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LANDON LECTURE

The Exploration of Space

Admiral Richard H. Truly
NASA Administrator

Kansas State University

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December 12, 1990

Alfred M. Landon Lectures on Public Issues
Kansas State University
Manhattan, Kansas

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Kansas State University Alfred M. Landon Lectures on Public Issues

In December 1966, Kansas State University inaugurated a lecture series honoring a most distinguished Kansan and elder statesman, Alfred M. Landon, and exploring the areas of his lifelong interest—public issues. The lectures are a tribute to the late Governor Landon, not only as a governor of Kansas and a nominee for the presidency of the United States, but also as a spokesman of unusual spirit and dedication on public issues.

Jon Wefald, President, Kansas State University
Charles E. Reagan, Chairman, Landon Lecture Series

Kansas State University, 1991
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The Exploration of Space

Admiral Richard H. Truly

Thank you, Dr. Wefald.

NASA people do not get the opportunity to visit the heartland of America very often because virtually all our research and operations centers are along the Atlantic, Gulf, and Pacific coasts. So I especially welcomed your invitation to address this important forum.

Foreign visitors often remark that they did not understand America until they saw the magnitude of the nation's heartland: the great plains, the rich farmland, the towering cities rising along broad rivers. Then the reason for the optimism associated with the American character becomes clear.

Optimism is not the only thing rooted here. You find wisdom, too—especially in Kansas. I can personally vouch for this.

Standing here as the administrator of NASA, and having suffered through a summer of shuttle fuel leaks, the discovery of a myopic space telescope, a budget battle that left us $6 billion short in the space station account over the next five years, I can assure you that your forefathers were realists when they decided that the state motto should be: "To the stars through difficulties."

I knew at least one Kansan who lived by the motto. He was my old space shuttle flying buddy, Joe Henry Engle. Joe Henry and I flew both the space shuttle "Enterprise" and the "Columbia" together, and he never failed to let me know that he was as good as he was because he hailed from "Chapman, by God, Kansas, buckle of the wheat belt."

NASA has other links with this great state. Some are especially strong, like the memory of Dwight Eisenhower, whom you commemorate so eloquently with the museum in Abilene. It was his role to be president when the Soviet Union launched Sputnik and presented the first serious challenge to America's technological preeminence.

Ike was urged to respond with an intense program lodged in the agency already in the forefront of the dangerous U.S.-Soviet competition: the Department of Defense.

But he feared creation of a massive, single-minded, centrally directed American technical bureaucracy so; instead he created a highly visible civilian space agency, my space agency, your space agency, NASA. In his vision it would reflect traditional American values of individual creativity, diversity, elevation of the human spirit, and, especially, openness.

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NASA's other important link to Kansas between our decades-long aeronautics is your aircraft manufacturing industry with famous names like Boeing, Cessna, Beech, and Lear.

Because of the fascination with space exploration, a lot of people forget that the first "A" in NASA stands for aeronautics and a 75-year old flight research program that has been unsurpassed in the world for decades.

If you visit the aircraft manufacturers in Wichita today you will find their products loaded with technology developed by NASA, technology that makes aircraft stronger, safer, faster, and more economical.

An instant in human history

When you think about it, it is astounding to consider what has happened since the Wright Brothers first flew on December 17, 1903.

In 87 years—a mere instant in the million-year history of intelligent beings—we have progressed from the sands of Kitty Hawk to the dusty mountains and deserts of the moon; from Robert Goddard's four-second rocket flight to the passage of the pioneers and the voyagers beyond the planets of our solar system into the void of deep space.

How, against such a long human history, could these great events happen so quickly?

And why here in America? Why did the human race fly first here? Why were Americans the first—and so far only—to walk on another body in space? Why is technological achievement measured against American standards?

I think two factors have distinguished America from the other nations of the world.

First, America was—and is—the land of opportunity. From the beginning, it opened its gates to all people regardless of race, religion, and origin. Today the door remains open, and they still come, bringing their skills, their hopes, their willingness, and their determination.

The other is America's emphasis on freedom: freedom of religion, freedom of speech, freedom of the press, freedom of movement, freedom to choose the government, freedom to make economic decisions, freedom to set your own goals and pursue your own life. Freedom to reach for the stars!

This has been a climate in which new ideas and new capabilities could flourish. And flourish they have. And they have flourished most in this wonderful field of activity—flight—that has filled the lives of all of us.

A revolution in knowledge

Today I want to talk most about the beginning of the exploration of space, about the moment in history you and I share, a period now only 33 years old. It commenced on October 4, 1957, when the Soviet Union showed us all that mankind could break the chains of gravity and place a manmade object in orbit around the earth.

This event has had a profound effect on humanity. It has led to:

- A revolution in global communication made possible by satellites.
- A revolution in all aspects of electronics, including information processing, made possible by the miniaturization driven by space programs.
- A revolution in military intelligence gathering that has helped keep the peace for a generation.
- A revolution in new products and process—in fact, more than 30,000 of them—to simplify life, do away with onerous tasks, save time, and improve the quality of living.
- A revolution in our knowledge of our home planet and our sense of responsibility to preserve those conditions that allow life to flourish.

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The first spacecraft photograph of Earth in its entirety [showed] a beautiful, inviting, but fragile, blue ball suspended very much alone in the harsh, black void of space.

Perhaps the greatest argument ever in behalf of the environment, and against pollution and nuclear war, was the first spacecraft photograph of Earth in its entirety: a beautiful, inviting, but fragile, blue ball suspended very much alone in the harsh, black void of space.

And then [came] the revolution in our knowledge of our solar system and the universe beyond, raising profound questions about mankind's role that have yet to be settled.

Our ancestors looked into the night sky and saw a majestic canopy of changeless stars. Then came the telescope, and the night sky suddenly was transformed. As time moved toward our generation, instruments of great power began to unveil the immensity and complexity of the universe.

Finally, space flight enabled astronomers to place their instruments above the obscuring atmosphere and see all the messages—all the radiation from all sources—the universe was sending us.

A changing view of the universe

This explosion of technical capability changed our view of the universe radically. Today we know it is enormously large and violently dynamic. It is populated by vast structures, like galactic strings and walls. It contains mysterious objects of unimaginable energy, like quasars and black holes.

In our own neighborhood, the solar system, we have visited every planet but Pluto—some several times—and discovered extraordinary things. We have found atmospheres reminiscent of the early earth, evidence of water, active volcanoes, and even the possibility of ancient oceans. We have encountered enormously deep canyons, mountains that dwarf our own, and unimaginably turbulent skies with storms that last for centuries, like Jupiter's great red spot.

We found oxygen locked in the rocks of earth's moon, which someday might be used as propellant. We found Helium 3, which some people believe could help produce energy on earth through fusion.

We succeeded in placing a lander on Mars to analyze the soil. Our orbiters there found evidence of ample frozen subsurface water on the planet. And we found more, so much more, in our initial journey through our solar system.

But we have not found what we really hoped to find—life. Thirty years of robotic and human exploration and observation have failed to disclose life anywhere except here on Earth. The message we have gathered from this failure is this: keep looking, and look harder.

To look out from Earth

Let me tell you where we stand today.

On January 26, 1986, America's space program was rocketing along. We had been flying the world's only returnable space vehicle, the space shuttle, for almost five years. The ability to routinely send large crews into orbit gave a great boost to the life sciences. We had embarked on the new science of microgravity materials processing. We were well along on the design of America's first permanent home in orbit, Space Station Freedom. Our robotic explorers were ranging the solar system. A commercial sector was coming into being. And we had even begun working on the technologies needed for people to return to the moon and explore Mars.

Then, on that day, we had a terrible accident. And not just Challenger; in a few months, two Titan 34-Ds, a Delta, an Atlas, a French Ariane, and a Soviet proton were lost. Here at home, this combination forced us to stop and focus all our attention on what we had done wrong and correct the problems. In the case of the Shuttle, it took two and one-half years, but we did it and resumed human space flight on September 28, 1988.

That flight opened the door to an intense, unprecedented period of activity in all areas of space science.

Magellan is already mapping Venus. Galileo is on the way to Jupiter, and Ulysses is moving out of the solar system's ecliptic plane to examine the poles of the sun. Cassini will orbit Saturn and send a probe to Titan in 1996. Just as Joe Henry and I flew close formation together, the comet rendezvous asteroid flyby mission will fly formation with a comet beginning in the year 2000. Orbiters also will be sent to the moon and Mars to pave the way for human exploration.

We are learning about climate, atmosphere, topology, geology and chemistry, especially the kind that might produce life.

In astrophysics, we will orbit four great observatories to look at the universe across the electromagnetic spectrum—from infrared and gamma rays—with unprecedented resolution and clarity. The first, despite what you

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hear, the Hubble space telescope, is returning excellent science. The gamma ray observatory will fly in April, and the advanced x-ray facility and the space infrared telescope facility will follow.

The cosmic background explorer confirmed predictions based on the big bang theory of creation and produced the first clear picture of our galaxy's center. And after conquering early mechanical problems you just read about, the astronauts and scientists were elated with the data they got, some of which is unique in the history of astronomy.

Our goals in astrophysics are ambitious: to uncover the nature of quasars and black holes, to discover places where life might exist, to learn the age and size of the universe, and to predict its ultimate fate.

Looking back at Earth

To do all I have just described requires us to look out from Earth, but it is just as important to look back.

In the 1990s, virtually every country in the world will participate in an effort to understand how earth's global systems work interactively. The purpose is to give this and future generations the data required to make accurate and timely decisions to prevent further deterioration of the environment.

This effort is *Mission to Planet Earth*. A key American contribution will be the earth observing system, a comprehensive series of polar orbiting spacecraft able to view the earth with a variety of instruments simultaneously. Other spacefaring nations will launch satellites, too.

Another area of intense interest is microgravity science.

Right now 16 NASA centers for the commercial development of space are developing ideas to test in microgravity. Fifty-two universities—including Kansas State University—are associated with these centers, as are 175 corporations, including many of America's largest.

Key to major progress in this area will be Space Station Freedom. It will provide large, well-equipped laboratories without the requirement of returning to Earth every few days. The United States, the European space agency, and Japan will furnish the laboratories.

Another reason, the chief reason, we need Freedom is to learn how the human body and psyche react to long-duration exposure to microgravity. This is the key for that future day when the first human lifts off the launch pad for that inevitable journey to Mars.

As you perhaps have detected, a great deal of our 1990s activities will help set the stage for human expansion beyond Earth orbit. President Bush announced that as a national goal in a talk July 20, 1989, the 20th anniversary of man's first landing on the moon.

In that speech the President called for the completion of Space Station Freedom; then a return to the moon, this time to stay; and then exploration of Mars.

Human exploration, preceded by robots, will expand the frontiers of scientific knowledge by employing our most powerful computer: the human mind. Only the human mind can make giant leaps of inference. Maybe computers will do that someday.

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The correct space program for America

What I have outlined for you this morning obviously is a most ambitious program. Is it the correct space program for America?

Last August we decided to step back and ask that question again. Encouraged by Vice President Quayle, in his role as chairman of the National Space Council, I appointed a committee of distinguished, experienced citizens to review the nation's space program and NASA and make recommendations. The group has completed its work, and last Monday its chairman, Mr. Norman Augustine of Martin Marietta, explained its findings to the press. I am happy to report the committee concluded that "America does want an energetic, affordable, and successful space program."

I am also happy to report that the program this independent group recommended coincides very closely with the programs and policies NASA has been pursuing. The committee stated that the United States should maintain a civil space program balanced among five elements:

- Space science.
- Mission to Planet Earth.
- Mission *from* Planet Earth, first to the Space Station, then to the Moon, and then to Mars with human beings.
- A greatly expanded technology development program.
- Creation of a more robust space transportation system.

While NASA took some lumps in the last two days from a media that seems to have turned NASA-bashing into a journalistic art, the committee said of us: "NASA, and only NASA, realistically possesses the essential critical mass of knowledge and expertise upon which the nation's civil space program can be sustained—and that the task at hand is, therefore, for NASA to focus on making the self-improvements that gird this responsibility."

NASA will study this report in great detail and will live up to its responsibilities. We hope that other organizations with responsibility for the nation's space program will, too.

The need for more technology

Earlier in this talk, I noted how technology invented to get us into space and out to the planets had been transformed by private enterprise into products and processes—and even whole industries—that changed the way we live.

To live permanently in space and on bodies other than earth will require a vast amount of additional new technology. If the past is prolonged, that means another big wave of new products and processes that could have an impact on us is just as great as the impact of microelectronics, computers, communications satellites, and all the rest.

Here are some of the new technologies we are or will be working on to return to the moon and go on to Mars: artificial intelligence, virtual reality, advanced robotics, telepresence and teleoperation, ultra high-strength and high-temperature resistant materials, supercomputers, wireless power transmission, and many others.

And I expect that we will experience a big breakthrough over the next quarter century of space exploration. Benjamin Franklin certainly did not envision New York City lit up at night or our digitized society when he flew a kite in a thunderstorm. And it is doubtful that the folks who dissected the atom realized they had found a new, practical energy source.

Expanding into space sets the stage for discovery, perhaps in medicine, or materials, or energy or transportation.

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Further, another revolution in our understanding of the universe is in the offing. Edwin Hubble unveiled the vastness of an expanding universe. Our orbiting telescopes have shown us how violent this universe is and have disclosed great mysteries to solve, like black holes and quasars.

Now we are lofting telescopes of enormous power. They will radically change our view of time and space again.

The continuing exploration of space will contribute to greater international cooperation. Rising costs and political imperatives are bound to drive spacefaring nations to cooperate. But the real driver, I think, is increasing belief that not nations, but the human race, should undertake the expansion of the planet.

The question of life

Finally, there is the question of life elsewhere.

Is there any? In a sense, everything NASA does seeks to answer that one question. We know one place in the universe where life exists. We have identified its vital components. We know the factors that allow it to flourish.

As we search the solar system with our robots, and scan the sky beyond with our telescopes, we look for similar components and factors.

What if, after having . . . searched for decades, we find nothing? . . . We may come to see ourselves as the sole keepers of the flame with a terrible responsibility to never let it go out.

What if, after having acquired the ability to search, and having searched for decades, we find nothing? Then we will have gained a sobering bit of knowledge. We may come to see ourselves as the sole keepers of the flame with a terrible responsibility to never let it go out.

But suppose, some night, a NASA receiver hears a signal that is unmistakably of intelligent origin?

How would the human race react? Fear by some, and elation by others, certainly. Probably a heightened sense of humanity. Maybe an end to certain conflicts which suddenly seem trivial.

But one thing for sure. The human race would be off on another great adventure—a learning adventure.

We would become eavesdroppers on an unprecedented scale, listening intently to the conversations of another civilization. We would want to know what they are like physically and intellectually, where they get their energy, how they combat disease, how and where they travel, what natural resources they have and how they use them, what traditions they hold dear and gods they hold sacred.

This certainly would happen because, if nothing else, mankind is curious. It has been all its existence. More than anything else, curiosity impelled folks over the next hill, across the next river, across the oceans, then the continents, then into the atmosphere, and now into space. Soon it will drive us to the next planet and then its moons, and then on to the next and the next.

Your invitation to me to deliver the Alfred M. Landon Lecture today has been an honor I will not forget. The opportunity for me to return to the center of this land I love has been a pleasure of immense proportions.

Thank you.

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Governor George Romney
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