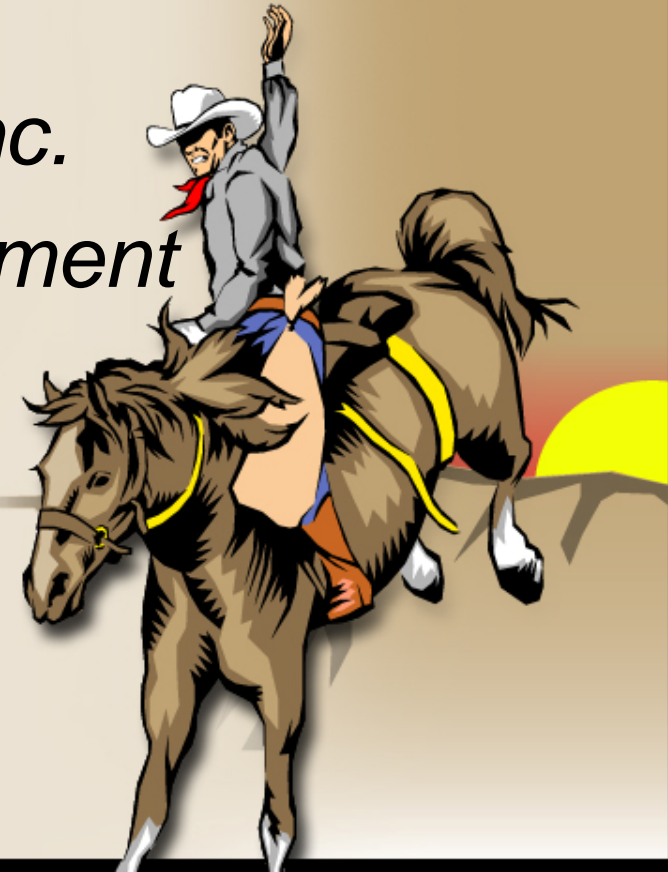


# Predicting Human Behavior During Emergencies

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*T. Shane Bush, BushCo, Inc.*  
*Human Performance Improvement*



# About Performance

- Performance represents an outcome, a result, or an accomplishment. Good or bad, a result is still a result!
- Performance is something that is measurable (at least in some manner).



# A WHOLE NEW MIND

*Moving from the  
Information Age to the  
Conceptual Age*



"Why right-brainers  
will rule the future."  
—*Wired*

**DANIEL H. PINK**

*author of Free Agent Nation*

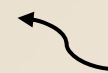
## A Simple Model

Performance *outcome*  $Y$  is a  
function of *factors*  $X$ .

Performance  
Outcome



$$Y = f(x)$$



Factors Affecting  
Outcome  $Y$



# EMERGENCY MANAGEMENT ROUNDUP

EXPECT THE UNEXPECTED

$$Y = f(x_1, x_2, x_3, x_4, x_5, \dots, x_n)$$

Little or no effect on y

Positive effect on y

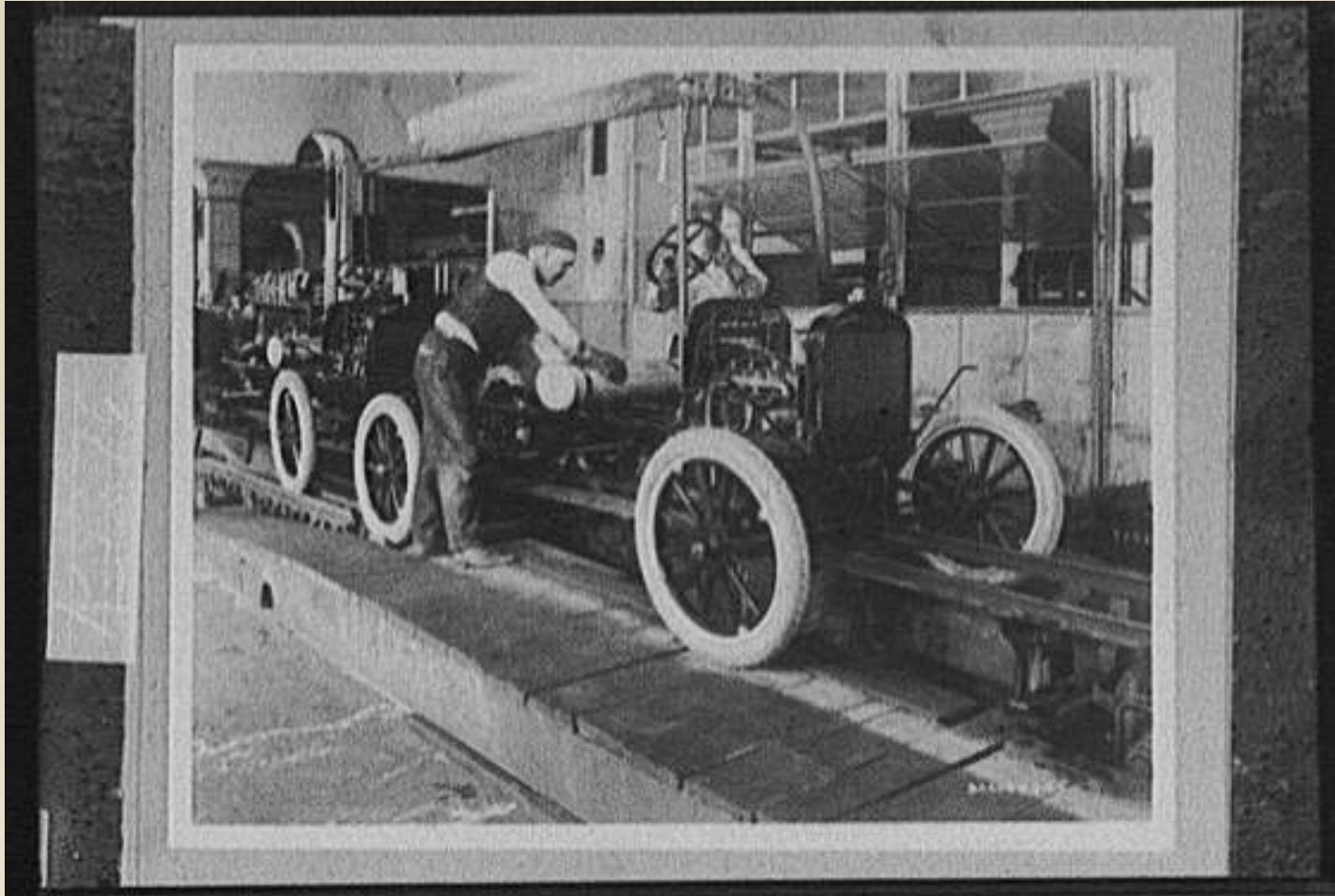
Negative effect on y

The real challenge is to identify those factors that do and don't drive performance.

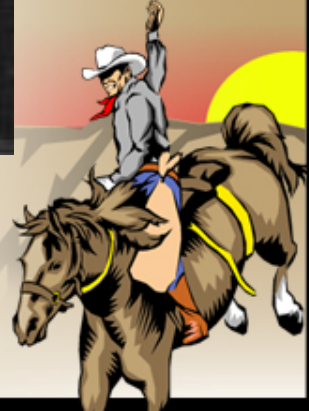


# Are People a Critical X?

EXPECT THE UNEXPECTED



Used by permission of  
Dr. Jerry Harbour

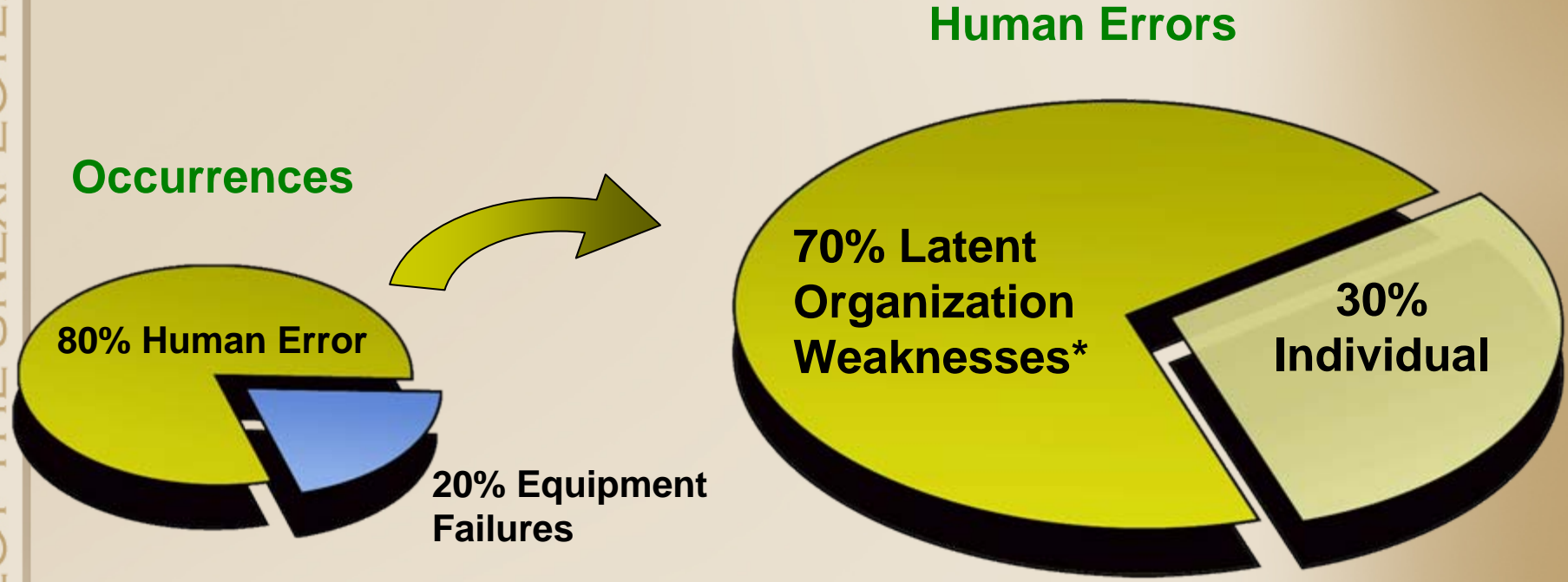


# The Challenge: Identifying what factors affect people performance



# EMERGENCY MANAGEMENT ROUNDUP

EXPECT THE UNEXPECTED



\* Latent Organization Weakness – Hidden deficiencies in management control process or values creating workplace conditions that can provoke an error and/or degrade the integrity of defenses





EXPECT THE UNEXPECTED

## Safety and the Role of Organizational Culture



**Space shuttle Columbia,  
re-entering Earth's  
atmosphere at 10,000  
mph, disintegrates.**

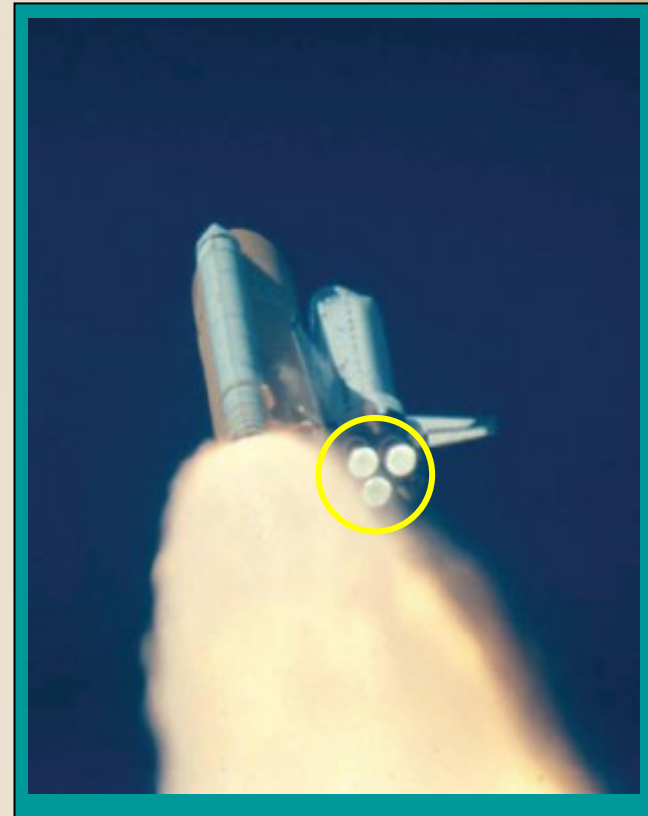
- All 7 astronauts are killed.
- \$4 billion spacecraft is destroyed.
- Debris scattered over 2000 sq-miles of Texas.
- NASA grounds shuttle fleet for 2-1/2 years.



- NASA had received painful lessons about its culture from the Challenger incident
- CAIB found disturbing parallels remaining at the time of the Columbia incident...

**“In our view, the NASA organizational culture had as much to do with this accident as the foam.”**

*CAIB Report, Vol. 1, p. 97*



# Columbia Key Issues

- With little corroboration, management had become convinced that a foam strike was not, and could not be, a concern.
- Why were serious concerns about the integrity of the shuttle, raised by experts within one day after the launch, not acted upon in the two weeks prior to return?
- Why had NASA not learned from the lessons of Challenger?



# Key Organizational Culture Findings

## – What NASA Did Not Do

- 1. Maintain Sense Of Vulnerability**
- 2. Combat Normalization Of Deviance**
- 3. Establish an Imperative for Safety**
- 4. Perform Valid/Timely Hazard/Risk Assessments**
- 5. Ensure Open and Frank Communications**
- 6. Learn and Advance the Culture**



## Learn and Advance the Culture

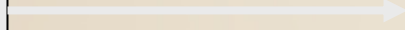
- NASA had not learned from the Challenger incident.
- Communications problems still existed.
  - Experts with divergent opinions still had difficulty getting heard.
- Normalization of deviance was still occurring.
- Schedules often still dominated over safety concerns.
- Hazard/risk assessments were still shallow.
- Abnormal events were not studied in sufficient detail or trended to maximize learning.



# Factors Shaping Managerial Behavior

EXPECT THE UNEXPECTED

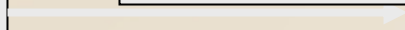
**Corporate Culture**



**Formal Structure, Systems, Plans, & Policies**



**Leadership – Efforts to articulate and implement an org's vision/strategy**




**Competitive & Regulatory Environment**



**The Behavior of an Organization's Management**





Bottom Line: Culture stuff  
matters.



## *Principles of Human Performance*

1. People are fallible, and even the best make mistakes
2. Error-likely situations are predictable, manageable, and preventable
3. **Individual behavior is influenced by organizational processes and values**
4. People achieve high levels of performance based largely on the encouragement and reinforcement received from leaders, peers, and subordinates
5. Events can be avoided by understanding the reasons mistakes occur and applying the lessons learned from past events

INPO



# Limitations of Human Nature

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

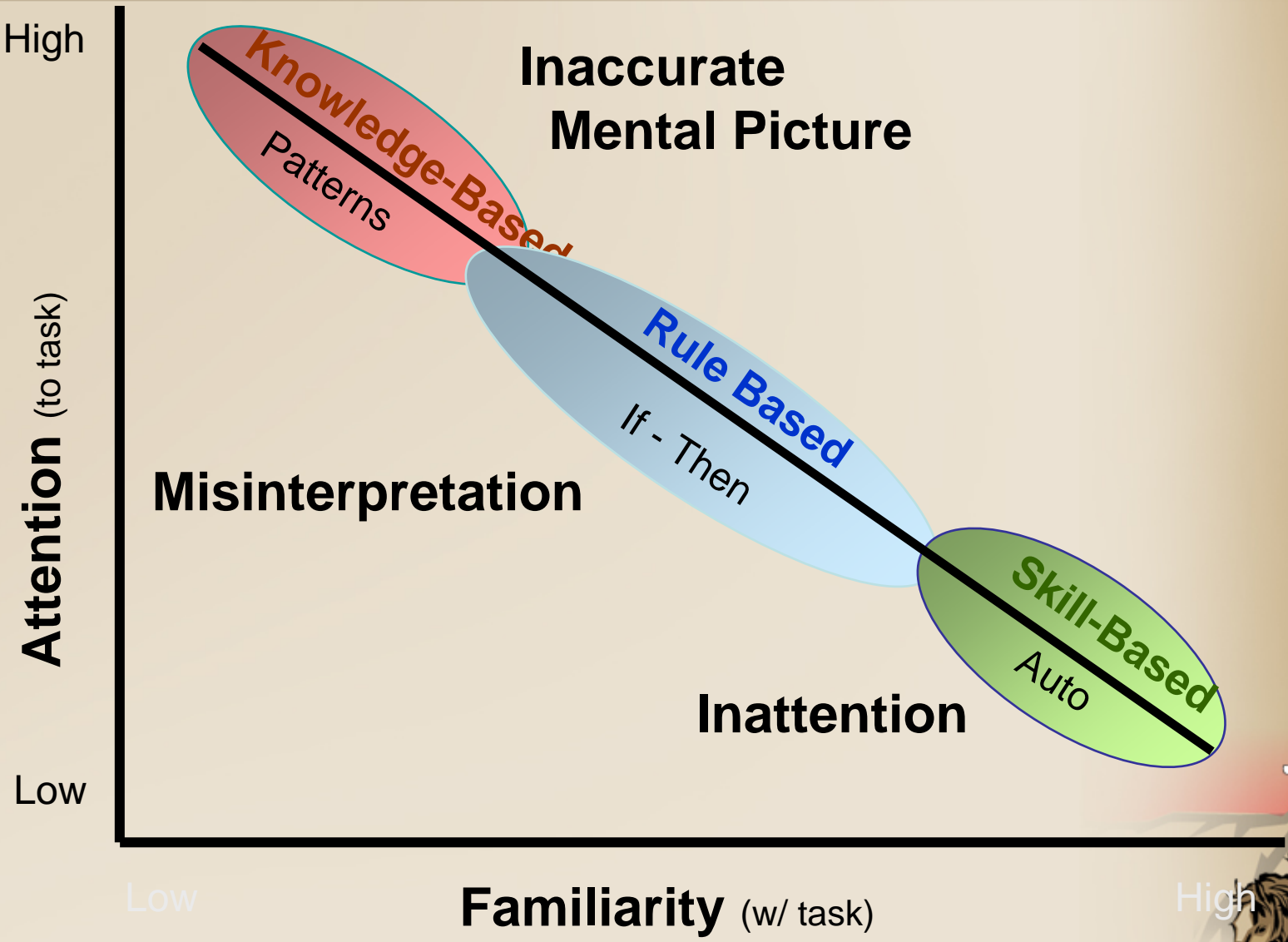


**Finished Files are the Result of  
Years of Scientific Study Combined  
With the Experience of Many Years.**



# Performance Modes--Attending Problems

EXPECT THE UNEXPECTED



Source: James Reason. *Managing the Risks of Organizational Accidents*, 1998.

# Patterns of Failure

EXPECT THE UNEXPECTED

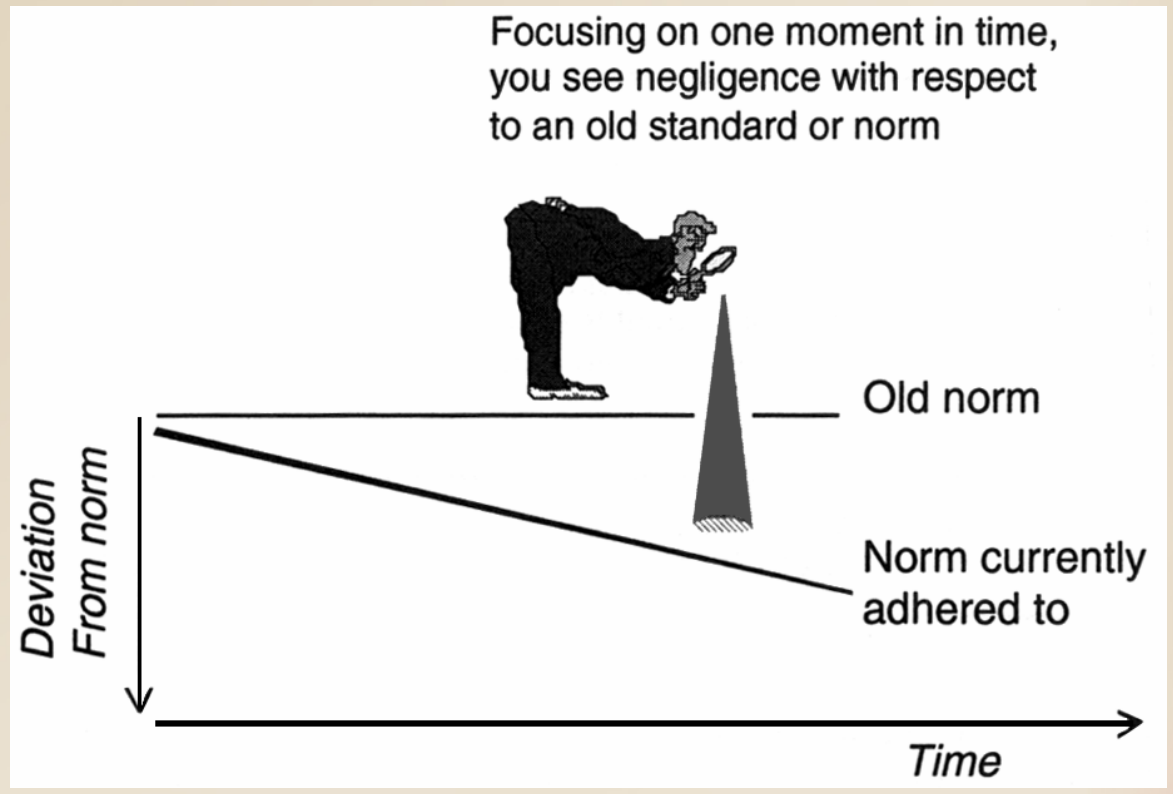


Illustration from: *The Field Guide to Human Error Investigations*



# Human Performance Tools

- Critical Steps
- Enhanced Pre-Job Briefing
- Peer Check
- Self Check
- Independent Verification
- Error Traps
- Just Culture
- Effective Communication
- Questioning Attitude
- Feeling of Uneasiness
- Enhanced Turnover
- 3 way communication
- Error Precursors
- Performance/Error Modes
- Devils Advocate
- Place keeping
- Poka Yoke
- SAFE Dialogue
- Discovery Clock
- STAR
- Training

EXPECT THE UNEXPECTED



## Human Error

To err or not to err is **NOT** the question -- we will err!

*People do not operate in a vacuum, where they can decide and act all-powerfully.*

*To err or not to err is not a choice.*

*Instead, people's work is subject to and constrained by multiple factors.*

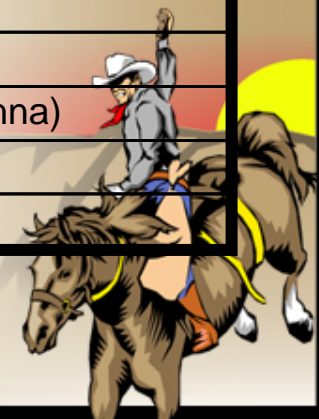
-- Sidney Dekker



# Error Precursors -- Short List

EXPECT THE UNEXPECTED

<b>Task Demands</b>	<b>Individual Capabilities</b>
• Time pressure (in a hurry)	• Unfamiliarity w/ task / First time
• High Workload (memory requirements)	• Lack of knowledge (mental model)
• Simultaneous, multiple tasks	• New technique not used before
• Repetitive actions, monotonous	• Imprecise communication habits
• Irrecoverable acts	• Lack of proficiency / Inexperience
• Interpretation requirements	• Indistinct problem-solving skills
• Unclear goals, roles, & responsibilities	• "Hazardous" attitude for critical task
• Lack of or unclear standards	• Illness / Fatigue
<b>Work Environment</b>	<b>Human Nature</b>
• Distractions / Interruptions	• Stress (limits attention)
• Changes / Departures from routine	• Habit patterns
• Confusing displays or controls	• Assumptions (inaccurate mental picture)
• Workarounds / OOS instruments	• Complacency / Overconfidence
• Hidden system response	• Mindset ("tuned" to see)
• Unexpected equipment conditions	• Inaccurate risk perception (Pollyanna)
• Lack of alternative indication	• Mental shortcuts (biases)
• Personality conflicts	• Limited short-term memory

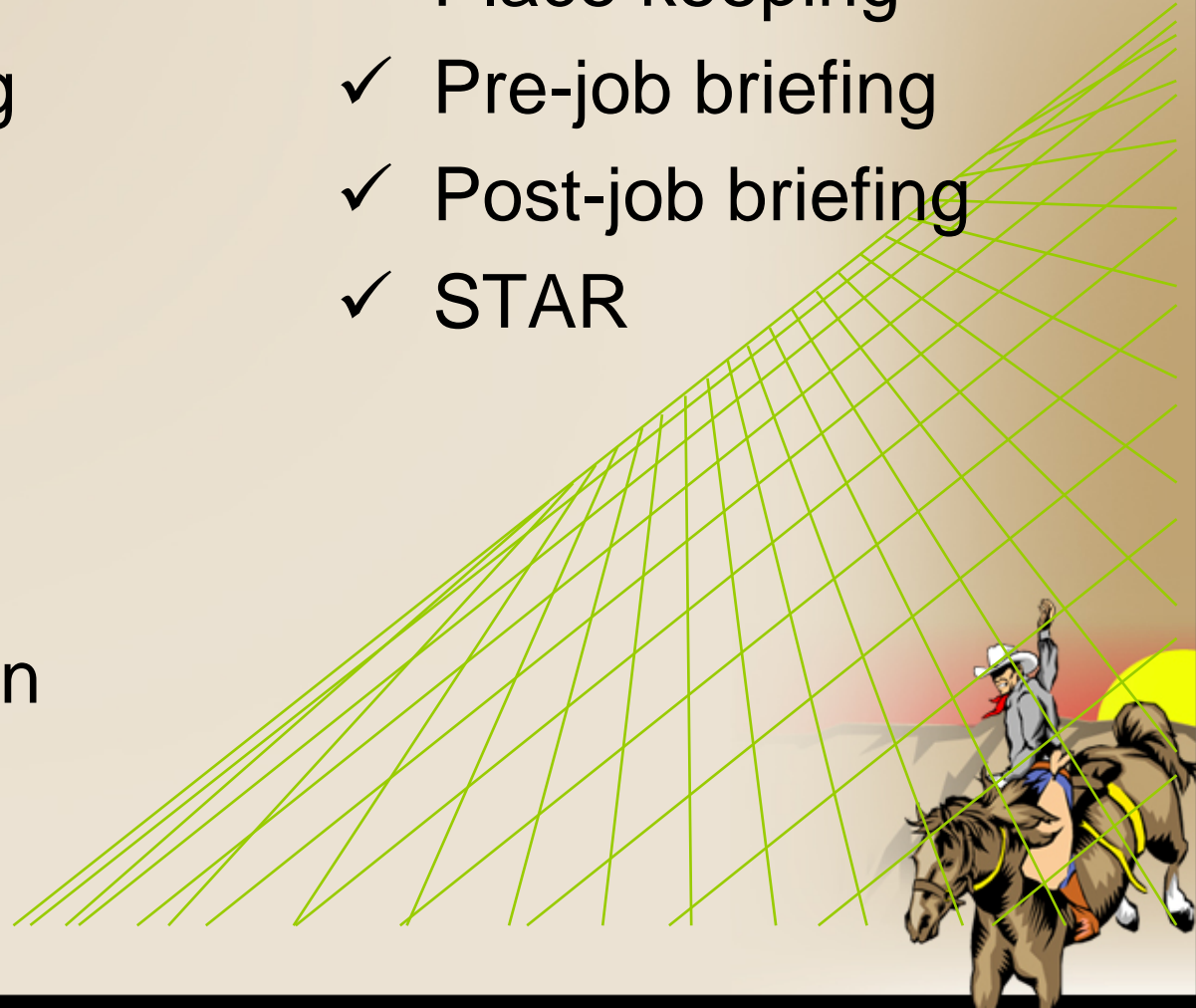


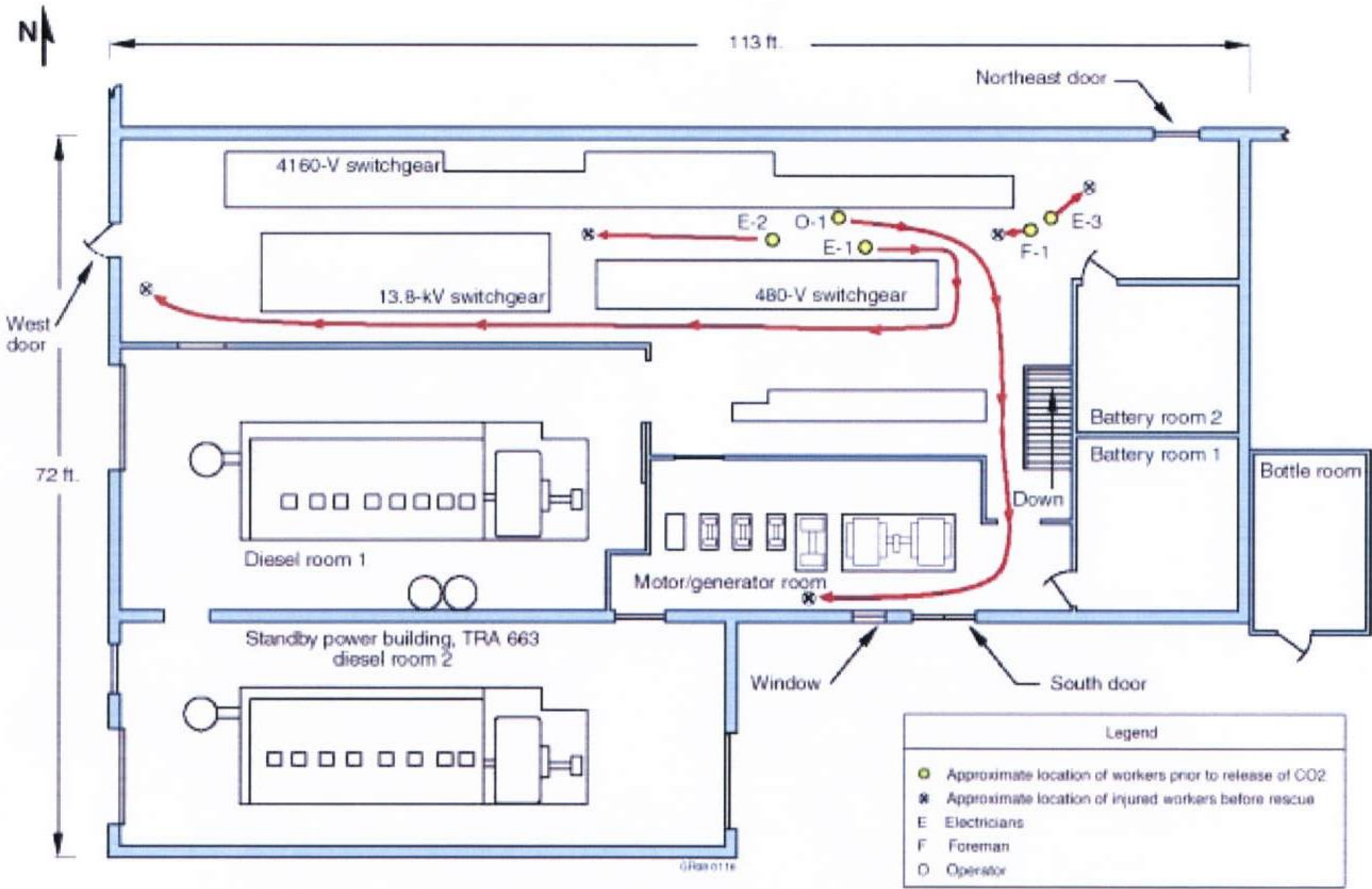


## *Error Prevention Tools*

- ✓ Self-checking
- ✓ Peer-checking
- ✓ Concurrent verification
- ✓ Independent verification
- ✓ Three-way communication
- ✓ Place keeping
- ✓ Pre-job briefing
- ✓ Post-job briefing
- ✓ STAR

EXPECT THE UNEXPECTED





**Exhibit 2-1. Building 648 Layout with Escape Routes of Five Injured Workers**

# Anticipate Error Traps

- Review the job-site conditions using the error precursors list
- Some error precursors are particularly powerful, depending on the performance mode of the individual performing the action -- for instance:
  - Skill-based performance -- strongly influenced by distractions, simultaneous tasks, and fatigue
  - Rule-based performance -- strongly influenced mindset and confusing procedures
  - Knowledge-based performance -- strongly influenced assumptions, first-time performance of the task, lack of knowledge, and inexperience



## *Defenses Against Error*

- In most cases, additional defenses employed to minimize the risk of an error or an event for a particular task will be administrative in nature, such as
  - Additional supervision
  - Use of error-prevention techniques
  - Improvements in procedures or job aids
- Contingencies should consider defensive functions to enhance the individual's and plant's ability to recover from error, especially at the critical steps, to avert an event



# About Performance

- Performance represents an outcome, a result, or an accomplishment. Good or bad, a result is still a result!
- Performance is something that is measurable (at least in some manner).

