Introduction: How Teamwork Is More Important than Technical Prowess

In 2001 during a routine training mission off the Hawaiian Islands, a U.S. Navy fast-attack nuclear submarine surfaced into a Japanese fishing trawler, severing the boat in half, killing nine people, and creating an international incident. The submarine was known as one of the best in the fleet, expertly operated by a hand-selected crew and led by a talented and charismatic captain.

That same year, a modern Airbus airliner broke apart in flight, crashing into a New York City suburb, and killing all 260 people aboard and 5 people on the ground. This jet used some of the aerospace industry's most advanced technologies and was flown by one of the best trained air crews in the world, yet resulted in the second deadliest aviation accident on U.S. soil to date.

In 1989, a fatal human crush occurred during a British football match in Sheffield, England, killing ninety-six spectators, injuring hundreds more, and traumatizing thousands. People had been packed so tightly in the stadium's 'pens,' or open viewing areas, that many died standing up while oblivious security officials actually pushed escaping fans back into the mayhem.

Finally, a pediatric cardiology unit at a well-reputed hospital in the United Kingdom continued to attempt a risky new surgical operation over a seven-year period even though the procedure was resulting in dozens of infants' deaths. Although doctors arguably possessed the technical skills, teamwork broke down as thirty to thirty-five more babies died than might be expected had the standard of care been equal to that at other hospitals.

In contrast to these examples of performance breakdown, there is the successful rescue of 155 people from the icy waters of the Hudson River in New York City in January 2009, when their airliner experienced a dual engine failure after multiple bird strikes. What enabled this heroic team to succeed – effectively making sense of their challenges in a technologically complex and dynamically evolving environment – while these other teams failed? These five case studies – the USS Greeneville submarine collision, Hillsborough Stadium football crush, American Airlines Flight 587 in-flight breakup, Bristol Hospital pediatric cardiology deaths, and US Airways Flight 1549's Hudson River landing – provide data to understand better the dynamics that impact team performance in high-risk fields. In different ways, each case illustrates how teamwork can be more important than technical prowess in preventing disaster in high-risk fields.

For our purposes, a high-risk team is two or more people working together in an environment where there is significant risk of injury or death to the team or to others as a result of the team's performance. Professionals in fields such as aviation, military, law enforcement, and firefighting risk their own personal safety at work every day, making these excellent examples of high-risk professions. Other fields such as automotive technology, emergency planning, engineering, medicine, nuclear power, or off-shore drilling, among others, may not seem as risky for individuals working within them, yet decisions and actions made by people in these fields can greatly affect the safety of others. Just imagine yourself on the operating table – the surgeon and his or her team's safety may not be directly at risk, but your health certainly is. Therefore, we will consider these high-risk teams as well.

All groups and organizations have subtle, and not so subtle, dynamics that influence team behavior. Yet, teams operating in high-risk fields have unique, often covert, characteristics influenced by the nature of their tasks, their hazardous and unforgiving operating environments, and the ambiguous ways clues to a crisis often emerge. Factors such as time urgency, peer pressure, exposure to personal risk, professional competitiveness, fear of malpractice suits or other forms of retribution, inter- and intra-team conflicts, reputation management, shifting tasks, conflicting goals, uncertainty, dealing with casualties, handling media pressures, and otherwise living with the weighty repercussions of one's decisions often combine to make decision making in high-risk teams an exceptionally stressful activity.[1]

In addition to high-risk professionals managing these stressors, recent disasters have illuminated a surprising range of individuals required to act as key decision makers during a crisis, especially during the initial onset of a problem when it may not yet be clear what the issue is. For instance, actions taken by principals, teachers, and university administrators during school shootings; hospital employees during hurricane evacuation; hotel managers during natural disasters; plant supervisors during industrial accidents; and chief executives during product recalls play central roles in determining when, and if, a situation escalates to full-blown crisis. As a result, it is evident that a wide range of professionals require the ability to think through crisis and manage anxiety, sifting through ambiguous and often conflicting information in order to determine a course of action.[2]

Social science researchers call this process naturalistic decision *making* (NDM), when knowledgeable individuals are operating in dynamic environments with ill-defined goals and ill-structured tasks that require real-time decisions in reaction to continuous change.[3] Developed about twenty years ago, we are only starting to understand the variety of factors that come to play in such scenarios. Yet several NDM studies[4] found that the difference between expert and novice decisions was more often related to the decision-making process itself, not the rank or experience of the individual. How teams gather and share information, developing a 'mental model' of the situation as it unfolds, proves pivotal.

Military studies found that Army commanders store memories of lessons learned in tactical situations as 'war stories' available for retrieval when required. In aviation, we call this hangar flying. These stories become stored templates of knowledge, resources that experienced commanders can draw on when faced with a new challenge.[5] However, this information acquisition process can take years. How can we help teams accelerate their learning process?

Airline pilot Chesley "Sully" Sullenberger, captain of US Airways Flight 1549, provides some guidance: "In addition to learning fundamental skills well," he notes, professionals in high-risk fields "need to learn the important lessons that have been paid for at such great cost over generations" – the teamwork and leadership failures, written in blood, which have provided key lessons learned in the past. Captain Sullenberger emphasizes:

> We need to know about the seminal accidents, and what came out of each of them. In other words, we need to know not only what to do but why we do it. So that in the case when there's no time to consult every written guidance, we can set clear priorities, and follow through with them, and execute them well.[6]

One way to accomplish this is to examine case studies of leadership and teamwork challenges as we do in this book. Like war stories and hangar flying, this approach is an invaluable tool to consider 'what if' scenarios in a controlled setting before people become challenged in high-tempo operations. Although technical training approaches have worked adequately in the past, the complexity of new operating systems, expansion in automation, and pace of technological developments demand new thinking as accidents increasingly result – not from individual error – but from dysfunctional interactions at the interface of human and machine.[7]

As a result, we need new models of accident causality based on socio-technical systems theory that can address the complex interrelatedness of operations in today's high-tech systems. *Socio-technical* theory emphasizes that to improve teamwork, organizations must balance social, or *socio*, factors – such as organizational culture; group norms; values and identity; psychological expectations; and emotions like trust, fear, and anxiety – with *technical* factors – such as modern, well-designed equipment; accurate operating manuals and checklists; relevant standard operating procedures; and effective training methods. Until socio-technical factors are in balance, optimum team performance will not be achieved.

To explore teamwork within these complex socio-technical systems, a *systems psychodynamics* perspective proves helpful. Systems psychodynamics integrates psychoanalytic theory, group study, and open systems perspectives as a way to understand the collective psychological behavior within and between teams and organizations.[8] The advantage of this approach is that it provides a way to consider the motivating forces resulting from the interconnection between various subunits of a social system.[9] As systems become increasingly complex, we can no longer accurately predict the ways things might fail. Therefore, teams must learn to think through crisis, considering the myriad of possibilities that might be occurring.

As a result, we find that team chemistry, the challenge of collaboration, the influence of the system, and the impact of the environment during the critical incubation period while a disaster unfolds prove pivotal to the outcome. As the case studies in this book demonstrate, ultimately a team's ability to learn and adapt spontaneously to the evolving situation, manage individual and group anxiety, and make proper sense of emerging events increases the likelihood of preventing or surviving an organizational disaster. This suggests that teamwork is more important than technical prowess in mitigating organizational disaster. Intended for both frontline operators as well as a wide variety of academic programs – from business management and organizational psychology to educational leadership and public administration – this book bridges the span between practitioner training guide and NDM research report and addresses gaps in our thinking about *crisis decision making*, a relatively new field of management.[10] Understanding the internal dynamics of groups and the stressors teams must manage in order to succeed, will allow people to become more effective leaders, followers and teammates in all kinds of situations.

1

Rethinking Normal Accidents and Human Error – A New View of Crisis Management

In 1984, Charles Perrow published *Normal Accidents*, one of the first texts to consider the impact of our increasing use of technology in high-risk fields, analyzing the implications on everyday life. Because risk can never be entirely eliminated, Perrow argued, system designers can neither predict every possible failure scenario nor create perfect contingency plans for front-line operators. In other words, no matter how effectively conventional safety devices such as warning systems, overflow valves, or automatic shutdown features perform, some accidents are unpredictable because some failures are simply not 'conventional.' Particularly challenging is the fact that as one unexpected failure stresses different parts of the system in unusual ways, compound failures emerge with increasingly unanticipated results. In fact, these types of unpredictable, compound failures are so inevitable, Perrow argues, we should call them 'normal accidents,' not because of their frequency, but because these accidents are the 'normal' consequence of ever-evolving technologies generating increasingly complex operating systems that stress team operations and sense making in unpredictable ways.[1]

As a result, one of the major factors precipitating compound failures in complex systems is the inability of operators, trained to respond 'by the book,' to evolve their mental picture of the system failure as new data emerge. Such a failure is either so catastrophic or so complex that it shocks people's sense-making capacities. It becomes literally incomprehensible.

Examples of this lack of imagination and flawed sense making abound. In 1977, a Southern Airways DC-9, Flight 242, departed Huntsville, Alabama, en route to Atlanta. Descending from 17,000 feet, the jet entered a thunderstorm, sustained a lightning strike that shattered the cockpit windscreen, and ingested massive amounts of water and hail, flaming out both engines. As the pilots attempted unsuccessfully to restart the engines, the jet glided toward the ground unpowered. Breaking out of the clouds minutes before impact, the aircraft crashed on a rural highway, colliding with a gas station and killing sixty-two people on board and eight people on the ground. Miraculously, nineteen passengers and both flight attendants survived.[2] No turbojet in history had ever experienced a similar failure. It was unimaginable.

The probability of this compound failure was considered so remote, the Federal Aviation Administration (FAA) did not mandate pilots' training for this type of emergency, and the aircraft manufacturer's flight manual provided no guidance.[3] As the incident unfolded, the captain alerted Atlanta air traffic controllers (ATC) about their predicament, demanding, "Get us a vector to a clear area, Atlanta."[4] Yet, ATC was so dumbfounded by the jet's emergency, they repeatedly requested the struggling crew to switch radio frequencies and check their transponder code, minor concerns in the midst of this chaos.

In addition, more than eight minutes before the DC-9's dual engine flameout, another commercial jet had also reported "heavy moderate turbulence and quite a bit of precip"[5] as they flew through the same storm.[6] However, when they complained, rather than consider the danger, ATC defensively responded that there was another aircraft in the area and "He'd be a lot harder than the cloud."[7] Had the FAA, aircraft designers, airline company policies, and ATC training been better able to prepare this aviation team to think through crisis and make sense of the severity of the emergency as it unfolded, this scenario might have ended differently.

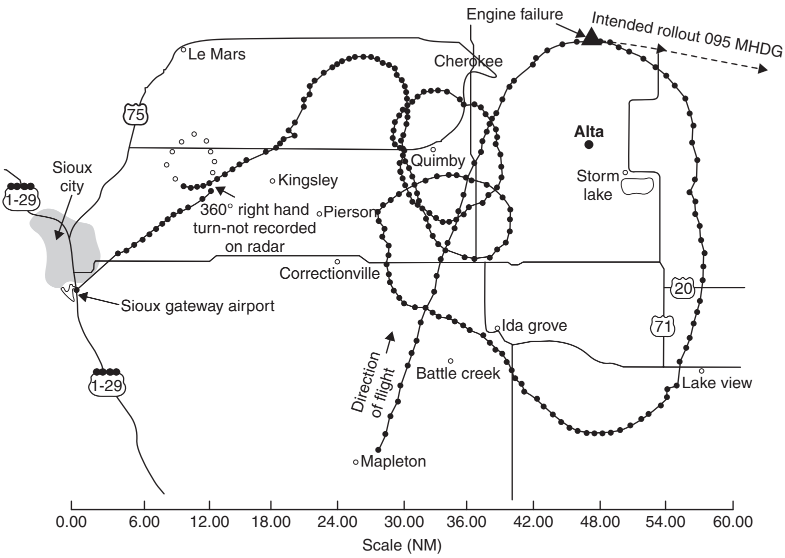

FIGURE 1.1. United Airlines Flight 232 ground track as the team learned the parameters of their emergency and developed proper response measures.[8]

Similarly, the much-publicized crash of United Airlines Flight 232 in 1989 also resulted from compound system failures, unpredictable in their cascading effects. Yet, unlike the Southern Airways example, United Flight 232's team adapted in the moment, allowing for better sense making and team learning as the crisis unfolded, enabling a relatively successful landing given the circumstances.

About one hour after departing Denver en route to Chicago O'Hare Airport, United Flight 232, a DC-10, suffered a catastrophic failure of its number two engine mounted in the tail. As engine components broke away from the airplane, pieces severed hydraulic lines pressuring the flight control systems. With all controllability lost, the aircrew had to relearn how to fly the airplane, working together to use asymmetrical thrust on the two remaining wing-mounted engines to steer the jet to an emergency landing at Sioux Gateway Airport, Iowa (see Figure 1.1). One hundred ten passengers and one crewmember died.

Yet, astonishingly, 165 passengers and 10 crewmembers lived. Once again, no one had ever trained for this type of emergency, and aircraft manuals provided no guidance for the failure of all three hydraulic systems in flight. It was considered an inconceivable scenario.[9]

Driven in part by the increasing occurrence of 'normal accidents' – such as the KLM and Pan Am 747 collision in Tenerife in 1977, Three Mile Island nuclear accident in 1979, National Aeronautics and Space Administration's (NASA) Challenger crash and Russia's Chernobyl nuclear accident in 1986, the London underground's Kings Cross fire in 1987, and Piper Alpha oilrig explosion in 1988 – James Reason published *Human Error* in 1990, another significant text in the burgeoning field of *crisis decision making*. Reason's *Swiss Cheese* model broke failures down into *active* errors, associated with frontline operators like pilots, nuclear control room crew, and medical teams, and *latent* errors, associated with system designers, high-level decision makers, and managers.[10] Rather than blame accidents on individual workers' active errors, Reason argued frontline operators were often just one link in the chain inheriting defective systems full of latent errors – accidents waiting to happen – such as poor system designs, incorrect installations, faulty maintenance, poor training, inaccurate operating manuals, and bad management decisions driven by overly economic considerations. These insidious latent errors lay dormant in the system, waiting for opportunities to emerge and link with operators' active failures, in a "window of accident opportunity."[11]

Building on Perrow and Reason's contributions, new frameworks based on the psychoanalytic study of disasters have emerged with a particular focus on sense making, analyzing factors leading to team performance breakdown, accident, and death in high-risk industries. Examples include studies of nuclear power plants,[12] Mount Everest climbing expeditions,[13] medical operating rooms,[14] NASA explorations,[15] wildfire fighting,[16] oil platforms,[17] and Post-9/11 airlines.[18] Previously, most research explained disasters as resulting