Considering Resilience Engineering

Christopher Nemeth, PhD, CHFP
Group Leader, Cognitive Systems Engineering
Klein Associates Division

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Considering Resilience Engineering

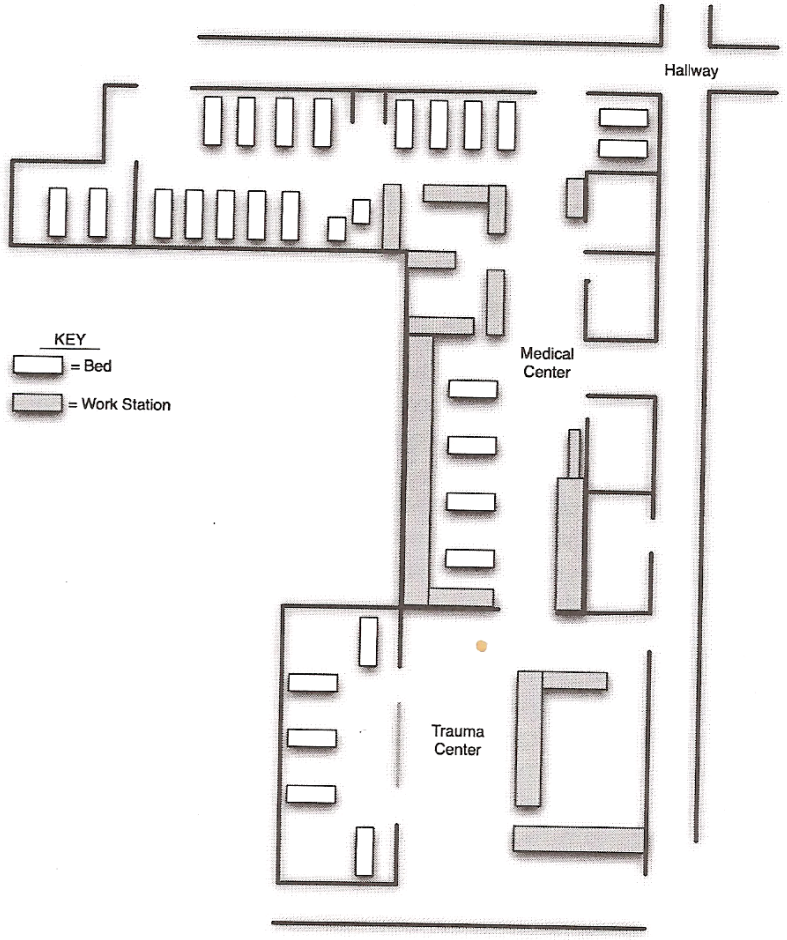
- A Resilience Story
- The Need for Resilience, and CSE
- A Resilience Engineering Story
- Resilience Engineering Issues and Questions
- Looking Forward

ED in Free Fall-A Resilience Story

Set of contiguous units:
5-bed trauma care
21-bed pediatric care, severe illness, mild illness, boarders

1. Routine day. System is operating under usual conditions and practitioners describe as "run of the mill."

Anticipates changes outside of the routine and adapts in a way that is apparently seamless.

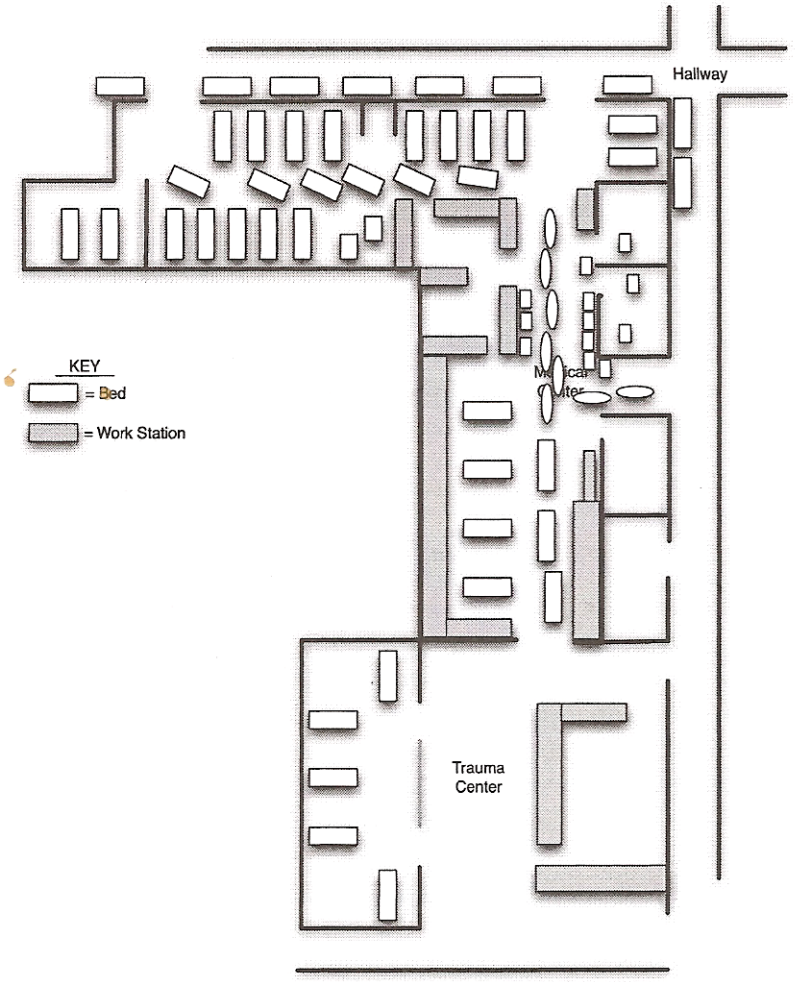


ED in Free Fall-A Resilience Story

2. As load and demands increase, a key individual recognizes system degradation and initiates adaptive responses.

3. Demands increase to the point that the required adaptations occur at the level of the whole department.

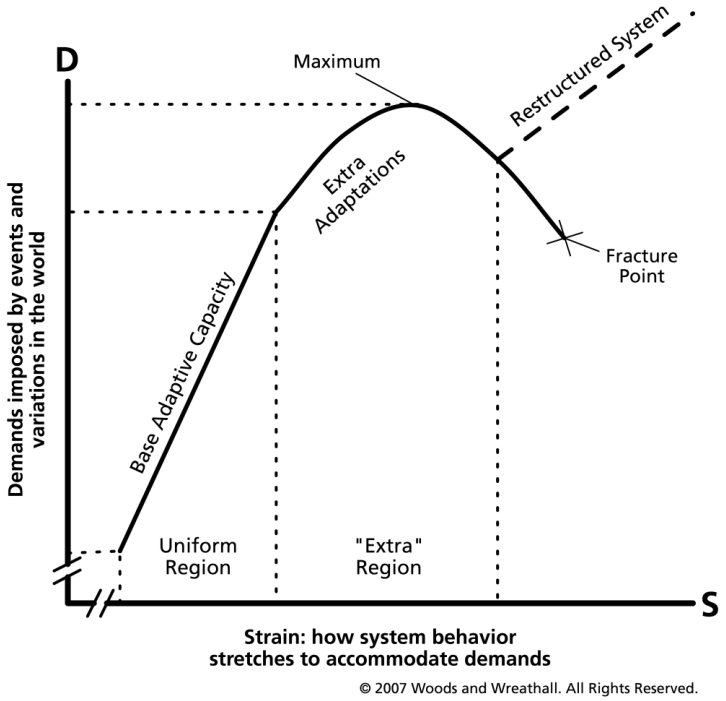
4. Catastrophic events (e.g., mass casualties or natural disasters) require a complete (but rare) reorganization of work in their wake



Resilience

The intrinsic ability of a system to *adjust* its functioning prior to, during, or following changes and disturbances so that it can *sustain required operations*, even after a major mishap or in the presence of continuous stress.

The ability of systems to mount a robust *response* to unforeseen, unpredicted, and unexpected demands and to *resume or even continue* normal operations.

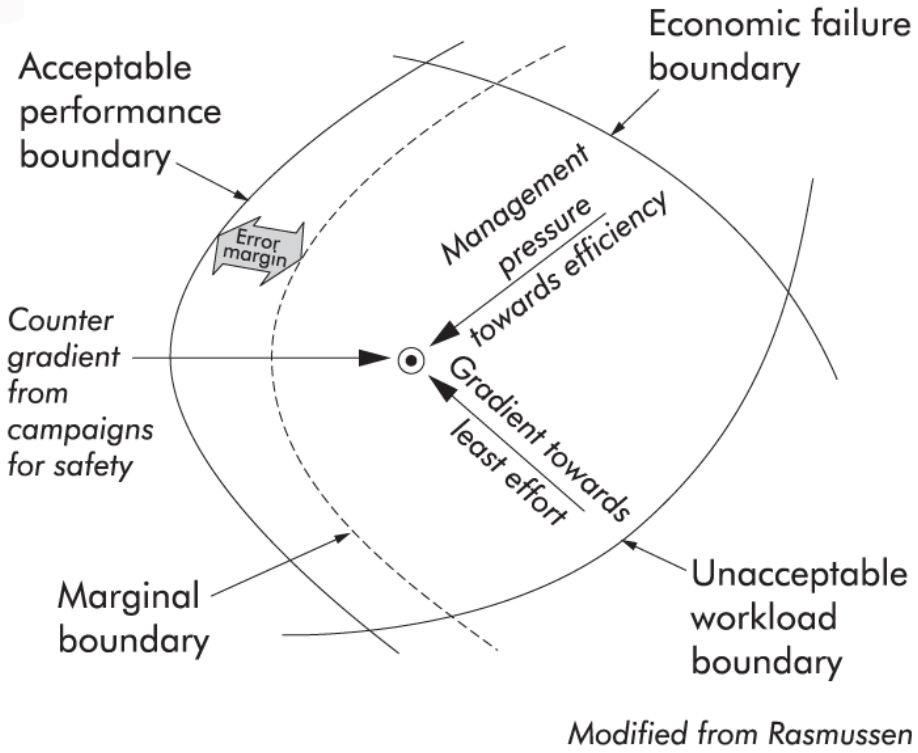


Woods and Wreathall 2008

The Need for Resilience

Organizations seek to remain economically viable and to leverage workforce capability

Pressure to improve efficiency and lessen workload push the operating state toward the marginal safety boundary



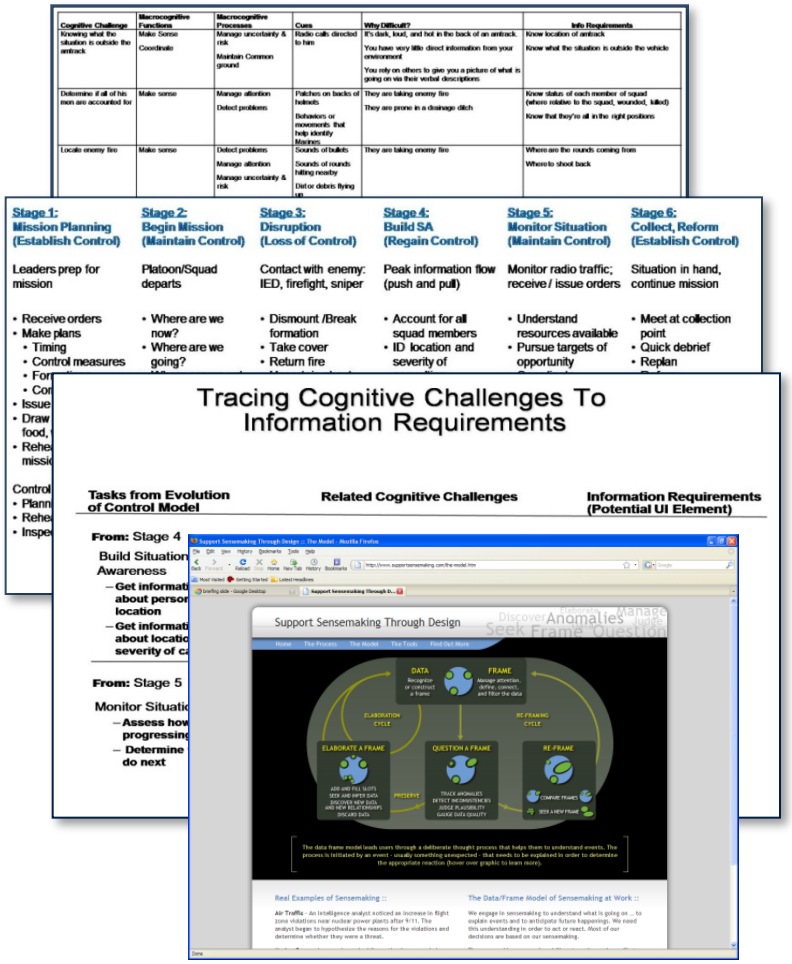
Safe operating envelope, adapted from Cook and Rasmussen, 2005.

CSE matches technology to human performance

- Understand work domains, operator cognitive work in context
  - *situation assessment*
  - *learning, recollection*
  - *planning, re-planning*
  - *decision making*
  - *managing uncertainty and risk*
  - *outcome assessment*
- Identify how cognitive work can be supported:
  - *technology, work processes, work spaces*
- Develop solutions to improve system performance:
  - *reliability, efficiency, and safety*

CSE process drives end product

Cognitive work challenges drive functional requirements, and potential user interface elements



Cognitive Task Analysis interview data lead to

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Operator cognitive models, to

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Decision and information requirements, to

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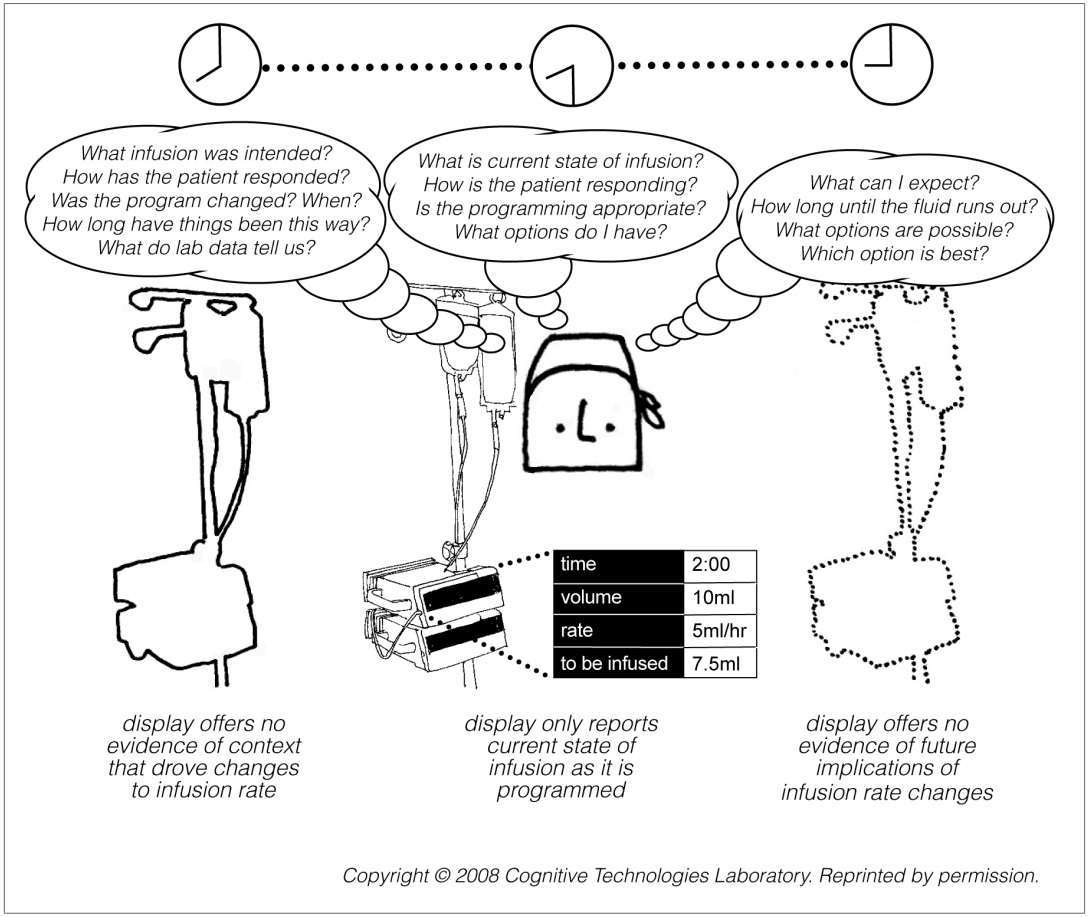
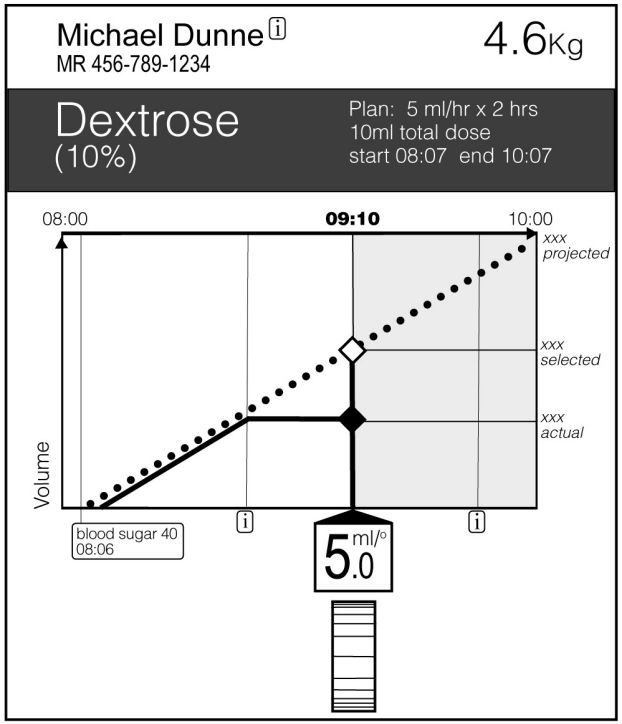
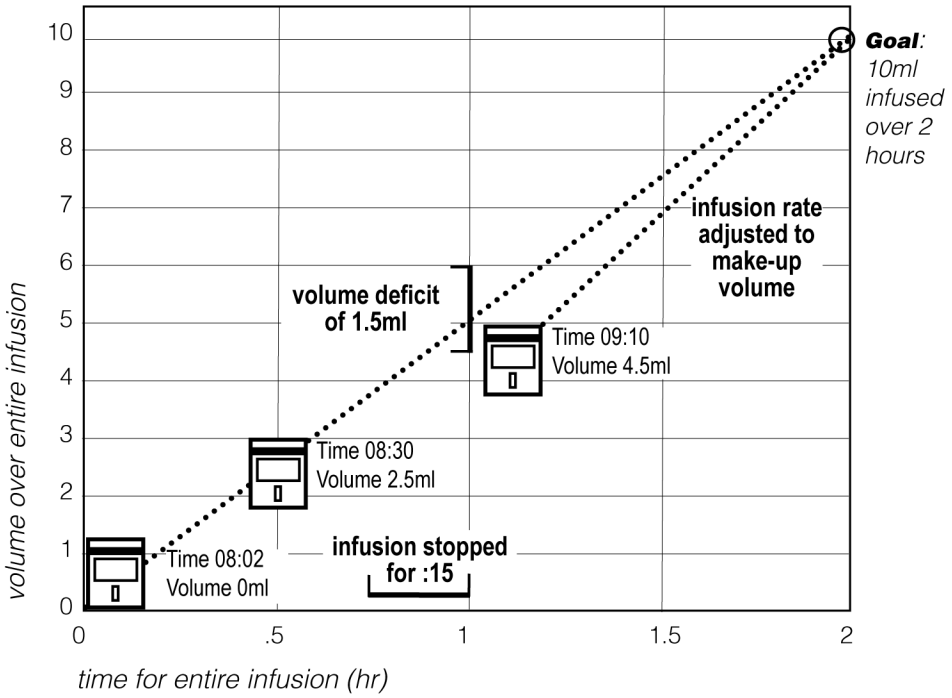
Prototypes to be evaluated and optimized

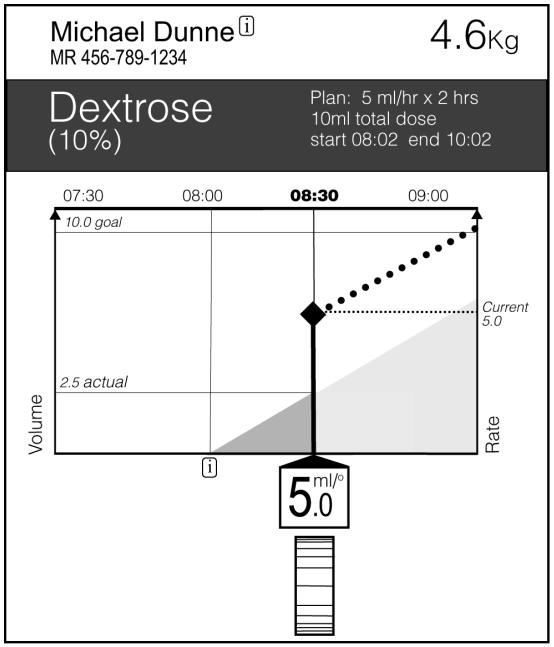
Infusion Device-A Resilience Engineering Story



Infusion Device-A Resilience Engineering Story







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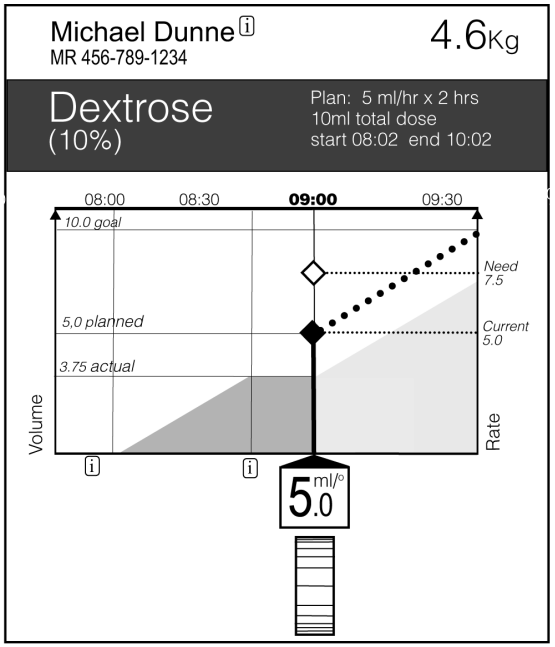

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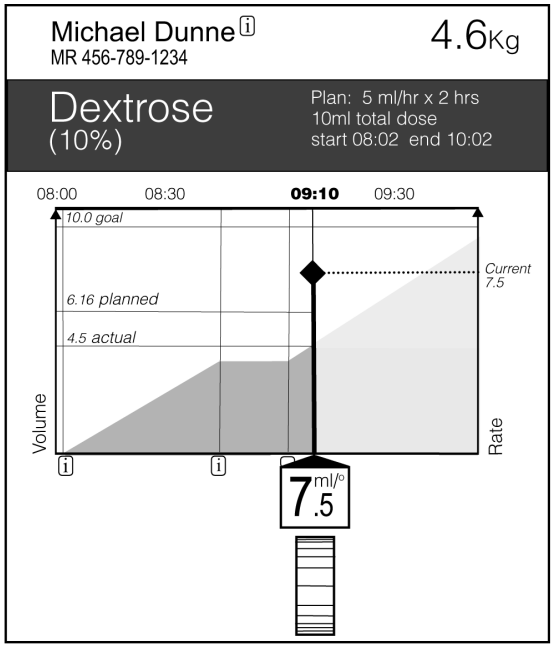

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Resilience Engineering

Acknowledges the inability to specify all possible threats and responses.

Provides methods and tools
to manage safety and productivity
by assessing changes in the adaptive capacity of an organization as it confronts disruptions, change, and pressures.

Issues: Preparation

- Have we learned from past lessons?
- Does an organization have the requisite imagination to foresee future challenges?
- How can various voices be integrated to produce a coherent future view?
- Which proposals are worthwhile, and how can we tell?
- How can views of challenges be brought to others' attention, and integrated?
- How does an organization respond when it learns of a challenge?
- Is the response sufficient, and how can we know?

Issues: Restoration

- At what point is it appropriate to draw "take away" lessons?
- What lessons were learned in the wake of surviving a challenge?
- How are those lessons viewed?
- Who is responsible to consolidate the account of what happened, why, and what to do about it?
- If changes are needed are they for the short or long term?
- Are changes authentic, or simply to serve a social agenda?
- How vulnerable are changes to the tug of "business as usual?"
- Can changes be made outside the scope of the organization?
- Will influences push the organization in a similar direction?

Looking Forward

Further exploration is likely to include:

- The role of system engineers, developers
- Acceptance of human performance study data
- System of systems implications (e.g., bounding)
- Unforeseen effects
- Measures of organizational adaptability

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cnemeth@ara.com

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