Commencement Address
University of North Dakota
August 3, 2007

George A. Seielstad

The most important statement I can make is to congratulate all you graduates on your accomplishments. I extend my congratulations as well to your parents, siblings, spouses, other relatives, former teachers, and friends who instilled in you an appreciation for the value an education offers.

I will share with you a glimpse of what it means to be on the other side of the teaching-learning enterprise. The reward for faculty is to have the opportunity to interact with young people, including some new ones every year. The way clever ideas arise is most often by looking at the world from a different perspective. Each generation of students enters the University with such a new perspective. . . . along with the boldness to ask probing questions. New dreams, new visions are born by seeing the world with fresh eyes, the kind you came to this University with a few short years ago. So thank you for the perspective you have shared with us, and for the questions you raised.

Today is an occasion to celebrate the educational accomplishment that earned you the degree you are about to receive. You are now certified as a learned person in some particular human endeavor. However, the world is changing at an astonishing pace. So if you are content to rest on the body of knowledge you have acquired here at UND, you will soon be learned about a world that no longer exists. Instead of being learned, for your own good and for the good of the world, be learning . . . for the rest of your life.

It is common at every commencement to warn graduates that they are entering the real world. It's true you will soon launch a career, raise a family, buy a house, join social and community organizations, and do other things that are real aspects of a life. But I actually am going to talk about the Real World, by which I mean the one we live on, Planet Earth. The heart of the message about the planet I want to share with you is this:

> *We humans–all of us collectively–in a very short time on the clock by which Nature operates, have become a colossal force for change on the planet. So large and rapid are the changes we are inflicting that they exceed Earth's ability to sustain them any longer. The time is Now to bring our behavior into consonance with the capacity of the planet to provide not just for our needs, but for the needs of all those who will follow us.*

The good news is that we who have created the problem are also, together, capable of its solution. The human imagination–especially if we tap into all its dimensions that are distributed among the world's great cultures--is so vast, fluid, dynamic, and adaptive, that it is capable of extraordinary inventiveness. Please add your personal ingenuity–one product of your education here–to this globally distributed pool of human imaginativeness.

You are a particularly lucky generation, because you are present at a moment in history

when the opportunity given you is for historical greatness. You matter! The future of everything humanity has accomplished since our intelligence evolved will depend on the wisdom of your actions over the next few years. I am confident you will act wisely.

The reason I am confident is because people have always done the right things when given the right information. As a way to envision what the right information is, let me call upon what I described earlier, your youthful ability to see the world with fresh eyes. The eyes I ask you to adopt are those of an astronaut in space. From that lofty perspective here are some of the things you will notice, in addition to the Earth's breathtaking beauty:

- The protective layer of atmosphere, beneath which are maintained all the conditions that make Earth habitable, is exceedingly thin–in relative dimensions, about the thickness of the skin on an apple.

- Outside that gossamer membrane is the cold, dark emptiness, the near-perfect vacuum of the interplanetary medium–an environment totally hostile to any kind of life.

- The only way an astronaut can survive in that hostile environment is inside a specially constructed spacesuit. The suit must maintain a livable temperature, provide oxygen to breathe, discard the carbon dioxide exhaled, and protect against dangerous radiation. At great expense and using considerable human ingenuity, engineers have succeeded in creating such artificial cocoons–good for survival in space for a matter of hours at best.

- An astronaut in that engineered environment is a spaceship floating in the interplanetary medium. So is the object about which she is orbiting, Spaceship Earth. All those services that had to be engineered for the astronaut's brief benefit are provided free on the Earth–and have been for several billion years. Think of what Nature provides. . . automatically and at no expense to you:
  - Nature moderates the temperature.
  - She purifies water.
  - Creates and stabilizes soil
  - Recycles nutrients
  - Screens out harmful radiation
  - Pollinates plants
  - Provides a gene pool from which future medicines and foods can be drawn
  - Offers opportunities for spiritual renewal

With all the wisdom humans can muster, we have no possibility to engineer a system so benevolent in meeting our fundamental needs indefinitely.

This is a powerful reminder that we need to look at our planet in a new way. Instead of exploiting its natural resources to support every human desire for wealth and glory, let us exploit human resources (among which you are perfect examples) to support responsible planetary stewardship of the natural resources.

To illustrate why we need a different relationship with the planet, let me list a few ways that the world you are graduating into differs from the one into which you were born. Let's focus on the most recent quarter of a century, which is a blink of an eye in the history of the planet:

- Consider the Population. Today's world has 2 billion more people than on the day you were born.

- Also during your lifetimes, a chunk was carved from forests in the tropics equivalent in area to about half the continental U.S.

- The world now consumes 1.4 million more gallons of oil every day than it did a quarter of a century ago, an increase of an astonishing 60%. Since the amount of oil being extracted from the Earth for the first time now exceeds the quantity of new oil being discovered, the supply will one day soon not match the demand . . . at which point the most advanced nations will face a situation with which they have no previous experience.

- The air you breathe today has about 12 percent more carbon dioxide than when you were born. That extra greenhouse gas has helped warm the planet by about three-fourths of a degree (F) in your lifetime. While that may not seem like much, consider that the entire history of civilization dates back only about 10,000 or 12,000 years to the birth of agriculture. Scientific reconstructions of temperature stretching back nearly a million years show that the period of civilized societies coincides with a "sweet spot" in terms of overall warmth and of stability of the global temperature. And by our actions–especially the burning fossil fuels and the denuding of forests–we have just begun to nudge Earth's system out of that sweet spot into unknown territory. A dangerous experiment with an entire planet is underway.

- Our planetary re-engineering is making the world less inviting for other animals, plants and microbes whose intricately linked activities are the foundation of our existence. Today's rate of extinctions is 100-1000 times what it was during the aeons before humans.

The comprehensive perspective from space tells us something about the human family as well. An astronaut does not see sharp boundaries separating nations, all of which are a different color as in an atlas. The political boundaries and the nationalism they embody often set people of one nation-state against those of another. But the boundaries are arbitrary human conventions. In reality, all peoples are on this spaceship together. Although we are one common family, Earth's bounty is not shared in a way that treats all peoples fairly. A billion people on this globe live on less than $1 per day; another two billion on less than $2 per day.

So small is the globe, so tight and rapid is the communications web that carries news from one place to all others, so quick and easy is it to travel between locations, that the ability of a small fraction of the planet's population in the advanced countries to consume most of the resources, to generate most of the pollution, and to accumulate most of the wealth, at the expense of an overwhelmingly large fraction of the population separated from the rich by a chasm of

frightening proportions, is a fiction that cannot be perpetuated forever.

In his book **Collapse**, Jared Diamond made a list of countries where environmental degradation has reached the crisis stage. The list includes:

Afghanistan
Iraq
Pakistan
Somalia
Rwanda
Haiti
Indonesia
And 7 other countries

He also made a list of the most unstable countries politically in the modern world. The two lists are identical. If you made a list of the poorest nations in the world, some of these countries would be on it. As they would on a list of the countries with the **fastest growing populations.**

The point is, the health of an environment, the health of an economy, and the health of a society and its political systems are intertwined. All three must be healthy, or none is.

Acquiring the education you received here at the University of North Dakota is a privilege. But the privilege does carry an obligation: you must commit yourselves to confronting the world's problems. There are no problems beyond your capability to solve. In fact, what you have before you are outstanding opportunities disguised as difficult problems. The facts are that:

- The scientific characterization of the Earth is solid.
- Technologies already exist, and new ones loom on the immediate horizon, the implementation of which would start humanity on a healing path for the planet.
- Your most needed contribution at this historical inflection point is wholehearted acceptance of the moral obligation and the ethical responsibility to be good stewards of the planet.

The moral and ethical foundations on which good stewardship rests have three dimensions. Your challenge, everybody's challenge, is to assure just and equitable treatment:

- Among all the people with whom you will coexist on this small but wondrous planet.
- Between your generation and all the generations that will follow.
- And finally between the human species and all the other species on the planet whose collective enterprise is what maintains an environment in which life can thrive.

Thank you in advance for your responsible planetary stewardship on behalf of today's and tomorrow's citizens of the world, as well as on behalf of our many relatives in the grand family of

life on this vibrant, exuberant planet.

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Biography of George A. Seielstad

Dr. Seielstad is a *summa cum laude* graduate of Dartmouth College (1959) and a recipient of a PhD from the California Institute of Technology (1963). Both degrees were in Physics. Prior to joining the University of North Dakota, he had a long career in radio astronomy, a field he entered while a graduate student. His wish is that every student is as lucky as he, for when he entered the field still in its infancy, his faculty mentors had an idea for a new kind of telescope that would reveal a cosmos that had never been studied before. Every observation was a breakthrough discovery.

Seielstad spent one year after his PhD at the Geophysical Institute of the University of Alaska, then returned to Caltech's Owens Valley Radio Observatory for 19 years. During that time he advanced from postdoctoral fellow to assistant director. In 1986, he was appointed director of the National Radio Astronomy Observatory's Green Bank, West Virginia site. There he concentrated on providing to the next generation of scientists a telescope with which they could advance the frontier beyond the stage Seielstad's generation had carried it. The result is today's Green Bank Telescope, the largest fully steerable and the most versatile radio telescope in the world.

Dr. Seielstad joined the University of North Dakota in 1993 as Assistant Dean for Academic Affairs in what was then called the Center for Aerospace Sciences and is now know as the John D. Odegard School of Aerospace Sciences. He was also appointed Professor in the Space Studies Department. In 1994, then-Dean Odegard appointed Seielstad his Associate Dean, a position he held until 2004. In 1997 Seielstad was named the first Oliver Benediktson Professor of Astrophysics, an endowed chair named after its generous benefactor. In 2006 President Kupchella invited Dr. Seielstad to serve as a Senior Advisor to the President.

During his tenure at the University of North Dakota, Seielstad's interests expanded to include the new discipline of Earth System Science. He founded the Northern Great Plains Center for People and the Environment, the work of which is focused on achieving both a healthy planet and economy. Together with the Center's faculty Seielstad also created a unique graduate degree program in Earth System Science and Policy. The Center for People and the Environment anchored a collaboration with seven other universities called the Upper Midwest Aerospace Consortium. In 2005, the Center for People and the Environment was selected by NASA to operate its premier research aircraft as a national facility. Since then, the aircraft has conducted missions to study Earth's environment in Utah, Mexico, Hawaii, Alaska, Cape Verde, and most recently Costa Rica. It is the University's ambassador to the world.

George Seielstad has published 70 scientific papers, has authored two books, and is writing a third. Beginning in 2003, he serves as Chairman of the Executive Management Board for NASA's Deep Space Network. He also was appointed by the Secretary of Interior to serve on the National Satellite Land Remote Sensing Data Active Archive Advisory Committee from 2003 until 2006.