

# TOP 10 Helicopter Crashes

# WE ARE NOT FINDING NEW WAYS TO CRASH HELICOPTERS

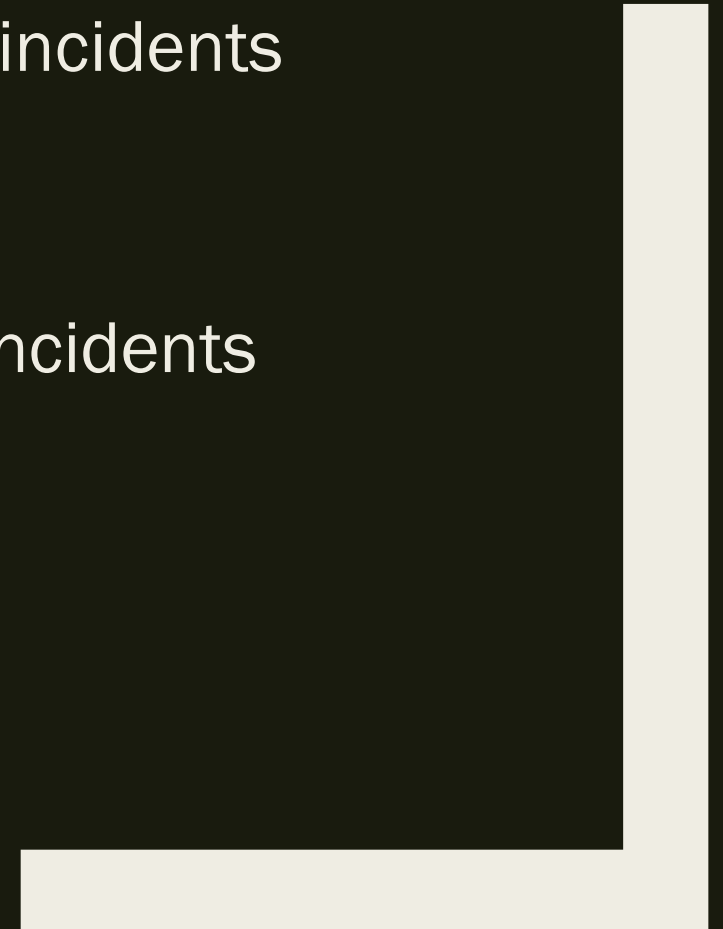
HAI Safety Committee



# HELICOPTER ACCIDENT STATISTICS:

- 2004 – 2014.....2,020 accidents/incidents
- 2004 – 2014 .....477 Fatalities
  
- 2014.....140 accidents/incidents
- 2014..... 37 fatalities

Source: NTSB Accident Data Base



# Overview

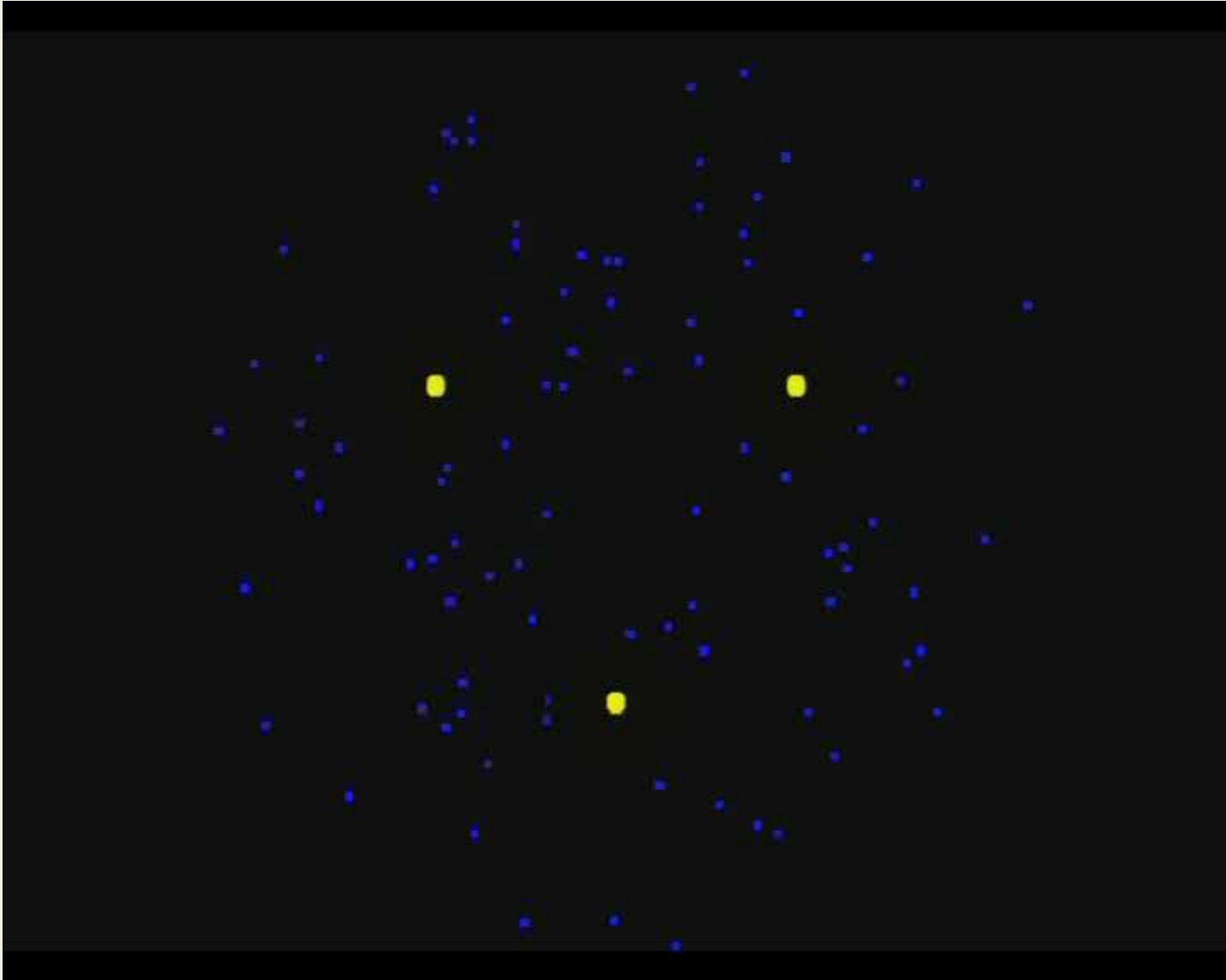
- Over the last 10 years there have been over 2000 rotorcraft accidents/incidents investigated by NTSB.
- Probable cause often includes “Pilot Error”.
- The fact remains that even with all of the new technology available, humans are still at the controls.
- This talk will focus on human performance improvement to trap human error during critical events.

# Human Factors ≠ Human Error

- Human Factors: The study of how human beings function within various work environments as they interact with equipment in the performance of various roles and tasks (human machine interface): ergonomics, human engineering, training, human resources.
- Human Error: A phrase that generally means the slips, lapses and mistakes of humankind.

# Human Factors

- Personality Characteristics
- Fatigue
- Dehydration
- Stress
- Pride
- Inattention Blindness
- Cognitive Dissonance
- Confirmation Bias
- Fight or Flight
- Muscle Memory



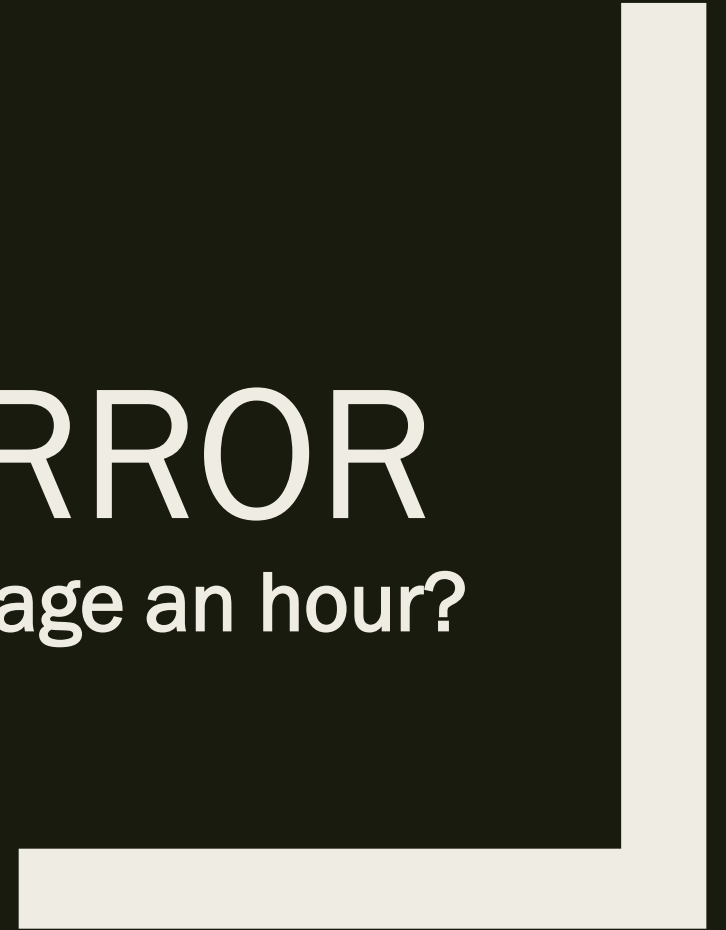
# **The Spinning Dancer**



5

# HUMAN ERROR

How many errors do we average an hour?



# Error

- Unintentional departure from an expected behavior.
- We need to separate the error from the outcome.
- We do not typically notice our own errors.
- If you try to eliminate human error you will go broke and insane, instead we need to manage the consequences of human error.



Human Error is very predictable and many of our errors have little or no consequence.



# A New Perspective

- It is impossible to have an event caused by **one single** active human error.
- It takes a team effort to have an event.
- Focus needs to be on the context of the event to reveal and trap our weaknesses.

- Accidents are unexpected combinations of normal variability within the system.
- Because the variability is within expected norms, the accidents are triggered by normal actions, rather than action failures.

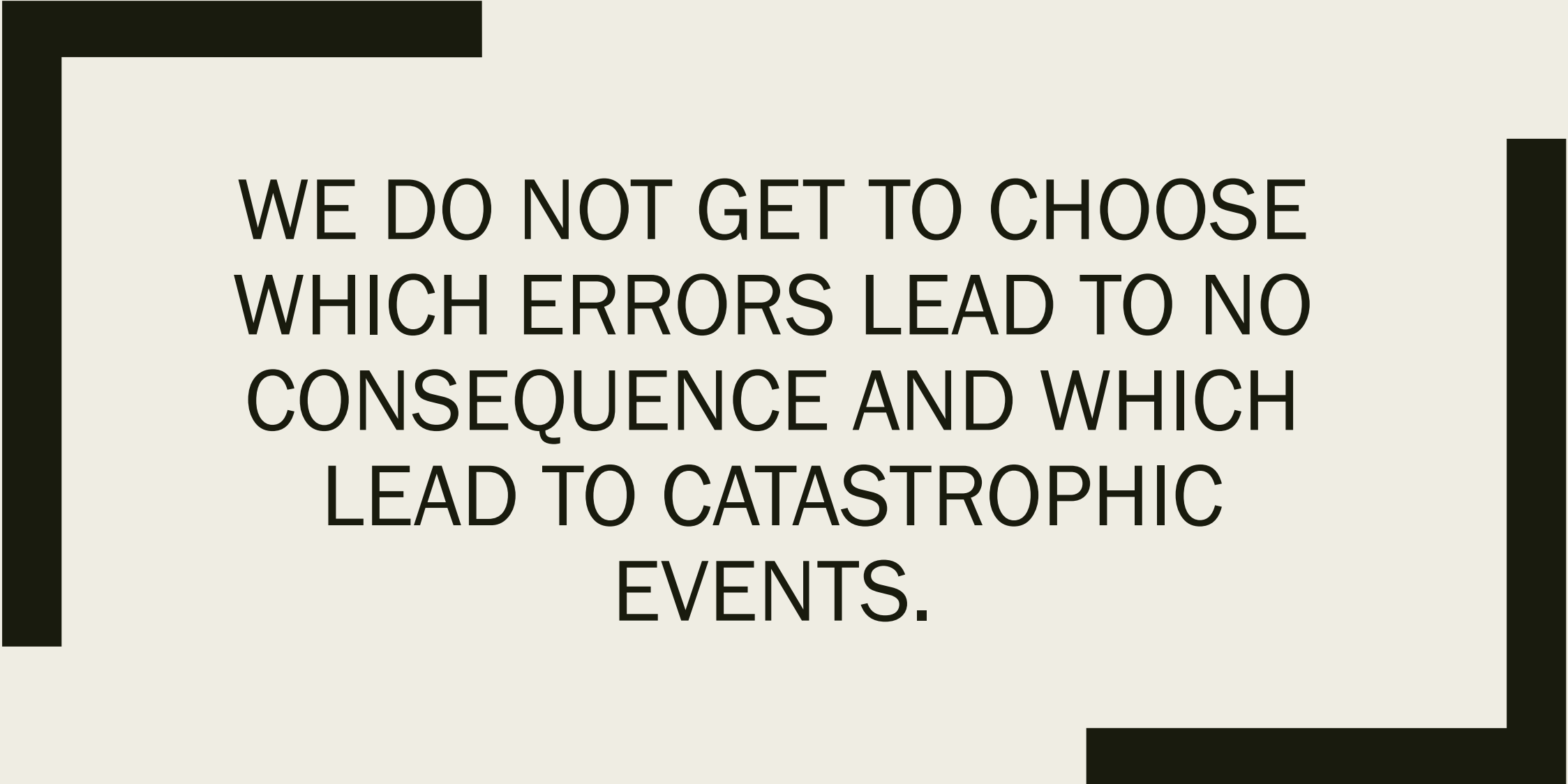
**There is Another Way to Look at  
Events...**



“Accidents are a systemic by-product of people and organizations trying to pursue success with imperfect knowledge and under pressure of other resource restraints (scarcity, competition, time limits).”

**Sidney Dekker**

**Events are**  
**System**  
**Outputs**

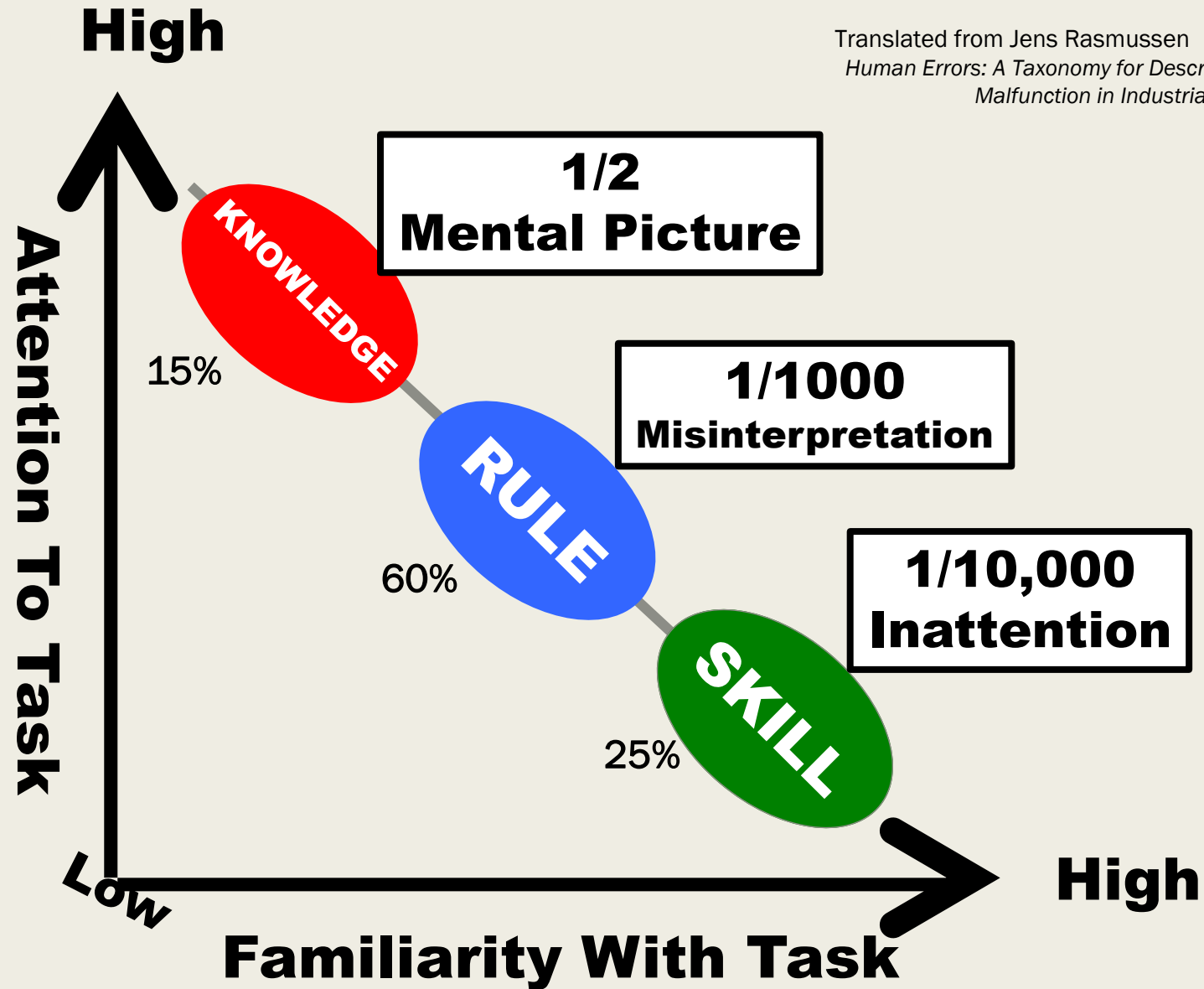


WE DO NOT GET TO CHOOSE  
WHICH ERRORS LEAD TO NO  
CONSEQUENCE AND WHICH  
LEAD TO CATASTROPHIC  
EVENTS.



# Performance Modes

Translated from Jens Rasmussen  
*Human Errors: A Taxonomy for Describing Human  
Malfunction in Industrial Installations*



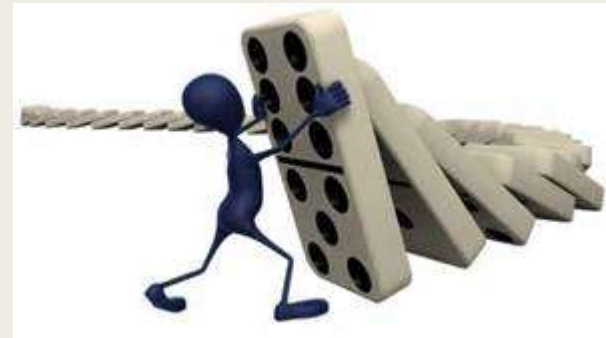
**A reliable  
organization can  
spot an action  
**going** wrong...not  
an action ***gone***  
wrong.**

# Traditional Investigations

- Investigations are focused on the facts not the context. The results are placed into buckets:
  - *Pilot Error*
  - *Mechanical*
  - *Weather*

# Root Cause Analysis

- Root cause analysis is to prevent similar events from happening again.
  - *Corrective Action Recommendations typically involve Training, Policies and Procedures and Behavior Modification*
- The problem is most of our conditions will never line up the same way again.



# **Procedures are important...**

**But they are not sufficient  
enough to Create Safety.**

**Our Organizations have Become  
Complex-Webs of Procedures  
that are incomplete and difficult.**

**Procedures  
Do Not Lead  
to New  
Thinking.**

# Here is what we know...

- Fear is a bad motivation for smart workers.
- Small statistical failures have the opposite effect – they almost create a preference to take chances.
- All procedures are incomplete and underspecified.
- Complex Procedures Encourage Violation
- Most corrective actions fix what did not happen.
- Events contain local rational.
- Process deviation is normalized over time and through success.
- **In stable systems – people will cheat towards risky behavior.**
- **In stable systems – workers by default are less attentive.**
- Most of our systems are remarkably stable-until they're not.
- Accidents are the result of unexpected combinations of normal process variability.
- For failure to happen something was missed and some defense was not present.
- **A well designed organization is not a stable solution to achieve, but a learning process to keep active.**

# Why investigations regress into the bad apple theory ...

- It's EASY
- Difficult to not be judgmental about poor performance
- Emotional need to punish the guilty
- Our “hindsight bias” makes it hard to view the event from the workers’ perspective
- Resistance to finding organizational or system problems that need fixing



## **In theory**, investigations intend to...

- Find the latent conditions and organizational weaknesses that “caused” the accident
- Address the conditions and weaknesses to prevent recurrence

## **In practice**, it is easy to ...

- Focus on bad decisions, inaccurate assessments, and deviation from written guidance
- Conclude how workers, management and the programs failed to prevent the accident

**It's all about the apples!**

# **How We Look at Learning Events.**

**An unwanted outcome is not the result of a single ACTION oriented error, rather it is a team event.**

**Interview within  
24 hours of the event.**

This is not a performance review.... It is an event review...

We are not talking to you because of the the way you performed, we are talking to you because you were closest to the accident....

**Safety is not the  
absence of  
accidents.**

**Safety is the  
presence of  
Defenses.**

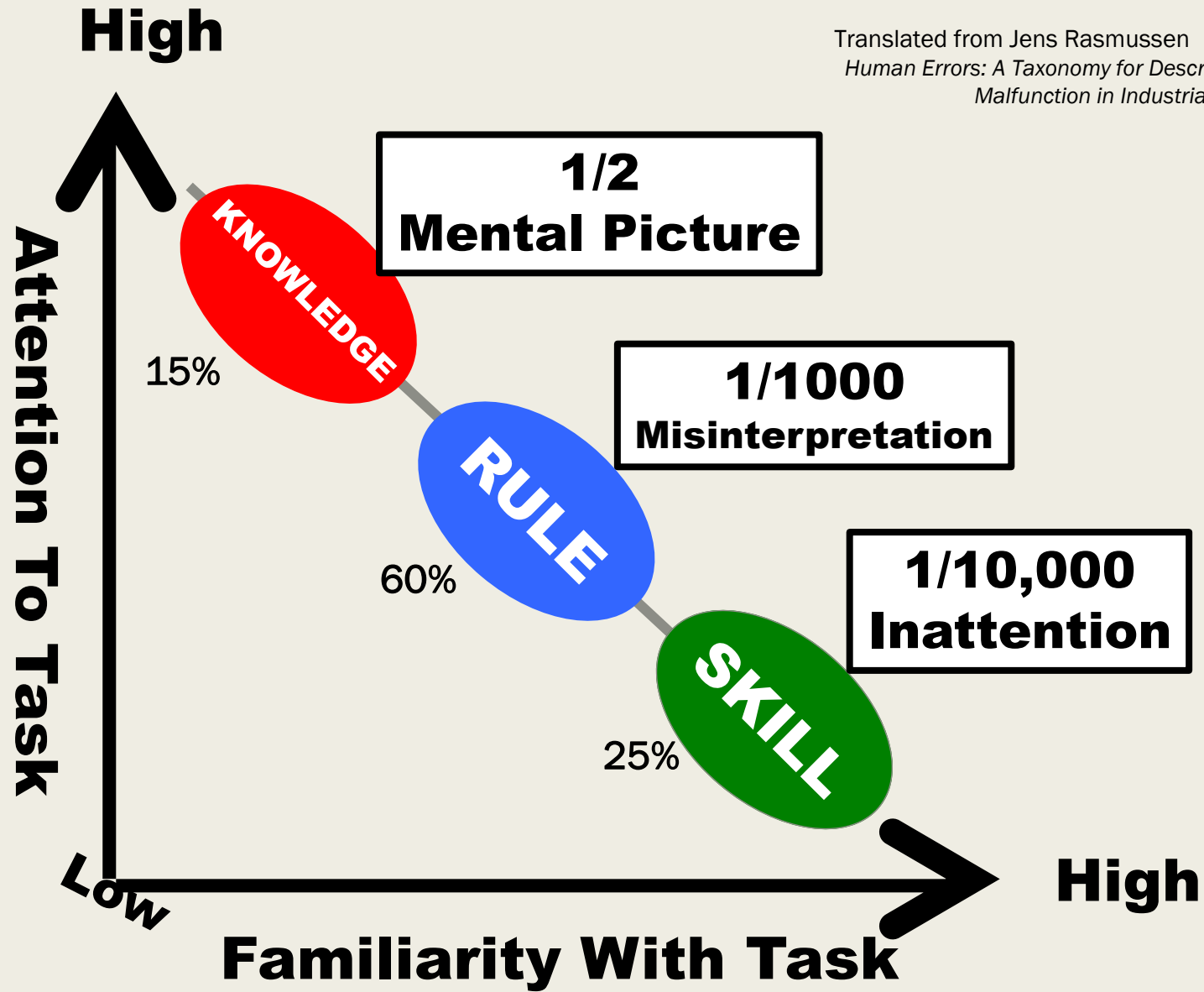
When organizations go for long periods of time with no accidents or unwanted outcomes, they believe they have it figured out and it won't happen to them. This is known as the gambler's dilemma and no one is immune, not even NASA...





# Performance Modes

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**The  
Power  
of  
Early  
Hazard  
ID**



**The  
Power  
of  
Early  
Hazard  
ID**



# Minimize Error Consequences During Critical Tasks

- Identify Critical Steps/Tasks
  - *Injury*
  - *Interruption of mission*
  - *Damage to facility/environment/equipment*

# Top Error Precursors

Error Precursor table

Task Demands	Individual Capabilities
<input type="checkbox"/> Time pressure (in a hurry)	<input type="checkbox"/> Unfamiliar with Task
<input type="checkbox"/> High workload (memory requirements)	<input type="checkbox"/> Lack of knowledge
<input type="checkbox"/> Simultaneous multiple tasks	<input type="checkbox"/> New Technique (not used before)
<input type="checkbox"/> Repetitive actions (monotonous)	<input type="checkbox"/> Imprecise communication habits
<input type="checkbox"/> Irrecoverable acts	<input type="checkbox"/> Lack of proficiency/inexperience
<input type="checkbox"/> Interpretation requirement	<input type="checkbox"/> Indistinct problem-solving skills
<input type="checkbox"/> Unclear goals, roles and responsibilities	<input type="checkbox"/> "Hazardous" attitude for critical task
<input type="checkbox"/> Lack of or unclear standards	<input type="checkbox"/> Illness/fatigue
Work Environment	Human Nature
<input type="checkbox"/> Distractions/interruptions	<input type="checkbox"/> Stress (limits attention)
<input type="checkbox"/> Changes/Departures from routine	<input type="checkbox"/> Habit patterns
<input type="checkbox"/> Confusing displays or controls	<input type="checkbox"/> Assumptions (inaccurate mental picture)
<input type="checkbox"/> Workarounds/OOS instruments	<input type="checkbox"/> Complacency/Overconfidence
<input type="checkbox"/> Hidden system response	<input type="checkbox"/> Mindset
<input type="checkbox"/> Unexpected equipment conditions	<input type="checkbox"/> Inaccurate risk perception ( <u>Polyanna</u> )
<input type="checkbox"/> Lack of alternative indication	<input type="checkbox"/> Mental shortcuts (biases)
<input type="checkbox"/> Personality conflicts	<input type="checkbox"/> Limited short term memory

(Reference DOE Handbook, 2009)

# System or Human Error?



# How many errors can you predict?



# Top Error Precursors

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# Latent Conditions

- LATENT CONDITION - An undetected situation or circumstance created by past latent errors that are embedded into the organization or production system lying dormant for periods of time doing no apparent harm.
- LATENT ERROR – An error, act or decision disguised to the individual that results in a latent condition until revealed later, either in the event, active error, or self assessment.



# System Events

- Events are not caused by one active error, latent conditions must be present.
- Latent conditions are to organizations what resident pathogens are to the human body.
- You want to die with them rather than from them.

# Critical Decision Making



- Past Experiences
- Training
- Flight hours
- Situational Awareness
- Confirmation Bias
- Individual Personalities
- Human Factors

# Flight Experience

- Pilot has never been scared before.
- New pilots are scared to say no
- Over confidence
- Pressure to fly
- Hours experience
- Simulator time



**Pilot trained  
in simulator  
to  
experience  
IIMC  
conditions**



**Pilot never  
has  
experienced  
IIMC  
conditions  
until RIGHT  
NOW**

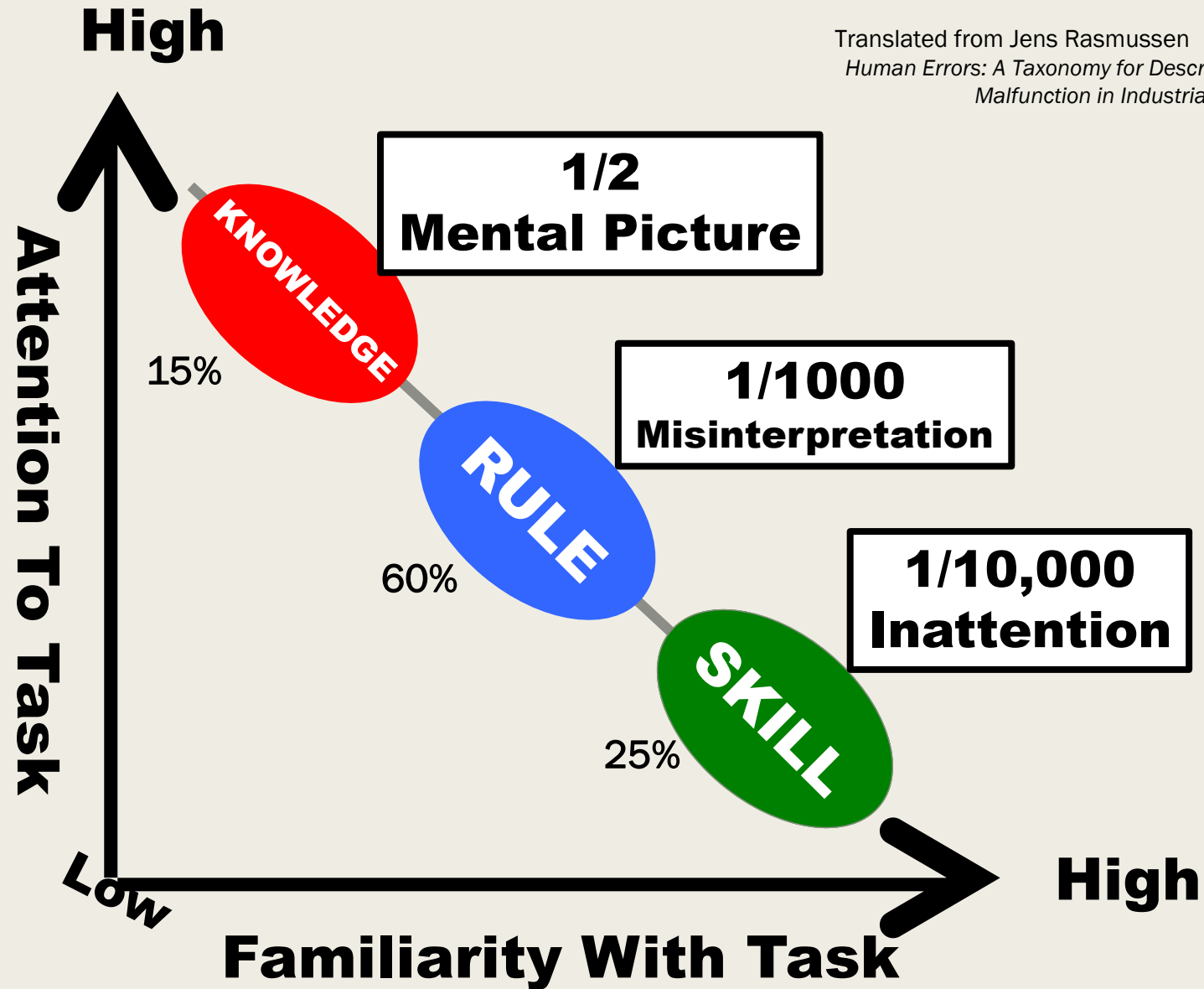


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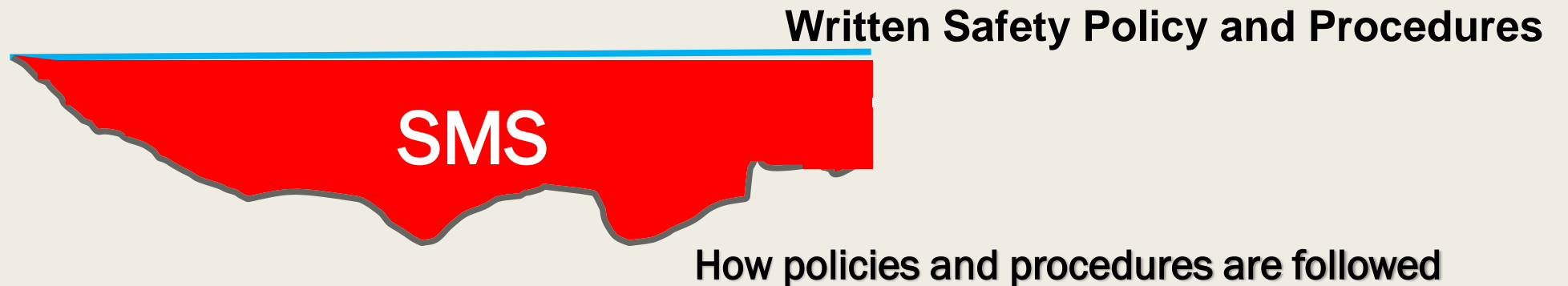
***The Flying Tiger***

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# Safety Management System (SMS)

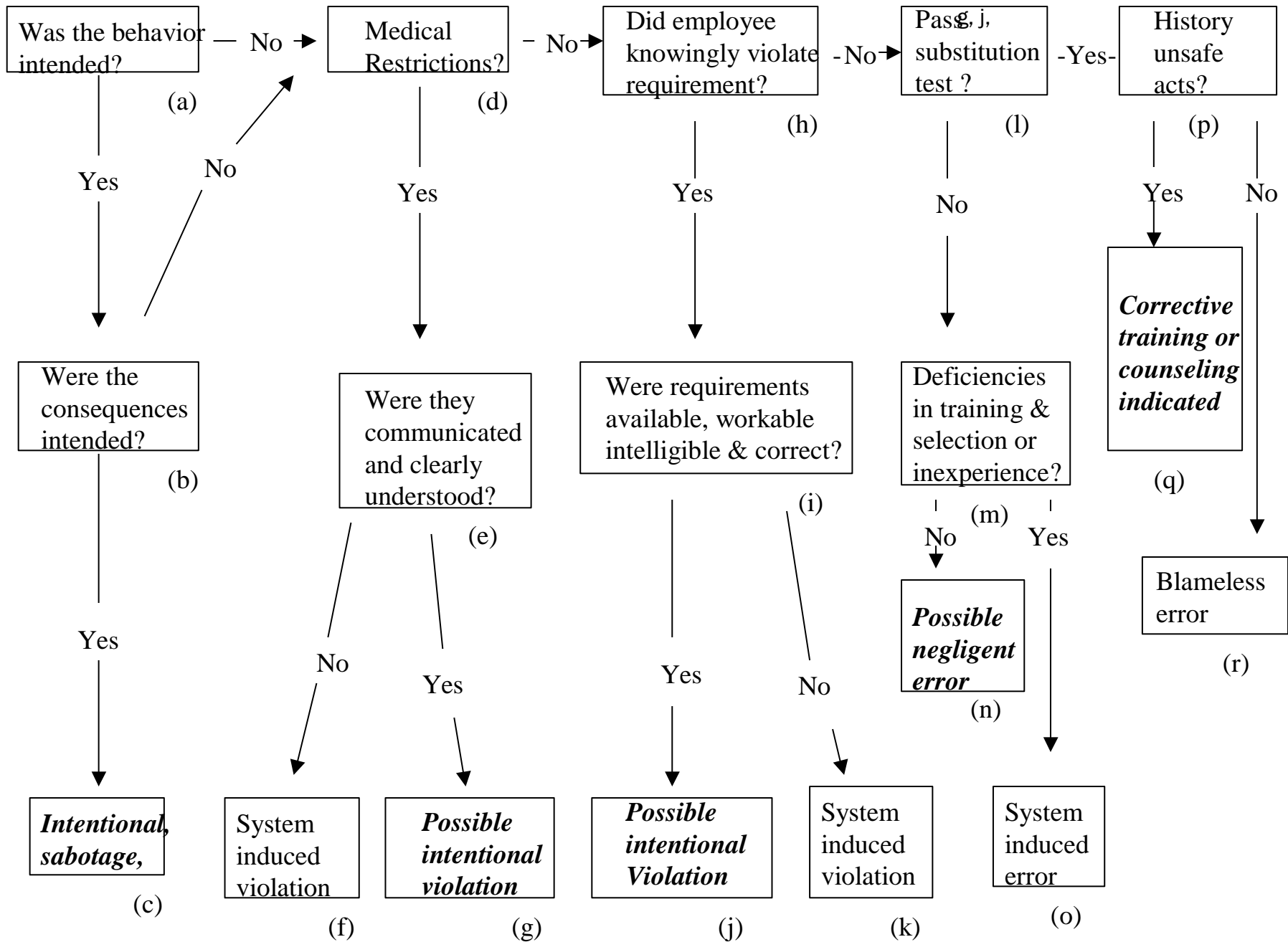




# Work Arounds

- Work arounds – this is the systems' way of telling the policy writers that the policy is not working. Pay attention to these things.

# Culpability Decision Tree



JUST CULTURE

# Where do we go from here?

- Identify Critical Steps (Events that could lead to significant unwanted outcomes.)
- Identify the error precursors
- Look at the tools/defenses to control the consequences.
- Integrate the tools/defenses into the process or system. Employees need to know when to use Peer Check, Self Check, Trust but Verify etc.

# Top Error Precursors

- Planners
- Policy Writers
- Designers
- Maintenance
- Medical Crews
- Etc.

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# Control Processes

- Task Preview
- Job Review
- Questioning Attitude
- Stop when unsure (aka Land)
- Self- Check
- Procedure Use and Adherence
- Validate Assumptions
- Three-way Communications
- Phonetic Alphabet
- Place Keeping
- Peer Check
- Concurrent Verification
- Independent Verification
- Peer Review
- Project Planning
- Decision Making
- Chronic Uneasiness

# Perspective

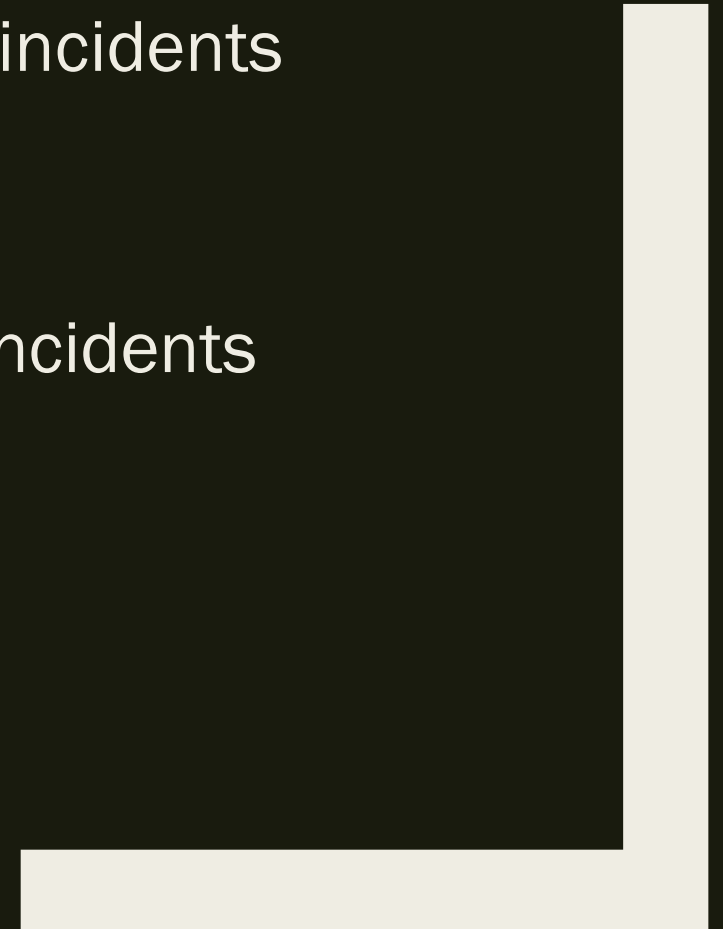
- Humans use technology as a production gain.
- If you are 50, you will probably be exposed to at least 2 new technologies before you retire.
- This is the first time in history that we have had 4 generations working at the same time. Do your written procedures make sense to all?



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# LAND & LIVE

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