Must accidents happen?
Lessons from high-reliability organizations

Karlene H. Roberts and Robert Bea

Executive Overview

In the more than 15 years since the initial publication of Charles Perrow’s Normal Accidents, practitioners and academics have contemplated how plane crashes, earthen-dam collapses, ship collisions, nuclear disasters, and chemical-plant explosions can be prevented, mitigated, or avoided. While no one has yet learned how to make the inevitable avoidable, a literature on high-reliability organizations (HROs) has developed that gives some hope that disasters can be minimized in frequency and severity. The value of this research to practicing executives is to take the lessons learned through the research on HROs and apply them to their own organizations. This article is about how to beat the odds of having an incident or accident that one is unprepared for, regardless of the organization’s purpose. Neither the sausage maker nor the chemical-plant manager is immune from errors that can have far-reaching consequences. The three major recommendations we offer are that managers should aggressively seek to know what they don’t know, design reward and incentive systems to recognize the cost of failure and the benefits of reliability, and communicate the big picture to everyone.

In the more than 15 years since the initial publication of Charles Perrow’s Normal Accidents, practitioners and academics have contemplated how plane crashes, earthen-dam collapses, ship collisions, nuclear disasters, and chemical-plant explosions can be prevented, mitigated, or avoided. While no one has yet learned how to make the inevitable avoidable, a literature on high-reliability organizations (HROs) has developed that gives some hope that disasters can be minimized in frequency and severity. The value of this research to practicing executives is to take the lessons learned through the research on HROs and apply them to their own organizations.

No one disputes that such normal accidents as the explosion of a nuclear-power plant, the sinking of a petroleum tanker, or the crash of an airliner are events of major significance to both those involved and society at large. Every executive knows, however, that any organization-wide accident or disaster, while perhaps not newsworthy enough for coverage by CNN, still has a major impact on the people and future of his or her organization. Even if the only newspaper coverage of the disaster is in Investor’s Business Daily and the only television coverage is on CNBC, the effects of accidents must be minimized or mitigated. The simple truth, as Perrow states, is that any system, and especially any system that is complex and interdependent, will eventually fail. Managers can either accept the inevitable and wait for these normal accidents to happen, or take proactive measures that allow them to put off the day of reckoning as long as possible.

Marking the fifteenth anniversary of the publication of his seminal book, Perrow sat down with Robert Bea, an expert in the commercial marine industry, and Karlene Roberts, a management scholar who helped delineate the study of high-reliability organizations, for a conversation. This article draws heavily on that conversation, as well as on other research and experiences that provide some key ideas about how managers can delay or prevent major organizational catastrophes that can harm them and their employees (e.g., Barings Bank and the Russian submarine Kursk), harm an unknowing public (e.g., Chernobyl, Bhopal, and the U.S. Navy submarine Greeneville), bring un-
wanted public attention to them (e.g., Korean Air and Alaska Airlines), result in litigation (e.g., Dana Farber Cancer Institute and Firestone Tire), or result in the loss of customers or funding (e.g., NASA and Long Term Capital Management). The conversation’s purpose, as reflected in this article, was to define the reasons accidents are, in many ways, normal and inevitable, to identify the reasons why some high-reliability organizations have beaten the odds and have fewer accidents than expected, and offer some lessons any manager can use in any organization to minimize accidents and maximize the reliability of the organization and all its systems.

Perrow begins his book with a story about an empty coffeepot left on a burner and cracking from the heat. A chain of events ends with a man’s losing out on a job opportunity because he doesn’t show up on time for the interview. The story illustrates the point that, in most organized systems, especially technologically complex ones, everything is intertwined; the tighter the intertwining, the more susceptible the system is to disaster if anything goes wrong in any part of the system.

Accidents can be viewed as normal because the interdependencies in a system are so great that one small glitch in one place can lead to a large failure somewhere else. Most of the time, the glitch is isolated and fixed before it can mess up something else. Sometimes, however, it’s impossible to catch every glitch, and accidents happen. The more tightly coupled the components of the system and the more complex the interdependencies, the tougher it is to catch everything. Things happen so quickly that the glitches affect something else, or something unexpected happens before the problem can be identified and fixed. Examples are the losses of both the Mars Climate Orbiter and the Mars Polar Lander, where the glitches were simple but the interdependencies were so great and happened so quickly that there was no way to fix the problem once failure was detected.

A key finding in risk-mitigation research that fits well with our way of thinking is that roots of catastrophes are embedded in operational systems, latent until an undesirable combination of events occurs. This means that small problems can cascade into accidents if they aren’t stopped by preplanned organizational, technical, or procedural defenses. Designing such defenses is what system planners and engineers do. If they do their work well, nearly all latent catastrophes are prevented before the minor problems become catastrophic. Yet no planner is infallible, and no system engineer is smart enough to anticipate every possible problem. The barriers to catastrophe they so carefully design still can have holes that no one thought of. Sometimes these holes line up like slices of Swiss cheese. Just as one can sometimes see a hole all the way through even a thick block of Swiss cheese, the little problem gets through all the barriers and becomes a big problem. What makes this alignment problem particularly difficult to completely avoid is that some holes or barriers are present all the time, while others may open and close depending on the circumstances. When a problem cascade begins, like the coffeepot on the stove, the holes suddenly line up, and a catastrophe happens.

**Keys to Enhancing Reliability in Complex Organizations**

Research on HROs offers some strategies that organizations can pursue to delay and even defer the inevitable accidents. These studies of aircraft carrier flight decks, medical facilities, financial institutions, fire fighting incident command systems, and commercial petroleum organizations offer techniques to improve the reliability of organizations that should probably fail often, but don’t. These studies have identified three basic things these organizations do to enhance their reliability, and they offer helpful lessons to any organization seeking to increase its reliability:

- HROs aggressively seek to know what they don’t know.
- HROs design their reward and incentive systems to recognize costs of failures as well as benefits of reliability.
- HROs consistently communicate the big picture of what the organization seeks to do, and try to get everyone to communicate with each other about how they fit in the big picture.

We will look at these three basics and offer some lessons learned that can help all organizations enhance their reliability. Whether one’s business is a chain of quick lube outlets, HMO provider, or SUV tire manufacturer, today’s customers demand an organization that is highly reliable. In an increasingly competitive marketplace populated with increasingly informed consumers, learning
and applying the lessons of HROs may well be the competitive advantage that distinguishes between those organizations that succeed and those that fail.

**HROs Aggressively Seek to Know What They Don’t Know**

Research on HROs shows that they are better at finding out what they don’t know than are organizations that have higher accident frequencies. They train their people to look for anomalies, recognize decoys, and, most importantly, to decouple systems when problems are discovered and then empower employees to act. HROs know that odd things can occur and want their people to be on the lookout for these odd or unusual things instead of assuming that they don’t matter or are not important. These organizations know that the system designers and organizational planners can’t anticipate everything, and that sometimes bad things happen in spite of great effort to plug the holes in the barriers against accidents. They also know that people are human and make mistakes in spite of carefully designed systems.

Loma Linda University Medical Center in southern California, for example, operates a pediatric intensive care unit (ICU) that may be the best of its kind, at least within the southwestern U.S. area it serves. It takes from other hospitals only the most severely ill children and has the best mortality/morbidity rate for units of comparable size in its area. Two MDs manage the unit, one with previous experience as a Navy aircraft carrier pilot (in which team functioning is important), the other with experience as a Los Angeles ambulance driver and a paramedic (in which rapid decision making is important). These doctors knew that the best-laid plans would not always be enough to handle situations that occur in the highly complex and rapidly changing circumstance of an ICU. They designed the ICU to accommodate this lack of knowing in advance all that they would like to know. They hired well-trained medical people and pushed decision making about patient care and treatment to the lowest organizational level commensurate with medical knowledge. Nurses often have better knowledge about the state of their patients than do doctors, and when empowered to act, can respond rapidly to the complex and rapidly changing circumstances that often occur in an ICU. The unit is also designed so teams can move around when the patient load is heavy. The ICU is sufficiently flexible that people in it can look for knowledge that may exist in places they never dreamed of. Because they knew what they couldn’t know about individual patient needs, they designed the system to bring all the available knowledge to bear in a quick and efficient manner.

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Organizations that have higher frequencies of accidents tend to suffer from organizational hubris. They are used to not having problems and think that everything is under control. They don’t worry about what they don’t know or the possibilities of problems in their systems. They are comfortable that the designers have anticipated and precluded all potential problems in the system design and assume that their operators will generally operate within those design parameters. A number of analyses of the operation of Long Term Capital Management Fund accuse John Meriwether and his band of investors of this hubris.5

HROs spend disproportionately more money than other organizations training people to recognize and respond to anomalies. This is aptly illustrated by United Airlines’ experience at Sioux City, Iowa, in 1989. UAL-232, a DC-10 carrying 296 people, departed from Denver’s Stapleton Airport enroute to Philadelphia with a stop scheduled at Chicago’s O’Hare International Airport. About an hour into the flight, the number two engine exploded, cutting off the aircraft’s hydraulic power. The explosion was caused by a crack in the fan disc, manufactured by Alcoa 18 years before the accident. The pilot radioed UAL’s maintenance base about the loss of hydraulic power, a problem no one had ever seen before. The maintenance base had no suggestions, and, unknown to the flight crew, reached the conclusion that the plane was doomed. The pilot requested an emergency landing from the Federal Aviation Administration, which informed him that the nearest airport was at Sioux City.

An off-duty pilot riding in the main cabin came forward to help the pilot and the first officer. The cockpit crew relied on its crew resource management (CRM) training to maneuver the plane to Sioux City, where airport personnel and the National Guard prepared for its arrival. Although a DC-10 had never landed at Sioux City, emergency ground personnel had coincidentally practiced for just such a possibility a short time before the emergency. But a critical piece of fire-fighting equipment malfunctioned and could not be used to put
out the fire that started on impact. The crash killed 111 people; 185 survived. UAL subsequently replicated the situation repeatedly in its DC-10 simulator at Denver, but has never achieved as positive a result as did the pilot and his crew. All commercial airlines today use some form of CRM training, which focuses on building teamwork skills so that crews can prevent accidents from turning into catastrophes.

The lessons learned are simple: organizations that have fewer accidents are those that teach their people how to recognize and respond to a variety of problems and empower them to act. The training teaches people not only how to react to specific situations, but also, and perhaps more importantly, how to respond to situations that aren’t in the training manual. Preventive training also includes recognizing decoys or false trails, so that people see that not everything is as it appears. Finally, such training helps people recognize how to decouple highly coupled systems quickly to minimize the harm caused by the initial accident to the total system.

Operators at Diablo Canyon nuclear power plant, for example, work their regular shifts three weeks every month. The fourth week they train. While the normal shift work performed during the three weeks is typically uneventful, training during the fourth week is intentionally designed to present a wide range of unusual and potentially dangerous scenarios to test operator knowledge and reaction time. This training provides operators a break from the anticipated smooth operation of the nuclear reactor. It also keeps them alert to all the things that can go wrong and reinforces the idea that the organization needs to aggressively know what it doesn’t know to keep a catastrophe from occurring.

Employees in HROs also learn to develop responses that can detect unusual or unplanned problems. Operators are formally trained to recognize situations that may be getting out of control. This formal training is underscored by informal, but strong, cultures that recognize that the system may not be so well designed that safeguards will take care of any anomaly. Every problem belongs to every operator until he or she fixes it or finds someone who can.

These practices are often violated in organizations. An excellent illustration is the Vasa, a ship built in Sweden in 1628. Less than a mile into its maiden voyage, it keeled over and sank in 110 feet of water in Stockholm harbor. An article in this issue reviewing the factors contributing to this disaster describes a stability test in which 30 sailors ran back and forth from one side of the deck to the other. After three times, the ship almost capsized. The admiral chose to ignore the results and told no one. He saw no reason to worry, even though the design was radically new and top heavy because of decorative modifications mandated by the king of Sweden.

How can organizations train their people to respond properly to little glitches, and prevent them from turning into big problems? Just as a fire drill teaches people what to do when the alarm goes off or a hospital disaster practice teaches people how to respond to simulated catastrophes, simulated accidents help organizations prepare people for the real thing. Such training reinforces the idea that people must not become complacent, that the organization believes that accidents might happen, and that it worries about its ability to respond. Furthermore, it gives people throughout the organization the opportunity to see what responses work and how, so they can locate areas where changes may be needed to successfully cope with the normal accidents it expects will eventually happen.

Some HROs design in redundancy to ensure that there are several ways to catch problems before they become catastrophes. U.S. Navy aircraft carrier operations are characterized by much human redundancy in oversight of operations to make sure nothing is missed that can potentially turn into an accident. A ship’s control tower, for example, is responsible for all activity on the flight deck and hanger deck. It uses more than 20 communication devices, ranging from radios to sound-powered telephones, to ensure communication contact with critical parts of the ship. The landing signal officer on the flight deck is connected directly to the air boss (a commander) in the tower in five different ways. The tower contains a regular telephone, two sound-powered hot lines, two radios, and a public address system. These multiple communication channels are supplemented by the tower’s capability to call the deck foul, or not ready to receive an airplane, which serves as one final way to provide communications with the landing signal officer.

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When organizations spend money to create redundancy, there is no question in anyone’s mind that the organization believes it can’t know everything and must take the possibility of accidents
seriously. Members of these HROs learn what is important by observing where the organization focuses its time, energy, and resources. There is no question on a Navy aircraft carrier about the importance of safety and accident prevention. All anyone has to do is to mention the disastrous USS Forrestal fire in July 1967, which killed 134 crew members, and everyone’s attention is focused on how critical safety is to everyone on a ship.

HROs use failure simulations to train everyone to be:

• heedful of the possibility of accidents;
• flexible in their thinking about accidents and solutions;
• able to formulate appropriate responses, avoid decoys, and develop decoupling strategies;
• empowered to fix problems;
• aware of organizational commitment to accident prevention.

HROs use accident analysis to:

• build an organizational memory of what happened and why;
• develop a science of accidents that can happen in that particular organization;
• communicate organizational concern with accidents to reinforce the cultural values of safety;
• identify parts of the system that should have redundancies.

HROs Balance Efficiency with Reliability

Organizations that have fewer accidents than expected balance the tension between rewarding efficiency and rewarding reliability. Firms that have reduced numbers of accidents are fully aware of the simple truth that what gets measured gets managed. They seek to establish reward and incentive systems that balance the costs of potentially unsafe but short-run profitable strategies with the benefits of safe and long-run profitable strategies. They make it politically and economically possible for people to make decisions that are both short-run safe and long-run profitable. This is important to ensure that the focus of the organization is fixed on accident avoidance. When organizations focus on today’s profits without consideration of tomorrow’s problems, the likelihood of accidents increases.

A classic example of the conflict between short-run gains versus long-run costs is the airplane crash of U.S. Commerce Secretary Ron Brown and 34 executives and military crewmembers on April 3, 1996, on a flight into Dubrovnik from Croatia. The Dubrovnik airport is primitive and equipped only with a nondirectional World War II-style navigation beacon. In its press release of the official findings, the U.S. Air Force said that the field command approved the mission despite orders to the contrary from headquarters.\(^8\) While we have no firm information relevant to this point, it may be that in situations like this pilots and commanders are under considerable pressure from people of higher status to perform questionable operations. In safety terms, the rewards of complying with a direct order overshadow the benefits of safe operational practices. Since most people do what is rewarded, rewarding the unsafe and not recognizing the safe leads inevitably to unsafe behavior and accidents.

Some medical teams recognize the impact that mistakes can have financially on them and physically on their patients. But others do not. A 1999 National Research Council, Institute of Medicine report on medical errors and their causes garnered far more attention at the federal government policy level than could have been imagined by its contributors.\(^8\) It noted that 40,000 to 100,000 patients may die each year as a result of their medical care, not their underlying diseases. This is truly alarming. Investigation into the sources of error in this industry found they are more apt to result from poor management of the healthcare process than from other issues.\(^9\) For example, the majority of errors in healthcare are prescription errors, including pharmacists’ misreading prescriptions or errors created by misunderstanding look-alike-sound-alike drug names. Many of these errors can be attributed to physicians’ not writing clearly. Indeed, poor penmanship may even be a sign of status as a doctor, to the point that getting physicians to write more clearly may require a cultural change. When prescriptions get to the pharmacy, there is too often no procedure or system in place to ensure that they are read and filled correctly. A related problem in getting prescriptions filled correctly is based on the premier status of the doctor as the decision maker about patient healthcare. This status makes it unlikely that anyone double checks interaction effects of drugs with other medications. The assumption is made that doctors know what they are doing and are responsible for their patients’ medical treatment, so no one routinely checks for possible interactions. Other members of the healthcare system are not rewarded for double checking, but are rewarded for obeying

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doctors’ orders. Incorrectly aligned reward systems contribute to this problem. Since this necessary double checking is not measured, it isn’t managed and some patients die as a result.

Some organizations do an excellent job of finding the balance between maximizing today’s profits or benefits against tomorrow’s potential disasters. The most obvious illustrations are the many organizations that intentionally build in expensive redundancy just in case something goes wrong. Airlines have two qualified pilots on each commercial flight; many ports require a specially trained pilot, as well as the ship’s captain, to direct a ship to its dock; air-traffic controllers work in pairs to ensure that at least two sets of eyes are on the aircraft in the sky at all times. These organizations have learned the terrible consequences of accidents and discovered the importance of balancing efficiency with reliability. Other organizations are increasingly seeking to better resolve the critical dilemma of trading off short-run profits for long-term safety. Too often, managers talk about the importance of safety, have safety-first signs posted in obvious places, and lecture to everyone about the importance of safety to the organization. But when the numbers going to Wall Street are at risk, the same managers don’t follow through on their talk. HROs know that rewarding for performance and asking for safety will have everyone focused on financial performance. They make sure that they find an appropriate balance between the two. Many HROs are in highly visible situations so their incentive to spend the money to ensure they stay HROs high. It still seems appropriate for all organizations to learn from them that, if reliability and safety are critical, it has to be measured, incentivized and rewarded or it won’t happen. It shouldn’t take the accidental sinking of a Japanese fishing boat by a U.S. Navy submarine to remind every manager of the importance of ensuring the reliability that will allow the organization to survive the long run, even if the short-run gains of deferring maintenance, repairs, training, or testing are tempting.

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HROs:
- use interviews, focus groups, and employee surveys to ensure that the real goals of the organization are the same as the public goals;
- review the reward and incentive system from the standpoint of balancing long-run safety impacts or unintended consequences with short-run financial goals;
- develop and reward measures of safety and include them as part of employee evaluation to balance the financial measures;
- develop creative accounting techniques to account fully for the costs of having accidents and assign value to avoiding them.

HROs Communicate the Big Picture to Everyone

Firms that have fewer accidents have developed systems and processes for communicating the big picture to everyone in the organization, and encourage their members to talk about how what is happening affects the entire organization. This is a major challenge that begins with top management’s encouraging the culture to be supportive of open communications. This, of course, is tied into the previous point, as the reward and incentive system has to reinforce an open flow of communication as well as support the open discussion of organizational purpose.

Examples of how this HRO factor operates can be seen in effective disaster-response teams. Incident Command Systems (ICSs) are frequently used in addressing community emergencies. They are constructed at emergency scenes to coordinate know-how and equipment to achieve specific objectives often within severe time constraints. Since large-scale disasters frequently require the combined resources of many disparate organizations, a process or fluid organizational structure needs to be quickly created to coordinate all the participants and keep them from getting in each other’s way. They do this by defining and communicating a common big picture and by quickly establishing a command and control system that fits all the participants into a common goal with a common reporting structure. These ICSs are organized to include all five of the functional areas that need coordination in joint efforts to address emergencies—command, operations, planning, logistics, and finance.

The ICS concept was successfully used to address and extinguish the immense fire in Malibu, California, in 1993. The event spanned 10 days, and the fire was fought under volatile conditions over treacherous or difficult-to-reach wildlands and in
Requests for retardant were denied, weather briefings were unevenly distributed, and no one took responsibility for better distribution. Crews were told to be aggressive and later criticized for being too aggressive. The ICS was invisible... and there was no guidance for helicopter use which meant that people competed continuously... for its services.¹²

Lack of effective briefings may lead to serious communication problems and an inability to get critical information disseminated to those who need it.

While the importance of communication may seem self-evident to most managers, HROs truly emphasize it. They spend time and money developing and maintaining an effective communication capability that allows them to shape and share the big picture of what the organization is all about, why it does what it does, and what everyone in the organization should be looking for and worrying about as they do their jobs. This emphasis would make it important for the helmsman on the Herald of Free Enterprise passenger and freight ferry, sailing from Zeebrugge to Dover in 1987 with 460 passengers, 80 crew members, 81 cars and 47 trucks, to notice that the open door indicator light was on, to understand its significance and check it before the ferry sank. He didn’t and it did. One hundred eighty-eight passengers and crew members perished.

Communicating the big picture to everyone helps avoid these kinds of failures and directly contributes to reliability, as everyone knows how what they say and do ties into the purpose of the organization, and knows that it’s important to stay in touch with everyone if and when they see something wrong. In HROs, everyone knows the big picture and constantly communicates that understanding with their peers and coworkers. When something looks wrong, workers check it out.

In HROs:

- top management tells stories about employees who saved the company major dollars, embarrassment, or injury;
- all managers are encouraged and rewarded to communicate openly with each other, especially in situations that seem odd, unusual, or problematic;
- Incident Command Systems are created as a standing procedure with well-known decision rules about when they are engaged.

Various residential areas. From the outset, resource deployment proceeded at a torrid pace. Three minutes after the first call was received, approximately 55 people, seven engine companies, two water-dropping helicopters, and a bulldozer were dispatched to the scene. Within 80 minutes, over 950 people and several hundred pieces of equipment had been routed to the fire. In the end, 839 fire engines and 44 aerial units (consisting of helicopters and fixed-wing aircraft) were called into service. Firefighters responded from 456 fire agencies across 12 states and ultimately numbered more than 7,000.

As the incident evolved, the organizational complexity increased substantially to deal with the many dimensions of such a large disaster. Search and rescue, medical aid, residential evacuation, and hazardous-materials containment all became operational imperatives, along with fire-suppression activities. Moreover, personnel from a large number of non-fire agencies (law enforcement, Red Cross, city and county governments, Air National Guard, Federal Aviation Administration, and the Federal Emergency Management Agency) were required to integrate their activities. Such an effort could not have been successful without good, open communication. The major communication problem that had to be dealt with was the shortage of radio channels, which quickly become used in any major incident.

On the other hand, not having an effective big-picture communication capability leads to ineffective coping with a disaster. Communication failures in the 1994 South Canyon, Colorado, fire contributed to the deaths of 14 people.¹¹ In assessing the reasons for the disaster, a number of factors were identified. No one understood the importance of creating and sustaining a big-picture overview of the fire, and then assuming the responsibility for ensuring that all elements of the first team could continuously communicate about how their efforts were contributing to the big-picture goal. There were, for example, no formal, coordinated briefings. Briefings are a means to give people a common framework in advance of their work, including assumptions about what they may face, what might develop, and how they are to function and update their pictures of what is going on. Lack of effective briefings may lead to serious communication problems and an inability to get critical information disseminated to those who need it. At South Canyon, briefings were casual. To compound the communication difficulties, radio discipline was practically nonexistent. The lack of an effective ICS led to other problems in command and control. As reported by one of the survivors,
Oyster's Story: HRO Theory in Action

Effective implementation of HRO practices prevented a serious accident aboard the aircraft carrier USS Constellation during night-flight operations in 1999. A piece of rubber seal was inadvertently left in the catapult track just before the launch of an F/A-18 Hornet fighter. The Hornet's engines ingested the rubber and the pilot could stay aloft only by using the plane's afterburners. The pilot, whose call sign was Oyster, was ordered to jettison his bombs and fuel tanks and to eject. He continued flying, and received a second eject order.

By this time I'm talking to the rep in CATCC [Deputy Carrier Air Group Commander] on the flight deck, and CAG [Carrier Air Group Commander] who's on the bridge with the captain. We decide that the thing to do is climb to 3,000 feet and dirty up (lower the landing gear) to see if I'm going to have any excess power and will be able to shoot an approach.

Oyster managed to get the Hornet level and turned back toward the ship. Despite a succession of explosions every time he moved the throttle, and rapid loss of fuel, Oyster managed to land the Hornet successfully.

The story provides evidence of an organization that always worries about accidents, trains its people to deal with them, and empowers them to act. It also shows the balance between the reward structure for saving the plane and being safe. Finally, it shows the communication of the big picture to all involved and how the system is set up to include all who need to communicate quickly and accurately to bring expertise to bear on the problem. In this case, the holes of the cheese fit together but the utilization of the three concepts associated with HROs worked to prevent a problem from becoming a disaster.

Oyster and his team engaged in several behaviors found in HROs. First, there was open and good communication among the experts in how to recover an aircraft in trouble. Redundancy existed in the heads of the various people contributing to the situation. At one point, Oyster forgot about the effect that jettisoning had on his fuel state. However, the CAG reminded him of his low-fuel position. An appropriate reward system was in place. Oyster knew the problem of losing over $50 million worth of aircraft and associated items. He was ordered to eject for his safety, a clear indicator that the organization placed a high premium on safety. However, his training and experience were sufficient that he also knew he still had control, and his training taught him the call was his. His training on how to make an emergency landing was also important. The ship had, in effect, an incident command system—the people with correct information who came on line to help him out. These people literally wait in the wings to do crucial jobs should the situation require it. Oyster had experienced simulation training on how to be heedful, flexible, and formulate appropriate responses to normal and abnormal flying conditions. The result was an accident that didn’t happen.

Oyster had experienced simulation training on how to be heedful, flexible, and formulate appropriate responses to normal and abnormal flying conditions. The result was an accident that didn’t happen.

Accidents are normal in the sense that they aren’t likely to be eliminated on either a system or organizational level. The lessons learned from HROs offer promise that all organizations can benefit from attending to these issues and implementing the lessons learned. For the most part, these are not costly ideas to implement, and the benefits for an organization that can dodge one disaster or avoid one accident that otherwise would have occurred may be immeasurable. Whether an organization makes sausages, fixes TVs, or produces nuclear turbines, the costs of accidents will always be too much.

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Endnotes


Karlene H. Roberts is a professor at the Haas School of Business, University of California, Berkeley. She has studied high-reliability organizations extensively and has worked with many organizations and institutions. She serves several federal government agencies, including the Committee on Human Factors of the National Academy of Science. Contact: karlene@haas.berkeley.edu.

Robert Bea is a professor in the Department of Civil and Environmental Engineering, University of California, Berkeley. He has worked with the U.S. Army Corps of Engineers, Shell Oil, and Royal Dutch Shell in various international assignments. He has been vice president of the Ocean Services Division of Woodward-Clyde Consultants and of PMB—Bechtel. Contact: Bea@CE.berkeley.edu.

Executive Commentary

Dean L. Bartles
General Dynamics—Ordnance and Tactical Systems

There I stood, one cold Maryland December morning, 28 years ago, at the tender age of 16, face to face with the biggest 10-point buck whitetail deer I had ever seen. This is the exact situation I had dreamed about for years. I did everything exactly as my father had taught me. I remained calm as I slowly lifted my Winchester 270 rifle, took aim and slowly squeezed, not pulled, the trigger. Instead of my rifle knocking me back on my bottom as it nearly did every time I had shot it before, instead of a sound so loud that anything within a couple-mile radius could have easily heard, instead, there was a very faint “click.” Off ran my trophy buck as if he had been shot out of my rifle just like the defective round of ammunition should have, had it not been defective. If only the ammunition company that had produced this incompetent round had taken the time to position itself to be a “high reliability organization,” or “HRO” for short, perhaps I would have the childhood memory I had hoped for, instead of the disappointment that I still carry today. I have never seen another buck as big as I remember that one to have been.

When I first heard the term, HRO, I thought it was a new acronym for some kind of health-related organization similar to an HMO. Although it can be a health-related organization, it can also be any other type of organization or corporation that
strives to “do it right,” not just “do it” as the famous sneaker manufacturer advertises. “Getting it right” the first time, every time, is what an HRO strives to do. Every senior manager in every conceivable organization could benefit from taking the time to read and put into practice the key points presented in the article by Roberts and Bea. Having spent the last 18 years of my career in the ammunition industry, I cannot overemphasize the importance of the authors’ recommendations. It is paramount to the continued success of the organization, and the health and safety of the employees, as well as the public at large in many circumstances, for every organization to strive to become a high-reliability organization.

The manufacture of ammunition is an excellent example. Had the company I work for not invested the time, people, and financial resources to study, re-study, and continue to re-study, the manufacturing processes inherent in a very dangerous product, it is impossible to say how many lives might have been lost from the consequences of inadequate safety, not to mention how many trophy bucks might have gotten away just like mine did due to a defective product.

If a company wants to begin looking at becoming an HRO, I suggest they begin by looking at every step of the production process of their respective products. It is important to obtain an understanding of the essential operations that are most prone to human error, or possess high risk of significant consequence in the event of a problem. In the ammunition arena these are referred to as critical defects. Every problem that gets classified as a critical defect has the potential to cause severe injury to the eventual product user. Each production operation that falls into this category then is further analyzed to set up measurement criteria to ensure that redundant steps are built into the inspection processes. The objective is to ensure that the probability of a critical defect making it all the way through the system and into the consumer’s hands is less than one in a million. I can think of one example where there are at least six inspection points from the time the initial operation is completed before the end product rolls out the door. Surprisingly, the sixth point has actually caught a few bullets that the first five missed!

Simultaneous with the aforementioned analysis, companies must create reward and incentive systems just as Roberts and Bea describe. In my company, safety and quality carry just as much weight as sales and profit numbers when it comes time to determine short-term incentive payouts at year end. As the authors point out, “If reliability and safety are critical, then it has to be measured, incentivized, and rewarded or it won’t happen.”

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Dissemination of the importance of reliability and safety to everyone in the organization by top management is paramount to the success of the programs. In the bullet business, the last thing you want is people “shooting from the hip.” Everyone must be singing from the same sheet of music and the entire program must be orchestrated from opening act to the last curtain call. Striving to become a high-reliability organization should be every company’s goal.

I have a new dream now. This time I am standing beside my nine-year-old son who has just spotted his first ten-point buck. He remains calm, just as I have taught him. He takes aim, and “click.” Only this time, it was supposed to be “click,” as he takes the perfect picture with his brand new digital camera. It was produced by a company that has taken the time to become an HRO, and we are confident that the picture will come out perfect.

Dean L. Bartles is vice president of Marketing and Business Development for Ordnance and Tactical Systems, a division of General Dynamics Corporation. He is also chairman of the American League of Export Security Assistance and serves on the U.S. State Department’s Defense Trade Advisory Group. He received his doctorate in business administration from Nova Southeastern University. Contact: dean.bartles@stp.gd-ots.com.