Address by

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It is a great pleasure for me to appear before this fine organization. It is indeed encouraging to know that the wives of the leaders of the aerospace research and industrial teams are contributing their time and effort to help graduate students further their research education. As one who knows of the need for more and more scientists for the United States space program, I compliment you for your important contribution.

It's not often that I have the opportunity to speak to a group of women. In the day-to-day activity at NASA, we sometimes seem to overlook the contribution of women to our programs.

The number of women earning $11,000 or more annually in scientifc jobs in Government has increased drastically in recent years. In NASA, for example, approximately three percent of the engineers and scientists are women. NASA is staffed by Civil Service personnel who have met the basic entrance requirements for the job: those of education, experience, and quality of performance. The reason for the small proportion of women scientists is the relatively small number of applicants.

Regarding women-astronauts, essentially the same situation prevails. NASA has always had the same requirements for both men and women. There has never been discrimination with regard to sex or any other basis. The reason we do not have a woman-astronaut is because none that have the necessary qualifications have made formal and complete application. They must be qualified in both scientific or engineering background, and possess the required test pilot experience.

Incidentally, I might add that the large majority of NASA's women scientists and engineers are successfully combining marriage with their careers in science.

This afternoon, I would like to talk with you about NASA's Manned Space Flight Program, and particularly on the implications and significance of the space program on our society and upon our future.

Few dispute that today we stand at the threshold of a new era. The Industrial Revolution has been the dominant economic and social force in the world for about 200 years, since the advent of Watt's steam engine. It is now being challenged by another force, one which has been characterized as the Third Revolution - the Knowledge Revolution.

In this era of unprecedented change, new knowledge is a kingdom whose wealth cannot be estimated, and a vital natural resource that can never be exhausted. Our reservoir of knowledge has thus become much more than a mere instrument for perpetuating our culture. It has come to be a prime index of our greatness, functioning not only as a source of our strength, but as a measure of our fitness to survive and grow as a nation. For today, knowledge, as much as guns and butter, measures the true power of modern states.

In the very forefront of this "Knowledge Explosion," which is so radically changing our whole way of life here on earth, is man's exploration into space.

This new and dynamic force is a powerful creator of knowledge in many very tangible ways. Man's accomplishments in space have unlocked the human imagination; they have increased man's spirit of adventure and

pioneering; and they have presented him with the greatest scientific and technological challenge of all time - the breaking away from the confines of his local planet.

For a million and a half years there have been man-like creatures on this planet. And during all of these eons, man has been confined to the thin membrane of his Earth's atmosphere. Now, in just the past five and a half years, man has broken these confines.

For some, however, the meaning of this achievement is seen only dimly and superficially. The purposes of space exploration and discovery are no clearer to many men in this age than they were in the days of Galileo.

It does take a great deal of vision to see beyond the initial difficulties of opening a new frontier. No one would pretend to foresee all the changes that will follow in the wake of our explorations and discoveries in space. When he first set foot in the New World, Columbus surely could not have envisioned the America of the Twentieth Century - a land of oil and steel and factories and wheat fields and skyscrapers and 200 million people.

In like manner, it is difficult to evaluate the ultimate results of our exploration into the new environment of space. However, countless examples from history show that it does pay, often in the most unexpected ways, for man to satisfy his natural curiosity. There is absolutely no doubt in my mind that a dynamic space program will ultimately bring rewards in knowledge, wonders, and resources far surpassing the investment

it requires in money, materials, and brainpower. Indeed, the steps that we have taken to date have already moved us to new thresholds in many arenas. In this perspective, space exploration can indeed be one of the bases upon which we will build the future technological structure required to support a progressive, evolutionary society.

Before we examine these ramifications and implications of the space effort, let us pause briefly and examine where we are today in space. The past year and a half has been a period of particularly significant achievement in our Manned Space Flight Programs - Gemini and Apollo. In Gemini, ten successful manned flights have been conducted since March of last year. Eighteen U. S. astronauts have logged nearly 2,000 man hours in space.

We have conducted extensive extravehicular activity. We have demonstrated precision on-time launch capability and precision spacecraft maneuvering, culminating in the world's first rendezvous in space. We have been able to fly two spacecraft in formation and to assemble the Gemini spacecraft with the Agena target vehicle, as a precursor to the assembly of large space stations. We have used the powerful thrust of the Agena's engine to conduct extensive post-docking maneuvers, and to "launch" the spaceship into new and higher orbits.

We have demonstrated controlled spacecraft reentries resulting in increasingly precision landings. And we have performed many significant scientific, technological, and medical experiments. All of these operations are essential to the Apollo lunar mission and to other space operations of the future.

Excellent progress is also being made in the Apollo Program, in which we are working to establish clear United States pre-eminence in space. The work to bring this about is focused on the mission objective of Apollo -- the landing of men on the moon and their safe return, before the end of this decade.

The first major flight mission in the Apollo Program was successfully carried out last February. This key milestone, an unmanned flight test of the three-man Apollo spacecraft and the Saturn I launch vehicle, was followed by two more successful unmanned flights during 1966. We are approaching the next major milestone in the Apollo Program -- the first manned Apollo flight to take place from Cape Kennedy in the First Quarter of 1967.

Work is also progressing toward the flight tests of a much larger space vehicle, the Apollo-Saturn V, which will make the actual lunar flights. The first unmanned flight of this vehicle is scheduled for the second quarter of 1967, with manned flights in 1968, and the first manned lunar mission planned before the end of 1969.

This is one of two crucial years in the Apollo Program and I am happy to report that we are moving ahead rapidly and successfully. We are meeting our key milestones on schedule. This progress is particularly gratifying since Apollo constitutes the largest and most complex scientific, engineering and technological undertaking in the history of the Free World.

It is clear that the immediate objective of our program to open this new space frontier is not sufficent of itself to justify the expenditure of such resources. The real meaning of our space efforts is far greater than the exploration of space, and the new marvels and discoveries to be found in space.

I would like to discuss this broad significance, first in terms of its current impact, and then in terms of the potentials for the future.

The current implications of the space program are immense. In the international arena, for example, our space programs - and Manned Space Flight in particular -- may be considered as a measure of our ability to compete with a formidable rival, and as a criterion of our ability to maintain technological eminence worthy of emulation by other people. And there can be no doubt but that the Soviet Union considers space as a vital element in the Cold War spectrum of conflict.

The influence of our scientific and technological progress and prowess is and has been one of the deciding factors in keeping the Cold War peace over the past 20 years. Scientific and technological capability constitutes a basic source of national power. Pre-eminence in this field is an important instrument in international relations, and influences our dealings with other nations involving peace and freedom in the world.

Our space effort is a vital element in this global competition for pre-eminence, and is increasing our scientific and technological power. Should we fall behind in the area of space technology, we would jeopardize our national interests, on Earth as well as in space.

In our space programs the world sees a nation of great scientific and technological capability. And I mean, quite literally, "sees", since NASA conducts its operations before the eyes of hundreds of millions of people all over the world. These people do not have to take the word of a scientist or an engineer or a politician. They can say: "I saw it myself!"

Let me turn now to the national impact of the space program.

The effect on education in the United States, for example, has been decisive. The space program has served as a focus for the revolution which is still in progress throughout the American educational system. It has done this by establishing new standards and depth in our curricula from the grade school through the post-graduate level. It has challenged and served as a catalyst to bring more of our finest and most creative minds to the teaching profession. We in NASA have supported a program that is producing more than 1,000 new Ph.D.'s a year in all branches of learning.

The Space Age demands and creates a strong and unrelenting pursuit of excellence. Space information, striking a responsive chord in the natural interests and enthusiasms of young men and women, provides and requires the motivation and stimulation to achieve higher standards. I consider this inspiration to the nation's youth as one of the most important side effects of the space program.

The implications of the space program on the future of men on Earth is immense. NASA programs are already yielding knowledge of the weather transcending man's past knowledge. The communications satellites pioneered by NASA are providing communications between men heretofore impossible. Our manned flights have shown the great adaptability of men to space -- it is as though man were meant for space.

Further in the future, our explorations into space will answer vital questions about our solar system and the cosmos as a whole; it will enable us to investigate for life on other planets; and potentially it will give us an understanding of the origin of life itself.

As President Johnson has said, "We expect to explore the moon, not just visit it or photograph it. We plan to explore and chart planets as well. We shall expand our Earth laboratories into space laboratories and extend our national strength into the space dimension."

We do not know all that we shall learn when we are able to place men, instruments, telescopes, and laboratories beyond the envelope of the Earth's atmosphere. But we do know that we shall know a great deal more than we can possibly now know about the reality of which we are a part. In many fields - geology, astronomy, physics, chemistry, biology, to name but a few - we are opening up whole new worlds.

It would be presumptuous of me to forecast the eventual meaning of man's greater knowledge of the universe. A little closer to Earth, however, the impact of space activities has already begun to show up in many areas affecting our daily lives.

For example, let us consider the economic benefits of space at a time when increasing emphasis is being placed on programs to better our country through elimination of poverty, and greater attention to human welfare.

In this connection, we should recall that the space program is being carried out on Earth, in almost every portion of the country, and reaches into almost every corner of American life. It involves not only science and technology, but also every form of ordinary business and professional activity. In fact, only about 15 percent of the people working on the Apollo Program are scientists and engineers.

The space program has created and is helping to create new basic industries for our economy. The number of private companies and space research organizations participating in the space program has grown to more than 20,000. Thousands of companies in turn are selling goods and services to the space-program companies, and untold thousands more are selling to people whose paychecks come from these companies.

From the foregoing, the direct economic impact of the space program is quite obvious. The technology benefits are equally exciting. Whenever a laboratory develops a new scientific concept or a piece of hardware for space purposes, the probability is that the development will turn out to be useful somewhere in Earth-bound life. Over the next 20 years, you will see a fantastic parade of new products, improvements on old ones, and price cuts on expensive ones.

Now, let us turn to the future.

While the current impact of our space program is enormous, the potentials and implications for the future are almost infinite. Through the imaginative use of the capabilities and equipment which we are creating in the Apollo Program, we will be able to carry out a wide variety of missions of direct earthly benefit and of significant scientific values to mankind here on Earth. Let us consider a few of these applications of our space resources.

Use of the space near Earth is already yielding practical dividends and offers the opportunity for world-wide exploitation. In the future, the ability to predict the weather accurately three days in advance, for any spot on Earth, would save billions of dollars annually in agriculture, forestry, and commerce.

Communications satellites have already demonstrated their practicality on a commercial basis. The Ford Foundation recently proposed that a satellite communications system be established for domestic commercial and non-commercial television, which the Foundation predicted would be vastly cheaper than the present system of transmission.

Space technology is also being put to use to survey the Earth's resources to care for the world's growing population. At the present rate of growth, it is estimated that population will double by the year 2000, totaling from six to seven billion people. And in another 35 years, it will double again, totaling from 12 to 14 billion. The daily task of providing adequate food, clothing, and shelter to these multitudes will be unbelievably difficult.

Manned satellites in Earth orbit, equipped with suitable sensing equipment, can search for and monitor the world's natural resources and provide information of great value to national and international agencies concerned with feeding the world's hungry mouths.

For example, the causes of crop diseases, water or mineral imbalances in the soil, may be detected from space. Excess salinity of the soil in cotton fields of Texas showed clearly in photographs made during the Gemini flights.

To offset the growing consumption of surface water, underground rivers could be detected by measuring the tiny differences in soil temperatures above them. Such streams hold thousands of times more water than all known surface rivers. Snowfall may be measured, and spring thaws predicted, for the subsequent control of floods, and for overall management and control of water resources.

These are some of the present and foreseeable benefits of the exploration of space. And I submit that the ultimate benefits, now largely unpredictable, will dwarf these by comparison.

Looking a little further into the future, one can foresee many dramatic and important developments in space exploration. The most notable of these include: the development of large permanent manned space stations, supplied by regular ferry services; the building of "spaceports" around the country; development of recoverable and re-usable launch vehicles and highly maneuverable spacecraft; the establishment

of permanent bases on the moon, similar to those now in use in the Antarctic continent; and, finally, the launching of manned planetary expeditions to Mars, Venus, and beyond.

Space exploration in its broadest meaning and in all of its ramifications has become a powerful force, in and of our nation, exerting great influence upon our present and future - socially, economically,politically, and even morally. It expands our horizons even as it shrinks the world. It is a complex combination of many related elements. It is a broad-based scientific and technological endeavor. It is a creator of new technologies, new techniques, and new methods of management. It has great significance for our national security. It is a stimulus for our econimic and national growth. It is a catalyst to the achievement of the goals of our society. And it provides us with the dimensions of a great challenge - to explore space for the benefit of all mankind.