



# Human Performance Improvement Follow-up

Sam McKenzie

Chuck Ramsey

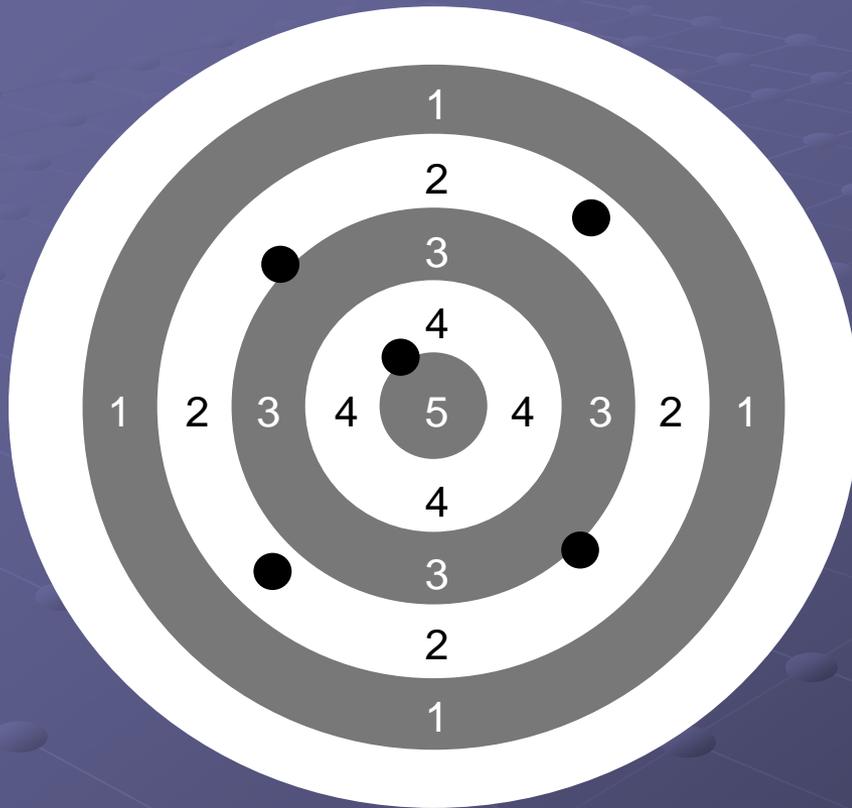
May 21, 2010

# *Purpose of HPI*

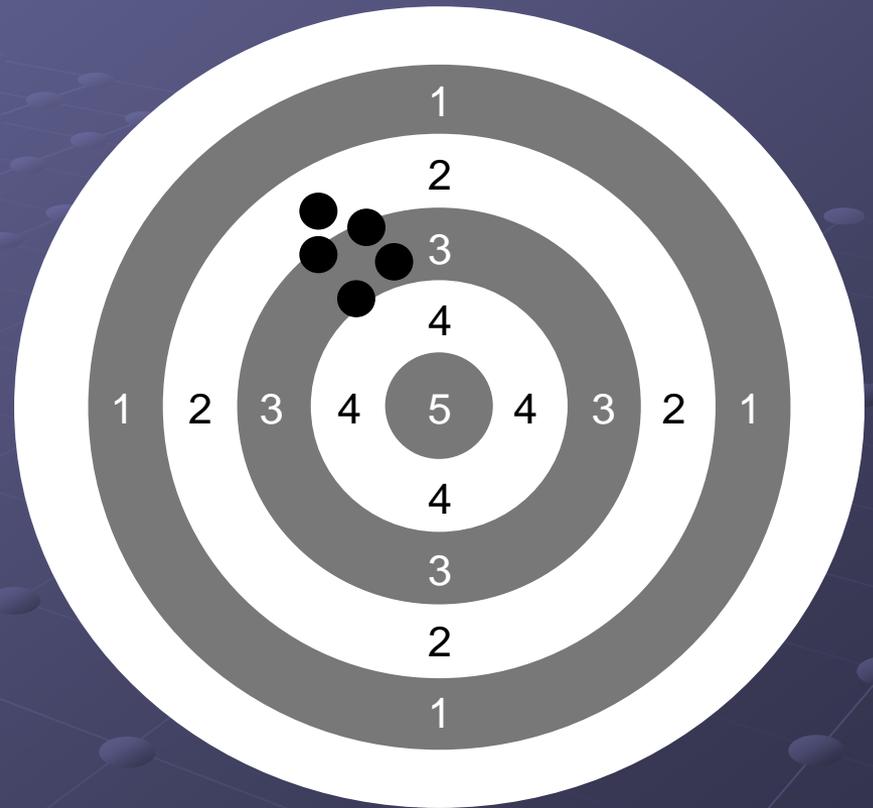


To minimize the  
frequency and  
severity of  
events

# Human Performance



**Target No.1**



**Target No.2**



# Two Kinds of Error

Active Error ←



→ Latent Error

(leading to latent conditions)

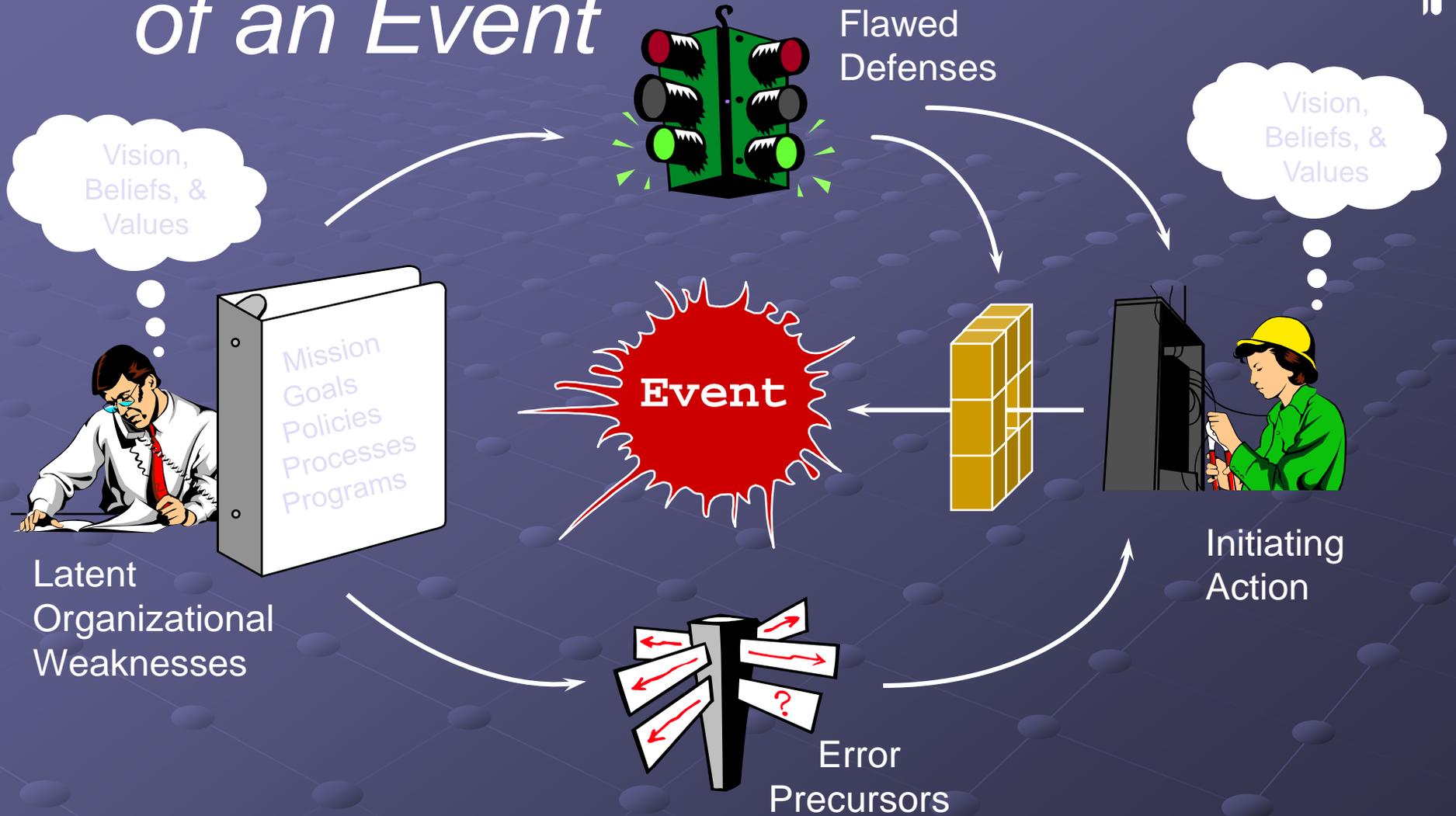
# Principles of Human Performance Management



- ❖ Humans are fallible . . .
- ❖ Error is predictable. . .
- ❖ Organization influences behavior.
- ❖ Behaviors are reinforced.
- ❖ Events are avoidable.



# Anatomy of an Event





# SNS Events

# Strategic Approach



1. Anticipate and prevent active error at the job-site.
2. Identify and eliminate latent organizational weaknesses.

# Traps of Human Nature



- ❖ Stress
- ❖ Avoidance of mental strain
- ❖ Inaccurate mental models
- ❖ Limited working memory
- ❖ Limited attention resources
- ❖ Mind set
- ❖ Difficulty seeing own errors
- ❖ Limited perspective
- ❖ Susceptible to emotion
- ❖ Focus on goal
- ❖ Fatigue



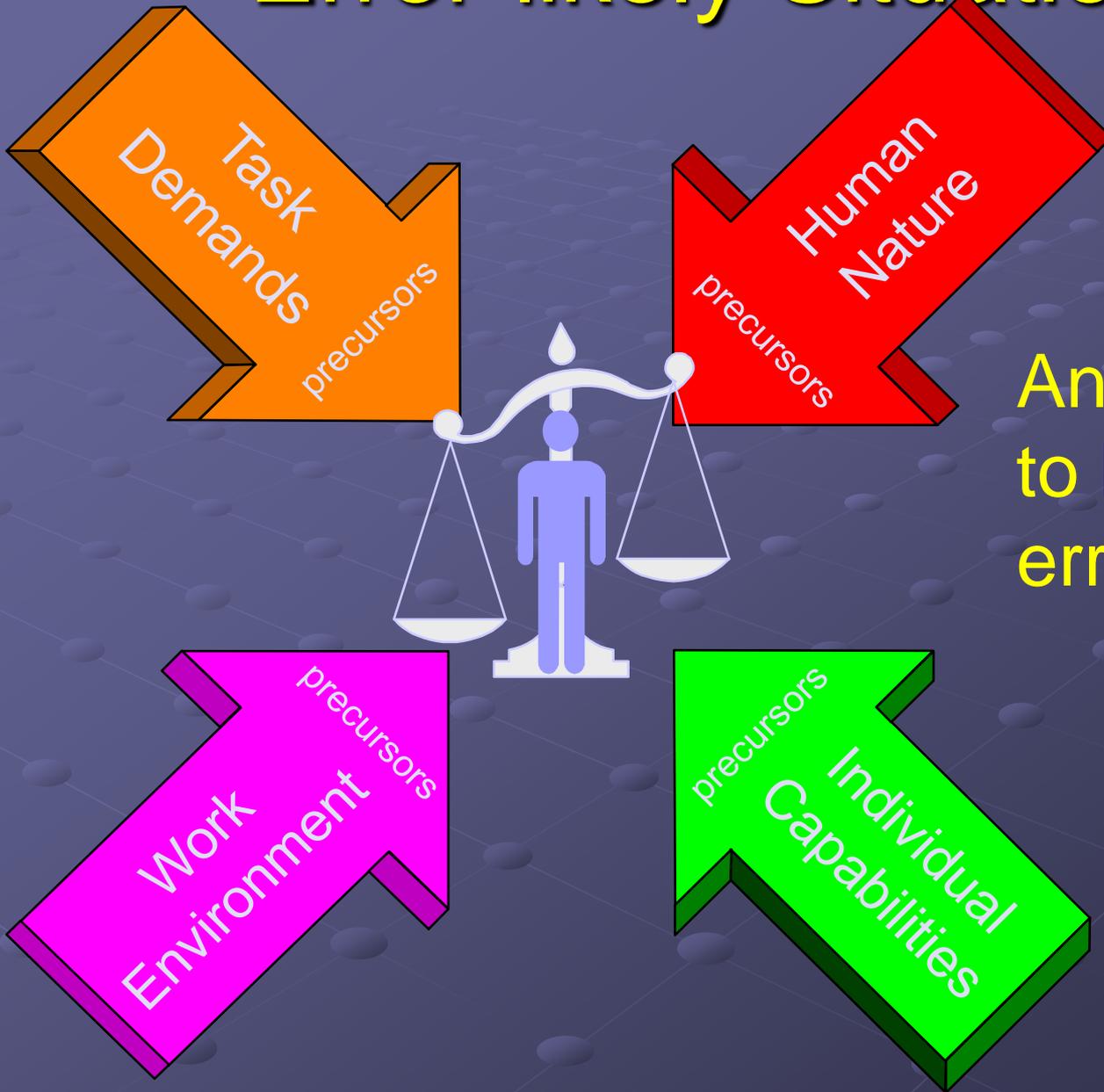
# Error Precursors



- ❖ Task Demands
- ❖ Work Environment
- ❖ Individual Capabilities
- ❖ Human Nature



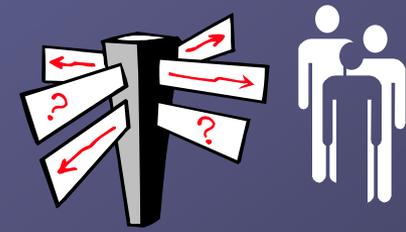
# Error-likely Situation



An error about to happen due to error precursors

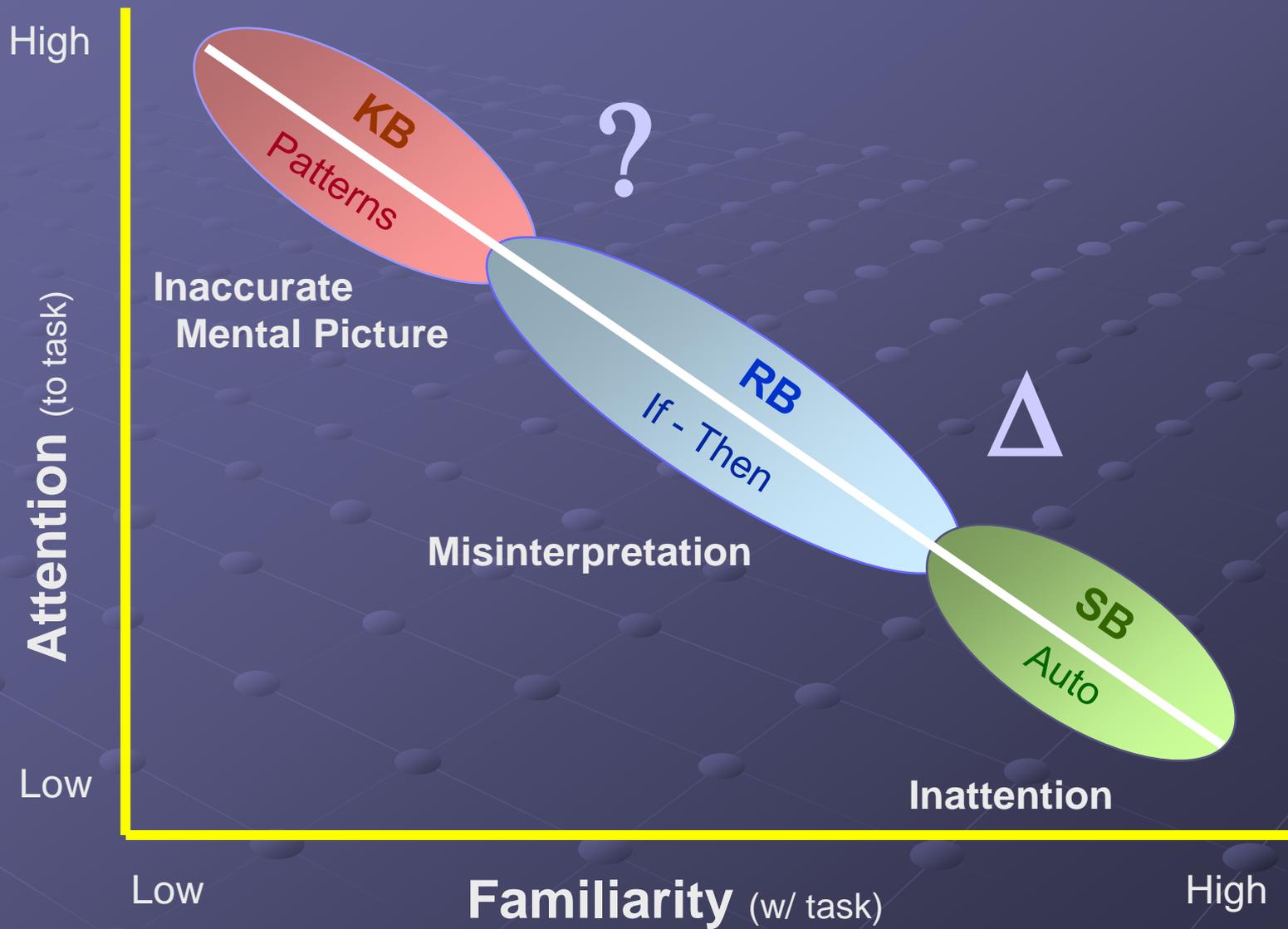
# Error Precursors

## short list



Task Demands	Individual Capabilities
<ul style="list-style-type: none"> <li>Time pressure (in a hurry)</li> </ul>	<ul style="list-style-type: none"> <li>Unfamiliarity w/ task / First time</li> </ul>
<ul style="list-style-type: none"> <li>High Workload (memory requirements)</li> </ul>	<ul style="list-style-type: none"> <li>Lack of knowledge (mental model)</li> </ul>
<ul style="list-style-type: none"> <li>Simultaneous, multiple tasks</li> </ul>	<ul style="list-style-type: none"> <li>New technique not used before</li> </ul>
<ul style="list-style-type: none"> <li>Repetitive actions, monotonous</li> </ul>	<ul style="list-style-type: none"> <li>Imprecise communication habits</li> </ul>
<ul style="list-style-type: none"> <li>Irrecoverable acts</li> </ul>	<ul style="list-style-type: none"> <li>Lack of proficiency / Inexperience</li> </ul>
<ul style="list-style-type: none"> <li>Interpretation requirements</li> </ul>	<ul style="list-style-type: none"> <li>Indistinct problem-solving skills</li> </ul>
<ul style="list-style-type: none"> <li>Unclear goals, roles, &amp; responsibilities</li> </ul>	<ul style="list-style-type: none"> <li>“Unsafe” attitude for critical task</li> </ul>
<ul style="list-style-type: none"> <li>Lack of or unclear standards</li> </ul>	<ul style="list-style-type: none"> <li>Illness / Fatigue</li> </ul>
Work Environment	Human Nature
<ul style="list-style-type: none"> <li>Distractions / Interruptions</li> </ul>	<ul style="list-style-type: none"> <li>Stress (limits attention)</li> </ul>
<ul style="list-style-type: none"> <li>Changes / Departures from routine</li> </ul>	<ul style="list-style-type: none"> <li>Habit patterns</li> </ul>
<ul style="list-style-type: none"> <li>Confusing displays or controls</li> </ul>	<ul style="list-style-type: none"> <li>Assumptions (inaccurate mental picture)</li> </ul>
<ul style="list-style-type: none"> <li>Workarounds / OOS instruments</li> </ul>	<ul style="list-style-type: none"> <li>Complacency / Overconfidence</li> </ul>
<ul style="list-style-type: none"> <li>Hidden system response</li> </ul>	<ul style="list-style-type: none"> <li>Mindset (“tuned” to see)</li> </ul>
<ul style="list-style-type: none"> <li>Unexpected equipment conditions</li> </ul>	<ul style="list-style-type: none"> <li>Inaccurate risk perception (Pollyanna)</li> </ul>
<ul style="list-style-type: none"> <li>Lack of alternative indication</li> </ul>	<ul style="list-style-type: none"> <li>Mental shortcuts (biases)</li> </ul>
<ul style="list-style-type: none"> <li>Personality conflicts</li> </ul>	<ul style="list-style-type: none"> <li>Limited short-term memory</li> </ul>

# Performance Modes



# Error-reduction Techniques

@ jobsite



- ✓ Conservative decision-making
- ✓ Change management
- ✓ Three-way communication
- ✓ Concurrent verification
- ✓ Independent verification
- ✓ Meetings
- ✓ Peer-checking
- ✓ Placekeeping
- ✓ Prejob Briefing
- ✓ Problem-solving
- ✓ Procedure use & adherence
- ✓ Questioning attitude
- ✓ Self-checking
- ✓ Stop & collaborate
- ✓ Two minute walkdown

# Team Errors



- ❖ Social Loafing
- ❖ Halo Effect
- ❖ Pilot / Co-pilot
- ❖ Free Riding
- ❖ Groupthink
- ❖ Risky Shift





# GroupThink

<http://www.youtube.com/watch?v=T-t0OwWc0Qw&feature=related>

# Breaking The Human Performance Paradigm



Minimum frequency and severity of plant events, with high safety margins and reliability and no fuel-damaging events.

***Re*** + ***Md*** → ***∅E***

*[reducing error*

*AND*

*managing defenses*

*leads to*

*zero events]*

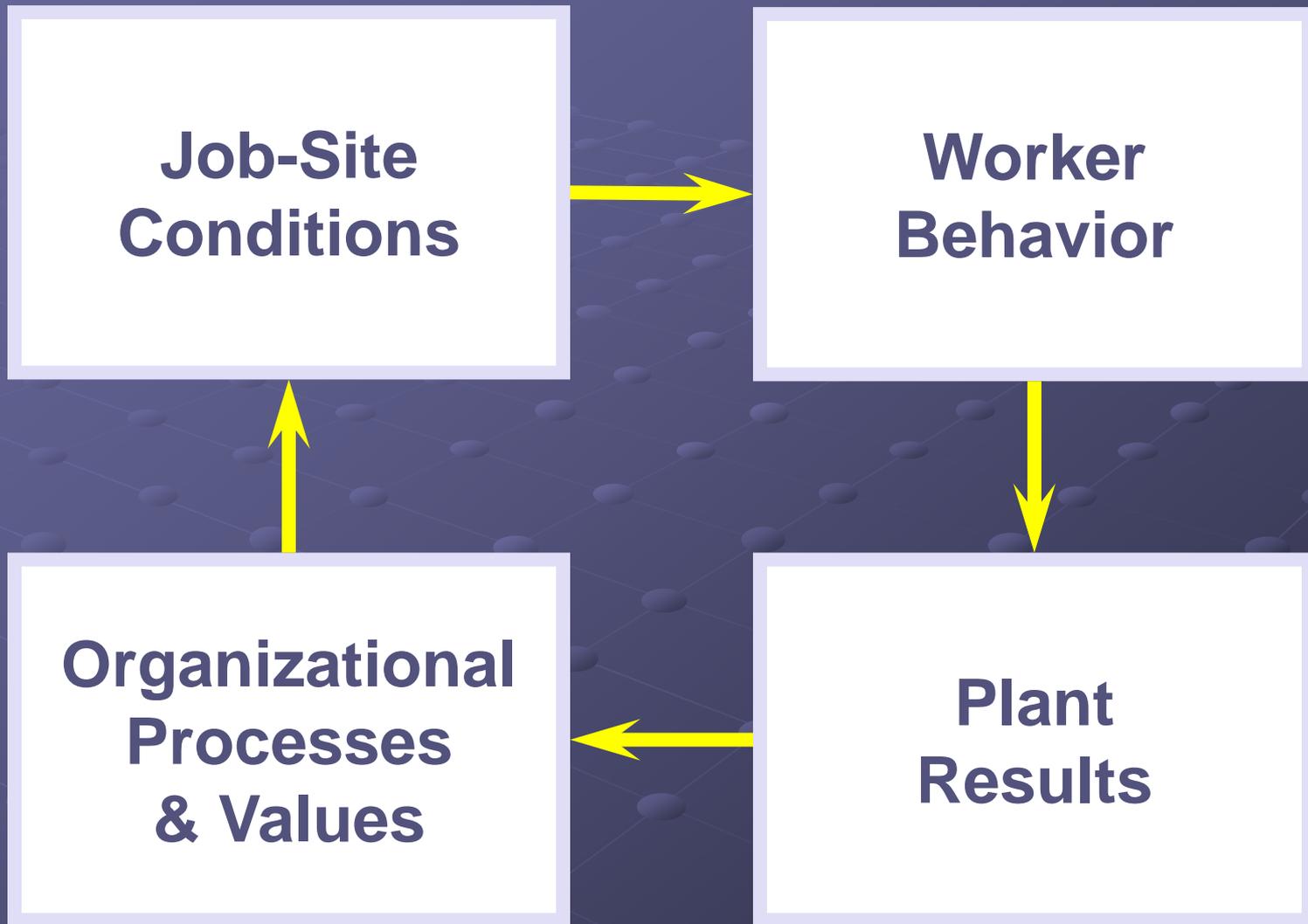
*[Aka: Individual*

*+*

*Organization & Processes >>>>*

*Performance Improvement]*

# The Performance Model





# Dual Purposes

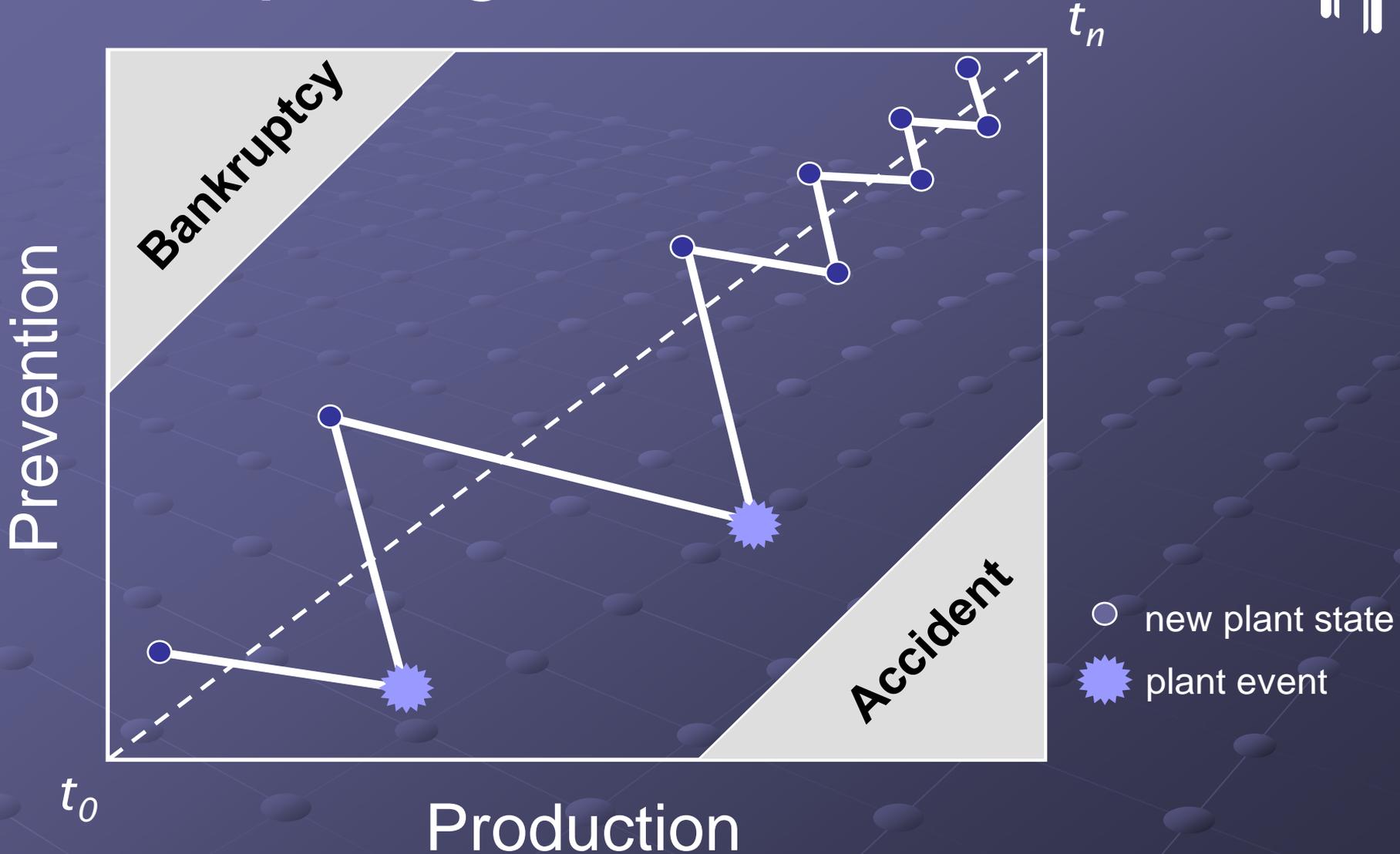


To consistently search for and eliminate conditions that provoke human error while reinforcing defenses.

To facilitate the accomplishment of the organization's mission in accordance with its norms, values, and strategies.



# Competing Resources



Source: James Reason. *Managing the Risks of Organizational Accidents*, 1997 (in press).

# Defense -in- Depth





# Latent Organizational Weaknesses (sources)



## Processes (structure)

- ❖ Work control
- ❖ Training
- ❖ Accountability policy
- ❖ Reviews & approvals
- ❖ Equipment design
- ❖ Procedure development
- ❖ Human resources

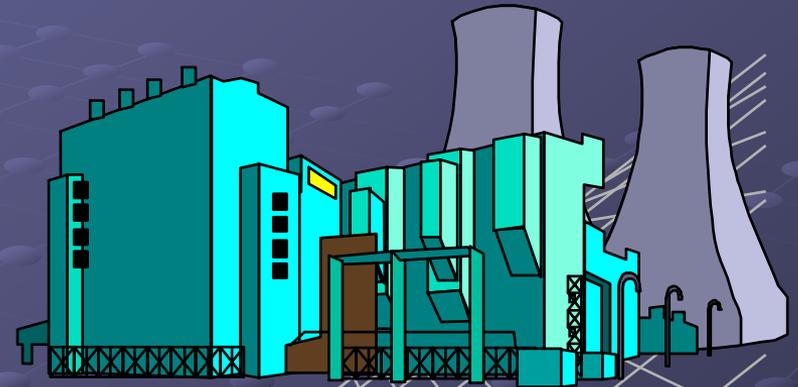
## Values (relationships)

- ❖ Priorities
- ❖ Measures & controls
- ❖ Critical incidents
- ❖ Coaching & teamwork
- ❖ Rewards & sanctions
- ❖ Reinforcement
- ❖ Promotions & terminations

# Finding Latent Organizational Weaknesses



- ❖ Self-Assessments
- ❖ Benchmarking
- ❖ Post-job Critiques
- ❖ Trending
- ❖ Surveys and Questionnaires
- ❖ Observations
- ❖ Root Cause Analysis



# Leadership Practices



1. *Facilitate open communication*
2. *Promote teamwork*
3. *Reinforce desired behaviors*
4. *Eliminate latent organizational weaknesses*
5. *Value prevention of errors*

# Reinforcement



## *Consequences that Increase Behavior*

1. GET SOMETHING YOU WANT
2. AVOID SOMETHING YOU DON'T WANT

**BEHAVIOR  
INCREASES**

**Behavior**

1. GET SOMETHING YOU DON'T WANT
2. LOSE SOMETHING THAT YOU HAVE

**BEHAVIOR  
DECREASES**

## *Consequences that Decrease Behavior*

# Task Preview



# Post-Job Critique



1. Purpose: Organizational improvement (OE)
2. Quick and easy
3. Production and Prevention
4. Management acknowledgement
5. Follow-through



<http://sharepoint.ornl.gov/safety/hpi/HPI%20Video/Forms/AllItems.aspx>



Human  
Error

More flawed defenses  
& error precursors

Individual counseled  
and/or disciplined

# *Blame Cycle*

Latent organizational  
weaknesses persist

Reduced trust

Management less  
aware of jobsite  
conditions

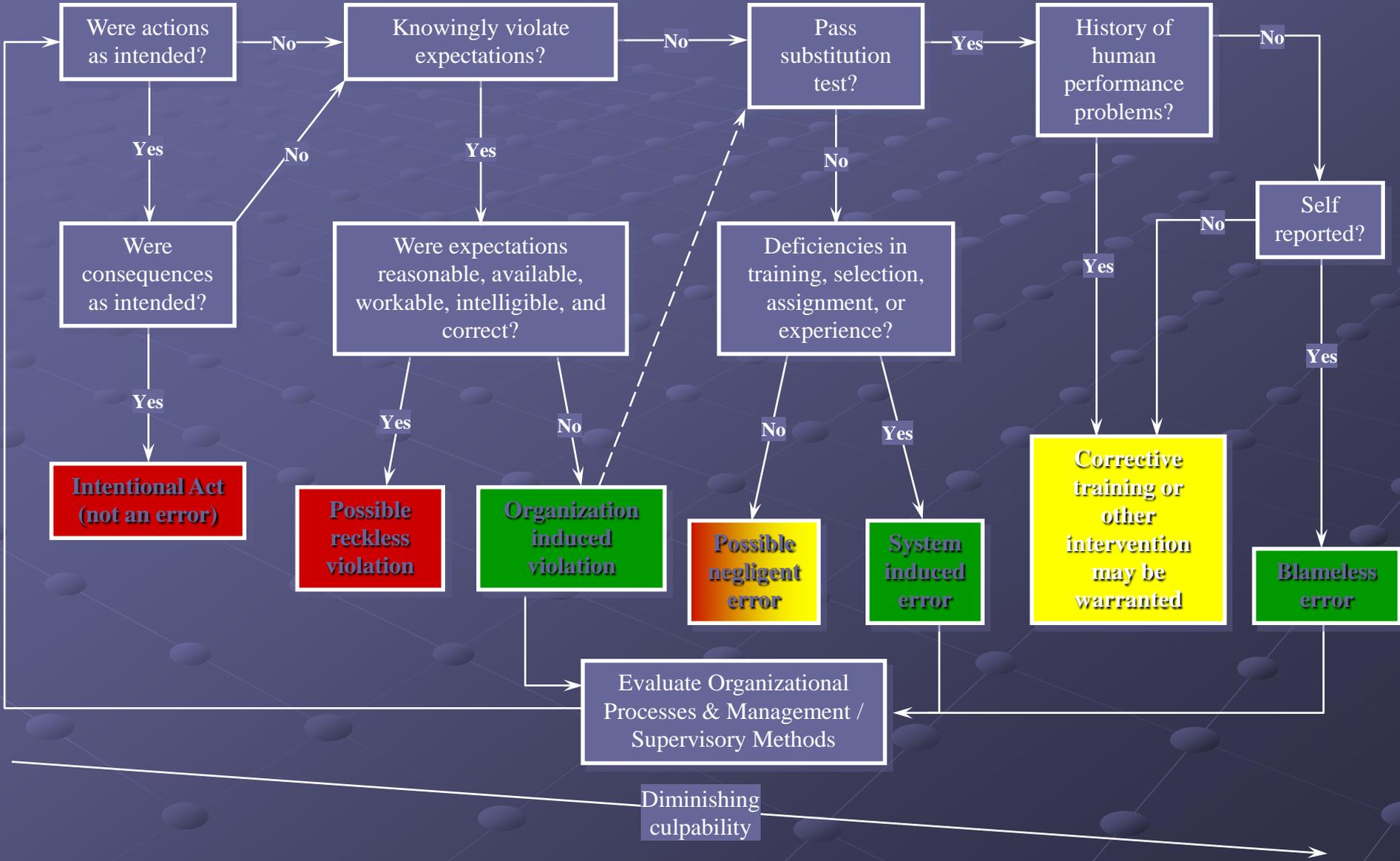
Less  
communication

Source: Reason, *Managing the Risks of  
Organizational Accidents*, pp.127-129.



# Culpability Evaluation Flowchart

- Discipline required
- Accountability PR&D
- Process Issue





Tunnel Fire

HVCM  
Explosions/Fires

CMS Hydrogen  
Release(s)

Rad Posting  
Violations



Root  
Cause

Changes

Root  
Cause

Root  
Cause

Root  
Cause

Assumptions

Habit Patterns

Interpretation

Time Pressure

Unclear Goals

Stress

# Error Precursors

New Technique

Workarounds

Simultaneous

Hidden System Response

Hazardous Attitude

Complacency

Repetitive Actions

## Organizational Weaknesses

# Implementing a “Program”



1. Senior Management Commitment
2. Steering Committee
3. Self-assessment
4. Strategy
5. Communicate and Empower
6. Implement
7. Evaluate
8. Maintain

