"TOWARD THE NEXT MILLENNIUM: A VISION FOR SPACESHIP EARTH"

by NASA Administrator Daniel S. Goldin
World Space Congress
September 2, 1992

In this International Space Year, our world is far different than the one Christopher Columbus knew 500 years ago. Indeed, it's far different than just a few years ago.

35 years ago, when Sputnik was launched and the Space Age began, the Soviet Union and the United States were bitter rivals. Today, our planet is no longer divided into camps. The Berlin Wall has been reduced to a pile of souvenirs. Repressive governments around the world are receding in favor of democracy. And while there are still conflicts, the threat of global nuclear war has greatly diminished.

What does this mean for the future of space exploration? It presents challenges, but also new opportunities. Foremost among these opportunities is Western cooperation with Russia. I went to Russia in July to begin exploring the possibilities. Tom Stafford, who was on the Apollo-Soyuz flight, was greeted with hugs everywhere we went.

Standing inside the Zagorsk monastery, an old woman of very modest means kept staring at my NASA lapel pin, which she clearly recognized. So I gave it to her, and with tears she told us how space represented the future for her grandchildren. Such is the power of space exploration to inspire people from every walk of life.

We are now negotiating with Russia the details of joint human space flight which will improve both our programs: the flight of a cosmonaut on the space shuttle, an astronaut on Space Station Mir, and docking the American space shuttle with Mir. In parallel, Europe and Japan are studying new cooperation with Russia as well.

The increasingly international character of space has been evident all year long in both the Russian and American programs. In the last 12 months, the very first astronauts from Austria, Britain, and Kazakhstan visited Mir, as well as German and French astronauts.

Last January, an international crew flew aboard the American space shuttle which carried the International Microgravity Laboratory, with experiments from Canada, Europe, Japan and the United States.

Last month, an international crew deployed the European Retrievable Carrier, and carried out experiments with the Tethered Satellite System, a collaboration between the U.S. and Italy. Also last month, the U.S.-French TOPEX/Poseidon mission was launched on Ariane to revolutionize the way we look at the world's oceans and how they affect our weather. We launched the Japanese/American Geotail spacecraft to study the Earth's magnetosphere.

And we are just 10 days away from the launch of the Japanese Spacelab. This is a key precursor mission to our current best example of international cooperation: Space Station Freedom.

Building on the knowledge gained from Mir, Space Station Freedom will be the first outpost on humanity's trail to the stars. That's the place we will begin to understand the long term effects of space on the human body and develop countermeasures to allow interplanetary voyages.

Space Station Freedom is the largest international science and technology project ever undertaken. As such, it stands as a shining example of what we can achieve by working together.

Space Station Freedom will be a unique resource -- an international laboratory orbiting 200 miles above planet Earth, where scientists can systematically study how living organisms and other substances behave in microgravity. Just as Apollo's technology is still paying back benefits to our economies, the scientific progress we expect on Space Station Freedom will pay back dividends on Earth in the form of new technology, new industries, and new jobs, even as we press on to the Moon and to Mars and beyond.

I've been NASA Administrator for five months now, and I've spent most of that time listening. I've visited all but one NASA Center, and listened to NASA employees at all of them. I've talked to the leaders of the world's space agencies, executives of aerospace companies large and small, people in academia, the President and Vice President, Members of Congress, even people I meet in cabs, restaurants and airplanes.

Tonight, I'd like to integrate what I've heard with the thoughts I wrote down the night before I was confirmed for this job. I'd like to sketch for you a vision of what I think we, as a planet, can achieve in space.

Now, a sketch can only be the broad outlines, not the fine details. But I'd like you to open your minds and see the possibilities. Don't put limits on your thoughts, or express with certainty that something is impossible. Because as we've seen in the Space Age's short history, yesterday's impossibility has a way of becoming today's new reality.

And let me stress, I don't have a monopoly on creative new ideas, but these are some of the best I can think of and should spark a debate as we work toward a shared vision.

First, I believe the next international scientific research outpost beyond Space Station Freedom will be on the Moon. The best reason to go back to the lunar surface is not to look down, but to look up, for what we hope to find are not rocks, but planets -- planets around nearby stars.

The Moon is the perfect place for astronomy. On the Moon's thermally and seismically stable surface, we can build telescopes and interferometers that are orders of

magnitude beyond what's possible on Earth and in orbit. On the Moon, night-time lasts for 14-days and there's no atmosphere to cloud the view. Super telescopes measuring every frequency -- from gamma rays to radio waves -- could discover a whole universe of knowledge that's invisible to us on Earth.

Suppose an interferometer on the Moon were able to image planets around nearby stars. Then, suppose through spectroscopic analysis we determined that one of those planets was blue, with an atmosphere composed of oxygen, carbon dioxide, ozone, and water vapor.

Imagine what such a discovery would mean. It would alter forever our view of Earth's place in the universe and spawn a whole new scientific discipline: the comparative study of solar systems, perhaps even the comparison of living planets.

Another reason for going back to the Moon is that it has resources that Earth may need some day. We don't know exactly what resources are there, but exploring the unknown always yields the unexpected, and offers unlimited possibilities.

For instance, perhaps helium-3 could be mined from the soil to power fusion reactors which have yet to be invented that generate electricity with almost no radioactive byproducts. It's estimated that 25 tons of helium-3 a year could eliminate all the fossil-fuel burning electrical plants in the U.S. 50 years from now.

And since the Moon is only three days away, it's an ideal place to test the space hardware we'll need for the next milestone in human space flight: the exploration of Mars.

We are about to take the next step along the way to the Red Planet. In three weeks, we will launch the Mars Observer to examine the surface characteristics, such as temperature and geology, of Mars. The Russians will send international landers in 1994 and 1996. Then NASA's MESUR, the Mars Environmental Survey, can put a series of landers, some with micro-rovers, to study surface features, weather, and seismic activity. Unlike the Viking landers, which of necessity landed in safe, but relatively barren spots, these new landers will head for the more risky and challenging areas of Mars -- such as the areas near the polar caps where water may be present below the surface, hydrothermal hot spots that Mars Observer may find, and dry river gorges. Even if some form of life does not now exist, there may be fossilized remains.

This search for life -- this urge to explore to the very limits of our technology -- is not idle curiosity. It's a biological imperative -- wired right into our DNA. It's what defines us as human beings. It's what made the first homo sapiens leave the warm comfort of Africa and walk to Europe, Scandinavia and Siberia. It's what brought Asians over the Bering Strait into North and South America. It's what made the Polynesians brave the mighty Pacific in their tiny canoes to colonize island after island.

There is something intrinsic to life itself that says, "To grow is to live; to stop is to die." Exploration is part of what we live for. It's how we grow as intelligent beings.

In his book Mission to Mars, Mike Collins wrote: "Call it genes, character, culture, spirit, ethos: by whatever name, it is within us to look up into the night sky and be curious, [and] within us to commit our bodies to follow our eyes."

Going to the Moon and Mars is just the first step in getting to know the neighborhood that is our solar system. I believe it is possible for the people of Earth to send orbiters to map the resources of every major body in the solar system, even Pluto.

We can put landers on those planets and moons, some with micro-rovers. We can look for minerals on asteroids, and check comets for traces of the primordial soup from which the cosmos was formed. We can bring samples back from these bodies to Earth for study. All this can be done in just 20 years.

And I'll throw out a special challenge here. I believe we can build a spacecraft in three years weighing hundreds, not thousands of pounds, and costing a few hundred million dollars, not billions -- and have it arrive at Pluto, the last unexplored planet, in the first years of the 21st century. It can be done.

The secrets of how our solar system, our planet, and life itself began, are written on the planets, moons, asteroids, and comets. By studying them, we can reconstruct the evolution of Earth -- so much of which has been erased from the surface by the forces of erosion, wind, rain, and volcanoes.

Because Earth is just one part of the solar system, it is through studying the rest that we can hope to fully understand Earth's environment and its future.

For instance, Venus is the same size as Earth, but with a runaway greenhouse effect. Why? Mars may have had a dense atmosphere and surface water. What happened to them?

How does solar activity effect our climate? Shortly after Galileo invented the telescope, there was a 70 year period in which almost no sun spots were observed and the Earth experienced what is known as the Little Ice Age. As these questions demonstrate, exploring space helps support Mission to Planet Earth, because what's happening in space affects what's happening on Earth.

To figure out the puzzle of global climate change, we all including the developing nations, have a role to play. Data on the biosphere must be collected from terrestrial sites around the world. Dozens of countries in Latin America, Asia, Africa and elsewhere are already involved. Then from the vantage point of space, dozens of spacecraft will collect complementary data on the atmosphere, oceans, and land. All of this data from Mission to Planet Earth must be widely and easily accessible to researchers in every nation so they can figure out the complex feedback of all these natural systems on

our climate. It's only after we understand these natural processes and cycles, including the sun, that we can isolate what effect human activity has on our environment.

Back in 1968, when Apollo 8 made the first trip around the Moon, those astronauts sent back a picture that changed our world-view forever. For the first time, we saw the Earth as it really is: a small blue planet in the vast black of space. From that distance, you couldn't see international boundaries -- just a thin, cloud-swept atmosphere that is the only thing separating all known life from the emptiness of space. It made us all realize that we are all crew members on a Spaceship called Earth.

Mission to Planet Earth is more than a responsibility -- it's a duty, and a moral commitment to future generations. Because we don't inherit the Earth from our parents; we borrow it from our children.

I have two daughters. The worries I had growing up about nuclear war they now have about the economy and environment. They ask me if they will be able to have as good a life in 20 years as I did -- whether they'll have good jobs and a healthy environment. Their concerns, and the concerns of other children are what caused me to accept my current job, to try and make the world a better place. We are accountable to the people of the world and our children for the science needed to understand climate change.

The international cooperation necessary to explore the Earth, explore the Moon, and send humans to Mars, I believe, can inspire the people of the entire planet to see what can be accomplished if we replace our habit of confrontation with cooperation.

The 1990s are a time of preparation -- a tiny bridge of time between the past thousand years and the next thousand years. Consider how suddenly, as the Horizon Decade of the 1990s arrived, the Cold War ended, and a time of incredible change began.

As one millennium ends and another begins, the nations of the world have the chance to break the cycle of warfare that has marred human history until now and make the new millennium one of peace.

This hope for the future, however, tends to get lost in the rapid changes of the present. Our societies and economies and space programs spent decades in Cold War, and the transition will be hard.

During times of turbulent change, it is tempting for us to resist -- to try holding on the false comfort of a past that no longer exists. Does the world go away when the ostrich sticks its head in the sand, or is it the ostrich that goes away -- and gets left behind?

Yes, we must all take care of our domestic and social concerns, but we must also look outward, look ahead, and move on to the next frontier. It is by reaching out into space -- exploring the unknown -- that we will create inspiration, hope, and opportunity

for growth so that our children will have an even better future than what our parents left us.

Space is the one place that brings out the best in all of us. In the harsh, unforgiving environment of outer space, teamwork and reliance on the work of others is the only means of survival. Think back to Apollo-Soyuz and that first historic handshake in space. One could argue that that simple rendezvous had only symbolic value. But symbols are important. If Apollo-Soyuz is a symbol of what adversaries can do, imagine what friends can do -- what we all can do.

As the members of the Space Agency Forum on the International Space Year make that group permanent, it could serve as a place to promote international cooperation. We need a way to improve the coordination of activities among the leaders of the world's space agencies.

Earlier this week, I met with those leaders and discussed the future of exploration. In an era of tight budgets, duplication and overlap are a luxury we cannot afford. If we intend to complete the exploratory missions I just mentioned in years rather than a good portion of a century, no nation can do it alone. But if each of us is willing to give in a little bit on what we insist on doing and share the burden, then together -- as one planet, one people -- we can coordinate our efforts and resources, and achieve everything I mentioned today.

With a shared vision and an integrated plan, we have the power to inspire the people of the world by launching a New Age of Exploration.

To do it, though, we must change the way we do business. We can't stick with the status quo. We can't stay with the same old programs, the same old contracts, just because they feel comfortable. Corporate and personal interest should not get in the way of moral duty.

Our space agency budgets will not triple to finance this new exploration. Nor should they, because our societies do have other pressing needs. Therefore it is up to us -- the space professionals -- to figure out how to revolutionize the culture of our organizations to carve money for new projects out of existing budgets.

We must push out beyond our comfort zone, and make ourselves build spacecraft smaller, faster, and cheaper. Let's see how many we can build that weigh hundreds*, not thousands of pounds; that use cutting edge technology, not 10-year old technology that plays it safe; that cost tens and hundreds of millions, not billions; and take months and years, not decades, to build and arrive at their destination. Let's be bold and not be afraid. It's OK to take risk when you're pushing the frontiers of the possible.

* An exception would be for instruments, such as gamma ray collectors, that need large mass to function, or the need for large apertures or simultaneity of measurement, which would require a large platform. I don't mean to imply we'll repeal the laws of physics.

Finally, and most importantly, we must remember that our space programs belong to the people of the world. They want to feel a part of it, to experience planetary exploration through the eyes of our spacecraft and human explorers, and have all the scientific discoveries explained to them in understandable language.

When I took this job, President Bush said that too often the only TV pictures Americans see about NASA are the shuttle taking off or landing. He challenged me to more effectively communicate to the public the science NASA that performs, and how it affects peoples' lives. That's a challenge I accepted along with my job. When we send someone into space, it's not one person going, but entire nations -- an entire planet -- that worked together to put them there.

People everywhere have a deep-seated desire for knowledge, and many of our most profound remaining unanswered questions can only be answered in space. How did the universe begin? How did life begin on Earth? Can we tell what Nature and what humans are doing to change our environment? Are we alone, or is there life on other planets? Are there other planets beyond what our earthly telescope can see?

It is through their space programs that the people of the world expect the answers. It is through their space programs that people will find out what's happening to our environment. And it is through their space programs that people will break the bonds that have chained us -- temporarily -- to Earth, and let us establish ourselves as a multi-planetary species.

When I moved into the Administrator's office five months ago, I found a plaque in a display case -- covered with dust. The plaque bore the signatures of Armstrong, Aldrin, and Collins, along with the Apollo 11 patch. On the top, it's written, "Carried to the Moon aboard Apollo 11. Presented to the Mars 1 crew." Finding that plaque struck me like a thunderbolt, for it said more eloquently than anything else could the challenge that awaits the generation who will come and pick up the torch.

As far as I'm concerned, that plaque has been gathering dust long enough. It's time for all of us to get moving and take it to Mars.

And on that first mission to Mars, we'll send another plaque with a picture of Spaceship Earth on it with an inscription that says, "Carried on the first human flight to Mars. Presented to the crew of the first interstellar spacecraft from Earth."

Is there life on Mars? Maybe not now. But there will be.

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