

# Enterprise Dynamics: An Architecture-Based, Decision-Driven Approach

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# Problem

- **Failure rates in the acquisition of complex systems for new operational capabilities are well over 50%.**
  - Significant cost and schedule overruns, and/or shortfall in outcomes (Flint, D., Gartner Research Paper, 2/4/05)
- **There is limited consideration of the complex dynamic interactions of policy, operational, economic, technical, and organizational elements of the enterprise.**

National Research Council, Committee on Network Science for Future Army Applications, January 2006 "Network Science", p. 3: "... **trying to implement net-centric operations capabilities as envisioned by the DoD is like trying to design and build a modern combat jet aircraft without resorting to the science of fluid dynamics.**"

# Background

## Frameworks, Regimens, and Dynamics

### MIT-CLIOS\* 12-step process

- **Representation**  
Structure:
  1. Describe the system (identify issues and goals)
  2. Identify major subsystems
  3. Develop the CLIOS diagram (nesting, layering, expanding)Behavior:
  4. Describe components and links
  5. Seek insight about system behavior
- **Evaluation**
  6. Refine system goals and identify performance measures
  7. Identify options for system performance improvement
  8. Flag important areas of uncertainty
  9. Evaluate options and select those that behave “best” across uncertainties
- **Implementation**
  10. Strategy for implementation
  11. Identify opportunities for institutional changes and architecture development
  12. Post-implementation evaluation and modification

### Elements of Descriptive Enterprise Dynamics

**Landscapes for System Representation and Characterization**

**Architectures for Enterprise Content:**  
Dynamic Multi-Agency Nested-Services Oriented Architecture (MANSOA)



**Models of Dynamic Relationships – Unifying diverse disciplines & methods**

**Decisions & Incentives as drivers of enterprise evolution**

### MITRE-SEPO Regimen

- Characterize continuously
- Identify or define targeted outcome spaces
- Tailor developmental methods to specific regimes and scales
- Analyze and shape the environment
- Establish rewards (and penalties)
- Formulate and apply developmental stimulants
- Judge actual results and allocate rewards
- Formulate and enforce fitness regulations (policing)

\* Complex Large-scale Integrated Open Systems, Joe Sussman, MIT, 2002

# Objectives



Dynamics are important!

- **Develop proactive methods to plan, design, and manage the dynamic transformation of the enterprise**
- **Formulate an enterprise science describing basic unifying principles and conceptual frameworks governing enterprise structure and behavioral dynamics (ESE)**
- **Integrate knowledge from multiple disciplines**
  - Performance engineering
  - Computational organization science
  - Behavioral economics
  - Complex adaptive systems
  - Network science
  - Evolutionary biology
  - Design engineering; mfg. systems
  - Computer science
  - Mathematics; operations research

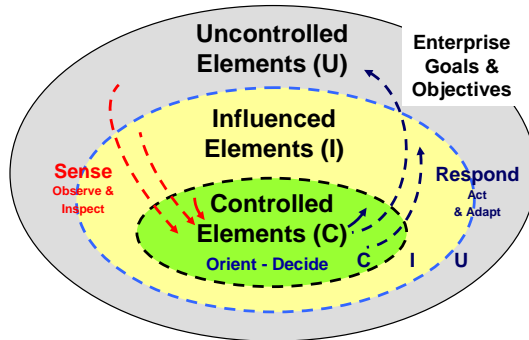
# Activities

- **Theories and Frameworks for Descriptive Enterprise Dynamics**
  - Landscapes that characterize specific enterprise types
  - Unifying state-space representations
  - Dynamic architectures
- **Enterprise Modeling and Simulation**
  - Describing the acquisition of new enterprise capabilities and operational performance
  - Forum of multi-disciplinary methods and results
- **Acquisition Gaming Facility**
  - Learn, train, and validate methods
- **ESE Applications to Net-Centric Enterprises**

# Highlight

## Descriptive Enterprise Dynamics Landscape Perspectives, Dynamic Elements, and Methods

### Operational Perspective



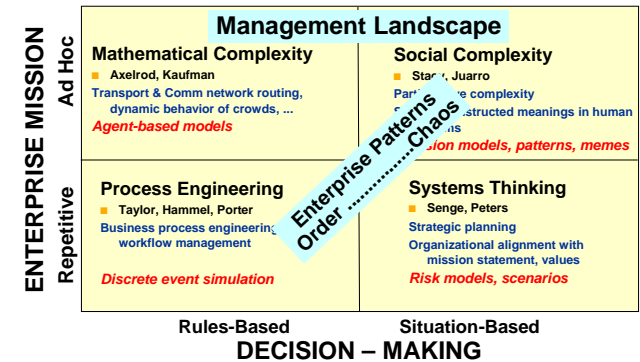
### Elements of Descriptive Enterprise Dynamics

- Mission Performance Dynamics
- Organizational and Behavioral Dynamics
- Management Decision Dynamics
- Information Dynamics
- System and Technology Dynamics

### Multi-Scale Perspective On Performance

- US/Global Economy
- Economic Sector
- Multi-agency Enterprise
- Agency as an Enterprise
- Acquisition Enterprise
- R&D Enterprise

### Management Perspective



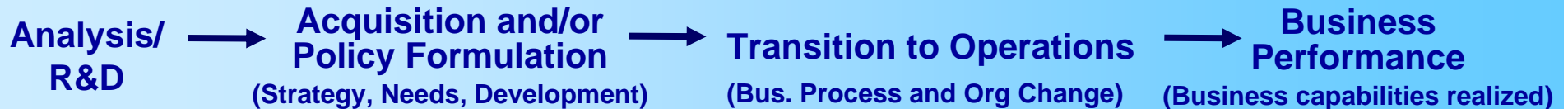
### Methods & Models:

- Systems Dynamics
- Agent Based (SEPO)
- Fourier Cycles and Lags
- Highly Optimized Tolerance
- Micro/Macro Economic
- Control/Influence Theoretic



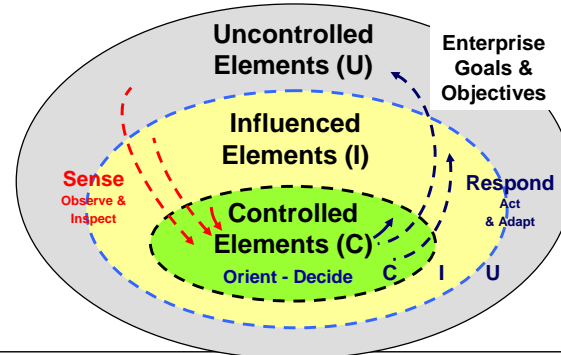
ESE Profiler

### Temporal Perspective



# Demonstration

## Planning & Acquisition Gaming

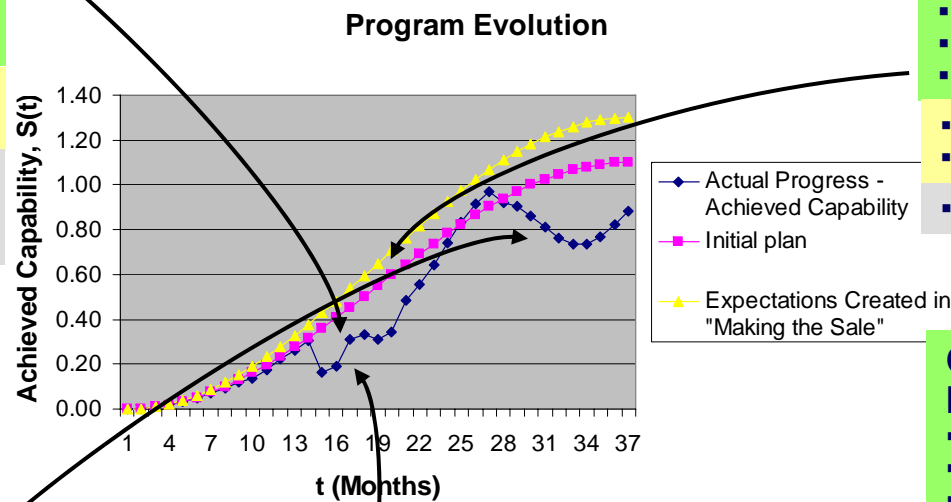


- The Public & Commerce ("Customers")**
- Acceptance
  - Funding
  - Random events in RoW

- Agency Management**  
CIO, CTO, CFO
- Agency policies
  - Funding allocation
  - Objectives
  - Acquisition strategy
  - Architecture
  - Standards
  - Technology maturity
  - Contract type & incentives

- Contractor selection
- Business outcomes
- Random Events, e.g.
- Contractor performance
- Legislation

- Congressional, OMB**
- Funding
  - Goals
  - Governance policies
  - Acquisition strategy
  - Architecture
  - Random events in RoW

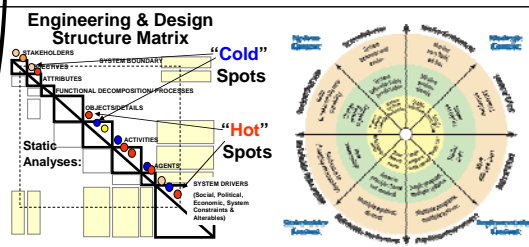


- Program Management**
- Tactical management
  - Personnel mgmt and staffing
  - Resource allocation

- Incentives
- Contractor performance
- Business outcomes
- Random events, e.g., loss of key personnel

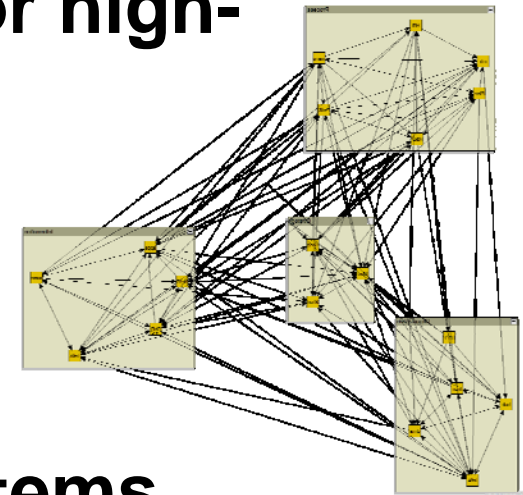
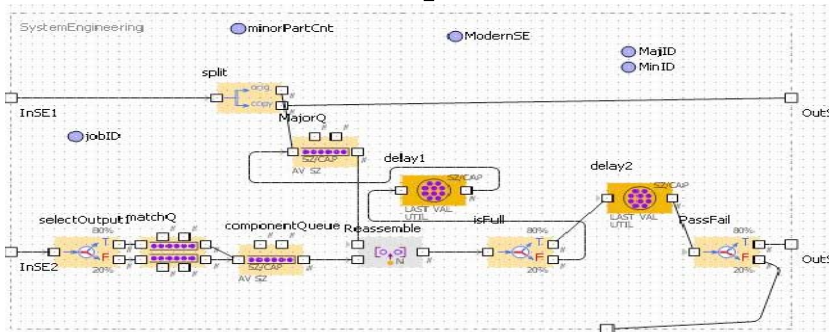
- Operations Management, COO**
- Implementation
  - Process change
  - Training
  - Operational performance
  - Implementation Outcomes
  - Random events, e.g., legislation

- Program**
- Complexity
  - Outcomes
  - Random events
  - Technical glitches



# Impacts

- Improved methods for dynamic architecting of the enterprise and more reliable operational outcomes
- Improved acquisition processes with synchronization of multiple decision cycles in developing new capabilities for high-performance operations



- Foundation for enterprise systems engineering and governance in complex environments

# Future Plans

## Complete, Integrate, and Apply Methods

### Enterprise Landscapes

Describe the manifold dimensionality of the enterprise – from operational, scalar, temporal, management, and performance perspectives

### Descriptive Enterprise Dynamics

Understanding the dynamic interactions of policy, organizations, economics, technology, and social elements of operations (POETS-O)  
– A new discipline for enterprise systems engineering

### Dynamic Architecting

A method for rigorously structuring and designing the enterprise to address the acquisition of capabilities to deal with complex operational problems

### Enterprise State-Space Modeling

Qualitative and quantitative multi-disciplinary methods for analyzing dynamic interactions – applying agent-based, systems dynamics, HOT, and control-theoretic methods

### Acquisition Gaming

An interactive training and learning process to illuminate dynamic factors and management actions that improve the acquisition process

### Enterprise Modeling Forum

An ongoing forum to exchange new developments and insights into enterprise planning, acquisition, and operational performance