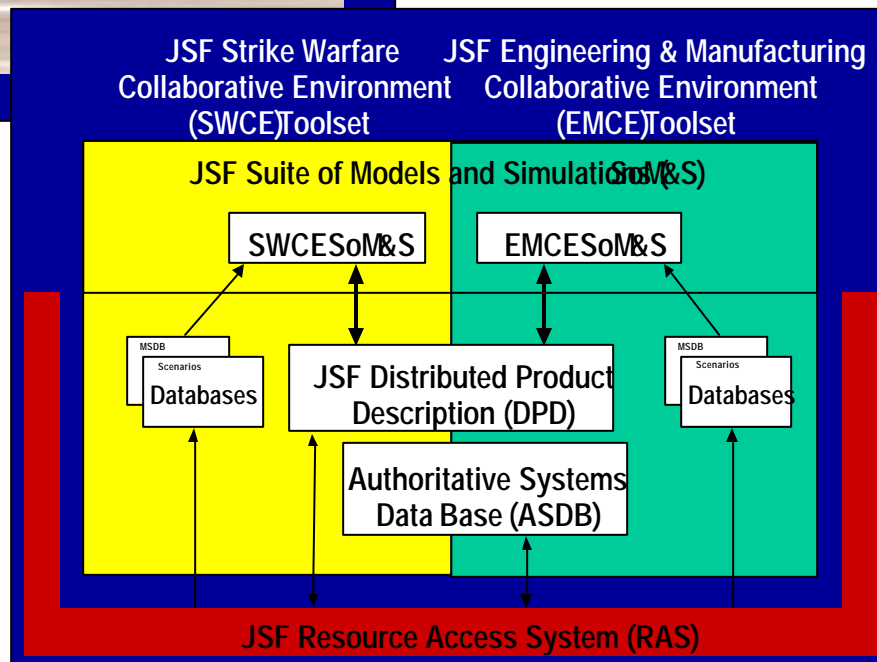
Acquisition Council Draft for Coordination
December 4, 1998

- Joint SBA task force, including **government and industry**, identified cultural, process, and technical elements
- Identified **actions needed** to implement new approach to systems acquisition efficiently, expeditiously, and non-intrusively

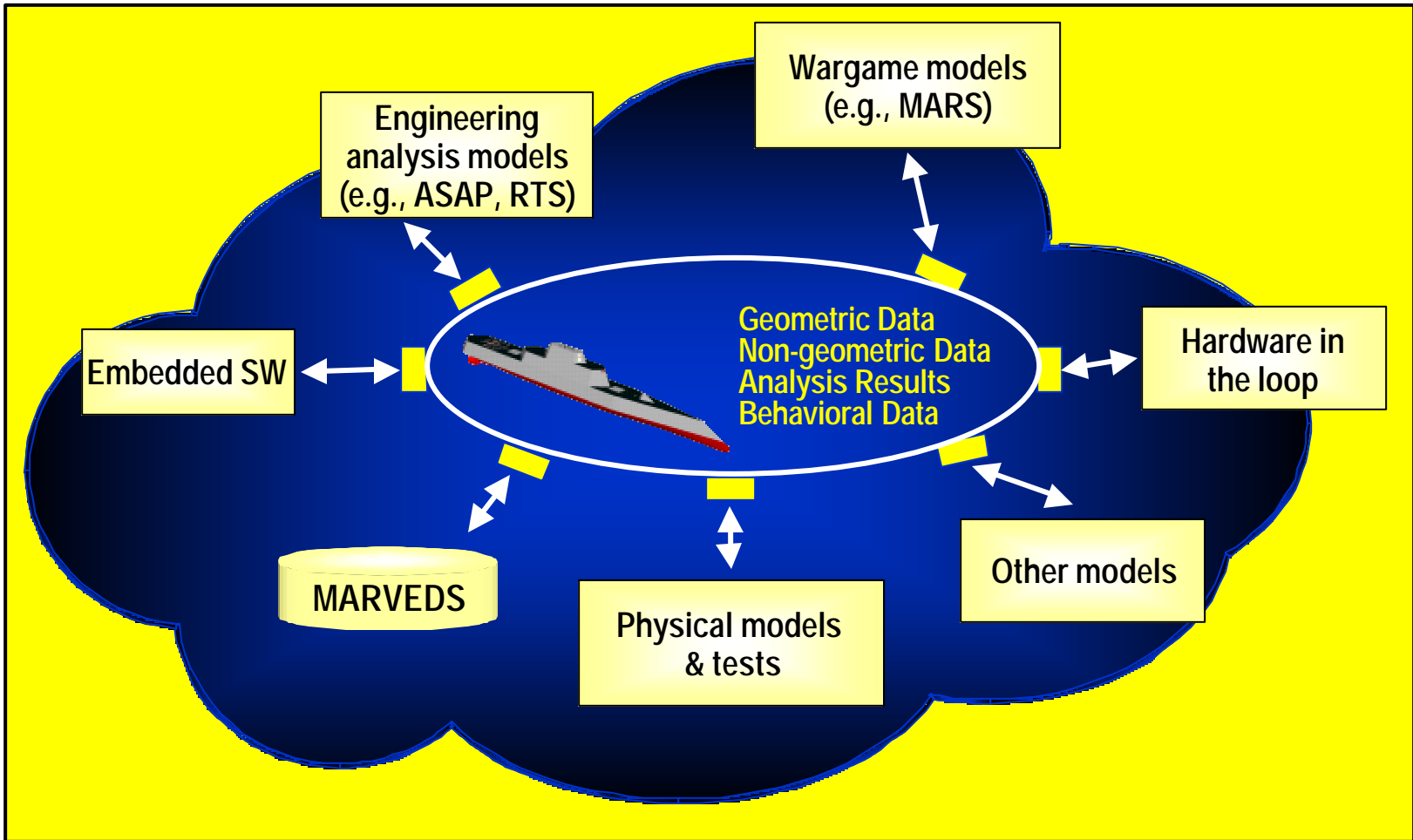
Key Ideas

- **Shared system or product description**
 - a shared, definitive source of data describing the system which evolves as the system matures and serves as a common reference for multiple disciplines through system development life cycle
- **Multiple concurrent views and assessments of the system**
 - based on shared system descriptive data allowing for consideration of more options, and their implications, at each stage of the development and acquisition process
- **Early and continuous use of simulation**
 - in lieu of hardware prototyping and live test; by representing as many aspects of a systems in simulation for as long as possible, reducing costs of development
- **Common tools**
 - employed at different stages of the acquisition process and reuse of tools (including simulations) which have been used by others, reducing cost and time and increasing credibility since each user doesn't have to do all the tool development for themselves

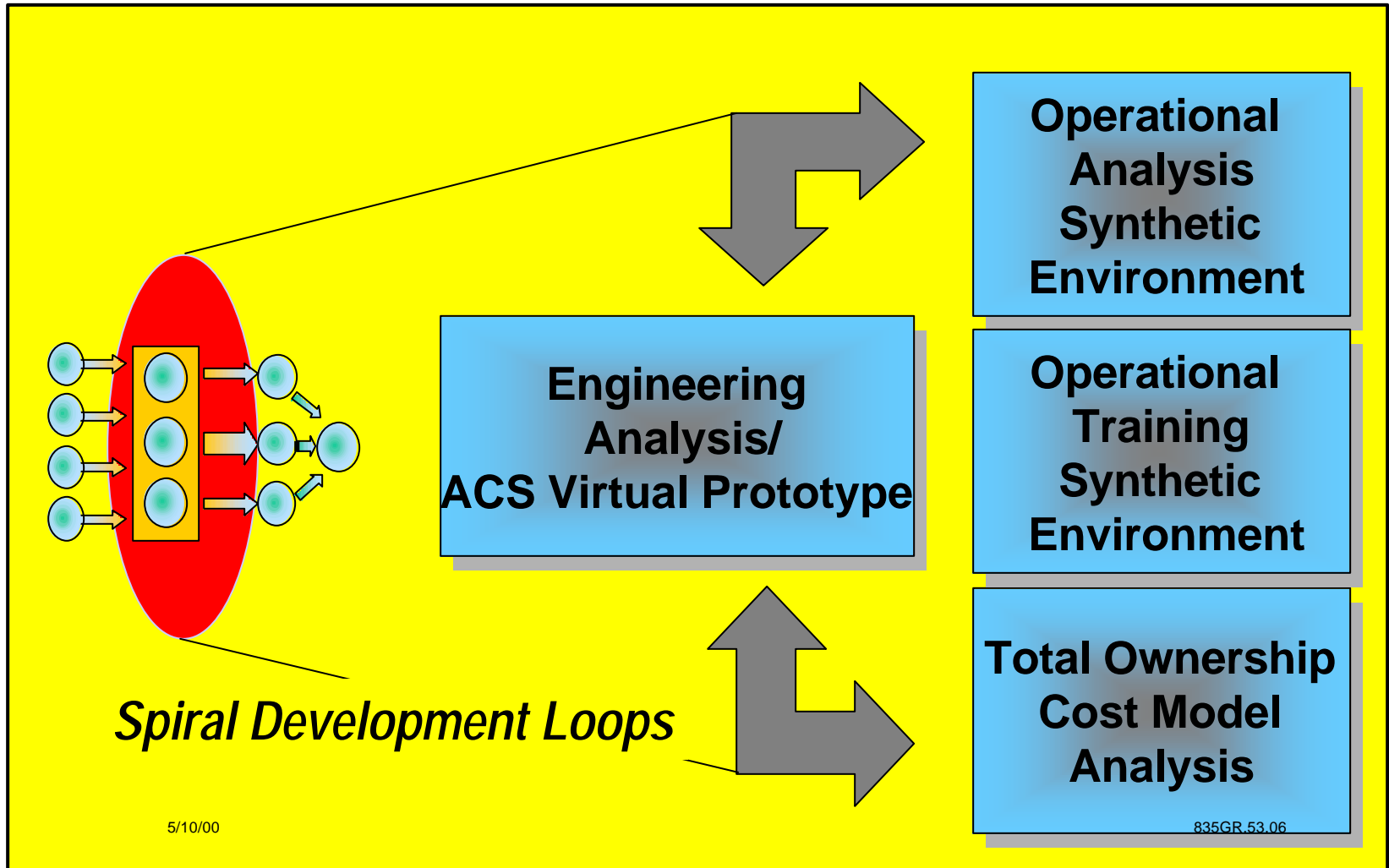
Joint Strike Fighter



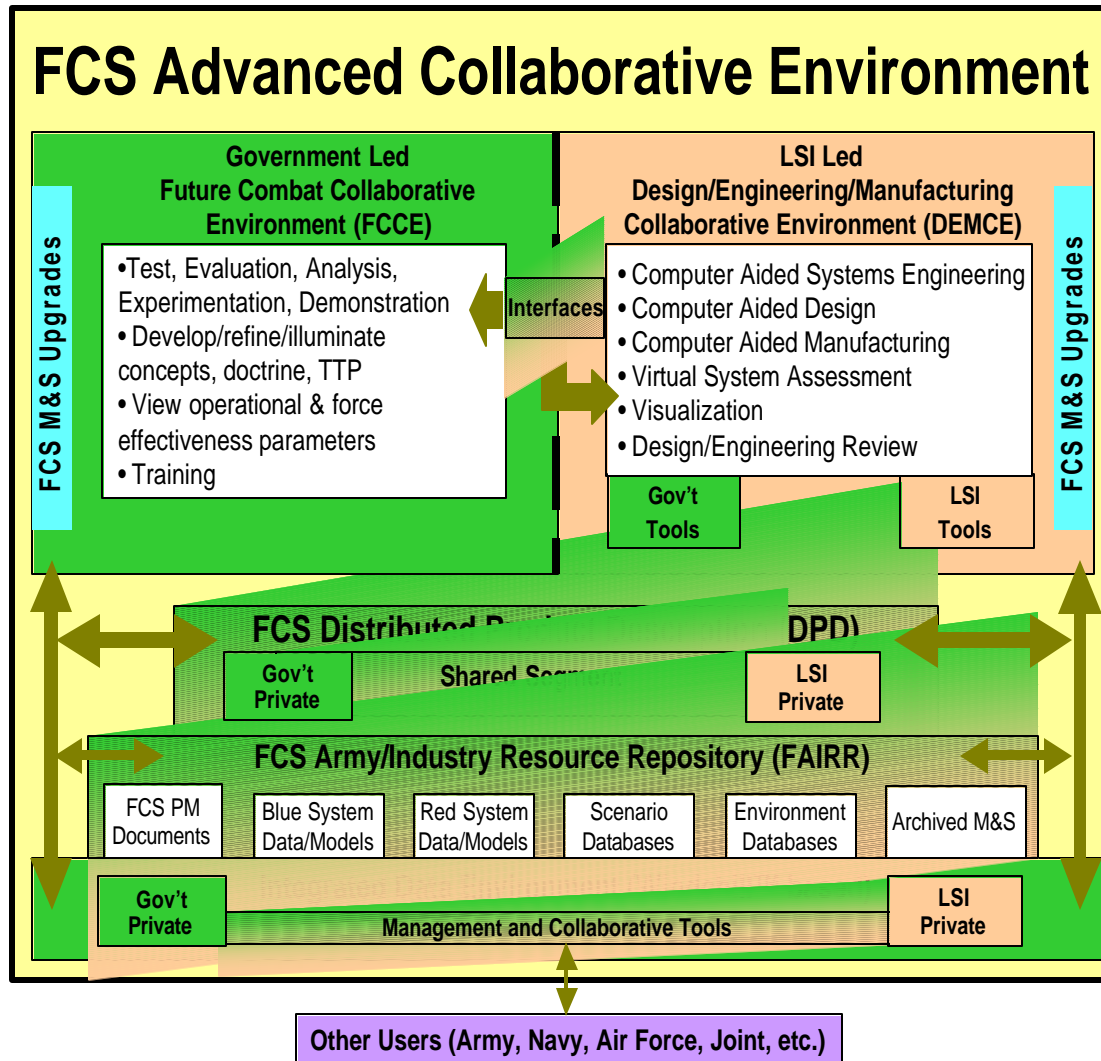
DDXX



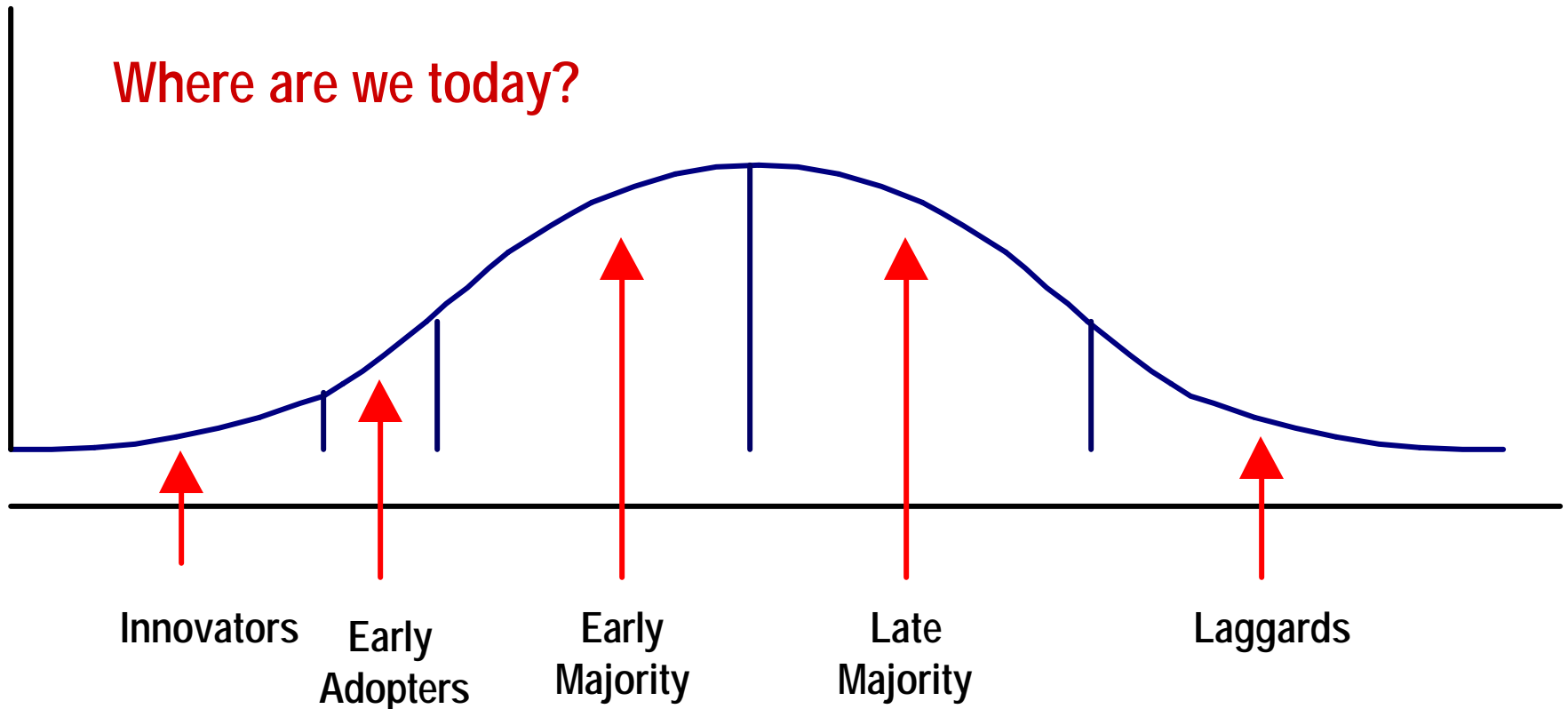
Aerial Common Sensor



Army Future Combat System



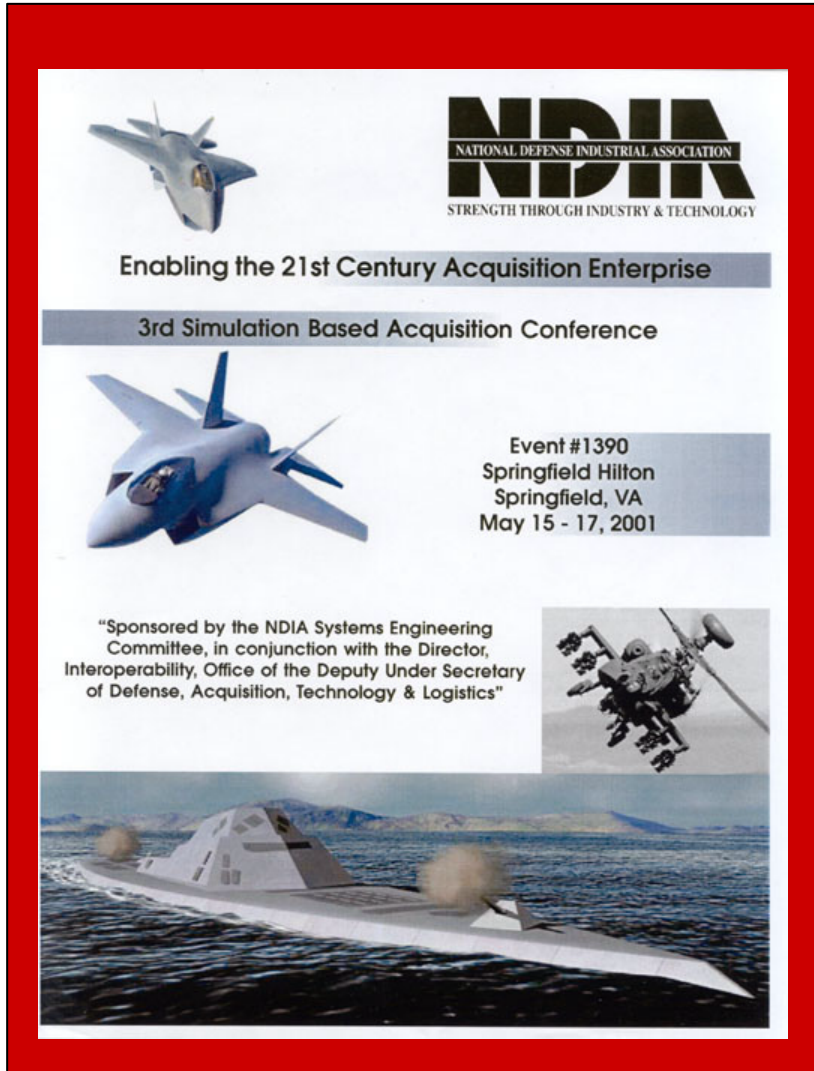
Technology Adoption Life Cycle



Boeing 777? *DDXX?*
JSF? *FCS?*
SBA Roadmap?

...probably further to the left
than we would like to think.....

NDIA SBA Conference May 2001 Findings



The poster features the NDIA logo at the top right, with the text 'NATIONAL DEFENSE INDUSTRIAL ASSOCIATION' and 'STRENGTH THROUGH INDUSTRY & TECHNOLOGY'. Below the logo is the title 'Enabling the 21st Century Acquisition Enterprise' and '3rd Simulation Based Acquisition Conference'. The event details are listed as 'Event #1390', 'Springfield Hilton', 'Springfield, VA', and 'May 15 - 17, 2001'. A quote from the NDIA Systems Engineering Committee is provided, along with images of a fighter jet, a satellite, and a stealth bomber.

NDIA
NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Enabling the 21st Century Acquisition Enterprise

3rd Simulation Based Acquisition Conference

Event #1390
Springfield Hilton
Springfield, VA
May 15 - 17, 2001

"Sponsored by the NDIA Systems Engineering Committee, in conjunction with the Director, Interoperability, Office of the Deputy Under Secretary of Defense, Acquisition, Technology & Logistics"

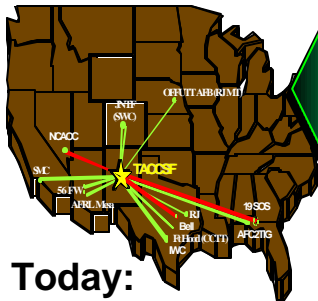
- Progress has been made
 - **Programs/Services** are creating the systems engineering environments for their specific applications
 - **Industry** investing for their own competitive advantage
- However....
 - **Limited attention to system-wide issues**
 - Ongoing developments will **not 'work together' across systems** throughout the lifecycle to create the needed leverage
 - Many needed components are available from ongoing efforts, but these are **not designed to be reused, there is duplication of efforts and there are missing elements**

'System of Systems' Pose New Challenges

- Systems of systems pose new challenges
 - For operations
 - and for development
- To address these challenges, common environments which can be used across systems are needed
- In each of the Services, and at the DOD level, new initiatives are being created to address the SOS development issues
- These new initiatives provide broader and more extensible advanced systems engineering environments to support future system development

Air Force Joint Synthetic Battlespace

WARFIGHTER Requirements, Training & Rehearsal



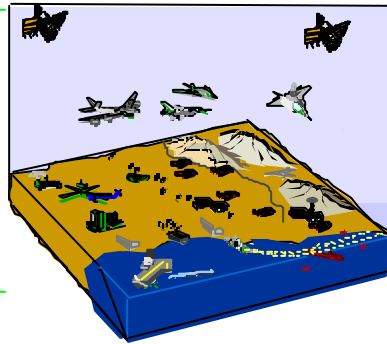
Today:

Unable to Fully Understand
Operational Impacts in a
Heavily Vegetated
Environment
--Camouflage, Hyper-spectral,
...

Future:

Able to Understand
Operational Impacts in all
Environments

Joint Synthetic Battlespace



A Common Architecture That:

- Represents the Natural
Environment Realistically
- Physics Based Sensor Models
- Allows Integration of Legacy
Simulations

ACQUISITION S&T, R&D, T&E

Government Sites
Contractor Sites



Today:

Unable to Fully Understand
System of Systems and
Environmental Impacts

Future:

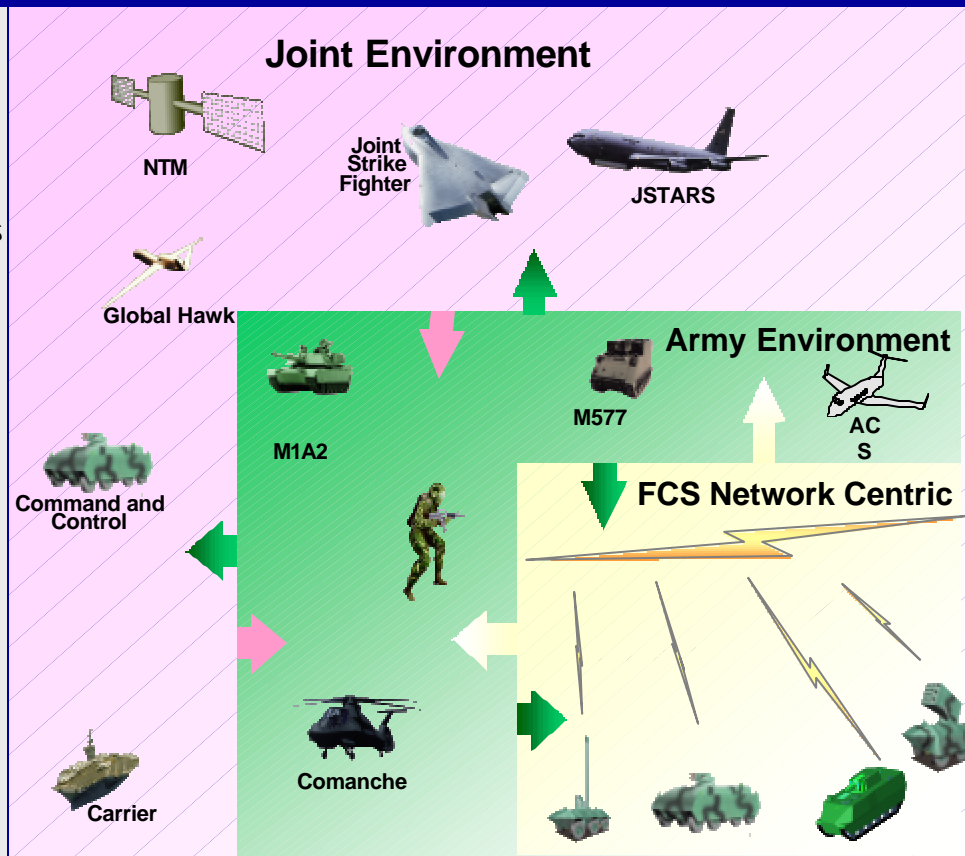
Simulations Readily Available
to Assess System
Complexities

Army Joint Virtual Battlespace

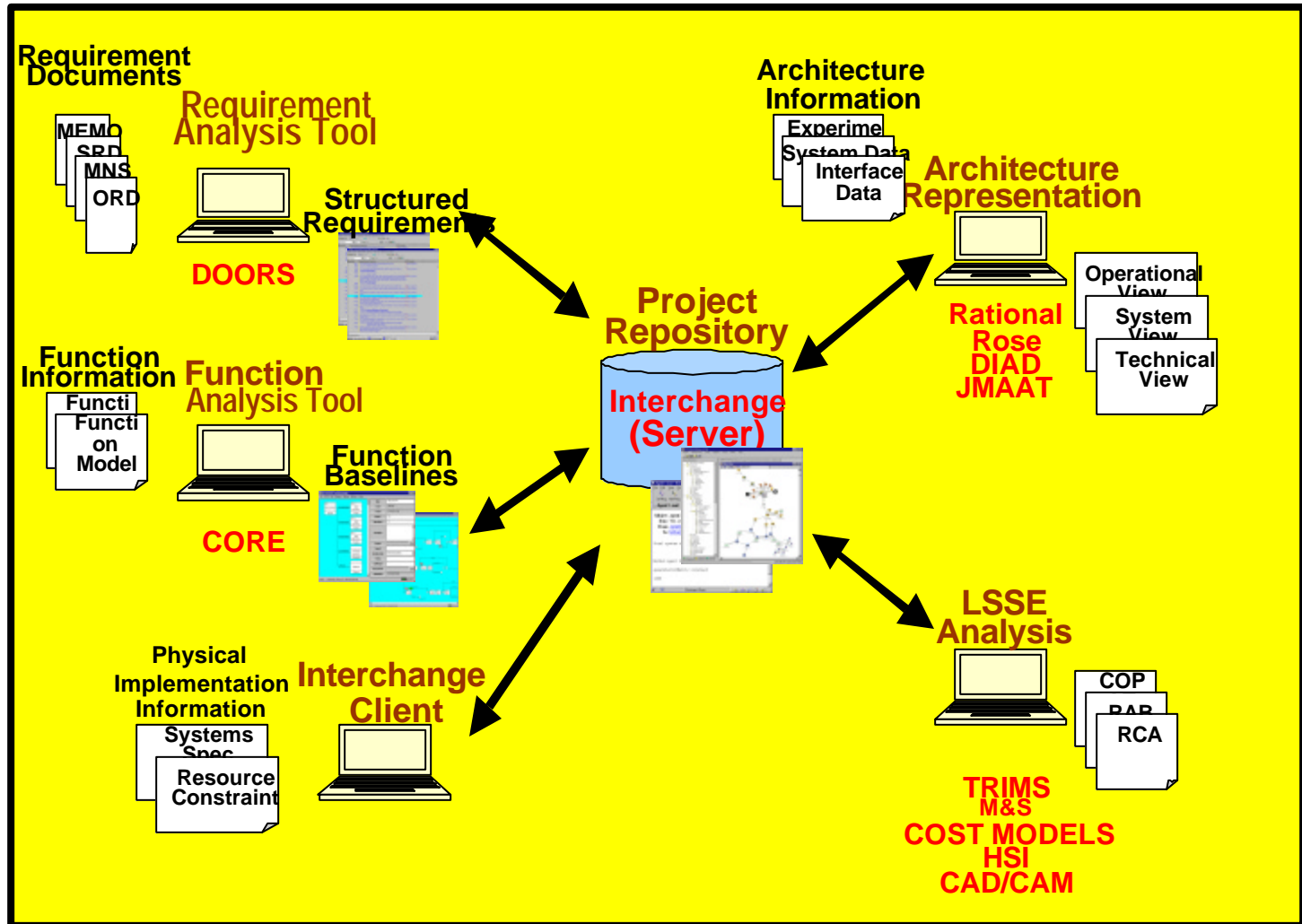
SMART
(**S**imulation & **M**odeling for **A**cquisition,
Requirements and **T**raining)...
...Tool To Support The Objective Force and
Future Combat System

JVB Design Includes:

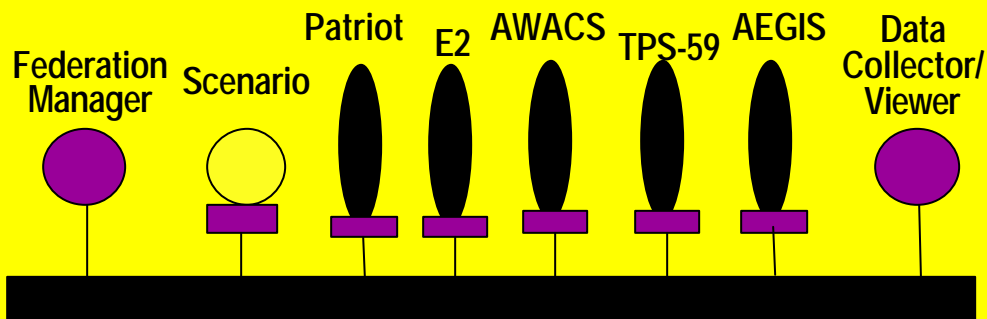
- Joint Forces
- Legacy Forces
- Objective Force
- Future Combat Systems
 - C3
 - ISR
 - Robots
 - New Weapons
- Dynamic Weather
- Dynamic Terrain
- High Fidelity Terrain
- Certified Data



Navy Collaborative Engineering Environment

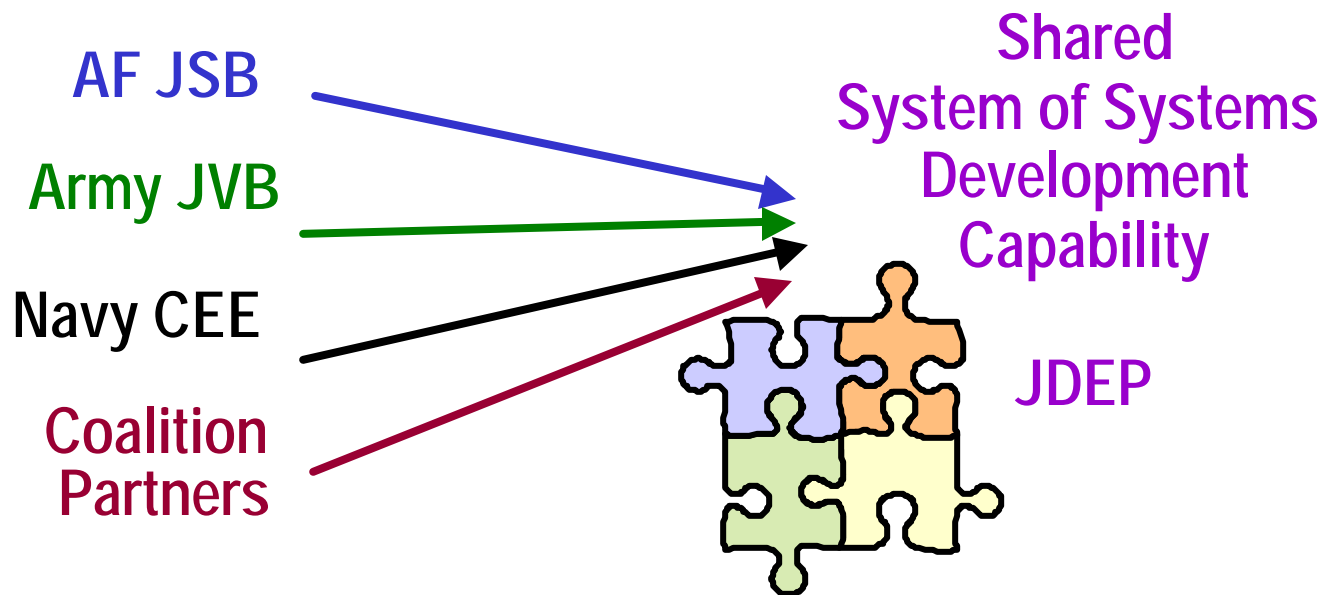


Joint Distributed Engineering Plant



- JDEP will build interoperable forces by providing a tool for
 - Developers to engineer interoperability into their systems
 - Testers to test and evaluate interoperability among systems
 - War fighters to assess operational capabilities of forces
- Single Integrated Air Picture (SIAP) Systems Engineer
 - **Pilot development of systems of systems engineering environment for the DOD**

Interoperable Systems of Systems Require Interoperable Development Environments

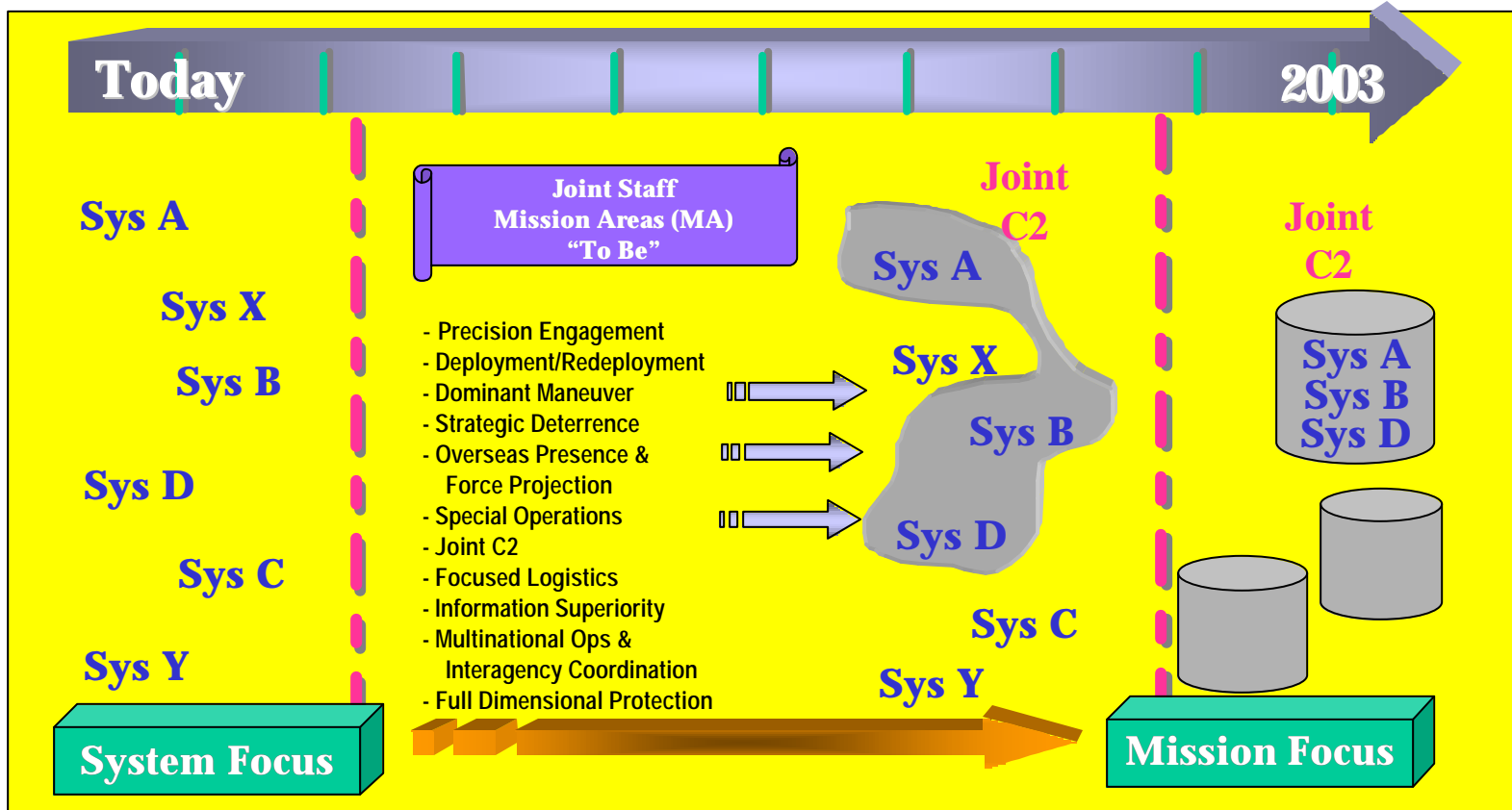


As with interoperable war fighting capabilities, Service and Joint development capabilities must work together to create the needed system of systems development and engineering environment

Challenges

- Challenges of advanced systems of systems engineering environments **parallel** those of interoperable operational systems of systems
- **Cooperation** among Services and DOD communities to create need components
- Need ways to continue to identify and address **technical and policy** areas
 - Key interfaces and common standards
 - Opportunities for shared developments
 - Building components for reuse and sharing
 - Routine application of shared engineering capabilities throughout the system of systems life cycle

Future Vision



System of System Engineering Environments

Simulation-supported system of system engineering environments will develop hand-in-hand with mission area capabilities

Summary

- Concepts of **simulation support to acquisition and development** are key to advanced engineering environments
- Early emphasis on individual systems and improved efficiency
- Future direction toward enabling **systems of systems** development, test and war fighter assessment
- Interoperable systems of systems to support joint war fighting requires shared **system of system engineering environments**