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Economic Considerations in Managing DoD Research, Development, Test and Evaluation Simulation Assets

Danny Weddle, Ph. D.

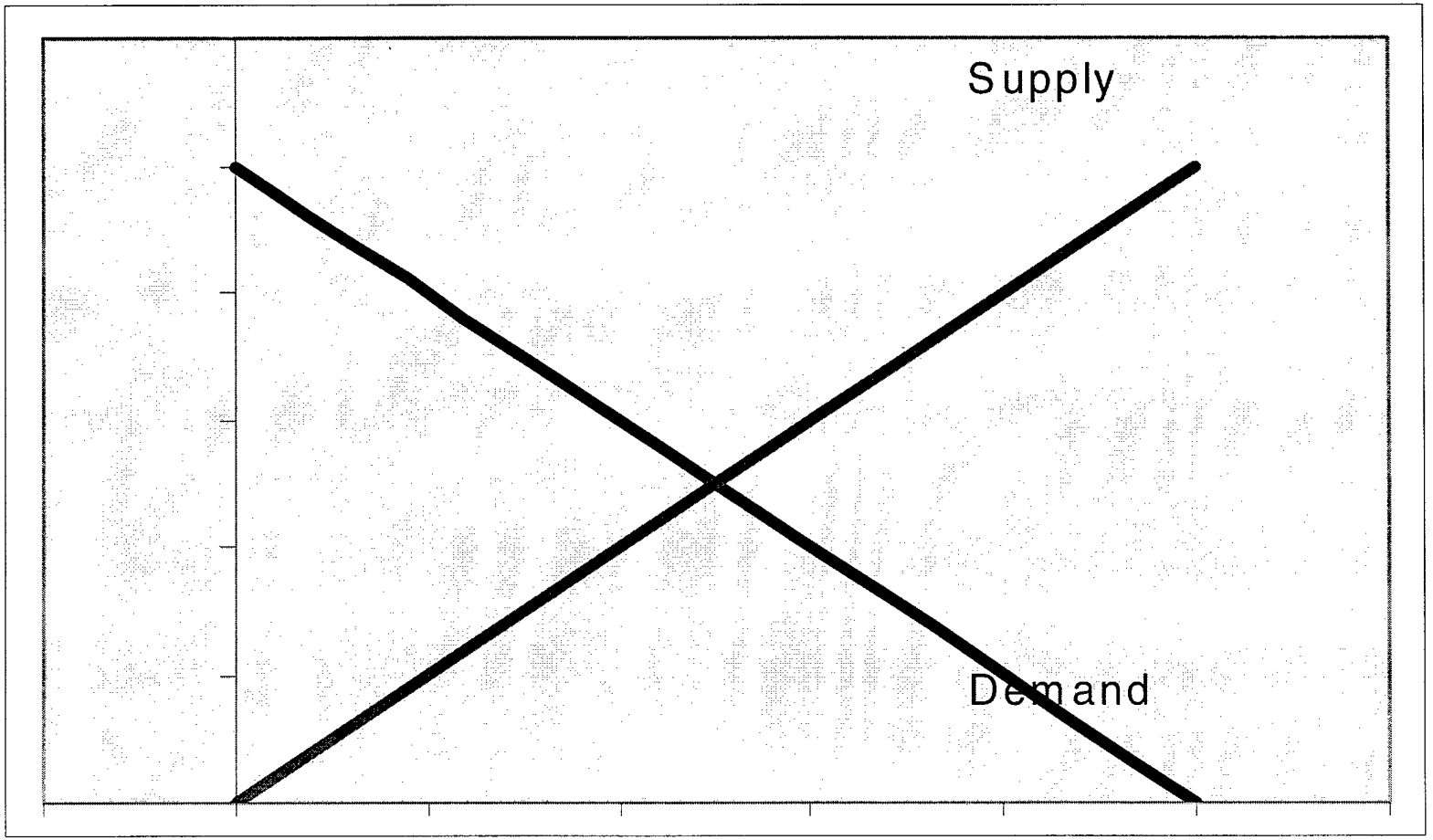
Naval Air Systems Command

Patuxent River, MD

Topics

- DoD Funding of Research Development Test and Evaluation Simulation Facilities
  - Defense Business Operating Fund
  - Major Range Test Facilities Base
  - High Performance Computing Modernization Program
- Economic Benefits of Simulation
- Why traditional Market Models Don't Apply

DoD Labs: Standard Supply Demand Curves Don't Apply



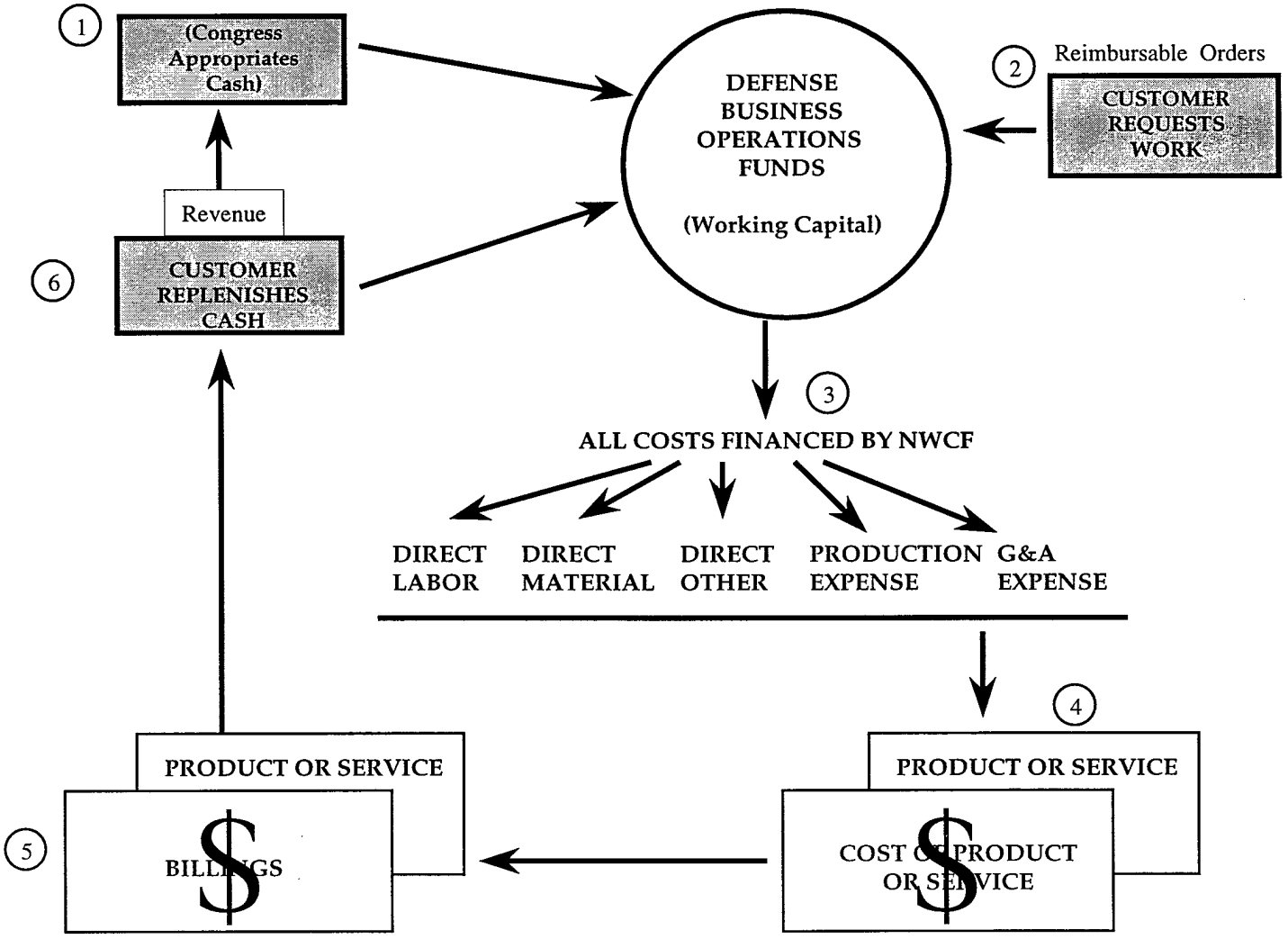
Methods of Funding Laboratories

- Defense Base Operating Fund
- Major Range Test Facilities Base

WHAT IS DBOF?

- *Defense Business Operations Funds, aka revolving funds, are accounts established to finance a cycle of operations to which reimbursements and collections are returned for reuse in such a manner as to maintain the principal of the fund*

Defense Business Operations Funds
Cycle of Operations



DBOF

Customers Pay for

- Non- labor direct program costs
- Direct labor through stabiliized rate
- Share of Production Cost
- Share of G&A cost
- M&O of Equpment
- Equipment replenishment

MRTFB Equipment Investment

- Funded from MRTFB Institutional or Office of Secretary of Defense Central T&E Investment fund
- Users charged for portion of O&M through charging rates

DBOF Capital Purchase Investment

- Equipment > 100k
- Investment fund replenished from user charges
- Rates include O&M and Depreciation

MRTFB

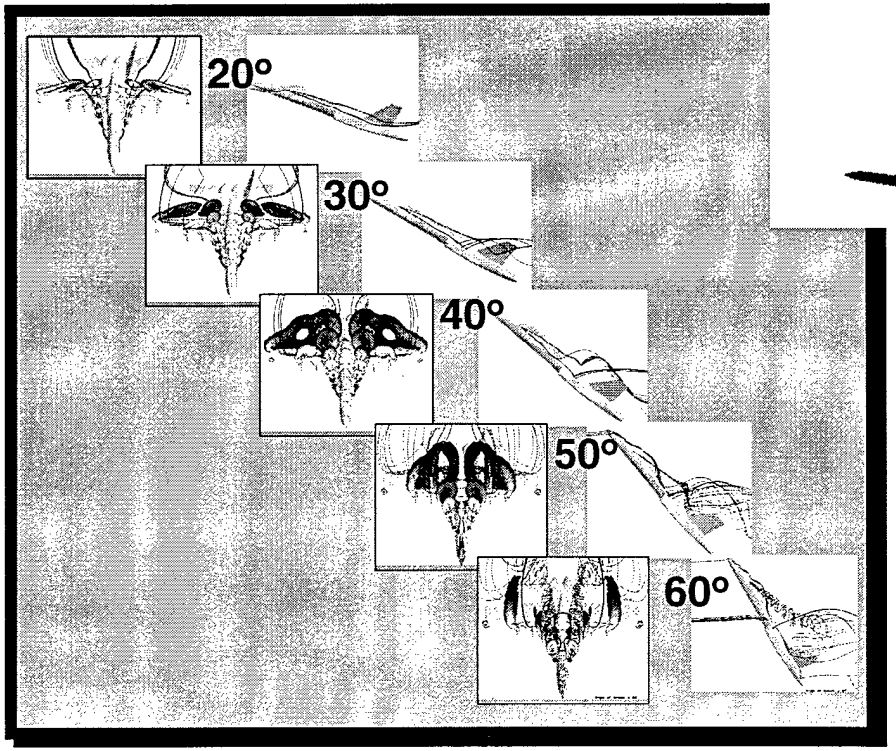
- 19 Designated Test and Evaluation Activities
- DoD Customers pay for
  - Non Labor Direct Program Costs
  - Direct labor
- For DoD customers, MRTFB Institutional Fund Pays for
  - Production cost
  - G&A Cost
  - Equipment Investment
- Rationale: DoD T&E customers can't afford to pay total cost

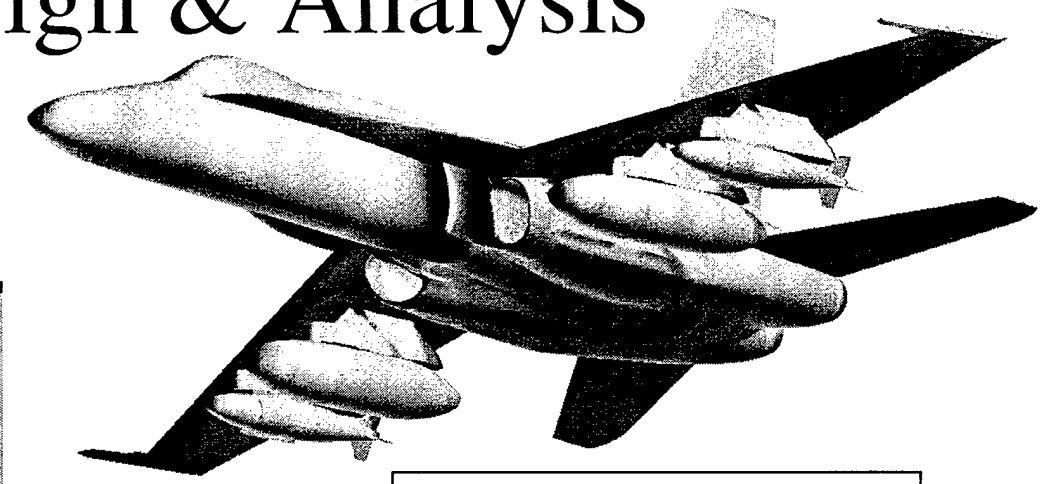
HPC Program Initiatives

- HPC Centers
  - Major Shared Resource Centers
  - Distributed Centers
- Networking
  - Defense Research and Engineering Network
- Software
  - Common HPC Software Support Initiative
- Priority Applications
  - Challenge Projects

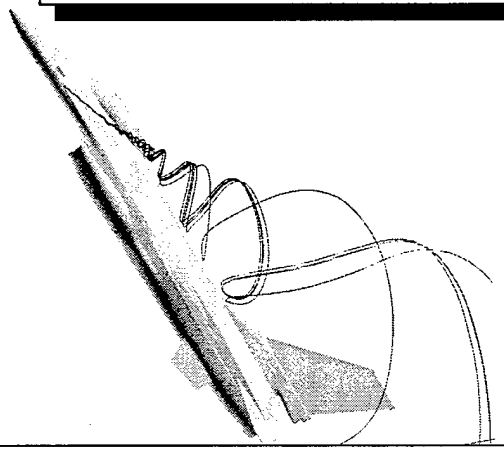
HPC Contributions to Aircraft Design & Analysis

Unsteady Aerodynamic Analysis



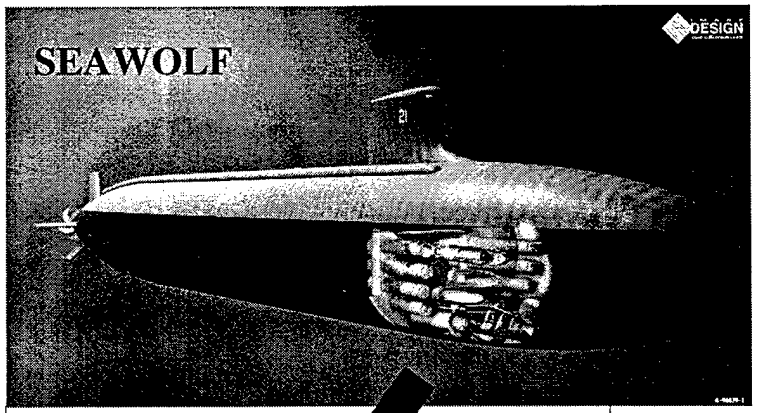


Stores Certification



Nose-slice Departure

LARGE-EDDY SIMULATION APPLICATION TO THE SEAWOLF REVERSE FLOW PROBLEM



PROBLEM DEFINITION

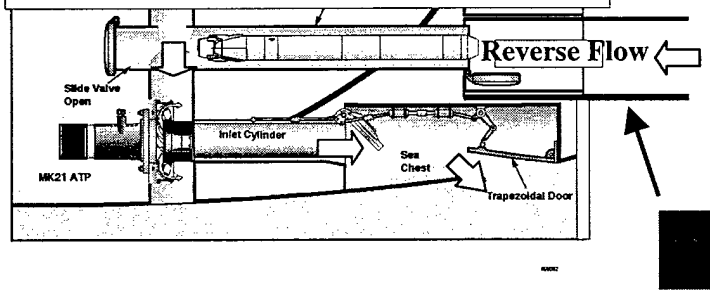
- **Excessive Adverse Pressure across Weapon**
- **Excessive Pressure in Torpedo Tube Recess**
- **Reverse Flow through the Launchway**

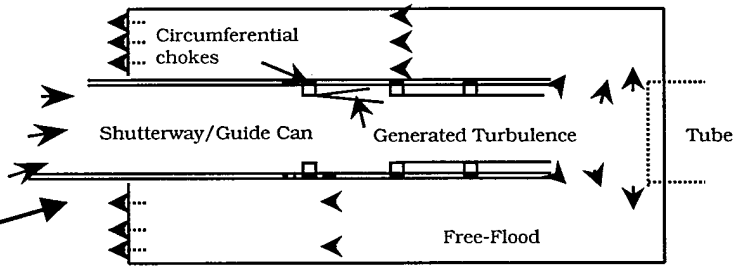
PROBLEM CAUSE

- **Under-predicted Pressure Recovery of HRIS Design**
- **High Pressure Recovered within Shutterway/Guide-can**

PROBLEM SOLUTION

- **Insert Circumferential Chokes to Reduce Pressure via Increased Turbulent Activity**
- **Perform LES Computation for Accurate Choke Design Using MSRC High Performance Computing Facilities**





TORPEDO LAUNCHWAY

LES APPLICATION

PROJECT: NAVO NUWC225 - Large-Eddy Simulation (Dr. Stephen Jordan, NUWC, Code 8321, Bldg.1246, Newport, RI)

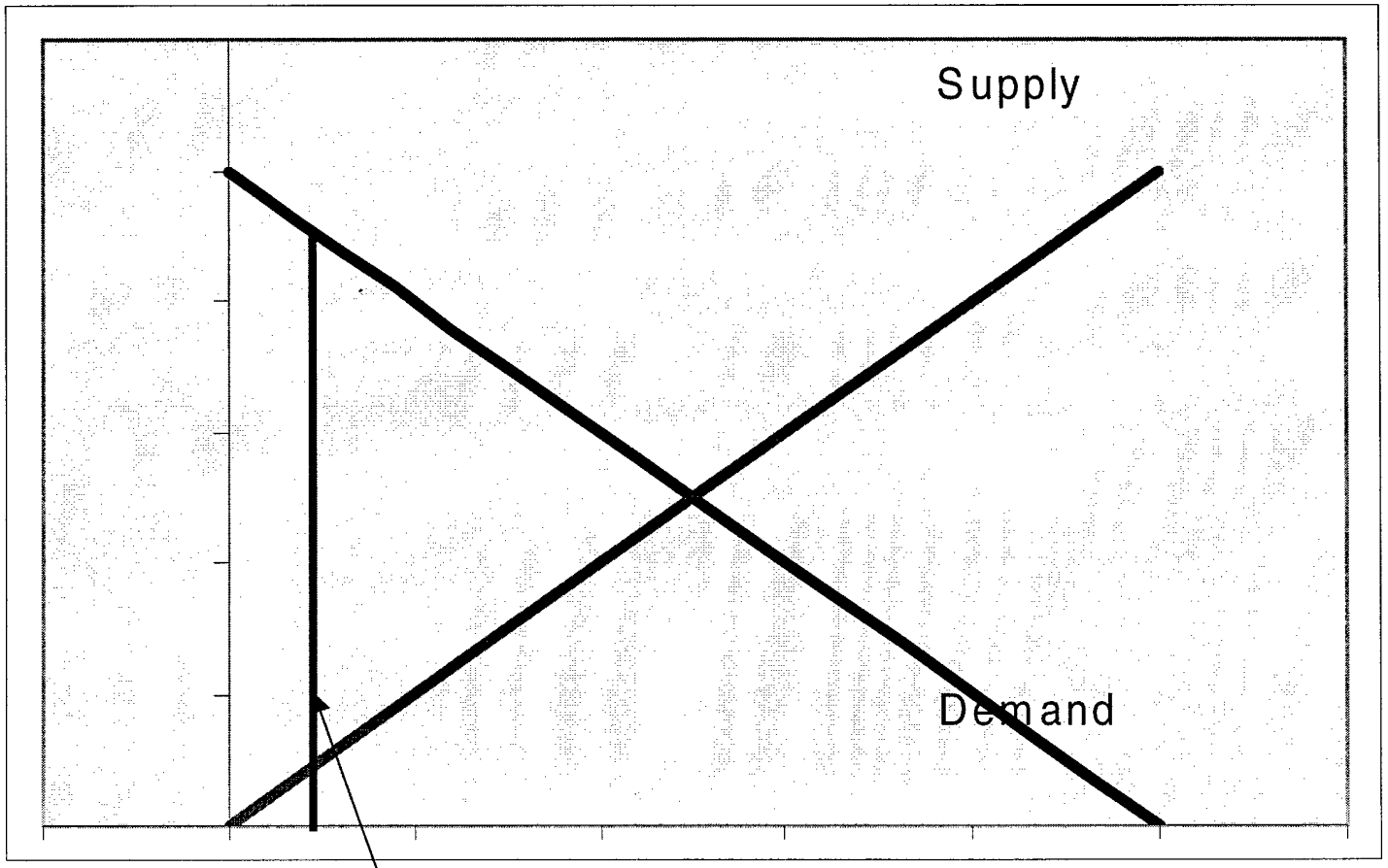
HPC FUNDING

- All funding for Major Shared Resource Centers provided by program
  - Investment
  - M&O
  - User Support
- No use charge for approved DoD users
- Defense Research and Engineering Network funded by program: point of presence at all major RDT&E sites
- Distributed Centers
  - Investment funded through program
  - With a few exceptions, Centers must pay M&O
  - Key for Test and Evaluation for Real Time Applications

1995 DoD High Performance Computing Modernization Program Fee-For-Service Report

- Army, Navy&Air Force previously tried various forms of fee-for-service for HPC: It was a failure
- Seven non-DoD government centers: none used for advanced systems
- Five Industry Centers: Only one used
- Attempts to recover cost from researchers results in death spiral; stifles innovation

Supply/Demand for RDT&E Facilities



Why Market Economics Don't Apply

- Unique, very technically complex systems with relatively few customers
- Typical DoD acquisition has considerably shorter time horizon than it takes to develop a major new capability
- DoD Budgeting Process

Economic benefits of simulation

- Getting it right before the system is built
- Eliminating major failures during system development
- Reduced life cycle cost

Simulation Based Acquisition

- "An iterative, integrated product and process approach to acquisition, using modeling and simulation, that enables the warfighting, resource allocation, and acquisition communities to fulfill the warfighter's materiel needs, while maintaining Cost As an Independent Variable (CAIV) over the system's entire lifecycle and within the DODs system of systems."

Defense Systems Management College

Simulation Based Acquisition: A New Approach

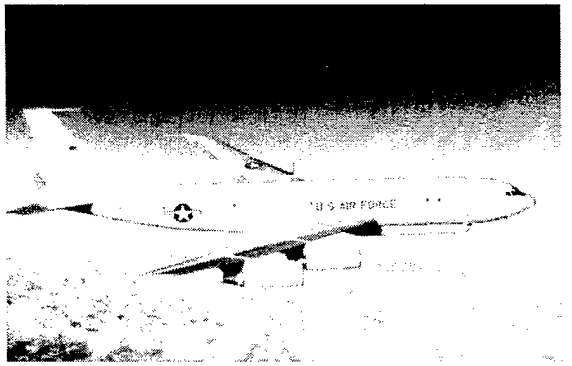
Report of the 1997-1998 DSMC Military Research Fellows
Lt. Col. Michael VR. Johnson, Sr., USA
Lt. Col. Mark F. MdKeon, USMC
Lt. Col. Terence R. Sxanto, USAF

Simulation Based Acquisition (SBA)

- "An integrator of simulation tools and technology across acquisition functions and program phases and across programs. It is a concept in which M&S as a resource is more efficiently managed in the acquisition process. In a defense environment of decreased funding, SBA addresses both the decreasing availability of resources for system development and the increasing power of M&S tools.[46]"

Simulation Based Acquisition Road Map
December 1998

The Rationale

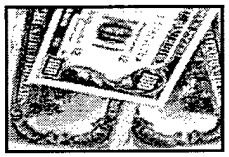


Gain Early Understanding in Order to:

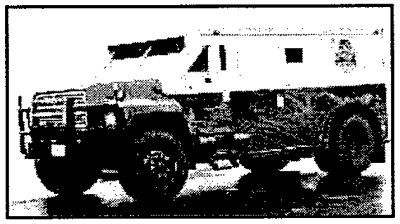
- Identify problems early
- Smooth transition between phases
- Achieve long-term savings
- Reduce cycle time

"M&S early in a program can be compared to a Warfighter's preparation for the deep battle."

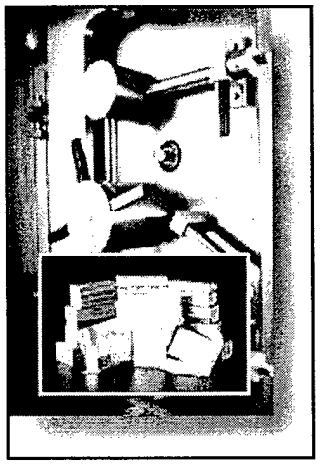
The Case for Early Involvement: Cost to Fix Problems



Requirements
$1



Design
$10



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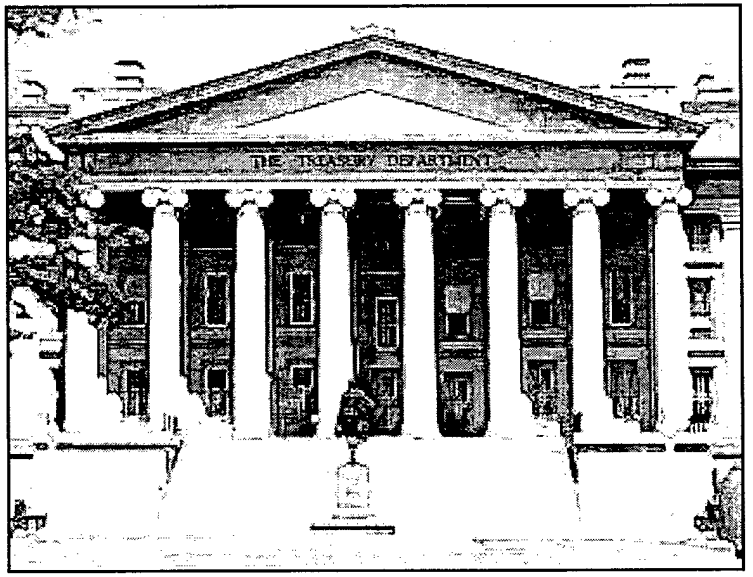
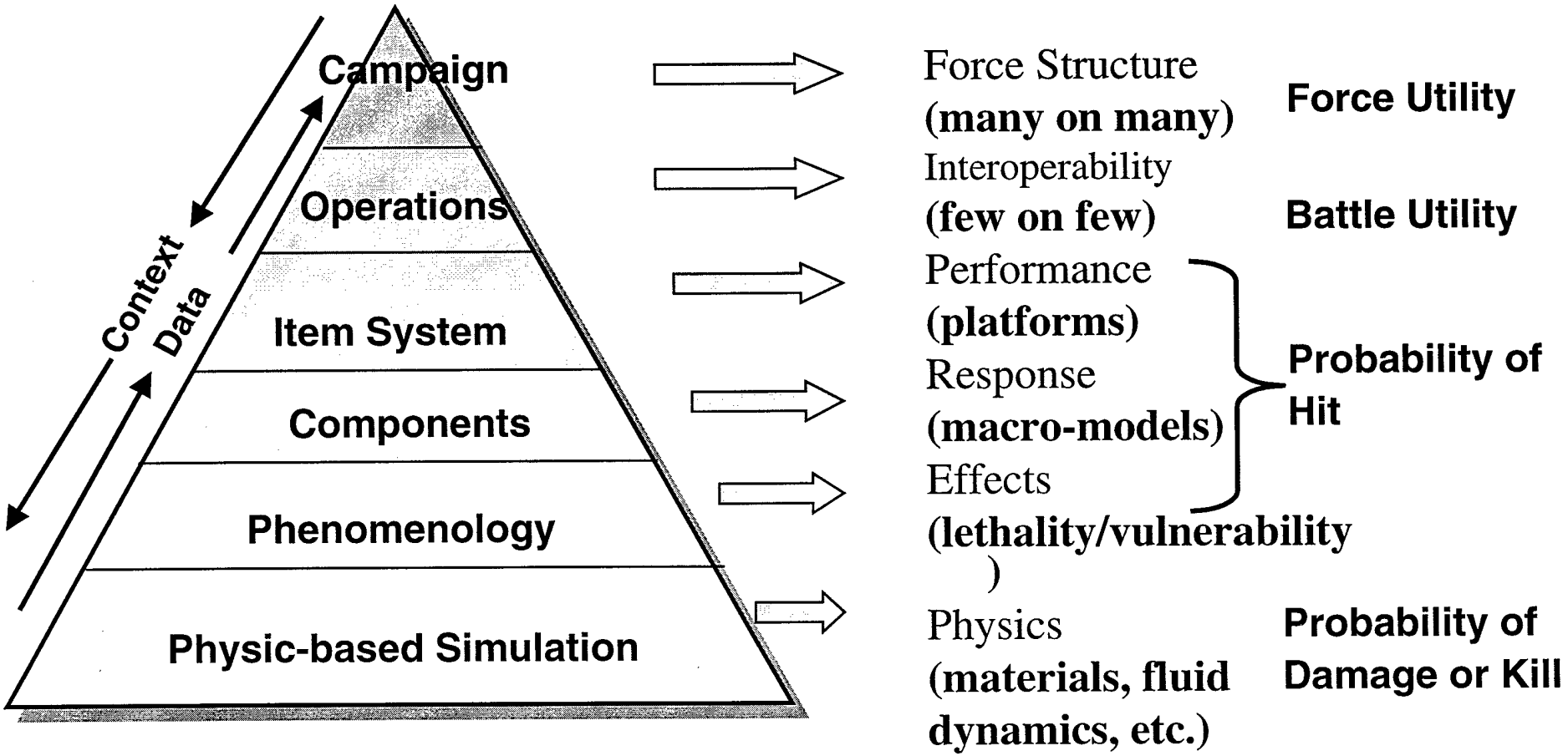


Test
$1000

Total System Assessment Integrated M&S from Physics to Campaign

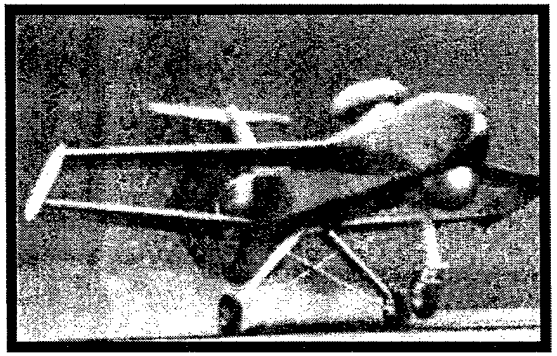


Simulation Based Acquisition

- **Per "Webster":**

  - **"Something being acquired, having as its basis the use of a computer to calculate"**

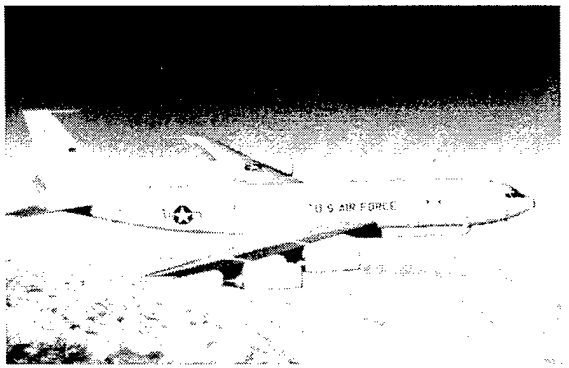
Myths



- Operational testers won't use M&S
- M&S is cheap
- Testing and M&S are opposite ends of a balance scale

TRUTH IS: M&S and Testing are intertwined; when they are not, neither is effective

The Rationale



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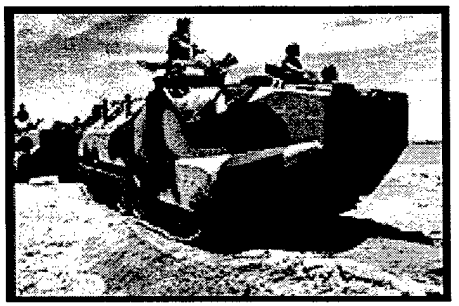
Cradle To Grave Application



- Combat development
- Engineering and manufacturing development
- Test and Evaluation
- Training
- Sustainment

Modeling & Simulation

Summary

- Simulation has very high economic benefit to DoD RDT&E
- Standard market models don't apply
- Funding mechanisms accommodate benefits and non commodity nature of facilities