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SPACE EXPLORATION AND INTERNATIONAL PROBLEMS IN THE USE AND CONTROL OF OUTER SPACE

A thesis submitted to the faculty
of San Francisco State College in
partial fulfillment of the
requirements for the
degree
Master of Arts

by

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CERTIFICATION OF APPROVAL

I certify that I have read, "Space Exploration and International Problems in the Control and Use of Outer Space," by Edward Harold Curtis, and that in my opinion this work meets the criteria for approving a thesis submitted in partial fulfillment of requirements for the Master of Arts degree at San Francisco State College.

Urban G. Whitaker, Jr., Professor of International Relations

DeVere E. Pentony, Chairman of the Department of International Relations

Ralph M. Goldman, Professor of Government

PREFACE

The present study is by no means to be taken as a complete survey of the international problems that have been generated as a result of the impact of space exploration efforts. It is limited to a consideration of the international problems involved in the use and control of outer space and an analysis of the United Nations Committee on the Peaceful Uses of Outer Space. The Committee is the most significant agency in being today that may offer a means to the satisfactory solution of these problems.

The investigation revealed that there were really only two studies available that cover the range of problems that prevail on the international scene as a result of space exploration efforts. These are: Philip C. Jessup, and Howard J. Taubenfeld's, Controls for Outer Space, a book published in 1959, and Lincoln P. Bloomfield, editor, Outer Space: Prospects for Man and Society, published in 1962. Both works are excellent and have been relied upon heavily in the present analysis. Unfortunately, the work by Professors Jessup and Taubenfeld is somewhat obsolescent due to the rapidly

evolving field of space exploration and the evolution and action of the United Nations Committee on the Peaceful Uses of Outer Space subsequent to the publication of the book in 1959.

In addition to the comprehensive sources cited above, a substantial number of articles have appeared in the scholarly journals and other current sources that deal with individual facets of the space exploration effort and its impact on the international community. These articles require some synthesizing in order to provide a cogent view of the problem areas and the efforts being made to solve these problems related to outer space.

This thesis is a modest attempt to identify the problems facing the international community today as a result of man's having begun the exploration of outer space, and to present an analysis of his efforts to resolve these problems on an international basis. There is no intent on the part of the writer to offer solutions to current problems in the use and control of outer space or to speculate as to what may be the solutions of problems that arise in the future as a result of man's continuing efforts in space exploration.

Chapter I of the thesis presents an introduction and an overview of the impact of space exploration on the international community. ~~Chapter II traces~~ man's efforts to reach outer space from early rocket development through manned space flight. ~~Chapter III~~ is an analysis of the international problems which arise in the use and control of outer space. ~~Chapter~~ IV is a study of the United Nations Committee on the Peaceful Uses of Outer Space, its origin and history, its functions and achievements, and the tasks that lie ahead. Chapter V encompasses the conclusions that have been drawn on the basis of the evidence revealed in the present study. Two appendices have been provided to assist the reader. Appendix A is a glossary of the space terms used in the study, and Appendix B is a chronology of the significant space events since 1957.

The bibliography is selective, because a complete list of all works consulted would be nearly as long as the thesis itself. I have attempted to examine every source in either book, pamphlet, or article that was related to the subject and was available for my perusal. Consequently, I have limited the "Works Cited" to the books, articles, pamphlets, and speeches which are mentioned in the text or cited in the footnotes.

The writer is indebted to the National Aeronautics and Space Administration for providing the most up to date information on the United States space program. The required information was not available in other published sources during the time that this investigation was being conducted. A note of appreciation is also due Robert D. Crane, Director, Space Research Institute, and Dr. Arthur Larson, World Rule of Law Center, at Duke University, Durham, North Carolina for the materials provided pertaining to the international space law program and up to date developments in the field of space law.

Dr. Urban G. Whitaker, Jr., my thesis advisor for this undertaking, and Professor of International Relations at San Francisco State College, rates special mention - first for his patience, expert advice and scholarly counsel throughout the investigation. Secondly, but even more greatly appreciated, were his comments on the original manuscript, along with those of Dr. DeVere E. Pentony and Dr. Ralph M. Goldman, the other members of my graduate committee.

E.H.C.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION AND OVERVIEW

Introduction. The age of space is upon us. Almost overnight we find ourselves at a new frontier of measureless dimensions. We are, of course, only at the beginning of man's long reach into space. Things that now seem utterly fanciful in the realm of spaceflight will become commonplace in the decades ahead. Space beckons, and our nature being what it is, we must accept the challenge and discover whether we are designed to survive the alien world beyond the earth, and whether our international concepts can be adjusted to meet the challenge.

The total impact of space exploration upon the international community has not yet been delineated, however, to some extent, the impact on the exercise of international relations is evident. One of the most crucial problems facing the international community is the control and use of outer space. The concern over espionage activities, orbital thermonuclear weapons, the capability of nations to mount and sustain orbital space stations and the fundamental capability

of manned flights into the extended peripheral elements of space, in my opinion, make a definition of the factors involved in the use and control of outer space paramount to a continuing successful space exploration program.

The conduct of international affairs will continue to be intermingled with the problems involved in the use and control of outer space until a solution is reached that is to the satisfaction of the members of the international community. It appears that the dominant factor in the settlement of this crucial issue will be the United Nations Committee on the Peaceful Uses of Outer Space. The Committee is a subject of emphasis throughout the present study.

Just a few decades ago, the suggestion that a man could orbit the earth once every ninety minutes riding aboard an 18,000 mile per hour satellite would have evoked incredulous stares, yet it has happened several times in the past two years. [1] For as long as man has had the intelligence to realize that space exists, he has dreamed of escaping the layers of atmosphere which surround his planet and of exploring the vastness of the universe which lies beyond. Man's fantasy became fact on October 4, 1957, when the Soviet Union hurled

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[1] William J. Weiser, The Space Guidebook, (New York: Coward-McCann, 1960), p. 229.

the first man-made satellite into orbit around the earth. [2] Man's achievements in space since Sputnik I have been tremendous, but they pale to feeble ventures in contemplation of future space exploration projects. Only in the light of what man has already done could he look ahead with almost certain knowledge that many of his new dreams will be realized.

The influence of space exploration efforts extend far beyond scientific and technological development. No area of human thought or activity has escaped the impact of this endeavor. The challenge that faces mankind today is the reduction of space to manageable proportions, the agreement and acceptance of space as a gift unto himself, and the ability to reach conclusions as to how he can best control that space so as to provide the international community with the wealth of dividends that can accrue as a result of space exploration efforts.

Space: The new frontier. Space exploration is an issue in national and world politics. Our government is spending billions on research, development, testing, and production in the field of space. Thousands of scientists, engineers, and other technicians are engaged

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[2] Lincoln P. Bloomfield, ed., Outer Space: Prospects for Man and Society, (Englewood Cliffs: Prentice-Hall, Inc., 1962), p. 159.

in space activities. [3] During the past sixty years, our Western society has been dominated by the influence of major developments in science and technology. This period has been marked by the emergence in rapid succession of new fields of engineering and new industries. We have passed with bullet like rapidity from the automotive age, to the air age, to the nuclear age, and now to the age of space.

As man has moved into the area of space exploration and the development of space technology, a requirement for space programs management has evolved. [4] The National Aeronautics and Space Act was passed by Congress on July 29, 1958. The Congress declared that it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind. In accordance with this policy, a civilian agency was established to implement this concept. Among the objectives set up by the Act were cooperation with other nations in aeronautical and space activities and in peaceful application of the results. The National Aeronautics and Space Administration was also to make the

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[3] National Aeronautics and Space Administration, Space: The New Frontier, (Washington: U.S. Government Printing Office, 1962), pp. 4-5.

[4] Ibid., p. 5.

widest practicable dissemination of information concerned with the activities of the agency and the results obtained. [5]

During the five years that NASA has been in existence it has had a program dealing with all facets of the space exploration effort. The agency has launched deep space probes, fired unmanned satellites into orbit, launched sub-orbital manned flights, and launched manned vehicles into orbit around the earth. NASA's aeronautical and space program represents the center of U.S. efforts to move forward in space, and to date has made valuable contributions of a scientific nature to all the world. [6]

The United States, for many years has occupied the enviable position of being "first" in the field of scientific and technological development. However, evidence indicates that the Soviet Union has been forging ahead in the space field and now holds a commanding lead in space achievements. For example, a rocket of more than two hundred tons thrust was used to launch the Sputniks and Luniks. [7] The Russians also boasted

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[5] Hugh L. Dryden, Space Exploration, NASA, (Washington: U.S. Government Printing Office, 1962), p. 1.

[6] NASA, NASA Research Progress, (Washington: U.S. Government Printing Office, 1962), p. 4.

[7] Albert Ducrocq, Victory Over Space, (Boston: Little, Brown and Co., 1961), p. 23.

of several million pounds of thrust when the "twin" Cosmonauts were launched into tandem orbit in August, 1962. The spectacular achievements of the Soviets in space lend credence to their claim that they do hold a lead in the race for space. The Soviets launched the first man-made satellite in October 1957, [8] and launched the first manned orbital flight in April 1961. [9] The feat in August 1962, of placing two Cosmonauts into separate tandem orbital flights further entrenched the Soviet Union in their leading position in the field of space exploration. [10]

In August, 1962, an article by Senator Barry Goldwater appeared in the San Francisco Chronicle and was centered on a discussion of space exploration. This article gave some insight into the implications of man's journey into the realms of outer space. He said:

> Most important to the people on earth, space offers a means for extending world power and influence to the nation capable of using the new means of technology and scientific knowledge. For space is obviously a battle medium, and the scientific and technical conflict is underway right now. 11

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8 Ibid., p. 3.

9 New York Times, April 13, 1961.

10 New York Times, August 13, 1962.

11 Barry Goldwater, "Controlling Space and the Earth," San Francisco Chronicle, August 12, 1962, Editorial Page.

The position of leadership in the world community may well be decided on the basis of a nation's capability in space and its level of scientific achievement. It is difficult to deny that the world position of the Soviet Union was enhanced considerably by the launching of the first Sputnik in October, 1957. The importance of space feats to a nation was expressed in a United Press International article appearing in the San Francisco Chronicle following the tandem orbital flights of the Soviets in August, 1962. The article was a discussion of the significance of the flights and the problems of the Soviets at that time and the conclusion relates that:

> The Soviet Union's latest space achievement is of incalculable value to Nikita S. Khrushchev. It goes a long way toward easing his problems, at home and abroad, and it is a painful blow to the United States. 12

It is difficult to make a yardstick measurement of the level of prestige that a nation enjoys in the international community. However, in the last decade or so an element that has been primarily important in establishing world power position, has been the degree of scientific and technological achievement that a nation has attained. Undoubtedly, the scientific

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12 San Francisco Chronicle, August 14, 1962, p. 1.

achievements of any nation in space stirs anxieties on the question of space warfare, bombs in orbit, spies in the sky, and other military space vehicles. The political implications of the space effort are far reaching and the tactics and weapons that would be used in World War III can be easily imagined.

Space exploration involves almost every science known to man. The process is full of unknowns, threatened with unimagined perils, and it requires money in war-sized chunks. As yet no one has been able to determine with any degree of accuracy what the program to place a man on the moon will cost the American Taxpayer. The best educated guess is twenty to forty billion dollars. To illustrate the indirect benefits that may accrue from such an expenditure, NASA points out that a vigorous program will create new jobs, stimulate the economy, increase the rate of technical progress, provide new household and industrial products and materials, and provide the opportunity for scientific leadership. [13]

There is considerable significance attached to the achievement of extraordinary feats in space. From a layman's point of view,it may be considered only for the scientific importance of the feat and the capability of the nation concerned. However, from a national

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[13] Edward H. Kolcum, "NASA Fund Request Total $3.9 Billion," Aviation Week, (January 22, 1962), p. 29.

policy maker's point of view, the feat may have far reaching national security impact. Space is man's new frontier and as he explores further into the outer reaches of the medium he is confronting himself and the international community with problems. The crucial matter is the solution of these self-created problems in such a manner that all of mankind may benefit from space exploration efforts.

Man's challenge in space. It is inconceivable that man can move forward in the exploration of space without affecting the relationships of men throughout the world. As he progresses from one space step to the next one, people are drawn closer together and the daily relationships of each nation of the international community becomes more shaded with the social patterns of other nations within the group. Each event in space has some impact on the attitudes and values of the people who become aware of their significance. It is conceivable that efforts in space exploration will broaden man's view of himself and the world, and consequently, will result in a better society for all mankind. [14]

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[14] Donald N. Michael, "Peaceful Uses," in Bloomfield, ed., Outer Space, pp. 59-63.

As man protrudes further into space, he is faced with many problems that have long ago been met and solved on earth. The problem of space control which will be discussed in depth in a later chapter raises many perplexing questions. For example, how are the boundaries in space determined? Who will be responsible for damage caused by objects falling from space? What methods will be used to control exploratory efforts on the planets, if and when man reaches other planets? Some elementary investigations have been made in an attempt to answer these questions, but for the most part they remain unanswered. In this age of space and expanding technology, attention must be given to the requirement that we realistically plan for the use and control of outer space. [15]

In the emphasis that has been placed on technology, we may tend to lose sight of the fact that man also has his place in space despite the heralded publicity that has been given to the astronauts and cosmonauts. He has a role to fill just as surely as he has pioneered in the exploration of land, sea, and air. Even though the machinery has reached an extremely high level capability

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[15] William Leavitt, "Speaking of Space," Air Force and Space Digest, (October, 1960), p. 86.

the man counts as well as the machinery. As yet creative ability and courage have not been built into a machine, and neither has dedication to mankind been incorporated into a black box. [16] One remarkable fact emerging from the exploration of space is that people accustomed to the traditional patterns of development have been able to accept and react to drastic departures in technologies, methods, and procedures. We have been faced with an intense challenge to our learning processes and the necessity to expand hurriedly and productively into new sciences and career fields. In space man is on the threshold of a new frontier of incomprehensible vastness, a frontier offering him at once a promise and a threat. [17]

There is dissent as to the purpose and magnitude of the space exploration program and whether or not it is as scientifically important as the people have been led to believe. For example, in a scorching speech in San Francisco in April, 1963, the famous British scientist, Sir Robert Watson-Watt discussed his ideas of some problems facing science and scientists that he considered

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[16] Roscoe C. Wilson, "Research and Development Today for Military Space Systems Tomorrow," Air Force and Space Digest, (April, 1960), p. 52.

[17] Loc. cit.

to be more important than exploring space. He contends that the world had better be more concerned with the population problem than space exploration. He said, "The same vigor and intelligence we now apply to speeding the advances of physics, could revolutionize the economics of the underfed nations." [18] He said further that, "Before long the world's population will be 6 billion, and at least 2 billion will be undernourished unless we are wiser and more vigorously humanitarian than we are now." [19] Despite this dissention from an eminent scientist, the urge to continue the exploration of space is strong, and in order to continue there are problems that must be considered and solved.

The behavioral response patterns that man has developed over several thousand years in order to resolve his environmental problems on earth may not qualify as solutions for the problems he will encounter in outer space. The fundamental problem of supporting human life in space is that of overriding a completely hostile environment and providing essential life support items. The essential physical ingredients of life support include management of the thermal environment, provision

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[18] Sir Robert Watson Watt, "Insanity in High Places," San Francisco Chronicle, April 3, 1963.

[19] Loc. cit.

of food and water, an atmosphere of suitable composition, and handling of waste products. Equipment to meet these essential needs, with a high degree of reliability required, becomes quite complex for missions of extended duration. In other words, if man is to escape from his planet for extended periods, he must either take his environment along or adapt to a different one. [20]

As a result of space exploration efforts, man now has a laboratory in which he can observe the universe unhampered by the restrictions of our atmosphere. The explosive growth of technology is the dominant factor in the space age, and we are faced with a technological struggle unparalleled in our history. The struggle which is long term in nature is a singularly difficult one because the scope of technology has become so broad and diversified. Keeping pace with the onrush of technology is a challenge of great magnitude. It involves practically all of our scientific, economic, industrial, and educational resources. [21] The revolution which faces mankind as a result of the scientific and technological achievements realized from the exploration of space is bound to include

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[20] James E. Gunckel, "Space Farming...Agriculture's New Challenge," Air Force and Space Digest, (October, 1960), p. 91.

[21] Wilson, "Research and Development," pp. 54-57.

new concepts in each of the above fields. History abounds with examples of men striving to attain difficult goals and achieving vast unforseeable results. [22]

As space exploration proceeds and man's ascent in the vertical dimension lengthens, man remains as the vital link between the aspirations and the goal. Man's intelligent ability is by far the best computer system available. In the field of science he is unsurpassed in judging, evaluating, interpreting, and reacting to the most complicated situations. The intricate problems to be faced will require every capability at his command as he ranges farther out into space. [23]

Man has ranged from corner to corner of the earth's surface, he has conquered vast seas, and he appears to be on his way to conquering outer space. As man travels through space, perhaps his experience will provide a tool for achieving better relationships among the nations of the international community.[24]

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[22] Hugh L. Dryden, Industry's Toughest Assignment: Make It Work, (Washington: U.S. Government Printing Office, 1962), p. 1.

[23] Charles H. Terhune, Jr., "In the Soaring Sixties, Man is on His Way—Up," Air Force and Space Digest, (April, 1960), p. 71.

[24] Loc. cit.

The international challenge of space. The challenge which faces the international community as a result of space exploration is tremendous, and the implications are far reaching. The policies, intentions, and capabilities of the nations of the world must be considered in relation to each other, and the unanswered questions concerning man's control and use of outer space must be answered. The thread of uncertainty that has wound itself around the age of space exists because of the enormous quantity of unknowns, and the questions that are yet to be answered as the exploration effort becomes more commonplace. Some of the most perplexing questions that are being considered by the leaders of the international community today are the questions concerning international security in this dynamic age of space. In the words of General James M. Gavin, "...we must learn to think of the earth as a tactical entity and of space as the next great strategic challenge——space and the mind of man." [25] It is quite possible to launch weapons from any point on the earth and release them at almost any other point on the earth. This possibility threatens the destruction of the international community unless the means of guaranteeing peace is found. [26]

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[25] James M. Gavin, War and Peace in the Space Age, (New York: Harper and Brothers, 1958), p. x.

[26] Ibid., p. 19.

One need only consider the complications of an international nature that resulted from the U-2 incident involving the Central Intelligence Agency Pilot, Francis Gary Powers, in order to envision the magnitude of the complications that are likely to develop through the use of the space medium for espionage activities. [27] This is just one example of the challenge that is facing the international community in the search for a means to control and administer the use of outer space by the nations of the world.

Along with the problems of use and control of space, is the problem of World War III by accident. This problem is further complicated by the impact of accelerated technological development to meet the requirements of space exploration efforts. With respect to this problem, Professor Carl Dreher said, "The chances of an accidentally precipitated thermonuclear exchange are further increased by forced development at a pace unprecedented in the whole history of technology. [28] It is not at all inconceivable that the earth could be surrounded by orbiting thermonuclear devices with a potential yield of 100

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[27] Alexander Werth, Russia Under Khrushchev, (New York: Hill and Wang, 1961), pp. 302-304.

[28] Carl Dreher, "War by Accident," Charles A. McClelland, ed., Nuclear Weapons, Missiles, and Future War, (San Francisco: Howard Chandler, 1960), p. 100.

megatons. Envision the capability to release such devices in tne hands of a world power, and the preciseness available to place them within a mile or two of any desired point on earth. [29]

The recognition of the implications of the international problems in the use and control of outer space came soon after the first satellite was launched. In December, 1958, the United Nations, through the action of the General Assembly, decided by Resolution 1348, to establish an Ad Hoc Committee on the Peaceful Uses of Outer Space. The Committee was asked to report to the Assembly's fourteenth session in 1959, on the following items: (1) The activities and resources of the United Nations, its specialized agencies and other international bodies relating to the peaceful uses of outer space; (2) the areas of international cooperation in this field which could appropriately be undertaken by the United Nations; (3) future organizational arrangements to facilitate international cooperation within the field and within the framework of the United Nations; and (4) the nature of legal problems which might arise in carrying out programs to explore outer space. [30]

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[29] Bloomfield, ed., Outer Space, pp. 129-132.

[30] United Nations, Yearbook of the United Nations, 1959, (New York: United Nations, 1960), p. 24.

The action by the General Assembly of the United Nations was the first serious effort up to this time to lay any kind of framework for the regulation of the control of outer space. This is mentioned here only briefly in order to emphasize the virtual lack of concepts concerning the problem of controlling the use of outer space. A detailed analysis of the history, function, and achievements of the United Nations Committee on the Peaceful Uses of Outer Space will be included in a later chapter.

The problem of control in outer space has been likened, in some respects, to the problem of control in Antarctica, but there is a crucial difference. The activities of man in outer space are more of a potential threat, direct or implicit, to every nation on earth. In the United Nations itself, it was the Soviet Union which in March, 1958, first proposed a United Nations Space Agency and called for a resolution specifying that outer space should be used for peaceful uses only. Later it refused to participate in the Ad Hoc Committee on the grounds that its interests were given inadequate representation. [31]

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[31] Howard J. Taubenfeld, "A Treaty for Antarctica," International Conciliation, Nr. 531, (January, 1961), pp. 307-311.

The tasks of resolving the problems related to the use and control of outer space has only begun. In the following chapters an attempt will be made to relate the steps that have been taken and are being taken to resolve these crucial problems. The next chapter will relate the history of man's venture into outer space as it has been recorded to date. Chapter III will analyze the problems facing the international community in space, and Chapter IV will provide a consideration of the United Nations Committee on the Peaceful Uses of Outer Space in detail.

Man's reach into outer space has created new problems not faced by the world in the past. These problems are a challenge to the international community and they must be resolved if the maximum benefit of space exploration is to be achieved. Politically, it appears that the "Cold War" which has gripped the world since World War II is undergoing change, and the status of the world powers may be influenced in the quest for control of outer space. In this chapter an introduction to the problems in space has been provided. In the following chapters man's efforts to solve these problems will be related.

CHAPTER II

THE ROAD TO SPACE

The history of rocket development. The history of rocket development is interwoven with evolving ideas of the universe and space travel, because only with the development and application of the rocket principle is space travel possible. While there are several vague references to rocket type devices in early Greek writings, the distinction of inventing workable rocket weapons belongs to the Chinese. Oriental historians say rockets were first used in 1232, A.D., [1] when Ogodai, son of Genghis Khan, led an army of Mongol invaders against the city of Kai-fung-fu. During the bitter siege, the Chinese fired "arrows of flying fire" at the raiders and succeeded in terrorizing the attackers. [2] Early rockets had two drawbacks; they weren't very accurate, and they were dangerous for unskilled troops to employ in the heat of battle. This was the first recorded use of rockets and these early rockets reached Europe by 1258. [3]

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[1] Weiser, The Space Guidebook, p. 181.

[2] Ibid., pp. 181-182.

[3] NASA, Space: The New Frontier,

The early nineteenth century brought a period of intense interest in the military rocket. The British used them against the French in 1806 and partially destroyed the port of Boulogne. Their effectiveness was again demonstrated when the British fired 25,000 rockets against the city of Copenhagen, leveling much of the city by rocket kindled rocket fires. Napoleon's troops were stopped by rocket fire in the sieges of Leipzig and Danzig. [4] Perhaps the most familiar reference to the use of rockets in past wars as far as Americans are concerned is the War of 1812, when British forces attacked Fort McHenry in Baltimore with ship launched rockets. This engagement inspired Francis Scott Key to the composition of the now immortal National Anthem of the United States, "The Star Spangled Banner." [5]

The interest in rockets lulled in the latter 19th century due to the development and improved accuracy of effective artillery weapons. However, an important aspect of development in rocketry in the nineteenth century was the introduction of a solid propellant type rocket by Great Britain's Sir William Congreve. This rocket type was used extensively in the Napoleonic Wars. [6]

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[4] Weiser, pp. 182-183. [5] Ibid., p. 183.

[6] NASA, Space: The New Frontier, p. 9.

The entrance of the Russians onto the rocket development scene was marked by the publication in 1903, of the first treatise on space travel advocating the use of liquid fuel rockets. This paper was produced by Konstantin Ziolkovsky, a Russian school teacher, and it remained virtually unknown outside Russia, and at the time little attention was given it by other Russians. [7]

The basis for the age of modern rocketry was laid by Herman Oberth, a Rumanian-German, and Robert H. Goddard, an American working separately. Professor Oberth provided the basic impetus for experimental rocket work in Germany, when in 1923, he published his book, The Rocket into Interplanetary Space. He discussed many of the problems still facing scientists today and explained the theories and mathematics involved in lifting an object from the surface of the earth and sending it to another world. [8]

Dr. Goddard first proposed the use of rockets for powering spaceships in his private notebook late in the 1890's. In 1919, he wrote a paper titled, "A Method of Reaching Extreme Altitudes," and it was published by the Smithsonian Institute. His ideas about rocket propulsion up to this time had been confined primarily to the solid

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[7] Ibid., p. 10.

[8] Loc. cit.

propellant or powder type elements. By 1920, he had decided that the most practical fuel for rocket power would be liquid fuel, and he set about proving that fact. [9] He launched the first liquid fuel rocket in Auburn, Massachusetts on March 16, 1926. The rocket travelled approximately 184 feet in 2.5 seconds, as timed by a stop watch, and achieved a speed of about sixty miles per hour. [10] The fuel used to power this rocket was liquid oxygen and gasoline.

The efforts of Dr. Goddard, much like the efforts of so many eminent scientists of earlier years met with public disdain and ridicule. He was forced to leave Massachusetts and moved to Roswell, New Mexico in 1930, to continue his rocket testing with a grant secured through the efforts of Charles A. Lindbergh. This test site was no more than 200 miles from the present White Sands Proving Ground Test Site. His work continued here in self-imposed exile and secrecy until 1941, and virtually laid the foundation for the present sience of rocketry. Dr. Goddard continued his rocket research until his death in 1945. [11]

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[9] G. Harry Stine, Rocket Power and Space Flight, (New York: Holt and Co., 1957), pp. 7-8.

[10] Willy Ley, Rockets, Missiles, and Space Travel, (New York: The Viking Press, 1958), p. 133.

[11] Stine, p. 8.

Peenemunde. While Dr. Goddard was developing rockets in the United States, the German scientists were moving forward in their rocket development program which was ultimately located at Peenemunde. I recall quite vividly, that in the late months of 1944, after I had landed in France with my Unit in World War II, and we were moving by truck convoy through France, we heard an unusual sounding aircraft. The sound was somewhat like that of any other aircraft, and yet it was considerably different. We had stopped for a short rest in a small French village and there was darkness around us. One of our members who spoke fluent French, inquired of one of the villagers as to what was passing overhead, and he replied, "it is a plane without a pilot." Actually,we were hearing a German launched V-1, "buzz-bomb," which was a product of Peenemunde. The Rocket Research Center of the Germans had been established at Peenemunde in 1936, after the Waffenprufamt (Army Weapon Department), and more specifically the Ballistic Branch had been charged with rocket research in 1929. [12]

The impact of the rocket research and development conducted at Peenemunde, which resulted in the V-1 and V-2, rockets used by the Germans is already history, but the results of this research and development on

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[12] Ley, p. 198.

the race for space is still making history today. The first civilian employee at the German Rocket Research Center was Wernher Von Braun, the German scientist who has had a heavy hand in guiding America's space efforts since World War II. The first few years at Peenemunde were plagued with failures and disappointments, and needless to say, shortage of funds threatened the very existence of the project more than once. [13]

It is interesting to note that the German Army started serious development of military rockets as early as 1930. After proving that liquid rockets could be built, the rocket experimental station at Peenemunde was established in 1936, near the Baltic Sea as a combined effort of the German Air Force and the German Army. It was a military institution organized as a research institute, combined with a production plant. The mission of this installation was research and development through production, training of troops, and supply to the front. World history is often influenced by odd factors. The first large rockets were built because the Treaty of Versailles did not mention rockets, and they were built where they were built because the chief engineer knew about an out of the way place where his father had gone duck hunting. [14]

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[13] Ibid., p. 200.

[14] Ibid., p. 198.

The Peenemunde group recognized the importance of guided missiles, rockets, and the space age at an early date. Their long term program for space systems included automatic long range ballistic missiles, manned and unmanned hypersonic gliders and satellites, and finally, manned space vehicles themselves. In addition, they recognized the eventual need for high energy propellants, nuclear rockets, ion rockets and photo rockets. [15]

The developmental pattern that led to the German V-1, and V-2, rockets as we have come to know them was one of trial and error, disappointment and failure, shortage of funds and time, and finally of success dimmed by Germany's loss of World War II. The developmental sequence included a series of rockets identified as A-1, A-2, A-3, etc. Each step in the sequence usually resulted in an improved developmental item. [16]

The German rocket work was under the command of Colonel (later General) Walter Dornberger, the Army commander, Wernher von Braun, scientific chief, Walter Thiel, Ernst Steinhoff, and other top rocket experts. The first products of the research were two vertically launched liquid oxygen and alcohol rockets, the A-1, and the A-2. These two specimens were fired in 1934,

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[15] Eugene M. Emme, ed., The Impact of Air Power, (New York: Van Nostrand Co., 1959), p. 870.

[16] Ley, Rockets, Missiles, pp. 198-205.

just before Christmas. Both rockets reached altitudes of 6500 feet. [17] This work was all accomplished at Kummersdorf (Berlin) and it was not until later that the activity was transferred to Peenemunde, on Usedom Island in the Baltic Sea. [18]

The development of the A-3, was begun at Kummersdorf and completed at Peenemunde and in many ways, this rocket was the forerunner of the A-4, which we knew as the V-2. At the time, the design requirements for the V-2 seemed incredible. The range called for, 160 miles or more, was double that of the famed Paris Gun of World War I. [19] The velocity required was well in excess of 3000 miles per hour and thrust was to be on the order of twenty-five tons. In addition, a 2000 pound explosive payload was called for to be delivered within two miles of the chosen target—an accuracy, incidentally, which was never reliably achieved. However, by the end of World War II, the V-2 rocket missiles were destroying targets 220 to 230 miles from the launch sites, and achieving speeds up to 3800 miles per hour. [20]

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[17] Ibid., p. 201. [18] Loc. cit.

[19] The Paris Gun had shelled the city of Paris in 1918 from the forest of Crepy, 80 miles away.

[20] Andrew G. Haley, Rocketry and Space Exploration, (New York: Van Nostrand Co., 1958), pp. 60-61.

The first operational use of the V-2 was not against London, but against Paris. On September 6, 1944, two rounds were fired, one round fell far short; the other hit the city. To give some idea of the impact that the German launched V-2 rockets had on the city of London, the following information is quoted from pages 237 and 238 of the previously cited book by Willy Ley, Rockets, Missiles and Space Travel:

> At approximately 20 minutes to 7 on the 8th September (1944) Londoners on their way home from work or preparing for their evening meal were startled by a sharp report which sounded almost, but not quite, like a peal of thunder. At 1843 hours (6:43 P.M.) a rocket fell at Chiswick, killing 3 people and seriously injuring another 10. 16 seconds later another one fell near Epping, demolishing some wooden huts but doing no other damage. During the next 10 days rockets continued to arrive intermittently at the rate of rather more than two a day. On the 17th September the Allied airborne operation against the lower Rhine at Arnhem was launched. Thereupon the German High Command ordered rocket firing troops to move eastwards, and on the following day attacks ceased on London for the time being. Up to that time 26 rockets had fallen in this country or close enough to its shores to be observed; 13 of them had landed within the London Civil Defense Region. The higher figure does not represent the total fired during the period, which was certainly not less than 29 and probably more than 30. [21]

The above paragraph covers the beginning of the V-2 bombings of London two days after the first operational

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[21] This paragraph and the one quoted on the following page are identified by Ley as being quoted from a report by Air Chief Marshall Sir Roderic Hill in the London Gazette, Tuesday, October 19, 1948.

V-2 rockets had been launched against Paris, the following paragraph summarizes the total effect at the close of the German offensive in March, 1945:

> The German offensive came to an end at 1645 hours (4:45 P.M.) on the 27th March (1945) when the one thousand, one hundred and fifteenth rocket to fall in this country or in sight of the shore fell to earth at Orpington, in Kent. The campaign had lasted seven months. During this time the Germans had fired at least 1300 rockets at London, and some 40 or more at Norwich. Of these 518 had fallen within the London Civil Defense Region and none at all within the boundaries of the latter city. Altogether 2511 people had been killed and 5869 seriously injured elsewhere. These figures would have been substantially smaller but for a number of unlucky incidents, in which rockets chanced to hit crowded buildings.

Even though Hitler's management of Germany's wartime rocket program is one of several mistakes that worked in the Allies' favor, a number of military historians claim that if the V-2's had been successful six to twelve months earlier the course and even the outcome of World War II might have been quite different. [22] Regardless of the effect of the program on World War II, the impact of the development had far reaching effects on the age of space that has evolved in the next two decades. The story of the German work with the V-2 at Peenemunde has been told many times, but it was really here that the basic advances were made that eventually permitted the accomplishment of

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[22] Haley, Rocketry and Space Exploration, p. 60.

manned space flight. The Germans were after range and speed, and they met the need by propelling a rocket into a high trajectory and letting it literally fall out of the sky onto a target. Thus the military requirement for long range ballistic missiles has led to the development of engines powerful enough to hurl huge payloads into space. [23]

The story of Peenemunde as it affected the course of events in World War II, more or less came to an end on May 5, 1945, when it was stormed by Russian Infantry under Major Anatole Vavilov. However, Peenemunde results live on today through the techniques and data that was captured by the allies at the close of the war. These data and techniques have effectively provided the springboard into space. [24]

There is little doubt that the real key to opening the door to space has been provided by the research, development, testing and production of rockets and rocket systems by the Germans in their World War II project at Peenemunde and by individuals such as Dr. Goddard who devoted his life to the probing of the secrets of rocketry. Many things have been said about the relationship of

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[23] James H. Straubel, et. al., ed., Space Weapons, (New York: Fredrick A. Praeger, 1959), p. 37.

[24] Ley, p. 244.

rocket development and space exploration, but Dr. Walter Dornberger most aptly summarized the German accomplishments at Peenemunde with these words: "We have led our generation to the threshold of space—the road to the stars is now open." [25]

On to outer space. Astronomers remind us that the exploration of space began centuries ago when man began to study the skies. Through the centuries a vast amount of information has been obtained through light analysis and study of the phenomena identified by the astronomers. The most vivid aspects of space exploration, however, have occurred since man learned that he could hurl objects into orbit around the earth. Thus, we now date the age of space from the launching of the first man-made satellite from the earth on October 4, 1957. [26]

From the beginning, the United States space program has had four general objectives: (1) to study the space environment by scientific instruments; (2) to begin the exploration of space and the solar system by man; (3) to apply the science of space technology to the development of earth satellites for peaceful purposes; and (4) to apply space science and technology to military purposes for national security. [27]

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[26] Dryden, Space Exploration, p. 1.

[27] Ibid., p.2.

The principal applications of earth satellites which have made important progress are to weather, communications, and navigation problems. TIROS I, [28] a camera carrying, picture taking satellite, was the forerunner of a weather observation system in space which will protect the world against the ravaging effects of weather. TIROS I was launched April 1, 1960, and from the satellite's orbit, two television cameras relayed over 22,000 pictures to weather scientists on earth. Study of these pictures enabled man to identify and locate storm details that might otherwise be missed using conventional observation networks. [29]

The most dramatic and influential effort in the field of communication satellites to date was the launching of Telstar on July 10, 1962. This was a joint effort of NASA, and the American Telephone and Telegraph Company and the project cost some 70 million dollars. This project became personally realistic to the American and European people alike as they viewed telecasts direct from across the ocean via Telstar. [30]

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[28] TIROS is symbolic for Television, Infra-red, Observation Satellite.

[29] NASA, TIROS, (Washington: U.S. Government Printing Office, 1961), p.1.

[30] New York Times, July 11, 1962.

There are several important advantages that can accrue to the international community as a result of the employment of communication satellites. For example, vistas open up for ultimately improving contact between people and bringing world-wide entertainment to everyone. Another factor in the employment of communication satellites is the rapid growth of international message sending with almost instantaneous relay of happenings from one point on the earth to another. A third factor lies in the realm of international politics and in the competition between systems to demonstrate technological proficiency as well as to project a favorable world image. A final factor is the use of communication satellites for national defense. This could be of vital significance in circumstances such as "blacking out" of the natural ionosphere as a result of nuclear explosions. Not a peaceful use, but an indication of the fine line that can divide purely civil, peaceful uses from military use of a technology for the defense of a nation. [31]

The above paragraphs have mentioned just a few of the many distinct advantages that are accruing to mankind as a result of space exploration. The unmanned space probes, the satellites, the high balloon ascents, the

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[31] Lincoln P. Bloomfield, The Peaceful Uses of Space, (New York: Public Affairs Committee, 1962), pp5-9.

heroic endeavors of the pilots in the space research aircraft, and the astronauts and the cosmonauts, these and many more have contributed to man's reach for space.

The background of the Soviet reach for outer space is somewhat more obscure than our own, but their achievements on the road to space have been tremendous, timely, and dramatic. Millions of words have been spoken and printed on the subject of space since October 4, 1957, when the Soviets launched their first Sputnik into orbit around the earth and, with much the same energy, let loose a barrage of propaganda designed to convince the world that the Russian accomplishment proved the innate superiority of the Soviet system and its technology. [32]

The American people were totally unprepared for the impact of the launching of Sputnik I. Official and unofficial estimates as to where the Russians were and how they got there, were at considerable variance. One element that did emerge as certain fact, they had been first in outer space. Subsequent study, and the facts uncovered by observation and scientific analysis, confirmed a high degree of competency. These facts were further confirmed by the launching of Sputnik II, November 3, 1957, and Sputnik III, May 15, 1958. [33]

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[32] Straubel, Space Weapons, p. 1.

[33] Aviation Week, March 13, 1961, p. 188.

The Soviets have consistently displayed a superior rocket system for the task of hurling payloads into space. For the most part the satellites that have been placed in orbit by the Russians have been much more massive and heavier than the satellites orbited by the United States. As a striking example of this evidence, one only has to compare the weight of Vostok I, the vehicle in which Russia's Yuri Gagarin orbited the earth, and the Friendship 7, in which Lieutenant Colonel John Glenn orbited the earth three times. The Vostok I, weighed 10,460 pounds, and the Friendship 7, vehicle weighed 4265 pounds. [34]

Regardless of the scientific position of the United States and Russia, as important as this factor is, the more important factor is that man's dream to explore the far reaches of outer space are a reality and the old saying that "the sky is the limit" just isn't true today. Certainly, penetrating outer space has a special fascination to the explorer instinct of man. However, no one state can expect to be first and foremost in today's world in every aspect of science and technology. In particular, in space technology there are so many experiments that are practical to perform, so many systems for military or peacetime applications that can be brought

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[34] San Francisco Chronicle, August 12, 1962, p. 16.

into being using outer space, that any country with substantial resources choosing to work in the field must be expected to conceive and carry out some favored projects ahead of other nations. It is unrealistic to talk about achieving space supremacy, if supremacy in this context means controlling all of the space that surrounds the earth and denying entry into that space to every other nation. This ambition can be ruled out, if not for technological reasons alone, then by a combination of technological and economic factors. [35]

Man's reach for space has involved many facets of his way of life and the scientific contributions of space exploration have been phenomenal. The most prominent factors in a race for space have been the satellites and manned exploration efforts. Quite logically, the initial effort to orbit objects was with uninhabited capsules, and from the beginning, safety of man has been a primary factor. In this setting, man has progressed in six years to long sustained manned orbital flights around the earth. This progression is indicative of the intense interest with which man is willing to pursue the program of exploration in the far reaches of outer space.

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[35] Straubel, et. al., Space Weapons, p. 164.

The artificial satellites. It doesn't take an expert mathematician to picture the curve of technological progress stretching out sleepily for centuries, and then beginning to curve upward a century ago with the development of steam power, electricity, the telephone, the automobile, the airplane, and then zooming straight upwards in the exploration of space. In the course of the last century, these new inventions in rapid succession have had a tremendous impact on the daily life of man, and the question has arisen as to where the technological explosion is leading the human race. The exploration of space has increased the perplexities of our society to a substantial degree, but at the same time, scientific benefits in terms of knowledge are accruing to mankind. [36]

Creation of an artificial earth satellite called for the solution of a number of complex and fundmentally new scientific and technological problems. First, and probably foremost of the problems was the development of a suitable rocket to hurl the item to a sufficient altitude to enter into an orbital pattern. Secondly, the object had to attain a speed of approximately 18,000 miles per hour at a moderate distance from the earth in

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[36] Bloomfield, ed., Outer Space, pp. 1-6.

order to achieve the desired orbital capability. The problem in achieving orbit with a satellite is that the satellite must enter the altitude desired at a given velocity at the moment of release and, what is more important, it must be travelling exactly parallel to the earth's surface. [37] In achieving orbital flight circular orbit is only remotely possible, and in general, an orbit will usually be an ellipse with the center of the earth in one focus. With one or two exceptions, all orbital flights of artificial satellites to date have been elliptical orbits. [38]

The artificial satellites require a carrier rocket possessing several thousand pounds thrust, or in the case of larger vehicles, several hundred thousand pounds of thrust. The solution of the booster requirement problem as well as other complex tasks, has been made possible by the latest achievements of science and technology in the most diverse fields. Large sums of money and a great deal of creative and experimental work was required to develop the boosters of the magnitude the Russians used to launch the Sputniks. The international impact of scientific and technological progress of this

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[37] I.M. Levitt, Target for Tomorrow, (New York: Fleet, 1959), pp. 86-87.

[38] Ibid., pp.87-89.

order indicates an extremely high level industrial and scientific capability in the Soviet Union. Although the distinction of being "first" in space belongs to the Soviets, and their space feats have been most precise and spectacular, the achievements of the United States should not be belittled. In the United States space programs some of the most scientifically systematized contributions to the age of space have been made. The spectacular results achieved with Ranger II in the scientific flight by the planet Venus attest to this fact. [39]

The entrance of the United States into the field of space exploration was marked by the successful launching of its first artificial satellite on January 31, 1958,[40] almost four months after Sputnik I. The significance of other artificial satellites launched by the United States has been indicated. The scientific achievements of TIROS and Telstar have been recognized throughout the world. These two space accomplishments by the U.S. indicate the scientific benefits that are accruing to mankind as a result of the artificial satellite program.

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[39] New York Times, December 15, 1962.

[40] New York Times, February 1, 1958.

Numerically, the United States has launched at least twice as many artificial satellites as the Soviets. It should be noted that the Soviet satellites have represented much larger payloads, for the most part, than satellites launched by the United States. One of the striking differences between the programs of the United States and the Soviets is the fact that an attitude of secrecy generally surrounds the Soviet efforts. Charles Collingwood, on the CBS television program, "Eyewitness Report," in August, 1962, commented on this matter. He was discussing the tandem flights of the Russian Cosmonauts, and noted that the Soviets had released an unusual amount of information about the flights of the Russians in this instance. He contended that the Soviets were previously reluctant to provide data pertaining to their space achievements, while the United States did so on a wide basis.[41]

Looking at the achievements of the artificial satellite research programs of both the United States and the Soviet Union, one can recognize several factors that are now having, or will have, far reaching and long lasting impact on the course of international relationships among the peoples of the world. Certainly these

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[41] Charles Collingwood, "Eyewitness Report," Columbia Broadcasting System, Friday, August 17, 1962.

outstanding achievements were necessary in order to lay the foundation for manned exploration of the outer space medium, and the scientific benefits that are accruing to the affairs of mankind are phenomenal. There is more involved in space exploration than the mere satisfaction of man's natural curiosity. The scientific data which is gained can be translated into benefits to man's peaceful existence on his own planet. There are specific advantages which are already apparent such as: expanded world communications through the use of extra-terrestial satellite relays; intercontinental television, already partly realized with Telstar; advances in meteorological science; navigation, geodesy, and mapping; and by no means least, the opportunity for interplanetary travel and exploration. Space will not submit readily to conquest. The exploration of space will follow the pattern by which man mastered flight within the atmosphere, adding to his skill step by step.[42]

Man into space. Excitement probably unequaled in this century prevailed when the world was notified that the Soviet Union had successfully placed a man into

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[42] NASA, The Challenge of Space Exploration, (Washington: U.S. Government Printing Office, 1959), p. 3.

orbit around the earth and returned him unharmed on April 12, 1961. [43] Cosmonaut Yuri Gagarin, a Russian Air Force Major, had been chosen by the Soviets to become the first man in the history of the world to orbit the earth. This feat was accomplished in Vostok I, a space vehicle that weighed approximately five tons. Only limited details of the preparation and termination of the flight were made available to the world, but sufficient evidence was available to indicate that Yuri Gagarin had made the orbital flight. The orbital portion of the flight was accomplished at slightly less than 18,000 miles per hour within a period of approximately ninety minutes. [44]

Regardless of the disappointment that the American people felt that the first manned flight was accomplished by a Russian instead of an American, their praise for the sheer accomplishment of the feat was lavish and sincere. Whole new vistas of space exploration possibilities were now open to men faced with the challenge of looking at their earth from outer space.

The orbital flight of Cosmonaut Gagarin preceeded the first American orbital flight by some ten

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[43] New York Times, April 13, 1961.

[44] Donald W. Cox, The Space Race, (New York: Chilton Books, 1962), pp. 3-5.

months and again indicated that the Russians did hold a sizable lead in the race for space. The efforts of the United States to place a man into orbit was accomplished on a somewhat more step by step basis than the Soviet effort. The first rocket boosted launch of an astronaut into space for America, was the sub-orbital flight of Navy Commander Alan B. Shepard, which took place on May 5, 1961. [45] A major event in the United States program to achieve manned exploration of interplanetary space, the flight of Astronaut Shepard began at 9:34 A.M., Eastern Standard Time, when the space capsule was launched from Cape Canaveral, Florida, by a modified Redstone rocket vehicle. Approximately 15 minutes later, after following a ballistic path carrying 302 statute miles down range, reaching a peak altitude of 116.5 miles above the earth, and achieving a maximum speed in excess of 5000 miles per hour, the capsule and its occupant parachuted safely into the sea near the Bahama Islands. [46]

The primary objectives of the Mercury-Redstone flight of May 5, 1961, carrying Astronaut Shepard included: (1) familiarizing a man with a brief but

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[45] New York Times, May 6, 1961.

[46] National Academy of Sciences, "Project Mercury," IGY Bulletin, Bulletin Nr. 49, Washington, D.C., (July, 1961), p. 2.

complete space flight experience——lift-off, powered flight, weightlessness, re-entry into the heavier atmosphere, and landing; (2) evaluating man's ability to perform useful space-flight functions, including manual control of the spacecraft attitude before, during, and after firing the retro-rockets that slow the capsule for re-entry, and maintaining voice communication with the ground; and (3) studying man's physiological reactions during space flight. Added to these were the general objectives of continued testing of the Mercury spacecraft and its numerous systems, and of providing training for ground support and recovery personnel. [47]

The United States took the second step forward in the space exploration by man program on July 21, 1961, when the second manned, sub-orbital test flight, carrying Astronaut Virgil I. Grissom, was launched from Cape Canaveral, Florida at 8:20 A.M., Eastern Standard Time. The capsule followed approximately the same path as Shepard had flown two months before. The sixteen minute flight of Grissom reached a peak altitude of 118 miles, a maximum velocity of 5280 miles per hour, and a distance down range of 303 statute miles. While the flight performed by Grissom was highly successful, the

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[47] Loc. cit.

spacecraft was lost shortly after landing at sea when the explosive bolts unexpectedly blew the capsule hatch, allowing the craft to fill with water and sink. Most of the flight data had been telemetered to the ground, but the film record of the on-board camera was lost. [48]

The Soviet Union again astounded the world in August, 1961, with the announcement that their second Cosmonaut, Gherman Titov, had orbited the earth 17.5 times within a period of 25 hours and 18 minutes in a spacecraft called Vostok II. Lift-off for Titov had occurred at about 9:00 A.M., Moscow time on August 6, 1961, with the landing being effected at 10:18 A.M., August 7, 1961. The apogee of the orbit was 110.36 miles, and the perigee was 159.34 miles, with a total distance travelled of 436,937.31 miles. [49] The remarkable results of this flight established that man can survive weightlessness and travel in outer space for extended periods without any noticable ill effects. Again the scientific results of this flight are known only to the Russians, since they have elected not to release the data to the remainder of the world.

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[48] Ibid., p. 14.

[49] Gherman Titov and Martin Caidin, I Am Eagle, (New York: Bobbs-Merrill, 1962), p. 205.

The United States jubilantly achieved their place in manned orbital flight in space, when they launched Marine Lieutenant Colonel John H. Glenn Jr., into orbit around the earth in the space vehicle named Friendship 7, on February 20, 1962. [50] The spacecraft in which Astronaut Glenn orbited the earth three times and returned safely within a period of four hours and fifty-six minutes, had a weight launch of 4265 pounds, orbital weight of 3000 pounds, and an on water recovery weight of 2400 pounds. The world was given a "ringside" seat to the flight of Colonel Glenn, as it was widely televised and publicized in its entirety. The vehicle used to launch the spacecraft was a modified Atlas D, and at launch the vehicle and spacecraft stood 93 feet tall including a 16 foot tower above the spacecraft. The launch system consisted of three emergency systems to allow escape of the Astronaut in the event the booster failed. Lift-off occurred at Cape Canaveral, Florida, at 9:47 A.M., Eastern Standard Time, February 20, 1962. The apogee was 141.2 miles, and the perigee was 86.84 nautical miles. Landing of the spacecraft occurred in the ocean southeast of Cape Canaveral, near Grand Turk, after four hours and fifty-six minutes of flight. The flight miles were 81,000, and the

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[50] New York Times, February 21, 1962.

acceleration forces entertained by the Astronaut was eight "G's" during launch and something greater than eight "G's" during the re-entry process. The historical significance of the orbital flight of John Glenn is already apparent. Although dimmed somewhat by the previous spectacular achievements of the Soviets, Yuri Gagarin and Gherman Titov, this magnificent feat will take its place of prominence in the historical diary of space. [51]

In the words of John Glenn at his press conference at Cape Canaveral on February 23, 1962, "I think we've hardly scratched the surface. We had a lot of attention focused on this one, but our efforts really haven't gotten us very far into space, if you think about it." At this moment the United States was preparing for the orbital flight of the next American Astronaut. The second U.S. manned orbital flight was performed by M. Scott Carpenter, a Lieutenant Commander in the United States Navy, and one of the seven Project Mercury Astronauts. The flight was accomplished on May 24, 1962, consisted of three orbits, and essentially the same flight time and distance of John Glen's earlier orbital flight. [52]

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[51] All facts in this paragraph were compiled from: NASA, John H. Glenn Orbits the Earth for America, (Washington: U.S. Government Printing Office, 1962), pp. 1-8.

[52] New York Times, May 25, 1962.

For the most part the flight of Astronaut Carpenter would have been categorized as "routine" by most except for some anxious hours at the terminal portion of the historic journey. The space capsule, named Aurora 7 by the Astronaut himself, splashed down in the Atlantic at 12:41 P.M., on May 24, about 250 miles downrange from the planned impact point. There was then a forty-one minute period of silence when Carpenter's well-being was in doubt. It was 1:22 P.M., when a Navy P2V patrol plane, following a radio beacon signal from the spacecraft, spotted the spacecraft and Carpenter in a raft beside it. He was later picked up by helicopter and flown to the Aircraft Carrier Intrepid. [53] These orbital flights of Astronauts Glenn and Carpenter were essentially the "foot in the door" of space for the United States with eventual space exploration programs that are designed to place men on the moon.

The Soviets "rocked" the scientific world again in August, 1962, when they placed two Cosmonauts into tandem orbital flights around the earth. These two, Major Andrian Nikolayev and Lieutenant Colonel Pavel Popovich, were launched into orbit twenty-three hours and thirty-two minutes apart. Major Nikolayev was launched

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[53] NASA, Astronaut M. Scott Carpenter, Aurora 7, (Washington: U.S. Government Printing Office, 1962), p. 24.

at 11:30 A.M., Moscow time, on August 12, 1962, and his orbital mate, Colonel Popovich was launched at 11:02 A.M., on August 13, 1962. This amazing tandem orbit lasted four days and sixty-four orbital trips around the earth for Major Nikolayev, and nearly three days and forty-eight orbital trips for Colonel Popovich. [54] The spacecraft used for this spectacular journey were called Vostok III, and Vostok IV. According to the Cosmonauts, they were within three miles of each other at one time during the flight. The world had nothing but praise and admiration for this outstanding feat in space exploration, and conceded that this indicated that the Soviets were enjoying a commanding lead in the space race. For the first time in the space exploration program, the Soviets, for reasons known only to themselves, decided to provide more information to the world concerning these tandem orbital flights than they had on any previous flights. A three hour and forty-three minute news conference was held at Moscow University's Main Hall on August 21, 1962, wherein the Cosmonauts discussed their achievement at length. [55] Clearly, this was the most intricate space feat to date.

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[54] New York Times, August 15, 1962.

[55] New York Times, August 22, 1962.

The space flight of longest duration completed by the United States in 1962, was accomplished by Astronaut Walter M. Schirra Jr., a Commander of the United States Navy, and one of the seven original space astronauts chosen by NASA to participate in the first phases of the manned space flight program for the United States, which was designated as Project Mercury. The flight was scheduled for a total of six orbits, three more than had been accomplished by the two previous American Astronauts who had orbited the earth. Lift-off for Commander Schirra in his space capsule which he had named Sigma 7, occurred at approximately 8:15 A.M., Eastern Standard Time, from Cape Canaveral, Florida on October 3, 1962. The total flight time from lift-off until impact in the water 330 miles Northeast of Midway Island in the Pacific was nine hours and fourteen minutes. The orbital flight was elliptical with the apogee of the orbit at 176 miles, and the perigee at 100 miles. The flight through outer space consisted of six complete orbits of the earth for a total distance of 160,000 miles, at a speed of 17,560 miles per hour, with each orbit requiring slightly more than eighty-eight minutes to complete. [56]

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[56] All facts in this paragraph are quoted from: New York Times, October 4, 1962.

Air Force Major L. Gordon Cooper has the distinction of achieving the longest sustained manned orbital flight for the United States in the Project Mercury space project. Astronaut Cooper was launched into an orbital flight pattern at 8:04 A.M., Eastern Standard Time, from Cape Canaveral, Florida on May 15, 1963. The flight was destined to terminate some thirty-four hours and twenty minutes later after the space capsule Faith 7 had completed twenty-two circuits of the earth. This flight exceeded the flight of Soviet Cosmonaut Gherman Titov by some nine hours and five orbits, but came almost two years after Titov had made his historic flight in August, 1961. Perhaps the most striking aspect of Gordon Cooper's orbital journey was the functional participation of the man element in the re-entry process of the Faith 7 capsule in the terminal phase of the mission. It was a place for calm, calculated human reason based firmly on technical knowledge. This spectacular performance by Astronaut Cooper was a dramatic rejection of any argument that machines alone and not man will be the key to future explorations in space. [57]

The nearly perfect orbital flight of the Faith 7 capsule had persisted from the moment of launch and

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[57] All facts used in this and the following two paragraphs concerning Major Cooper's flight are from: New York Times, May 16, 17, 1963.

into the nineteenth orbit. At this time, while out of radio contact over the Western Pacific, Astronaut Cooper was accomplishing his space cabin checks and determined that his automatic control system was indicating an inoperative condition. Subsequent contact between Gordon Cooper and the Cape Canaveral experts confirmed that the precise positioning of the Faith 7 capsule for the firing of the retro-rockets, the triggering of those rockets, and the jettisoning of the retro-package would have to be accomplished on a manual basis. With the aid of Colonel John Glenn, [58] who "talked" him through the re-entry sequence, Gordon Cooper made a phenomenal pin-point landing less than four miles from the recovery ship, the U.S.S. Kersarge.

Astronaut Cooper's twenty-two orbit flight ended the U.S. Project Mercury program. Significantly, the flight marked the sixth successful manned space launch by the United States in this series with no failures. These six launches illuminate the precision with which the manned space program has gone forward, and indicate the important part that man plays in this era of space exploration.

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[58] Colonel John Glenn, the first American to orbit the earth on February 20, 1962, was aboard the Command Ship Coastal Sentry 275 miles South of Japan.

Notwithstanding the fact that the flight of Major Cooper was precisely initiated, successfully engineered, and dramatically terminated, the feat is still dimmed by the continuing spectacular successes of the Soviets in space. While giving no indication that the United States was gaining in the space race, the flight of Astronaut Cooper did signify the continuing interest of the United States in improving its manned space flight capability. Regardless of the position of leadership in space achievements, the feats of both the Soviet Union and the United States have added a tremendous store of scientific knowledge about the space that surrounds our earth. Undoubtedly, future feats will continue to add knowledge, not only about space, but also about the planets that are a part of space.

Man in his everlasting quest for knowledge concerning the Universe has accomplished feats in the field of space exploration in the past five years that are nothing short of fantastic. Entirely new areas of knowledge, research, education and science have been opened through the space exploration program, and many benefits have resulted for mankind. However, at the same time, man has created problems in the use and control of outer space that must be solved by the international community. In the following chapters these problems will be dealt with in some detail.

CHAPTER III

INTERNATIONAL PROBLEMS IN SPACE

The problem of national attitudes. From the beginning the United States space program has been beset by the fact that public opinion has reacted to it with sharply conflicting views as to its pace, emphasis, and urgency. Although the United States has played an active role in inviting international consideration of the problem of outer space, as a nation we are not yet entirely clear as to what course in international space affairs our national interests truly dictate. In terms of the development of exploratory space techniques, it would appear from the outset that the policy of the United States has been an emphasis on the peaceful pursuits as opposed to any other. However, essentially our government seems to have been divided between two courses, both arguably in the national interest. One views outer space as simply another area in which military superiority is essential; the other sees it as above all a challenge toward development of more orderly procedures. [1]

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[1] Bloomfield, ed., Outer Space, pp. 173-174.

On a public basis, the United States has consistently professed an attitude of agreement with the concept of the use of outer space for peaceful purposes and the cooperation in space exploration activities between the nations who are predominant in the field. The heart of the space program is diversification and respect for the interests of all participants and these elements are essential to international cooperation. In March, 1962, in a speech at Berkeley, California, President Kennedy commented on this matter as follows:

> A cooperative Soviet-American effort in space science and space exploration would emphasize the interests that unite us instead of the conflicts that divide us...and would remind us on both sides that knowledge, not hate, is the passkey to the future—that knowledge transcends national antagonisms—that it speaks a universal language—that it is the possession, not of a single class, a single nation or a single ideology, but of all mankind...The pursuit of knowledge itself implies a world where men are free to follow out the logic of their own ideas. It implies a world where nations are free to solve their own problems and to realize their own ideals...No one can doubt that the wave of the future is not the conquest of the world by a single dogmatic creed, but the liberation of the diverse energies of free nations and free men. No one can doubt that cooperation in the pursuit of knowledge must lead to freedom of the mind and of the soul. [2]

President Eisenhower declared several times that the United States was willing to enter into any reliable

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[2] John F. Kennedy, Charter Day Address, University of California, Berkeley, California, March 23, 1962, from: New York Times, March 24, 1962.

arrangement which would mutually control outer space missile and satellite development. In 1958 in correspondence with then Soviet Premier Bulganin, Eisenhower offered to discuss the problem, but without effect. [3] In his first State of the Union message President Kennedy invited all nations including the Soviet Union to join with us in a variety of space activities, saying that, "...both nations would help themselves by removing their endeavors from the bitter and wasteful competition of cold war." [4] In an address to the United Nations General Assembly on September 25, 1961, President Kennedy proposed as part of the United States disarmament plan, "...keeping nuclear weapons from seeding new battlegrounds in outer space." He further outlined some United States proposals regarding peaceful uses of outer space which included those of "...extending the United Nations Charter to the limits of man's exploration in the universe, reserving outer space for peaceful, use, prohibiting weapons of mass destruction in space, and opening the mysteries and benefits of space to all nations." [5]

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[3] Bloomfield, ed., Outer Space, p. 174.

[4] John F. Kennedy, State of the Union Message, January, 30, 1961, New York Times, January 31, 1961.

[5] Cox, The Space Race, p. 327.

If the policy of the United States is to continue to be one of advocating that the vast outer space be confined to the pursuit of peaceful purposes, then, much more can be accomplished through the United Nations. Despite difficulties, there are encouraging possibilities that this organization will attack and overcome the problems that are facing the international community in the use and control of outer space. The field of space exploration is vastly complex, and international control is necessary if international benefits are to be derived from the results.

A basic difference in Soviet and United States space exploration programs has been the attitude of Soviet secrecy toward the details of their space feats. They also take exception to the United States and its policy of developing space for peaceful purposes. This attitude is based on the contention that the space defense systems of the United States such as Samos and Midas are incompatible with the policy. The Soviets appeal to the desires of the world for peace and to the hopes that in outer space an area devoted to peaceful purposes only can be created. [6]

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[6] Robert D. Crane, "Soviet Attitude Toward International Space Law," The American Journal of International Law, Vol. 56, No. 3, (July, 1962), p. 702.

Since the Soviets launched their first artificial satellite, and particularly since they proved their ICBM capability by launching Luniks, they have indicated an interest in trading their space superiority for the United States superiority in the non-space strategic delivery systems. This trading would include the United States bombers and IRBM's that are overseas within striking range of the Soviet Union. According to the Soviets, this can be accomplished by U.S. agreement to dismantle all of its overseas bases, and by Soviet agreement to the demilitarization of outer space, which would eliminate the Soviet strategic delivery system by rendering illegal the passage of ICBM's through space.[7]

The Cuban Crisis which occurred in October, 1962, and the subsequent withdrawal of the Soviet Union missiles following the confrontation by the United states, and the quarantine which was imposed by Presidential action leave some doubt as to whether or not the Soviets would still support this position. [8] Premier Khrushchev, in his message to President Kennedy indicating that he was withdrawing his missiles, indicated that the action was in the interest of peace. [9] However,

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[7] Loc. cit.

[8] New York Times, October 23, 1962.

[9] New York Times, October 29, 1962.

in some cases the action was viewed as Soviet weakness in military power.

Basically, it seems that the Soviet attitude toward space and the problems involved in the use and control of outer space have been politically oriented. However, the Soviets have from time to time indicated their interest in the concept of cooperation in space efforts and the use of the space medium for peaceful purposes. For example, Professor Arnold L. Horelick says, "Both the United States and the Soviet Union, in various official pronouncements, have agreed in principle that the use of outer space should be confined to peaceful purposes." [10]

The Soviets have consistently demonstrated an attitude of superiority in space exploration technology, and furthermore, they have supported this attitude with outstanding achievements in the race for space. As indicated in the previous chapter, the Soviets launched the first artificial satellite on October 4, 1957, placed the first man into orbit around the earth on April 12, 1961, orbited a man around the earth for a period in excess of twenty-four hours in August, 1961, and achieved the first tandem orbit of two Cosmonauts in August, 1962. This is a formidable array of achievements by the Soviets.

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[10] Arnold L. Horelick, "Outer Space and Earthbound Politics," World Politics, Vol. XIII, No. 2, (January, 1961), p. 325.

The Soviet space exploration program indicates a more advanced state of space technology than the United States when it is viewed from the manned flight feats that each nation has performed. This is not suprising to the American people today, but such was not the case in 1957. Considerable suprise was evident throughout the United States in October, 1957, when the Sputnik I was launched by the Soviet Union. Professor Gabriel Almond says that in a public opinion poll, "A question asked in the United States in February 1958 showed that almost half of the respondents admitted to being shocked by the launching of Sputnik." [11] The fact is that the United States had reveled in the position of "first" in the field of science and technology for so long that it was unbelievable to the American people that the Soviets had forged ahead in the field of space exploration.

Undoubtedly, the Soviet attitude toward space exploration efforts will continue to be one of competition and an insistence of maintaining superiority over the United States in space achievements. The question of controls and the problems to be faced in the use and legal administration of outer space must ultimately

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[11] Gabriel A. Almond, "Public Opinion and the Development of Space Technology," Public Opinion Quarterly, Vol. 24, (Winter, 1960), p. 556.

be settled and Soviet participation in the measures taken to resolve these problems is mandatory. In the article by Professor Almond which was quoted on the previous page, he says, "It may be that in a few years competition will level off, with the United States and Russia in more equal positions." [12]

The problem of defining space. The question of boundaries in outer space permits no simple answer. Space has been defined as, "...that part of the universe between—and possibly beyond—celestial bodies. It may be infinite and limitless. Man's knowledge is not yet comprehensive enough to tell him if there are boundaries."[13] The primary problem of determining boundaries in outer space is its apparent limitlessness. Additionally, the situation is further complicated by the fact that the span of time in which man has been engaged in space activities is so brief and the progress so dynamic that few precedents have been established. These very factors, however, point out that agreements for the use and control of outer space must be reached if the program of space exploration is to continue to move forward.

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12 Ibid., p. 558.

13 NASA, Space: The New Frontier, p. 4.

Obviously, the problem of defining space, determining space boundaries, and establishing the applicability of international law to space will become more pressing as the international programs of space exploration do move forward. Along with these problems is the determination of whether or not new international law must be developed to govern the use and control of outer space. An important aspect of defining space is the fact that almost all important legal problems of space exist independently of any territorial division of space into soveriegn and non-sovereign areas. The problem might be even more complicated if it becomes deeply involved with the question of sovereignty. [14] The primary consideration is that formidable problems face the international community in the definition and control of outer space, but the really crucial matter of solving these problems is not in outer space, it is here on earth. [15]

Clearly, any attempt to define or identify the limits of outer space will immediately evoke the question of sovereignty and soveriegn rights. In common aeronautical terms, reference is quite often made to

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[14] Philip C. Jessup and Howard J. Taubenfeld, Controls for Outer Space, (New York: Columbia University Press, 1959), pp. 205-209.

[15] Bloomfield, ed., Outer Space, p. 151.

"air space." In fact, the right of nations to exclude foreign aircraft from its air space was recognized on a formal basis in the Convention for the Regulation of Aerial Navigation signed at Paris in 1919, and in the amending Protocols. [16] There have been numerous international incidents in the last decade wherein one nation of the international community has charged some other nation with violation of "its" air space.

Perhaps the most widely publicized of these incidents was the U-2 flight over Soviet territory by the United States in May, 1960. (Chapter I). The traditional rule is that a nation has complete and exclusive sovereignty over the air space above its sovereign territory. In the traditional context this was sufficient to determine the upper limit of sovereignty. [17] However, it is obvious that in the case of space exploration, the vertical extent of sovereignty cannot be defined in terms of an indefinite quantity such as air space.

It is interesting to note that the open seas are considered as free to all by most nations today. There was a time when powerful nations sought to lay claim to vast stretches of the ocean, and only when it appeared obviously impossible to control the seas totally did the

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[16] Jessup and Taubenfeld, p. 201.

[17] Ibid., p. 202.

concept of freedom of the seas become internationally accepted. Even with the acceptance of the principle of freedom of the seas, different nations have different attitudes toward territorial waters. [18]

The Soviet discussions of the definition of outer space have emphasized that there should be no anology with the regime of air space, because this would subject outer space to the sovereignty of national boundaries. [19] The importance of international space law and the attempts to develop such law is underlined by the speed with which man has evolved from earth into space and the importance of space related activities to the peoples of the world. The definition of outer space is related to both the direct and indirect benefits which can accrue to mankind. The direct benefit of communication satellites which can serve as global mass communication medium is easily recognized. A most important benefit of a direct nature is the function of weather satellites, especially in view of developing a more reliable capability of predicting devastating storm centers and establishing effective control measures. [20] One can hardly overlook the important

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[18] Bloomfield, ed., Outer Space, p. 158.

[19] Robert D. Crane, "Law and Strategy in Space," ORBIS, Vol. VI, No. 2, (Summer, 1962), p. 295.

[20] Crane,"Soviet Attitude Toward," p. 693.

indirect benefits of space exploration such as the impact on the educational systems, and the significance for the economic development of the nation. Probably the most important benefit to be reaped from space exploration is the tremendous advancement of scientific and technological knowledge.

Incorporated with the problems of defining the status of outer space and the applicability of international law in the space medium are problems that have been publicized to a much lesser degree, but which may be as important in reaching a successful solution. For example, Vessels on the high seas, according to international law carry the nationality of their flag. Will this same concept prevail in the case of space ships? Another interesting question is the consideration of liability for injury of persons and damage to property caused by debris or falling objects from space vehicles or space launching units. One writer has suggested the possibility of creating an international mutual insurance fund to take care of losses that evolve from accidents in and from outer space. [21] The problem of liability for damages has been considered largely in terms of damage caused on the ground by

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[21] Bloomfield, ed., Outer Space, p. 161.

space vehicles during their initial or "climb out" phase, or after re-entry, and in terms of the rights of launching nations to vehicles and crews which have entered foreign territory. There are also other problems that must be considered such as nuclear fallout, interference with communication networks, and the possibility of problems developing through the arbitrary control of weather elements.

Both the United States and the Soviet Union have taken steps before the United Nations Committee on the Peaceful Uses of Outer Space to devise systems of liability for space vehicle accidents and the return of space vehicles and personnel. At the tenth meeting on September 10, 1962, the representative of the Soviet Union presented the Committee with a draft declaration of the basic principles governing the activities of States in the exploration and use of outer space and a draft international agreement on the rescue of Astronauts and space ships making emergency landings. [22] At the eleventh meeting on September 11, 1962, the representative of the United States presented the Committee with a draft proposal on assistance to and return of space

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[22] United Nations, Report on the Committee on the Peaceful Uses of Outer Space, A/5181, (September, 1962), p. 5.

vehicles and personnel and a draft proposal on liability for space vehicle accidents. [23]

It appears that the establishment and definition of the status of outer space and the use and control of the medium must be accomplished on an international basis through a process of cooperative effort. The work that has been accomplished by the United Nations, and specifically by the Committee on the Peaceful Uses of Outer Space is encouraging. In the final analysis, this organ will more than likely be the agency that resolves the problems. In viewing the international problem of defining outer space, one must bear in mind that the age of space is only a few short years old. Vast ideological differences exist between the world's two major actors in space, and the field of technology is so dynamic that unless international control is achieved some chaotic conditions may develop within the international community. [24]

The problem of boundaries in space. In the previous section a general discussion of the definition of outer space was presented and the problem of boundaries was considered as an allied factor. In this section, a more

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[23] Loc. cit.

[24] Bloomfield, ed., Outer Space, p. 163.

detailed analysis of the problem of boundaries in space will be presented. The problem of geographic boundaries between nations has existed throughout history, but in many cases the solution to these boundary problems has been aided by lines of demarcation that were generously provided by nature. For example, boundaries have been established by rivers, mountains, and oceans. In addition to these natural boundaries, it has been possible for man to establish acceptable boundaries through arbitration and mutual agreement, or in some cases to change or establish new boundaries as a result of conflict. The boundaries of the planets are, of course, as clearly marked as the boundaries of the ocean, but the vast space in between presents the real problem.

If the resources of the United Nations are relied upon, and joint agreements can be reached for the joint utlization of space toward the benefit of all mankind, perhaps it will not be necessary to draw boundaries in space. Senator John F. Kennedy had ideas for the joint utilization of space when he said:

> Primarily the exploration of space is an action of science and of human adventure, It ought to be placed on an international footing as soon as possible. Certainly our friends in the North Atlantic Community ought to share in it, and we ought to explore also with the Russians whether

> this is not one of those activities which we might not conduct together rather than in competition. 25

It is reasonable to assume that if the possibility of international agreement on the cooperative use of outer space rather than trying to bound the medium exists, that the most logical source for providing such an agreement is the United Nations. In the words of David Cushman Coyle:

> The danger that space exploration would focus on a contest between the Soviet Union and the United States for military advantage could be avoided if the two antagonists could agree at an early stage that cooperation was the better way. The United Nations provides the meeting ground for the first stages of such an agreement which if achieved could be one of the greatest successes of its first fifteen years. 26

Various suggestions have been put forth as a basis for drawing boundaries in space. These suggestions are most commonly in terms of the vertical dimension and range from twenty-five miles to infinity. Some favor thirty miles and others favor fifty-two miles, the height at which centrifugal force takes over. 27 Consideration

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25 John F. Kennedy, The Strategy of Peace, (New York: Popular Library, 1960), Edited by Allan Nevins, p. 134.

26 David Cushman Coyle, The United Nations and How it Works, (New York: New American Library, 1962), p. 144.

27 Bloomfield, ed., Outer Space, p. 155.

has been given to establishing the boundary at the lowest point in altitude at which an artificial satellite will enter into an orbital configuration and remain for at least one orbit. However, the problem of the difference between the apogee and the perigee of an elliptical orbit must be considered in this case. Even though there is considerable divergence on how and where the boundaries in space can be drawn, there seems to be legal and governmental agreement that national soveriegnty does have a boundary somewhere in the vertical dimension. Above this boundary, national boundaries are no longer binding and the medium of space is available to all with the capability to take advantage of space exploration. [28]

It has been generally conceded by scientists that clearly ascertainable physical boundaries cannot be established between the air space and the regions beyond, usually referred to as outer space. Regardless of this inability to define the boundaries between air space and outer space, numerous schemes have been offered for the zonal division of space. These schemes are generally based on the following assumptions:

> (1) that present legal arrangements for use of conventional air space would be unaffected by

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[28] Ibid., pp. 155-156.

> the arrangements adopted for outer space; (2) that the arrangements adopted for outer space must differ substantially from those adopted for air space; (3) that outer space must have a legal "status" which could be discovered or agreed upon; (4) that for this purpose it was necessary to fix a single boundary in terms of location; (5) that the establishment of such a boundary was possible without serious regard to physical facts (except those used in the establishment of the boundary itself), present and future technological developments, the functions of spacecraft, or the purpose of space activities. 29

Probably the most promising as well as suprising action in regard to the concept of boundaries that has occurred to date was the agreement reached at a meeting of the International Aeronautics Federation on October 4, 1960. As a result of this meeting the Soviet and United States participants agreed to a standard by which manned space flights would have to reach sixty-two miles to qualify as space flights. It could be that this agreement holds the key to some future agreement on the boundaries for outer space. [30]

The Convention for the Regulation of Aerial Navigation which was signed in Paris in 1919, led to universal agreement on the full and absolute sovereignty of a state in the air space above its territory. It should be pointed

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[29] Myres S. McDougal and Leon Lipson, "Perspectives for a Law of Outer Space," in, Myres S. McDougal, et al., Studies in World Public Order, (New Haven: Yale Press, 1960), pp. 918-919.

[30] Bloomfield, ed., Outer Space, p. 156.

out, however, that the term air space was never adequately defined. [31] The very nature of outer space, the non-existence of definable boundaries or sub-divisions, and the ability of craft to move through the medium at such tremendous speeds, presents problems that have not been encountered in international affairs prior to the age of space. At this moment in time, the problem is somewhat less complicated than it could become simply because only the Soviet Union and the United States have succeeded in placing objects into orbital flight around the earth. It is obvious that both the United States and the Soviet Union are weighing the problems of outer space. It has already become clear to both governments that the use of outer space can include military activities. This observation alone illustrates a pressing need for definition and control of the medium in the interest of the international community. Other international problems have been surmounted and the solution to the problem of delimiting and controlling outer space will be possible with foresight and an energetic dedication of the international community to the task that now confronts it.

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[31] Jessup and Taubenfeld, Controls for Outer Space, pp. 201-202.

The problem of space law. The development of effective space law for the control and use of outer space will depend on the cooperative efforts of the United States and the Soviet Union working in the closest harmony with the United Nations. There are several types of legal problems that can be anticipated as a result of space exploration efforts. These would probably include claims for the maintenance of minimum order in outer space, claims to exclusive and inclusive use of outer space, claims with respect to fixing boundaries, and claims with respect to deprivations. In addition, there will be the problem of distinguishing the types of activities permitted in outer space, and claims concerning the liability for damage caused by launched space objects. [32]

The formulation of adequate space law can serve not only to promote scientific research and economic progress for the international community, but can also facilitate the growth of a free and peaceful world order. The fact that there has been little progress made so far in the development of space law is emphasized by Professor F.B. Schick in an article in the Bulletin of the Atomic Scientists. In this penetrating discussion of the prospects

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[32] McDougal and Lipson, "Perspectives for a Law of Outer Space," pp. 923-926.

for law and order in the realm of outer space he says:

> ...that agreements on certain space activities are better than none and that such agreements are imperative for the continuation of scientific space exploration. Accordingly they can be concluded independently from negotiations for general and complete disarmament. 33

It is reasonable to assume that the principal actors in any future controversy with regard to the use and control of outer space will be nation-states. This assumption can be made because they are the ones with the necessary rocketry techniques and funding to proceed with the space exploration program. This by no means rules out the possibility that private funds will be involved in space launch activities. A case in point is the launching of the communication satellite Telstar, which was basically financed by private capital. It will be recalled that the launching of the satellite was conducted under the auspices of a governmental agency. [34] International organizations also may be given some consideration as probable future participating agencies in outer space, but it appears that their primary function will not be the launching of space objects and the exploration of space, but that they are

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[33] F.B. Schick, "International Law in Outer Space," Bulletin of the Atomic Scientists, (November, 1962), p. 2.

[34] New York Times, July 11, 1962.

more likely to be active in the formulation and application of law governing the use and control of space. [35]

It appears that space law must be procedurally oriented in the sense that it can be directed toward reaching agreement between the United States and the Soviet Union through negotiation. This, of course, does not preclude the adoption of a unilaterally announced and implemented space law by either nation as a matter of protection of their vested interest in the space exploration effort. One of the necessary requirements of effective space law was indicated by Professor Jessup, he said:

> It is perfectly clear that the political game that will develop in space will be governed by the kind of understanding reached, particularly between the Soviet Union and the United States. For us, then, it becomes a question of studying the most advantageous techniques for reaching agreement on space activity. Ultimately this is a question of accomodation and mutual persuasion. [36]

There has been some interest in the possibility of solving the space law problem along the functional approach method. This approach tends to lessen the

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[35] McDougal and Lipson, "Perspectives for a Law of Outer Space," pp. 920-921.

[36] Leon Lipson, "International Political Implications of Activities in Outer Space," Report of a Conference sponsored by the Rand Corporation, R-362-RC, October 23, 1959, p. 80.

problem of boundaries and definition with respect to space. In using the functional approach the particular nation state that is faced with a question of legality of a satellite function can take a committed position on just that one function. For example, if a question arises with respect to a satellite that is probing solely as a scientific function, negotiation and agreement can be effected on this particular function without regard to the nations other satellite functions. This allows flexibility of policy with relationship to other space functions and relieves the immediate legal problem which is under question. [37] Of course, any consideration of space law, space legal agreements, or the evolution of space law will necessarily be concerned with the prospect of military activity in space. However, it appears that strictly military space activities will have to be considered under exclusive national jurisdiction until such time as a treaty on general disarmament can be concluded. [38] The prospects for such an agreement do not appear to be favorable in the near future.

There have been several suggested methods whereby international control and legal administration of outer

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[37] Robert D. Crane, "Planning for Space Legal Policy," Space Flight Report to the Nation, American Rocket Society, (October 9-15, 1961), p. 9.

[38] Schick, "International Law in Outer Space," p. 5.

space might be achieved. The previously mentioned system of the evolution of a space law system based on the concept of functionalism can be useful and meaningful in certain respects, but on the other hand the concept is bound by certain limitations. As Professors Jessup and Taubenfeld point out:

> What functional cooperation, however beneficial, cannot provide is assurance of the national security of the states of the world—that activities of man in outer space and on the other celestial bodies will be peaceful. This is a crucial omission. Further, the critical question whether peaceful and military activities in outer space can in fact be segregated must still be posed. If the answer is "no," the feasibility of the use of functional arrangements as a substitute for an over-all political regime must again be questioned. 39

In viewing functionalism as a solution to the pressing need for control and law in the use of outer space, however, we can read other comments that support the concept and consider it to be, if not satisfactory as a starting point, at least adequate until further steps can be taken. For example, Professor Schick feels that functionalism must underlie modern space law, and in the article, "International Law in Outer Space," which was quoted earlier in this chapter he makes a good case

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39 Jessup and Taubenfeld, Controls for Outer Space, p. 268.

for his position that the concept of functionalism merits the close scrutiny of the international community. He says:

> The functional concept for a space law will also facilitate agreement on advance information about the purpose, time, place, and anticipated orbit of launchings into space, since such launchings could vitally affect the very existence of other states. The same applies to international information concerning the payloads of certain space vehicles, to the problem of identifying space vehicles, to the safe return of such vehicles and their crew from foreign jurisdiction, and to the need for agreement on legal responsibility of the launching state for damages caused by its activities. Even the urgent need for agreement on the type of information to be made universally available without delay is an example in support of space functionalism. 40

In the initial effort to discern some approach to settlement of the problem of space law, analogy was frequently drawn between Antarctica and outer space in terms of their territorial status. This analogy, however, has lost much of its pertinence since the unanimous adoption of the December 20, 1961, United Nations Resolution on International Cooperation in the Peaceful Uses of Outer Space. This resolution provides that: "Outer space and celestial bodies are free for exploration and use by all states in conformity with international law and are not subject to national

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40 Schick, p. 4.

appropriation;..." [41] This is a stronger source of international law for space than mere analogy with Antarctica, and provides not for a mere thirty years moratorium on further territorial claims as does the Antarctica Treaty, [42] but for a permanent renunciation of all such claims in space.

Clearly, the problem of defining space, agreeing on the boundaries in space, and providing effective space law to govern outer space are problems that are pressing the international community for solution. The way to the solution of these problems is not clear, but the mounting evidence indicates that hope for timely and adequate solution rests largely with the United Nations. The really vital organ is the Committee on the Peaceful Uses of Outer Space. In the following chapter the origin, history, function, achievements, and tasks of the Committee will be discussed in detail. This chapter will reveal the importance of the agency as the most likely source of solution to the international problems in outer space.

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[41] United Nations General Assembly, "Resolutions Adopted by the General Assembly," A/RES/1721 (XVI), January 3, 1962, p. 1.

[42] Taubenfeld, "A Treaty for Antarctica," Article XII, p. 321.

CHAPTER IV

THE UNITED NATIONS COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE

Origin and history of the Committee. The United Nations interest in the peaceful uses of outer space was first formally expressed in a resolution adopted by the General Assembly at its twelfth session. This action occurred a little over a month after the first man-made object was placed into orbit around the earth. The resolution voted by the Assembly on November 14, 1957, was aimed at urging states to give priority to a disarmament agreement. The agreement was to provide, among other things, for joint study of an inspection system designed to insure that the sending of objects through outer space would be for peaceful and scientific purposes. [1]

The Sub-Committee did not consider the matter, but in the course of the year two items relating to various aspects of the peaceful uses of outer space were proposed

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[1] United Nations Review, Vol. 4, No. 16, (December, 1957), p. 56.

for inclusion in the agenda of the Assembly's thirteenth session. The first, was presented by the Soviet Union on March 15, 1958, and was directed toward the discussion of"the banning of the use of cosmic space for military purposes, the elimination of foreign military bases on the territories of other countries, and international cooperation in the study of cosmic space." [2]

When the two items were discussed at the thirteenth session under the general heading "question of the peaceful uses of outer space," two draft resolutions,which were considerably different in approach and emphasis, were submitted to the Assembly's Political Committee, to which the question had been referred. Under the first draft submitted by the Soviet Union, the Assembly would recognize the need for a four point international agreement to include a ban on the use of outer space for military purposes; the elimination of foreign military bases on the territories of other countries; the establishment of appropriate military control over the carrying out of these obligations; and the establishment of a United Nations agency for international cooperation in the study of cosmic space. [3]

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[2] United Nations, Official Records of the General Assembly, Thirteenth Session, Agenda item 60, (New York: United Nations, September 16, to December 13, 1958, and February 20, to March 13, 1959), p. 4.

[3] Ibid., p. 3.

The second draft was submitted by twenty members: Australia, Belgium, Bolivia, Canada, Denmark, France, Guatemala, Ireland, Italy, Japan, Nepal, the Netherlands, New Zealand, Sweden, Turkey, The Union of South Africa, The United Kingdom, the United States, Uruguay, and Venezuela. This draft proposed the establishment of an ad hoc committee to report to the Assembly's next session on the activities and resources of the United Nations, the specialized agencies, and other international bodies relating to the peaceful uses of outer space. In addition, the committee was to investigate areas of possible cooperation in this field that would be to the benefit of all nations regardless of economic status. Finally, the committee was to consider future United Nations organizational arrangements to facilitate cooperation in space matters and look into the nature of legal problems that might arise in carrying out programs of space exploration. [4]

During the debate the Soviet Union submitted a revised text of its draft resolution which omitted its previous stipulation that any question of outer space should be linked with an agreement for the prohibition of the launching of rockets into outer space for military purposes and for the elimination of all military

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[4] Ibid., pp. 5-6.

bases on foreign territory. The revised proposal called for the establishment of an international committee within the framework of the United Nations, for cooperation in the study of cosmic space for peaceful purposes, and for the appointment of an eleven member preparatory group to work out the program and rules of the committee. The committee was to have three main functions: (1) continuation of the cosmic space research being carried on as part of the International Geophysical Year; (2) organization of the exchange and dissemination of information on space research; and (3) coordination of national research programs. The sponsors of the twenty-power draft also revised their text to incorporate those elements of the revised Soviet proposal which were in their view consistent with their original concept. In particular, they proposed that the ad hoc committee should study, in addition to the items in the first draft, the functions of the preparatory group proposed by the Soviet Union. [5]

In the discussion that followed these proposals attention was centered on the membership of the proposed ad hoc committee. There was general agreement that the committee should include the countries most advanced in space exploration, but despite considerable discussion between the United States and the Soviet

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[5] Ibid., pp. 6-8.

Union, a basis for the selection of members was not established. Near the end of the discussion, the Soviet representative withdrew his draft resolution, which he contended, had been submitted in the interest of conciliation and as a basis for unanimous decision, and it appeared unlikely that it would achieve these purposes. The twenty power draft was then put to a vote and was adopted in committee by a vote of fifty-four to nine with eighteen abstentions. After the vote, Czechoslovakia and the Soviet Union announced that they would not participate in the work of the ad hoc committee because the proposal adopted represented an attempt to impose on the Assembly a membership for the committee which made fruitful cooperation impossible. [6]

On December 13, the draft was adopted by the Assembly as Resolution 1348 (XIII). The resolution established an ad hoc Committee on the Peaceful Uses of Outer Space, composed of the representatives of Argentina, Australia, Belgium, Brazil, Canada, Czechoslovakia, France, India, Iran, Italy, Japan, Mexico, Poland, Sweden, the Union of Soviet Socialist Republics, the United Arab Republic, the United Kingdom and the United States. The Committee was asked to report to the Assembly at its fourteenth session on the

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[6] Ibid., pp. 7-8.

activities and resources of the United Nations, the specialized agencies, and the other international bodies relating to the peaceful uses of outer space. It was also asked to investigate the programs of space exploration for peaceful purposes that could be undertaken under the auspices of the United Nations.

The Committee was instructed to take into account the following proposals: (1) continuation of the outer space research being carried on within the framework of the International Geophysical Year; (2) the possibility of organizing for the mucual exchange and dissemination of information on outer space research; and (3) the coordination and assistance of national research programs. Additionally, the Committee was to consider future international arrangements to accomplish international cooperation within the framework of the United Nations and legal problems that might arise out of space exploration efforts. [7]

The ad hoc Committee which was established by resolution 1348 (XIII) met from May 6, to June 25, 1959. Czechoslovakia, Poland, and the Soviet Union, which had voted against the resolution in the General Assembly, and India and the United Arab Republic, which had abstained, did not take part in the Committee's work.

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[7] United Nations, Yearbook of the United Nations, 1959, pp. 24-25.

The Committee's report on various scientific, technical, legal and organizational matters referred to it was submitted to the General Assembly, discussed and considered by the Assembly's Political Committee, but without positive action at the fourteenth session.

In connection with the ad hoc Committee's report, a draft resolution was submitted by Brazil, Czechoslovakia, France, India, Japan, Poland, Romania, Sweden, the Soviet Union, the United Arab Republic and the United States. The draft proposed the establishment of a twenty-four member Committee on the Peaceful Uses of Outer Space, composed of, Albania, Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Czechoslovakia, France, Hungary, India, Iran, Italy, Japan, Lebanon, Mexico, Poland, Romania, Sweden, the Soviet Union, the United Arab Republic, the United Kingdom, and the United States. [8]

The Committee, whose members were to serve during 1960 and 1961, was given the task of analyzing the appropriate areas of international cooperation with the idea of determining the feasibility of establishing programs in the peaceful uses of outer space which could be undertaken under the auspices of the United Nations. The investigation was to consider the assistance

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[8] Ibid., p. 27.

or continuation on a permanent basis of the outer space research carried on in the International Geophysical Year. They were also to consider the development of an organization for the exchange and dissemination of information on outer space research and to encourage the development of national research programs. Finally, the Committee was to look into the aspect of legal problems that might arise from the exploration of outer space and to report on its activities to subsequent sessions of the General Assembly. The draft resolution gained wide support and was adopted by the General Assembly with no objections as Resolution 1472 (XVI) on December 12, 1959. [9]

This was the beginning of the United Nations Committee on the Peaceful Uses of Outer Space. The significance of the establishment of this committee under the auspices of the United Nations is marked by the fact that this was the first fruitful result of man's efforts to create the necessary machinery to cope with the complex problems involved in the use and control of outer space. The establishment of this committee is a major step in the direction of solving the problems in the use and control of outer space.

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[9] United Nations Review, Vol. 6, No. 7, (January, 1960), pp. 62-63.

The function and achievements of the Committee. The new Committee on the Peaceful Uses of Outer Space did not meet until November 27, 1961, due to disagreement between members on various procedural matters.[10] The first meeting was convened by the Acting Secretary-General after consultations with members in response to requests he had received from some of them. The Committee held an organizational meeting, elected its officers, and, after hearing statements by the Acting Secretary-General and several delegations, adopted a factual report to the General Assembly. The long delay in progress of the Committee was due to an inability of the United States and the Soviet Union to agree on issues regarding officers of the Committee and the voting procedure. This disagreement between the two powers stemmed, in part at least, from the fact that the Soviet Union was aware of its superior position in the race for space. Donald Cox surmises that the delaying tactics of the Soviets was held to be intentional by some observers. He says,"Competent U.N. observers surmised that the Soviet Union, in view of its lead over the U.S. in outer space, did not want a space conference held until 1961 at the earliest—or until

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[10] United Nations Review, Vol. 8, No. 12, (December, 1961), pp. 1-2.

it put one of its cosmonauts in orbit." [11] However, if this was the case, it appears that the delay would have ceased in April, 1961, when the first Russian had orbited the earth.

The report of the Committee was discussed by the Political Committee of the General Assembly at its fifteenth session in December, 1961. Several of the members expressed regret that the Committee had been unable to make progress, and a number of suggestions were made regarding the taking of decisions in the Committee. The representatives of the Soviet Union and Czechoslovakia suggested that experience in the Committee for Space Research (COSPAR) and the International Conference on Antarctica indicated that cooperation in outer space matters could best be achieved on the basis of joint decisions by the Powers principally concerned.

An expression of regret was voiced concerning the absence of the Soviet Union from the sponsors of a joint draft resolution which had been submitted by Australia, Canada, Italy and the United States. A revision of that draft, submitted jointly by the delegations of the twenty-four members of the Committee

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[11] Cox, The Space Race, p. 300.

on the Peaceful Uses of Outer Space, after consultations between the United States, the Soviet Union, and other delegations, took into consideration a number of points which had been made in the debate. Among other things it proposed to add four new members, Chad, Mongolia, Morocco, and Sierra Leone, to the Committee and to reflect the increase in the membership of the United Nations since the fourteenth session. The revised draft, as modified to reflect the consensus of the Powers mainly interested in outer space, was unanimously adopted by the General Assembly as Resolution 1721 (XVI) on December 20, 1961. [12]

The Resolution 1721 (XVI) which was passed by the General Assembly, in addition to continuing and expanding the membership of the Committee on the Peaceful Uses of Outer Space, provided certain other functions to be accomplished by the Committee. These functions were outlined in five parts in the resolution. Part A invited the enlarged Committee to study and report on the legal problems arising from the exploration and use of outer space. Accordingly, two principles were offered for the guidance of the States: (1) international law including the United Nations Charter; and (2) outer space and celestial bodies are free for exploration

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[12] United Nations Review, Vol. 9, No. 1, (January, 1962), pp. 11-12.

and use by all States in conformity with international law and are not subject to international appropriation. Part B called upon States launching objects into orbit or beyond to furnish information promptly to the Secretary-General, who was to maintain a public registry of information. The Committee was also requested to maintain contact with organizations involved in space matters and arrange for the exchange of information supplied by governments. Part C referred to the meteorological applications of advances in outer space and requested the WMO to prepare a report, in consultation with other specialized agencies and governmental and non-governmental agencies for early submission to the Economic and Social Council and to the Committee for review and transmission to the General Assembly. Part D invited the Expanded Program of Technical Assistance and the Special Fund to give favorable consideration to requests from Member States for assistance in developing their communication facilities in order to make effective use of outer space. Part E of the resolution continued and expanded the membership of the Committee and requested it to meet not later than March 31, 1962. [13]

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[13] United Nations General Assembly, Resolutions Adopted by the General Assembly, Sixteenth Session, Agenda Item 21, A/RES/1721 (XVI), January 3, 1962, pp. 1-5.

The expanded Committee on the Peaceful Uses of Outer Space was convened on March 19, 1962 and, after unanimously re-electing its retiring officers, held a series of eight meetings devoted to the programs and organization of the work of the Committee. During the Discussion, statements were made by all members of the Committee and by the Acting Secretary-General. The Committee also heard statements by representatives of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Meteorological Organization (WMO), the International Telecommunication Union (ITU), and the Committee on Space Research (COSPAR), which had been invited to participate in the work as observers. [14]

This series of meetings was concluded with the ninth meeting of the Committee which was held on March 29, 1962. In a concluding statement, the Chairman noted with satisfaction the atmosphere of cordiality and mutual cooperation which had prevailed during the discussions. The latter had, he believed, re-emphasized the necessity and possibility of international cooperation in the peaceful use and exploration of outer space. There had been general agreement that such cooperation would contribute substantially to the growth of mutual

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[14] United Nations Document A/5181, p. 3.

understanding and the consolidation of friendly relations among nations. In that respect, many delegations had, he noted, expressed deep satisfaction at the exchange of messages between the Chairman of the Council of Ministers of the Soviet Union and the President of the United States as prospects of concrete projects in the field of exploration and use of outer space for peaceful purposes. Many specific proposals and suggestions had been made by members of the Committee concerning scientific, technical, and legal studies and, for detailed study of those matters, and in accordance with resolutions 1472 (XIV), and 1721 (XVI), the Committee was creating a scientific and technical and a legal sub-committee, both composed of all members of the Committee. [15]

The Committee also noted the substantial role of the specialized agencies—WMO, ITU, UNESCO, and of COSPAR in promoting and facilitating international cooperation in the field of space research for peaceful purposes. The Committee also arrived at the conclusion that the aim of its work should be the coordination of activities carried out by the specialized agencies and by the governmental and non-governmental organizations in the field of the exploration and use of outer space for peaceful purposes. The Committee further decided

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[15] Ibid., Annex I, p. 1.

that it should organize its work so as to assist in the study of measures for the promotion of international cooperation in outer space activities. The Committee was to maintain close contact with all agencies concerned with outer space matters and asked the Secretary-General to prepare a survey of agencies for that purpose. [16]

The Committee was reconvened at the United Nations Headquarters on September 10, 1962, and held seven meetings between that date and September 14. During this series of meetings consideration was given to the report of the Scientific and Technical Sub-Committee on the work of its first session, along with the reports prepared by the WMO and the ITU. The resolution concerning international cooperation in the peaceful uses of outer space adopted by the Economic and Social Council on August 2, 1962, at its thirty-fourth session was also considered at this time. The most important aspect of this series of meetings was the approval by the Committee of a recommendation for the establishment under United Nations auspices of an international equatorial sounding rocket [17] launching facility for the use of all States

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[16] Ibid., Annex I, p. 2.

[17] Sounding rockets may be of one or more stages. Generally speaking they are designed to reach altitudes up to 4000 miles and return data to earth. If they exceed 4000 miles they are designated as space probes.

who wish to cooperate in the use of outer space for peaceful purposes. The Committee noted with interest that the government of India expressed an interest in being the host State for such a facility on the terms proposed by the Scientific and Technical Sub-Committee. India stated that it should be understood that the project would be a United Nations project in which the principal Powers concerned would cooperate. [18]

The full recommendations of the Scientific and Technical Sub-Committee which were approved by the Committee on the Peaceful Uses of Outer Space are much too extensive to be covered in detail in this study. However, for those wishing to pursue the subject in detail, the full report is included in the United Nations Document Number A/5181, which has been cited here. Herein, it suffices to say that in addition to the recommendation for the establishment of the international equatorial sounding rocket launching facility, the Sub-Committee embraced the concepts of exchange of information, encouragement of international space programs, and the dependence of the Committee upon the specialized agencies to the fullest extent possible. These meetings concluded on September 14, 1962, on a harmonious note. [19]

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[18] United Nations Review, Vol. 9, No. 10, (October, 1962), pp. 18-20, and 34.

[19] United Nations Document, A/5181, pp. 8-14.

The tasks before the Committee. With the space exploration effort moving forward at a technological pace unequaled in this century, the question of the tasks that are confronting the international community and how these tasks will be accomplished becomes more pressing with the launching of each object into outer space. These tasks, as I see it, are rapidly becoming the responsibility of the United Nations Committee on the Peaceful Uses of Outer Space. I have drawn this conclusion because there is no other organization on the present international scene that has any capability for the resolution of the problems created by the age of space other than the United Nations.

There are several areas wherein a pressing need for international agreement is necessary if the space exploration program is to proceed in an orderly and controlled fashion. A crucial action that must take place soon, with hundreds of manned and unmanned satellites programmed for launching in the future is the regulation of radio communication. According to Dr. Franz Matsch in his opening statement before the Committee on September 10, 1962, this was one of the important tasks that lay ahead of the Committee. He told the Committee that, "An important task for this Conference will be the allocation of radio frequency

bands for operational earth satellite systems, together with bands for telemetry etc." [20] A primary example of the problem is the tiny satellite Vanguard I which has been whirling around in stable orbit since March 17, 1958. The satellite has long since performed its useful scientific purpose, but the solar powered transmitter on this tiny satellite continues to beep away, thus cluttering up valuable and limited ultra-high frequency radio channels. The only way to remove such satellites is by means of some sort of anti-satellite satellite. [21]

Another vital area that is overdue for mutual international agreement and which could very well be handled by the Committee in cooperation with the WMO, is the area of weather and the exploitation of new meteorological data that can be provided by weather satellites. The WMO in its report to the Committee in response to resolution 1721 (XVI), proposed the establishment of a system to be called "The World Weather Watch," and stated its purpose to the world would be to serve, "...as a cooperative global meteorological observing and prediction system designed to assist meteorological services of the world to discharge

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20 Ibid., Annex II, p. 3.

21 Cox, The Space Race, p. 292.

their responsibilities without each service having to perform all the steps needed for this purpose." [22] In the report, the WMO outlined detailed information for the organization and financing of such an organization and declared that it would be called "WWW." The report also emphasizes the fact that now, with the introduction of earth orbiting satellites, meteorologists have for the first time a global platform from which to observe the entire earth's atmosphere and to take advantage of the syntheses performed by nature in organizing cloud systems as indicators of air masses, fronts, jet streams, and storms. [23]

Another area that presents the Committee on the Peaceful Uses of Outer Space with an important task is the area of cooperation of nations taking part in joint space functions. The discussion of the launching of the communication satellite Telstar indicated that this was a joint function that was effectively handled by national agreements. However, in this discussion, the reference is to functions which are conducted by nation-states on a joint cooperative basis. This type

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[22] World Meteorological Organization, First Report on the Advancement of Atmospheric Sciences and Their Application in the Light of Developments in Outer Space, (Geneva, Switzerland: Secretariat of the WMO, 1962), p. 20.

[23] Ibid., p. 24.

of joint international function has already been accomplished by States on an individual basis, but not under United Nations auspices. For example, in July, 1960, a "piggy-back" satellite was launched as the result of United States-Canadian agreement. Part of the payload was designed and built in Canada. Again last year (1962), an international satellite built in Britain was launched at Cape Canaveral, Florida. [24] These launches exemplify the feasibility of international cooperation in joint space exploration efforts. The important factor is that in order for nations of the world to share in the benefits, the projects should be unified under the guidance of the United Nations.

Finally, a most important task that lies ahead of the Committee is the establishment of adequate space law to guide the States in the use and control of outer space. The legal problems facing the international community with respect to space were covered in the previous chapter. However, at that point the importance of the Committee on the Peaceful Uses of Outer Space and its function in this area was left for discussion in this section of the study. The legal Sub-Committee was established in March, 1962. The purpose of the Sub-Committee was to make a detailed study of the legal

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[24] Cox, The Space Race, p. 294.

problems which might arise from the exploration and use of outer space. During the series of meetings held by the Committee in September, 1962, five proposals were submitted to the Sub-Committee for consideration. Unfortunately, the Sub-Committee could never reach agreement on any of the proposals and they were submitted to the General Assembly for subsequent consideration. [25] Irrespective of the fact that there was no agreement among the several member nations of the Committee on the five proposals submitted, the vital nature of the tasks for this Sub-Committee is still apparent.

The significance of the Committee on the Peaceful Uses of Outer Space lies in the fact that it is an international body created under the auspices of the United Nations. The growth and effectiveness of the Committee will depend on its success in solving the problems that have arisen in the international community as a result of space exploration. The fact that the Committee has been organized, is in motion, and has recognized that the problems in space do exist is encouraging. The future of successful space exploration efforts will depend, to a large degree, on the success of this vital Committee.

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[25] United Nations Document Number, A/5181, p. 14.

CHAPTER V

CONCLUSIONS

The age of space is dated from October 4, 1957, by the spectacular achievement of the Soviet Union hurling the first man-made satellite into orbit. A feeling of elation at man's accomplishment saturated the entire international community. As the efforts in space have become more spectacular, and man himself has revolved around the earth, the pride of people in their space accomplishments have become even more pronounced. However, as man has protruded further into the realms of outer space he has indeed created some problems for the international community that were non-existent in the pre-space exploration age.

The present study has been an effort to identify the problems that man has created for the international community through his achievements in space. This has been done by tracing his evolutionary progress in space exploration, identifying and analyzing the problems that face the international community concerning the use and control of outer space as space exploration moves forward and finally, considering the efforts of the international

community to resolve these problems primarily through the United Nations and especially the Committee on the Peaceful Uses of Outer Space. There has been no intent in this study to provide a solution to the problems in the use and control of outer space.

Obviously, some of the problems that face the international community with respect to the use and control of outer space are not entirely new. For example, the problem of boundaries in outer space has been encountered in terms of boundaries on the high seas. Available evidence permits one to conclude that the drawing of boundaries in space is much more confusing and will be difficult to handle by any means other than an international agreement for joint use of the medium by the members of the international community. This very fact lends importance to the requirement that the services of the Committee on the Peaceful Uses of Outer Space be used in the resolution of the problem of control of outer space.

There has been little discussion by the members of the international community concerning the military aspect of the space medium. However, the facts before the world relate that the field of outer space is rich with opportunities for military exploitation for those nations with the technological skill and other resources available

to take advantage of the medium. In fact, each time an intercontinental ballistic missile is tested by either the United States or the Soviet Union it travels through what is now considered as outer space even though the boundaries are not clearly drawn. The tremendous significance of the U-2 incident permits one to conclude that the problem of military exploitation of space is a problem to be dealt with by the international community.

Undoubtedly, immeasurable benefits can accrue to mankind as a result of his efforts in traversing the vast reaches of outer space. The most important of these have been mentioned throughout the study. For example, the broadening of the knowledge of the universe through manned space flights and deep space probes. The possibility of world-wide mass communication networks through communication satellites such as Telstar and Relay, and the evolution of a world-wide weather watch system will surely benefit mankind. The possibility that exists for accelerated mail delivery around the world by spacecraft and the accelerated travel of man himself to widely separated nations in a matter of only a few minutes is intriguing and provides a real challenge. One can conclude that man stands to benefit from his efforts in space exploration if the efforts are channeled in the proper direction.

Clearly, the problem of law for outer space exists and the problem becomes more pressing as man intensifies his efforts to explore the outermost reaches of the universe. The problems of liability for damage, the return of space personnel and vehicles, and the allocation of radio frequencies are some of the problems that face the international community now and demand the development of adequate space law. In addition, there are the problems of arbitrary control of weather, nuclear fallout, and the scheduling and announcement of space events before they occur which must be considered in order to provide adequate guidance for the use and control of outer space. At this time, the only international machinery that has been organized for the purpose of solving these and other problems in the use and control of outer space is the Committee on the Peaceful Uses of Outer Space of the United Nations. While the achievements of the Committee have been somewhat less than spectacular to date, it is the only organized agency that is international in scope, is operational, and is addressed to the concept of reaching a solution to the space problems that confront the international community.

History reveals that man's technological achievements result in both benefits and problems for

mankind. He developed the automobile and the requirement for adequate roadways and control evolved. He developed the airplane and was confronted with a need for airways and controlling agencies. In both cases he has met and resolved some of the problems while still others persist. It is conceivable that the international problem of the use and control of outer space will be met and conquered in the same manner, except on an international basis. The most pressing problems will be solved, and undoubtedly, new problems will arise. These new problems will be resolved simply because the real challenge of mankind lies in his ability to meet and solve complex problems.

APPENDIX A

GLOSSARY OF SPACE TERMS

Apogee: The point or position at which a moon or an artificial satellite in its orbit is farthest from its primary.

Artificial Satellite: A man-made object which has been placed in orbit

Astronautics: The science and technology of space flight.

Booster: A propulsion unit which is used in the initial stages of a space flight.

Burnout: The cessation of burning in a rocket, resulting from consumption of the propellants.

Centrifugal Force: The apparent force tending to carry an object away from the center of rotation.

Escape Velocity: The velocity which if attained by an object will permit it to overcome the gravitational pull of the earth. The escape velocity from Earth's gravity field is approximately seven miles per second.

"G" Forces: The forces of gravity as they apply to a body moving through space.

Ionosphere: A layer or region of the atmosphere characterized by ionized gasses.

Lift-off: The moment of departure of a space launch vehicle from the launch pad.

Liquid Propellant: A rocket propellant in liquid form such as liquid oxygen.

Lunar: Of or pertaining to the moon.

NASA: National Aeronautics and Space Administration.

Orbit: Path of a body relative to its primary.

Orbital Velocity: The speed of a body following a closed or open orbit, most commonly applied to elliptical or near-circular orbits.

Payload: That portion of a space flight vehicle that is considered as useful cargo.

Perigee: The point at which a moon or artificial satellite in its orbit is closest to its primary.

Probe: An unmanned projectile sent into space beyond 4000 miles to gather information.

Primary: The body around which a satellite orbits.

Propellant: A liquid or solid substance burned in a rocket for the purpose of developing thrust.

Retro-rocket: A rocket which discharges counter to the direction of flight to retard forward motion.

Satellite: A body moving around a primary.

Space: The part of the universe between celestial bodies.

Thrust: The amount of "push" developed by a rocket and measured in pounds.

Translunar: Beyond the moon.

Weightlessness: Lack of resistance to the effect of gravity. [1]

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[1] The glossary of space terms was compiled from: National Aeronautics and Space Administration, The Challenge of Space Exploration, (Washington: U.S. Government Printing Office, 1959), pp. 45-47.

APPENDIX B

CHRONOLOGY OF SIGNIFICANT SPACE EVENTS

October 4, 1957: Sputnik I, the first man-made satellite was placed in earth orbit by the Soviet Union.

November 3, 1957: Sputnik II, an earth satellite carrying the dog Laika, was launched by the Soviet Union.

January 31, 1958: Explorer I, first satellite placed into orbit around the earth by the United States.

May 15, 1958: Soviet satellite, Sputnik III, weighing approximately 3000 pounds placed into orbit.

January 2, 1959: Lunik I, launched by the Soviet Union with an orbital weight of approximately 3200 pounds.

February 28, 1959: Discoverer I, a 1300 pound satellite placed into a near polar orbit by the United States.

April 13, 1959: Discoverer II, a 1600 pound satellite launched by the United States and achieved near circular polar orbit.

September 12, 1959: The Soviet Union launched Lunik II, which made a lunar impact.

October 4, 1959: The Soviet Union launched Lunik III, a translunar satellite producing the first photos of the moon's far side.

March 11, 1960: The United States launched Pioneer V, which established communications with earth from a distance of 22.5 million miles.

April 1. 1960: The United States launched Tiros I, a video system which relayed cloud cover photos.

May 14, 1960: The Soviet Union launched Sputnik IV, which was designated as a spacecraft.

June 22, 1960: The United States launched two satellites simultaneously with one launch vehicle.

August 10, 1960: The United States launched Discoverer XIII, and recovered the ejected capsule.

August 19,1960: The Soviet Union launched Sputnik V, to successfully test a capsule recovery system. The capsule reportedly contained two dogs, rats, mice, fleas, fungi, water, plants, and seeds.

February 4, 1961: Sputnik VII, was launched by the Soviet Union to test the feasibility of placing a large satellite into a precise orbit. (14,292 Pounds).

February 12, 1961: The Soviet Union launched Sputnik VIII, and launched a 1500 pound satellite from the orbiting Sputnik.

April 12, 1961: Major Yuri Gagarin became the first man in history to orbit the earth in a one orbit flight for the Soviet Union.

May 5, 1961: Commander Alan B. Shepard completed a fifteen minute sub-orbital flight for the United States. The flight achieved an altitude of 115 miles.

July 21, 1961: Captain Virgil I. Grissom completed a sub-orbital flight for the United States almost identical with the flight of Commander Shepard.

August 6, 1961: Major Gherman Titov began an orbital flight for the Soviet Union that lasted twenty-five hours and eighteen minutes, covered a distance of 435,000 miles, and consisted of seventeen orbits.

February 20, 1962: Lieutenant John H. Glenn, Jr., became the first American to orbit the earth when he piloted a space flight for the United States that lasted four hours and fifty-six minutes and consisted of three orbits.

May 24, 1962: Commander M. Scott Carpenter became America's second astronaut to orbit the earth in a three orbit flight similar to the Glenn flight.

July 10, 1962: The communication satellite Telstar, was placed into orbit by the United States permitting the first transoceanic telecast by direct methods.

August 12, 1962: Major Andrian Nikolayev was launched into orbital flight by the Soviet Union. The flight lasted four days and consisted of sixty-four orbits.

August 13, 1962: Lieutenant Colonel Pavel Popavich was launched into tandem orbit with Major Nikolayev by the Soviet Union. The flight lasted almost three days and forty-eight orbits.

August 27, 1962: Mariner II, was launched by the United States to gather scientific data relative to the planet Venus.

October 3, 1962: Commander Walter M. Schirra, Jr., was launched into orbital flight by the United States. The flight lasted nine hours and six orbits.

May 15, 1963: Major L. Gordon Cooper orbited the earth twenty-two times for the United States.

June 14, 1963: Lieutenant Colonel Valery F. Bykovsky began an orbital flight for the Soviet Union that lasted for 81 orbits.

June 16, 1963: The Soviet Union launched the first woman into orbit around the earth. Valentina Tereshkova orbited the earth 48 times. [1]

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[1] All facts were compiled from the New York Times, October 5, 1957, through June 17, 1963.

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