

**Presentation to
DPAAS Conference on
Simulation Based Acquisition
June 7, 2000**

“Big Industry View of SBA”

**Michael W. Johnson
Engineering Technology
Phantom Works/Boeing**

Big Industry Definition

- **Large aerospace corporations with**
 - **Large % of sales with DoD**
 - **Extensive design & manufacturing capability**
- **Two views in this presentation**
 - **SBA Industry Group**
 - **NDIA Modeling & Simulation subcommittee**
 - **Michael Johnson**

There Is No Corporate Big Industry View of SBA

- **OSD SBA initiative has lost momentum**
 - **SBA Roadmap null and void**
 - **Rapid turnover of SBA spokesperson's at OSD level**
- **SBA not well defined to Corporate Leadership**
 - **Independent Service views and messages surfacing**
 - **Feels and looks like more modeling & simulation rather than an Acquisition change**

SBA is a big deal and needs consistent, persuasive voices and action from the top of DoD. New draft of DoD 5000 Directive and Instructions regarding Acquisition does not provide this impetus to SBA.

The SBA Industry Steering Group

- Ball Aerospace
- Boeing (2)
- Draper Laboratory
- CACI
- CTC
- Dynetics
- EDS
- General Dynamics
- JJ McMullen Assoc.
- Lockheed Martin (4)
- MITRE Corp
- Nichols Research
- Northrop Grumman
- OptiMetrics
- Pacific Sierra Corporation
- Raytheon (2)
- SAIC
- SRI International
- TASC
- Trident Systems (2)
- United Defense (2)
- Vanguard Research
- VisiCom Laboratories
- & Others

SBA ISG Accomplishments

- **Modified DoD's Vision for SBA to include "industry"**
- **Held on-site visits at Boeing (1997), General Dynamics, TARDEC**
- **Drafted an SBA Concept of Operations (CONOPS)**
- **Wrote an SBA Requirements Document, later renamed the SBA Functional Description Document (FDD)**
- **Hosted two 3-day conferences on SBA; Orlando (March '98) and Dallas (November '98)**
- **Pressed successfully for DoD Policy Initiative on M&S Used in Source Selections**
- **Briefed Results to the Acquisition Council, DSB, NDIA, EIA, AIA, Affordability Task Force**
- **Supported DSMC Fellows and DoD's SBA Task Force**
- **Conducted SCS Summer Conference Panel on "The Business Case for Simulation Based Acquisition"**
- **Interaction with JSF on development of DPD definition**

SBA ISG Accomplishments (Currently)

- **Working on idea of industry consortium**
- **Industry input to new OSD players in M&S and SBA**

What is SBA?

- **Fundamentally a revolutionary change to the DoD Acquisition process**
- **Affects all of our product life cycle processes**
 - **Concept development**
 - **Product engineering and design**
 - **Manufacturing**
 - **Operation, Support, and T&E**

SBA Defined

- **Revolutionary Acquisition Initiative**
 - **Emphasizes Modeling & Simulation as a Primary Tool**
 - **M&S Applied and Endures Throughout the Life Cycle**
 - **Products Validated Through M&S Before Production**
- **Major Impact On T&E Culture and Purpose**
 - **Digital Representations are Tested**
 - **Physical Test Articles are Primarily for Model V&V**
- **Major Paradigm Changes in Three Domains**
 - **Culture, Process, Environment**



How Did SBA Start?

“The bottom line is that

Integrated Product and Process Development

*backed by strong commitment to computer based
modeling and simulation tools provides a dominant
competitive edge in the commercial marketplace
and a clear warfighting edge on the battlefield.”*

Honorable Paul Kaminski

The Boeing 777



- **100% Digital Design**
- **FlyThru Allows for Faster, Less Expensive Assembly**



- **60% to 90% Reduction in Rework over Previous Programs**
- **Required Major Change in Culture**



SBA Vision

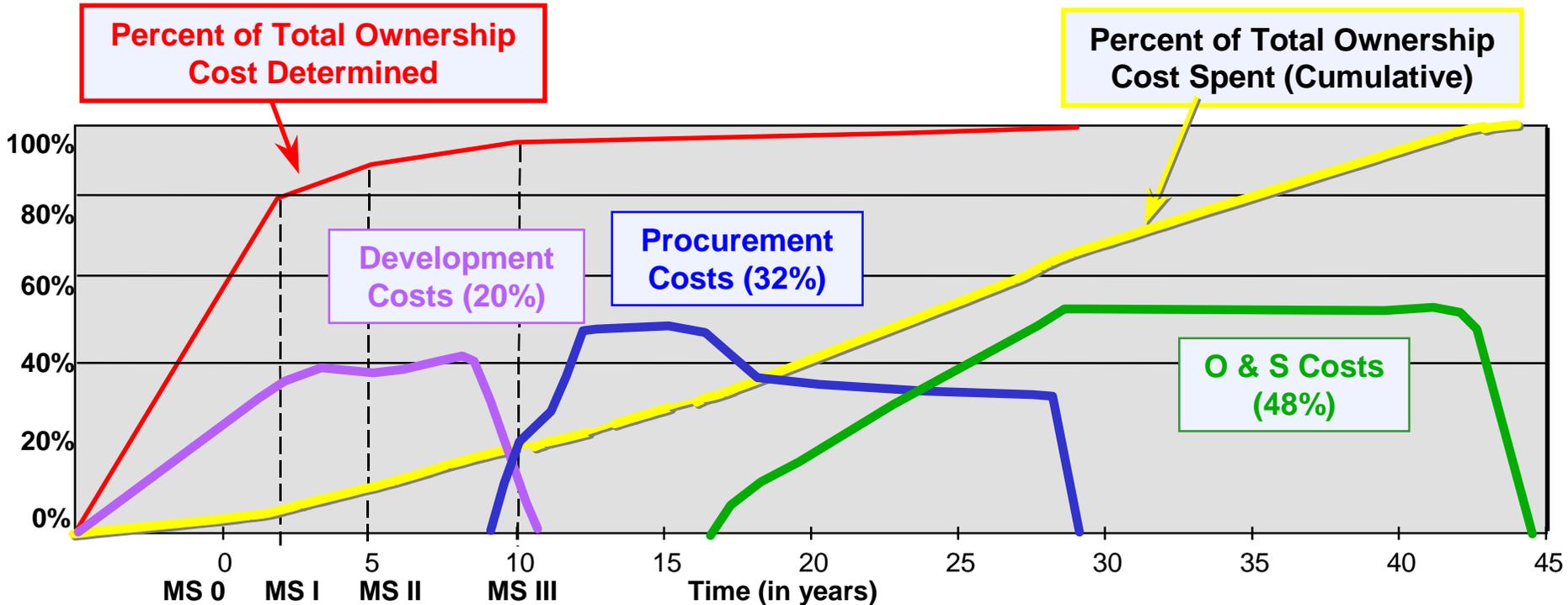
“... an acquisition process in which DoD and Industry are enabled by robust, ***collaborative*** use of simulation technology that is ***integrated across acquisition phases and programs***”



SBA 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 Total Ownership Costs ***throughout the total life cycle***
- Enable Integrated Product and Process Development (IPPD) across ***the entire acquisition life cycle***

Greatest Opportunity to Impact Cost Occurs Before Milestone II

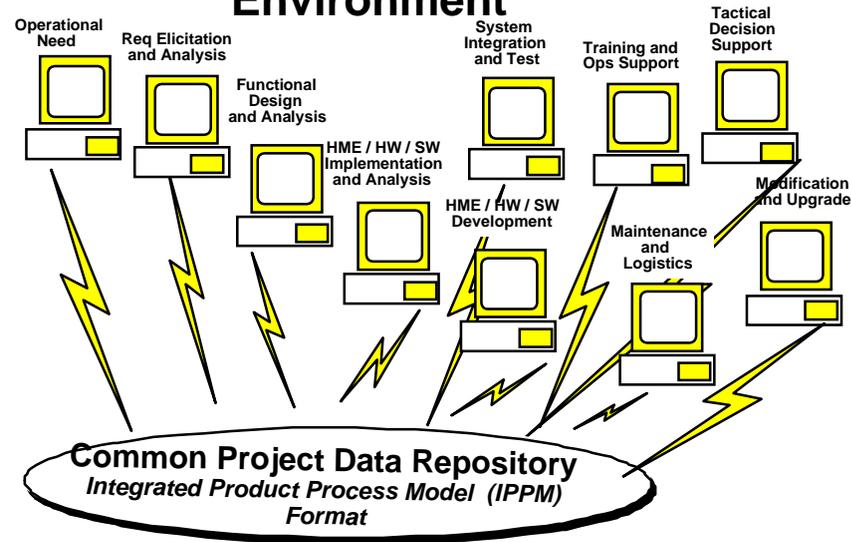


- **Big Mistakes Occur Early in Design Lifecycle**
- **Target System Requirements and Design Constantly Evolving**

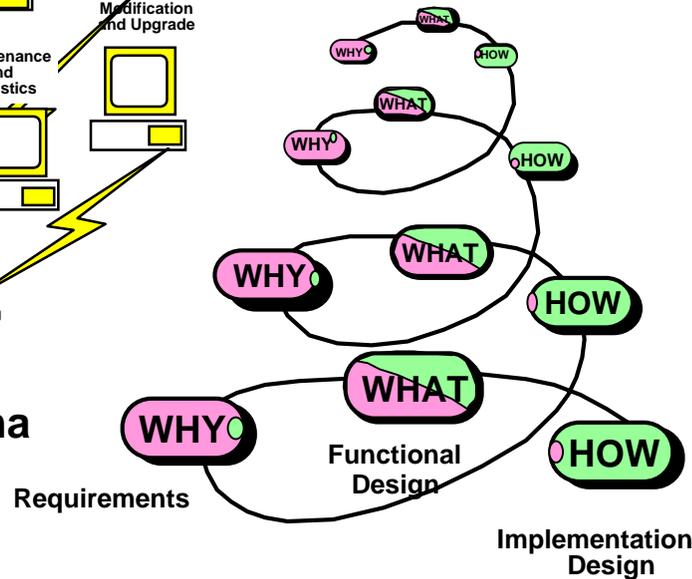
Efficient Exploration of the Design Space Early in the Program Is Key to Reducing Total Ownership Cost

SBA Vision Summary

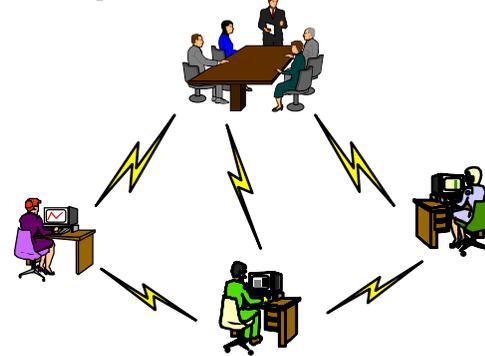
1 Integrated Engineering Environment



2 Iterative Acquisition Process



3 Evolved Acquisition Culture



• Integrated Design Data Schema

• Dist System Info Repository

- User Transparent Web Style Access

• Collaborative Distributed Engineering

- Seamless Integration of Engineering Disciplines

• Iterative Spiral Process

- Rapid Evaluation of Multiple Options
- Electronic Exchange of System Models

• Integrated Process Teams

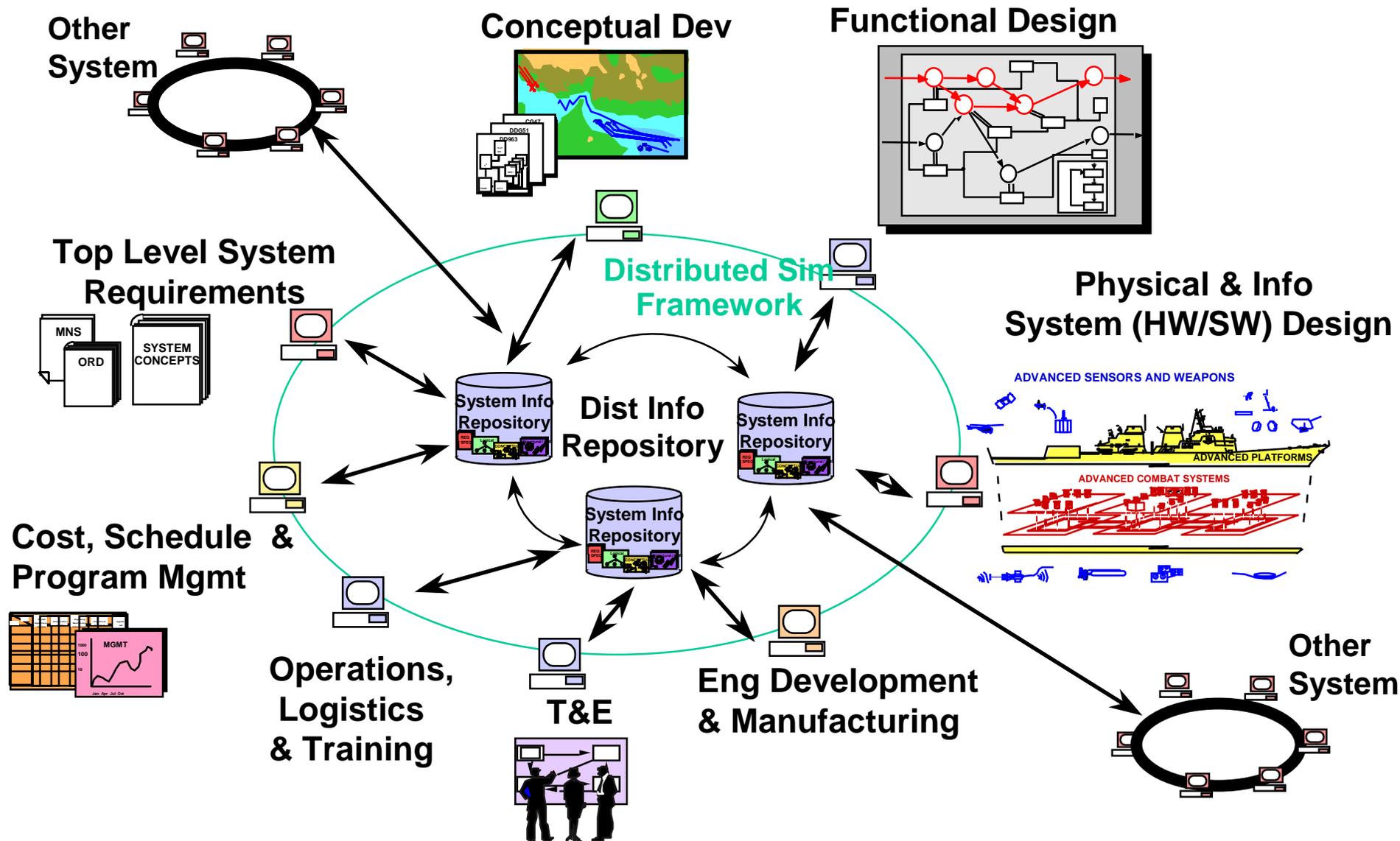
- HME and Info Systems

• Changing Roles and Responsibilities

- Policy and Education
- Standards and Guidelines

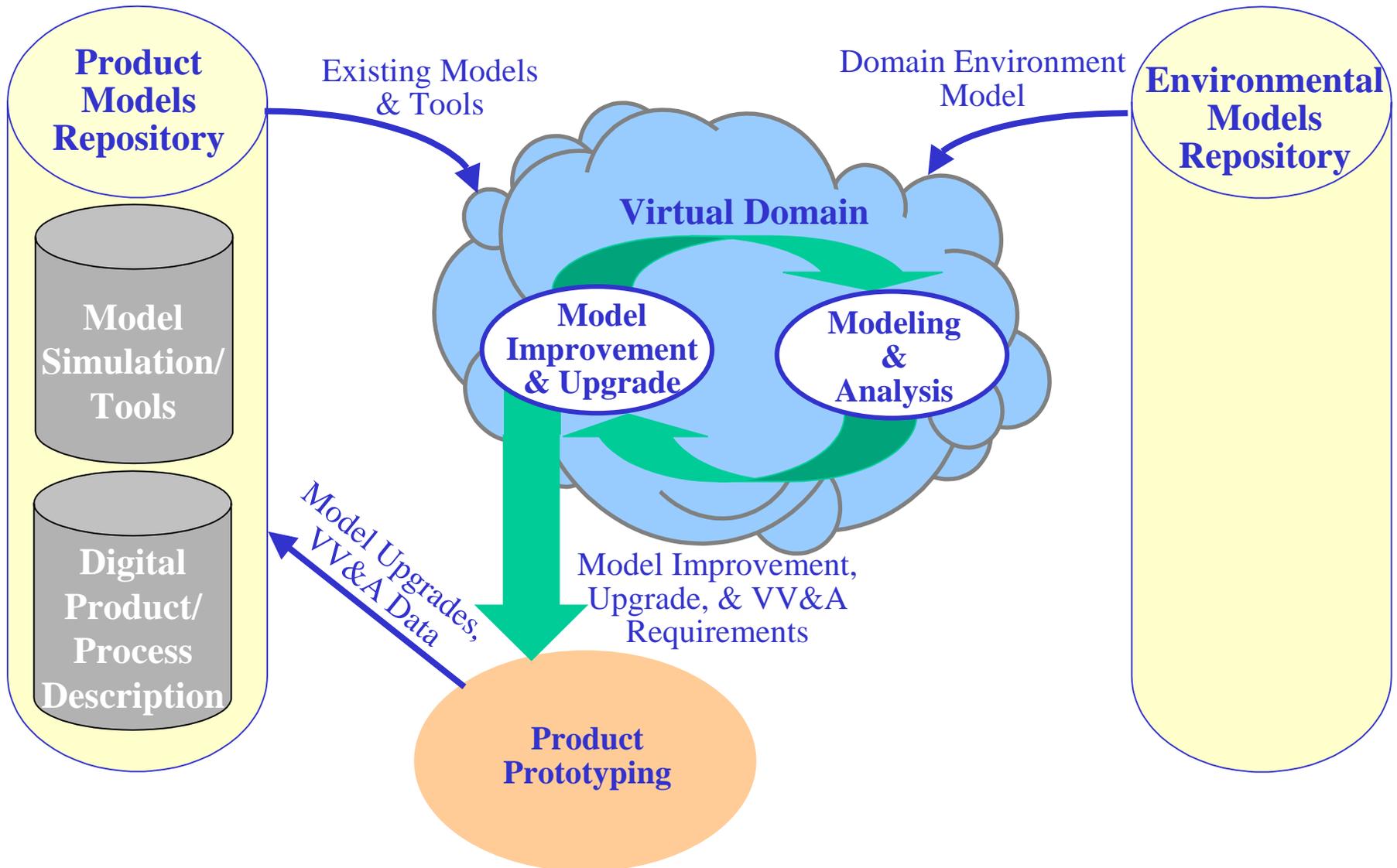
**EFFICIENT AUTOMATION / MULTIPLE BASELINES
MULTI-DOMAIN / CONCURRENT SIMULATION CAPABILITIES**

SBA Operations Concept Illustration

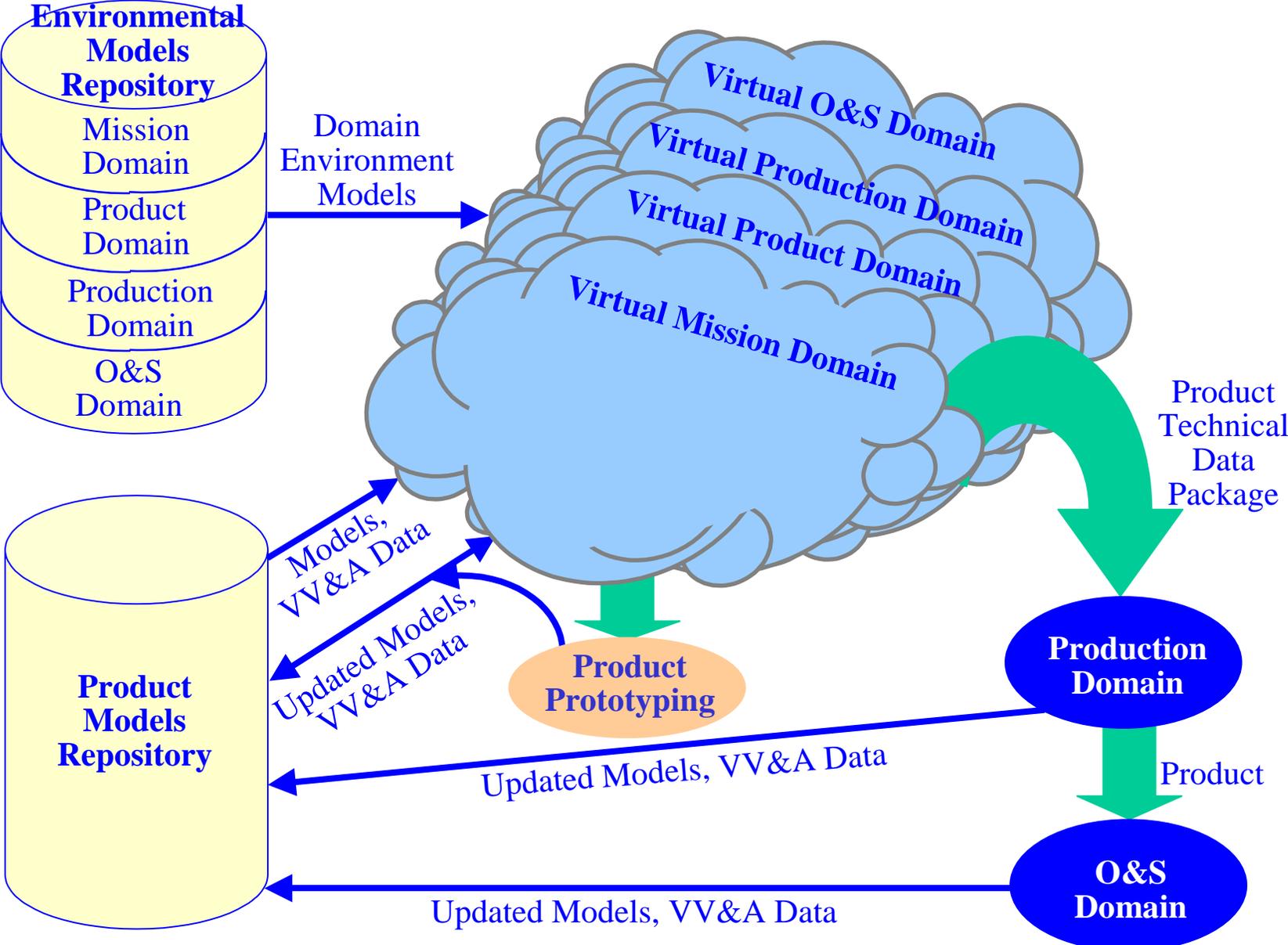


Extensive Re-use Within Phases and Across Acquisition Programs

Product Analysis & Development Process In A Virtual Domain



Simulation Based Acquisition Process





Two Key Concepts

Collaborative Environments

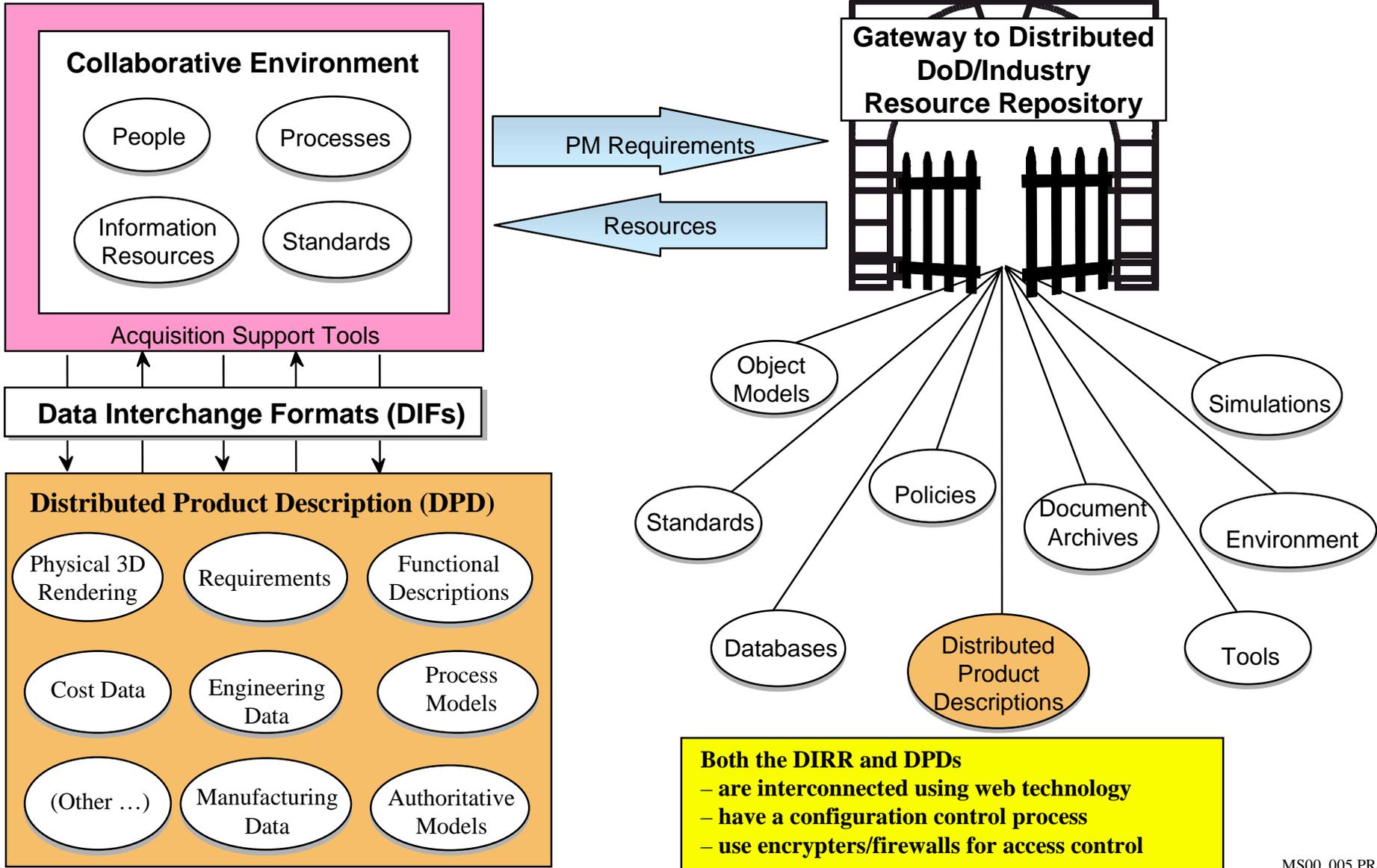
A permanent or semi-permanent collection of resources, people, processes, and tools assembled to attack a given problem

- Focused on a critical mission area (*such as Strike Warfare*)
- Focused on product orientation (*such as a Ship Product Area*)

Distributed Product Descriptions

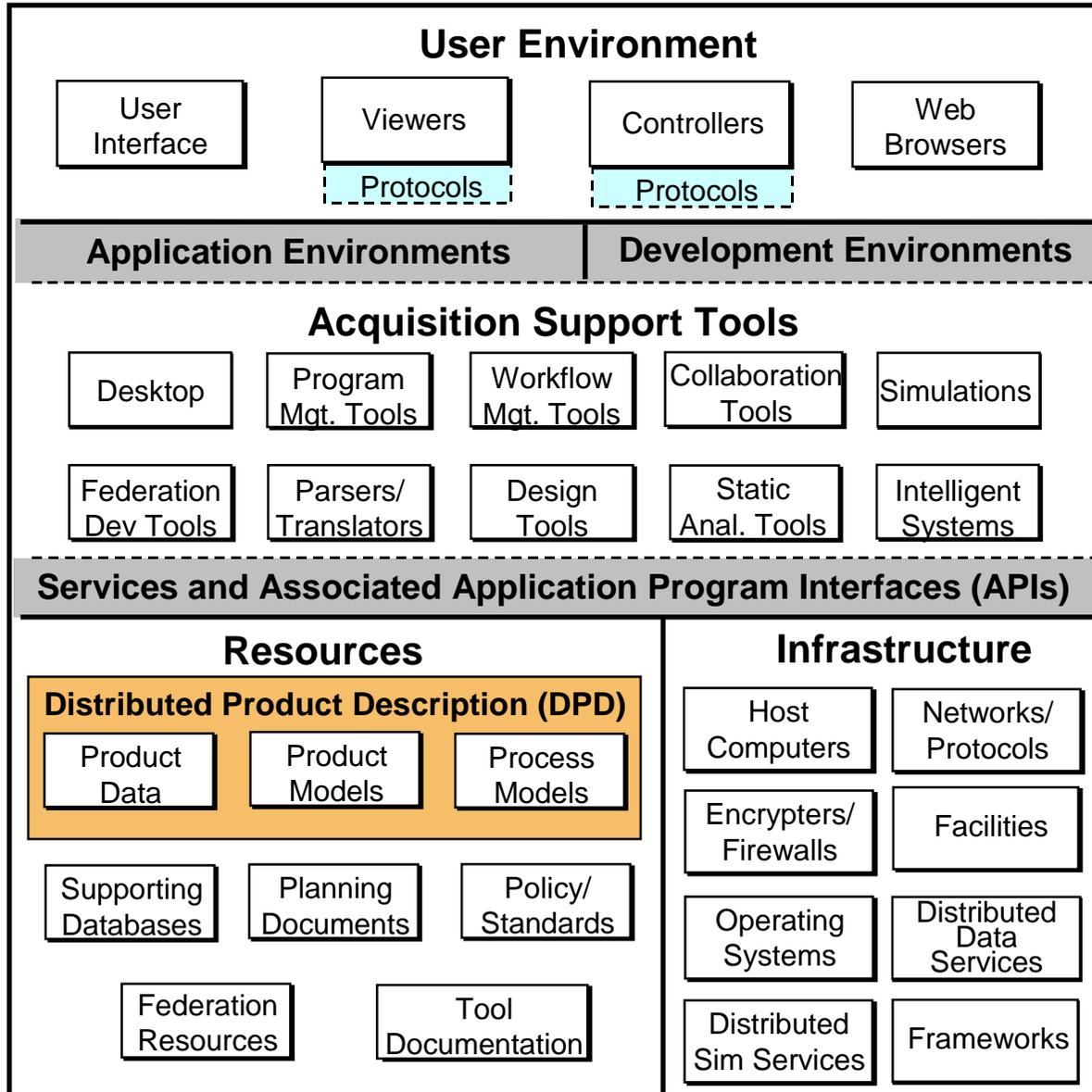
A 3-dimensional representation of a system, along with associated process data (e.g., system function, system requirements, manufacturing processes, cost data, etc.)

Top-Level View of SBA Systems Architecture

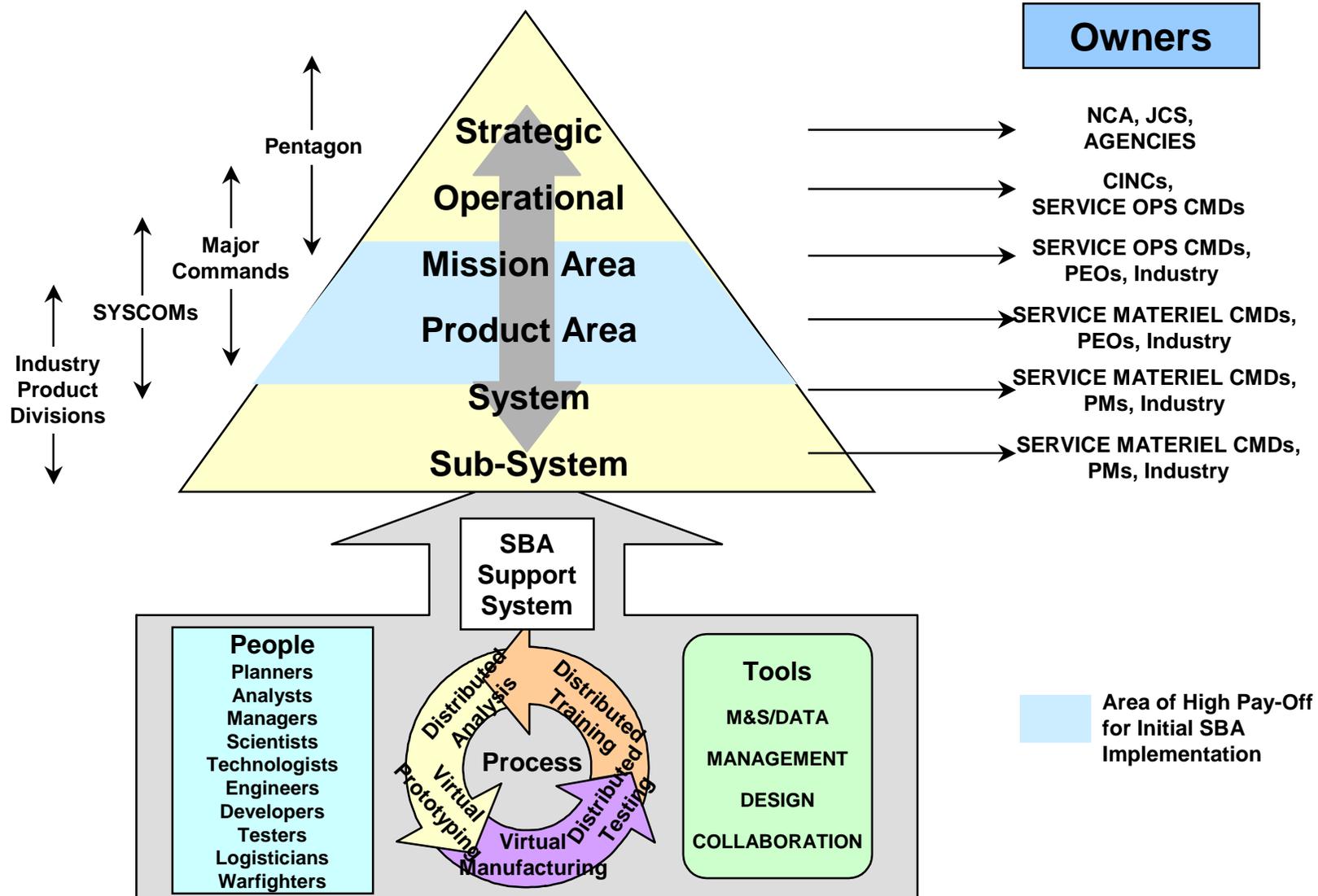




Collaborative Environment Reference Systems Architecture



Proposed Levels of To-Be Collaborative Environments



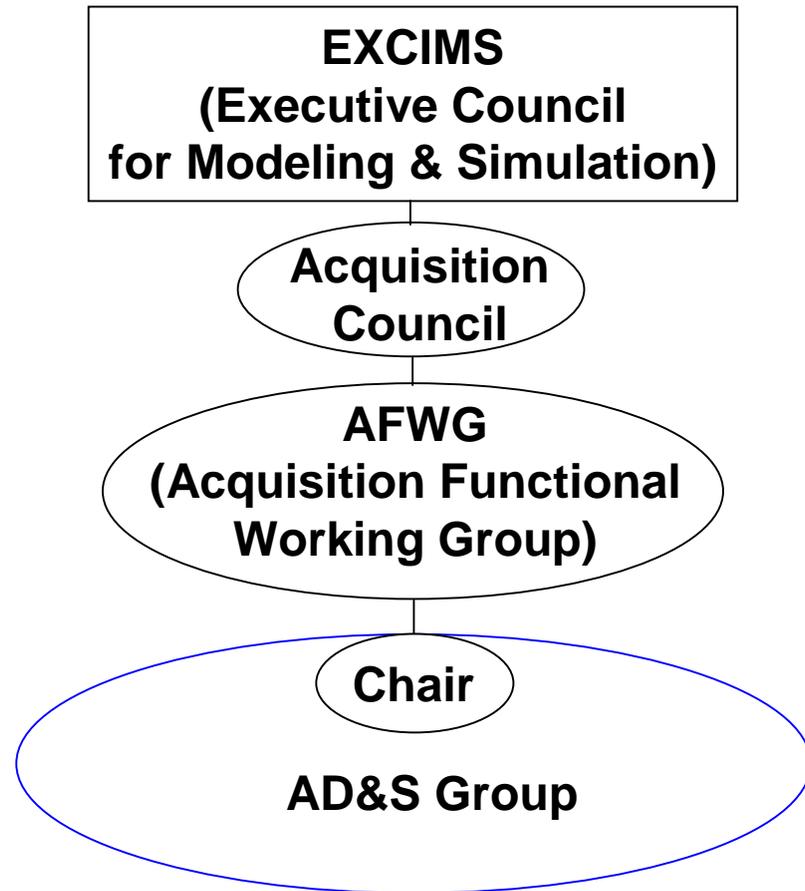
SBA Architecture Development & Standards Group

Functions

- Architecture Development
- Standards Coordination
- Architecture Integration
- DPD Template Development

Candidate Members

- DTSE&E
- Collaborative Environment Representatives (PMs, Warfighters, Technical Representatives, Others)
- DMSO
- DoD M&S Executive Agents
- Industry Representatives





Task Force Recommendation Areas Listed by Category

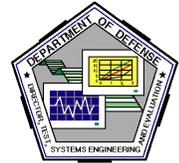
<u>Category</u>	<u>ID</u>	<u>Recommendation Area</u>
Management	MG-1	Integrated SBA Organizational Relationships
	MG-2	Planning, Programming, and Budgeting for SBA
	MG-3	Service/Agency SBA Programming and Budgeting
	MG-4	Functional Area Integration
	MG-5	Verification, Validation, and Accreditation (VV&A) Process
	MG-6	Metrics and Return on Investment (ROI)
	MG-7	Incentives
Operational Architecture	OA-1	DoD Collaborative Environment Structure
	OA-2	Service/Agency Collaborative Environment Structure
	OA-3	Collaborative Environment Experiment Efforts
	OA-4	Collaborative Environment Evolution
Systems Architecture	SA-1	Distributed Product Description Templates and CONOPS
	SA-2	Distributed Product Description Evolution
	SA-3	DoD/Industry Resource Repository
	SA-4	Science & Technology and Research & Development
	SA-5	Standard Environmental Representations and Information
	SA-6	Standard Threat Models
	SA-7	Total Ownership Cost Models
	SA-8	Program Management Tools
Technical Architecture	TA-1	Technical Architecture Development
Policy & Legislation	PL-1	Policy and Guidance Development
Education & Training	ET-1	Continuous Education and Training Effort
	ET-2	SBA Education Outside Acquisition Forums
	ET-3	Defense Acquisition University Education Courses
Industry	IN-1	Industry Initiatives

SBA ISG Recommendations

- **Establish SBA as the unifying concept for RBA**
 - **Coordinate ongoing activities**
 - **Focus R&D investment and provide advocacy**
 - **Industry will follow**
- **DPDs are the cornerstone for SBA success**
 - **Invest early in DPD template development**
- **Clarify the near-term action/investment plan**
 - **Task priorities and sequences consistent with requirements**
- **Develop Collaborative Environments using a disciplined system engineering approach**
 - **Define CE requirements first**
 - **Develop a single reference architecture**
 - **Use experiments to reduce risk**
- **Organize for success**
 - **Align responsibility for SBA with acquisition authority**
 - **Provide enduring institution to “chip away” at SBA challenges**
 - **Formulate executable strategy for industry partnership**



SBA Core Issues



- 1. Real industry involvement (big & small)**
- 2. Focus on acquisition, not become too M&S centric**
- 3. Reconcile SBA with the other Department initiatives**
- 4. Resourcing and the implications of resourcing**
- 5. Experiment criteria and design of experiments**
- 6. How do we deal with legacy information systems**
- 7. Underlying/supporting policy - reconcile SBA (standards) with Acquisition Reform**
- 8. Flow of how to iterate between reference system architecture and collaborative environments: top down vs. bottom up or both**
- 9. *Building a business case for SBA**

SBA Business Case Implications

There are significant economic differences between commercial marketplace and DoD marketplace that affects SBA implementation.

Commercial

- Better, cheaper, faster product will allow selling more units
- Never out of market totally
- Investment timing choices are not restricted
- Single product domain
- Reduced production cost extremely high leverage

DoD

- Usually fixed number of units
- Lose prime contract and usually out
- Investment up front limited by contract plus contractor overhead/IR&D rates
- Many product domains
- Cost contracts-limited profit

DoD Barriers to Full SBA

- **Extreme resistance to Purple Service Acquisition**
- **Getting Services to agree on common SBA processes, common system models**
- **Moving different color of money and spending early**
- **Moving HLA concept down to specific model to model interface**
- **Handling classified, special access programs, etc.**
- **Legacy systems, i.e., start-up problem**
- **New draft to DoD 5000.1 and 5000.2 addresses SBA weakly and puts modeling and simulation into Test Function**

New DoD 5000.1 Directive Final Coordination Draft

E. Policies & Principles

-
-
- **Effective Management**

-
-
-

Simulation Based Acquisition. The Department must **strive** for an acquisition process in which DoD and industry are enabled by robust, collaborative use of simulation technologies that are integrated across acquisition phases and programs. Program Managers **shall make effective use** of modeling and simulation to reduce the time, resources, and risk associated with the entire acquisition process; increase the quality, military worth and supportability of fielded systems; and reduce total ownership costs throughout the system life cycle.

New DoD 5000.2 Instructions Final Coordination Draft

2.2 Systems Acquisition

-
-
-
- 2.2.1 Begin Development and Develop and Demonstrate Systems

-
-
-

The purpose of the System Development and Demonstration phase is to complete the discovery process, develop a system, reduce program risk, ensure system supportability, design for producibility, assure affordability, and demonstrate system integration and utility. Discovery and development are aided by the use of simulation based acquisition and test and evaluation and guided by a system acquisition strategy and test and evaluation master plan (TEMP). All modeling, simulation, test, and evaluation activities shall be integrated into an efficient continuum planned and executed by an integrated test and evaluation product team (T&E IPT)... Modeling, simulation, and development test shall be under the direct responsibility of the PM or a designated test agency...

Big Industry Economic Issues with SBA

- **Potential of no EMD prime contractor**
- **Leveling the playing field**
- **More internal investment required in modeling & simulation**
- **More competition for manufacturing**
- **Sharing of models & intellectual capital**
 - **Actually using modeling, simulation and tools as competitive discriminant**
- **Net reduction in DoD procurement dollars?**
- **Lack of direct positive feedback on reducing O&M costs, i.e., limited market problem**

Nevertheless What Can Industry & DoD/Services Do Together to Lower Cost of DoD Procured Systems?

DOD

- Provide standard, common, and interoperable models for threat systems
- Provide standard, common, and interoperable models for natural environment
- Provide standard, common, and interoperable simulations for red/blue systems in a scenario
- Share models used in source selection with industry
- Use best of class industry models for internal DoD analyses
- Establish collaboration centers for product requirements trades in modeling & simulation environment

Nevertheless What Can Industry & DoD/Services Do Together to Lower Cost of DoD Procured Systems? (Continued)

Industry

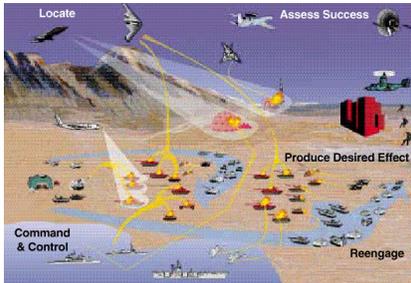
- **Share industry developed models with DoD and other industry**
 - **Recoup investment methods?**
- **Support interoperability standards for models, i.e., HLA**
- **Avoid forcing tool selections, focus on standards for data exchange**
- **Enter into early modeling & simulation collaboration with DoD technical community at the requirements stage**

Boeing “SBA” Status

- **Individual programs responding to their customers “SBA” direction**
 - **JSF (Air Force)**
 - **NMD LSI (BMDO)**
 - **Future Combat System (Army)**
- **Phantom Works “Lean & Efficient Tools & Processes” Thrust**
 - **Large Phantom Works funding, 25% of total**
 - **Charter for common tools & processes for product concept development, product design, & product manufacturing**
 - **Focal for NASA ISE Initiative**
- **Phantom Works “Theater Simulation” project**

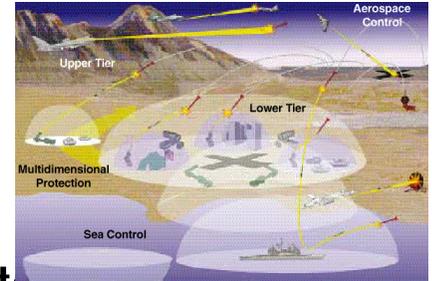
Theater Simulation Concept

PHANTOM WORKS



Engagement, Theater & Force Structure Models

- Value of C4ISR, Battle Mgmt
- Benefits of New Systems - JSF, UCAV, etc.



HLA

- Detailed System Performance
- CONOPS, TTPs, Joint Ops

Virtual Simulation and HWIL Facilities

HLA



Theater Simulation

PHANTOM WORKS



Objective

- Design, develop and implement an enduring enterprise-wide theater simulation capability
- Focus on developing an affordable, available, and response capability; leveraging existing Boeing assets; and aligning with future government efforts in virtual, constructive, and distributed simulation
- Utilize common processes and interface standards
- Support both a simulation development environment and evaluation/analysis of new systems with variable fidelity representations, superior visualization/data presentation, and operator-in-the-loop/hardware-in-the-loop capability

Technical Approach

- Leverage existing assets, distributed across the enterprise, grow to include HWIL
- Build network of virtual simulations using standardized interfaces/protocols - focus on CMD
- Build federation of constructive models selected from best available - focus on space control issues
- Align with government model selection

Deliverables	Schedule				
	Q1-00	Q2-00	Q3-00	Q4-00	2001+
Development Plan	SELECT		PLANS		5-YR
Virtual Network	ICDR				COMBINE
Constructive Federation	TEST				

DRAFT

Core Competencies; Boeing Vision 2016

- *Detailed Customer Knowledge & Focus*
 - _____
 - _____
 - _____
- *Large Scale System Integration*
 - _____
 - _____
 - _____
 - _____
- *Lean Efficient Design and Production System*
 - _____
 - _____
- **Modeling & Simulation/Simulation Based Acquisition**
 - _____

Summary Observations

- **SBA as an OSD initiative has lost most all wind in it's sails**
 - **Services taking it up individually with a variety of approaches**
 - **SBA is not the dominant revolutionary or even evolutionary concept in new DoD 5000 Acquisition changes**
- **Boeing looked on as a industry leader in modeling and simulation, i.e., 777, JSF, NMD**
 - **Trying to exploit use of modeling & simulation as a discriminant**
 - **Heavily funding streamlined, computer based, product life cycle process and tools**
- **Use of modeling & simulation is going to increase on DoD & NASA programs independent of any SBA initiative**
 - **Cheaper than prototypes**
 - **Complexity of products**
 - **Systems of systems interactions/dependencies/netcentric warfare**
 - **Computing capability cheaper and more capable**