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Leading with system safety

A C-level imperative for oil, gas, and chemical companies

Executive Summary

Safety in the oil, gas, and chemical (OG&C) industries is far from being “solved.” There is no data to contest that the next major catastrophe is right around the corner. Studies are showing quite the opposite; major catastrophes continue to happen for reasons that these industries have already learned in the past. History continues to repeat itself. OG&C companies should consider radically changing how they approach improving safety, and they need to directly action it from the C-suite. Here are five actions that OG&C companies can take to initiate, enable, and sustain system safety from the top.

Safety and reliability have been a top OG&C priority for decades. But with companies operating in an ever-changing landscape of regulatory mandates, high-profile disasters, media scrutiny, and public demands for worker and environmental protections,¹ there is always a reason to focus on improving safety standards. A 2020 study, the 26th edition since 1974, showed that the hydrocarbon industry in 2018–2019 had the highest concentration of large losses (major catastrophes) in a two-year time period since 1988–1989.² Of additional concern, the same study found that the root causes identified in the 1988–1989 incidents continued to be seen over and over in the 2018–2019 incidents; indicating that lessons learned from the past are not consistently being incorporated into today's ways of working.³

While acknowledging that it is essential to get safety right, OG&C companies are finding that the way forward has many complexities to navigate. For example, despite years of investments and initiatives, it is still difficult to determine if OG&C companies' safety measures are enough to truly move the needle.

There currently is no way to calculate that investing “X” amount of money will deliver “Y” amount of safety improvement. In addition, it is becoming clear that assessments of incident rates or near misses don't provide a fully accurate picture of how “safe” an organization is. Neither will assessing the trend of only major catastrophes provide any insight on an individual company or asset basis, as these do not happen on a regular basis: a trend near zero is not a reliable way to predict if your company will show up on the largest losses list in the next year or not. Underpinning this is the fact that the inherently hazardous and highly complex nature of OG&C operations means that they will always remain high-consequence industries.

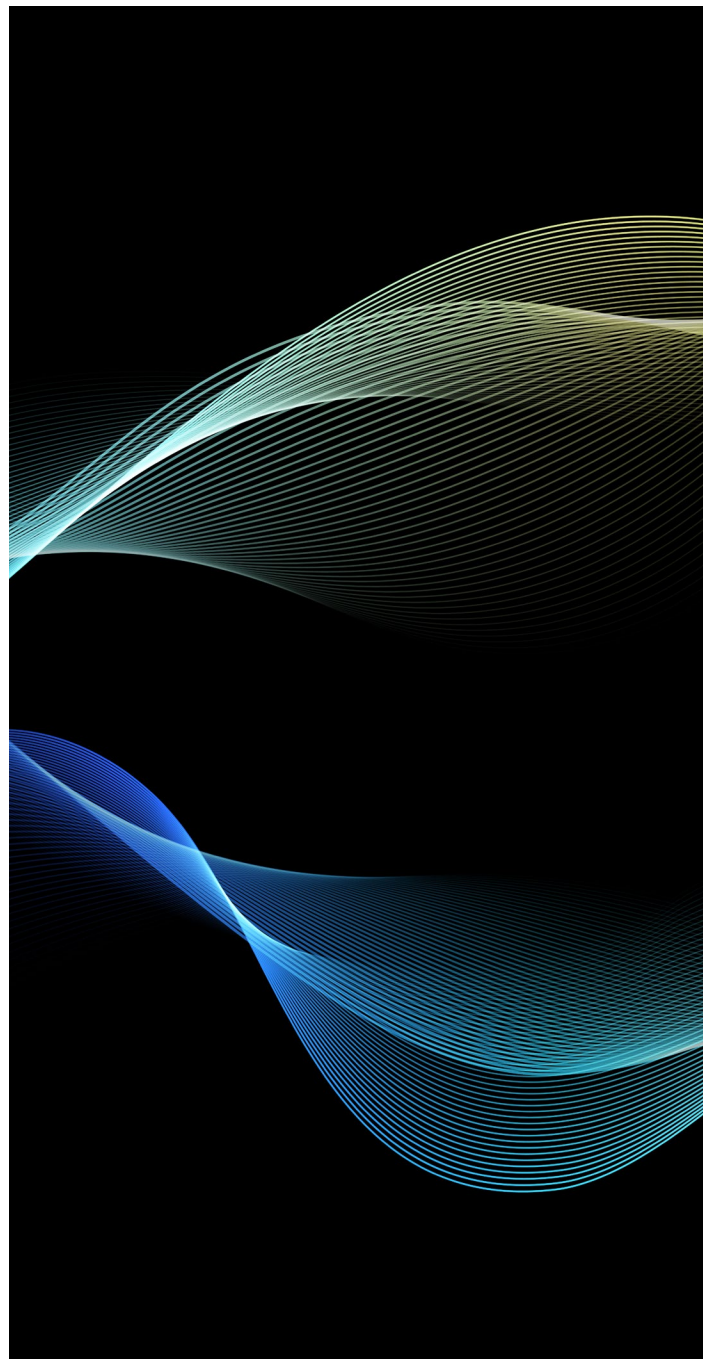
Despite these and other challenges, improving safety and reliability remains a strategic priority for OG&C companies. To achieve noticeable, enterprisewide change—to truly move the needle on safety—organizations should make sure that not only the championing of safety, but also the actioning of safety starts in the C-suite.

Redefine safety to change perspectives

How can OG&C C-suite leaders initiate, enable, and sustain safety across their organization? To begin, leaders need to define safety differently to broaden the conversation and ultimately the opportunities they have to act differently on safety. This requires widening the lens on safety and reliability from a targeted focus of discrete personal or process safety to a broader, holistic view.

OG&C companies have a rich history of successfully applying learnings from other industries and can do so again by adopting a model of safety known as *system safety*. The US Department of Defense (DoD) originated the term system safety in the 1980s, defining it as “the application of engineering and management principles, criteria, and techniques to optimize all aspects of safety within the constraints of operational effectiveness, time, and cost throughout all phases of the system life cycle.”⁴ Since then, the US Department of the Navy (DON)⁵ has continued to use the discipline of system safety and it has been adopted by other US government agencies, such as the Federal Aviation Administration (FAA),⁶ as well. Notably, the DON nuclear force, composed of aircraft carriers and submarines, is cited time and again as an example of the high level of safety and reliability other industries can look to emulate. At first glance, this term may not seem to be much different than other terms in the past. However, it is the application of this concept to all areas of an organization’s operating model that can bring the desired change in perspective.

The OG&C industries have made impressive advancements in occupational health and safety—think hard hats and slips, trips, and falls—as well as improving process safety, and developing safeguards for ways of working. Yet, more can be done. Safety as a concept should evolve over time within and across OG&C organizations. As the OG&C working environment becomes more global, complex, and interconnected, catastrophic accidents may be triggered by events far distant in time and location from the final incident. Decisions made months in advance may initiate a series of complex interactions that lead to explosions, ruptures, and other unplanned and undesirable events.

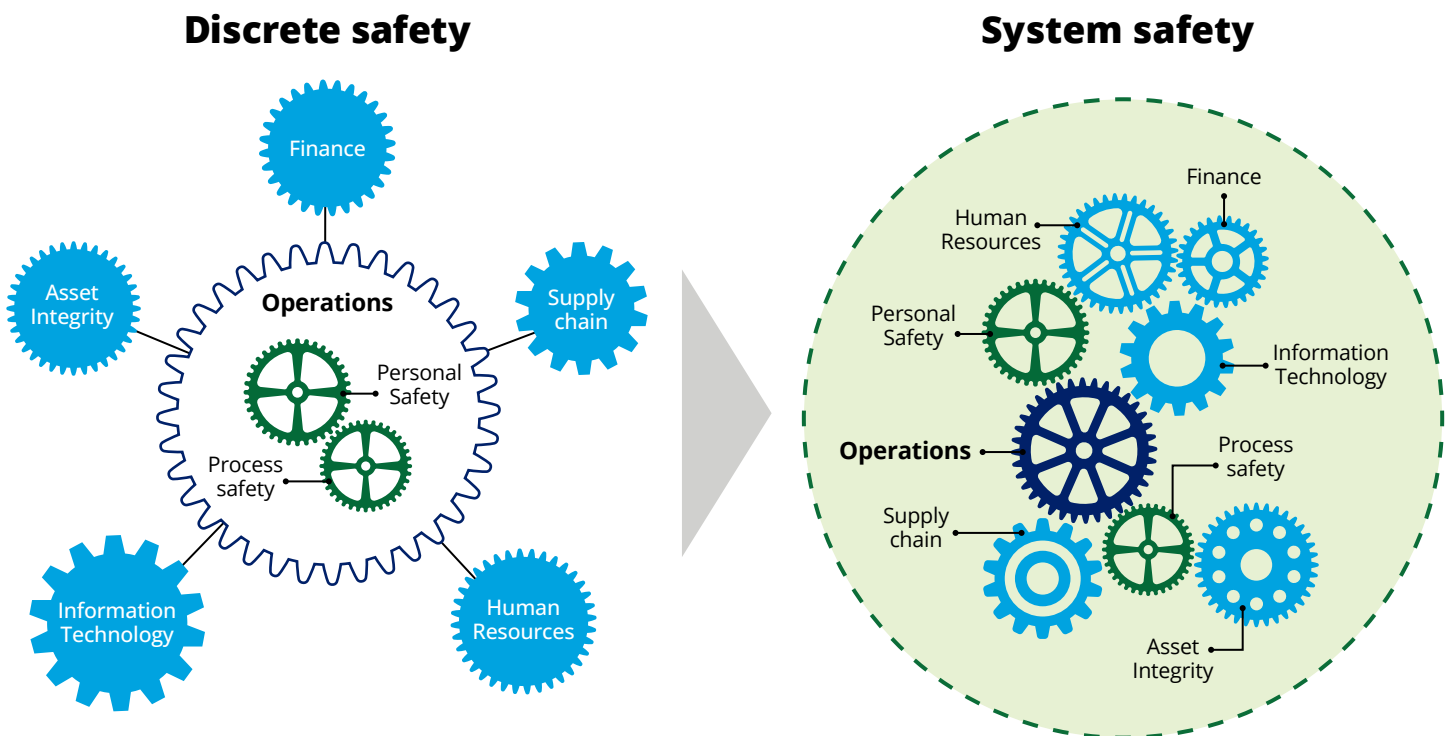


System safety is a simple concept with a powerful message: Safety is a shared, enterprisewide responsibility (figure 1). It's not an "operations" problem; it can't be delegated to frontline workers with the rest of the company saying, "figure it out and report back to us." Everyone, from the C-suite to the field, needs to lead with system safety. The resulting business benefits from getting safety right can be considerable and extend far beyond compliance to include the following:

- Financial savings can accrue from reduced costs associated with major catastrophes (e.g., property losses, liability claims, costs of business interruptions).
- Workforce can become more engaged and productive.
- Public trust can be made stronger and licenses to operate expanded.
- Business opportunities can open up in new markets or geographical areas.
- Reliability, ability to respond, and higher levels of resiliency can be concurrently improved.
- Control over and the capability to reduce environmental impact and overall carbon footprint can be increased.

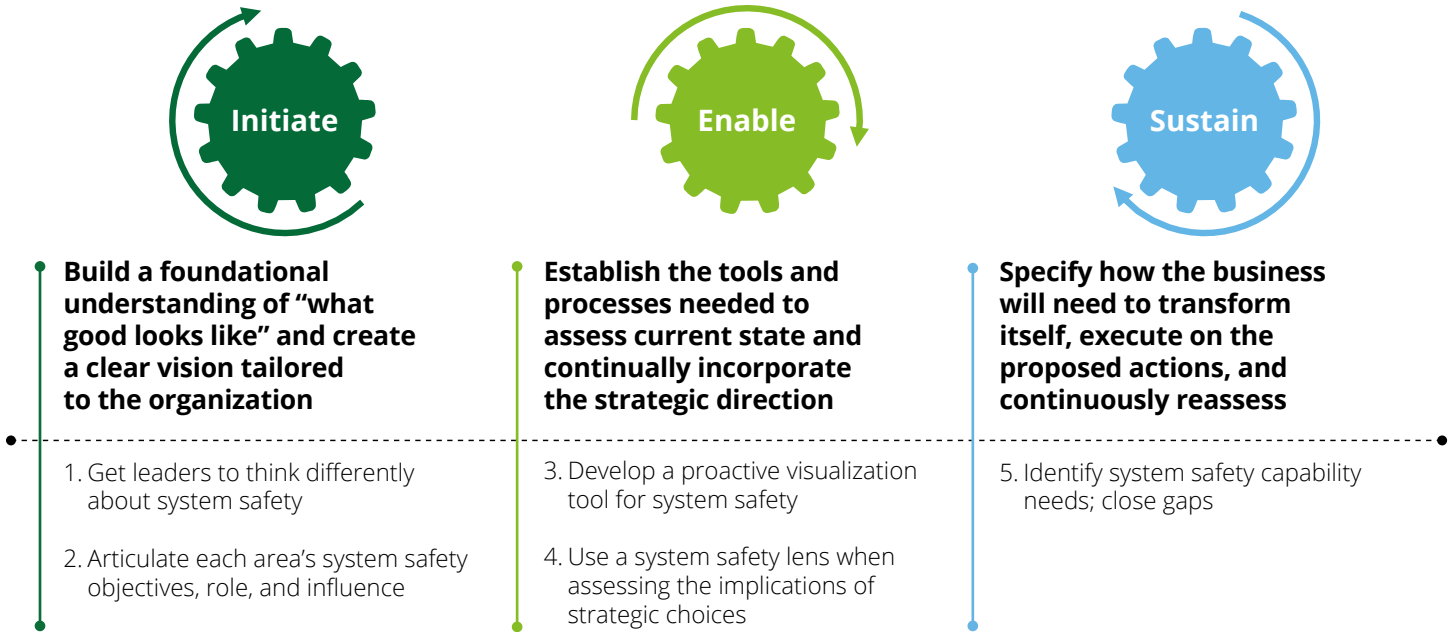
A strong, consistent approach and strategy to system safety can become a competitive advantage for companies; a way for an organization to differentiate themselves. An illustration of how a strong commitment to system safety benefits an organization can be seen by looking again at the US DON nuclear force. Since starting operations in 1955, the US Navy states that its "nuclear-powered warships are welcomed in more than 150 ports of call in over 50 foreign countries and dependencies."⁷ This is due to, in large part, a spectacular safety record spanning decades. What could it look like to build that type of reputation within the OG&C industries?

Figure 1. Safety is a shared enterprisewide responsibility



We propose five actions that OG&C companies can take to initiate, enable, and sustain system safety from the top (figure 2):

Figure 2. Five actions to initiate, enable, and sustain system safety from the C-suite



Initiate

1. Get leaders to think differently about system safety. It is critical that C-suite and executive-level leaders model behaviors that illustrate their commitment to strengthening the organization's safety culture. The Nuclear Regulatory Commission originally defined safety culture as “the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment.”⁸ Safety culture, along with High Reliability Organization (HRO) principles,⁹ provides critical insights for what types of behaviors need to be unlocked and encouraged to grow within an organization in order to strengthen system safety.

In its 2013 *Safety Culture Policy Statement*, the Bureau of Safety and Environmental Enforcement (BSEE), one of the regulators of the offshore oil and gas industry, listed nine characteristics or elements of a robust safety culture, leading with: “Leadership commitment to safety values and actions. Leaders demonstrate a commitment to safety and environmental stewardship in their decisions and behaviors.”¹⁰

There is evidence that a strong safety culture, driven by leadership, can positively impact safety performance when looking at process safety performance metrics.¹¹ Similarly, an analysis of 17 major petrochemical accidents that occurred between 1980 and 2010 found that a *poor* safety culture contributed in a significant way to 14 of the 17 accidents.¹² Leadership sets the organizational tone for system safety vigilance, something that needs to be cultivated day in and day out.

Organizations need to shift their thinking about system safety from frontline tactics to enterprisewide initiatives in order to institutionalize safety culture behaviors. Training leaders on what it means to act in a safe manner—to know what “good” looks like—can help enable this mindset. There are many ways organizations can bring these behaviors into focus, such as conducting case-based training using incident reports from within and outside the industry or discussing hard-learned lessons from catastrophic events the company has faced. One client, directed by its CEO to operationalize a mindset shift on safety and reliability, engaged its leadership team across operations, engineering, and asset integrity using

various methods, including HRO training, leading the organization to shift from an attitude of “prove to me there is a safety issue” to “prove to me there is not a safety concern.”

When leaders understand and embrace a strong safety culture, they can recognize and mitigate institutionalized barriers in order to model by their actions what behaviors are expected from their teams, opening the way for the rest of the workforce to follow.

2. Articulate each area’s system safety objectives, role, and influence. After receiving training on “what good looks like,” each area of an organization needs to determine the part they play in system safety. Every department—from support functions located in an office, such as supply chain, finance, and engineering, to workers on the rig or plant floor—should be able to clearly articulate its system safety objectives, as well as the role it plays and the influence it has on enabling and sustaining safety across the enterprise. Because each area’s position in and contribution to the company’s product/service value chain is unique, its safety objectives will differ, as will its role and influence in system safety. For example:

- Supply chain functions greatly impact system safety because they facilitate contractor and material quality management. High-quality materials are an important element of safe assets and equipment; so, too, are rigorous tracking and assurance processes for materials management. Supply chain and operations employees should have ongoing communications to ensure that the right qualifications and specifications are used during the procurement process. In addition, supply chain functions play an important role in ensuring that contractors and third parties have the right qualifications and are trained on the appropriate control of work processes.
- IT/Digital/OT support groups are vital to ensure that the right information—from supervisory control and data acquisition (SCADA) systems to work management systems—gets to the right people at the right time. Even seemingly small, innocuous code changes may create major disruptions or safety issues in a working process. When developers are given the opportunity to thoroughly understand the information needs of end users, they can better contribute to safety vigilance.

Enable

3. Develop a proactive visualization tool for system safety. The ability to track safety incidents and near misses is critical for companies operating in high-risk OG&C industries. Capturing this information, conducting in-depth analyses to identify root causes, and feeding that information back to the organization to make changes for the better has been the foundation of OG&C safety advancements over the years. When appropriately applied, near-miss metrics can also be leading indicators that provide real-time insights when a process or procedure is going wrong and stop the downward trajectory before it’s too late.

There are, however, dangers in using incident reports and near-miss metrics to make assumptions about how “safe” an OG&C organization is overall. First, it creates incentives for leaders to report good numbers—low incident rates, low near misses—which may foster an operational environment in which bad news is hidden, potentially hobbling a company’s ability to react and change course before things get worse. Second, metrics that track personal safety behaviors (e.g., personnel injuries, missed days worked) cannot predict or prevent major catastrophes.¹³ In other words, they cannot offer insight into overall system safety. What should leaders do to understand where they stand from a system safety perspective, and what data should they track to follow their safety efforts over time?

It is important to know what the organization is currently doing with regards to system safety and how the various safety controls and capabilities being deployed are interrelated. As safety expert Erik Hollnagel et al. states, “Safety management should therefore move from ensuring that ‘as few things as possible go wrong’ to ensuring that ‘as many things as possible go right.’”¹⁴ Leaders need to have a comprehensive view of what system safety capabilities and controls they currently have in place. Rather than build a safety KPI scorecard looking at past performance, leaders should build a strategic, proactive visualization tool assessing their current system safety efforts, what risks they are mitigating against, what they are not doing (and should be), and how the capabilities and controls in the company’s safety ecosystem are interacting. This view can then be used to anchor future system safety planning investments. Safety experts Todd Conklin and Sidney Dekker state,

“Start seeing safety as the presence of capacities that make things go well. And start seeing your job as identifying and enhancing those capacities.”¹⁵

What could this proactive visualization tool look like? Dr. Andrew Hopkins, well known in the OG&C industries for incident investigations, proposes that one way to create this holistic view is to use the bow-tie method; a risk assessment visualization tool used since the 1990s by select operators in the OG&C industries.¹⁶ Hopkins writes, “Most organizations have a good knowledge of the individual procedures and systems that have been put in place to manage risk. Often, there is much less understanding (if any) about the *overall* risk control strategy that is inherent in the decisions that have been made about the details.”¹⁷ While the bow-tie method has generally been thought of as a tactical tool to assess plant conditions and single-asset ecosystems, it could also be used in a more strategic way (i.e., as an interactive dashboard) to help leaders develop a holistic understanding of system safety in their organization. Whatever tool a company uses, it is important to be able to visualize how complex interactions impact safety and what capabilities should be fostered to mitigate system safety risks.

Once this visualization tool is in place, leaders should conduct ongoing collaborative working sessions to make sure that safety tools and processes are kept current, as well as continually reassess how the operating environment has changed. It is essential to guard against complacency. There is a general tendency for organizations to let down their guard a bit, particularly after posting a strong safety record over a period of time. This is exactly when an organization needs to become more vigilant, not less.

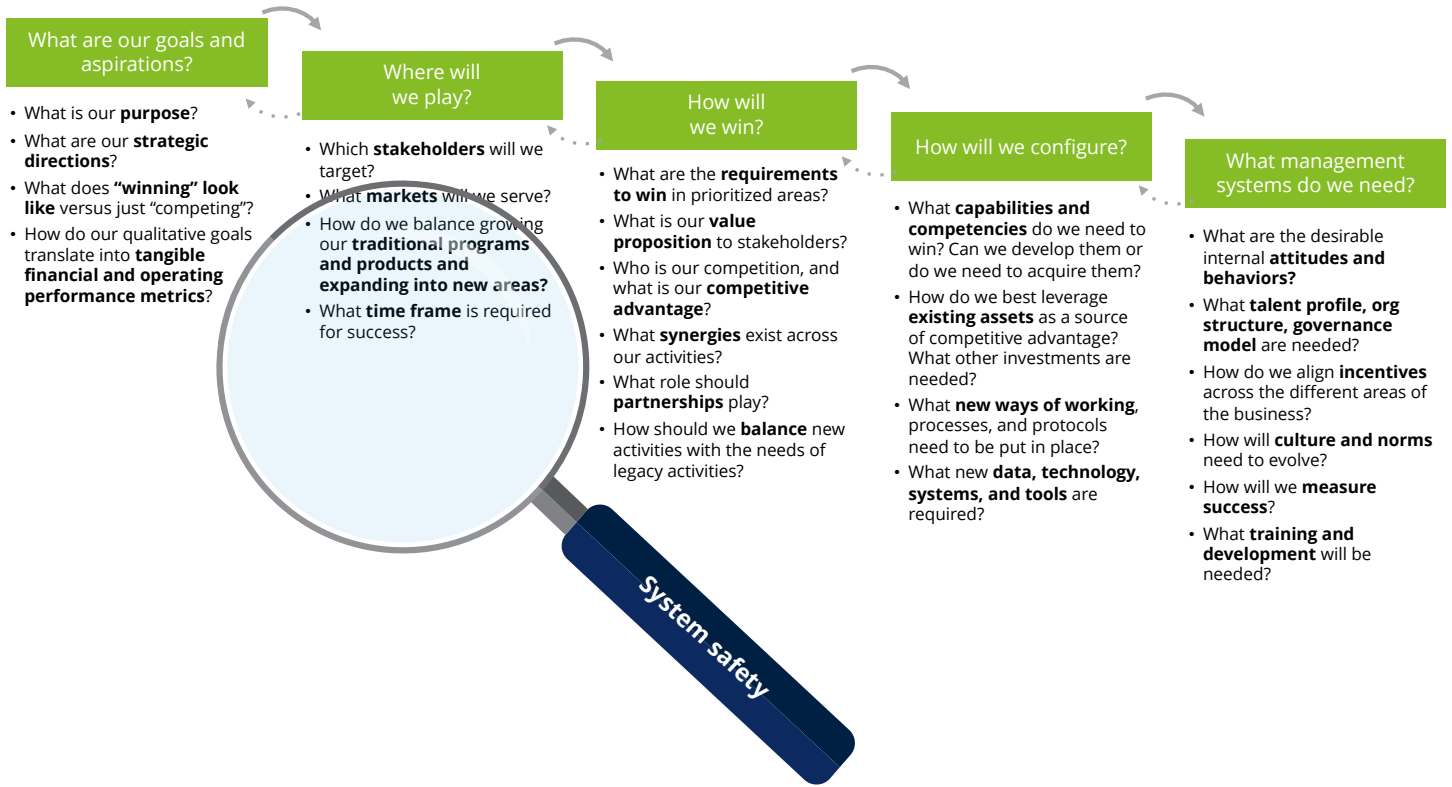
4. Use a system safety lens when assessing the implications of strategic choices. Assessing system safety is neither a one-and-done nor an add-on process because an organization is neither static nor locked in time. Rather, it should be a strategic, ongoing, and iterative process, particularly during times of change, when the potential for undesirable events can grow even larger. When leaders make major strategic choices that affect the future of the workforce and workplace, they should consider the potential implications for system safety. For instance, when a company engages in a merger, acquisition, or divestiture, the resulting entity may have budget constraints, insufficient staff, reassigned roles and responsibilities, conflicting priorities, and inefficient and/or more complex processes and procedures. These, individually or collectively, may result in missed handoffs, lost information, unfamiliar procedures, lack of accountability, and other factors that have been identified time and time again as underlying causes in major OG&C accidents.

Company executives should proactively and collectively develop a framework to assess each strategic choice through a system safety lens (figure 3).¹⁸ They can do this by assembling a group of function and department owners to identify potential impact areas and associated safety risks. Examples of the types of questions to ask include:

- Could this strategy create an environment where we no longer have control or a clear view of safety-critical information at all times?
- Are we going to lose important expertise in a specific area while staff members are tasked to support a special project?
- Are we adding new assets our workforce is not familiar with?
- Will this change established accountabilities and decision-making processes?

Then, based on each area’s potential magnitude of impact, assign a leader to develop a mitigation plan with clear goals and reporting measures.

Figure 3. Apply a system safety lens to strategic decisions



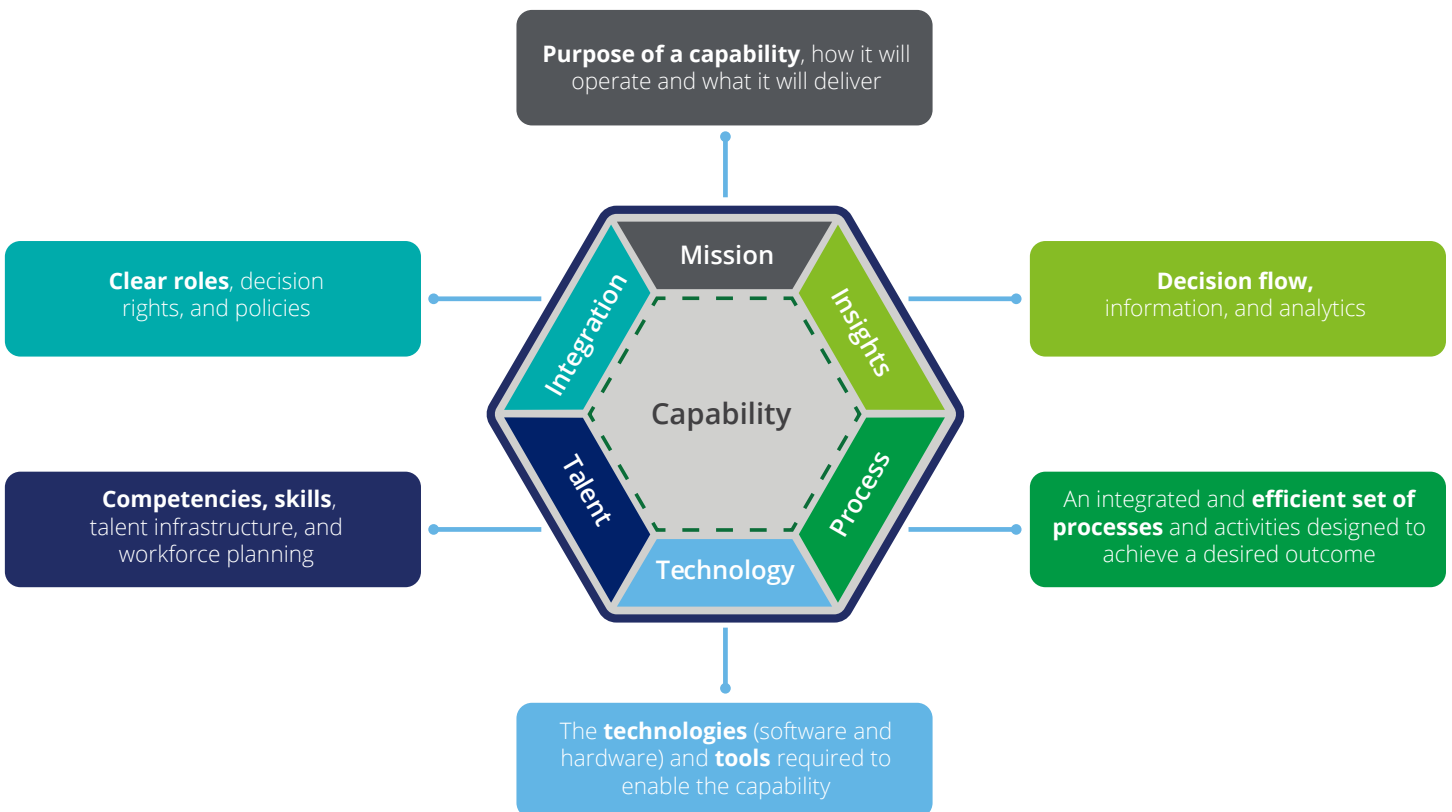
Sustain

5. Identify system safety capability needs;

close gaps. After leaders solidify their system safety objectives, build a proactive view of their capabilities, and assess safety implications of strategic choices, the way to sustainment is to identify the capabilities needed to meet these objectives and determine if they currently exist within the company or will need to be developed or acquired. One of the biggest mistakes a leader can make when considering safety in their organization is assuming that everything is working as intended: “We know what we need to do from a safety standpoint, and we are already doing it, right?” However, as previously noted, lessons learned are not always carried forward, and the same mistakes can continue to be made without constant vigilance to their danger.¹⁹ In another set of studies reviewing the root causes for process plant disasters over three decades (1988–2018), it was found that the most frequent issues documented in the first decade continued to show up just as frequently in the second decade and continued to be well represented in even the most recent cases.²⁰

What should companies do to combat this issue? As Conklin and Dekker state, “Safety is having the capacity to make things go well.”²¹ Companies need to confirm that they have the right capabilities in place and that these tools, processes, and ways of working are operating as intended to achieve the best result. Deloitte’s Capability Hexagon™ (figure 4) breaks down capabilities across six dimensions: mission, insights, process, technology, talent, and integration.²² An organization should assess these six dimensions from a system safety standpoint, identifying weak areas and building on strengths (figure 5). This type of assessment indicates where the company should devote time and resources, helps guide safety-related budget decisions, and should be seen as a continuum of abilities, striving to become stronger. Organization leaders should recognize that there is no final state of 100% safety that they can achieve; rather it is an ever-constant cycle of improvement they need to cultivate.

Figure 4. Deloitte’s Capability Hexagon™

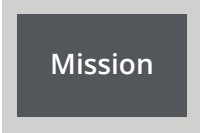


Examples only, not exhaustive

Figure 5. Example Capability Hexagon™ dimensions assessment

What insufficient looks like

- Focuses on financial gains and only views safety through the lens of compliance
- Conflicting priorities reduce importance of safety
- Strategy is reactive



What good looks like

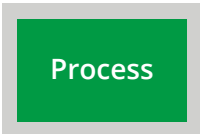
- Clear alignment between safety and other operational objectives of the organization
- Strategy incorporates system safety in actionable ways
- Responsibility is embraced over financial gains

- Data on near misses and lessons learned is not used for continuous improvement, or even sufficiently collected
- Inadequate data is available to make well-informed, risk-based decisions
- Bad news is suppressed and discouraged



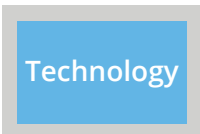
- An integrated view of safety controls exists, and there is proactive monitoring of control health
- Robust continuous improvement activities assess near misses and apply lessons learned
- Robust data is available to make both real-time and in-depth analyses

- Inability to execute work procedures as written, which can be seen by shortcuts and workarounds being routine
- Leaders commonly allow deviations from protocol without following formal MOC processes
- MOC processes are ineffective or completely absent



- Work design is practical, comprehensive, complete, and correct; personnel follow formal documentation
- Strong MOC process is consistently used and provides the necessary structure when dealing with contingency cases or abnormal conditions

- Inadequate systems and tools are tolerated, assets are not properly maintained, inadequate inspections and maintenance are normalized
- High propensity for mistakes and errors to be made due to lack or misfit of technology being used



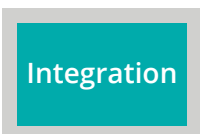
- Technology and data are leveraged to provide predictive analysis and more robust, risk-based decision-making
- Assets, tools and systems are appropriately maintained, enabling high levels of confidence in their state of integrity

- Inadequate or poor training is provided, and no strategy exists to build employee competencies over time
- Employees are commonly seen as the root cause of failures; emphasis is on blaming the actor
- Rewards only incentivize production outcomes

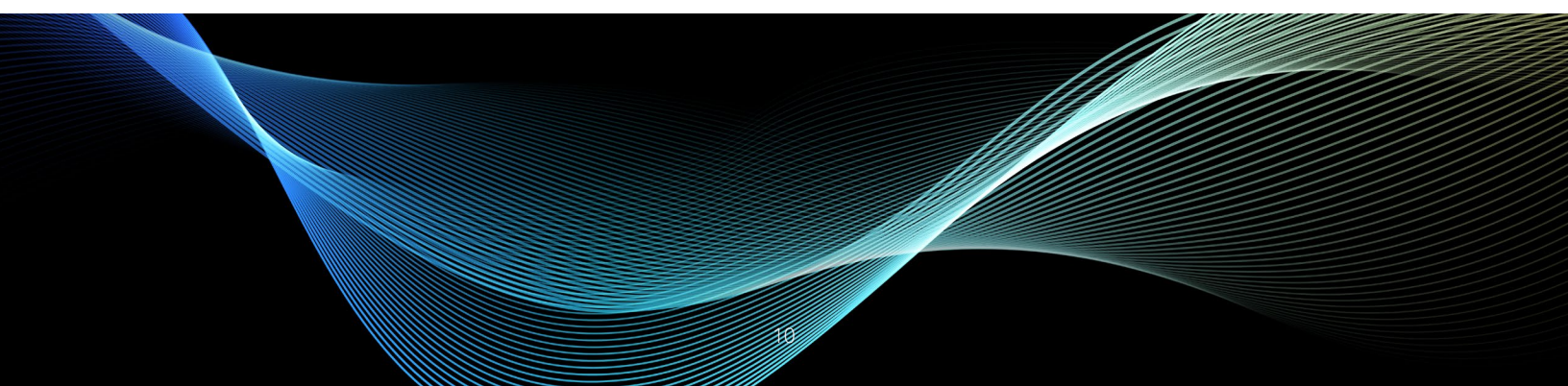


- Employees are seen as a critical link that can ensure real-time response to changing conditions and as such are supported by continuous advanced training
- Robust developmental program is in place with an emphasis on teaching the “why” as well as the “how”

- Inefficient communications, unclear accountabilities, and weak understanding of how different teams’ work impacts others
- Independence in accountabilities is undermined by overarching budget, schedule, delivery pressures



- Clear, documented accountabilities are set without any gaps between responsibilities
- Channels of communications are known and used between different groups
- Organizational design reinforces independence of review between different groups



Leading from the C-suite

Each OG&C organization’s journey to system safety is unique. By taking a strategic approach and following our suggested five actions to initiate, enable, and sustain system safety (figure 6), OG&C leaders can develop an understanding of what “good” looks like, build the capabilities needed to strive for that good, and lay the foundation to truly lead system safety from the C-suite, now and in the future.

Figure 6. How a strategic approach to system safety changes the game

		Example today	Example tomorrow	What is needed
Initiate	1. Get leaders to think differently about system safety	<ul style="list-style-type: none"> Limited awareness of how informal organizational structures and decision-making processes impact safety Siloed and limited views of how to act in a safe manner and what it means to “be safe” 	<ul style="list-style-type: none"> Deep-rooted recognition of “what good looks like” from a behavior-based assessment Expanded understanding of the complexity of behavioral patterns and impact on safety 	<ul style="list-style-type: none"> In-depth training for leaders on system safety, HRO principles, and safety culture Continually incorporating the principles and mindset into everyday meetings and decisions
	2. Articulate each area’s system safety objectives, role, and influence	<ul style="list-style-type: none"> Widespread assumption that frontline workers—“the field”—are the only ones who impact safety No recognition of the part each employee plays in overall system safety and the importance of staying vigilant 	<ul style="list-style-type: none"> Clear understanding of how decisions made far from “the field” can impact system safety now and in the future Strong ownership of each person’s part of system safety in every department and at every level 	<ul style="list-style-type: none"> Formal accountability in place for every leader to be able to articulate their team’s role in system safety Process to share system safety insights and impacts across teams
Enable	3. Develop a proactive visualization tool for system safety	<ul style="list-style-type: none"> Using incident or “near misses” rates to assess how safe the organization is Leaders are incentivized to report good safety numbers, stifling transparency No visibility into what capabilities the organization has to improve safe outcomes, nor any insight into the state of those capabilities 	<ul style="list-style-type: none"> Understanding that incident rates are solely used for lessons learned and no indication of future rates Transparency is rewarded over making “good numbers” Leaders have a single integrated view of their safety capabilities and gaps, the state of each, and how they interrelate 	<ul style="list-style-type: none"> An interactive strategic-level system safety dashboard that provides insight into the current state of all safety controls and capabilities within a leader’s group A process to continually assess this dashboard and make decisions around system safety gaps based on the overall view of the state of the group
	4. Use a system safety lens when assessing the implications of strategic choices	<ul style="list-style-type: none"> Strategic choices are made without any follow-through or understanding of impact to safety Larger operational changes are implemented without any discussion or coordination to minimize safety control disruptions because of lack of understanding 	<ul style="list-style-type: none"> System safety SMEs are consulted when reviewing the implementation plan for each new strategic choice Impacts to system safety are identified and tracked throughout implementation to minimize disruption to vital safety controls and capabilities 	<ul style="list-style-type: none"> Develop a process and framework to systematically assess system safety impacts every time major strategy decisions are made Define roles and responsibilities for leaders to follow through on any mitigating actions that are identified
Sustain	5. Identify system safety capability needs; close gaps	<ul style="list-style-type: none"> Leaders assume everything is operating as intended The same safety mistakes are repeated with no continuous improvement process in place 	<ul style="list-style-type: none"> Leaders know what safety controls and capabilities they need to foster and actively work to put these in place Continual assessments of the need for system safety capabilities are conducted 	<ul style="list-style-type: none"> The working state of system safety capabilities is assessed based on a comprehensive operating model framework Insights from the steps above are used to identify where to target funding, resources, and time

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Endnotes

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