High Consequence Event Management

SEAPOWER THROUGH ENGINEERING

5.1.10

TOPIC LEARNING OBJECTIVES

Upon successful completion of this topic, the student will be able to:

1. Discuss the relationship between effectively managing High Consequence Events (HCE) and the core tenants of the Navy Leader Development Framework.
2. Compare and contrast the Fukashima nuclear disaster with similar types of high consequence activities conducted by the Navy.
3. Discuss the role organizational culture plays in contributing to or reducing the occurrence of high consequence events.
4. Understand Heinrich's Triangle as it relates to accidents and near-misses and the role the human element plays in causing or preventing them from happening.
5. Understand The HCE Prevention Framework (HCEPF) Principles and Values.
6. Recognize the different types of human element weaknesses (and their corresponding positive attribute) and discuss how they can contribute (or prevent) to the occurrence of a high consequence event.
7. Explain what it means to be a risk-aware organization.
8. Review and discuss several real-world HCE case studies and the associated human element weaknesses.
9. Discuss tools available to utilize the HCEPF within your organizations and teams to create risk aware organizations.

STUDENT PREPARATION

Student Support Material

1. Strengthening SSP: The High Consequence Events Prevention Framework, 6 June 2018 [focus on pp. iv – 51]
2. HCEPF Tools Reference Guide Version 4, May 2020
3. HCEPF Fitness Regime Version 3, May 2019 [skim]

Primary References

1. Strategic Systems Program HCE Case Study
2. "Driving Toward "0"; Best Practices in Corporate Safety and Health"; The Conference Board, 2003
3. https://www.retroreport.org/video/major-malfunction-lessons-from-challenger/

Additional References

1. DOE Human Performance Improvement Handbook, VOL II
2. How Habits Work https://youtu.be/W1eYrhGeffc
3. Using Habit Insights in Military Strategy https://youtu.be/s7waGhujn44

BLUF

- Strategic Systems Program (SSP) developed the High Consequence Event Framework program to provide a common set of tools and nomenclature for its organization to use in developing a Risk Aware Culture
- Strengthening SSP: The High Consequence Events Prevention Framework provide the background on the program, previous work on risk prevention, analysis models and case studies
- The HCE Fitness Regime and HCE Tools Reference Guide is provided to you for reference and use throughout your career in leading and managing highly complex and technical programs and projects

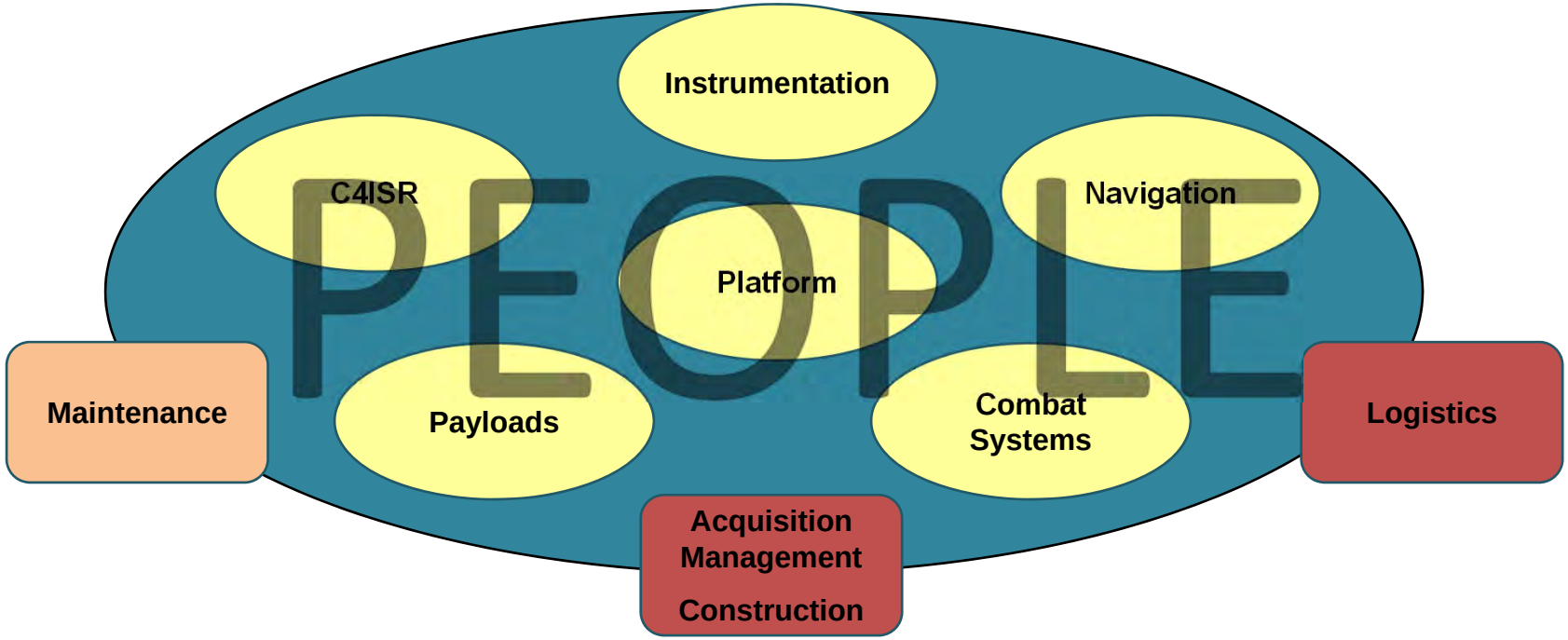
Fukushima Nuclear Accident
(video)

The Fukushima Nuclear Disaster

- March 2011 earthquake/tsunami/reactor disaster changed Japan's course
  - Precipitated a ***shutdown*** in an industry key to Japanese economic security
- Natural disaster was unstoppable, but the reactor accidents (3) arose from human failures to evaluate and respond to risk
- Population Safety: Japanese living near shore are taught to get ***one mile inland*** or ***one hundred feet above sea level*** after a tsunami alert; almost all who heeded survived
- Reactor Safety: Reactor plants and their emergency power supplies were located ***near shore*** and ***thirty feet above sea level***; no chance of survival
- Why: Failure of a critical system component -- the people

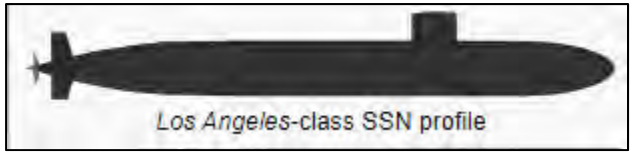
"The fundamental causes are to be found in the ingrained conventions of Japanese culture: our reflexive obedience; our reluctance to question authority; our devotion to 'sticking with the program'; our groupism; and our insularity"
Kiyoshi Kurokawa, Chairman

Typical Navy System Elements



Risk aware culture must be deliberately designed, like every other example on this page

LOS ANGELES (SSN 688) CLASS



USS GREENEVILLE (SSN 772)

- Los Angeles-class submarines were built in three successive flights between 1972 – 1996 (SSNs 688–773)
- SSN 751 – 773 had a significant upgrade with the 688i improvement program - quieter, advanced electronics, sensors, and noise-reduction technology
- Displacement submerged: 6,927 long tons
- Length 362 ft, Beam 33 ft, Draft 31 ft
- Propulsion 1 × S6G nuclear reactor
- Complement ~129
- ***62 Los Angeles Class boats built and deployed since 1976***

USS GREENEVILLE COLLISION

USS GREENEVILLE COLLISION: Inquiry yields answers and more questions

Nine k

13 Apr 01

From: Vice Admiral John B. Nathman, U.S. Navy
Rear Admiral Paul F. Sullivan, U.S. Navy
Rear Admiral David M. Stone, U.S. Navy
Rear Admiral Isamu Ozawa, JMSDF
To: Commander in Chief, U.S. Pacific Fleet

Subj: COURT OF INQUIRY INTO THE CIRCUMSTANCES SURROUNDING THE COLLISION BETWEEN USS GREENEVILLE (SSN 772) AND JAPANESE M/V EHIME MARU THAT OCCURRED OFF THE COAST OF OAHU, HAWAII ON 9 FEBRUARY 2001

Ref: (a) JAGMAN
(b) JAGINST 5830.1

Encl: (1) Record of Proceedings

PRELIMINARY STATEMENT

1. On 9 February 2001, at 1343 local time, the USS GREENEVILLE (SSN 772) and the Japanese Motor Vessel (M/V) EHIME MARU collided in waters nine miles south of Oahu, Hawaii. Within minutes of the collision, the M/V EHIME MARU was lost, along with nine of her embarked complement.

through the hull of the Ehime Maru on Feb. 9. The submarine was demonstrating a rapid-surfacing drill for 16 civilian passengers when it sank the Japanese trawler, a training boat for young commercial fishermen.

Greeneville Cmdr. Scott Waddle; his officer of the deck, Lt. j.g. Michael Coen; and the executive officer, Lt. Cmdr. Gerald Pfeifer, are the subjects of a rare court of inquiry. They could face discharge, courts-martial and even imprisonment.

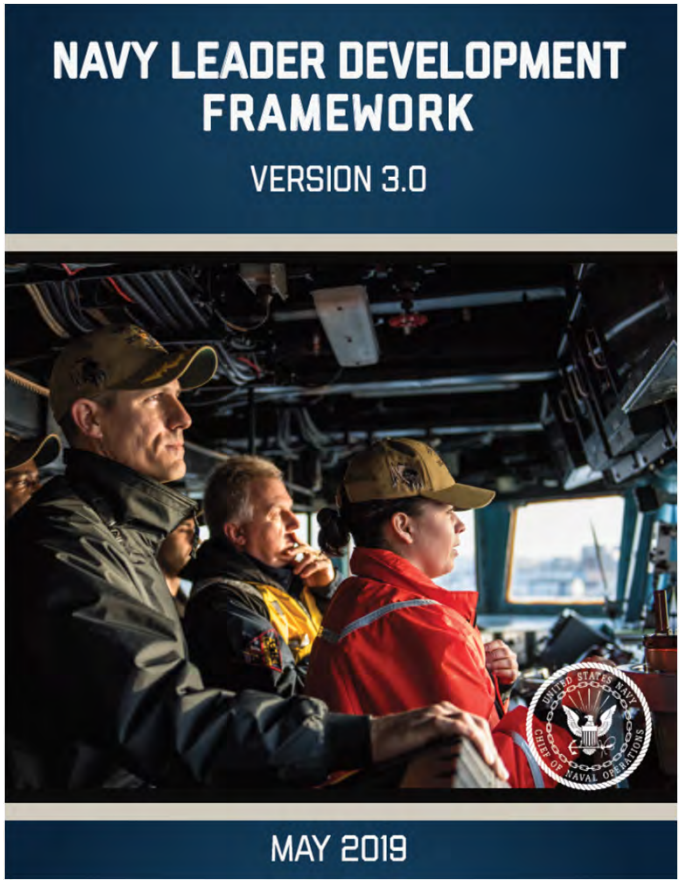
1

USS GREENEVILLE COLLISION

Court of Inquiry

- A principal cause of the collision was an artificial urgency created by the CO in the Control Room to complete all afternoon DV events and return to Pearl Harbor as close to schedule as possible.
- A principal cause of the collision was the CO's disregard of standard submarine operating procedures and his own Standing Orders.
- The artificial urgency created by the CO caused him to deviate from NWP guidance and his own Standing Orders when performing TMA, the ascent to periscope depth, and his visual search at periscope depth.
- The CO's order to the OOD that "I want you to prepare for and be at periscope depth in five minutes" was unreasonable and indicated time was a significant factor as GREENEVILLE continued through afternoon ship maneuvers.
- GREENEVILLE's command climate and the presence of civilian guests onboard affected the performance of watchstanders, and thereby indirectly contributed to the collision.
- As GREENEVILLE's Commanding Officer (CO), CDR Waddle was an engaged and personable leader. He assumed a "hands on" management style, particularly during operational evolutions requiring precision and attention to detail. This tendency was noted by COMSUBPAC, who specifically saw fit to mention this trait to CDR Waddle during an embark onboard GREENEVILLE in March 2000. At that time, COMSUBPAC told CDR Waddle to "not run too fast," and to give his crew the opportunity to grow.

Navy Leader Development Framework



"Effective Navy leaders demonstrate a deliberate commitment to grow personally and professionally throughout their careers. They work from a foundation of humility, embracing our core values of honor, courage and commitment…our Navy will develop leaders who demonstrate both operational excellence and strong character…"

How do humility, core values, operational excellence and strong character manifest themselves in the context of High Consequence Event Management?

Homework

- Assigned in Google Classroom
  - Strengthening SSP- HCE Prevention Framework
    - Answer questions (a) – (m) found on ‘Classwork’ tab in Google Classroom
  - Read three event summaries
    - CHANCELLORSVILLE pp. B25-32 (Strengthening SSP-HCE)
    - UK Daring Class shipbuilding pp. B54-58 (Strengthening SSP-HCE)
    - BHR fire Safety Report (separate .pdf file)
- Be prepared to deep dive Human Element Weaknesses from the event summaries in class

BLUF

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Developing the Culture

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

B-2 Crash at Andersen Air Force Base

- Air Force B-2 Spirit bombers had been deployed to Guam for short periods starting in 2006
- Guam's tropical climate produced routine humidity levels substantially higher than in the temperature and humidity-controlled hangers in Missouri
- Some B-2 maintenance technicians surmised that the additional humidity explained the problems they experienced in completing pre-flight checks, during which Air Data System (ADS) sensors were not providing proper indications. Discussions with the manufacturer suggested a ***workaround***, applying pitot tube heat, that would allow the pre-flights to be completed successfully
- Although the workaround achieved the intended purpose, ensuring adequate performance of the ADS, the solution was ***never formalized*** or officially disseminated across the community
- In 2008, a B-2 ground crew, ***unfamiliar with the workaround***, executed an ADS recalibration in response to alerts during pre-flight checks, in accordance with ***approved*** procedures
- Pitot tube heat dried the sensors, some of which, having been recalibrated while damp, were now no longer properly calibrated
- The ADS produced erroneous readings for speed on the subsequent rollout, leading the pilot to initiate a premature rotation. Then the aircraft's automatic Flight Control System made corrections based on the faulty readings, directing a steep attack angle; the plane quickly stalled and crashed. Both pilots ejected, but $1.4B plane destroyed

Developing the Culture

What's the right approach?

*"There are no organizations without institutional habits. There are only places where they are **deliberately designed**, 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

Exam Compromise at Malmstrom AFB

- Watch Officers of the 341st Missile Wing, assigned in two person teams in US Air Force Launch Control Facilities of Malmstrom Air Force Base, had to take periodic technical examinations to evaluate their level of knowledge of the systems that they were responsible to operate
- While other operational activities demonstrated the officer's readiness for and effectiveness in their jobs, ***the examinations had become, over time, a critical sorting mechanism*** that senior personnel used in evaluation of the watch officers
- The watch officers had developed the opinion that they had to score ***perfect grades*** on the exams to advance in their careers
- Faced with what they perceived as an ***impossible challenge***, the watch officer resorted to systematic cheating on the exams to ensure career progression

Why High Consequence Events Prevention?

- Premise…
- 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

Framework


Engaged People
Risk Aware Behaviors
Values
Principles
Enabling Tools

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

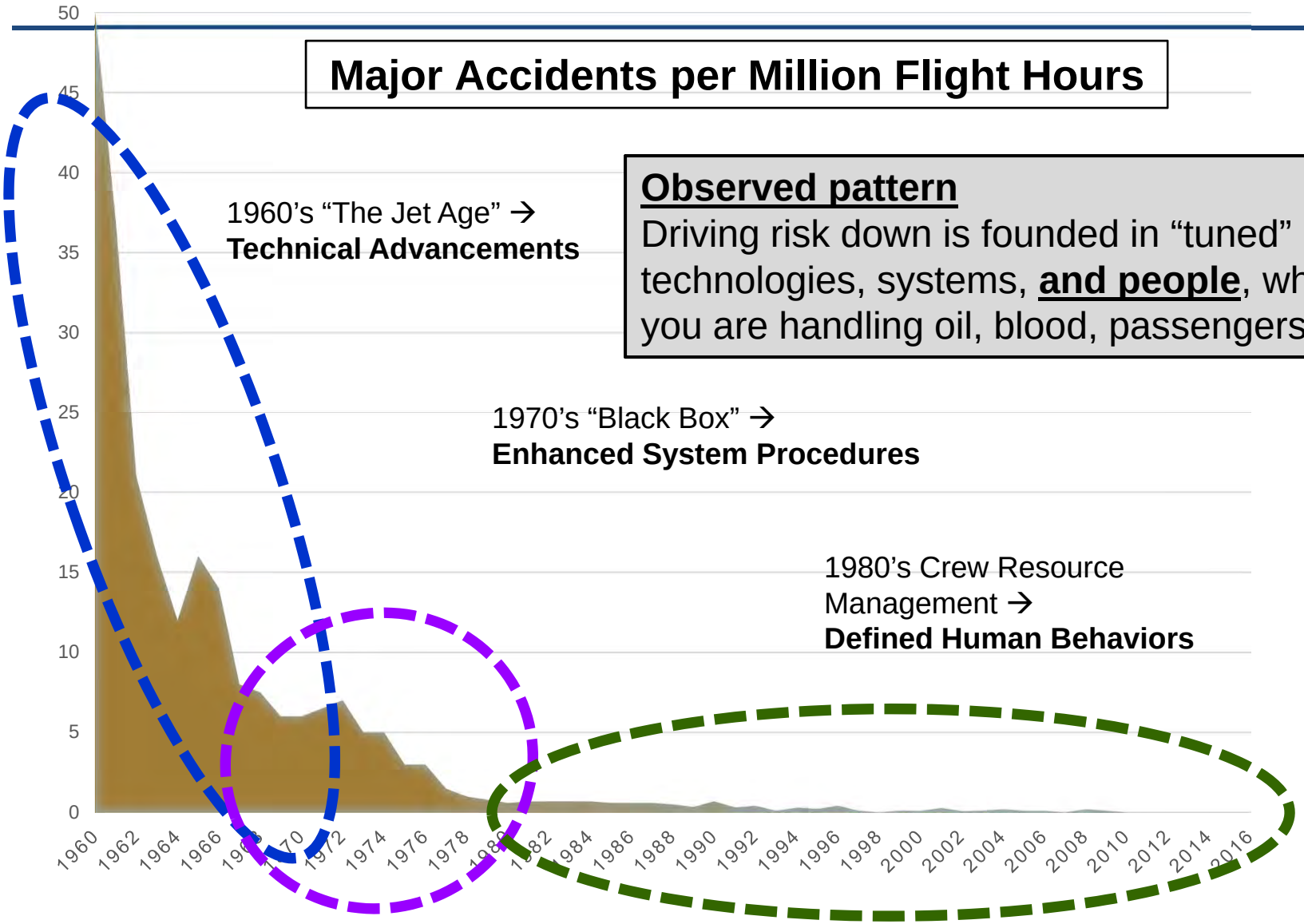
Co-workers ready to identify and resolve unnecessary risk, even outside of their team

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

B-52 Crash at Fairchild Air Force Base

- On 24 June 1994, a B52-H practicing maneuvers for an upcoming airshow at Fairchild Air Force Base, WA, crashed 18 minutes after takeoff, killing all four Air Force officers on board
- The aircraft exceeded speed, bank angle, and altitude regulations, leading the plane to stall, contact a power line, and impact the ground
- Investigation of the accident would reveal that the pilot had a long, ***widely-known history of violating flying regulations*** and technical order limitations but had been permitted to continue flying B-52s
- Although only the four people aboard the aircraft were killed, had the crash occurred during the airshow rather than at a practice session, the human cost could easily have been much greater

Correlating Data:
Airline Accident Rates 1960-2016

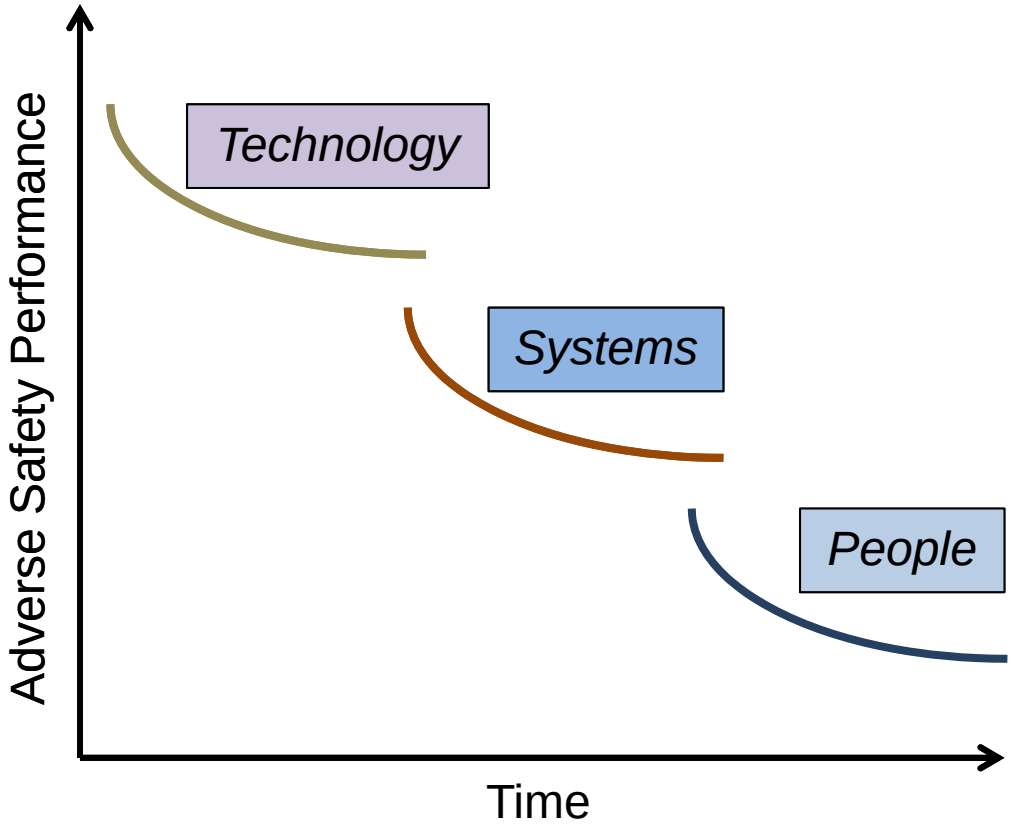


Observed pattern

Driving risk down is founded in "tuned" technologies, systems, **and people**, whether you are handling oil, blood, passengers, or ….

Three Levels of Performance Focus

Experience at Exxon-Mobil*



Corporate improvement across two decades

- Technology focus: safety at the component level
- Systems focus: safety through system of systems integration
- People focus: safety through personnel behavior…

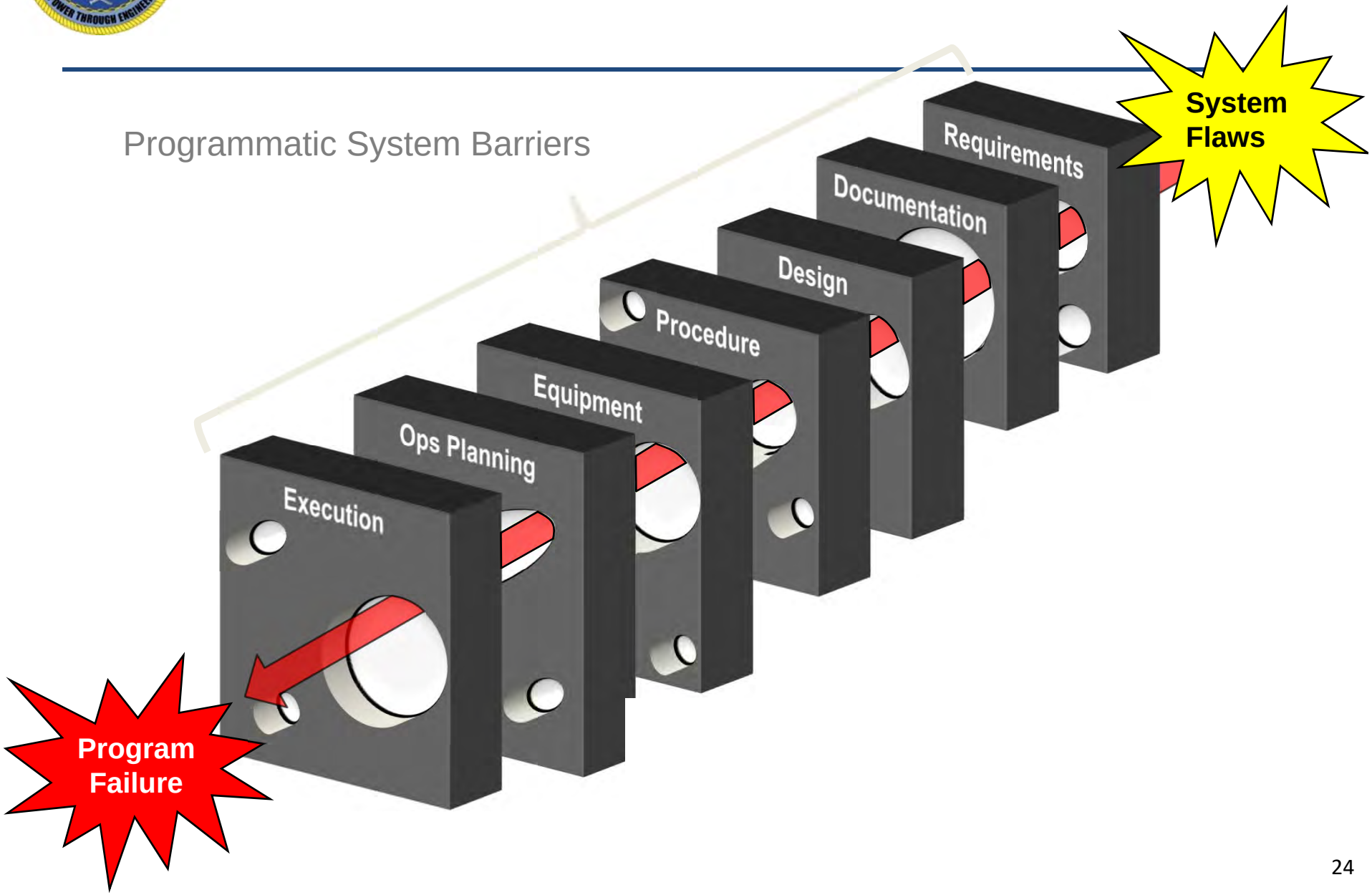
  Factors:
  - Leader commitment
  - Knowledgeable and skilled application of tools
  - Workforce buy-in
  - Personal accountability and willingness to intervene

All three domains are important – a holistic approach to risk and mission assurance requires attention to each

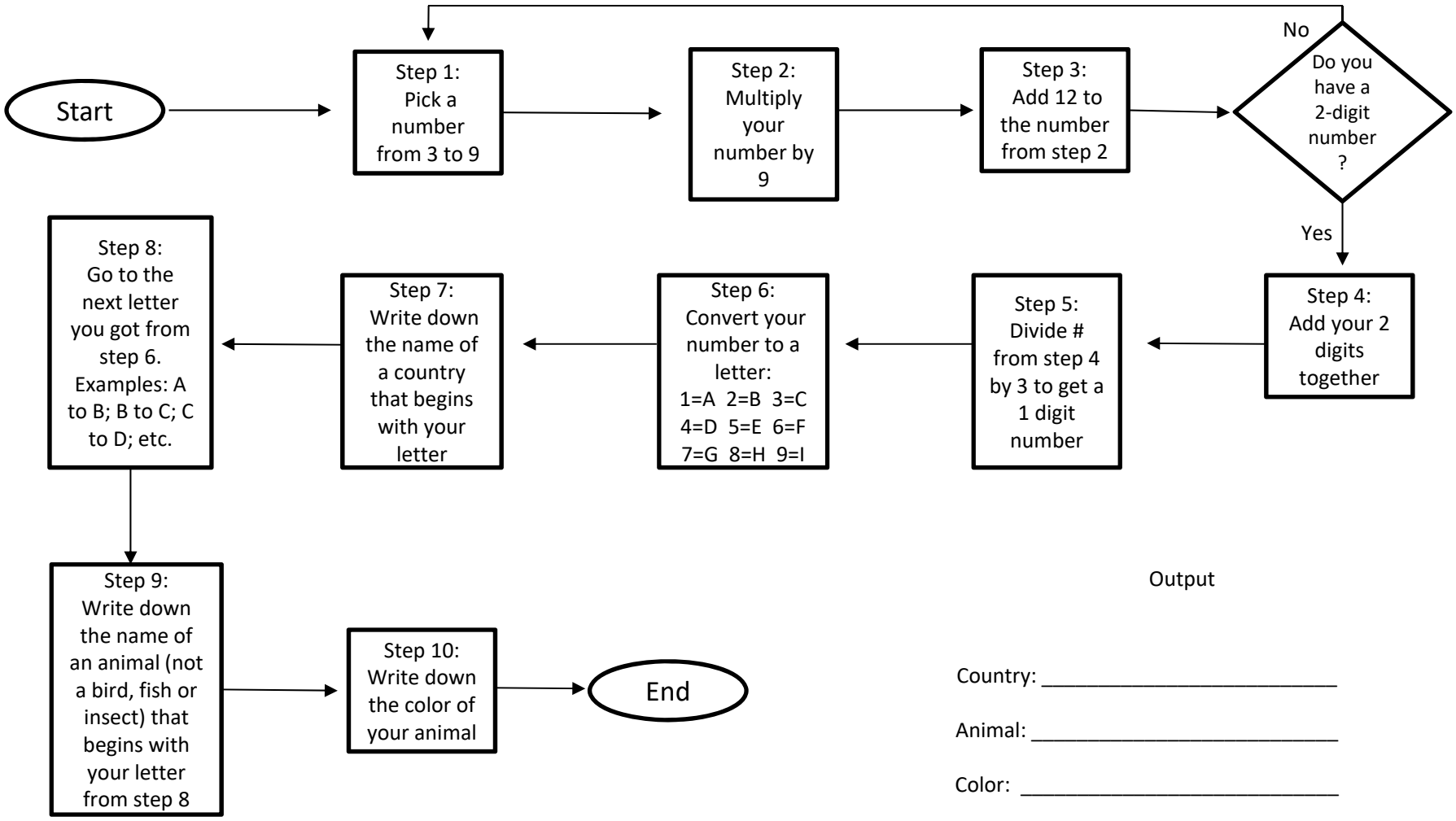
* "Driving Toward "0"; Best Practices in Corporate Safety and Health"; The Conference Board, 2003

"Barriers" to Block Failures

Programmatic System Barriers



Activity



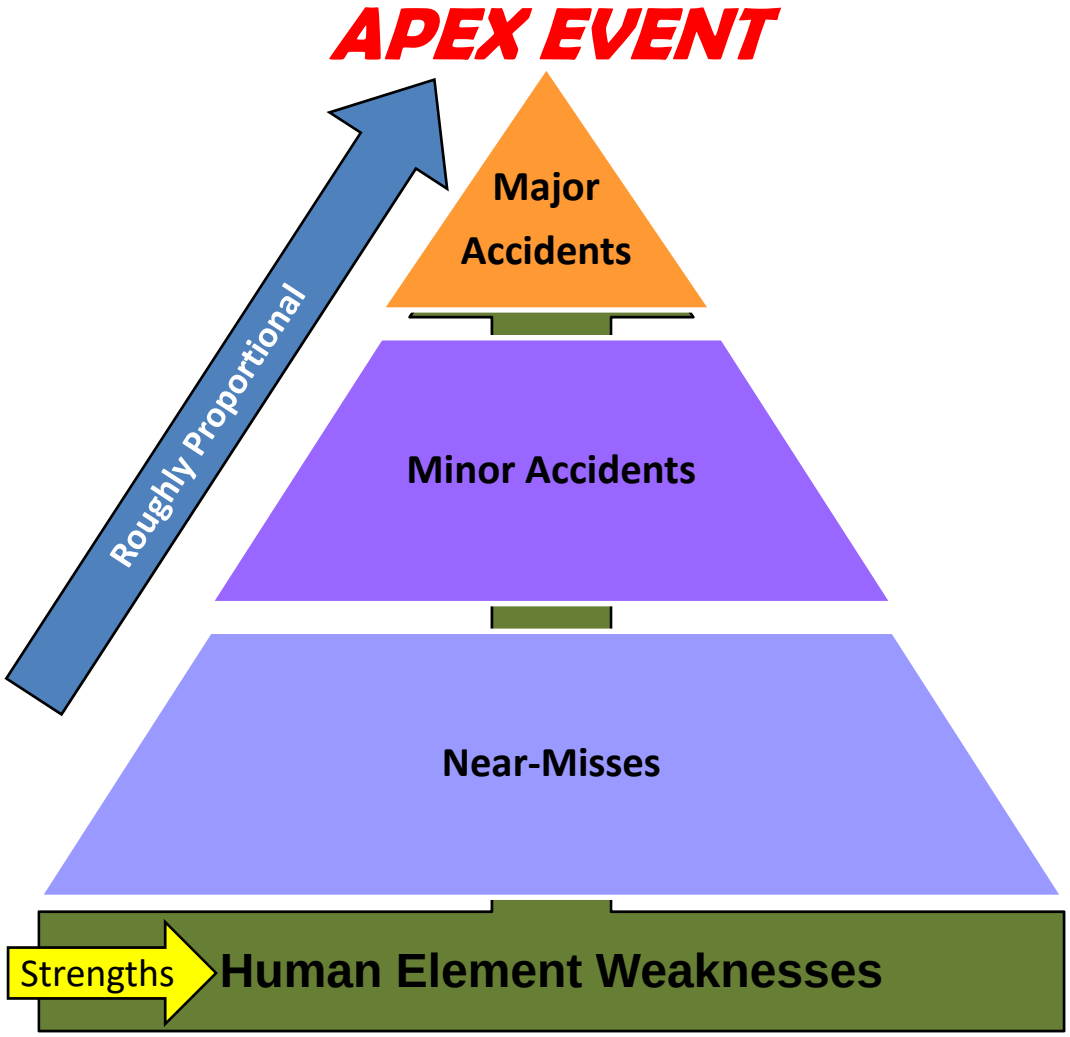
Output

Country: _____

Animal: _____

Color: _____

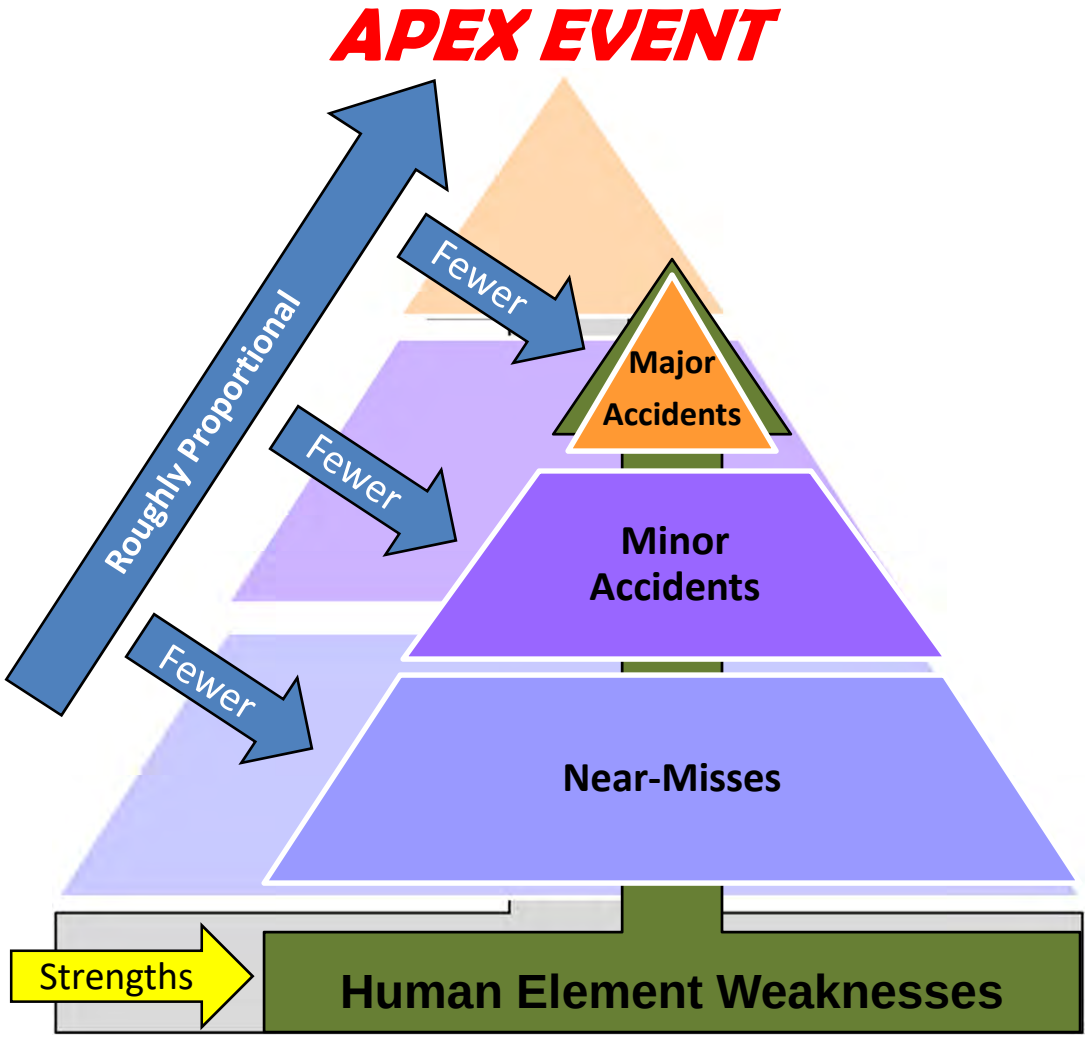
Heinrich's Triangle: Habits and Outcomes



Similar types of human errors are at the root of incidents of all sizes

Weaknesses in the Human Element (habits without forethought)

Heinrich's Triangle: Habits and Outcomes



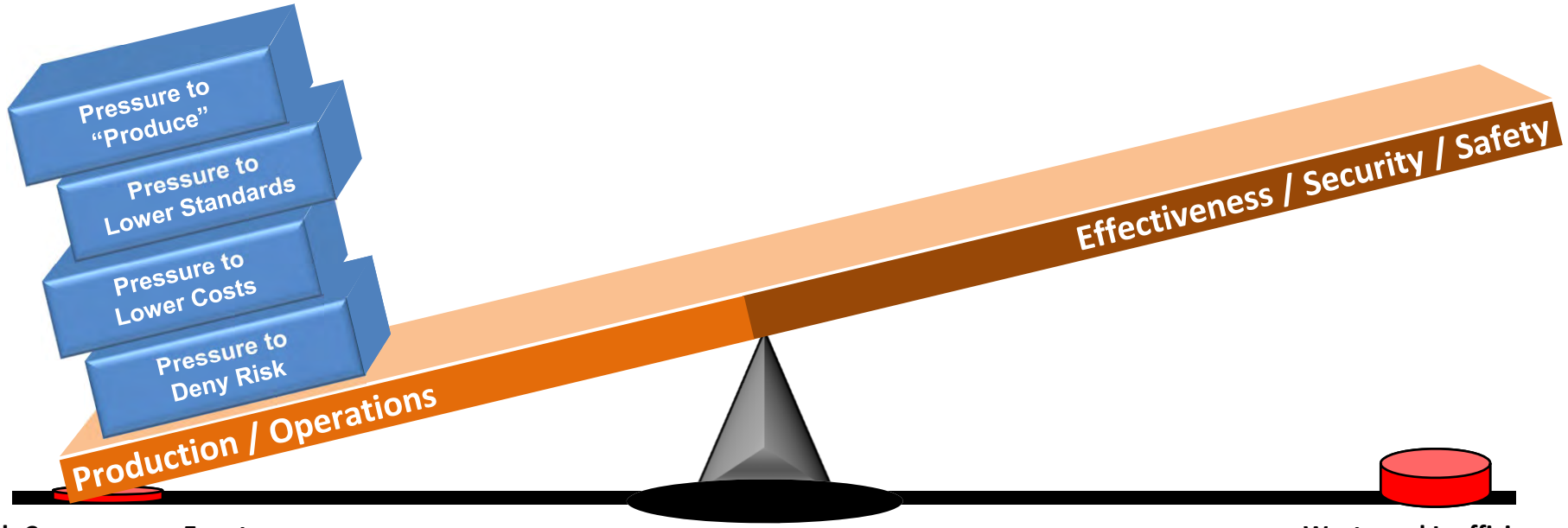
<u>If we learn from events at the lowest level and work on reducing those human element weaknesses…</u>

We should naturally reduce the likelihood of major events

And move away from the apex

Risk Ignorant/Cavalier Organization
A Losing Proposition

Ever-changing Pressures to Reduce Risk Margins

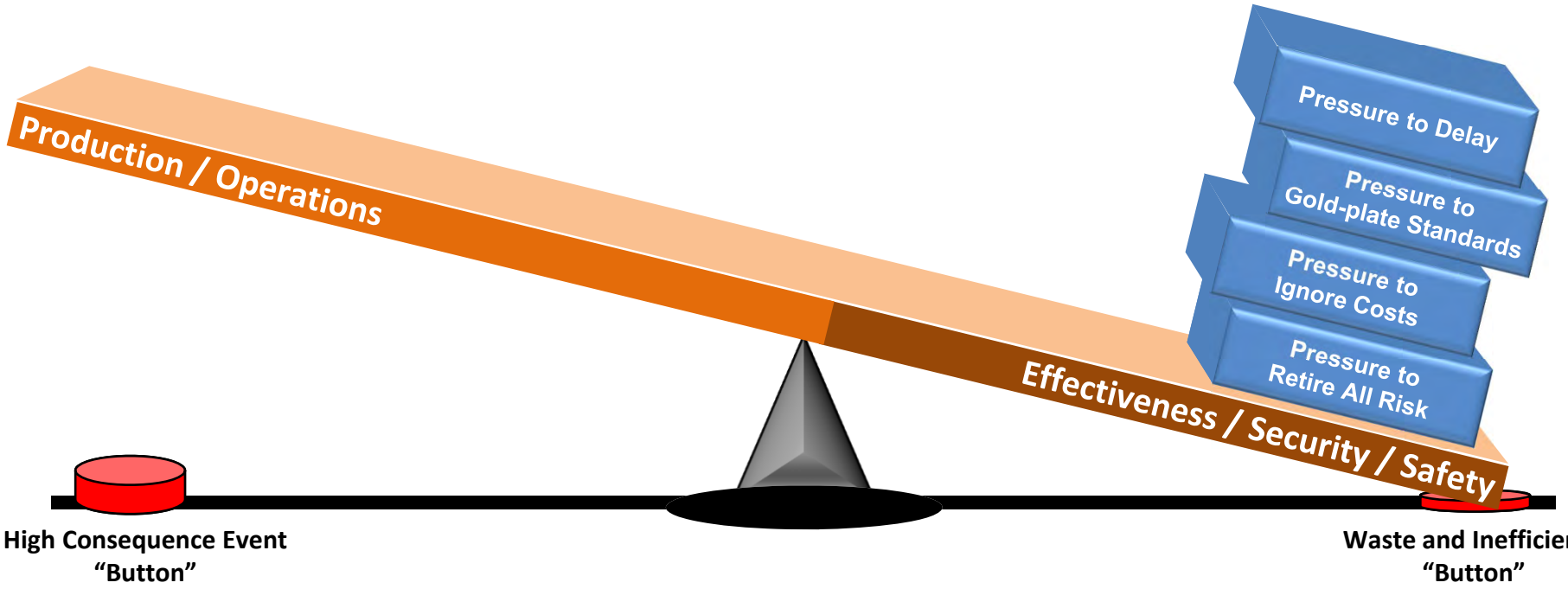


High Consequence Event "Button"

Waste and Inefficiency "Button"

Risk Averse Organization
Another Losing Proposition

Ever-changing Pressures to Increase Risk Margins

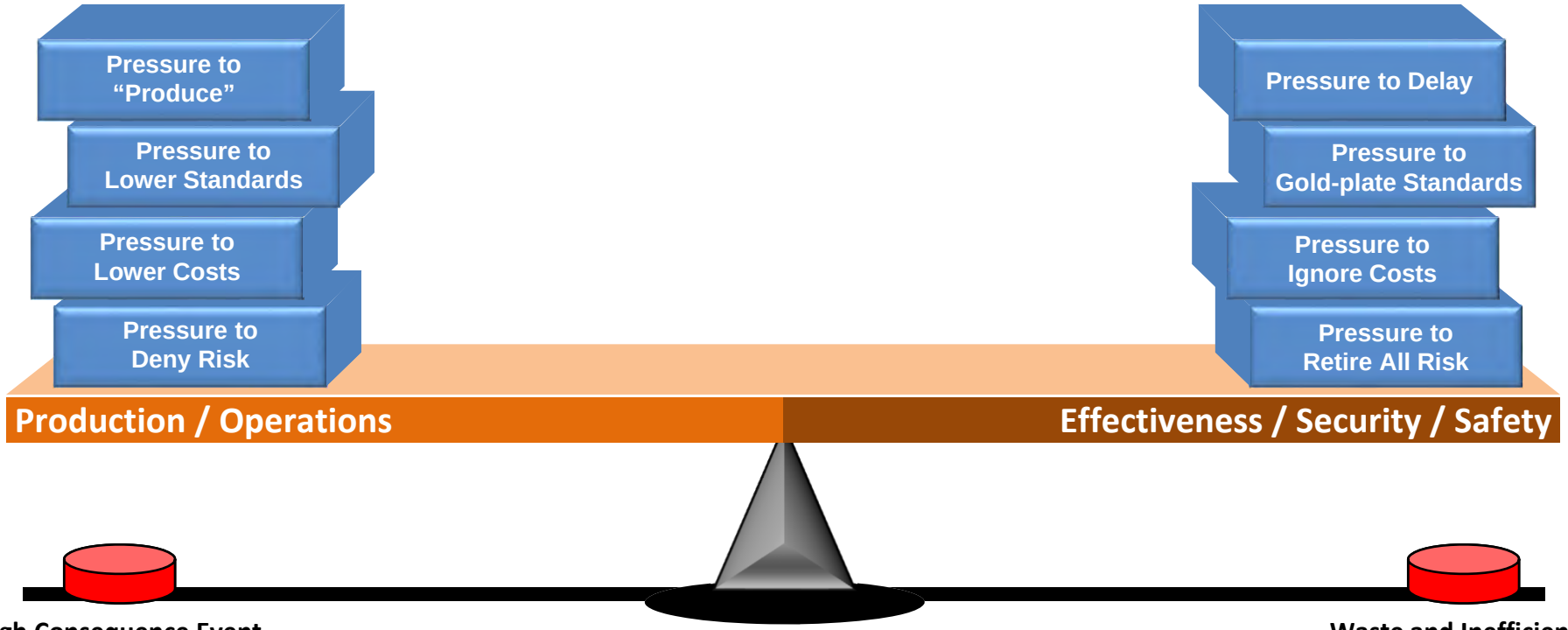


The Defense Program Balancing Act

Goal: Deliver and Provide Mission Assurance

Ever-changing Pressures to Reduce Risk Margins

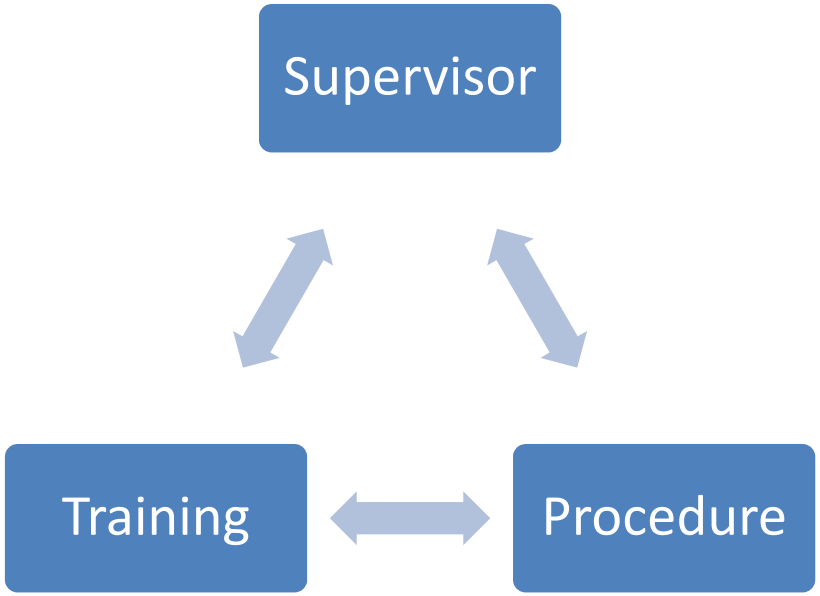
Ever-changing Pressures to Increase Risk Margins



High Consequence Event Button

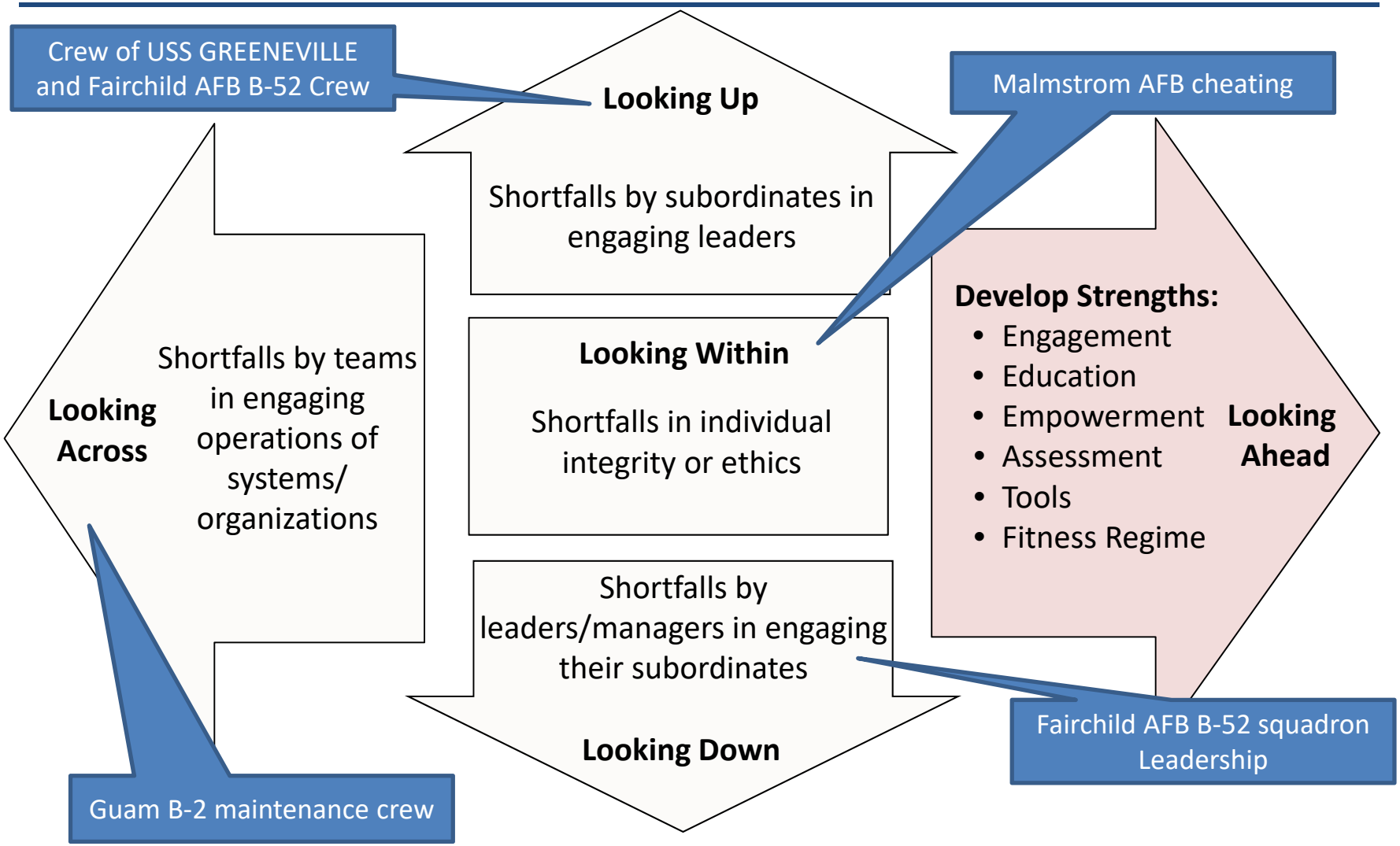
Waste and Inefficiency "Button"

Risk Aware Work Model



- Work model is focused on successful completion of activities, while explicitly recognizing the need to balance production and safety
- Simple model to think about the right mix of technical knowledge, procedure, and supervisory attention

Dimensions of Human Element Weaknesses



Objectives

- ***Identify the causes of failure*** of organizational performance in representative high consequence events
- ***Ascertain commonalities in the weaknesses*** that could, conceivably, lead to future program performance problems
- ***Engage community leaders***
  - Awareness of the kind of problems that arise in organizations
  - Avoidance of pitfalls that others suffered
  - Responsibilities that each individual has (as well as ***Authority*** and ***Accountability***) to engage their work with ***human element strengths***
- ***Incorporate strengths*** into day-to-day organizational/system operations – drive the organizational culture

Prevention of high consequence events is an all hands mandate

…and Behaviors

Risk Aware Behavior	VS	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*

Case Study

Teamwork: Each team will read the event summary and analysis in the appendix of Strengthening SSP: The High Consequence Events Prevention Framework and prepare a brief (4-5 slides) for the class

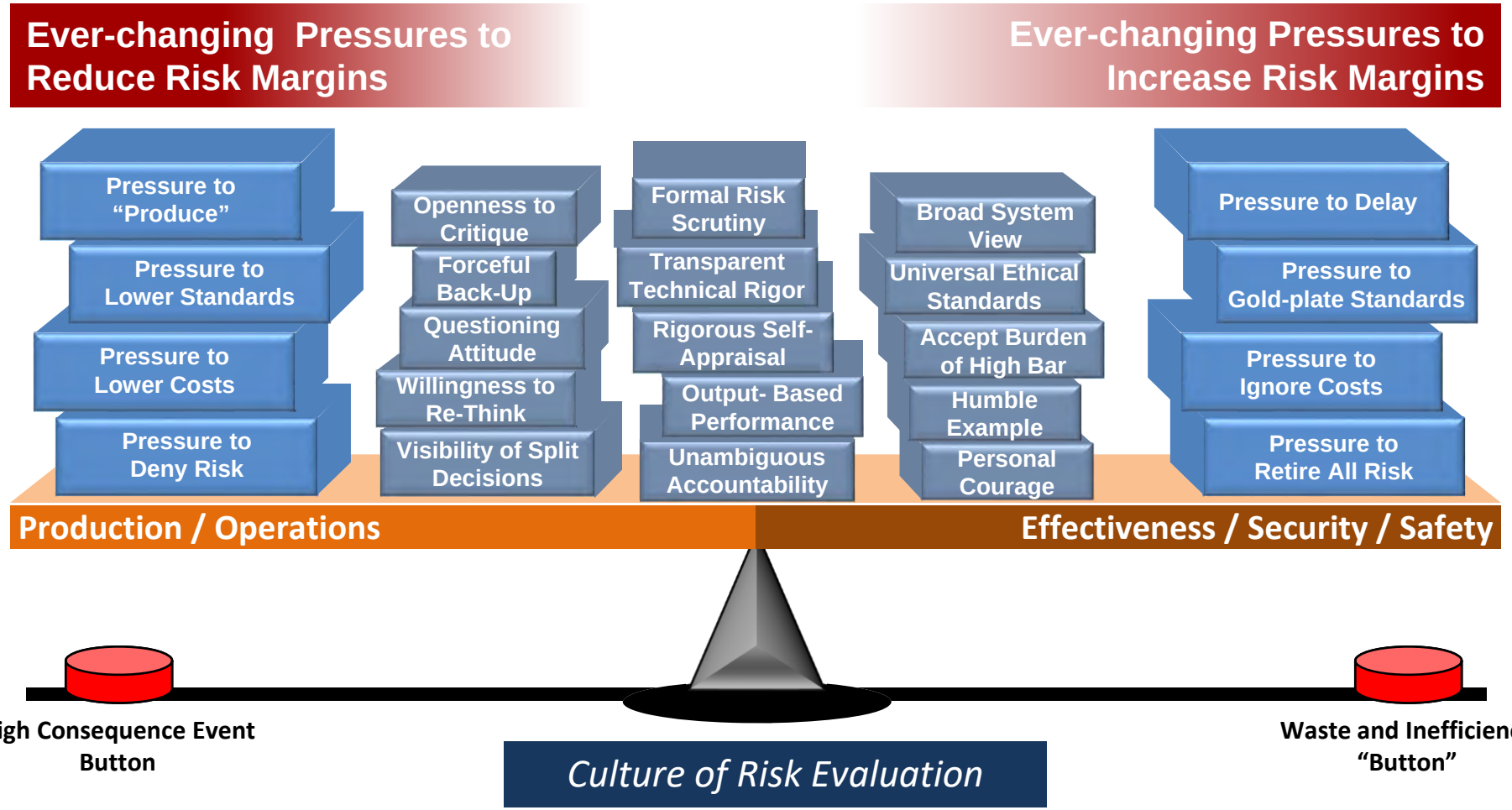
a. USS BONHOMME RICHARD Fire

b. UK DDG Type B45

c. USS CHANCELLORSVILLE Drone Strike

Risk Aware Organization
Balanced by a Mindful Human Element

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



Framework Tools

Risk Aware Behavior	VS	Human Element Weakness
LOOKING UP		
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Key Finding

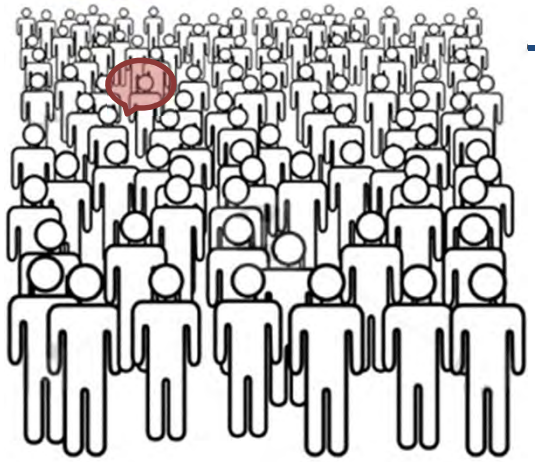
Need Both Technical and Human Element Strengths

- Organizations have technical strength but do not deploy it well because of weaknesses in the human element
- An organization with both cross-functional technical skill and core human element strengths acts to:
  - Prevent the occurrence of high consequence events by avoiding the sequence of "closed switches" that enable such events
  - Respond effectively with resilience when faced with the unexpected, coping with surprises for which there are no established procedures
- Root cause assessments typically identify technical failures but not the underlying Human Element causes that facilitated failures:
  - Technical/procedural focus: Technical errors, inattention, training gaps, and documentation shortfalls illuminated but not the underlying "why"
  - Human Element weaknesses left unaddressed: Shortstopping root cause assessment shortchanges utility, stymies change, and increases likelihood of recurrence

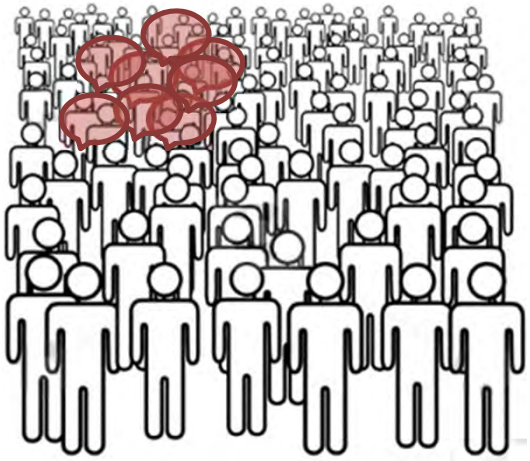
Four Keys for a Risk Aware Organization

- Senior leaders committed to and actively involved with HCEPF concepts
- 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

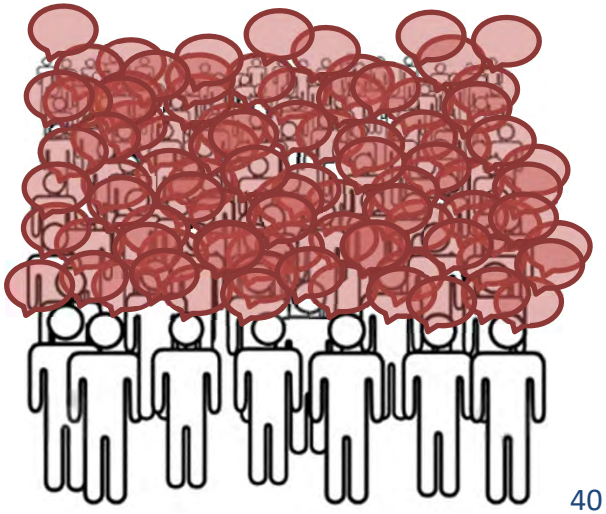
Importance of Keeping the Conversation Alive



If only a few people engage, the HCEPF will fade when other supervisors and team members go their own way



If only a few teams engage, the HCEPF will fade when the teams see the organization going another way

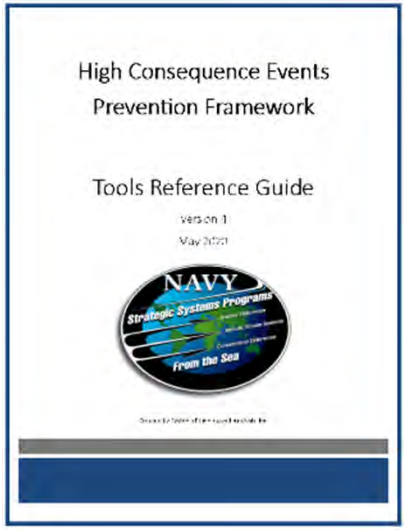


Building and sustaining a risk aware culture requires continuous engagement, across and at all levels of the organization

Organizational Tools: A Resource for Action

Tools Reference Guide

- A reference for more than forty ideas for tools
- Used to strengthen Risk Aware Behaviors
  - Individually, by teams, and organizationally
- Not intended to be a prescription
- Supports existing program processes
- Menu to mold and modify as needed



Tools

Individual	Function	Page
Act on Leemers		1
Bias Check		2
F.A.C.E.S.		3
Pause When Unsure		4
Personal Self-Assessment		5
Signature		6
S.T.A.R.		7

Individual and Team	Function	Page
Case Study Reviews		8
Decision Making		9
Job-Site Review		10
Mental Modeling		11
Procedure Review and Adherence		12
Risk Aware Work Model		13
Turnover Review		14
Validate Assumptions		15

Team	Function	Page
Brown Bags		16
Cross Organizational Consulting		17
Document Verification		18
Event Immersion		19
Five Whys		20
Operational Verification Practices		21
Post-Job Review		22
Pre-Job Briefing		23
Project Planning		24
Project Review		25
Stand Up		26

Team and Organization	Function	Page
Blue Ribbon Committee/ Red Team		27
Crew Resource Management		28
Event Critique		29
Focus Group		30
Focused Team Workshops		31
Independent Technical Review		32
Mentoring		33
Organizational Self-Assessment		34
Technical Review		35

Organization	Function	Page
Benchmarking		36
Change Management		37
Deferral to Expertise		38
Employee Surveys		39
Failure Spectrum		40
HCEPF Display Board		41
Lessons Learned Program		42
Newsletter		43
Operational Risk Assessment		44
Performance Evaluations		45
Performance Indicators		46
Performance Plan		47
Risk Aware Council		48
Training		49
Trend Analysis		50
Walk Around		51

All	Function	Page
Feedback		52
Near Miss Reporting		53
P.A.C.T.S.		54
Recognition		55

Function Key: = Setting Expectations, = Assessment, = Feedback, = Coaching, = Broadening the View

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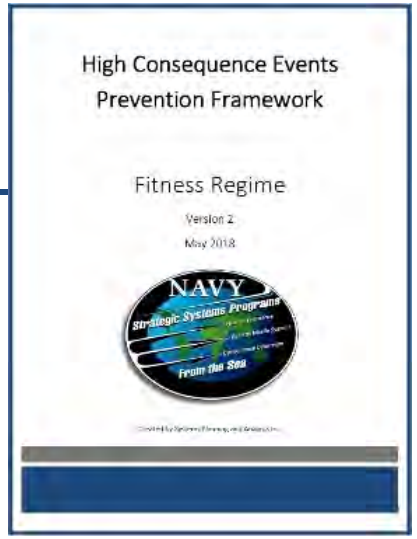
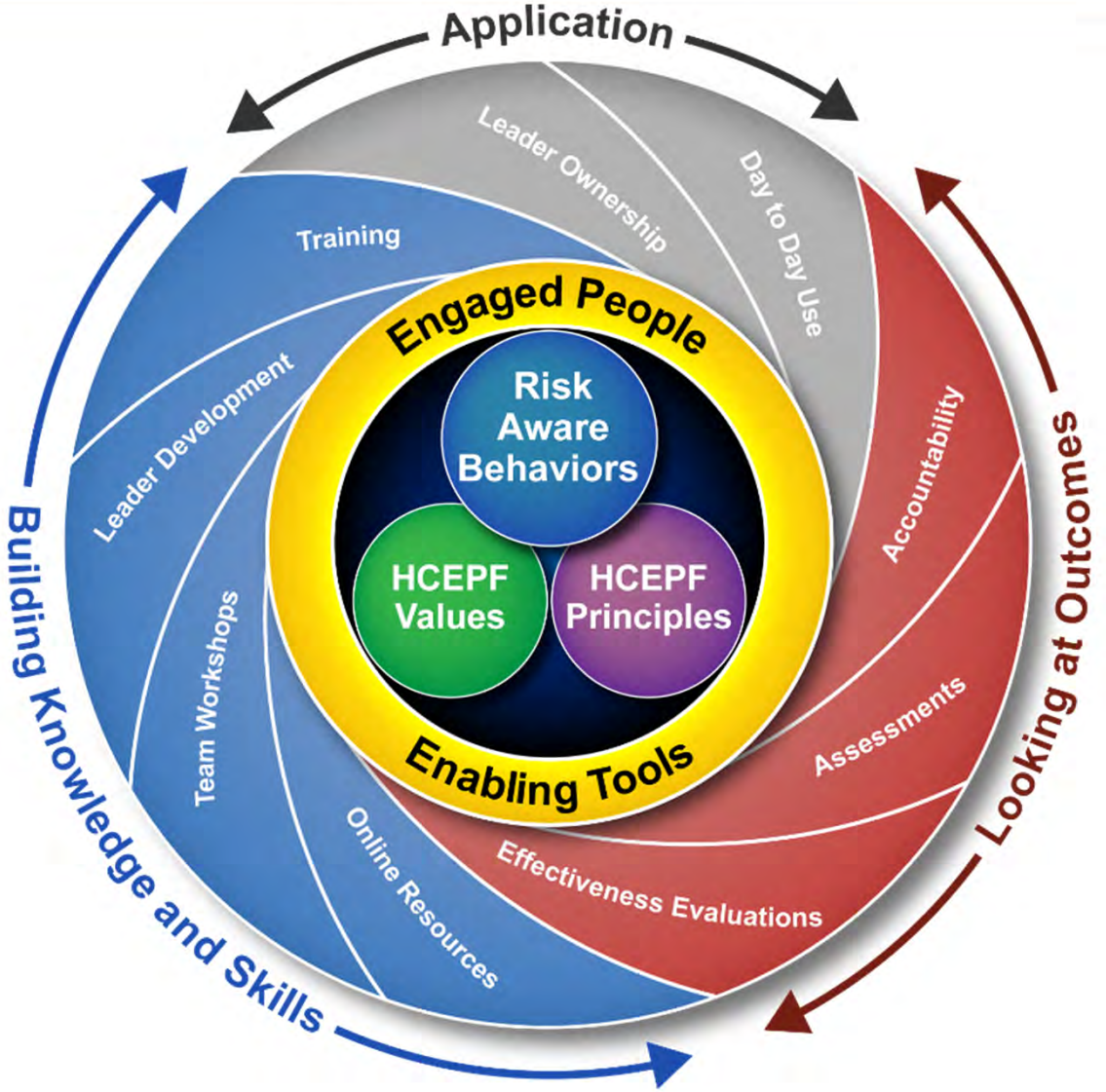
HCEPF Fitness:
Beating Entropy





Summary

- High Risk Technologies carry uniquely high burdens of responsibility
- Stewardship of complex Navy systems is explicitly a high risk endeavor
- Prevention of High Consequence Events requires ***both***
  - Technical expertise
  - Human Element strengths (up, down, across, within)
- Culture of Risk Evaluation is the Keystone Habit
- Human Element strengths promote conscious balance between excess risk and risk aversion
- Empowered individuals have ***Responsibility, Authority, and Accountability***
  — to demonstrate technical and Human Element strengths
- Sustained energy and leadership action is needed to make prevention real in your day-to-day work