

The Future of Human Space Exploration

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Foreword: The Future of Human Space Exploration by Johann Dietrich Woerner, General Director of the European Space Agency

In *The Future of Human Space Exploration*, Giovanni Bignami and Andrea Sommariva present a discussion of a very challenging topic: that of exploration. For the space community, exploration lies at the very core of space activity and brings together technology and science at the highest level. Exploration, whether robotic or human, requires that we think about possible effects that extend far beyond our day-to-day experience. The book focuses on all aspects of exploration, ranging from history, launcher and propulsion systems and spacecraft, to possible activities beyond science such as mining in the universe. It also covers the crucial aspects of human spaceflight. Large parts of the book are written in such a way as to give even the less-informed reader a clear understanding of the subject. At the same time, those already with an in-depth understanding can find detailed information about the physics that provides the background to these activities.

The most challenging part of exploration is neither the technology nor the science. Rather, it is to convince those organisations that handle public money to invest in exploration. The problem is that exploration is looking into the unknown and therefore cannot seriously promise a direct return on investment on Earth. However, examples from the past show that all exploration missions have had additional effects beyond their initial scientific purpose. For example, it was investigations of Venus that disclosed the greenhouse effect on Earth (better known as “climate