Preventing Failure

High Consequence Events Prevention Framework (HCEPF)

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Team Sub Focused
Leadership Program

TSFLP

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"As we look hard into recent events — and revisit and assess what we've learned from previous incidents, I am relying on you to reinforce those aspects of our **culture** demonstrated on BONHOMME RICHARD and across the Navy right now. Focus on the **positive** attributes — that will overcome the **negatives** we want to avoid."

ADM Michael Gilday, CNO (Navy Times, 7/22/2020)

https://www.defensenews.com/naval/2020/07/22/the-us-navys-top-officer-reveals-grim-details-of-the-damage-to-bonhomme-richard/
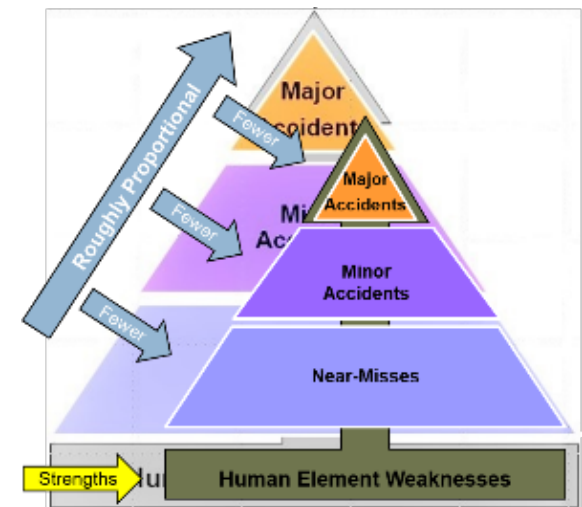
Why High Consequence Events Prevention?

- If a technically strong organization can identify the behaviors that can lead to human error within its operations, and

- If that organization and its people (from junior team members to top management) commit themselves to eliminating those behaviors and to building a stronger culture…

→ **The organization can prevent errors at their source**

Key to success: a strong culture and a strong technical foundation

Building a Risk Aware Culture

The High Consequence Events Prevention Framework (HCEPF) is designed to mitigate the risk of failure throughout an organization by developing a risk aware culture to prevent error at its source —*decisions*
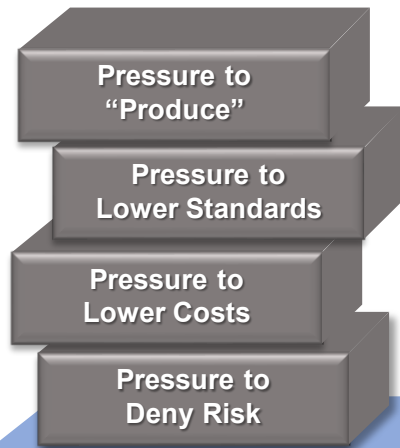
High Consequence Events Prevention Framework

Promoting Risk Aware Behaviors

Assessing risk culture

Learning from error and failures

Major Accident

Major Accidents

Minor Accidents

Near-Misses

Roughly Proportional

Fewer

Fewer

Fewer

Strengths

Human Element Weaknesses

Developing a team culture where people do the right thing, even when no one is watching

The Defense Program Balancing Act

Goal: Deliver and Provide Mission Assurance

Ever-changing Pressures to Reduce Risk Margins

Ever-changing Pressures to Increase Risk Margins

Pressure to "Produce"

Pressure to Lower Standards

Pressure to Lower Costs

Pressure to Deny Risk

Pressure to Delay

Pressure to Gold-plate Standards

Pressure to Ignore Costs

Pressure to Retire All Risk

Production / Operations

Effectiveness / Security / Safety

High Consequence Event Button

Do you want it "right" or "right now?"

Waste and Inefficiency "Button"

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Risk Ignorant/Cavalier Organization
A Losing Proposition

Ever-changing Pressures to Reduce Risk Margins

Pressure to "Produce"

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Pressure to Lower Costs

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Effectiveness / Security / Safety

High Consequence Event "Button"

Waste and Inefficiency "Button"
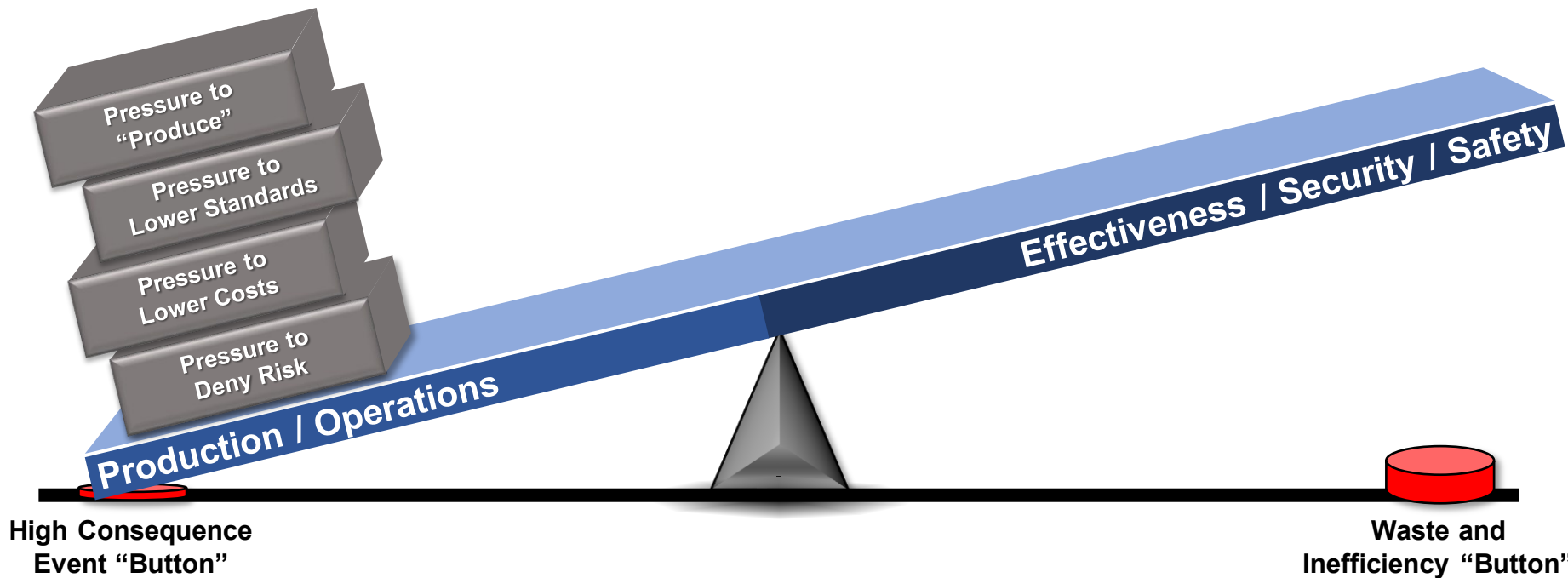
Risk Averse Organization
Another Losing Proposition

Ever-changing Pressures to Increase Risk Margins

Production / Operations

Effectiveness / Security / Safety

Pressure to Delay

Pressure to Gold-plate Standards

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High Consequence Event "Button"

Waste and Inefficiency "Button"
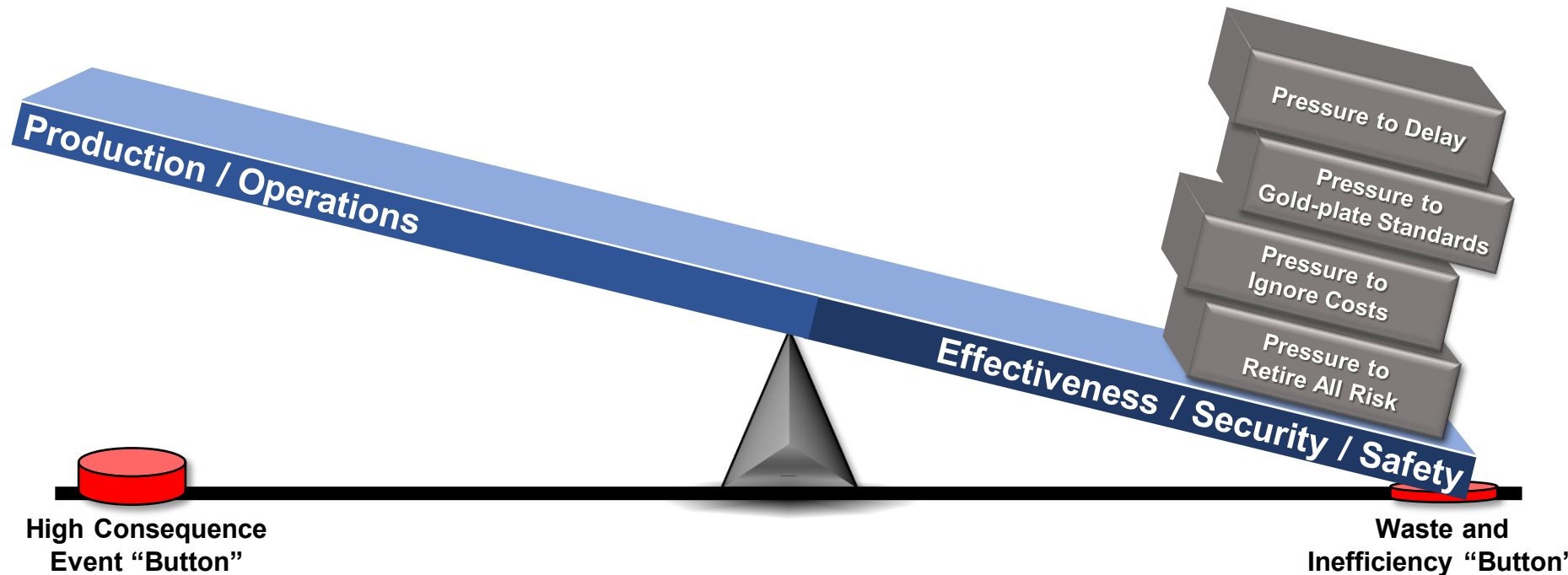
Scenario

You are working at a local Wells Fargo branch. Over the past few months your supervisors have increased sales quotas exponentially. When you expressed concern that these goals were unattainable, you were told they were non -negotiable and to do whatever it took to meet them. After a period of working unpaid overtime, you decided to create new checking and credit accounts using customer information in order to meet these objectives.

What behavior is present?

Unreasonable Demands

What's the problem?

"*Destructive organizational habits can be found within hundreds of industries and at thousands of firms. And almost always, they are the products of thoughtlessness, of leaders who avoid thinking about the culture and so let it develop without guidance.*" Charles Duhigg, *The Power of Habit: Why We Do What We Do in Life and Business*

B-2 Spirit crash in Guam

D5 Trident II Launch
DASO 30
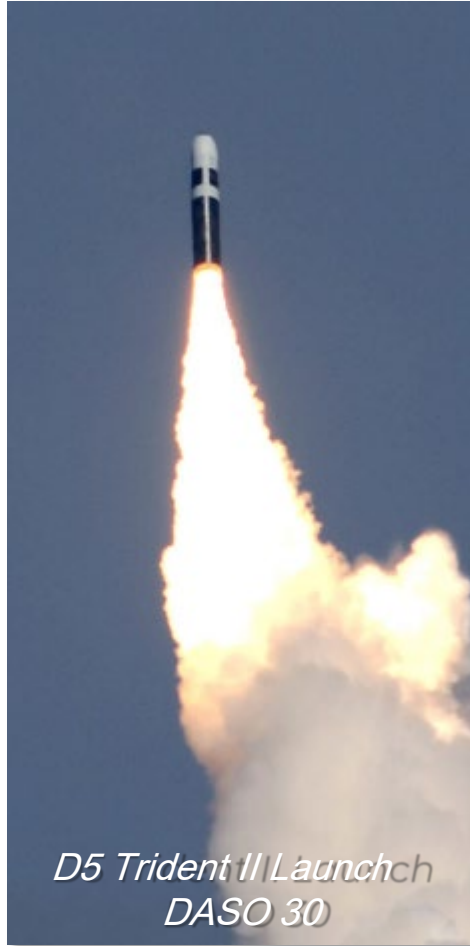
What's the right approach?

"There are no organizations without institutional habits. There are only places where they are <u>deliberately designed</u> *, and places where they are created without forethought .*"

Charles Duhigg, *The Power of Habit: Why We Do What We Do in Life and Business*

Good culture is deliberately designed

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Fukushima (March 2011): Where Human Error Prevailed

- Natural disaster followed by man-made disaster
  - Shutdown of an industry key to Japanese economic security
- Production–focused approach to risk by the utility
- A dichotomy:
  - Population safety VS
  - Reactor safety
- WHY did the cores melt?

The fundamental causes are to be found in the ingrained conventions of Japanese culture: our reflexive obedience; our reluctance to question authority; our devotion to 'sticking with the program'; our groupism; and our insularity"

Kiyoshi Kurokawa, Chairman, Fukushima Independent Investigation Commission

Three Levels of Performance Focus
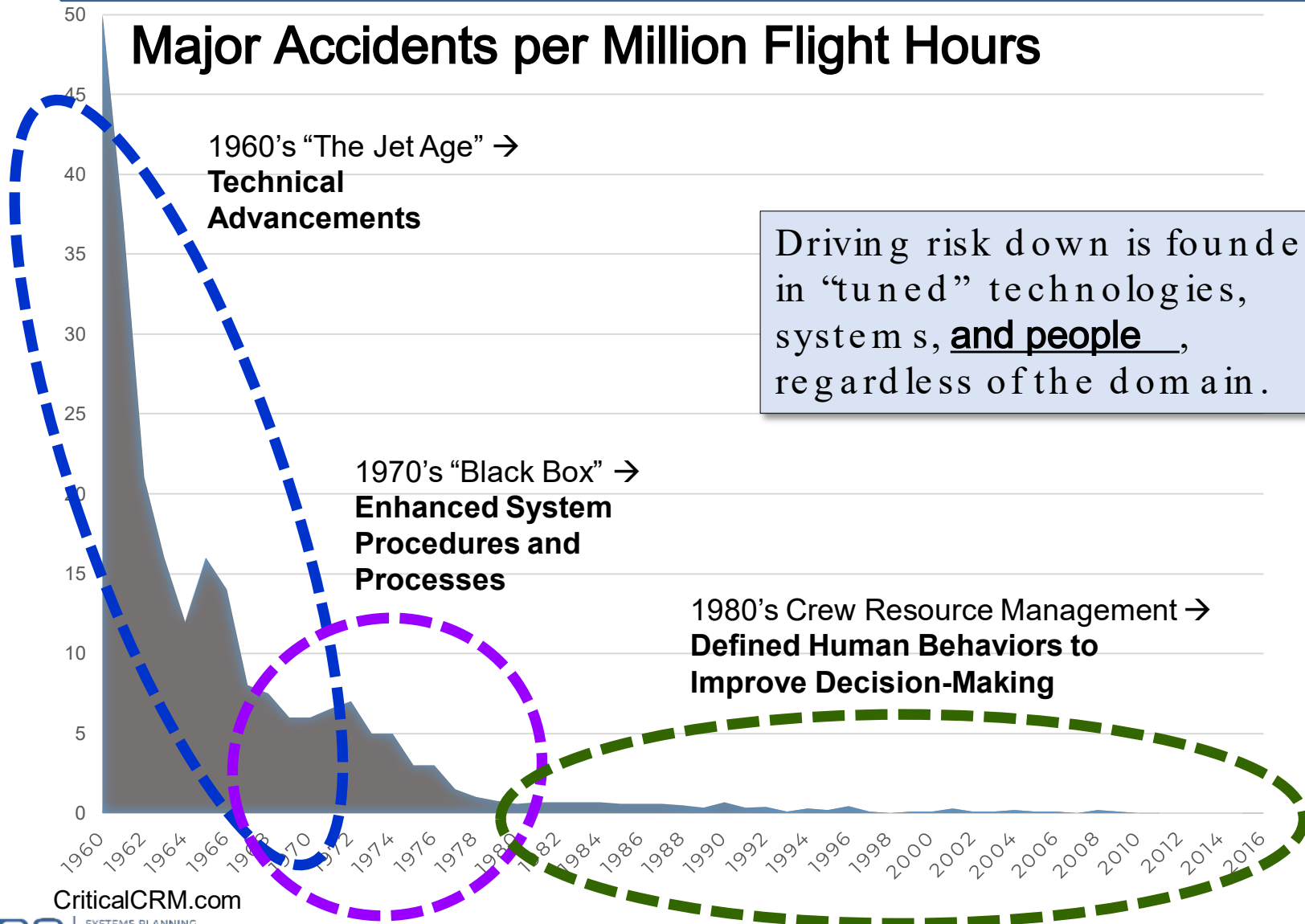## Experience at ExxonMobil
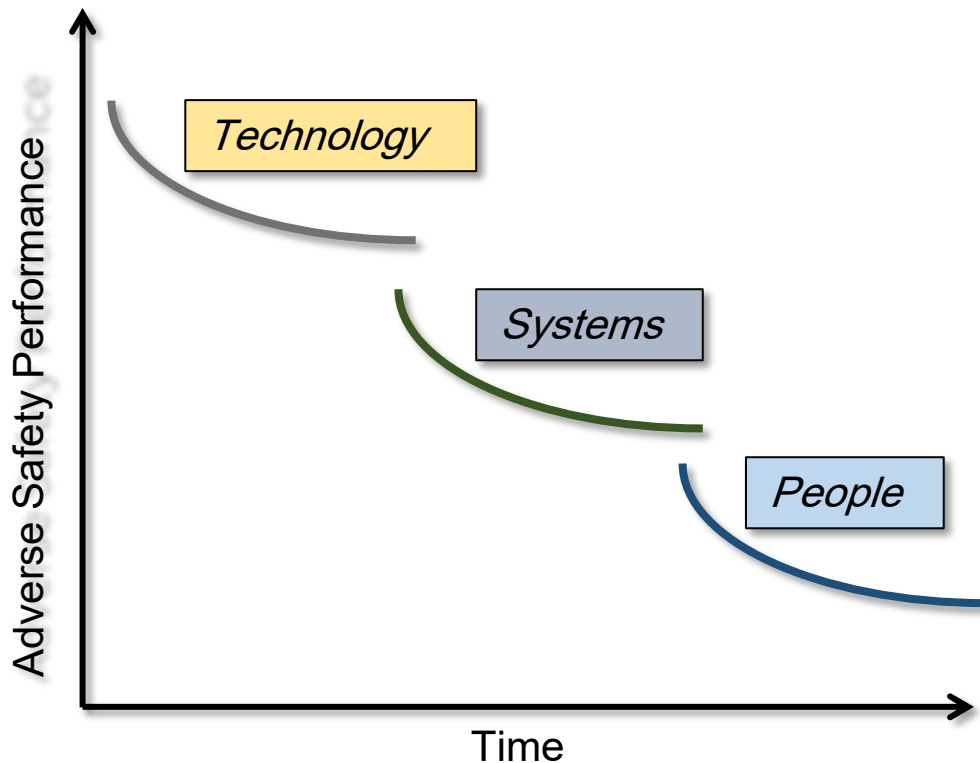
- **Technology focus** : safety at the component level

- **Systems focus** : safety through system of systems integration
  - Procedures
  - Processes
  - Compliance

- **People focus** : safety through personnel behavior. Factors:
  - Leader commitment
  - Knowledgeable and skilled application of tools
  - Workforce buy-in
  - Personal accountability and willingness to intervene

All three domains are important – a holistic approach to risk and mission assurance requires attention to each
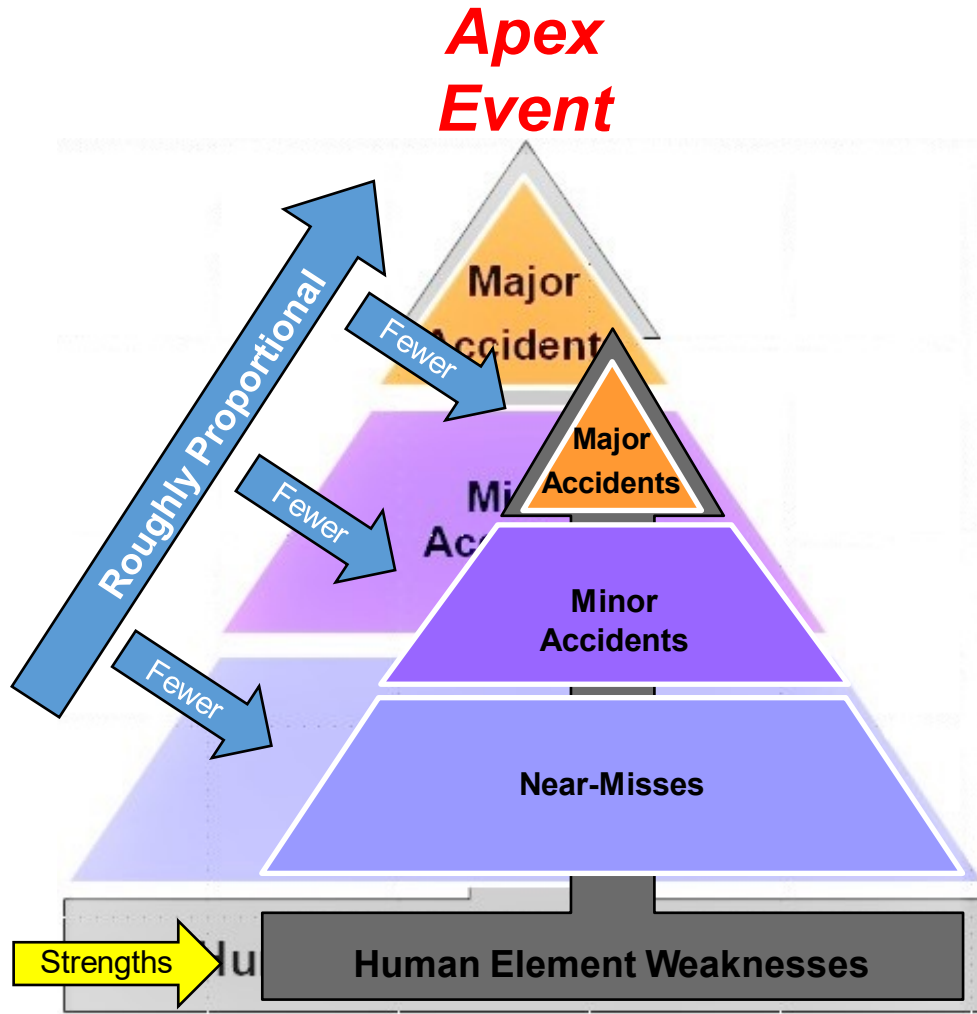
"Driving Toward "0"; Best Practices in Corporate Safety and Health"; The Conference Board, 2003

Major Accidents per Million Flight Hours

1960's "The Jet Age" →
Technical Advancements

Driving risk down is founded in "tuned" technologies, systems, **and people**, regardless of the domain.

1970's "Black Box" →
Enhanced System Procedures and Processes

1980's Crew Resource Management →
Defined Human Behaviors to Improve Decision-Making

CriticalCRM.com

50
45
40
35
30
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20
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0

1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016

Apex Event

Roughly Proportional

Fewer

Fewer

Fewer

Major Accidents

Minor Accidents
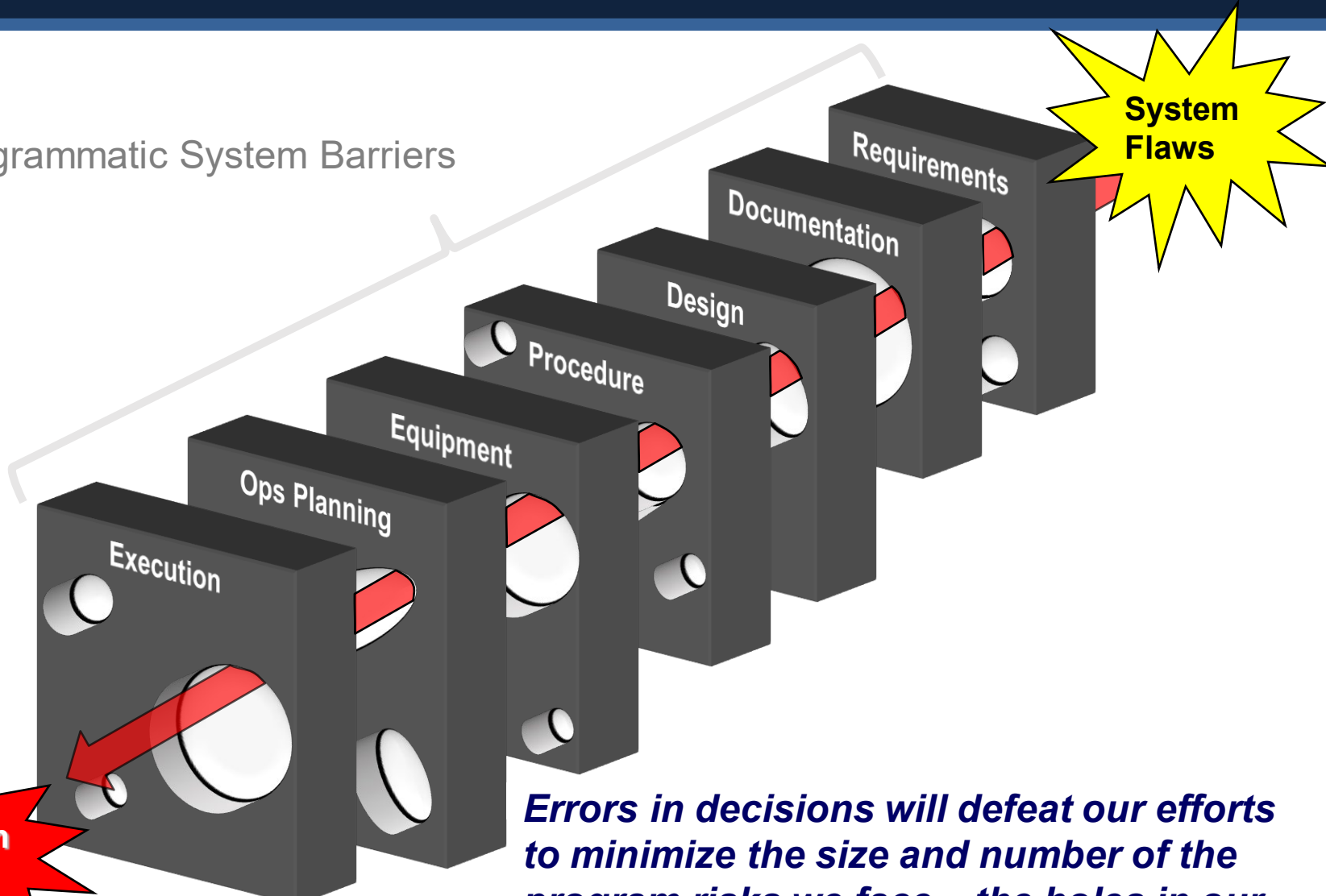
Near-Misses

Strengths

Human Element Weaknesses

If we learn from events at the lowest level and work on   reducing those human element weaknesses…

We should naturally reduce the likelihood of major events

And move away from the apex

"Barriers" to Block Failures

Programmatic System Barriers

System Flaws

Requirements

Documentation

Design

Procedure

Equipment

Ops Planning

Execution

Program Failure

Errors in decisions will defeat our efforts to minimize the size and number of the program risks we face – the holes in our technical and system barriers

Building a Risk Aware Culture
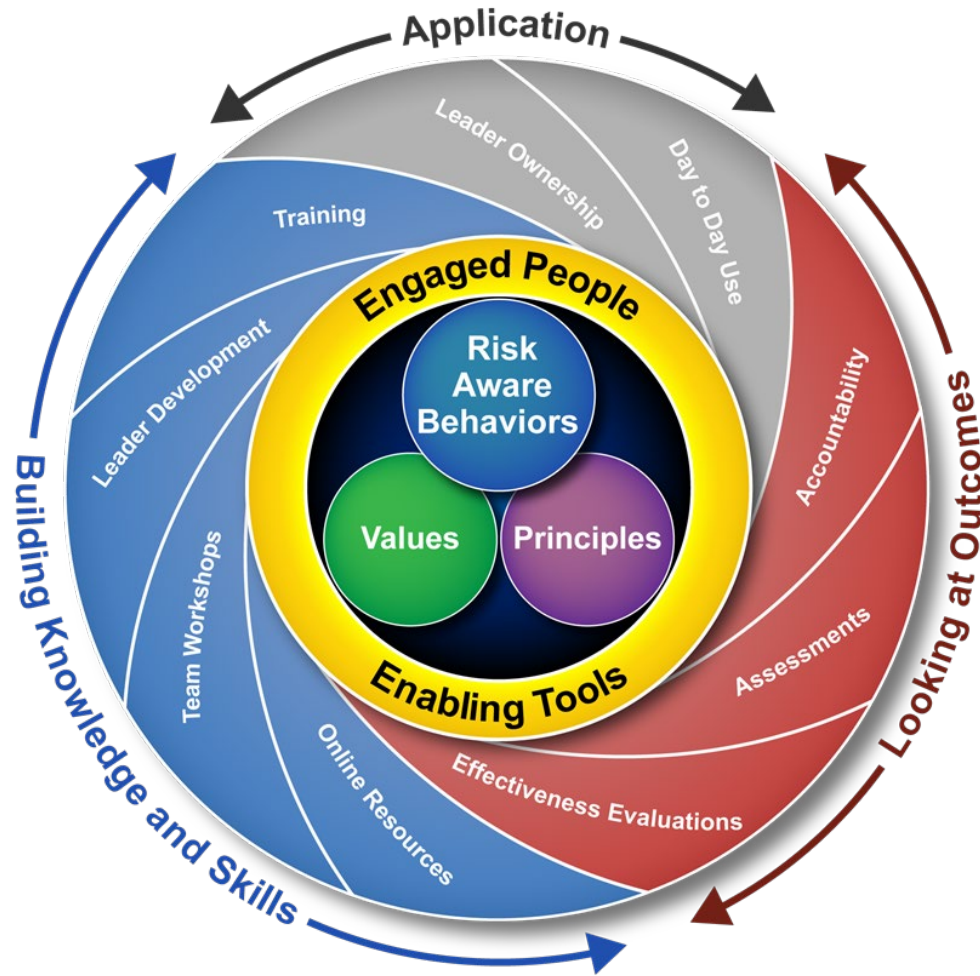
Principles

Principles of a Risk Aware Organization

Ownership
Leadership at all Levels

Empowerment
Responsibility, Authority, and Accountability

Mindfulness
Risk Aware Behaviors to Leverage Technical Strength

Assessment
Dynamic Risk Balance Between Safety & Production

Continuous Improvement
High Velocity Learning

Values

As a Risk Aware Organization We Value…

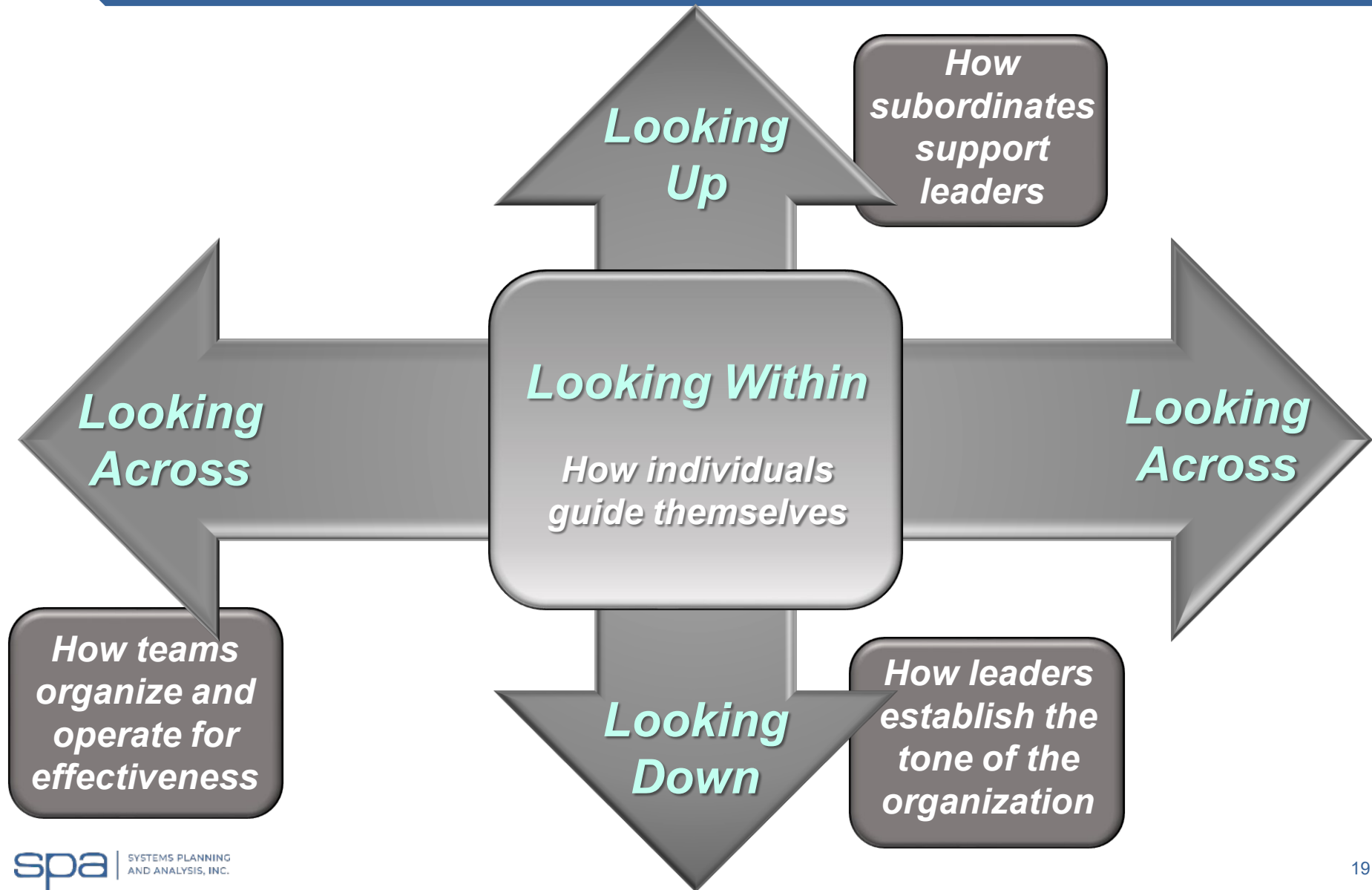Members who speak up, push back, and elevate risk issues if the approach is not right

Engaged supervisors who set the tone and standard for mindful behavior

Co-workers ready to identify and resolve unnecessary risk, even outside of their team

Individuals whose moral compass steers them, with integrity, to the right answer

*Values*s

As a Risk Aware Organization We Value…

Members who speak up, push back, and elevate risk issues if the approach is not right

Engaged supervisors who set the tone and standard for mindful behavior

Co-workers ready to identify and resolve unnecessary risk, even outside of their team

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…and Behaviors

Risk Aware Behavior	Human Element Weakness
LOOKING UP	
Questioning attitude	Reflexive obedience
Forceful back-up	Reluctance to question authority
Considered review of past decisions	Sticking to past program decisions
Transparent decision support	Concealment of dissension
LOOKING DOWN	
Encouragement of ideas and criticisms	Insularity
Openness to scrutiny and education	Technical arrogance
Invitation for benchmarking/innovation	Not invented here
Interrogation of the unexpected	Success suffices
Culture of risk evaluation	Culture of production
Integrated technical understanding	Tribal knowledge
Vertical knowledge and engagement	Passive oversight
LOOKING ACROSS	
Embrace of supportive, thoughtful process	Surrender to bureaucratic process
Formal, systematic risk engagement	Informal or stove-piped treatment of risk
Transparency and technical rigor	Groupism
Unambiguous execution of accountability	Absence of accountability
Output based evaluation	Focus on inputs vice outputs
Broad system ownership	Not my problem
Rigorous and open self-appraisal	Disregard of honest appraisal
LOOKING WITHIN	
Universal standards	Situational values
Loyalty to core values	Misplaced loyalties
Humility and leadership by example	I'm above the rules
Personal courage	Who am I to judge?
Public trust acceptance	Others do it, must be OK
Setting realistic, resourced goals	Unreasonable demands

- In a hospital ER, a cardiac patient arrives

- The ER physician directs a nurse to deliver a medication

- The nurse is disconfirmation seeking. Her education suggests the medication could kill the patient

- Leveraging her knowledge, the nurse questions the doctor; he forcefully rebuffs her intervention and directs that the medication be delivered without delay

You are the nurse; what would you do?

Does organizational culture help address such risks?

Derived from *"Intelligent Disobedience,"* Ira Chaleff

Risk Averse Organization
Balanced by a Mindful Human Element

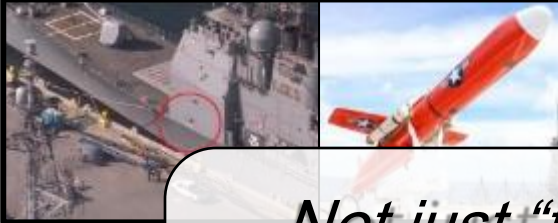**A deliberate design to maintain the balance in the face of dynamically changing pressures**

Ever-changing Pressures to Reduce Risk Margins

Ever-changing Pressures to Increase Risk Margins

Pressure to "Produce"

Pressure to Lower Standards

Pressure to Lower Costs

Pressure to Deny Risk

Openness to Critique

Forceful Back-Up

Questioning Attitude

Willingness to Re-Think

Visibility of Split Decisions

Formal Risk Scrutiny

Transparent Technical Rigor

Rigorous Self-Appraisal

Output- Based Performance

Unambiguous Accountability

Broad System View

Universal Ethical Standards

Accept Burden of High Bar

Humble Example

Personal Courage

Pressure to Delay

Pressure to Gold-plate Standards

Pressure to Ignore Costs

Pressure to Retire All Risk

Production / Operations

Effectiveness / Security / Safety

High Consequence Event Button

Culture of Risk Evaluation

Waste and Inefficiency "Button"

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Learning from the failure of others

Drone Impact on Chancellorsville
(Nov 2013)

Y-12 Complex Breach
(Jul 2012)

Fukushima Nuclear Plant
(Mar 2011)

Deepwater Horizon
(Apr 2010)

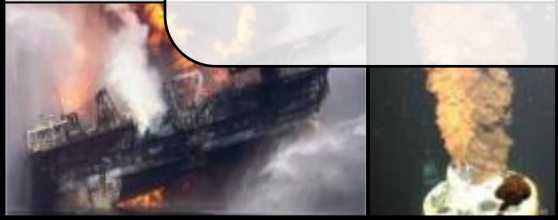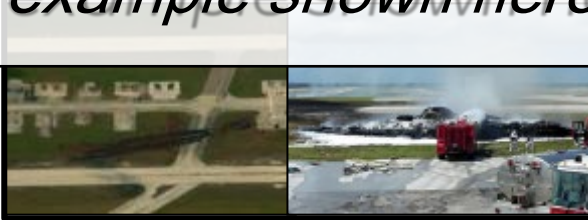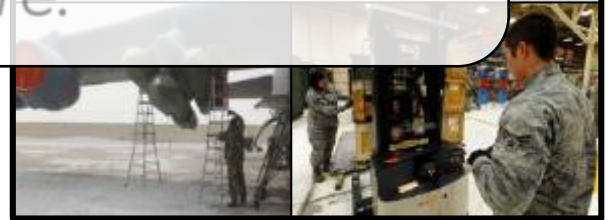**B-2 Crash on Takeoff from Guam**
(Feb 2008)

Nuclear Weapon Security Incidents
(Jun 2006, Aug 2007)

Not just "tip of the spear." Organizational weaknesses in the culture contributed to every example shown here.

Hurricane Katrina
(Aug/Sep 2005)

Shuttle Losses
(Jan 1986, Feb 2003)

**Greeneville Collision**
(Feb 2001)

Air Show Rehearsal
(Jun 1994)

You overhear the following conversation between two coworkers processing an important software change request for safety-critical software (e.g. fly-by-wire)…

- "Hey, weren't all the issues identified in the last technical review closed-out?"

- "Yes, I'm <u>pretty sure</u> they were."

- "Thanks! I'll delete them from the system…all done."

- "Okay, I think that makes sense."

What behaviors are present?

Tribal Knowledge

Groupism
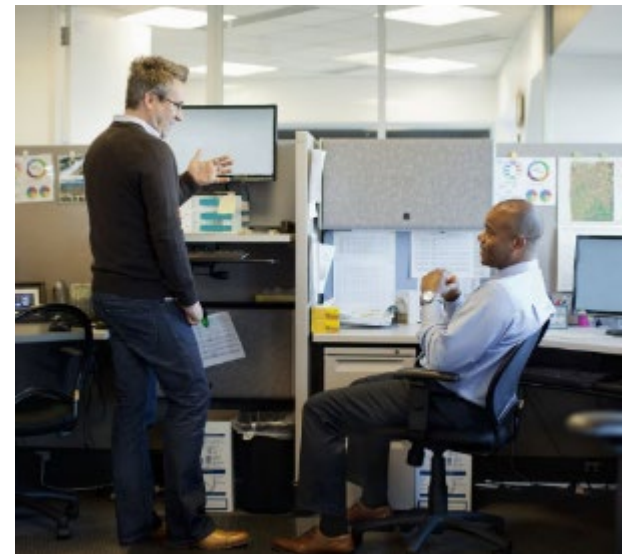
You are working on a manned space program and have just left a meeting where you learned that the space vehicle sustains damage from material coming off the large external fuel tank on   every launch   . Dutifully, you asked if it was a problem and were told that back   -of-the -envelope calculations looked good and that all of the missions had been 100% successful, which has supported a waiver for each launch.

What   behavior is present?

Success Suffices

Although Federal, State, and local officials were well aware that a large population, including many elderly and special needs residents, would <u>fail to evacuate New Orleans</u> ahead of a major storm, and that a major hurricane would flood the city, none of these levels of government planned for evacuating the flooded city . One (or all) of the concerned organizations should have taken responsibility for driving such planning.

What behaviors are present?

Not My Problem

Absence of

Accountability

In 2007, a B -52 bomber transported 12 Advanced Cruise Missiles to another base for maintenance. Operators thought none had nuclear warheads, but due to a series of errors, such as intermingling missile types in storage, half of them were nuclear armed —a surety violation. To make matters worse, shortly afterwards, a classified Minuteman III missile component was shipped to Taiwan in error. The rushed Air Force investigations into these incidents lacked depth in their analyses of root causes and left many convinced "that the primary motivation within the Air Force was to finish the reviews as quickly as possible, with as little further embarrassment as possible, and move on." Ultimately, the flawed investigations led to the forced resignations of the Air Force Secretary and Chief of Staff .
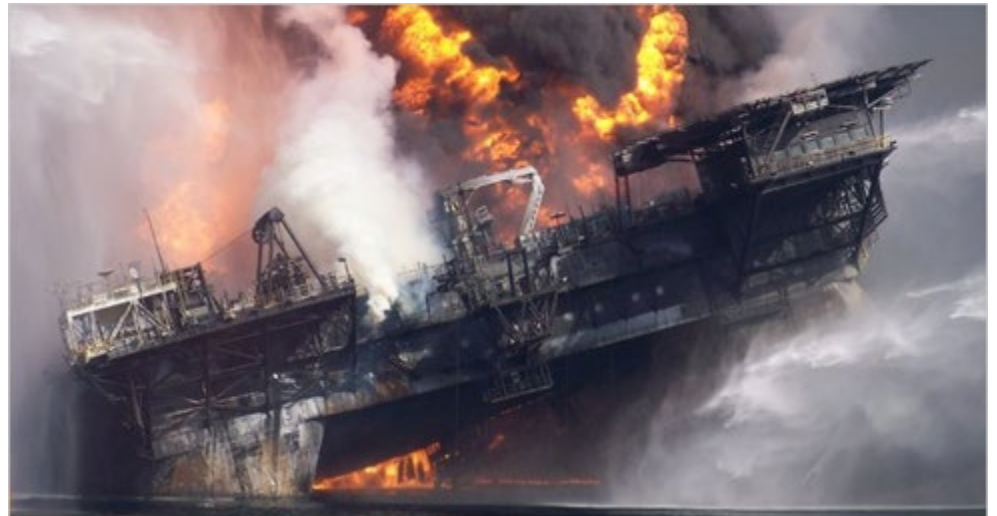
What behavior is present?

Misplaced Loyalties

The prime contractor chose, without explanation, to <u>override or ignore</u> a subcontractor's or a subordinate's expert advice regarding safety -related measures for the temporary disconnect at least seven separate times, believing the experts to be too conservative.

What behavior is present?

Technical Arrogance

BP leaders commenced sealing the well in preparation for moving the rig to a new drilling location, with knowledge that the cement mixture had been submitted to Halliburton for testing, although <u>testing had not been completed</u>. The cement job was declared successful based upon the amount of cement pumped and drill mud displaced, rather than a proper seal test. The seal failed, releasing 168 million gallons of oil and killing 11. The cement needed more time to cure to properly plug the well for reuse.

What behavior is present   ?

Focus on Inputs vice Outputs
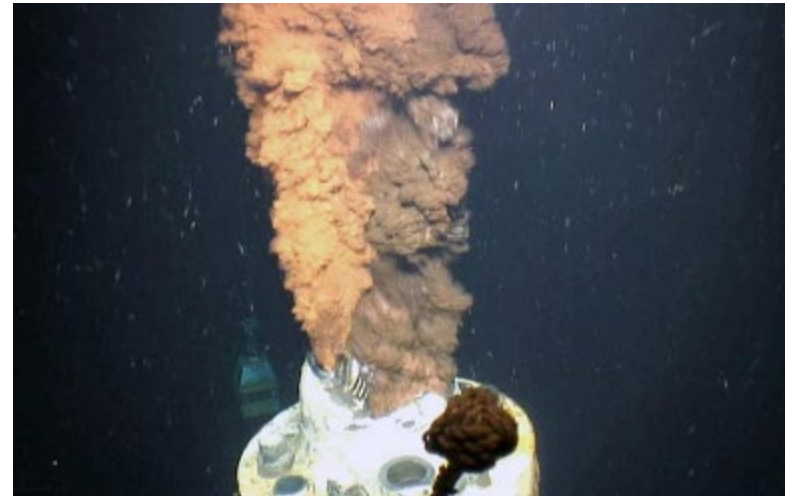
Four Keys to a Risk Aware Organization

Senior leaders committed to and actively involved with HCEPF concepts
- Develop Mindfulness/Risk Aware Behaviors
- Everyone has a leadership role
- Swarm issues not just casualties; fix problems before they metastasize

Supervisors armed with the knowledge and skills to effectively lead and apply risk aware tools and aids

Workforce convinced that events are preventable using skills to intervene and mitigate circumstances that are off course

All hands empowered to recognize and mitigate risks and to intervene to ensure risks are not realized
- At the technology, system, and people levels

"Success is a lousy teacher. It seduces smart people into thinking they can't lose. And it's an unreliable guide to the future." *Bill Gates*

Major Event: Type 45 (Daring-Class) Destroyer Procurement

- 1998 UK Strategic Defense Review
  - Confirmed r equirement for new maritime air-defense capability in 12 ships
  - Design initiated promptly
- Construction starts: 2003
- Plan reduced to 8 ships in 2004, then to 6 in 2006
- Daring commissioned in July 2009
- Daring's first operational deployment in 2012
- All ships in commission by September 2013

https:// www.youtube.com/watch?v=gzPzfOUlWWs

- Project incurred substantial cost and schedule overruns

- Platforms did not provide the level of capability initially envisioned

- Program execution and cost control improved following 2007 contract renegotiation

"….it is clear that what principally went wrong was that we were substantially overoptimistic about the time it would take to deliver, about the technical challenge it would represent, and about what it would cost…"

Sir Bill Jeffrey, MoD Permanent Under-Secretary, March 2009

Looking Within

Project planning was characterized by:

- Optimistic cost estimation to gain program approval

- Incorrect representation of costs in official reviews

- Liberal assumptions regarding unproven technologies

- Broad MOD acquiescence to shaky foundations

Others Do It, Must Be   OK

– MOD officials needed to display <u>public trust acceptance</u> by putting forward realistic development and procurement plans

Who Am I to Judge?

– The state and the public would have benefited had officials demonstrated the <u>personal courage</u> to disclose the program's true cost and capability risks

Looking Down

With sharp focus on keeping costs low, MOD officials:

- Developed optimistic plans for concurrent development of ship and principal combat suite

- Used fixed price contracting with eighty percent of the equipment on Daring new to service

- Reduced program objectives as projected costs increased and development of key technologies fell behind schedule

Culture of Production:

– With a <u>Culture of Risk Evaluation</u>, leaders would likely have taken a more balanced approach to production and effectiveness of the product

Requirements Errors

Looking Down/Across

Early requirements for the Daring did not include close-in defensive weapons capability despite:

- Ubiquity of such systems in comparable ships of allied Navies
- Combat experience of the Royal Navy in the Falklands War

Not Invented Here

- <u>Benchmarking</u> against requirements and standards in other Navies may have led responsible individuals in the MOD to integrate this key defensive system

Stovepiped   Treatment of Risk

- <u>Formal, systematic risk engagement</u> would likely have led to consideration of evident operational lessons

HMS Sheffield after being hit by an Exocet anti-ship missile in the 1982 Falklands War with Argentina. The ship later foundered.

Looking Up

Integrated battle force air defense capability was not delivered:

- Planned build reduced to six based on the expected performance of Network Enabled Capability (NEC)

- NEC was subsequently eliminated to reduce cost, but the required force structure was not revisited

Sticking to Past Program Decisions:

– There is no more appropriate time for <u>considering a review of past decisions</u> than when the entering assumptions that led to program decision have changed

Contracting Error

Looking Across

Multiple shipbuilders, contracted individually in a block-building approach:

- Expected MOD to referee integration among the providers
- When coordination problems ensued in execution, promptly painted the issues as a government problem.

Not My Problem:

– Although MOD needed <u>broad system ownership</u> from the participants in the block-build, contractual mechanisms to make it a reality were not established in the beginning of the program, and shipyard managers were apparently satisfied to work within their silos regardless of outcome

Looking Down

For a project whose requirements and design remained in flux long after the contract was signed the MOD team:

- Was understaffed and did not have access to a single, integrated picture of the entire project.

- Did not maintain a significant on-site presence at the shipyards

- Relied on the shipbuilders for evaluations of progress, cost, and risks

Passive Oversight:

– <u>Vertical knowledge and engagement</u> by the MOD was essential to ensure that the contractor understood the government's expectations, including their evolution over time, and remained on track to meet them

Looking Up

The shipbuilders were aware of the project challenges but failed to provide full visibility into the developing risks as decisions for change were made by MOD

Concealment of Dissension:

–Transparent decision support at all levels is a necessary element for programs to avoid pressing forward when they should be developing better understanding of existing and developing challenges

Looking Across

MOD established no independent evaluation process to monitor and assess results

Absence of   Accountability
Disregard   of Honest Appraisal:

–Unambiguous accountability facilitated by rigorous and open self appraisal should have allowed the project team to stay ahead of the growing challenges

Looking Up/Across

Communication of developing problems and obstacles up the chain within MOD was challenging

- Rigid bureaucratic structure that challenged information flow
- Perception that senior leaders would not welcome troubling inputs

Reluctance to Question Authority and

Surrender   to Bureaucratic   Process:

– The project team was not prepared to deliver the <u>forceful backup</u> necessary

– It was constrained by bureaucratic processes from making timely recommendations for change and did not <u>embrace the need for thoughtful and supportive processes</u> to ensure information flowed

Postscript: Failure of the UK Daring-Class Propulsion System

- First use of Integrated Full Electric Propulsion (IFEP   ) in a class of complex warships
- 8,000 hours shore testing planned to mitigate risk

What happened?

- Major IFEP component design changed after 5,000 hours of testing; MOD "decreed" remaining 3,000 hours sufficient for revised design
- Repeated total electrical failures at high injection temperatures; problems emerge after 4,000 – 5,000 hours; engines "degrading catastrophically"
- MOD refitting class with additional diesel engines; estimated cost of £1 billion

Why? Confirmation-seeking, risk cavalier decision making

- Excessive deference to MOD directives:
  - Reluctance to Question Authority
- MOD reluctance to delay build process:
  - Culture of Production
- Engineering specifications out of line with operational experience:
  - Surrender to Bureaucratic Process

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