

The Space Age in Perspective



The Space Revolution of the mid-twentieth century must be regarded as the most significant of all those great revolutions of history which have affected the fate of man. By definition, a revolution produces a series of pyramiding effects, one building on another. But, in the last analysis, these effects focus upon and culminate in truly significant changes in the social and economic relationships which shape a society. The social implications of space exploration and of the space age, therefore, demand the most detailed consideration and study.

Tremendous changes were brought about by the previous great historical forces: the Territorial Revolution of the 15th century; the Scientific Revolutions of the 13th and 18th centuries; the Religious Revolution in the 16th century; and the Commercial, Social, and Industrial Revolutions of the 18th century.

The vital transformations induced by each of these, in its own course and at its own time, have long been studied in the several disciplines of knowledge, especially in relation to the physical realm of the Earth's surface and as they affected the attitudes of individuals and of government. Important as were all these revolutionary epochs, there was, when viewed from modern concepts, one great limiting factor. This factor was that none of them was of immediate effect on the entire population of the whole world.

Uniqueness of the Space Revolution

The Space Revolution of the mid-twentieth century is unique because its course and direction affects every individual on each of the five continents. Moreover, its effects lie in an entirely new dimension—beyond the physical realm of man's earthly existence and into the boundless areas of space itself. The Space Revolution of today has resulted from the theories, hypotheses, and observations of scientists as their conclusions were tested and applied by engineers and technicians.

Historically, this has always been the procedure. Ever since the late 18th century, an "Age of Science and Technology" has continuously been evident. Technological developments, resulting from discoveries of myriad kinds, have affected society and even influenced the decisions of government. When viewed by modern standards, these technological developments came rather slowly. Society was able to assess their value and to absorb their application with, viewed from present day contexts, relatively little dislocation.

The most startling aspect of the Space Revolution has been the amazing rate of progress of its technological developments. The frontiers of knowledge have been pushed outward so rapidly that we approach a great intellectual revolution. The moon has been photographed from a vehicle on its surface. Man has walked in space. The imaginative processes of science fiction have quite truly been surpassed by the feats of scientific reality. Indeed, the modern scientists could be regarded as the genii of Arabian lore rather than the geniuses of the present. All this, and so much more, has taken place in a very short time, so brief it would be difficult for us to grasp were it not for the amount of information made available by the agencies which direct the national space program.

Let us consider a direct example of this brief time and of this great advance of knowledge. In 1946 Dr. Lee DuBridge spoke at the University of Colorado on atomic power—the great topic of the day—and all the possibilities the new source of energy presented. Twenty years later he again addressed an audience at the University of Colorado. His talk this time dealt exclusively with the development and importance of the missions of Ranger VII to the moon and Mariner IV to Mars. Dr. DuBridge discussed all the marvels that had come into being since 1946. He said, “. . . none of us really had any idea of all this at that time.” The span of time is even much shorter because the U.S. satellite program was not officially announced until 1955, and the National Aeronautics and Space Administration (NASA) was not founded until 1958. And, even more astonishing in this time sequence, the first rocket fired (July 24, 1950) from a little sandy spit area on the east coast of Florida, then known locally as Cape Canaveral, was a captured German V-2, which reached an altitude of only 50 miles.

Historical and Philosophical Background for the Space Age

What are some of the historical and philosophical situations which form a background to the space age? It is well known, but not so well understood, that science as an intellectual activity differs markedly from other imaginative efforts of man. Science seeks an exact knowledge of reality. The scientific objective, therefore, is focused upon observable facts of nature. Conclusions and deductions from such facts are the contributions of science.

The social scientist and the humanist must establish his procedure on assumptions. His objectives and conclusions relate to the unpredictable actions of individual man, or groups of men, which we call society.

There is, indeed, a close relationship among all the various disciplines of knowledge. To a great degree, all are founded on two fundamental procedures: historical relationships and the importance of the theoretical.

The historical relationships, or the historical perspective, approach is particularly indicated in the development of knowledge of the physical realm of the Earth's surface. Discovery, exploration, and observation resulted in the vast body of knowledge we have today. Not content with knowledge of observable facts, man began almost from the very first to speculate on what lay beyond the Earth's surface: the heavens, the universe, space itself. As Lucretius, Roman poet and philosopher of the 1st century, B.C., wrote:

Our age cannot look back to earlier things
Except where reasoning reveals their traces.

The history of space became, and is today, a proper subject of study. The historical aspects of the space age are quite definite and most revealing. There is an almost exact parallel between the expansion of Europe during the Great Age of Discovery in the 15th century and the exploration and expansion into space of the present day.

In the 15th century, Western Europe was emerging from the somewhat limiting and in-

hibiting factors inherent in the medieval period. To medieval man, most of the world appeared as a God-made mystery to be regarded with fear and concern. The Earth was flat; somewhere over the ocean was the end of the Earth. Fear of the ocean of darkness, the ocean of boiling water, and the great winds and storms which no ship could survive, dominated and inhibited even those who dreamed and speculated on what lay beyond.

The rise of humanism, the beginnings of a scientific spirit, and the development of more precise instruments of navigation made a more positive, aggressive, and adventurous attitude possible. The world came to be regarded as a reality to be explored rather than as a mystery to be feared.

It is not fantastic to compare those few early navigators who crossed the oceans in flimsy and insecure wooden boats some 500 years ago to those astronauts of today who have made the first manned flights into the realm of space. Certainly, as those of the 15th century conquered inhibiting factors of their day, we can, and indeed have, overcome some of the technical barriers of space.

The second fundamental approach is the importance of the theoretical. The development of a theory, of the hypothesis, preceded many of the great basic facts of science. This was the approach used by Kepler in reaching his basic law of the elliptical nature of planetary orbits, for which he tested and discarded some seventy hypotheses, in 1604. Even Newton's great laws of motion, so fundamental in our modern space program, were deductions from the theoretical speculations of those who had worked before, especially Galileo. As Newton himself phrased it, "If I have seen farther than others, it is because I have stood on the shoulders of giants."

There is a great value in the theoretical approach in the realm of the social sciences, as in the more exact sciences. It was noted earlier that the social scientist or the philosopher must establish his procedure on the basis of an assumption. Voltaire in the opening line of *Candide* (1759) says, "Man was born free but everywhere he is in chains." Did he or do we know this is a fact? Thomas Hobbes, writing earlier (1651) in the *Leviathan*, maintains the exact opposite: that compulsion is a natural factor of man. John Locke in his *Treatise of Civil Government* (1690) proclaims the legislative body to be the supreme power in the state. We have accepted the Lockian interpretation and have established our entire system of government and society on this principle. Clearly there are practical values of the theoretical procedure toward the problems of government and society, or actual legislation resulting from this approach.

Technology as a Revolutionary Force

The revolutionary aspect of technology is quite well known. Its effects are clearly evident in England during the late 18th and early 19th centuries. The historic Industrial Revolution transformed, relatively rapidly for the day, a predominantly rural country into an expanding urbanized nation. Social, economic, and political results were extensive and many problems arose: the rise of factories, crowding people together in confined areas; the development of new industrial centers and towns, with large populations and no representatives in Parliament; problems of health and of safety and working conditions in factories; and even problems of government itself. The English government could not deal with these because it had no experience with such problems. All these problems combined to bring England to the verge of revolution.

These problems, vast as they were to the men of that day and overwhelming as they appeared to the government, were solved by the rise of the great English Reformers. Nowhere in the pages of history did so many individuals consider the problems of government and society

within so short a space of time. Adam Smith outlined the basis of a new economic system, the classical as opposed to the prevailing doctrine of Mercantilism. Classic economic concepts endured for some 150 years, until the modern revolutionary doctrines of J. M. Keynes.

Jeremy Bentham surveyed the new challenges of an industrialized society on such a broad scale that significant legal and factory reforms were enacted. He also imparted a slogan and a basic philosophy to the entire period of reform. There were many more who contributed by their theoretical consideration of these problems to the practical solution by legislation.

Nowhere is the contribution of the English Reformers more completely indicated than in their consideration of the agitation for the political reform of the Parliament. They all combined to demand such a reform. In the early 19th century the English Parliament was a medieval instrument of government. Voting qualifications for its borough representation had not been changed for 400 years; some 267 landlords controlled 490 seats in a house of 658 members by direct nomination. The English Reformers succeeded in modifying Parliament so that the power in the state was swept from the hands of an 18th century landed gentry into those of the electorate—the common man.

Implications of the Space Age

The space age, even in its infancy, is having a profound impact on all of us, as individuals, on our national economy and national policy, and on the conduct of our international affairs. The following are only a few, the more obvious, areas on which the space age has and will have an impact.

First, the space age will require a leadership in the United States and in the nations of the democratic world far beyond that generally assumed. Herein lies a great challenge to our system of government and society.

Second, the space age will require a definite tightening of our national purpose and of individual effort and outlook. New knowledge and technological advances must be absorbed without dislocations. This absorption is already being accomplished; we are already experiencing it, principally because of the marvelous adaptability man has acquired and which has so often been demonstrated.

Third, the space age will require an increasing interference by government in society and in the lives and fortunes of those individuals who comprise society. Historically, it has always been that the more complex a society becomes and the more demands made upon it, the more regulation and supervision by government are necessary.

Fourth, the space age will require a new legal and judicial process and approach to the problems of international law; even, possibly a new kind of law itself.

Our legal system developed from the English Common law which evolved over hundreds of years and at a leisurely pace from innumerable situations of fact. In a broad historical sense, the present day is not normal. The pressures of the contemporary world will not permit space law to develop by slow, evolutionary procedures. Space law, unlike Common law, must come into being by anticipating situations.

Possibly a new type of international relations will emerge. For where are the boundaries in space? International law relative to flight in the airspace above a nation is quite clear and definitely recognized. But how far does national sovereignty extend beyond the narrow band of atmosphere? These problems, arising because of the space age, are even now receiving serious attention through studies and international conferences.

Fifth, the impact of the space age will require a reexamination and a reinterpretation of the democratic processes of government and society as conceived by the 17th and 18th century

English philosophers, especially John Locke. How will this be done? Perhaps it is already being accomplished through the adjustment and adaptability of society to modifying conditions. Perhaps this process is more desirable and more realistic than the formulation of a definitely conceived body of principles, as those formed in preceding centuries by men who attempted to fathom the mysteries of government and society and to explain their mutual relationships, contributions, and advantages.

Through whatever procedures such a reinterpretation may come, it is necessary. It is vital if we and our concepts of government and society are to survive in the contest with aggressive, highly controlled, foreign ideologies.

There are other areas, not so obvious, on which the space age has or will have an impact. In a very famous volume, *The Challenges of Space*, published in 1962 and edited by Hugh Odishaw, these challenges are presented principally from the technical standpoint. George Morgenthauer, in a speech in Boulder, Colorado, in August, 1964, said, "Almost everything in space is technically possible. Technically, we can land a man on the moon. The problem is the human, not the technical, factor."

The principal challenges of space, however, will undoubtedly lie in the broad field of government and society because it is there that its effects will be felt, as has all technical progress of the past. The spectacular developments of the space age must be considered in their historical relationships because the most changeless fact of history is the fact of change. This aspect of change may be clearly seen by referring to the rise of Newton's idea of the rigidity of physical nature.

Aspects of Change

Through critical attitudes mainly induced by the Religious Revolution of the 16th century, more objective opinions toward the physical world began to emerge. Those principally responsible for these changed opinions were Francis Bacon and Rene Descartes. Descartes, leader of the French Humanists, speculated on a more dynamic interpretation of physical nature. Although he accepted an infinite universe, he concluded it was arranged on mathematical principle. Sir Isaac Newton firmly established the mechanical certainties of physical nature and of a fixed universe, and this static concept remained the dominant basis of thought until modern times.

The rigid historical form of Newton's physical world was extended in the 19th century. James Clerk Maxwell expressed this concept in his address to the British Association in 1873. He said, ". . . the foundation stones of the material universe—remain unbroken and unworn. They continue this day as they were created—perfect in number and measure and weight." The basic tools of the physical universe, physics and chemistry, remained immobilized in 18th century rigidity. This was at the same time in which Darwin transformed biological concepts in his *Origin of Species* (1859). Even then, the President of the British Linnean Society said in his annual address in December, 1859, "I regret to report that no significant contribution in Biology has been made this year."

During the 20th century, especially in the early 1920's, the attitude toward the fundamental laws of physical cosmology and their constants has been profoundly modified. In the words of Stephen Toulmin, Director of the Nuffield Foundation, "We may yet be on the threshold of the greatest of all intellectual revolutions."

This revolution may be so extensive and so challenging as to require the fullest cooperation between the scientists who evolve these principles, the technicians who apply them, and the social scientists or sociologists who interpret the effects of the principles.

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The Space Revolution is not only challenging, it is exciting. Its full compass is best expressed by the modern poet, Angela Morgan.

To be alive in such an age
With every year a lightning page
When miracles are everywhere
And every inch of common air
Throbs a tremendous prophecy
Of greater marvels yet to be.
A challenge to the very sky,
Where endless realms of conquest lie.

All of this, with its vision of marvels yet to be, has been immeasurably accelerated by the space age. The impact of the space age on government and society is only beginning. We proceed rapidly toward the exploration of space with few concepts of just what this vast national effort really implies to man. Agencies have been developed to promote the scientific aspects of space technology, but nowhere does there exist a formal organization to study the effects of this vast program. A correlation of the impact of the space age is required because the Space Revolution will certainly be the most significant of all the great revolutions in history.