Space Mission Engineering The New Smad

The highlight of Gemini 4 was America's first EVA or "space walk," performed by astronaut Ed White, which allowed the US to catch up with the Soviet Union, who had already performed the world's first space walk. White's EVA was so successful that he had to be ordered back into the Gemini capsule after its completion. --

Called "spellbinding" (Scientific American) and "thrilling...a future classic of popular science" (PW), the up close, inside story of the greatest space exploration project of our time, New Horizons' mission to Pluto, as shared with David Grinspoon by mission leader Alan Stern and other key players. On July 14, 2015, something amazing happened. More than 3 billion miles from Earth, a small NASA spacecraft called New Horizons screamed past Pluto at more than 32,000 miles per hour, focusing its instruments on the long mysterious icy worlds of the Pluto system, and then, just as quickly, continued on its journey out into the beyond. Nothing like this has occurred in a generation—a raw exploration of new worlds unparalleled since NASA's Voyager missions to Uranus and Neptune—and nothing quite like it is planned to happen ever again. The photos that New Horizons sent back to Earth graced the front pages of newspapers on all 7 continents, and NASA's website for the mission received more than 2 billion hits in the days surrounding the flyby. At a time when so many think that our most historic achievements are in the past, the most distant planetary exploration ever attempted not only succeeded in 2015 but made history and captured the world's imagination. How did this happen? Chasing New Horizons is the story of the men and women behind this amazing mission: of their decades-long commitment and persistence; of the political fights within and outside of NASA; of the sheer human ingenuity it took to design, build, and fly the mission; and of the plans for New Horizons' next encounter, 1 billion miles past Pluto in 2019. Told from the insider's perspective of mission leader Dr. Alan Stern and others on New Horizons, and including two stunning 16-page full-color inserts of images, Chasing New Horizons is a riveting account of scientific discovery, and of how much we humans can achieve when people focused on a dream work together toward their incredible goal.

"The purpose of 'Human spaceflight operations : lessons learned from 60 years in space' is to share collective experience on human spaceflight operations. The lessons learned are applicable to anyone working in the space industry as part of a current or future national or international space program, private space enterprise, human, or robotic mission. The book's chapters cover the primary technical disciplines related to spaceflight operations. In each case, the essential concepts and evolution of the systems and technology are discussed in some detail, but the focus is on how spaceflight operations are performed. Lessons learned are derived from incidents that occurred during actual space missions. Some of these lessons are explained directly by the astronauts who experienced them firsthand"--

Two pioneers of space exploration, Robert Esnault-Pelterie and Ary Sternfeld, introduced the words 'astronautics' and 'cosmonautics, ' respectively, into the scientific language. The origin of the term 'astronautics' is well documented. In contrast, the history of the word 'cosmonautics' remains poorly known. Ary Sternfeld is also largely forgotten. The fiftieth anniversary of the breakthrough to space, celebrated in 2007, makes it especially appropriate to remember those visionaries who paved the way to cosmos. The book tells the stories of 'astronautics' and 'cosmonautics' and describes a most unusual life journey of Ary Sternfeld

As a technical organization, charged with performing groundbreaking and pathfinding challenges on a daily basis, NASA has long valued the role of its Chief Engineers and Lead Systems Engineers. Although it takes a team to accomplish our missions and no members are unimportant, the Chief Engineers and Lead Systems Engineers who we look to lead our technical teams are critical to the success of our endeavors. It is this corps of dedicated, experienced, and passionate problem solvers and leaders who battle the technical headwinds that face every project, finding often hidden solutions and overcoming seemingly insurmountable obstacles to create paths to success. Furthermore, it is that indomitable spirit of ingenuity and perseverance that defines the Agency. Developing our Chief Engineers and Lead Systems Engineers is a commitment of the NASA engineering community, and one of our tenets for excellence. This development ensures our corps of engineers obtain the depth of technical acumen that they require, first as discipline engineers and then as Chief Engineers and Lead Systems Engineers, but also the associated management skills and experience to ensure they can interact with the rest of the project team and with program, Center, and Agency leadership. What's more, this development also ensures that NASA Chief Engineers and Lead Systems Engineers proficiently serve as leaders of their own technical teams, and that's what this book is all about. These technical leaders are critical to successfully implementing the three safety tenets we inherited from the Apollo program. These include the following: Strong in-line checks and balances. This means that engineers check their fellow engineers, and that no one checks their own homework. 1. Healthy tension between responsible organizations. In NASA today that is the programs and the three Technical Authorities (Engineering, Safety, and Health and Medical). Each organization has to be on equal footing with separate but equal chains of command to allow issues to be raised independently and provide the healthy tension to create organizational checks and balances. 2. "Value-added" independent assessment. "Value-added" means you bring in outside technical experts to peer review critical issues. Having a fresh set of eyes on a problem can provide a different perspective, leverage different experiences and result in more robust solutions. 3. NASA arrived at these three tenets through considerable blood, sweat, and loss, and our commitment to them is now inscribed in our Agency governance. As Chief Engineers and Lead Systems Engineers, your role in this is paramount, and achieving excellence in this is an expectation of your job. Serving in this role is not an easy task, but it is a tremendously reward¬ing one. You are the leaders of your technical teams, owners of the technical baseline, standard bearers of engineering best practices, decision makers, risk mitigators and problem solvers. You are Chief Engineers and Lead Systems Engineers, the title of which should say it all.

From Voyager to Stardust, this complete guide to NASA's deep space probes features a DVD containing thousands of pictures and videos captured by the journeying probes. 250 photos, 100 in full color.

The goal of this book is to allow you to begin with a "blank sheet of paper" and design a space mission to meet a set of broad, often poorly defined, objectives. You should be able to define the mission in sufficient detail to identify principal drivers and make a preliminary assessment of overall performance, size, cost, and risk. The emphasis of the book is on low-Earth orbit, unmanned spacecraft. However, we hope that the principles are broad enough to be applicable to other missions as well. We intend the book to be a practical guide, rather than a theoretical treatise. As much as possible, we have provided rules of thumb, empirical formulas, and design algorithms based on past experience. We assume that the reader has a general knowledge of physics, math, and basic engineering, but is not necessarily familiar with any aspect of space technology. This book was written by a group of senior engineers with over 800 years of collective space experience. It reflects the insight gained from this practical experience, and suggests how things might be done better in the future. From time to time the views of authors and editors conflict, as must necessarily occur given the broad diversity of experience. We believe it is important to reflect this diversity rather than suppress the opinions of individual authors.

Advanced space exploration is performed by unmanned missions with integrated autonomy in both flight and ground systems. Risk and feasibility are major factors supporting the use of unmanned craft and the use of automation and robotic technologies where possible. Autonomy in space helps to increase the amount of science data returned from missions, perform new science, and reduce mission costs. Elicitation and expression of autonomy requirements is one of the most significant challenges the autonomous spacecraft engineers need to overcome today. This book discusses the Autonomy Requirements Engineering (ARE) approach, intended to help software engineers properly elicit, express, verify, and validate autonomy requirements. Moreover, a comprehensive state-of-the-art of software engineering for aerospace is presented to outline the problems handled by ARE along with a proof-of-concept case study on the ESA's BepiColombo Mission

demonstrating the ARE’s ability to handle autonomy requirements.

"Human spaceflight: mission analysis and design" is for you if you manage, design, or operate systems for human spaceflight! It provides end-to-end coverage of designing human space systems for Earth, Moon, and Mars. If you are like many others, this will become the dog-eared book that is always on your desk -and used. The book includes over 800 rules of thumb and sanity checks that will enable you to identify key issues and errors early in the design processes. This book was written by group of 67 professional engineers, managers, and educators from industry, government, and academia that collectively share over 600 years of space-related experience! The team from the United States, Austria, Canada, France, Germany, Japan, and Russia worked for four-and-one-half years to capture industry and government best practices and lessons-learned from industry and government in an effort to baseline global conceptual design experience for human spaceflight. "Human spaceflight: mission analysis and design" provides a much-needed big-picture perspective that can be used by managers, engineers and students to integrate the myriad of elements associated with human spaceflight.

The firsthand account of the trials and tribulations of engineering one of the most complex pieces of space technology, the Mars Rover Curiosity, by its chief engineer Rob Manning In the course of our enduring quest for knowledge about ourselves and our universe, we haven't found answers to one of our most fundamental questions: Does life exist anywhere else in the universe? Ten years and billions of dollars in the making, the Mars Rover Curiosity is poised to answer this all-important question. In Mars Rover Curiosity: An Inside Account from Curiosity's Chief Engineer, Rob Manning, the project's chief engineer, tells of bringing the groundbreaking spacecraft to life. Manning and his team at NASA's Jet Propulsion Laboratory, tasked with designing a lander many times larger and more complex than any before, faced technical setbacks, fights over inadequate resources, and the challenges of leading an army of brilliant, passionate, and often frustrated experts. Manning's fascinating personal account--which includes information from his exclusive interviews with leading Curiosity scientists--is packed with tales of revolutionary feats of science, technology, and engineering. Readers experience firsthand the disappointment at encountering persistent technical problems, the agony of near defeat, the sense of victory at finding innovative solutions to these problems, the sheer terror of staking careers and reputations on a lander that couldn't be tested on Earth, and the rush of triumph at its successful touchdown on Mars on August 5, 2012. This is the story of persistence, dedication, and unrelenting curiosity.

Principal Investigator-Led (PI-led) missions are an important element of NASAâ€™s space science enterprise. While several NRC studies have considered aspects of PI-led missions in the course of other studies for NASA, issues facing the PI-led missions in general have not been subject to much analysis in those studies. Nevertheless, these issues are raising increasingly important questions for NASA, and it requested the NRC to explore them as they currently affect PI-led missions. Among the issues NASA asked to have examined were those concerning cost and scheduling, the selection process, relationships among PI-led team members, and opportunities for knowledge transfer to new PIs. This report provides a discussion of the evolution and current status of the PIled mission concept, the ways in which certain practices have affected its performance, and the steps that can carry it successfully into the future. The study was done in collaboration with the National Academy of Public Administration.

The landing site selected for the crew of Apollo 16 was in the lunar highland area of Descartes. NASA chose to send John Young to command the fifth lunar landing mission. Young had as much or more flight experience than any other member of the astronaut corps. He had circumnavigated the moon on Apollo 10 and he had flown two Gemini missions. Young would later go on to be the first commander of the Space Shuttle. The Descartes landing site was chosen because it appeared to be of volcanic origin. If it was, it might reveal secrets about the origins of the Earth. For three days Young and Duke embarked on their rover, away from the Lunar Module 'Orion', through rugged landscapes, in search of the origins of our world. Meanwhile Ken Mattingly shot hundreds of photographs and probed the moon's magnetic field from the Command Module 'Casper'. Back on Earth the political climate was beginning to turn against NASA and the remarkable risks and exploits undertaken by the crew of Apollo 16 went almost unnoticed. The three intrepid explorers and their spacecraft harvested a wealth of new data about the Earth-Moon system in an almost flawless performance of skills and bravado. Compiled here are many important documents about the mission including the complete debriefing in the crew's own words. The CD-ROM features an exclusive interview with Commander John Young and the complete footage shot at Descartes, over 2500 still pictures and 18 interactive panoramas. Running time: over 10 hours.

Fundamentals of Space Systems was developed to satisfy two objectives: the first is to provide a text suitable for use in an advanced undergraduate or beginning graduate course in both space systems engineering and space system design. The second is to be a primer and reference book for space professionals wishing to broaden their capabilities to develop, manage the development, or operate space systems. The authors of the individual chapters are practicing engineers that have had extensive experience in developing sophisticated experimental and operational spacecraft systems in addition to having experience teaching the subject material. The text presents the fundamentals of all the subsystems of a spacecraft missions and includes illustrative examples drawn from actual experience to enhance the learning experience. It includes a chapter on each of the relevant major disciplines and subsystems including space systems engineering, space environment, astrodynamics, propulsion and flight mechanics, attitude determination and control, power systems, thermal control, configuration management and structures, communications, command and telemetry, data processing, embedded flight software, survuvability and reliability, integration and test, mission operations, and the initial conceptual design of a typical small spacecraft mission.

The history-making astronaut, aerospace engineer and respected advocate for space colonization outlines a plan for taking humans to Mars within the next quarter century, posing business-specific arguments while outlining practical strategies for travel and planetary homesteading.

DVD contains unique synchronized film and audio of the lunar landing, rendezvous and docking. Rare training footage of the crew aboard the KC-135, launch footage, multi-camera EVA silm, splashdown and recovery footage.
"Exceptionally absorbing and thrilling. ... Masterful." --Nature A "magnificent" (Scientific American), genre-defying narrative of the most ambitious science project ever conceived: NASA's deep space mission to Europa, the Jovian moon where might swim the first known alien life in our solar system In the spirit of Tom Wolfe and John McPhee, The Mission is an exuberant master class of creative nonfiction that reveals how a motley, determined few expanded the horizon of human achievement. When scientists discovered the first ocean beyond Earth, they had two big questions: "Is it habitable?" and "How do we get there?" To answer the first, they had to solve the second, and so began a vivacious team's twenty-year odyssey to mount a mission to Europa, the ocean moon of Jupiter. Standing in their way: NASA, fanatically consumed with landing robots on Mars; the White House, which never saw a science budget it couldn't cut; Congress, fixated on going to the moon or Mars--anywhere, really, to give astronauts something to do; rivals in academia, who wanted instead to go to Saturn; and even Jupiter itself, which guards Europa in a pulsing, rippling radiation belt--a halo of death whose conditions are like those that follow a detonated thermonuclear bomb. The Mission is the Homeric, never-before-told story of modern space exploration, and a magnificent portrait of the inner lives of scientists who study the solar system's mysterious outer planets. David W. Brown chronicles the remarkable saga of how Europa was won, and what it takes to get things done--both down here, and up there.
The United States must operate successfully in space to help assure its security and economic well being. The Department of the Navy is a major user of space capabilities, although those capabilities are now primarily provided by DOD, the Air Force, and NOAA. Following a DOD assessment of national space security management in 2001, the Navy commissioned a Panel to Review Space to assess Navy space policy and strategy. As an extension of that review, the NRC was requested by the Navy to examine its needs in space for providing future operational and technical capabilities. This report presents a discussion of the strategic framework of future space needs, the roles and responsibilities for meeting those needs, an assessment of Navy support to space mission areas, and a proposed vision for fulfilling Naval forces space needs.
Looks at the operations of the International Space Station from the perspective of the Houston flight control team, under the leadership of NASA's flight directors, who authored the book. The book provides insight into the vast amount of time and energy that these teams devote to the development, planning and integration of a mission before it is executed. The passion and attention to detail of the flight control team members, who are always ready to step up when things do not go well, is a hallmark of NASA human spaceflight operations. With tremendous support from the ISS program office and engineering community, the flight control team has made the International Space Station and the programs before it a success.
An argument that we have a moral duty to explore other planets and solar systems--because human life on Earth has an expiration date. Inevitably, life on Earth will come to an end, whether by climate disaster, cataclysmic war, or the death of the sun in a few billion years. To avoid extinction, we will have to find a new home planet, perhaps even a new solar system, to inhabit. In this provocative and fascinating book, Christopher Mason argues that we have a moral duty to do just that. As the only species aware that life on Earth has an expiration date, we have a responsibility to act as the shepherd of life-forms--not only for our species but for all species on which we depend and for those still to come (by accidental or designed evolution). Mason argues that the same capacity for ingenuity that has enabled us to build rockets and land on other planets can be applied to redesigning biology so that we can sustainably inhabit those planets. And he lays out a 500-year plan for undertaking the massively ambitious project of reengineering human genetics for life on other worlds. As they are today, our frail human bodies could never survive travel to another habitable planet. Mason describes the toll that long-term space travel took on astronaut Scott Kelly, who returned from a year on the International Space Station with changes to his blood, bones, and genes. Mason proposes a ten-phase, 500-year program that would engineer the genome so that humans can tolerate the extreme environments of outer space--with the ultimate goal of achieving human settlement of new solar systems. He lays out a roadmap of which solar systems to visit first, and merges biotechnology, philosophy, and genetics to offer an unparalleled vision of the universe to come.
The challenge of communication in planetary exploration has been unusual. The guidance and control of spacecraft depend on reliable communication. Scientific data returned to earth are irreplaceable, or replaceable only at the cost of another mission. In deep space, communications propagation is good, relative to terrestrial communications, and there is an opportunity to press toward the mathematical limit of microwave communication. Yet the limits must be approached warily, with reliability as well as channel capacity in mind. Further, the effects of small changes in the earth's atmosphere and the interplanetary plasma have small but important effects on propagation time and hence on the measurement of distance. Advances are almost incredible. Communication capability measured in 18 bits per second at a given range rose by a factor of 10 in the 19 years from Explorer I of 1958 to Voyager of 1977. This improvement was attained through ingenious design based on the sort of penetrating analysis set forth in this book by engineers who took part in a highly detailed and amazingly successful pro gram. Careful observation and analysis have told us much about limitations on the accurate measurement of distance. It is not easy to get busy people to tell others clearly and in detail how they have solved important problems. Joseph H. Yuen and the other contribu tors to this book are to be commended for the time and care they have devoted to explicating one vital aspect of a great adventure of mankind.
This book describes the most complex machine ever sent to another planet: Curiosity. It is a one-ton robot with two brains, seventeen cameras, six wheels, nuclear power, and a laser beam on its head. No one human understands how all of its systems and instruments work. This essential reference to the Curiosity mission explains the engineering behind every system on the rover, from its rocket-powered jetpack to its radioisotope thermoelectric generator to its fiendishly

complex sample handling system. Its lavishly illustrated text explains how all the instruments work -- its cameras, spectrometers, sample-cooking oven, and weather station -- and describes the instruments' abilities and limitations. It tells you how the systems have functioned on Mars, and how scientists and engineers have worked around problems developed on a faraway planet: holey wheels and broken focus lasers. And it explains the grueling mission operations schedule that keeps the rover working day in and day out.

Widely known and used throughout the astrodynamics and aerospace engineering communities, this teaching text was developed at the U.S. Air Force Academy. Completely revised and updated 2013 edition.

Changing the focus of the multibillion-dollar global aerospace business toward smaller, lower-cost spacecraft is not happening solely due to technical, managerial, financial or market motivations. Rick Fleeter's second book on the small, low-cost space programmes which are the fastest-growing segment of aerospace activity, gives the reader a keen understanding of the full spectrum of factors driving this profound change. The text then goes beyond engineering technologies and management techniques to envision the tantalizing prospects microspace has in store for the industry, its present markets and those of the future.

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 engineeringprocesses 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. NASA/SP-2007-6105 Rev1 supersedes SP-6105, dated June 1995

With the second edition of Space Mission Analysis and Design, two changes have been introduced in the Space Technology Library. Foremost among these is the intro duction of the Space Technology Series as a part of the Space Technology Library. Dr. Wiley Larson of the US Air Force Academy and University of Colorado, Colorado Springs, will serve as Managing Editor for the Space Technology Series. This series is a cooperative effort of the Department of Defense, National Aeronautics and Space Administration, Department of Energy, and European Space Agency, coor dinated by the US Air Force Academy. The sponsors intend to bring a number of books into the series to improve the literature base in the fundamentals of space technology, beginning with the current volume. Books which are not a part of the Space Technology Series, but which also represent a substantial contribution to the space technology literature, will still be published in the Space Technology Library. As always, we welcome suggestions and contributions from the aerospace com munity.

Following on from the hugely successful previous editions, the third edition of Spacecraft Systems Engineering incorporates the most recent technological advances in spacecraft and satellite engineering. With emphasis on recent developments in space activities, this new edition has been completely revised. Every chapter has been updated and rewritten by an expert engineer in the field, with emphasis on the bus rather than the payload. Encompassing the fundamentals of spacecraft engineering, the book begins with front-end system-level issues, such as environment, mission analysis and system engineering, and progresses to a detailed examination of subsystem elements which represent the core of spacecraft design - mechanical, electrical, propulsion, thermal, control etc. This quantitative treatment is supplemented by an appreciation of the interactions between the elements, which deeply influence the process of spacecraft systems design. In particular the revised text includes * A new chapter on small satellites engineering and applications which has been contributed by two internationally-recognised experts, with insights into small satellite systems engineering. * Additions to the mission analysis chapter, treating issues of aero-manouevring, constellation design and small body missions. In summary, this is an outstanding textbook for aerospace engineering and design students, and offers essential reading for spacecraft engineers, designers and research scientists. The comprehensive approach provides an invaluable resource to spacecraft manufacturers and agencies across the world.

Progress in space safety lies in the acceptance of safety design and engineering as an integral part of the design and implementation process for new space systems. Safety must be seen as the principle design driver of utmost importance from the outset of the design process, which is only achieved through a culture change that moves all stakeholders toward front-end loaded safety concepts. This approach entails a common understanding and mastering of basic principles of safety design for space systems at all levels of the program organisation. Fully supported by the International Association for the Advancement of Space Safety (IAASS), written by the leading figures in the industry, with frontline experience from projects ranging from the Apollo missions, Skylab, the Space Shuttle and the International Space Station, this book provides a comprehensive reference for aerospace engineers in industry. It addresses each of the key elements that impact on space systems safety, including: the space environment (natural and induced); human physiology in space; human rating factors; emergency capabilities; launch propellants and oxidizer systems; life support systems; battery and fuel cell safety; nuclear power generators (NPG) safety; habitat activities; fire protection; safety-critical software development; collision avoidance systems design; operations and on-orbit maintenance. * The only comprehensive space systems safety reference, its must-have status within space agencies and suppliers, technical and aerospace libraries is practically guaranteed * Written by the leading figures in the industry from NASA, ESA, JAXA, (et cetera), with frontline experience from projects ranging from the Apollo missions, Skylab, the Space Shuttle, small and large satellite systems, and the International Space Station. * Superb quality information for engineers, programme managers, suppliers and aerospace technologists; fully supported by the IAASS (International Association for the

Advancement of Space Safety)

One of the Washington Post's 20 Books to Read This Summer A riveting history of the epic orbital flight that put America back into the space race. If the United States couldn’t catch up to the Soviets in space, how could it compete with them on Earth? That was the question facing John F. Kennedy at the height of the Cold War—a perilous time when the Soviet Union built the wall in Berlin, tested nuclear bombs more destructive than any in history, and beat the United States to every major milestone in space. The race to the heavens seemed a race for survival—and America was losing. On February 20, 1962, when John Glenn blasted into orbit aboard Friendship 7, his mission was not only to circle the planet; it was to calm the fears of the free world and renew America’s sense of self-belief. Mercury Rising re-creates the tension and excitement of a flight that shifted the momentum of the space race and put the United States on the path to the moon. Drawing on new archival sources, personal interviews, and previously unpublished notes by Glenn himself, Mercury Rising reveals how the astronaut’s heroics lifted the nation’s hopes in what Kennedy called the "hour of maximum danger."

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."

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The Greatest Adventure explores the past, present, and future of the space race. The space race was perhaps the greatest technological contest of the twentieth century. It was a thrilling era of innovation, discovery, and exploration, as astronauts and cosmonauts were launched on space missions of increasing length, complexity, and danger. The Greatest Adventure traces the events of this extraordinary period, describing the initial string of Soviet achievements: the first satellite in orbit; the first animal, man, and woman in space; the first spacewalk; as well as the ultimate US victory in the race to land on the moon. The book then takes the reader on a journey through the following decades of space exploration to the present time, detailing the many successes, tragedies, risks, and rewards of space exploration.

Reducing Space Mission Cost is the first complete treatment of the technology, process, and problems in the most critical areas of modern spaceflight. The demand to reduce cost is unrelenting. This pioneering book addresses all aspects of this problem, including: Technology and processes for reducing cost Cost reduction in mission engineering, spacecraft design, manufacture, launch, and operations Implementation methods and problems The price of reducing cost 10 detailed case studies of what works in practice in: Science missions Interplanetary probes Communications spacecraft Test and Applications missions Beginning on the inside front cover, this book provides real cost data on a variety of missions, systems, and subsystems. According to the authors: `Reducing mission cost is hard enough if you know what the real costs are, and virtually impossible if you don't.' This book challenges traditional methods, yet recognizes that all space programs are run to minimize cost within the rules under which they are built and flown. It provides practical recipes for reducing cost in both new and ongoing missions and discusses what works, what government can do to help, and what methods intended to reduce cost may be counterproductive and unintentionally increase cost. As shown on the inside rear cover, the case studies described in the book have reduced total mission cost by 80% to more than 90% with respect to projections by traditional cost methods. This book is a follow-on to the now standard text and reference, Space Mission Analysis and Design, also edited by Drs. Wertz and Larson. It is required reading for professionals, students, and managers in astronautics or space sciences and managers or scientists involved in space experiments. This book shows that reducing space mission cost, without reducing reliability, is as possible as it is important for the future of space exploration.

This book describes prominent technological achievements within a very successful space science mission: the Herschel space observatory. Focusing on the various processes of innovation it offers an analysis and discussion of the social, technological and scientific context of the mission that paved the way to its development. It addresses the key question raised by these processes in our modern society, i.e.: how knowledge management of innovation set the conditions for inventing the future? In that respect the book is based on a transdisciplinary analysis of the programmatic complexity of Herschel, with inputs from space scientists, managers, philosophers, and engineers. This book is addressed to decision makers, not only in space science, but also in other industries and sciences using or building large machines. It is also addressed to space engineers and scientists as well as students in science and management.

From a long-term planning lead for the Mars Exploration Rover Project comes this vivid insider account of some of NASA’s most vital and exciting missions to the Red Planet, illustrated with full-color photographs—a wondrous chronicle of unprecedented scientific discovery and the search for evidence of life on Mars. “There are probably just a few of moments in human history when a small group of humans stood on the margins of a vast new world, and it is no stretch of the romantic imagination that the arrival

of two rovers on the surface of another planet was surely one of them." Human exploration of Mars is the most ambitious and exciting scientific goal of the twenty-first century. Few people know as much about this fascinating planet as Dr. Larry Crumpler. As one of the long-term planning leads for the Mars Exploration Rover Project, he helped control the daily communications between NASA and the rovers roaming the planet to gather scientific data. Thanks to the Rover Project, we now know that the dry, red dust of the planet's surface hides a wet, possibly living history, and that conditions were present for the evolution of complex, organic life. In this magnificent compendium, Dr. Crumpler recounts the history of the Red Planet, from the earliest days when ancient astronomers turned their eyes to the heavens to the breakthrough discoveries being unearthed by modern technology today, including some of the first images from the latest rover, Perseverance. Paired with stunning, full-color photographs taken by rovers and NASA satellites images, this magnificent "biography" of the red planet allows us to understand and experience it as never before. When the Spirit and Opportunity Rovers landed on Mars in January 2004, scientists expected them to function for 90 days. But those three months turned into fifteen years. With data gathered by the rovers, Dr. Crumpler and his fellow team members were able to reconstruct the planet's stunning geological past, when it was once inundated with water, and perhaps could have supported microbial life. Dr Crumpler also reveals the joys and demands of life as a scientist taking part in these historic missions. Exploring fundamental questions about this remarkable planet that have intrigued us earthlings for years, Missions to Mars illuminates Mars' significance in the solar system—and the human imagination.

This book is a completely rewritten, updated, and expanded follow-on to the 3rd edition of Space mission analysis and design. In recent decades, the number of satellites being built and launched into Earth's orbit has grown immensely, alongside the field of space engineering itself. This book offers an in-depth guide to engineers and professionals seeking to understand the technologies behind Low Earth Orbit satellites. With access to special spreadsheets that provide the key equations and relationships needed for mastering spacecraft design, this book gives the growing crop of space engineers and professionals the tools and resources they need to prepare their own LEO satellite designs, which is especially useful for designers of small satellites such as those launched by universities. Each chapter breaks down the various mathematics and principles underlying current spacecraft software and hardware designs.