



Improving Complex Enterprises with System Models

Presented By
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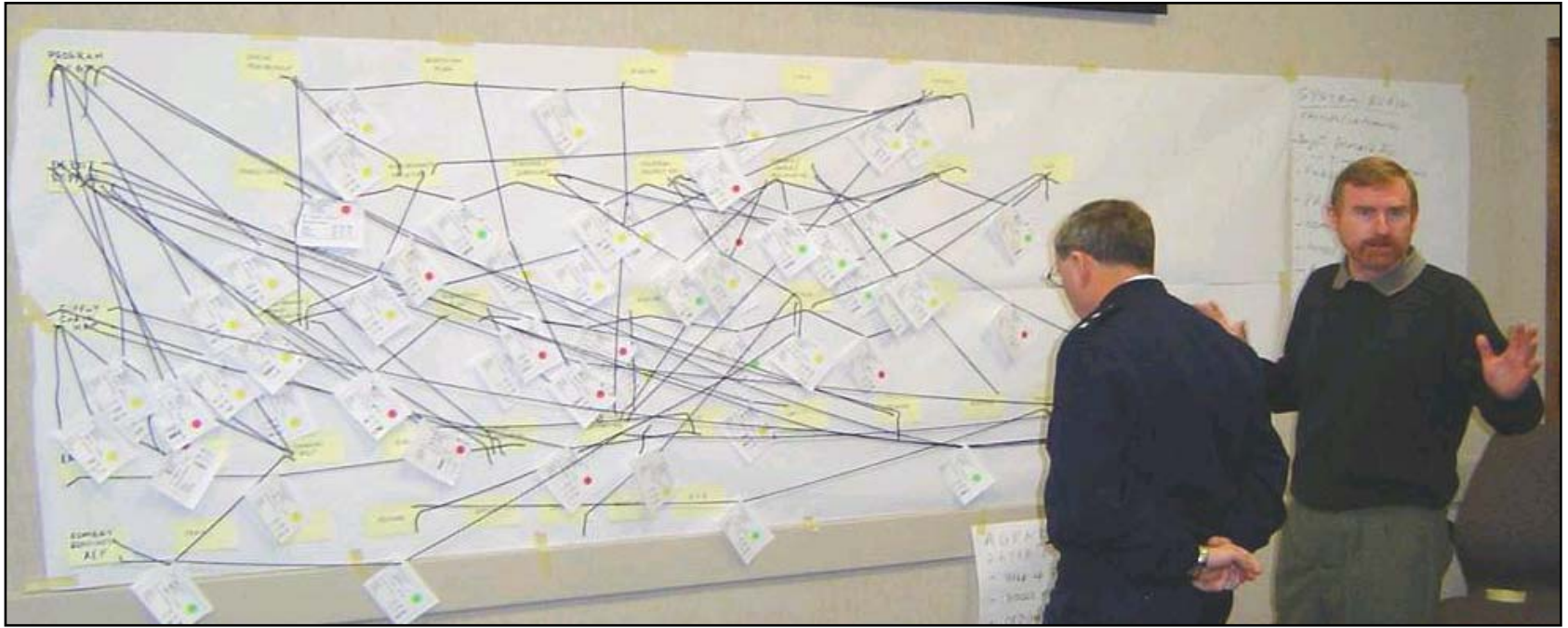
- **Imagine that you are a manufacturing CEO**
 - **Maintenance absorbs 37% of revenue**
 - **Maintenance costs are rising 4% per year (adjusted for inflation)**
 - **Machines are breaking more, 14% increase in 14 years**
- **What would you do?**
- **This is a thumbnail sketch of defense sustainment**
 - **6.5% of \$2.2 trillion federal budget, or \$144 billion**

Air Force Sustainment

- **LAI is active at the US Air Force Air Logistics Centers**
 - Three ALCs nationwide
 - Each has ~20,000 military and civilian personnel
 - **Hill Air Force Base / Ogden ALC**
 - Approximately 2,700 buildings
 - Supports F-16
 - ~1,350 F-16s in the US inventory and ~4,400 world wide
- **Sustainment performance measures**
 - Cost
 - Availability



Enterprise Value Stream Mapping and Analysis (EVSMA)



The challenge

- **Air Force Sustainment is a global, dauntingly complex enterprise**
- **How do you improve such a system? Where do you begin?**

“Moving the analysis up to higher levels of the organization seems to result in losing a grasp on quantitative performance measures.”

“EVSMA has stuffed in front of our faces the coupling between organizations. Getting our arms around the ALC enterprise has been slipperier than we thought.”

“You might as well try to end world hunger.”

Can a systems approach help here?

- **System dynamics is a worldview and a framework for analyzing problems**
 - Provides insight into the interactions between parts of a system
 - Past applications to Air Force sustainment have yielded unintuitive results
 - Strength: testing mental models and developing intuition



"Say... What's a mountain goat doing way up here in a cloudbank?"

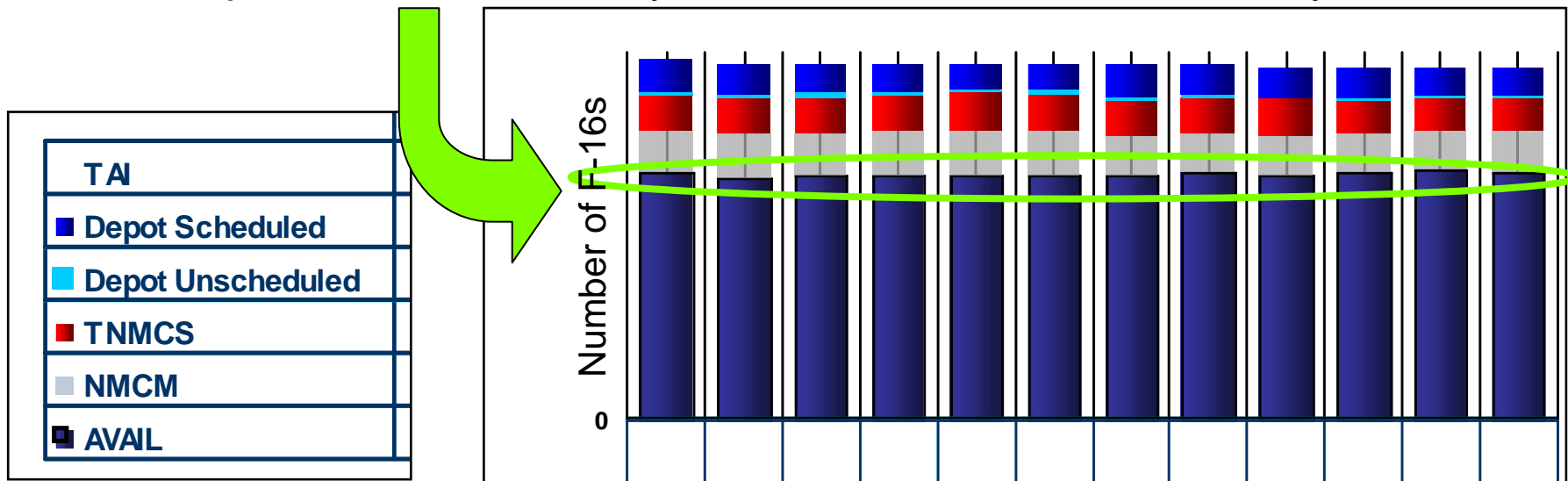
Gary Larson

Research framework

- **Apply systems methods at the ALC**
- **Questions**
 - **When compared with other improvement methods (like 6σ) does a systems approach lead to different conclusions?**
 - **Is it preferable? Under what circumstances?**
 - **How does the approach influence the change process?**
- **Methods**
 - **Observe the change process underway at Ogden**
 - **Apply system dynamics methods to improving F-16 availability and reducing costs**
 - **Develop and test hypotheses, compare with results from the current change process**

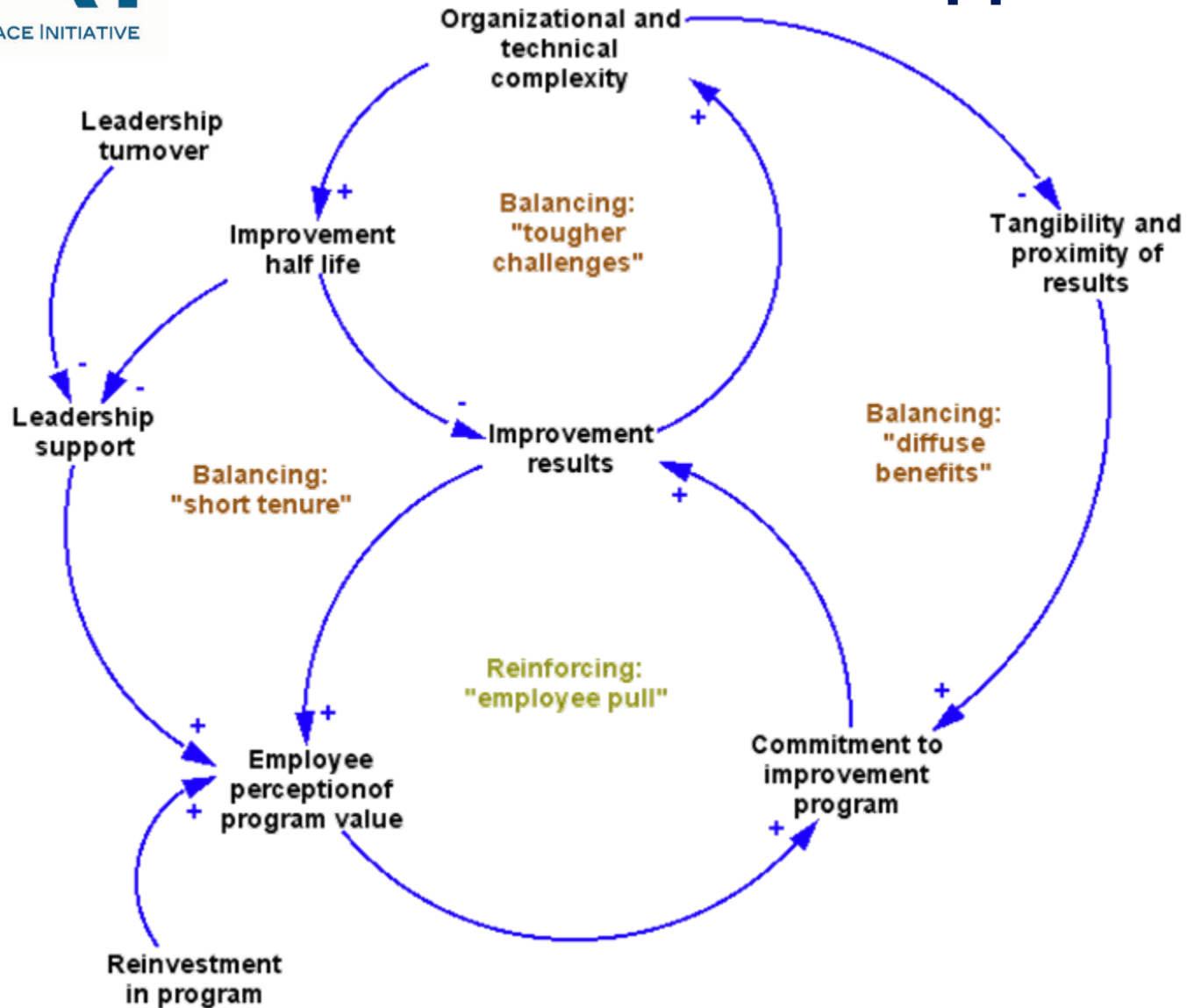
- **System observation: performance is conserved**
 - Strong negative covariance in depot levels and other categories
 - Would a “silo” analysis find this?
- **Hypothesis: under development**

Components of availability fluctuate, but overall availability is constant



- **Improvement can be self-sustaining**
- **Observation: depot improvements are more developed than logistics**
- **Hypothesis: difference is due to systemic influences**
 - **Reinvestment**
 - **Complexity of problems**
 - **Proximity of results**

Applications



- **Conclusion: logistics improvements must overcome balancing feedback**
- **Recommendations: create pull by**
 - **Enabling reinvestment in initiatives**
 - **Building commitment through leadership support and incentives**
 - **Institutionalizing improvement programs so that they survive leadership turnover**



Preliminary conclusions

- **System dynamics can be a useful compliment to other approaches, ...**
 - ... especially in complex enterprises
 - Yields different kinds of recommendations
 - Includes non-technical dimensions such as policy, leadership, and implementation challenges
 - Models carry information about the level of leadership needed to affect change
 - Great potential as a learning tool to help leaders “get their arms around” the ALC enterprise
 - Easily spans organizational boundaries and interactions
 - Flexible enough to accommodate non-market influences at the ALC