



Test and Evaluation of Complex Systems of Systems

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Framework for Complex System-of-Systems Assessment

- ▶ **Data Analysis and Analyst Observation of Live Systems Play**
- ▶ **Structured Collection of Users' Impressions**
- ▶ **Modeling and Simulation**

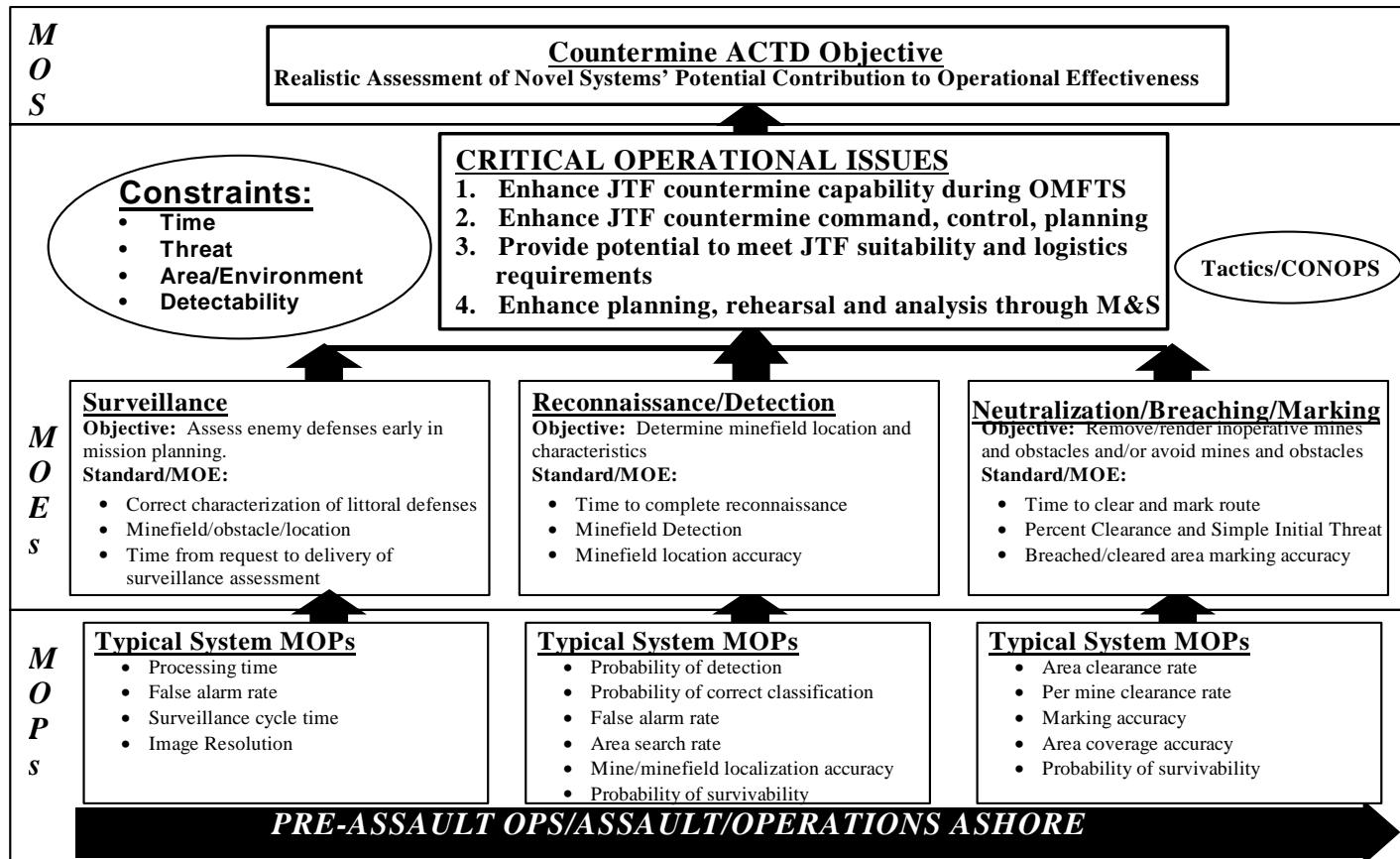


System Utility Assessment

- ▶ **The Assessment of System Utility Has Driven:**
 - » **Exercise Design**
 - » **Data Collection**
 - » **Instrumentation**
 - » **Modeling and Simulation Component**



Hierarchy of Measures





Criteria for Development of MOEs

- ▶ **Quantifiable and Measurable**
- ▶ **Doctrinally Sound**
- ▶ **Intuitively Clear**
- ▶ **Calculable within Modeling Environment**

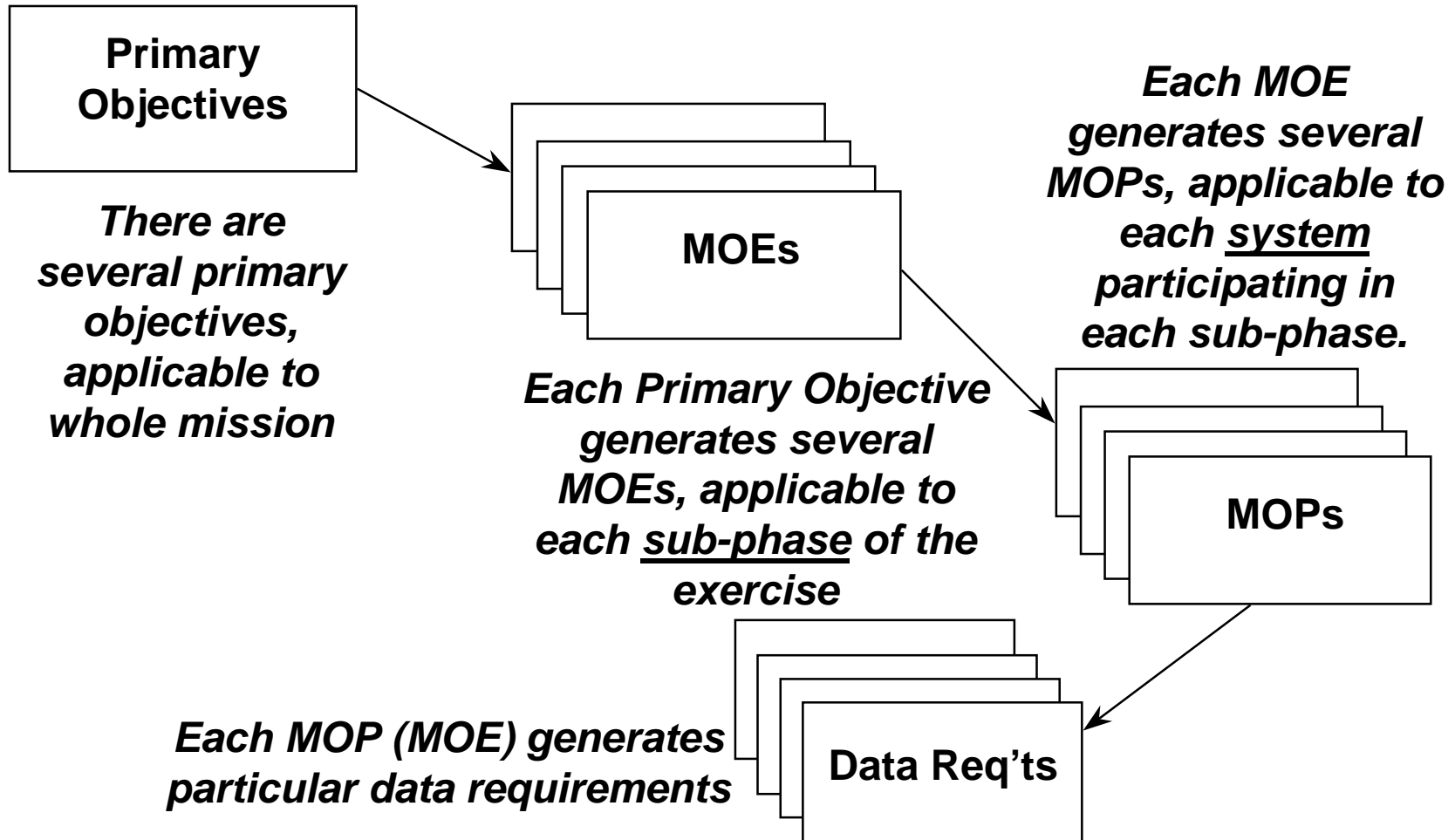


Analysis Objectives for Test Design

- ▶ **Naturally Motivate Use of Novel Systems**
- ▶ **Provide Maximum Opportunity to Demonstrate Significant Utility of Each System to the Top-Level MOEs**
- ▶ **Demonstrate Synergy of Novel Systems with Legacy Systems**
- ▶ **Demonstrate Significant but Fair Challenge to Each Novel System**
 - » **Understand system performance goals, intended concept of operation**



Data Requirements





Data Sources for Assessment

- ▶ **Automatic Data Collection via Instrumentation**
- ▶ **Manual Data Entry/Distributed Systems Data Recording**
- ▶ **Questionnaires and Interviews throughout Chain of Command of Operation**
- ▶ **Observer/SME Reports and Records**



General Approach

- ▶ **Understand as much as possible about system performance prior to each Demo.**
- ▶ **Evaluate performance during demonstrations against predictions.**
 - » **If consistent, then we understand marginal contribution of system.**
 - » **If not consistent, then**
 - **re-assess predictions or prediction tools,**
 - **re-assess validity of prior knowledge of novel system performance.**

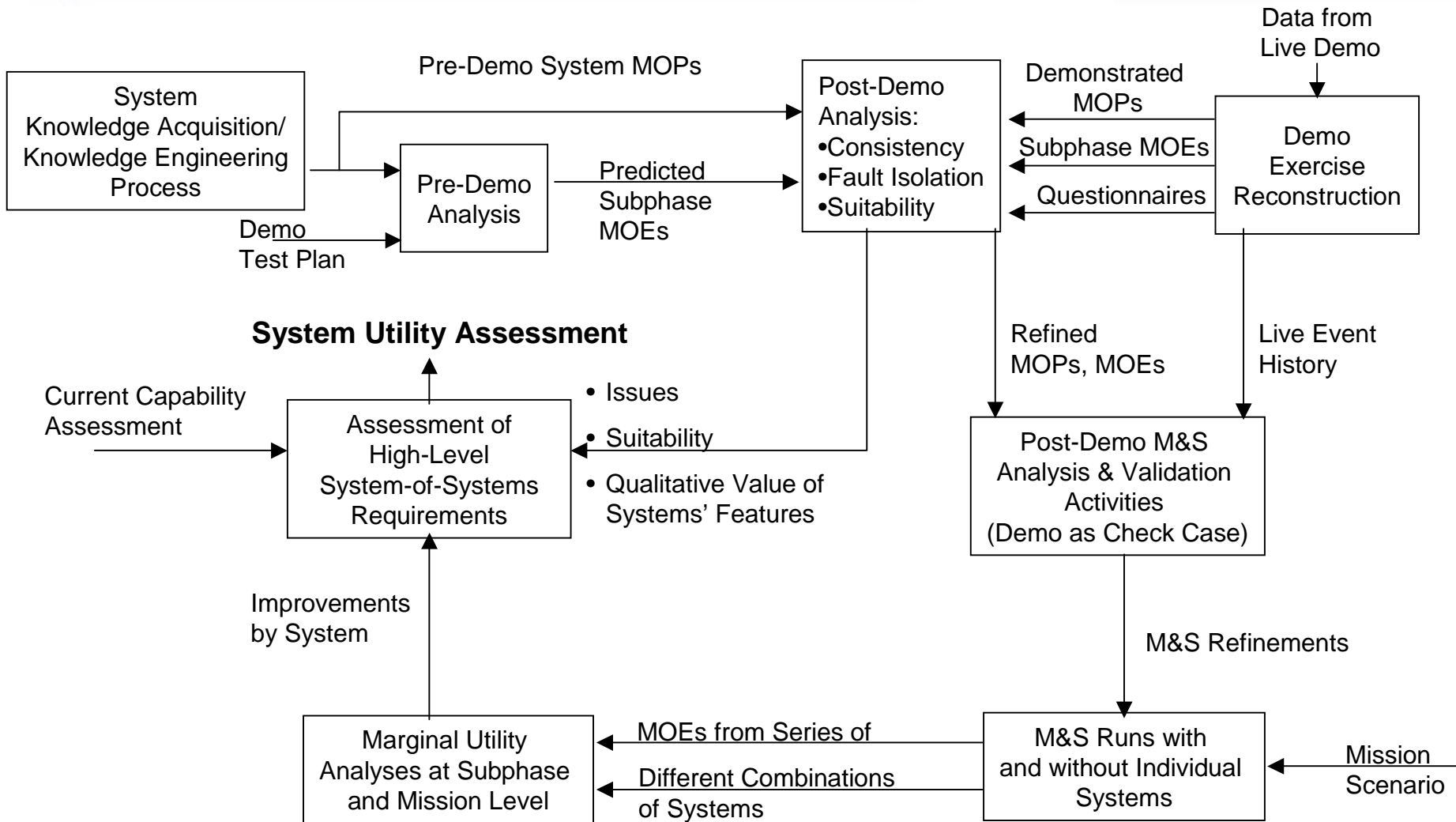


General Approach (cont'd)

- ▶ **Use as much existing test data and information as possible.**
 - » Rely on representative test results for baseline and systems.
 - » Additional tests only when necessary.
 - » Specify new instrumentation only when necessary.
- ▶ **Demos are geared to illustrate potential of systems.**
- ▶ **Models and Simulations are the connection between demo results and top level MOEs.**



Assessment of System Utility





Summary

- ▶ **Applicable for any System of Systems**
 - » **Set objectives**
 - » **Design experiment (scenario, technologies, CONOPS, etc.)**
 - » **Collect/Analyze appropriate data**
 - » **Feedback to modeling and simulation community**
- ▶ **Robust Assessment Necessary to determine if objectives of system-of systems mission are met**
- ▶ **Supports Investment Decisions**