The Soyuz Launch Vehicle The Two Lives Of An Engineering Triumph

The Saturn I and IB series of rockets fulfilled plans developed in the late 1950s to build a rocket which could triple the existing thrust levels of US rockets and equal the lifting capacity of the Soviet Union, launching satellites and spacecraft weighing more than 10 tonnes into Earth orbit and do it by the early 1960s. These rockets emerged from the work carried out by former V-2 technical director Wernher von Braun, working at the Army Ballistic Missile Agency in Huntsville, Alabama. Three times more powerful than anything launched by America to that date, with a cluster of eight rocket motors for the first stage, the first Saturn I flew on October 27, 1961, and propelled America into the heavy-lift business. It was the Saturn I, and its successor the Saturn IB, with a more powerful second stage, that did all the preparatory work getting NASA ready to put men on the Moon. Between 1961 and 1975, the 19 flights of the Saturn I and IB achieved several historic “firsts”, launching the world’s first high-energy liquid oxygen/liquid hydrogen upper stages into orbit in 1964, the first unmanned test of suborbital and orbital Apollo spacecraft in 1966, the first unmanned test of the Lunar Module in 1968, the first manned Apollo spacecraft Apollo 7 also in 1968, all three Skylab flights in 1973 and the last Apollo spacecraft flown in support of the Apollo-Soyuz Test Project in 1975.
The revised and updated sixth edition of em style="mso-bidi-font-style: normal;"Satellite Communications Systems contains information on the most recent advances related to satellite communications systems, technologies, network architectures and new requirements of

services and applications. The authors – noted experts on the topic – cover the state-of-the-art satellite communication systems and technologies and examine the relevant topics concerning communication and network technologies, concepts, techniques and algorithms. New to this edition is information on internetworking with the broadband satellite systems, more intensive coverage of Ka band technologies, GEO high throughput satellite (HTS), LEO constellations and the potential to support the current new broadband Internet services as well as future developments for global information infrastructure. The authors offer details on digital communication systems and broadband networks in order to provide high-level researchers and professional engineers an authoritative reference. The companion website provides slides for instructors to teach and for students to learn. In addition, the book is designed in a user-friendly format.

During a routine ER-2 aircraft high-altitude test flight on April 18, 1997, an unusual aerosol cloud was detected at 20 km altitude near the California coast at about 370 degrees N latitude. Not visually observed by the ER-2 pilot, the cloud was characterized bv high concentration of soot and sulfate aerosol in a region over 100 km in horizontal extent indicating that the source of the plume was a large hydrocarbon fueled vehicle, most likely a launch vehicle powered only by rocket motors burning liquid oxygen and kerosene. Two Russian Soyuz rockets could conceivably have produced the plume. The first was launched from the Baikonur Cosmodrome, Kazakhstan on April 6th; the second was launched from Plesetsk, Russia on April 9. Air parcel trajectory calculations and long-lived tracer gas concentrations in the cloud indicate that the Baikonur rocket launch is the most probable source of the plume. The parcel trajectory calculations do not unambiguously trace the transport of the Soyuz plume from Asia to North America, illustrating serious flaws in the point-to-point trajectory calculations. This chance encounter represents the only measurement of the stratospheric effects of emissions from a rocket powered exclusively with hydrocarbon fuel.

This absorbing book describes the long development of the Soviet space shuttle system, its infrastructure and the space agency’s plans to follow up the first historic unmanned mission. The book includes comparisons with the American shuttle system and offers accounts of the Soviet test pilots chosen for training to fly the system, and the operational, political and engineering problems that finally sealed the fate of Buran and ultimately of NASA’s Shuttle fleet.

This official NASA document provides an interesting review of NASA's experience working with the Russians and lessons on astronaut safety assurance of the Soyuz spacecraft. This report on Soyuz history was conceived as a possible analogy relevant to domestic commercial spaceflight vehicles. The question of how to human-rate new spacecraft has been asked many times throughout the history of human spaceflight. The U. S., Russia, and, now China have each separately and successfully addressed this question. NASA's operational experience with human-rating primarily resides with Mercury, Gemini, Apollo, Space Shuttle, and the International Space Station (ISS). NASA's latest developmental experience includes Constellation, but also encompasses X38, X33, and the Orbital Space Plane. If domestic commercial crew vehicles are used to transport astronauts to and from space, the Soyuz vehicle would be another relevant example of the methods that could be used to human-rate a spacecraft and how to work with commercial spacecraft providers. As known from history, the first U.S. astronaut to orbit on a Soyuz spacecraft was Thomas P. Stafford on July 17, 1975, during the Apollo-Soyuz Test Project (ASTP) mission. Norman E. Thagard was the first U.S. astronaut to launch on a Soyuz launch vehicle, Soyuz TM-21, on March 14, 1995, on a flight to the Russian Mir Space Station. This flight was associated with the U.S./Russian - Shuttle/Mir Program. The first Soyuz launched to ISS included astronaut William M. Shepherd, Soyuz TM-31, on October 31, 2000. Prior to this, NASA studied Soyuz as an assured crew return vehicle (ACRV) for Space Station Freedom (SSF) to be launched on the Space Shuttle. Presently, in preparation for Space Shuttle retirement, all U.S. astronauts are being transported to and from ISS in the Russian Soyuz spacecraft, which is launched on the Soyuz launch vehicle. In the case of Soyuz, NASA's normal assurance practices have had to be adapted. For a variety of external reasons, NASA has taken a "trust but verify" approach to Soyuz and international cargo vehicles. The verify approach was to perform joint safety assurance assessments of the critical spacecraft systems. For Soyuz, NASA's primary assurance was (and continues to be) its long and successful flight history. The other key measure relied on diverse teams of NASA's best technical experts working very closely with their foreign counterparts to understand the essential design, verification, and operational features of Soyuz. Those experts used their personal experiences and NASA's corporate knowledge (in the form of agency, program, center, and other standards) to jointly and independently assess a wide range of topics.

This bestselling reference guide contains the most reliable and comprehensive material on launch programs in Brazil, China, Europe, India, Israel, and the United States. Packed with illustrations and figures, this edition has been updated and expanded, and offers a quick and easy data retrieval source for policy makers, planners, engineers, launch buyers, and students.

Here, Dave Shayler examines the hurdles faced by space crews as they prepare and embark on space missions. Divided into six parts, the text opens with the fateful, tragic mission of the Challenger crew in 1986. This is followed by a review of the risks that accompany every space trip and the unique environment in which the space explorer lives and works. The next four sections cover the four parts of any space flight (training, launch, in-flight and recovery) and present major historical incidents in each case. The final section looks at the next forty years beyond the Earth's atmosphere, beginning with the International Space Station and moving on to the difficulties inherent in a manned exploration of Mars.

Contains a referential glossary of astronomy-related terms, biographies of important astronomers and astronauts, and a chronology of notable events contributing to the science.

Lynn Davis, known for surveys of natural and man-made wonders, has long been fascinated with the objects and venues of space exploration. Her photographs of the architectural icons, cornerstones, and abandoned sites of the space race reflect the many facets of a historically complex industry: the beginnings of space

exploration; the changing nature of technology; and a fascination with otherworldly ruins. She emphasizes the bold modernism of these sites while evoking the presence of obsolete technologies. Davis traveled to historic sites in Kazakhstan, Russia, Germany, French Guiana, and the United States. She received special permission to visit Baikonur in Kazakhstan, a leading launch site shrouded in secrecy since the 1950s, and her photographs offer one of the first inside glimpses of launches, transmission towers, fuel lines, and satellites.
Authorized NASA history of the first joint U.S.-Soviet space flight features many interviews with participants and firsthand observations of project activities. 86 pages of photos and a full-color insert. 1978 edition.

This book is the first known work in the west dedicated to revealing the full story of the Vostok space missions, and the first fledgling steps off our planet. In Leaving the Planet authors Rex Hall and Dave Shayler review this Soviet demonstration of technological progress. The text examines both the developmental and operational aspects of the missions, which at the time were clouded in secrecy. This fascinating and important text features a significant amount of new material on the spacecraft, as well as the history, design and development of the launch vehicle. It also includes the full story of the men and women who trained for these missions, some of whom never flew.

With over 2,300 entries, this fascinating and expansive dictionary covers all aspects of space exploration, from A-Train to Zvezda. This jargon-free new edition has been fully revised and updated to take into account the new developments in space exploration on an international scale over the last thirteen years, with new entries such as Hitomi, Space X Dragon, and Ariane 5 Rocket. All entries are fully cross-referenced for ease of use, and are supported by over 75 photographs, illustrations, and diagrams. In addition to the main definitions, this new edition also contains links to over 250 space-related websites. This authoritative, comprehensive, and clear dictionary is essential reading for anyone with an interest in astronomy and space travel.

The article explains the purpose and functioning of the Emergency Escape System (EES), contained in the inverted metal cup on top of the Soviet spaceships 'Soyuz-4 and -5'. This system is designed to help save the lives of the crew in case serious malfunctioning of the launch vehicle during the launch and throughout all the phases of the powered flight trajectory when putting the spacecraft into orbit. The article also discusses other emergency systems and safety features of the 'Soyuz' spacecraft. (Author).

This book describes a new type of rocket science needed to create low-cost, reliable, responsive space transportation. You don't have to be a rocket scientist to understand the issues explored within this book. The text is beyond the current state-of-the-art engineering of modern launch vehicles, going into a scientific investigation that opens the door to true design optimization. The purpose of this work is to enable the reader to understand how low-cost space transportation is practical, and why it has been so hard to achieve.

As the other major spacefaring nation, the Soviet Union is a subject of interest to the Congress in their deliberations concerning the future of U.S. space activities. In the course of an assessment of Civilian Space Stations (in 1983), the Office of Tech. Assessment (OTA) undertook a study of the presence of Soviets in space & their Salyut space stations. The major element in this technical memorandum was a workshop held at OTA in Dec. 1982: it was the first occasion when a significant number of experts in this area of Soviet space activities had met for extended unclassified discussion. As a result of the workshop, OTA prepared this report. Includes ¿Graphic Comparison of Soviet & U.S. Space Vehicles.¿ Illustrations.

An alphabetical dictionary containing over 1,500 entries on topics dealing with space, space flight, and space technology.

An overall view of the vast spectrum of knowledge needed by practicing rocket scientists and engineers, Introduction to Rocket Science and Engineering presents the history and basics of rocket theory, design, experimentation, testing, and applications. It covers an array of fields, from advanced mathematics, chemistry, and physics to logistics, systems engineering, and politics. The text begins with a discussion on the discovery and development of rockets as well as the basic principles governing rockets and rocket science. It explains why rockets are needed from economic, philosophical, and strategic standpoints and looks at why the physics of the universe forces us to use rockets to complete certain activities. Exploring how rockets work, the author covers the concepts of thrust, momentum, impulse, and the rocket equation, along with the rocket engine, its components, and the physics involved in the generation of the propulsive force. He also presents several different types of rocket engines and discusses the testing of rocket components, subsystems, systems, and complete products. The final chapter stresses the importance of rocket scientists and engineers to think of the unusual, unlikely, and unthinkable when dealing with the complexities of rocketry. Taking students through the process of becoming a rocket scientist or engineer, this text supplies a hands-on understanding of the many facets of rocketry. It provides the ideal foundation for students to continue on their journey in rocket science and engineering.

“The Soyuz Launch Vehicle” tells the story, for the first time in a single English-language book, of the extremely successful Soyuz launch vehicle. Built as the world’s first intercontinental ballistic missile (ICBM), Soyuz was adapted to launch not only Sputnik but also the first man to orbit Earth, and has been in service for over fifty years in a variety of forms. It has launched all Soviet manned spacecraft and is now the only means of reaching the International Space Station. It was also the workhorse for launching satellites and space probes and has recently been given a second life in French Guiana, fulfilling a commercial role in a joint venture with France. No other launch vehicle has had such a long and illustrious history. This remarkable book gives a complete and accurate description of the two lives of Soyuz, chronicling the recent cooperative space endeavors of Europe and Russia. The book is presented in two parts: Christian Lardier chronicles the "first life" in Russia while Stefan Barensky explores its "second life," covering Starsem, the Franco-Russian company and implementation of technology for the French Guiana Space Agency by ESA. Part One has been developed from Russian sources, providing a descriptive approach to very technical issues. The second part of the book tells the contemporary story of the second life of Soyuz, gathered from Western sources and interviews with key protagonists. "The Soyuz Launch Vehicle" is a detailed description of a formidable human adventure, with its political, technical, and commercial ramifications. At a time when a new order was taking shape in the space sector, the players being the United States, Russia, Europe and Asia, and when economic difficulties sometimes made it tempting to give up, this book reminds us that in the global sector, nothing is impossible.

This book presents a comprehensive overview of the programme from its beginnings up to the present, emphasising in particular the degree to which the Soviet space programme is orientated towards military capabilities.

"None of humanity's great achievements in space exploration would be possible without the work of the scientists who built those amazing rockets that blasted us into the heavens. This captivating resource about human accomplishments in rocket science covers the history of rocketry since the advent of rocket-powered missiles, as well as today's triumphs and our hopes for the future. Straightforward explanations of the science behind multi-stage rockets, liquid propellants, and sounding rockets are included. Sidebars cover pioneers in rocket science, challenges and setbacks in the field, and advice for pursuing a career in rocket science."

Rex Hall and Dave Shayler provide a unique history of the Soyuz spacecraft programme from conception, through development to its use, detailed in the only English language book available on this topic. Planned for publication in 2003, it will celebrate 40 years since the original concept of the Soyuz craft.

The International Space Station (ISS) program began in 1993, with Russia joining the United States, Europe, Japan, and Canada. Crews have occupied ISS on a 4-6 month rotating basis since November 2000. The U.S. Space Shuttle, which first flew in April

1981, has been the major vehicle taking crews and cargo back and forth to ISS, but the shuttle system has encountered difficulties since the Columbia disaster in 2003. Russian Soyuz spacecraft are also used to take crews to and from ISS, and Russian Progress spacecraft deliver cargo, but cannot return anything to Earth, since they are not designed to survive re-entry into the Earth's atmosphere. A Soyuz is always attached to the station as a lifeboat in case of an emergency. President Bush, prompted in part by the Columbia tragedy, made a major space policy address on January 14, 2004, directing NASA to focus its activities on returning humans to the Moon and someday sending them to Mars. Included in this "Vision for Space Exploration" is a plan to retire the space shuttle in 2010. The President said the United States would fulfil its commitments to its space station partners, and the shuttle Discovery made the first post-Columbia flight to the ISS in July 2006. Shuttle flights have continued and completion of the space station is scheduled before the shuttle is retired in 2010. Meanwhile NASA has begun development of a new crew launch vehicle, named Ares, and a crew exploration vehicle, named Orion. NASA programs were funded for FY2008 in Division B of the Consolidated Appropriations Act (P.L. 110-161). The Space Operations program, which includes the space shuttle and the ISS, was funded at $6.734 billion. For FY2009 NASA requested $5.775 billion for these programs, but in the process revised its budgeting to move its overhead costs to a new account called Cross-Agency Support. Under the new system, the FY2008 Space Operations program would have received $5.526 billion, about $250 million less than the FY2009 request. A FY2009 NASA authorisation bill (H.R. 6063) was introduced May 15, 2008. Among the provisions in the one-year authorisation bill is a "Sense of the Congress" urging co-operation in the Moon/Mars activities with other nations pursuing human space flight. The International Space Station (ISS) will provide for the visitation of various vehicles such as the Shuttle, Automated Transfer Vehicle (ATV), H-II Transfer Vehicle (HTV), Crew Return Vehicle (CRV), Reusable Launch Vehicle (RLV) and Soyuz. These vehicles will provide for crew replacement, consumables resupply, and equipment delivery. In order for these vehicles to approach and eventually dock with the ISS, there must be near continuous communications coverage between the visiting vehicle and the ISS, as well as communications between the vehicle and a Mission Control Center (MCC). Since the ISS communications systems are already designed and scheduled for ISS activation, the vehicles must either utilize these communications systems or provide their own. There are two means of two-way communications with the ISS. These are (1) S-Band communications using TDRSS, and (2) UHF communications using some form of the Space to Space Station Radio (SSSR) link. The RLV utilizes ISS compatible communications systems to communicate with both the ISS and a Mission Control Center. Since all vehicles must adhere to the Visiting Vehicle Interface requirements given in reference 1, the RLV communications system design must meet these requirements during entry into the ISS Approach Ellipsoid (AE) and during

Proximity Operations. Included in this paper are descriptions of these communications approaches as well as their potential utilization in the ISS communications system. Stillwagen, Frederic H. Langley Research Center