

## Challenger Launch Decision Risky Technology Culture And Deviance At Nasa

This open access book addresses several questions regarding the implementation of human and organisational factors (HOF) so that recent improvements in industrial safety can be built upon. It addresses sources of frustration in senior management with high expectations of operational recommendations and disquiet on the part of HOF specialists struggling to have an impact on high-level decision making. The brief explores these issues with an emphasis on examples and lessons learned based on the experience of its authors, who come from different academic disciplines and various industrial sectors such as oil and gas, energy and transportation. It then offers some ways forward for a better consideration of HOF in hazardous companies with a view of promoting safety and facing challenges in a rapidly changing world.

The book offers important insight relevant to Corporate, Government and Global organizations management in general. The internationally recognised authors tackle vital issues in decision making, how organizational risk is managed, how can technological and organizational complexities interact, what are the impediments for effective learning and how large, medium, and small organizations can, and in fact must, increase their resilience. Managers, organizational consultants, expert professionals, and training specialists; particularly those in high risk organizations, may find the issues covered in the book relevant to their daily work and a potential catalyst for thought and action. A timely analysis of the Columbia disaster and the organizational lessons that can be learned from it. Includes contributions from those involved in the Investigation Board report into the incident. Tackles vital issues such as the role of time pressures and goal conflict in decision making, and the impediments for effective learning. Examines how organizational risk is managed and how technological and organizational complexities interact. Assesses how large, medium, and small organizations can, and in fact must, increase their resilience. Questions our eagerness to embrace new technologies, yet reluctance to accept the risks of innovation. Offers a step by step understanding of the complex factors that led to disaster.

Diane Vaughan reconstructs the Ohio Revco case, an example of Medicaid provider fraud in which a large drugstore chain initiated a computer-generated double billing scheme that cost the state and federal government half a million dollars in Medicaid funds, funds that the company believed were rightfully theirs. Her analysis of this incident—why the crime was committed, how it was detected, and how the case was built—provides a fascinating inside look at computer crime. Vaughan concludes that organizational misconduct could be decreased by less regulation and more sensitive bureaucratic response.

Discusses the events and circumstances that led up to the Challenger disaster of 1986, as well as the aftermath and cover-up by NASA and the White House.

Reviews the circumstances surrounding the Challenger accident to establish the probable cause or causes of the accident. Develops recommendations for corrective or other action based upon the Commission's findings and determinations. Color photos, charts and tables.

Vaughan unveils the complicated and high-pressure world of air traffic controllers as they navigate technology and political and public climates, and shows how they keep the skies so safe. When two airplanes were flown into the World Trade Center towers on September 11, 2001, Americans watched in uncomprehending shock as first responders struggled to react to the situation on the ground. Congruently, another remarkable and heroic feat was taking place in the air: more than six hundred and fifty air traffic control facilities across the country coordinated their efforts to ground four thousand flights in just two hours—an achievement all the more impressive considering the unprecedented nature of the task. In *Dead Reckoning*, Diane Vaughan explores the complex work of air traffic controllers, work that is built upon a close relationship between human organizational systems and technology and is remarkably safe given the high level of risk. Vaughan observed the distinct skill sets of air traffic controllers and the ways their workplaces changed to adapt to technological developments and public and political pressures. She chronicles the ways these forces affected their jobs, from their relationships with one another and the layouts of their workspace to their understandings of their job and its place in society. The result is a nuanced and engaging look at an essential role that demands great coordination, collaboration, and focus—a role that technology will likely never be able to replace. Even as the book conveys warnings about complex systems and the liabilities of technological and organizational innovation, it shows the kinds of problem-solving solutions that evolved over time and the importance of people.

This handbook consists of six core chapters: (1) systems engineering fundamentals discussion, (2) the NASA program/project life cycles, (3) systems engineering processes to get from a concept to a design, (4) systems engineering processes to get from a design to a final product, (5) crosscutting management processes in systems engineering, and (6) special topics relative to systems engineering. These core chapters are supplemented by appendices that provide outlines, examples, and further information to illustrate topics in the core chapters. The handbook makes extensive use of boxes and figures to define, refine, illustrate, and extend concepts in the core chapters without diverting the reader from the main information. The handbook provides top-level guidelines for good systems engineering practices; it is not intended in any way to be a directive.

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The authors demonstrate that the imperfections in technology are related to the uncertainties in science described in the first volume.

A new approach to safety, based on systems thinking, that is more effective, less costly, and easier to use than current techniques. Engineering has experienced a technological revolution, but the basic engineering techniques applied in safety and reliability engineering, created in a simpler, analog world, have changed very little over the years. In this groundbreaking book, Nancy Leveson proposes a new approach to safety—more suited to today's complex, sociotechnical, software-intensive world—based on modern systems thinking and systems theory. Revisiting and updating ideas pioneered by 1950s

aerospace engineers in their System Safety concept, and testing her new model extensively on real-world examples, Leveson has created a new approach to safety that is more effective, less expensive, and easier to use than current techniques. Arguing that traditional models of causality are inadequate, Leveson presents a new, extended model of causation (Systems-Theoretic Accident Model and Processes, or STAMP), then shows how the new model can be used to create techniques for system safety engineering, including accident analysis, hazard analysis, system design, safety in operations, and management of safety-critical systems. She applies the new techniques to real-world events including the friendly-fire loss of a U.S. Blackhawk helicopter in the first Gulf War; the Vioxx recall; the U.S. Navy SUBSAFE program; and the bacterial contamination of a public water supply in a Canadian town. Leveson's approach is relevant even beyond safety engineering, offering techniques for "reengineering" any large sociotechnical system to improve safety and manage risk.

Work has never been as safe as it seems today. Safety has also never been as bureaucratized as it is today. Over the past two decades, the number of safety rules and statutes has exploded, and organizations themselves are creating ever more internal compliance requirements. At the same time, progress on safety has slowed to a crawl. Many incident- and injury rates have flatlined. Worse, excellent safety performance on low-consequence events tends to increase the risk of fatalities and disasters. Bureaucracy and compliance now seem less about managing the safety of the workers we are responsible for, and more about managing the liability of the people they work for. We make workers do a lot that does nothing to improve their success locally. Paradoxically, such tightening of safety bureaucracy robs us of exactly the source of human insight, creativity and resilience that can tell us how success is actually created, and where the next accident may well happen. It is time for Safety Anarchists: people who trust people more than process, who rely on horizontally coordinating experiences and innovations, who push back against petty rules and coercive compliance, and who help recover the dignity and expertise of human work.

The untold story of a national trauma—NASA's Challenger explosion—and what really happened to America's Teacher in Space, illuminating the tragic cost of humanity setting its sight on the stars You've seen the pictures. You know what happened. Or do you? On January 28, 1986, NASA's space shuttle Challenger exploded after blasting off from Cape Canaveral. Christa McAuliffe, America's "Teacher in Space," was instantly killed, along with the other six members of the mission. At least that's what most of us remember. Kevin Cook tells us what really happened on that ill-fated, unforgettable day. He traces the pressures—leading from NASA to the White House—that triggered the fatal order to launch on an ice-cold Florida morning. Cook takes readers inside the shuttle for the agonizing minutes after the explosion, which the astronauts did indeed survive. He uncovers the errors and corner-cutting that led an overconfident space agency to launch a crew that had no chance to escape. But this is more than a corrective to a now-dimming memory. Centering on McAuliffe, a charmingly down-to-earth civilian on the cusp of history, *The Burning Blue* animates a colorful cast of characters: a pair of red-hot flyers at the shuttle's controls, the second female and first Jewish astronaut, the second Black astronaut, and the first Asian American and Buddhist in space. Drawing vivid portraits of Christa and the astronauts, Cook makes readers forget the fate they're hurtling toward. With drama, immediacy, and shocking surprises, he reveals the human price the Challenger crew and America paid for politics, capital-P Progress, and the national dream of "reaching for the stars."

Now in trade paperback, the ground-breaking and carefully documented book that shows how couples come apart.

i Prologue 1 The Atomic Chef The disturbing story behind one of history's worst nuclear criticality accidents.2 The Embryo Imbroglio A deviation in procedure at a Manhattan fertility clinic results in a big surprise for two patients.3 Signal Detection How airline security officials in Paris classified and misclassified shoe bomber Richard Reid.4 Out of Synch The Canadians cry foul at the Barcelona Olympics when an American wins the gold, but the problem lies with the user interface of the judges keypad.5 Death on Call A US Special Forces team in Afghanistan mistakenly targets a precision-guided bomb on their own position.6 Picture Window Astronauts race to locate the source of a threatening air leak aboard the International Space Station.7 Event Horizon A harmless MRI scan at a New York hospital turns to tragedy for a young patient when good intentions interact with an invisible force.8 Freeway Driver Artist Richard Ankrum takes matters into his own hands to enhance a confusing freeway sign.9 Caught on Tape The nightmare flight of AeroPeru 603 off the coast of South America, and its surprising cause.10 911, More or Less A chain of errors in an emergency dispatch center has tragic consequences for a Los Angeles family.11 ATM Its Thanksgiving evening, and one unfortunate bank customer in New Jersey contemplates spending the holiday locked inside an automatic teller booth.12 Under the Radar Maintenance errors and low load estimates bring down a commercial airliner.13 Safer than Safe How early batches of Salk polio vaccine actually spread the dreaded disease rather than prevent it.14 Rhymes and Reasons The ergonomics involved in musician John Denver's final flight.15 A Kid in a Car A toddler in Kansas is strangled by an electric-powered vehicle window of a particular design.16 The Perilous Plunge This amusement park ride is much too perilous for one unfortunate customer.17 Titanics Wake Two Chicago dockworkers witness a maritime calamity of unthinkable consequence.18 Driven to Distraction A French motorist discovers yet another form of driver distraction.19 Negative Transfer NASA test pilot Milt Thompson faces certain death unless he can quickly determine why his experimental aircraft is wobbling out of control.20 End Game Greek shipping magnate Pandelis Sfinias contemplates his own fate and the causes of the sinking of the Express Samina ferry.

The Challenger Launch Decision Risky Technology, Culture, and Deviance at NASA, Enlarged Edition University of Chicago Press

Jim Wetherbee, the only five-time Space Shuttle commander, presents thirty techniques that astronauts use—not only to stay alive in the unforgiving and deadly environment of space, but also to conduct high-quality operations and accomplish complex missions. These same techniques, based on the foundational principles of operating excellence, can help anyone be successful in high-hazard endeavors, ordinary business, and everyday life. *Controlling Risk* shows you how to embrace these techniques as a way of operating and living your life, so you can predict and prevent your next accident, while improving performance and productivity to take your company higher

Discusses the social impact of the crash and analyzes the NASA decision making process

Voted the Best Space Book of 2018 by the Space Hipsters The dramatic inside story of the epic search and recovery operation after the Columbia space shuttle disaster. On February 1, 2003, Columbia disintegrated on reentry before the nation's eyes, and all seven astronauts aboard were lost. Author Mike Leinbach, Launch Director of the space shuttle program at NASA's John F. Kennedy Space Center was a key leader in the search and recovery effort as NASA, FEMA, the FBI, the US Forest Service, and dozens more federal, state, and local agencies combed an area of rural east Texas the size of Rhode Island for every piece of the shuttle and her crew they could find. Assisted by hundreds of volunteers, it would become the largest ground search operation in US history. This comprehensive account is told in four parts: Parallel Confusion Courage, Compassion, and Commitment Picking Up the Pieces A Bittersweet Victory For the first time, here is the definitive inside story of the Columbia disaster and recovery and the inspiring message it ultimately holds. In the aftermath of tragedy, people and communities came together to help bring home the remains of the crew and nearly 40 percent of shuttle, an effort that was instrumental in piecing together what happened so the shuttle program could return to flight and complete the International Space Station. Bringing

Columbia Home shares the deeply personal stories that emerged as NASA employees looked for lost colleagues and searchers overcame immense physical, logistical, and emotional challenges and worked together to accomplish the impossible. Featuring a foreword and epilogue by astronauts Robert Crippen and Eileen Collins, and dedicated to the astronauts and recovery search persons who lost their lives, this is an incredible, compelling narrative about the best of humanity in the darkest of times and about how a failure at the pinnacle of human achievement became a story of cooperation and hope.

On April 14, 1994, two U.S. Air Force F-15 fighters accidentally shot down two U.S. Army Black Hawk Helicopters over Northern Iraq, killing all twenty-six peacekeepers onboard. In response to this disaster the complete array of military and civilian investigative and judicial procedures ran their course. After almost two years of investigation with virtually unlimited resources, no culprit emerged, no bad guy showed himself, no smoking gun was found. This book attempts to make sense of this tragedy--a tragedy that on its surface makes no sense at all. With almost twenty years in uniform and a Ph.D. in organizational behavior, Lieutenant Colonel Snook writes from a unique perspective. A victim of friendly fire himself, he develops individual, group, organizational, and cross-level accounts of the accident and applies a rigorous analysis based on behavioral science theory to account for critical links in the causal chain of events. By explaining separate pieces of the puzzle, and analyzing each at a different level, the author removes much of the mystery surrounding the shutdown. Based on a grounded theory analysis, Snook offers a dynamic, cross-level mechanism he calls "practical drift"--the slow, steady uncoupling of practice from written procedure--to complete his explanation. His conclusion is disturbing. This accident happened because, or perhaps in spite of everyone behaving just the way we would expect them to behave, just the way theory would predict. The shutdown was a normal accident in a highly reliable organization.

Warns about our reliance on technology, and argues that the Challenger tragedy was inevitable because of the complex infrastructure

The constant threat of crises such as disasters, riots and terrorist attacks poses a frightening challenge to Western societies and governments. While the causes and dynamics of these events have been widely studied, we know little about what happens following their containment and the restoration of stability. This volume explores 'post-crisis politics,' examining how crises give birth to longer term dynamic processes of accountability and learning which are characterised by official investigations, blame games, political manoeuvring, media scrutiny and crisis exploitation. Drawing from a wide range of contemporary crises, including Hurricane Katrina, 9/11, the Madrid train bombings, the Walkerton water contamination, Space Shuttles Challenger and Columbia and the Boxing Day Asian tsunami, this is a ground-breaking volume which addresses the longer term impact of crisis-induced politics. Competing pressures for stability and change mean that policies, institutions and leaders may occasionally be uprooted, but often survive largely intact.

Chief engineer Thomas J. Kelly gives a firsthand account of designing, building, testing, and flying the Apollo lunar module. It was, he writes, "an aerospace engineer's dream job of the century." Kelly's account begins with the imaginative process of sketching solutions to a host of technical challenges with an emphasis on safety, reliability, and maintainability. He catalogs numerous test failures, including propulsion-system leaks, ascent-engine instability, stress corrosion of the aluminum alloy parts, and battery problems, as well as their fixes under the ever-present constraints of budget and schedule. He also recaptures the exhilaration of hearing Apollo 11's Neil Armstrong report that "The Eagle has landed," and the pride of having inadvertently provided a vital "lifeboat" for the crew of the disabled Apollo 13.

Normal Accidents analyzes the social side of technological risk. Charles Perrow argues that the conventional engineering approach to ensuring safety--building in more warnings and safeguards--fails because systems complexity makes failures inevitable. He asserts that typical precautions, by adding to complexity, may help create new categories of accidents. (At Chernobyl, tests of a new safety system helped produce the meltdown and subsequent fire.) By recognizing two dimensions of risk--complex versus linear interactions, and tight versus loose coupling--this book provides a powerful framework for analyzing risks and the organizations that insist we run them. The first edition fulfilled one reviewer's prediction that it "may mark the beginning of accident research." In the new afterword to this edition Perrow reviews the extensive work on the major accidents of the last fifteen years, including Bhopal, Chernobyl, and the Challenger disaster. The new postscript probes what the author considers to be the "quintessential 'Normal Accident'" of our time: the Y2K computer problem.

Just after 9:00 a.m. on February 1, 2003, the space shuttle Columbia broke apart and was lost over Texas. This tragic event led, as the Challenger accident had 17 years earlier, to an intensive government investigation of the technological and organizational causes of the accident. The investigation found chilling similarities between the two accidents, leading the Columbia Accident Investigation Board to conclude that NASA failed to learn from its earlier tragedy. Despite the frequency with which organizations are encouraged to adopt learning practices, organizational learning—especially in public organizations—is not well understood and deserves to be studied in more detail. This book fills that gap with a thorough examination of NASA's loss of the two shuttles. After offering an account of the processes that constitute organizational learning, Julianne G. Mahler focuses on what NASA did to address problems revealed by Challenger and its uneven efforts to institutionalize its own findings. She also suggests factors overlooked by both accident commissions and proposes broadly applicable hypotheses about learning in public organizations.

In the last decade, school shootings have decimated communities and terrified parents, teachers, and children in even the most "family friendly" American towns and suburbs. These tragedies appear to be the spontaneous acts of disconnected teens, but this important book argues that the roots of violence are deeply entwined in the communities themselves. Rampage challenges the "loner theory" of school violence and shows why so many adults and students miss the warning signs that could prevent it.

The Space Age began just as the struggle for civil rights forced Americans to confront the long and bitter legacy of slavery, discrimination, and violence against African Americans. Presidents John F. Kennedy and Lyndon Johnson utilized the space program as an agent for social change, using federal equal employment opportunity laws to open workplaces at NASA and NASA contractors to African Americans while creating thousands of research and technology jobs in the Deep South to ameliorate poverty. *We Could Not Fail* tells the inspiring, largely unknown story of how shooting for the stars helped to overcome segregation on earth. Richard Paul and Steven Moss profile ten pioneer African American space workers whose stories illustrate the role NASA and the space program played in promoting civil rights. They recount how these technicians, mathematicians, engineers, and an astronaut candidate surmounted barriers to move, in some cases literally, from the cotton fields to the launching pad. The authors vividly describe what it was like to be the sole African American in a NASA work group and how these brave and determined men also helped to transform Southern society by integrating colleges, patenting new inventions, holding elective office, and reviving and governing defunct towns. Adding new names to the roster of civil rights heroes and a new chapter to the story of space exploration, *We Could Not Fail* demonstrates how African Americans broke the color barrier by competing successfully at the highest level of American intellectual and technological achievement.

How do operators prevent the next accident that is inevitably trying to kill them? How do they improve performance? Can they do both simultaneously? Operators on the front lines of danger face hazards and make life-and-death decisions in dynamic, complex situations. They are the last line of defense, intended to prevent death and destruction. After accidents, organizations issue new rules. These will succeed (for a while) in preventing similar accidents. But, accidents are rarely so simple. Hardware does not "just break." A company may be blindsided by another accident that no one thought would occur. Investigators determine the latest catastrophe was tragically similar to a forgotten previous accident. Again, new rules are issued and procedures are updated--yet the cycle of accidents continues. Organizations, and operators, must need something more than rules and procedures. To succeed in dangerous environments, people cannot and should not rely solely on the rules, even in organizations with the noblest intentions. Operators need techniques for controlling risk to supplement the rules and procedures intended to manage risk. Controlling risk keeps operators alive in dangerous operations. Since the beginning of the space program, astronauts have been developing techniques based on principles of operations to help flight crews execute successful missions and stay alive and accomplish dangerous missions in the unforgiving environment of space. Astronauts, and operators in every hazardous profession, have learned these techniques always create better performance, helping them accomplish more missions with higher quality. When embraced as a way of operating, the thirty Techniques for Operating Excellence, illustrated in *Controlling Risk*, enable operators to work together, improve performance in high-risk businesses, and accomplish much more in this dangerous world!

Originally published in hardcover in 2009.

Human error is cited over and over as a cause of incidents and accidents. The result is a widespread perception of a 'human error problem', and solutions are thought to lie in changing the people or their role in the system. For example, we should reduce the human role with more automation, or regiment human behavior by stricter monitoring, rules or procedures. But in practice, things have proved not to be this simple. The label 'human error' is prejudicial and hides much more than it reveals about how a system functions or malfunctions. This book takes you behind the human error label. Divided into five parts, it begins by summarising the most significant research results. Part 2 explores how systems thinking has radically changed our understanding of how accidents occur. Part 3 explains the role of cognitive system factors - bringing knowledge to bear, changing mindset as situations and priorities change, and managing goal conflicts - in operating safely at the sharp end of systems. Part 4 studies how the clumsy use of computer technology can increase the potential for erroneous actions and assessments in many different fields of practice. And Part 5 tells how the hindsight bias always enters into attributions of error, so that what we label human error actually is the result of a social and psychological judgment process by stakeholders in the system in question to focus on only a facet of a set of interacting contributors. If you think you have a human error problem, recognize that the label itself is no explanation and no guide to countermeasures. The potential for constructive change, for progress on safety, lies behind the human error label.

On February 1, 2003, the unthinkable happened. The space shuttle Columbia disintegrated 37 miles above Texas, seven brave astronauts were killed and America's space program, always an eyeblink from disaster, suffered its second catastrophic in-flight failure. Unlike the Challenger disaster 17 years earlier, Columbia's destruction left the nation one failure away from the potential abandonment of human space exploration. Media coverage in the immediate aftermath focused on the possible cause of the disaster, and on the nation's grief. But the full human story, and the shocking details of NASA's crucial mistakes, have never been told -- until now. Based on dozens of exclusive interviews, never-before-published documents and recordings of key meetings obtained by the authors, *Comm Check* takes the reader inside the conference rooms and offices where NASA's best and brightest managed the nation's multi-billion-dollar shuttle program -- and where they failed to recognize the signs of an impending disaster. It is the story of a space program pushed to the brink of failure by relentless political pressure, shrinking budgets and flawed decision making. The independent investigation into the disaster uncovered why Columbia broke apart in the sky above Texas. *Comm Check* brings that story to life with the human drama behind the tragedy. Michael Cabbage and William Harwood, two of America's most respected space journalists, are veterans of all but a handful of NASA's 113 shuttle missions. Tapping a network of sources and bringing a combined three decades of experience to bear, the authors provide a rare glimpse into NASA's inner circles, chronicling the agency's most devastating failure and the challenges that face NASA as it struggles to return America to space.

What does the collapse of sub-prime lending have in common with a broken jackscrew in an airliner's tailplane? Or the oil spill disaster in the Gulf of Mexico with the burn-up of Space Shuttle Columbia? These were systems that drifted into failure. While pursuing success in a dynamic, complex environment with limited resources and multiple goal conflicts, a succession of small, everyday decisions eventually produced breakdowns on a massive scale. We have trouble grasping the complexity and normality that gives rise to such large events. We hunt for broken parts, fixable properties, people we can hold accountable. Our analyses of complex system breakdowns remain depressingly linear, depressingly componential - imprisoned in the space of ideas once defined by Newton and Descartes. The growth of complexity in society has outpaced our understanding of how complex systems work and fail. Our technologies have gotten ahead of our theories. We are able to build things - deep-sea oil rigs, jackscrews, collateralized debt obligations - whose properties we understand in isolation. But in competitive, regulated societies, their connections proliferate, their interactions and interdependencies multiply, their complexities mushroom. This book explores complexity theory and systems thinking to understand better how complex systems drift into failure. It studies sensitive dependence on initial conditions, unruly technology, tipping points, diversity - and finds that failure emerges opportunistically, non-randomly, from the very webs of relationships that breed success and that are supposed to protect organizations from disaster. It develops a vocabulary that allows us to harness complexity and find new ways of managing drift.

When the Space Shuttle Challenger exploded on January 28, 1986, millions of Americans became bound together in a single, historic moment. Many still vividly remember exactly where they were and what they were doing when they heard about the tragedy. Diane Vaughan recreates the steps leading up to that fateful decision, contradicting conventional interpretations to prove that what occurred at NASA was not skullduggery or misconduct but a disastrous mistake. Why did NASA managers, who not only had all the information prior to the launch but also were warned against it, decide to proceed? In retelling how the decision unfolded through the eyes of the managers and the engineers, Vaughan uncovers an incremental descent into poor judgment, supported by a culture of high-risk technology. She reveals how and why NASA insiders, when repeatedly faced with evidence that something was wrong, normalized the deviance so that it became acceptable to them. In a new preface, Vaughan reveals the ramifications for this book and for her when a similar decision-making process brought down NASA's Space Shuttle Columbia in 2003.

"Though ours is an age of high technology, the essence of what engineering is and what engineers do is not common knowledge. Even the most elementary of principles upon which great bridges, jumbo jets, or super computers are built are alien concepts to many. This is so in part because engineering as a human endeavor is not yet integrated into our culture and intellectual tradition. And while educators are currently wrestling with the problem of introducing technology into conventional academic curricula, thus better preparing today's students for life in a world increasingly technological, there is as yet no consensus as to how technological literacy can best be achieved. " I believe, and I argue in this essay, that the ideas of engineering are in fact in our bones and part of our human nature and experience. Furthermore, I believe that an understanding and an appreciation of engineers and engineering can be gotten without an engineering or technical education. Thus I hope that the technologically uninitiated will come to read what I have written as an introduction to technology. Indeed, this book is my answer to the questions 'What is engineering?' and 'What do engineers do?'" - Henry Petroski, *To Engineer is Human*

The stakes are higher than ever in *The Challenger*, the second book in the *Contender* YA trilogy by the New York Times bestselling author of the *Summoner* series, Taran Matharu. The first battle is over, but the Game is just beginning... Cade Carter and his friends have survived the qualifying round of the mysterious overlords' twisted games, decimated by the loss of so many of their comrades during the fight. But they have no time to mourn, for the next round of trials is about to begin. When the group discovers that their next foe will be even more ferocious than the last, Cade leads them on a quest out into their strange new world to find anything that might give them an edge. But what they find in the wilds could prove to be even more dangerous than the impending battle... The stakes are higher than ever in this thrilling sequel to *The Chosen*.

This book details the stories of Challenger's missions from the points of view of the astronauts, engineers, and scientists who flew and knew her and the managers, technicians, and ground personnel who designed her and nursed her from humble beginnings as a structural test article into one of the most capable Shuttles in NASA's service. Challenger veterans, including Gordon Fullerton and Vance Brand, describe their experiences and the differences between Challenger and her sister ships. The development of Challenger herself is explored in detail, including her design, development, construction, and preparation for missions.

The former launch commentator "offers a personal—and sometimes painful—look back at one of the darkest chapters in US human spaceflight" (Space.com). On January 28, 1986, the space shuttle Challenger launched from the Kennedy Space Center in Florida. Seventy-three seconds after launch, the fiery breach of a solid motor joint caused a rupture of the propellant tanks, and a stunned nation watched as flames engulfed the craft, killing all seven crew members on board. It was Hugh Harris, "the voice of launch control," whom audiences across the country heard counting down to lift-off on that fateful day. With over fifty years of experience with NASA's missions, Harris presents the story of the Challenger tragedy as only an insider can. With by-the-second accounts of the spacecraft's launch and a comprehensive overview of the ensuing investigation, Harris gives readers a behind-the-scenes look at the devastating accident that grounded the shuttle fleet for over two years. This book tells the whole story of the Challenger's tragic legacy.

In the years since the Mars Exploration Rover Spirit and Opportunity first began transmitting images from the surface of Mars, we have become familiar with the harsh, rocky, rusty-red Martian landscape. But those images are much less straightforward than they may seem to a layperson: each one is the result of a complicated set of decisions and processes involving the large team behind the Rovers. With *Seeing Like a Rover*, Janet Vertesi takes us behind the scenes to reveal the work that goes into creating our knowledge of Mars. Every photograph that the Rovers

take, she shows, must be processed, manipulated, and interpreted—and all that comes after team members negotiate with each other about what they should even be taking photographs of in the first place. Vertesi's account of the inspiringly successful Rover project reveals science in action, a world where digital processing uncovers scientific truths, where images are used to craft consensus, and where team members develop an uncanny intimacy with the sensory apparatus of a robot that is millions of miles away. Ultimately, Vertesi shows, every image taken by the Mars Rovers is not merely a picture of Mars—it's a portrait of the whole Rover team, as well.

This unique text provides a comprehensive framework for creating, managing, and interpreting qualitative research studies that yield valid and useful information. Examples of studies from a wide range of disciplines illustrate the strengths, limitations, and applications of the primary qualitative methods: in-depth interviews, focus group discussions, ethnography, content analysis, and case study and narrative research. Following a consistent format, chapters show students and researchers how to implement each method within a paradigm-neutral and flexible Total Quality Framework (TQF) comprising four interrelated components: Credibility, Analyzability, Transparency, and Usefulness. Unlike other texts that relegate quality issues to one or two chapters, detailed discussions of such crucial topics as construct validity, interresearcher reliability, researcher bias, and verification strategies are featured throughout. The book also addresses applications of the TQF to the writing, review, and evaluation of qualitative research proposals and manuscripts. Pedagogical Features \*Summary tables that highlight important content, such as the application of a method to vulnerable or hard-to-reach populations. \*Case studies that illustrate TQF standards in practice for each method. \*Guidelines for effective documentation (via thick descriptions) of each type of study. \*End-of-chapter discussion topics, exercises, and suggested further reading and Web resources. \*Chapters open with a preview and close with a bulleted summary of key ideas. \*Extensive glossary.

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\*Includes pictures \*Profiles the origins of the mission and what went wrong \*Includes online resources and a bibliography for further reading \*Includes a table of contents In the decades after the Apollo program, American space shuttles flew over 130 missions and successfully completed over 98% of them, but unfortunately, the two most famous missions were the ones that ended tragically aboard the Challenger and Columbia. The Space Shuttle Challenger was the most heavily used space shuttle in the three years it was operational, carrying the first minority astronaut and woman astronaut into space. Challenger was also the first space shuttle to complete a landing at night. On the morning of January 28, 1986, the Space Shuttle Challenger launched for the 10th time, beginning mission STS-51-L. Space shuttles had already successfully completed 24 missions, and no American spacecraft had ever failed to reach orbit during an official mission. On this mission, the Challenger was carrying a satellite for the Tracking and Data Relay Satellites system, which was to be deployed in orbit. The crew included Ronald McNair, who had already been the second African-American in space, and Ellison Onizuka, who had already been the first Asian-American astronaut in space. But the highlight of the mission was to be the "NASA Teacher in Space Project," in which a civilian teacher would give teaching lessons to his or her class while onboard the space shuttle. The winner of the competition was Christa McAuliffe, a high school teacher in Concord, New Hampshire, who wrote a winning essay and had to undergo a year of astronaut training before that fateful day. It was a beautiful morning, and many spectators came to the Kennedy Space Center to watch the launch, including McAuliffe's parents and her students. Several news networks were carrying live broadcasts of the launch, including live shots of McAuliffe's parents as they watched the Challenger liftoff. Mission Control's transmissions to the Challenger were being blared over loudspeakers to give spectators a play-by-play of the shuttle's ascent. Ascent seemed to be going normally during the first minute, but about 75 seconds into the ascent, a plastic O-ring used to seal a joint in one of the solid rocket boosters failed, causing a breach of hot gas. That gas spread to the other rocket booster and the external fuel tank, causing an explosion. When the spectators saw the explosion, many of them started cheering, unaware of what was really happening. But Mission Control quickly announced that there had been some sort of problem, and the crowd became confused and then panicky as the space shuttle, fuel tank and rocket boosters all broke apart and flew in opposite directions. Some cameras fixed on the falling debris as it fell to the ocean, while others stayed focused on McAuliffe's parents. The entire crew was killed in the explosion, and investigations concluded that they may have survived until crashing into the ocean. After the Challenger disaster, the space shuttles were grounded for about two years, and a commission issued findings that would be used in an effort to prevent similar tragedies. The Space Shuttle Challenger Disaster: The History and Legacy of NASA's Most Notorious Tragedy chronicles the disaster from the origins of its mission to what went so terribly wrong. Along with pictures of important people, places, and events, you will learn about the Challenger like never before.

As some of today's major and complex companies are worth more than the GDPs of some countries, traditional marketing approaches, such as glossy corporate campaigns, will have limited returns. Account-based marketing, also known as client-centric marketing, treats important individual accounts as markets in their own right, to help strengthen relationships, build reputation, and increase revenues in important accounts. A Practitioner's Guide to Account-Based Marketing outlines a clear, step-by-step process for readers to harness ABM tools and techniques and set up ABM programmes. Featuring insights from practising professionals and case studies from organizations including Microsoft, Accenture, O2 and Fujitsu, it also contains guidance on developing the competencies needed for account-based marketing and managing your ABM career. This updated second edition contains further discussion on how ABM initiatives can go from a pilot to being embedded in a business, new material on quantified value propositions and updated wider research. Meticulously researched and highly practical, A Practitioner's Guide to Account-Based Marketing will help all marketers to deliver successful B2B marketing.

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