

MISSION:

A WORLD OF INNOVATION

Systems Characterization: An Approach to Modernizing Disparate Legacy Systems

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Context

- **Effective Process Improvement**
 - **Business process improvement (BPI)** identifies potential changes in business workflows, and may involve people, resources, hardware, and software components
 - My focus is on the operational architecture, represented in activity or business process modeling artifacts
- **Optimization requires**
 - Understanding your end goal
 - Understanding where you are today
 - Developing a path to move towards that goal
- **Challenge on applying business process improvement to:**
 - Service delivery systems
 - Environment where Measures of Effectiveness not easily quantifiable and historical data unevenly collected
- **Examples:**
 - WarFighter FOCUS (WFF) Combat Training Centers (CTC): Provide efficient maintenance and sustainment services for Army training devices
 - Joint Readiness Training Center (JRTC) Maintenance work flow
 - Combat Training Center (CTC) Depot architecture
 - Air Crew Trainer workload modeling
 - Maintenance and sustainment support for a distributed multi-site system
 - Operations and Sustainment workload modeling

**Effective Process Improvement must be grounded in
fact-based decision making**

Considerations for Legacy Systems

■ System

- The people, hardware, software, facilities, policies, and documents required to produce the systems-level results
- Legacy systems evolve over time into a disjointed collection of heterogeneous elements, supplemented by add-on elements and often using out of date technology

■ Costs

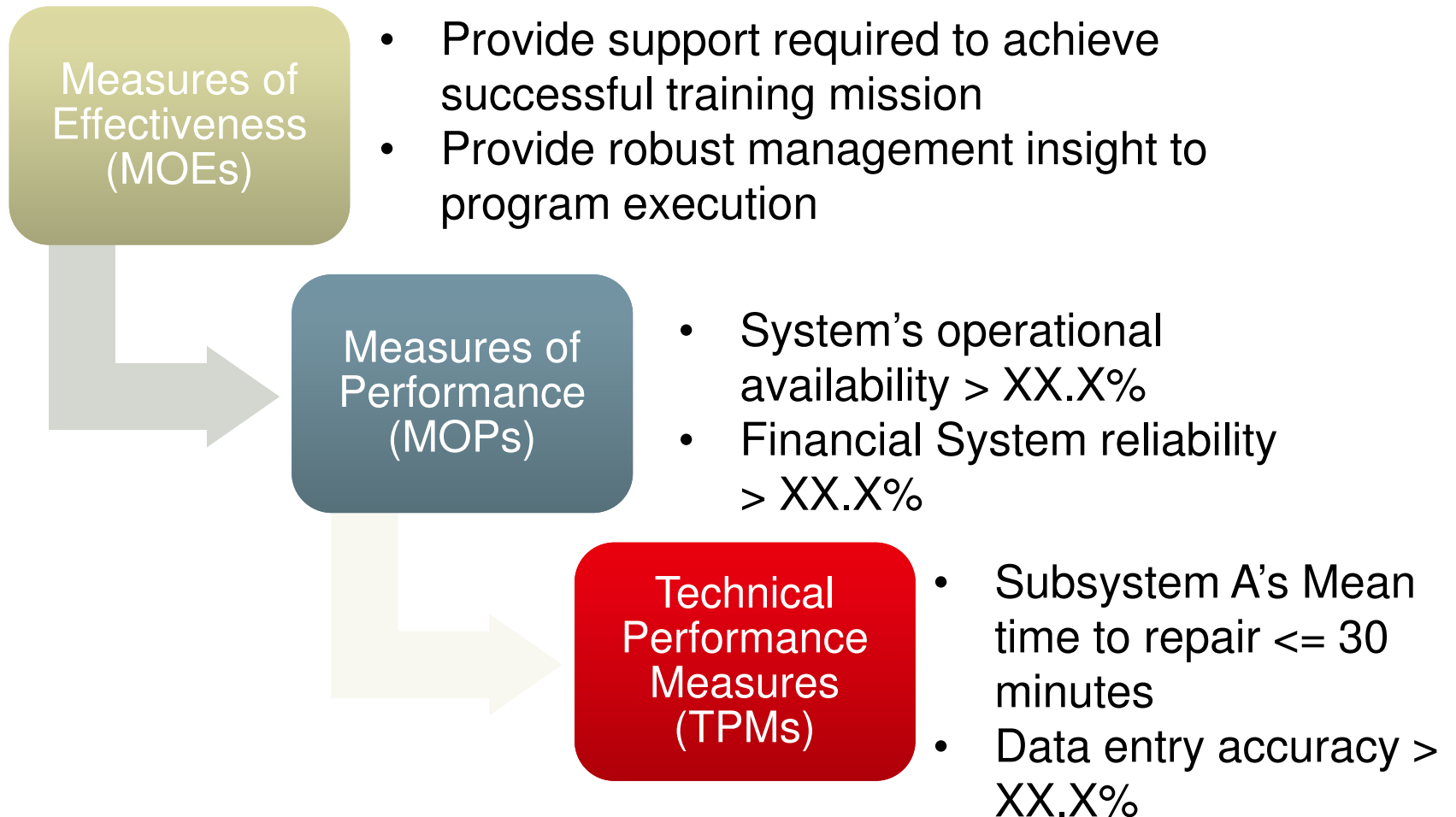
- Acquisition – Acquisition cost of an updated system must be balanced against the ongoing costs of operating and sustaining the legacy system
- Operations – Cost of running the system. Includes labor as well as equipment and facility costs
- Sustainment costs – Cost to maintain the system. Includes cost of preventative maintenance, repairs, and required technology refresh

■ Performance

- Old technology does not take advantage of more recent advances in usability and performance
- System users' expectations of usability evolve over time

Cost of legacy systems can be hidden in plain sight

Measures of Effectiveness Examples



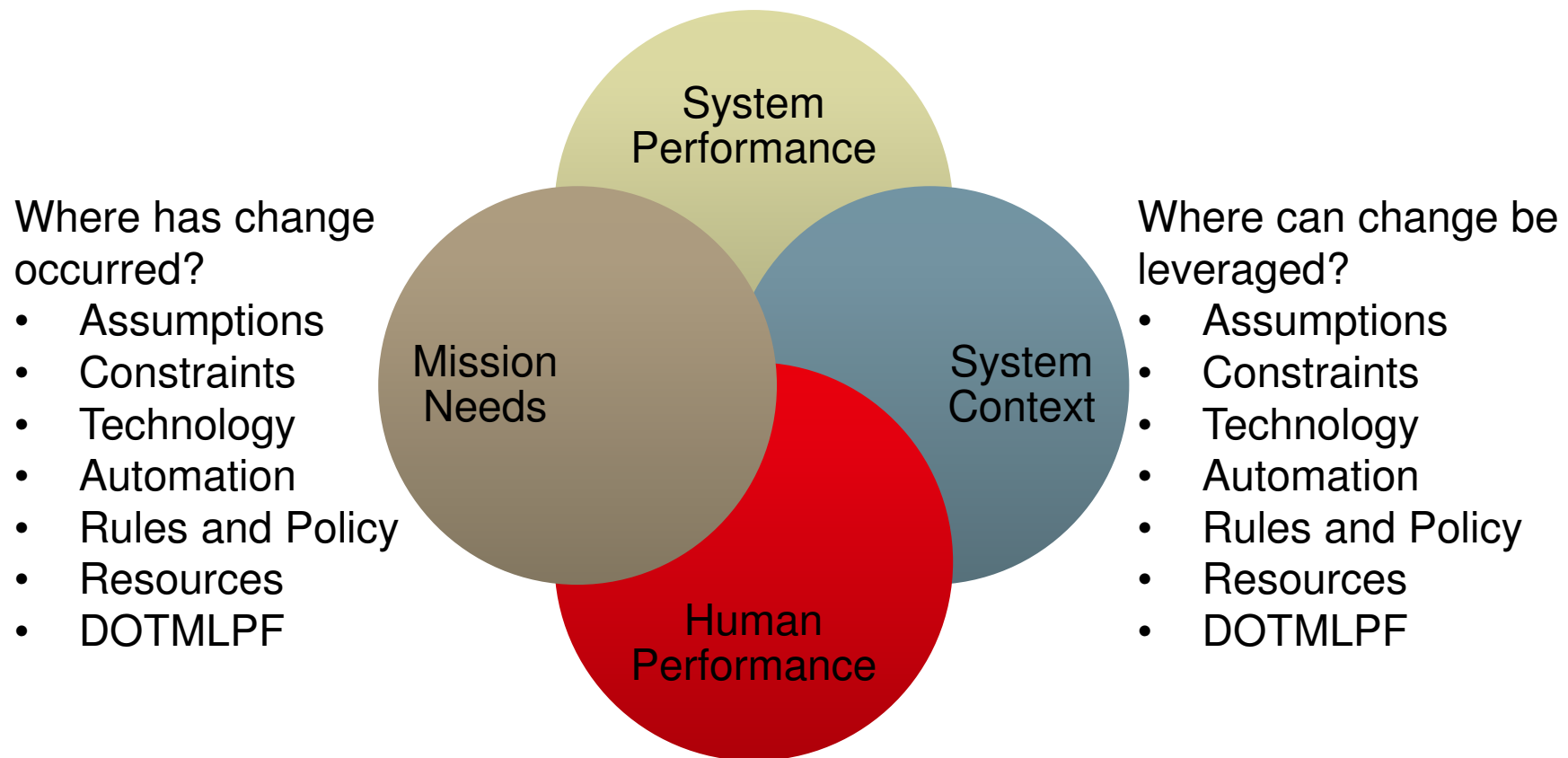
Know the end game – what does success look like?

Performance Improvement Areas

- Human interaction points
 - People do not always behave as the original designers expected
 - People do not have identical skills, training, experiences
 - Surge, emergency, or non-routine situations
- System Constraints
 - System constraints limit overall system performance
 - Bottlenecks form around limited resources
 - Capacity of the overall system may no longer be sufficient for today's demand
- Leverage Points
 - Specific modifications to the system that minimize the effects of the system constraint
 - May involve increasing capacity and/or speed of a limiting process through introduction of technology
 - May be a modification of policy, workflow or other non-technical solution

**Change can be effected through people, process
and/or technology**

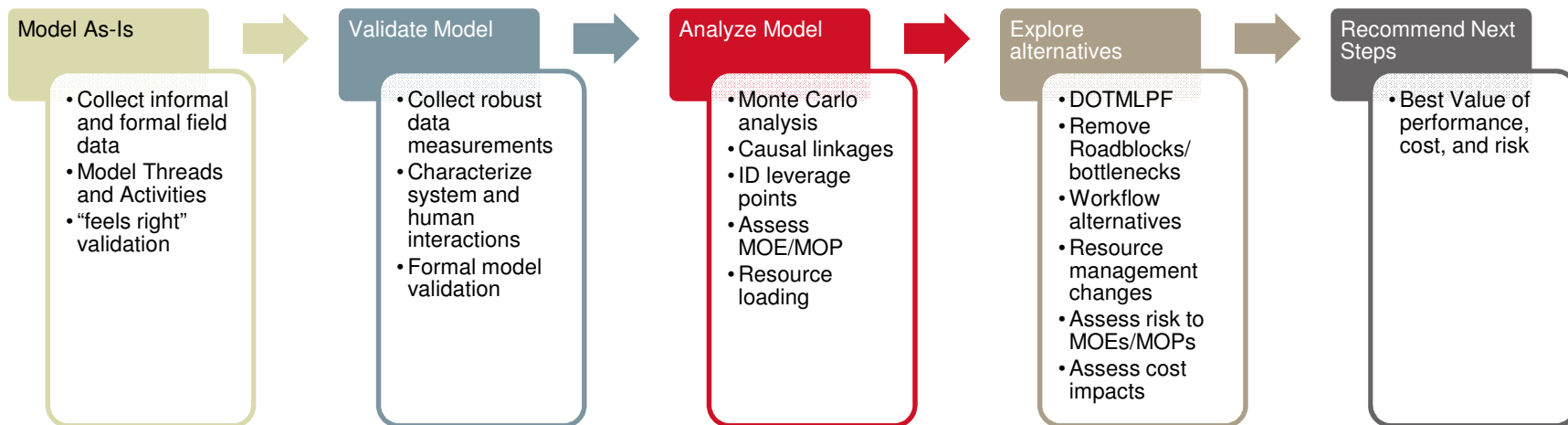
Where to look for leverage for change



DOTMLPF: doctrine, organization, training, materiel, leadership and education, personnel and facilities

Understanding the evolutionary path of the Legacy system can help identify areas of focus

System Characterization Process



DOTMLPF: doctrine, organization, training, materiel, leadership and education, personnel and facilities

You can't fix what you don't understand

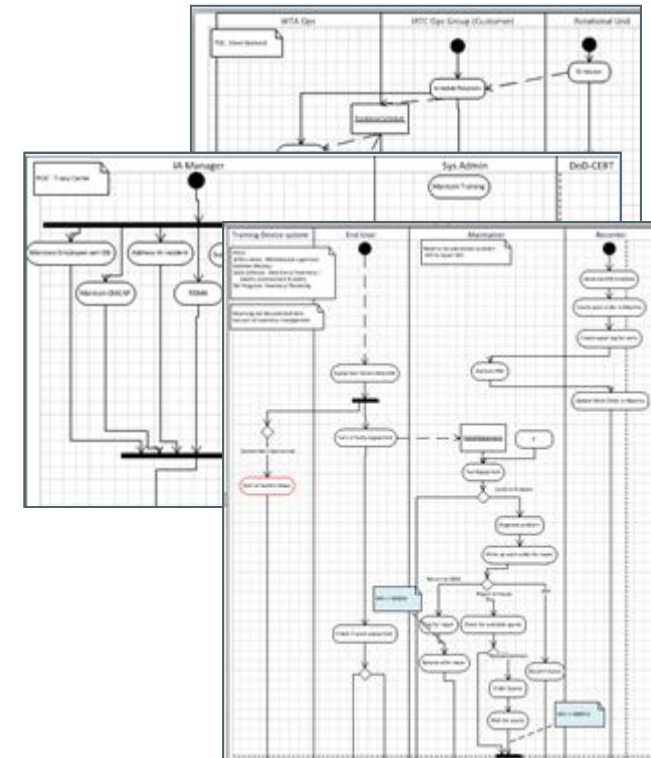
- | Instructions - Tasks Worksheet | | Instructions - Scenario Information Worksheet | |
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| Column A | Enter a brief description of the task. | Column A | Enter the resource pool identifier. A resource pool is a grouping of like resources. |
| Column B | Enter the minimum task duration. | Column B | Enter the skill code for the resource pool. See Table 1 for the skill definitions.
If the resource pool has more than one skill, enter the primary skill first. |
| Column C | Enter the average task duration. | Column C | If known, enter the labor grade of the resource pool. (Blank) |
| Column D | Enter the maximum task duration. | Column E | Enter an identifier for the shift. |
| Column E | Enter earliest task start time. | Column F | Enter the shift start time. |
| Column F | Enter the latest task start time. | Column G | Enter the shift end time. |
| Column G | From the drop-down box, select the probability of occurrence for the task. See Table 3 for the definitions. | Column H | Enter the resource pool identifiers assigned to the shift. |
| Column H | Enter the criticality. See Table 2 for definitions of criticality levels. | | |
| Column I | Enter the discipline required to complete the task. See Table 1 for a list of suggested skill types. The skill types can be | | |

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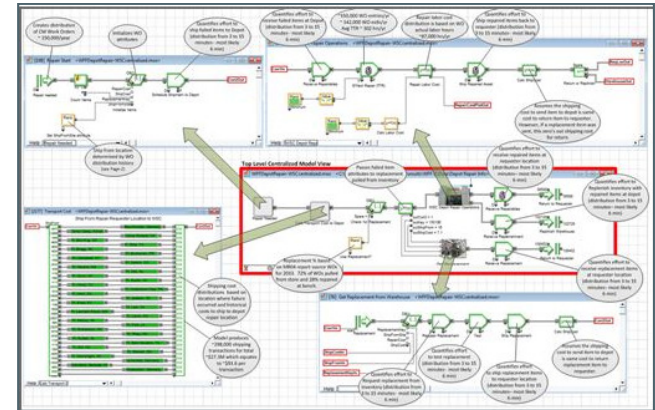
Modeling the As-Is system

- Leverage existing documentation when available
- Model key system threads and activity profiles
- Interview operators, analysts, maintainers, sustainers for normal day-in-the-life activities
 - Informal metrics on what tasks are performed and where majority of human interaction time is spent
 - Characterizes the human aspects (shifts, breaks, attention span degradation, stress, training, etc.)
 - Task Analysis of how the task is accomplished and resources required
- Build low fidelity model of the as-is systems
 - Work flow models
 - Characterized tasks
 - May be using a process flow modeling tool or excel spreadsheets depending on the nature of the work
- Example: WFF Joint Readiness Training Center (JRTC) maintenance work flow model
- Example: Field Service workload analysis model



Gather information from the as-is system to allow fact-based decision making

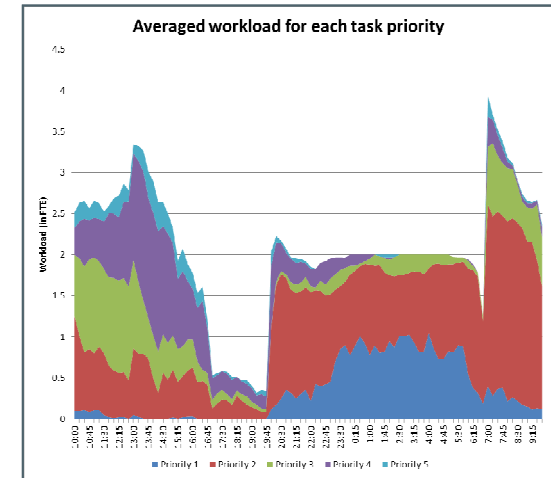
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Analyzing the as-is performance

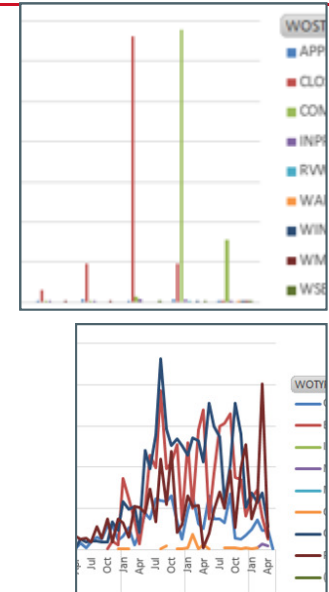
- Analyze for causal linkages and leverage points
- Explore system response to a range of conditions and their impact to the MOE and MOPs
 - Steady state
 - Surge
 - Unplanned crisis and/or emergency
- Identify bottlenecks and backups, and characterize system constraints
- Explore relationship of human activity and technology
- Example:
 - Field Service workload analysis
 - Intelligence Processing System



Explore the as-is system model to identify leverage points

Explore Alternatives & Recommend

- Architecture Areas to explore
 - Explore changes to system constraints
 - Explore changes to system capacity
 - Explore introduction of technology to replace manually intensive functionality
 - Explore process changes and work flow changes
- Understand relationships of alternatives to each other.
 - Some are either/or and preclude both alternatives being implemented
 - Some are compatible
 - Some are dependent upon other alternatives being also selected
- Select a set of reasonable configurations that represent the most likely packaging of specific improvements
- Estimate the cost to implement and the cost to be saved for each configuration
- Perform trade study to determine the best value
- Rework solution to combine best parts of alternatives
- Document recommendation substantiated with model and trade study results



Understand the pros and cons of different approaches to select the most appropriate path

Summary

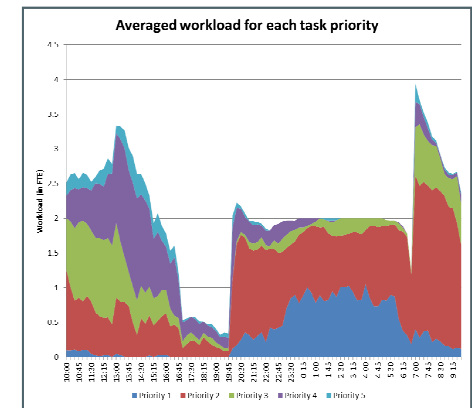
- Effective Process Improvement must be grounded in fact-based decision making
- Know the end game – what will success look like?
- Change can be effected through people, process and/or technology
- Explore the as-is system model to identify leverage points
- Understand the pros and cons of different approaches to select the most appropriate path

Biographies

- Jane Orsulak, Engineering Fellow, leads the Raytheon IIS Mission Analysis Capability Center (MACC), focusing on performing mission analysis and leveraging modeling and simulation tools. She is an Open Group Certified Master IT Architect. Prior to her work with the MACC, she worked as a system architect for unmanned systems ground control systems and was a key contributor to the NATO STANAG 4586 Unmanned Systems Interoperability Architecture standard
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- Julie Kent has been working in systems integration for over 20 years. She moved to Raytheon 9 years ago and programmed a TENA interface for the Instrumentation System at the National Training Center (NTC). Julie worked on database upgrades and integration to support training exercises at the NTC, Joint Readiness Training Center, and Joint Multinational Readiness Center. She also integrated COTS products to create a management information system that supports cross-platform work-order management and life-cycle support. She currently serves as a senior principle systems engineer for the Warfighter Field Operations and Customer Support contract, supporting live, virtual, and constructive training.
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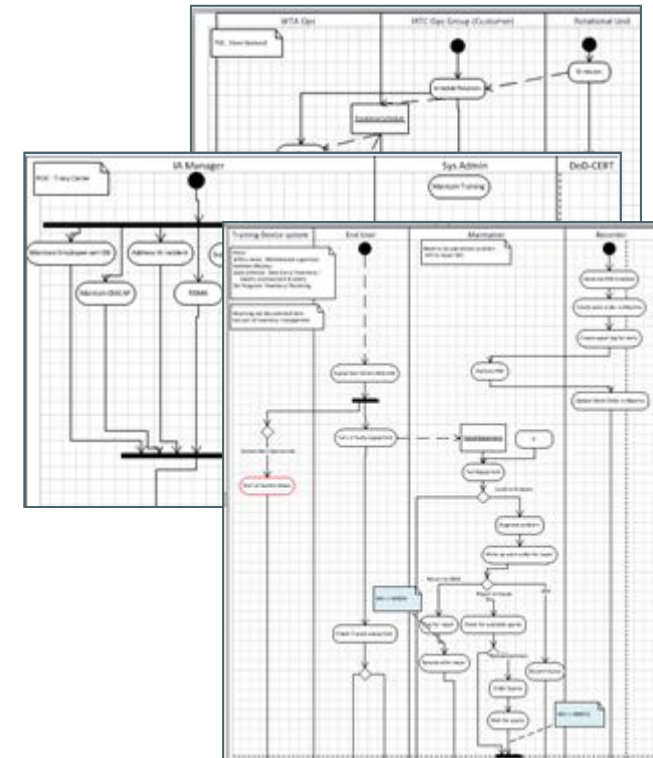
System Operations and Sustainment Example

- System provides operations and sustainment support to a software-centric, distributed system, including operational support to mission activities
- Question is how technology could improve the efficiency of the Operations and Sustainment staff
- Interviewed on-site staff for extensive data collection on day-to-day tasks
- Modeled in a discrete event simulation tool and validated against current operations
- Modeled various approaches to measure the improvement to performance metrics vice the cost to implement the approach



WFF Joint Readiness Training Center Example

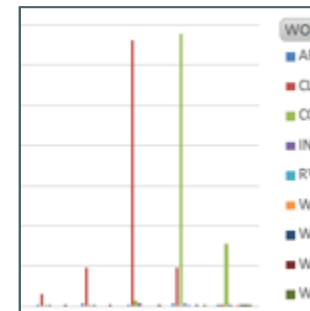
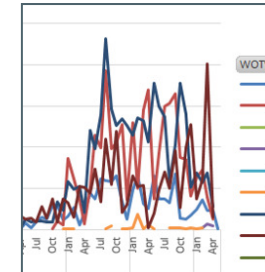
- Interviewed onsite staff for each of 4 key as-is workflows, focusing on Maintenance and Information Assurance processes
- Identified many areas where processes have been improved already
- Identified consistency issues among sites doing similar work
- Identified that overall processes are good, but adherence to the processes is not measured, and therefore, not as consistent as it should be
- As-is Process optimized to support one MOE objective over another



WFF Joint Readiness Training Center (Cont)

- Collected and analyzed historical data related to technical performance measures
- Validated with site subject matter experts
- Identified anomalies in data, tied to policy changes over life of program
- Now have metrics to use as foundation for process improvement recommendations
- Next steps
 - Expand analysis across training centers to leverage best practices
 - Provide regular metrics-based feedback to ensure that staff is adhering to documented process
 - Increase visibility of secondary objective and associated metrics to team

Work Order Type by Month



Work Status By year

	Column Lab =		FBCR2		IS		BDC		IS
Row Label =	Count of actlaborkers	Sum of laborkost	Count of actlaborkers	Sum of laborkost	Count of actlaborkers	Sum of laborkost	Count of actlaborkers	Sum of laborkost	Count of actlaborkers
4/3/7/2008					121	\$434,762	6	\$105	
2008					131	\$277,180	56	\$812	
2009					81	\$108,043	35	\$1,286	
2010					142	\$7,854	48	\$1,753	
2011					483	\$87,384	61	\$1,934	
2012	4	\$1,031							
2013	29	\$11,758	55	\$52,187	2275	\$1,421,030	171	\$11,083	618
2014	15	\$12,385	2	\$718	2642	\$2,329,684	152	\$50,065	885
2015			2	\$264	684	\$843,187	48	\$7,074	203
Grand Total	40	\$25,155	59	\$53,231	6663	\$5,758,815	373	\$73,525	1604

Work Order Labor Cost