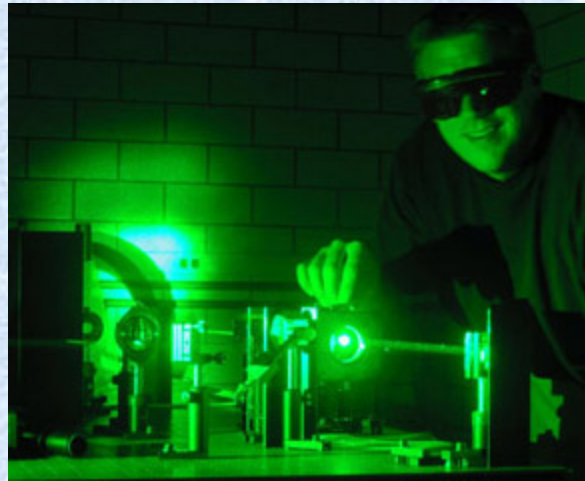


# Human Performance Improvement & Laser Safety



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# What is HPI?

Human Performance Improvement is a *Proactive, Systems Approach* to prevent adverse events

**vs.**

- Always looking through the rear-view mirror after an adverse event occurs

**vs.**

- Avoiding the underlying issues/root causes of events

# Human Performance Principles

1. People are *fallible*.
2. Many error- & injury-prone situations are *predictable*.
3. Individual behaviors are *influenced* by the physical and organizational environment.



“We would be eternally miserable if our errors worried us too much because, as we push forward, we will make plenty more.”

E. O. Lawrence, 1934



# Views of Human Error

## Old

vs.

## New

- Human error is a cause of accidents.
- To explain failure, investigators must seek to find failure.
- They must find people's inaccurate assessments and bad judgments.

- Human error is a ***symptom*** of trouble deeper inside a system...
- To explain failure, look for precursors/contributing factors.
- Find how people's actions made sense at the time, given the information and circumstances around them.

# Event Precursors/Influences

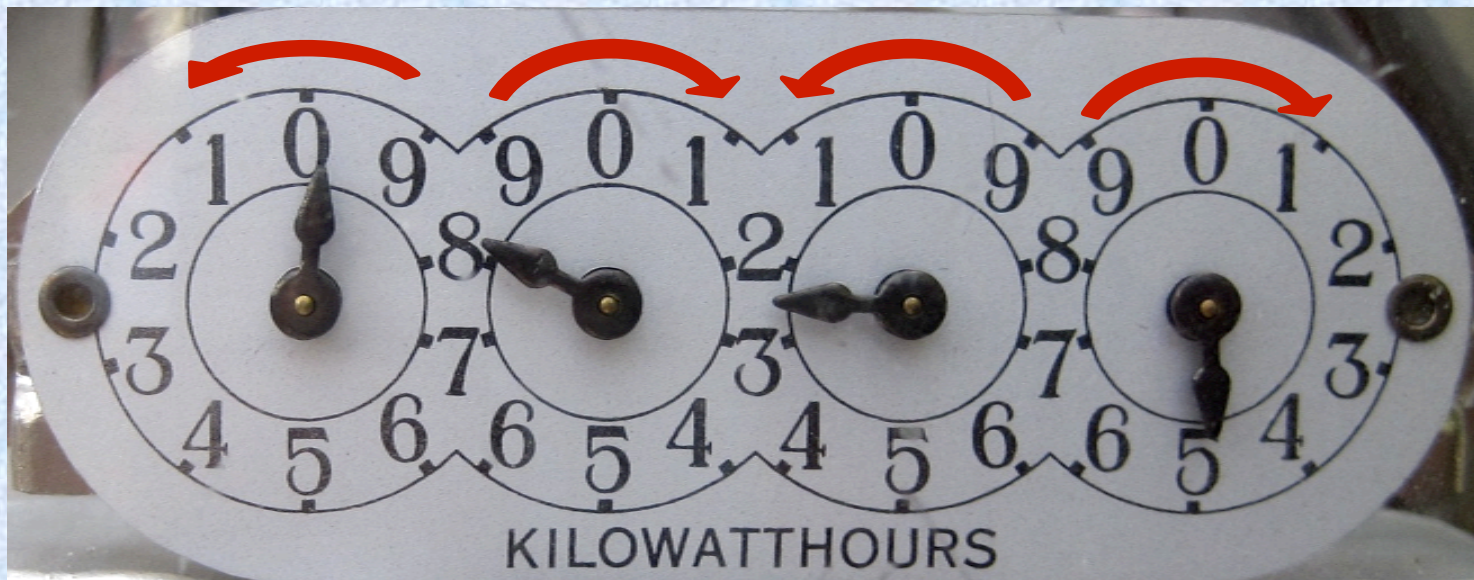
Task Demands		Individual Capabilities	
• Time pressure (in a hurry)		• Unfamiliarity with task /technique	
• High workload (memory requirements)		• Imprecise communication habits	
• Simultaneous, multiple tasks		• Poor problem-solving skills	
• Repetitive actions, monotonous		• In denial re: hazards of task (Pollyanna)	
• Unclear goals, roles, & responsibilities		• Illness / Fatigue	
Work Environment		Human Nature	
• Distractions / Interruptions		• Stress (limits attention)	
• Changes / Departures from routine		• Limited short-term memory	
• Confusing displays or controls		• Assumptions (inaccurate mental picture)	
• Unexpected equipment conditions		• Complacency / Overconfidence	
• Lack of teamwork		• Mental shortcuts (biases)	

Confusing displays, controls, procedures

Complacency / Over-optimism / Wishful thinking

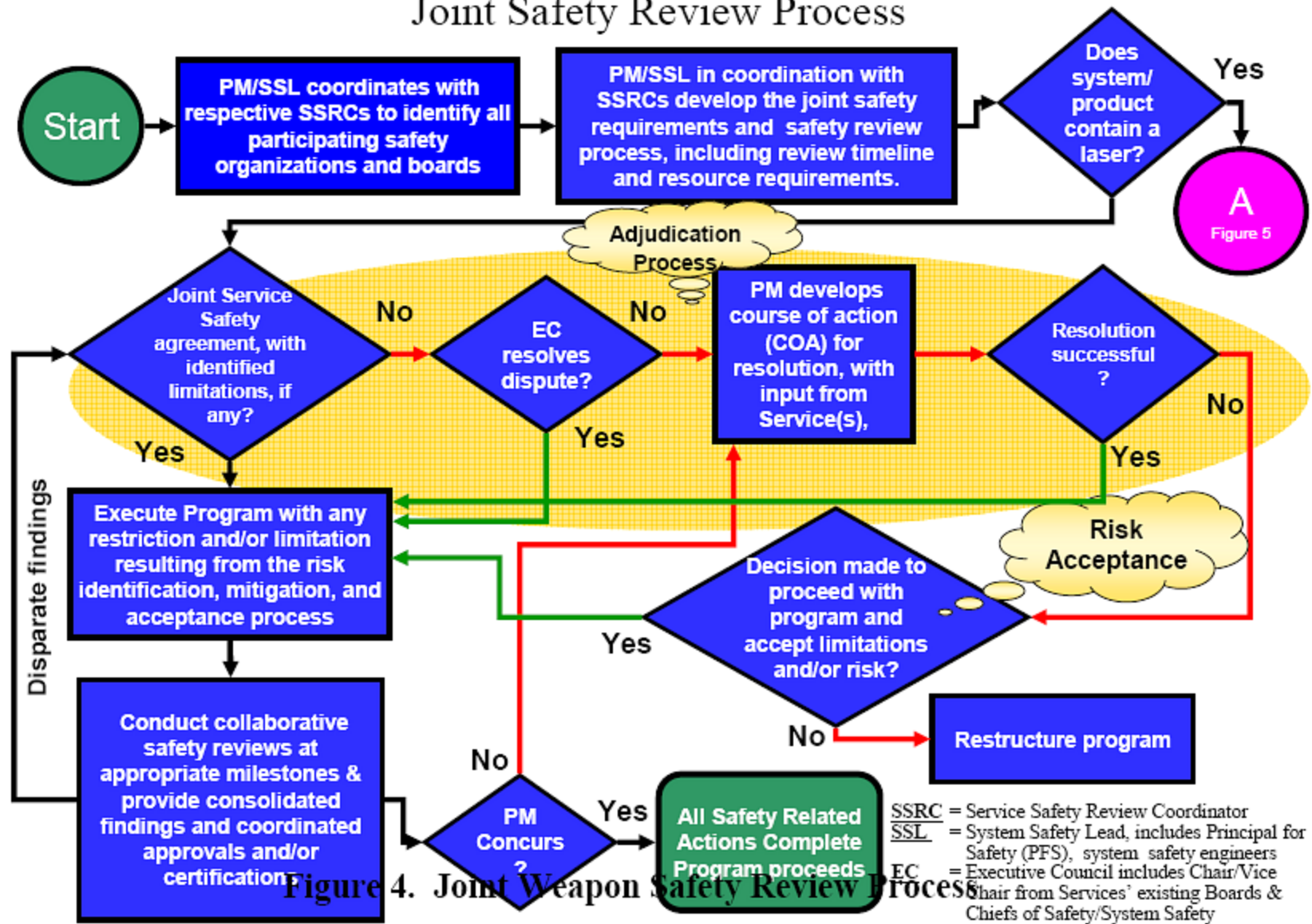
# Confusing displays or controls

Classic electric meter design– what's the problem?



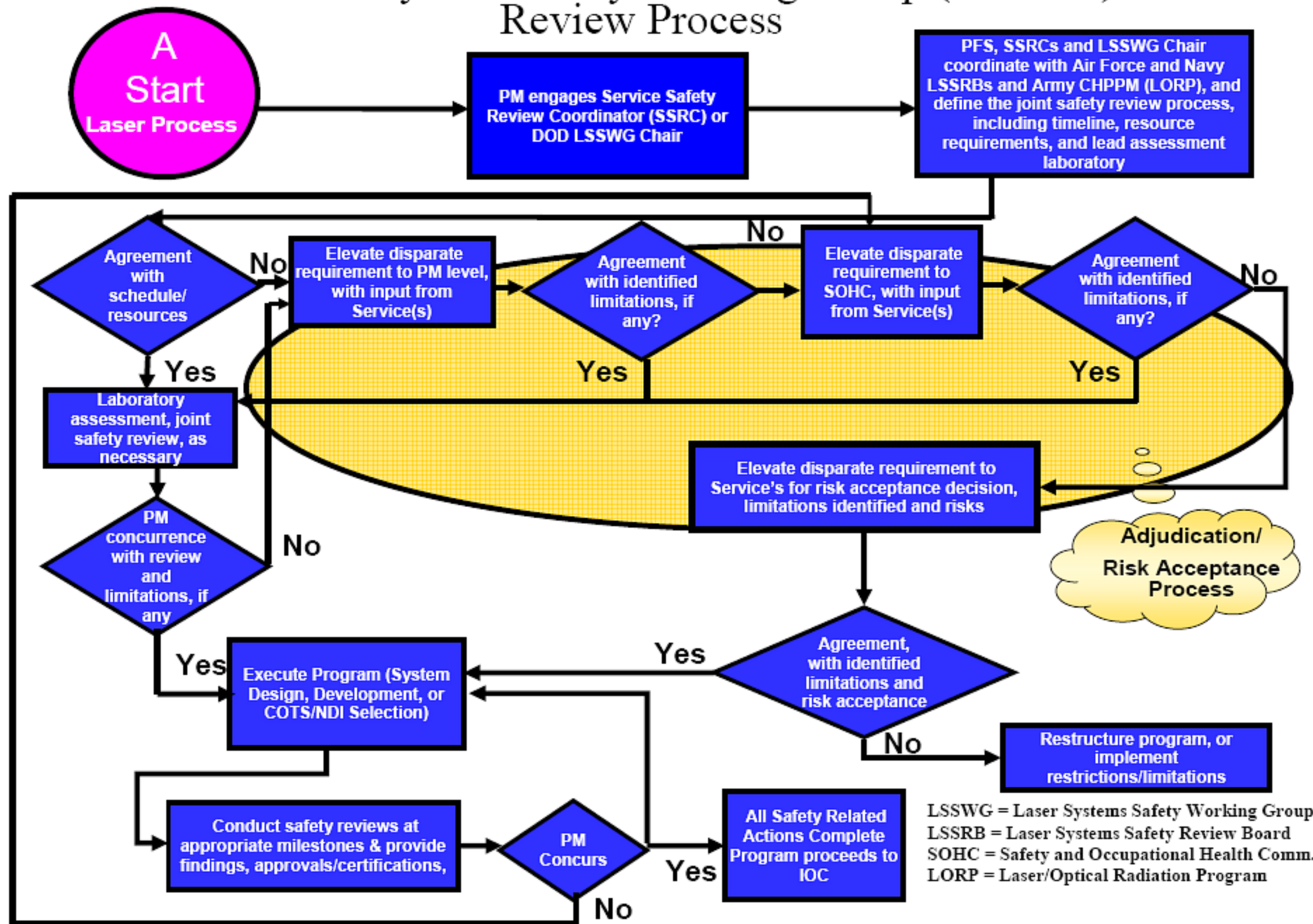


## Joint Safety Review Process





# Joint Laser System Safety Working Group (LSSWG) Review Process



LSSWG = Laser Systems Safety Working Group  
 LSSRB = Laser Systems Safety Review Board  
 SOHC = Safety and Occupational Health Comm.  
 LORP = Laser/Optical Radiation Program

# Over-optimism

Q: What are you doing?

Q: 'How long would you typically be in that sort of position?'

**A: Short time; maybe only 5 min at most**

?



# HPI ↔ Ergonomics ↔ Human Factors



Learn from Success

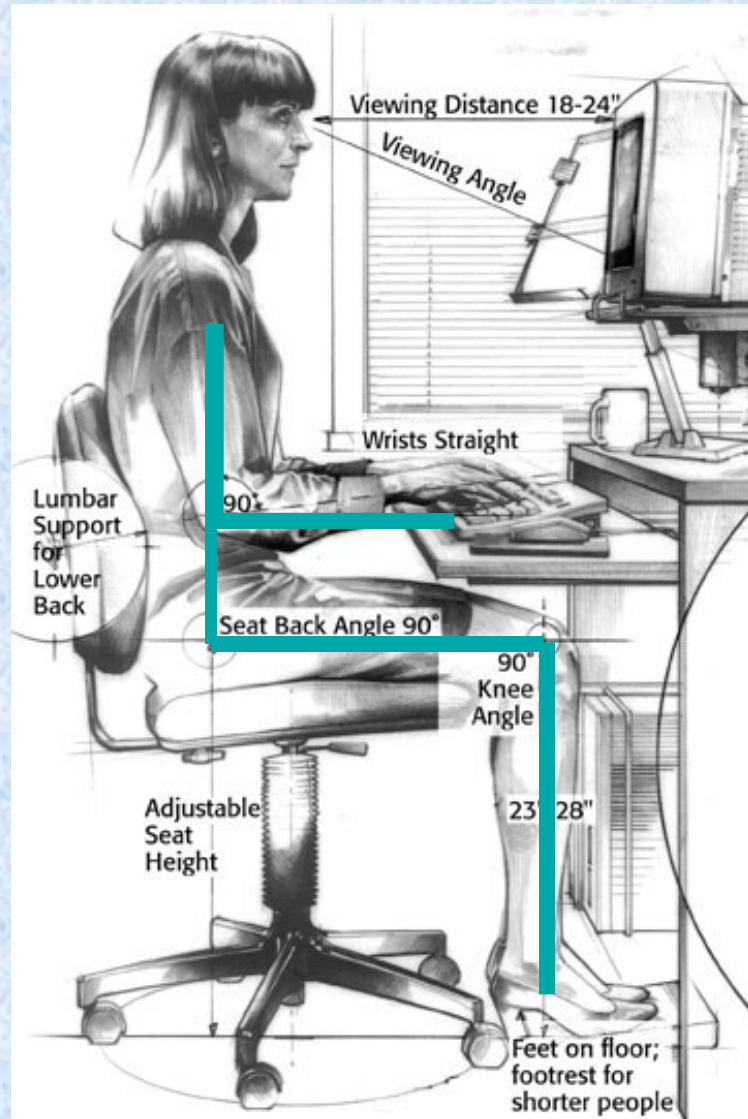
Learn from Failure

**Address:** *real* human capabilities and limitations

**Observe and ID:** how work is *really* done



# ‘Proper Posture’



- ‘Sit up straight!’
- ‘Keep your elbows, hips and knees at 90°’
- ***It’s ‘Correct’, it’s ‘Proper’, it’s...***

***BS !!***

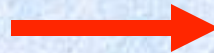


# ***Get real...***

When we leave their office,  
most people unload one way or another



Work as imagined

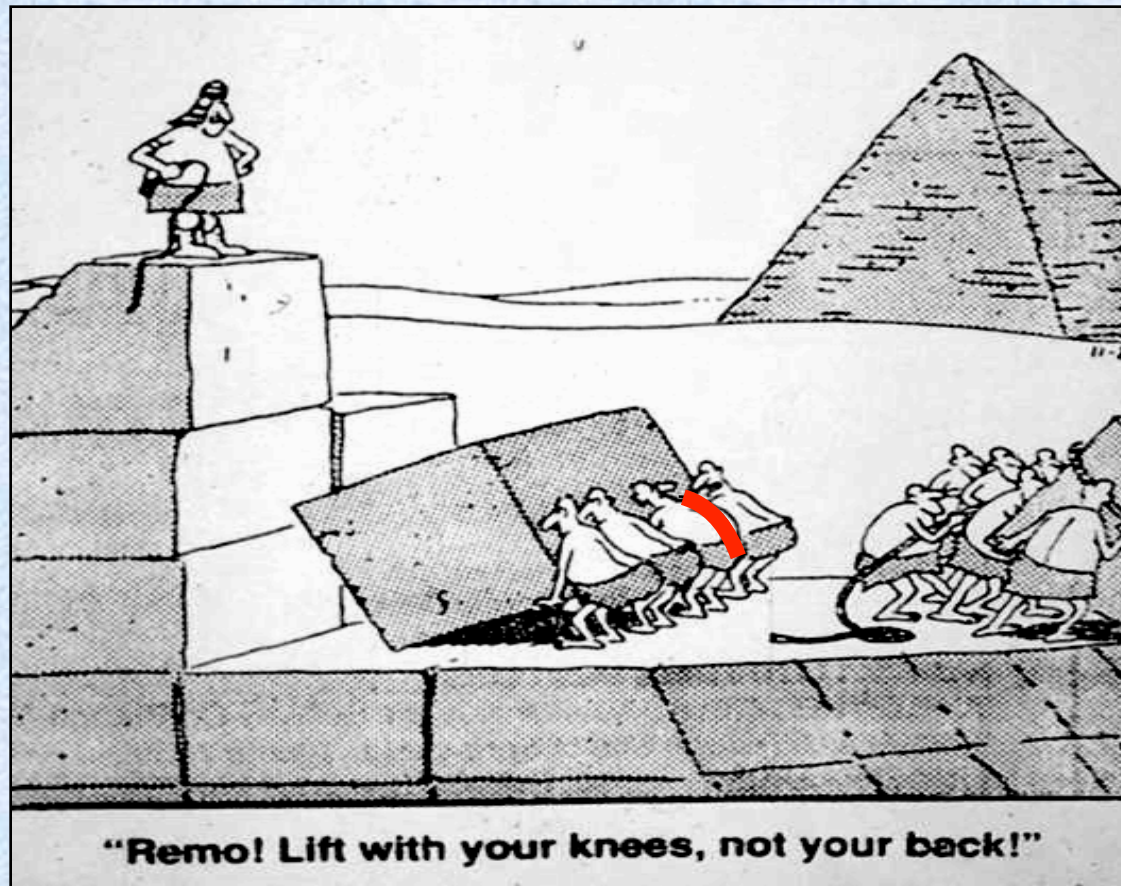


Work as it is really done

We should stop lecturing at people



# Training in 'Proper Lifting'





# Frank & Lillian Gilbreth

- Pioneers in ergonomics
- Frank and Lillian were parents of twelve children: *Cheaper by the Dozen*





Before the Gilbreths, operating rooms were chaotic, while the patient bled.



***“Nurse – scalpel!”***

# Pharmacy Workflow Redesign

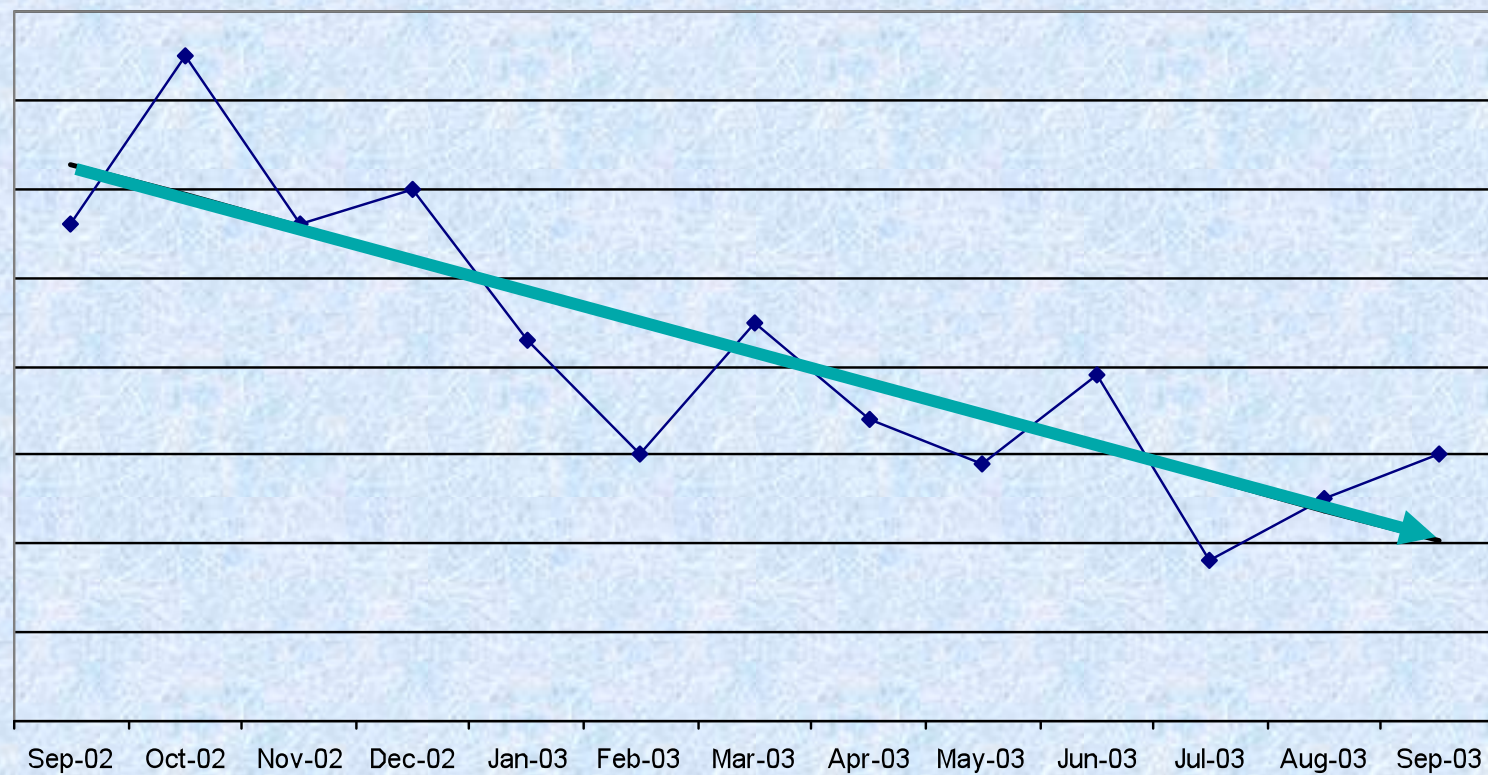






# Medication Errors

## Sept 02 – Sept 03

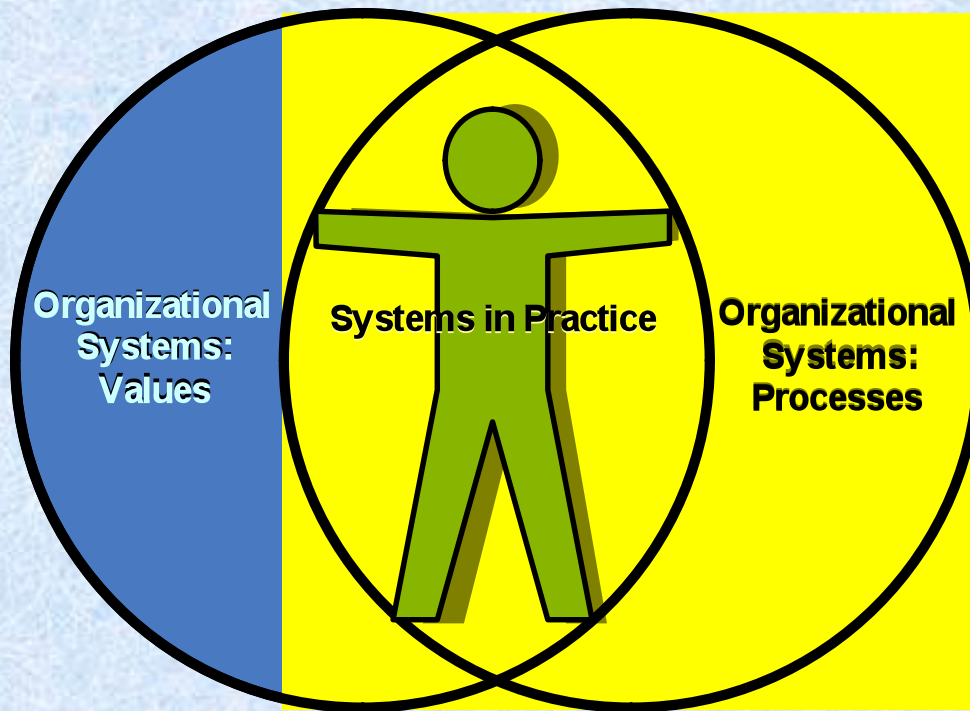




# HPI Objectives

- Management can create an environment where scientists, technicians, et al, can make good decisions by:
  - Recognizing the role of employee state of mind and human fallibility in performance.
  - Identifying how organizational systems can influence human behavior and how we can develop high-reliability organizations to positively influence human behavior.

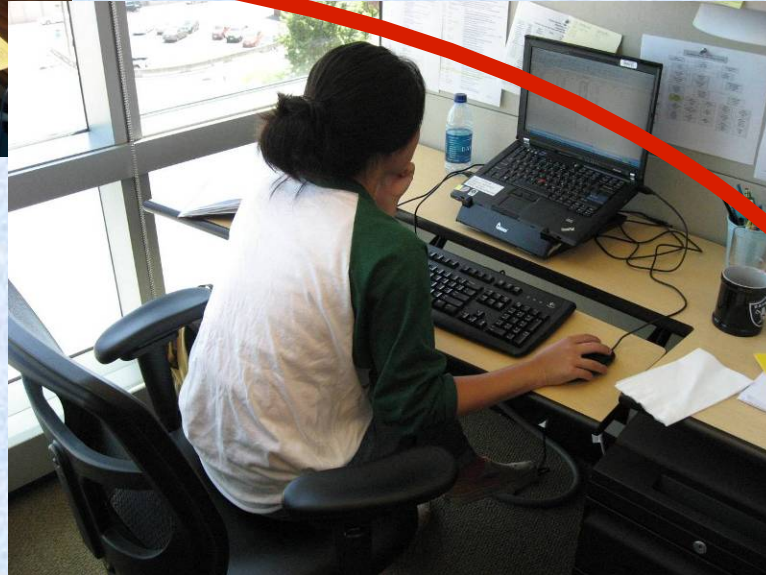
# Human ↔ Systems Interface



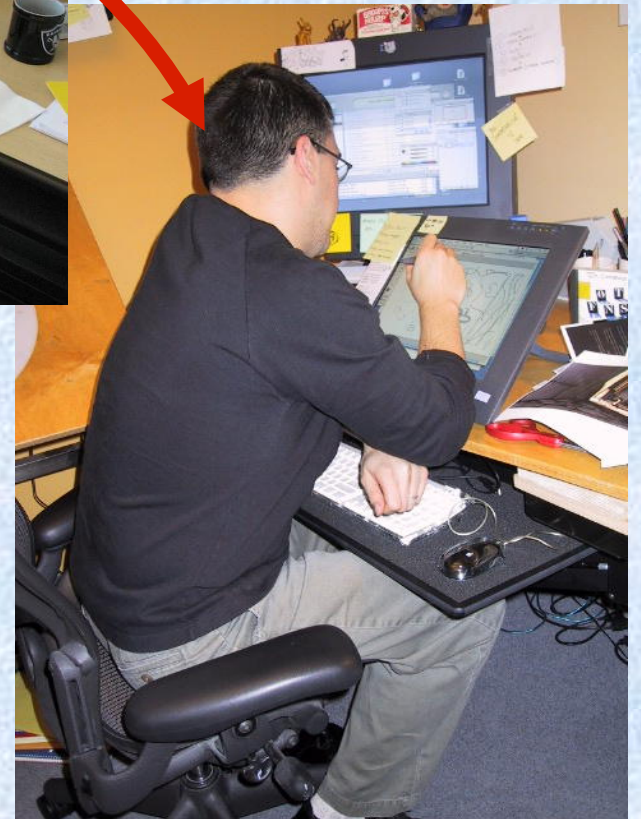
- People will never perform better than what the organization will allow.
- If a system relies on people doing the right thing every time, ***it will fail.***
- No working system remains in stasis.



Desktop

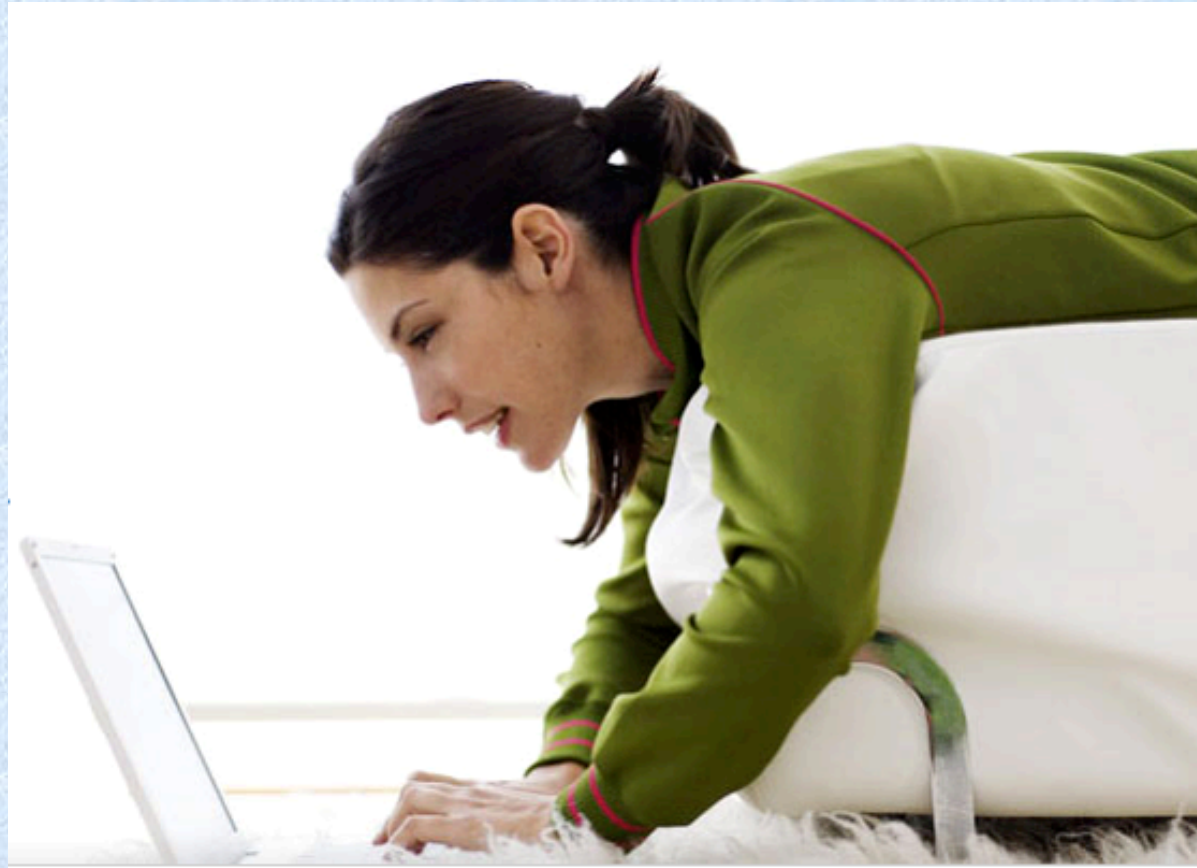


Notebook/Laptop



Tablet





# Types of Error

- **Active Errors** change equipment, system or processes that trigger immediate undesired consequences.
- **Latent Errors** result in undetected organization-related weaknesses or equipment flaws that lie dormant.

**Goal: Create error-tolerant systems**

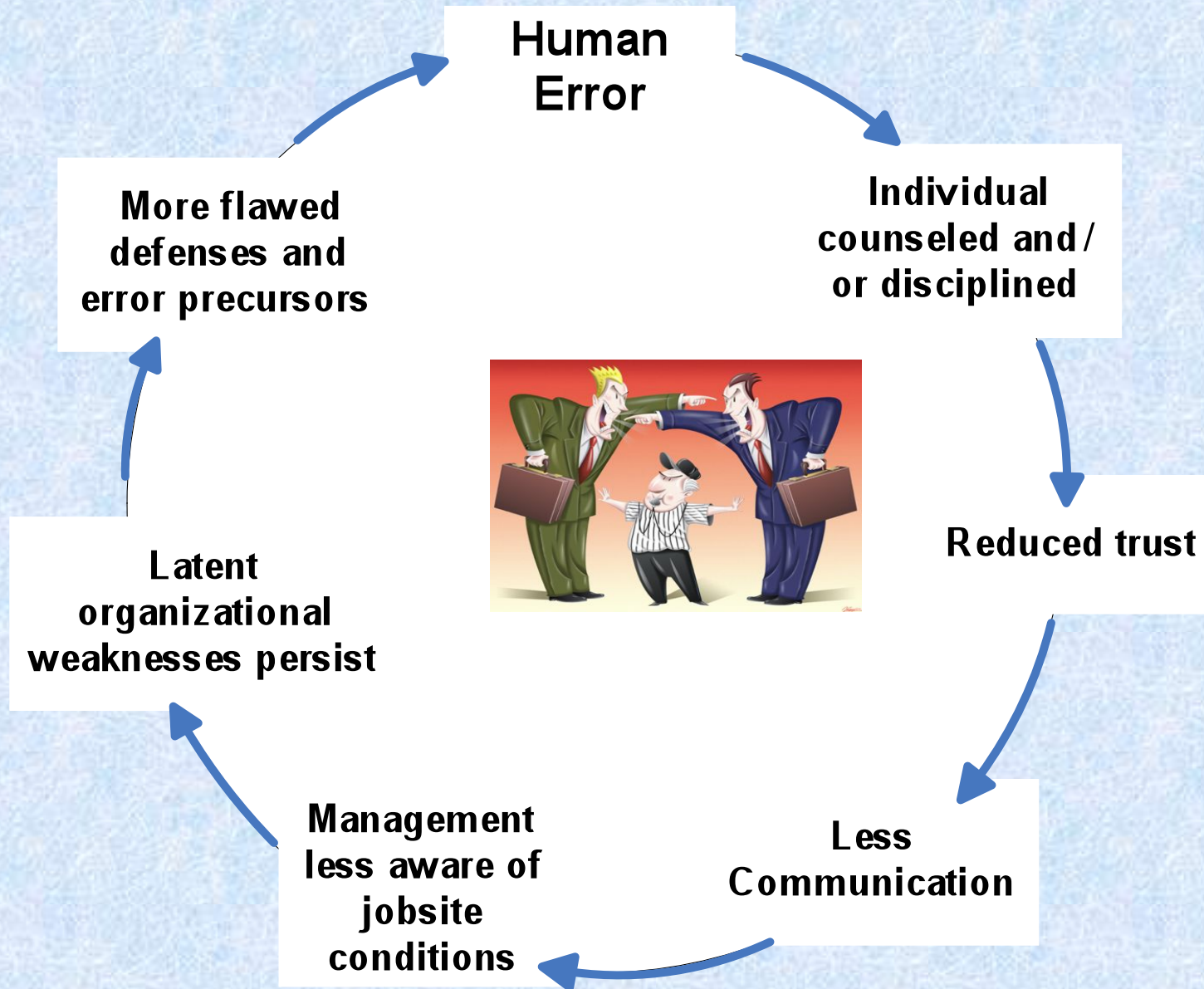
# Preventing the next “Accident”



"Figure out what happened to the last crew here, and tell the next crew not to do that."



# Blame Cycle



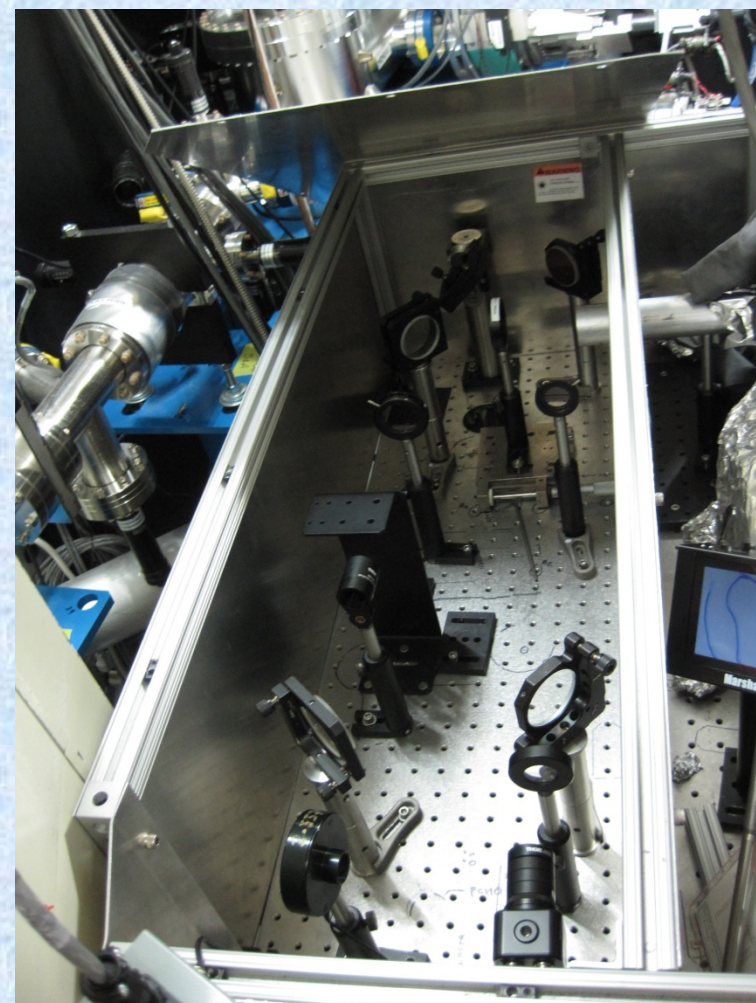


People will show you what they need...













**BP Texas City**

# **HPI: The New “Standard of Care”**

“Although errors and procedural deviations occurred during the startup, it is important to recognize that individuals do not plan to make mistakes. They are doing what makes sense to them at the time, given the work environment, the organization's goals, and other job-related factors.”

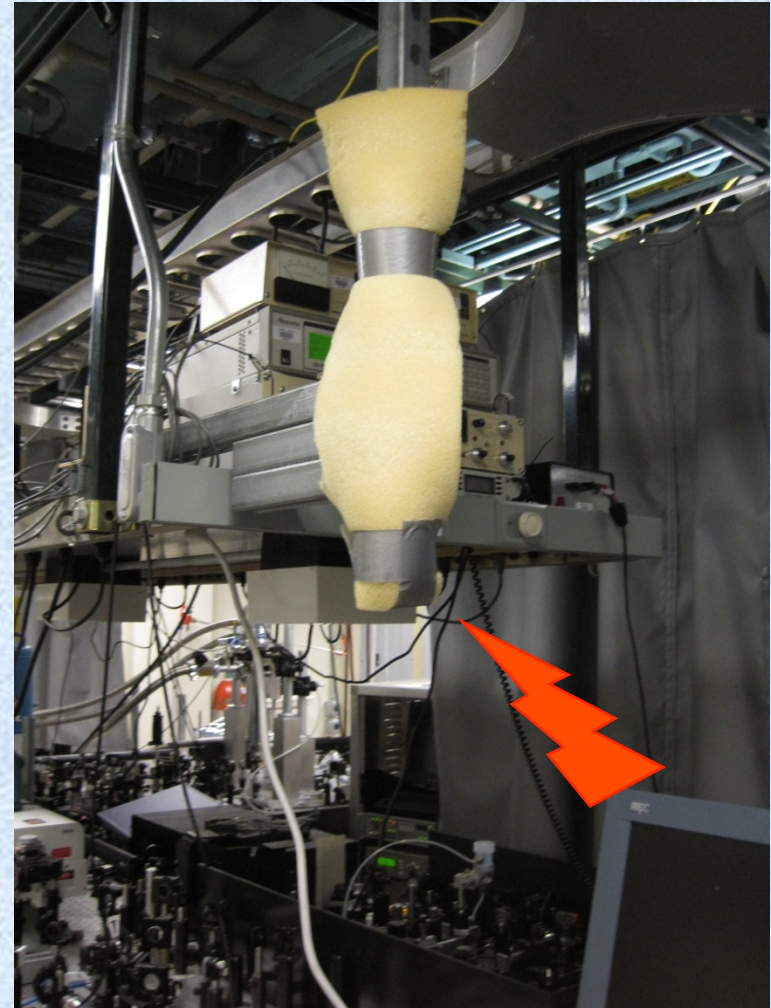
US CSB 3-20-2007

# High Performance Culture

- **Encourage Reporting:** Value errors and near hits as leading indicators.
- **Create a Just Work Environment:** Don't try to punish errors out of the system.
- **Flexibility:** Prepare workers to adapt effectively to changing demands.
- **Learning:** Create opportunities for observation, reflection and feedback.

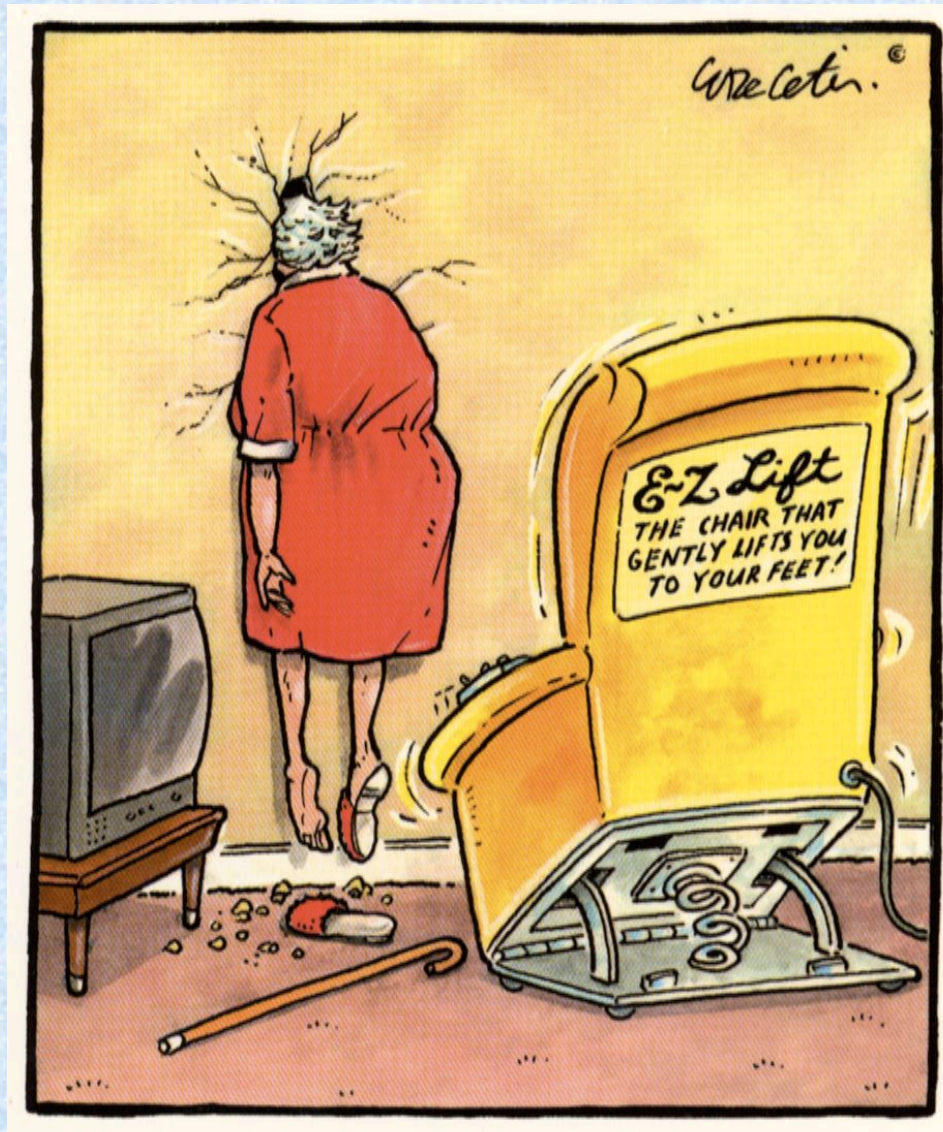


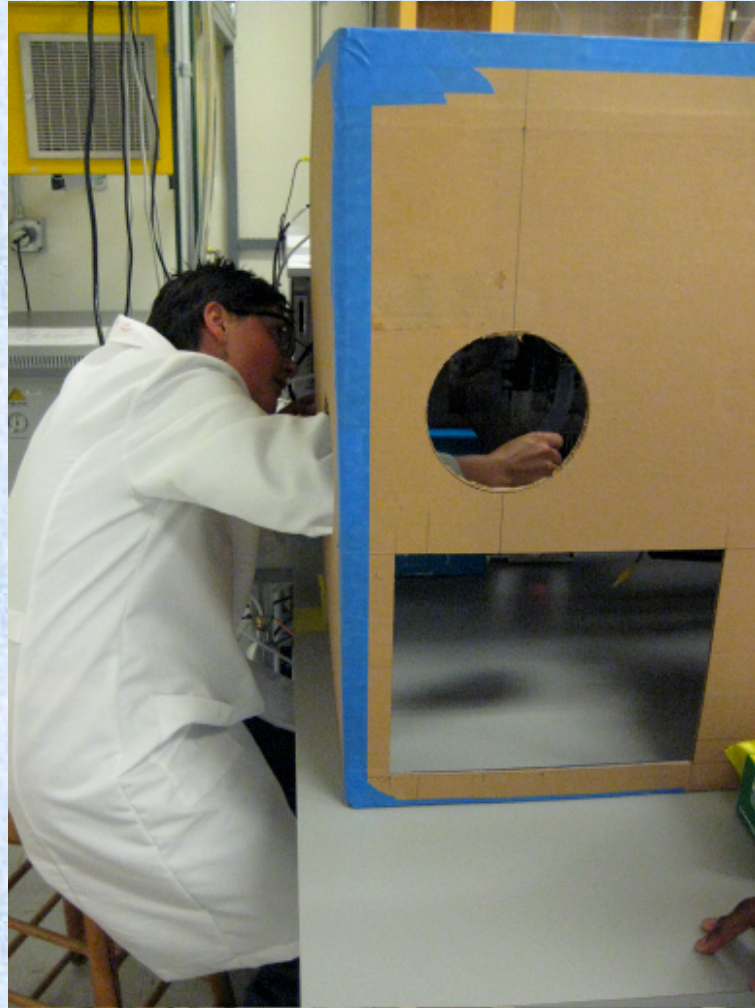
# Retrofits





Test-drive it first!!





- Create mock-ups to simulate proposed designs.
- Collaborate w/ users in analyzing & improving layout.



# The first milkshake



There must be a better way to do this!

# Thanks!!

***“Workplaces and organizations are easier to manage than the minds of individual workers. You cannot change the human condition, but you can change the conditions under which people work.”***

***— Dr. James Reason***