

## **The Case For Space How The Revolution In Spaceflight Opens Up A Future Of Limitless Possibility By Robert Zubrin**

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"Pressestimmen 'The Case for Space demonstrates the author's rare breadth of domain knowledge, which covers engineering, science, economics and policy as well as his depth of knowledge on every significant destination in the solar system from the Moon to the outer planets. In his new book, Zubrin's digs right into the issues of lunar resource extraction, energy generation, manufacturing and transportation that will drive the quick settlement of Earth's 'eighth continent.' Zubrin leaves no moon rock unturned in either closing or rejecting the business case for each idea.' --Greg Autry, Contributor, Forbes Magazine--Forbes' 'At last, here is the vision we were aiming

for when we landed on the Moon. The Case for Space is the case for the future!' --BUZZ ALDRIN, Apollo 11 'Zubrin's opinions and ideas are bold and his expertise, passion, and enthusiasm are in evidence throughout . . . . This title will be a hit with space-travel enthusiasts and researchers alike.' --BOOKLIST 'Zubrin is one of our generation's thought leaders in space exploration, and with The Case for Space he makes another major contribution to humanity's journey to the stars. . . . A must-read for every human being who dares to look up at the sky and imagine that someday we too will be ever present there.' --JIM CANTRELL, chief executive officer, Vector Launch Inc. 'The tools needed to move into space have radically changed in the last decade. Robert Zubrin has put together an excellent guide on how we got these amazing new machines and how we can now use them to break out into the solar system for the benefit of everyone. Highly recommended.' --HOMER HICKAM, author of Rocket Boys 'Zubrin lays out a vision for our space program whose boldness and clarity of thought we have not seen since we took on the challenge of reaching for the Moon. This is the kind of thinking we need. Nothing great has ever been accomplished without courage.' --JAMES R. HANSEN, New York Times-bestselling author of First Man: The Life of Neil A. Armstrong 'An exciting vision for the future of humanity in space. The narrative explains a practical, albeit challenging, path to the stars in the tradition of Mars Direct. ' --JOHN GRUNSFELD, Astronaut-Hubble Repairman, and former NASA Chief Scientist and Associate Administrator for Space Science 'One thousand years from now, whatever the human race has evolved into, we will look back and see the next few decades as the moment in time that the human race irreversibly moved off the Earth and to the stars. Why should we do that? It is our moral obligation, and in The Case for Space, Zubrin creates one of the most powerful and coherent arguments to date. This is a must-read for anyone

who cares about the survival of our species.' --PETER H. DIAMANDIS, MD, New York Times--bestselling author of Abundance and Bold 'Zubrin is a respected evangelist for manned spaceflight. This fascinating book--a distillation of his decades of expertise--combines a lucid exposition of future technologies with an eloquent and inspiring vision of humanity's future as a space-faring species.' --MARTIN REES, Astronomer Royal, past president of the Royal Society, and author of On the Future 'Beyond this tiny speck whirls a universe--truly everything. All who want their heirs to share some of that should read Robert Zubrin's fact-filled call for a push beyond our planet. As it happens, out there lie the tools, resources, and keys to saving our earthly garden home.' --DAVID BRIN, bestselling, award-winning author of The Postman, Earth, and Existence Über den Autor und weitere Mitwirkende **Robert Zubrin** (Golden, Colorado) is president of Pioneer Astronautics and also president of the Mars Society. For many years he worked as a senior engineer for Lockheed Martin. In addition, he is the author of many critically acclaimed books, including Mars Direct, How to Live on Mars, The Case for Mars (with Richard Wagner), Entering Space, Mars on Earth, Energy Victory, Merchants of Despair; the science fiction novels The Holy Land and First Landing; and articles in Scientific American, the New Atlantis, the New York Times, the Washington Post, Mechanical Engineering, and the American Enterprise. He has appeared on major media including CNN, CSPAN, the BBC, the Discovery Channel, NBC, ABC, and NPR. Leseprobe. Abdruck erfolgt mit freundlicher Genehmigung der Rechteinhaber. Alle Rechte vorbehalten. IntroductionGreat things are happening.On February 6, 2018, the SpaceX Falcon Heavy took flight, demonstrating a capacity to lift sixty tons to low Earth orbit while playfully sending a Tesla Roadster on a trajectory taking it beyond the orbit of Mars. To add to the coup, two of the Falcon's three booster stages flew back to

land gracefully together at the Cape, while the third barely missed pulling off a recovery landing on a drone ship stationed downrange. To understand how extraordinary this accomplishment was, let us recall that in 2009, the Obama administration's blue-ribbon review committee headed by former Lockheed Martin CEO Norm Augustine declared that NASA's Moon program had to be cancelled, because the development of the necessary heavy lift booster would take twelve years and 36 billion dollars. Yet SpaceX did it, in half the time and at a thirtieth of the cost. And, to cap it all, the launch vehicle is three quarters reusable. This is a revolution. The Moon is now within reach. Mars is now within reach. And it's just the beginning. SpaceX is developing the means to allow refueling the booster second stage after it reaches orbit. Once this technology is in hand, the Falcon's interplanetary payload will triple, giving it a capability greater than the mighty Saturn V rockets that sent astronauts to the Moon in the 1960s. SpaceX's fully reusable 150-ton-to-orbit 'Starship' launcher that is now under development will multiply that capability nearly three times over again. With such a system, the entire inner solar system will be wide open to exploration and development. The possibilities abound. A reusable rocket system that can send 60 or 150 tons to orbit can also send 60 or 150 tons from New York to Sydney in less than an hour. For comparison, a Boeing 737 has an empty weight of 45 tons. If the Falcon Heavy or its successor Starship two-stage launch system can be made fully reusable, then an entirely new market for space launch can be created, one involving not one hundred or so launches per year, as is currently the case, but hundreds or even thousands per day. Such a market would drive a radical cheapening of space technology, finally making possible all the dreams of space tourism, industrialization, and colonization that have been within view but out of reach since the dawn of the space age. So the

dam has been broken, and the four-decade-long post-Apollo age of stagnation in space launch and human spaceflight technology has come to an end. An entrepreneurial space race has erupted with players including Firefly, VectorSpace, Virgin Galactic, Stratolaunch, and most importantly, Jeff Bezos' Blue Origin, which will soon launch its own reusable New Glenn booster with similar capabilities to the Falcon Heavy, competing to take their share of a market which will soon explode in size. They will soon have plenty of company. SpaceX has shown that it is possible for lean hard-driving entrepreneurial ventures to do better what it previously was thought only the governments of major powers could attempt.

With the naysayers refuted, dozens of would-be emulators from around the world are sure to enter the fray, and their fierce competition will crash the cost of space launch, and with it, the cost of developing more advanced in-space technology as well. Furthermore, while NASA and the other government space agencies may have gone adrift in the space launch and human spaceflight arenas, they have delivered extraordinary results in the fields of space science. Indeed, over the past several years a series of remarkable discoveries has changed our understanding of the relationship between the human future and the rest of the universe. Launched in 2009, the wildly successful Kepler Space Telescope has found thousands of potential alternative Earths nearby. As a result, it is now clear that planetary systems ? potential homes for life ? are the rule in the universe rather than the exception. Also, since the 1990s, evidence has piled up to the point where it is now conclusive that asteroidal impacts on the Earth have been responsible not just for the extinction of the dinosaurs, but for other mass extinctions as well. The message here is that life on Earth is part of a larger cosmic system, which we humans ignore at our peril. In 1994, the US Strategic Defense Initiative Organization (SDIO) launched a low-cost

space probe to the Earth's Moon, finding evidence for the presence of water, the stuff of life and the basis of chemical industry, on the Earth's nearest neighbor. This was confirmed in 2009, when the Centaur upper stage that was used to launch NASA's LCROSS probe was crashed into a crater near the Moon's South Pole, sending up a cloud of water vapor. In 1996, NASA's Galileo probe uncovered evidence for what appears to be an ocean of liquid water under the ice-covered surface of Jupiter's moon Europa. This set off a wave of discoveries by subsequent probes, so that we now know that tidally-heated under-ice oceans that may contain life are a general phenomenon, existing not only on several of Jupiter's other major moons, but even Saturn's tiny satellite Enceladus—and probably on billions of other worlds throughout the universe. A string of incredibly successful NASA orbiters and rovers launched since the mid-1990s has revealed Mars to be a world rich in all the resources needed to support life, and therefore future technological civilizations. A few years ago, methane—which can only exist on Mars as a product of life or of hydrothermal environments that can support life—was detected by the Curiosity rover.

Then, in 2018, scientists using the MARSIS ground penetrating radar on the European Mars Express Orbiter announced the discovery of an underground lake of liquid salt water near the Martian South Pole. On the basis of such data, it is becoming increasingly likely that we will discover not only the remains, but even living survivors of ancient microbial life on the Red planet. As humble as such Martian microbes might be, the implications drawn from their existence are spectacular: the processes that lead to the origin of life are not peculiar to the Earth. If we combine this with the Kepler mission's discovery that most stars have planets, and that virtually every star has a region surrounding it—near or far depending upon the brightness of the star—which can support the type of liquid-water

environments that gave birth to life on Earth and Mars, the conclusion is that a very large number of stars currently possess planets that have given rise to life. The history of life on Earth is one of continual development from simple forms to more complex forms, with the more advanced forms manifesting ever-increasing degrees of activity, intelligence, and capability to evolve still further at an accelerated rate. If life is a general phenomenon in the cosmos, then so is intelligence. The implication is clear: We are not alone. Yet there is still more good news. In early 2018 the SHARAD ground penetrating radar team on NASA's Mars Reconnaissance Orbiter announced the discovery of massive ranges of glaciers on Mars, covered only by a few meters of dust, extending down from the poles to latitudes as far as 38 North (the same latitude as San Francisco), and containing an amount of water equal to ten percent of the fresh water supply of Earth. Then, in December of that year, the same team announced discovery of gigantic underground caverns on the Red Planet—potentially offering vast shielded habitation volumes for future human settlers. Collectively, these discoveries are making it apparent what sort of birthright humanity has been given, if only we are bold enough to step up and..."

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transition included going  
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**A noted space expert explains the current revolution in spaceflight where it leads and why we need it a new space race has begun but the rivals in this case are not superpowers but peting entrepreneurs these daring pioneers ar**

Revelation space is space opera of the grandest style filled with high drama and soaring narrative arias like a number of sf works reynolds book deals with

the fermi paradox the strange lack of other intelligent life in the universe or at least , the case for space demonstrates the author s rare breadth of domain knowledge which covers engineering science economics and policy as well as his depth of knowledge on every significant destination in the solar system from the moon to the outer planets in his new book zubrin s digs right, the case for space how the revolution in spaceflight opens up a

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Zubrin's book lays out a compelling vision for the future of humanity in space as space exploration increasingly becomes the domain of private companies and private citizens. Humanity may be on the verge of, the tiny satellites ushering in the new space revolution at the end of this road is the same, revolution definition is the action by a celestial body of going round in an orbit or elliptical course also apparent movement of

such a body round the earth how to .

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