

THE CENTURY OF SPACE SCIENCE

The Century of Space Science

Volume I

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Foreword

Space has become an essential element of the contemporary world. Even though the first satellite was launched only forty-four years ago, we have become dependent on space-based facilities for a wide variety of functions. Telecommunications, television and weather forecasting are unimaginable without satellites. We determine our position on Earth with a few meters accuracy with space-based systems. Observation of the Earth from space allows us to quantitatively and globally ascertain the state of the world's crops and forests, to forecast abundance and scarcity, and to take remedial measures.

Early on scientists realized that much knowledge about the Universe is inaccessible because of the Earth's atmosphere. Not surprisingly, therefore, they were the pioneers in placing instruments in orbit and to develop the necessary technologies for their utilization. Enormous progress resulted. In addition to visible light and radio waves, astronomical objects could be studied in X- and gamma-rays, in the ultraviolet and in the infrared, while also cosmic-ray particles could be studied in detail and their composition determined. Wholly new phenomena were discovered involving black holes and energetic processes, but also the cool gas and dust so important in the formation of stars and planets. In visible light the absence of the atmosphere allowed images to be obtained with superior resolution. Who has not marvelled at the beauty of the world revealed by the Hubble Space Telescope or at the wild scenes shown by SOHO on the surface of the Sun?

The study of the planets in our solar system made perhaps even greater progress. Instead of peering at these from a large distance, they could be visited by spacecraft with sophisticated instruments. Thus, the detailed structure and composition of the surfaces of Mars and the Moon could be analyzed and much could be learned about the other planets, satellites, comets. The early arrival of science in space

provided a strong impetus on the generalization of space technology for many different purposes. But it did more. Even in the darkest days of the cold war communication between the world's scientists continued. There was competition, but also collaboration, and a strong feeling provided that space should remain a domain for peace rather than war. One can only hope that this will remain so also in the future.

Mankind is continuously modifying the earth, its atmosphere and its oceans. While many would wish that this were not so, it remains an incontrovertible fact. Only satellites observing the Earth can provide the global knowledge that is needed to ascertain the resulting changes in detail and to indicate the remedial actions that are needed. The observations of the "ozone hole" over antarctica and the subsequent restrictions on the use of the chemical substances responsible is an illustrative example. Our current understanding of the implications of the results of the observations of the earth is still very limited and sometimes controversial. Continuous monitoring and analysis are essential if a prudent management of the Earth System is to be implemented.

Space activities make their own contribution to polluting the planetary environment. Many large and small debris from earlier launches create risks for new satellites. Fortunately, the space agencies have become aware of this and measures are being taken to reduce such problems. Also proposals have been made for advertising in space. Quite apart from the damage this would do to astronomical observations, it would prevent humanity from watching the star covered night sky, which has been an inspiration to prophets and philosophers and to every human from the earliest days.

Space scientists, whose deeds are described in this book, have shown the way into space with its manifold scientific and technological opportunities. In space there are no geographical boundaries and no property rights. So let us ensure that space will remain a heritage for all of mankind for responsible scientific exploration and technological utilization.

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