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"AN EXPERIMENT"

COMMENCEMENT ADDRESS
BY
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Good evening, Provost Samuels, distinguished guests, graduates, members of the faculty, ladies and gentlemen. I am deeply honored to be delivering this Commencement Address as your guest for the 1997 Rutgers-Newark Convocation Exercises. Not only is this a truly momentous occasion for the graduates, it recalls, for many of us, the memories of our own graduation ceremonies as "the place where it all began." We call these proceedings "commencement" exercises--not a time of endings, but a time of beginnings. And I ask you--the beginning of what? What is it that you are beginning today?

Being a physicist, as many of you know, let me propose to the graduates that you are about to begin an experiment--for life, itself, is, for each of you, a grand experiment--replete with hypotheses and parameters and variables and an unknown outcome. But even for those of you graduating with a science degree, this experiment will be like none you have performed before.

In this experiment, you will be both the scientist and the laboratory specimen--both the observer and the subject. You will have many interested audiences. Your peers, your parents, and--I can say with experience as a professor--your former instructors will be watching with rapt interest the outcome of your experiment. But ultimately, the individual holding the greatest stake in the outcome, the person who stands to benefit or suffer the most, is you--each of you.

Like any experiment, we begin this one with a series of questions--lines of inquiry that will help us to form a hypothesis: Who am I? What will my life be? Where will I make my contributions? Many of you, feeling the rush of expectancy for the moment when you finally will hold your diploma, believe that you already have a hypothesis: I will be a mathematician. I will be an artist. I will be an entrepreneur. Let me assure you, in this case, the hypothesis evolves as the experiment progresses.

Consider for a moment the potential variables to be anticipated. Some of you will experience great challenges: career changes, financial hardships, golden opportunities. All of you will face difficult decisions. Some variables you will be able to regulate and contain; others will be beyond your control. Time itself is a pivotal factor in this experiment; not even the wisest among us can tell you for how long you have this laboratory reserved. In the words of Crowfoot, the 19th century Native American warrior and orator:

> What is life? It is the flash of a firefly in the night. It is the breath of the buffalo in the wintertime. It is the little shadow that runs across the grass and loses itself in the sunset.

Lastly, any experiment has parameters, and in this experiment called Life, you must set your own parameters. These are the elements over which you have control--your priorities, your moral and ethical judgments, your level of ambition, your work ethic, your degree of global awareness. By setting these parameters at the outset, you ensure that the conduct of your experiment will not be haphazard. Where will you place your energies? How will you deal with success? With failure? What example will you set for those who follow? These "parameters" will give those you encounter a sense of where you are rooted, as well as a sense of how easily you will be uprooted. These factors make up what I call an individual's "operational vision."

Twenty-nine years ago, in the Spring of 1968, I sat much the same as you are sitting here today, in the Dupont Athletic Center at the Massachusetts Institute of Technology, awaiting the awarding of my Bachelor of Science degree--full of expectancy, knowing that my experiment was about to begin. I had my own hypothesis: "I will be a physicist"--and I felt a sense of accomplishment at having come so far. On that day in 1968, a friend of mine (Dr. Jennifer Rudd) and I were the first African-American women to graduate from MIT. She went on to medical school and is now a physician here in New Jersey. I remained at MIT as a graduate student, and received my Ph.D in theoretical elementary particle physics in 1973.

For the next 18 years, I conducted research in theoretical physics, solid state and quantum physics, and optical physics.

In 1991, I joined Rutgers University, at the New Brunswick/ Piscataway campus, as a Professor of Physics, while remaining a consultant to AT&T Bell Laboratories in semiconductor theory. I continued to do research, to participate in conferences, and to lecture, both in the U.S. and abroad. I had the opportunity to function in a wide range of professional capacities, and I was given a number of appointments, including as a member of the New Jersey Commission on Science and Technology under three Governors: Thomas Kean, Jim Florio, and Christine Todd Whitman. The variables continued to change; my experiment continued to evolve.

In late 1994, President Clinton nominated me to the U.S. Nuclear Regulatory Commission, and stated his intention to name me as Chairman. After confirmation by the U.S. Senate, I took office as a Commissioner in May of 1995, and became the Chairman of the U.S. Nuclear Regulatory Commission on July 2, 1995.

As some of you may know, the Nuclear Regulatory Commission (NRC) is the independent regulatory agency that is responsible, among other things, for ensuring the safety of the nation's 110 nuclear power plants. The NRC charter encompasses the oversight of many other uses of nuclear material as well, including, for example, nuclear medicine, industrial radiography, and licensing the first-of-its-kind U.S. high-level waste repository.

As for <u>my</u> experiment: educated as a physicist, I now find myself in a unique position that combines the roles of Chief Executive Officer, leading policy planner and Commission representative in collegial decision-making, and official spokesperson for the agency on both domestic and international issues.

Having served at the NRC for two years, I can say that the duties of the agency, and of my role as Chairman, are extraordinarily interesting and multifaceted. One might imagine that nothing could be more exclusively technical than the task of ensuring the safety of nuclear power plants: setting and enforcing standards, inspecting to ensure compliance, and performing nuclear safety research. In reality, however, many disciplines are involved in NRC activities. The agency is a crossroads at which technology, law, economics, public policy, national security, and sometimes foreign policy considerations intersect.

Let me give you a few real-world examples of these intersections. One of the critical issues relating to nuclear power, in this country and worldwide, is the permanent disposal of high-level radioactive waste, including spent fuel. Nuclear waste disposal is both a technical issue and one of public policy. We have seen decades of delay in achieving a workable facility for the permanent disposal of nuclear wastes, and this delay has, in turn, had a significant negative effect on public attitudes toward nuclear power.

Based on what we know today, the NRC believes that safe deep geologic disposal of high-level nuclear waste, including spent fuel, is feasible, at least in principle. By law, the U.S. Department of Energy (DOE) is the responsible Federal agency for designing, developing, and constructing a geologic repository for high-level radioactive waste. DOE has the responsibility to accept spent fuel from commercial power reactors, as well as high-level radioactive waste from the defense program, and to dispose of that material in a geologic repository.

The Nuclear Regulatory Commission has the responsibility of licensing the geologic disposal facility, before spent fuel or high-level waste can be accepted at such a repository for disposal. We must determine, once we receive an application from DOE, whether its specific plans for a repository are satisfactory. Try, if you will, to think of another issue with comparably long-term implications--a period measured not just in centuries, but in millennia!

Meanwhile, some utilities are running out of space to store spent fuel at their nuclear power plants. To address that problem, the Congress has been considering several bills under which an interim centralized storage facility would be constructed, also to be licensed by the NRC. This would mean additional responsibilities for the NRC, to license not only such a storage facility, but also certain transportation aspects of the spent fuel movement, including the casks in which the fuel is moved and stored.

Consider another issue, this time with both domestic and international implications. The Department of Energy has a large quantity of surplus nuclear materials from its weapons program. Those materials include plutonium. What should be done with it? Should it be treated as high-level waste and disposed of in a repository, or should it be mixed with uranium and recycled as fuel in nuclear reactors? From the standpoint of maximizing usable resources, the latter course sounds attractive, but for almost two decades, it has been U.S. policy that the dangers of a plutonium fuel cycle are too great--because of the risk of nuclear proliferation and terrorism--to justify recycling. Some have called for a re-examination of that policy. But what about U.S. <u>and</u> Russian <u>surplus</u> weapons-grade plutonium?

In December 1996, the Department of Energy released its plan for surplus weapons-grade plutonium disposition, which involves a two-track strategy. The first course of action would involve mixing the plutonium with glass, in a process called vitrification, and then disposing of it as high-level radioactive waste. The second strategy consists of mixing the plutonium with uranium to create mixed-oxide fuel (or MOX) for use in commercial nuclear reactors. Any recycling of plutonium in this country, or any use of recycled or surplus weapons-grade plutonium in fuel for commercial reactors, would require NRC approval.

The downfall of Communism brought a variety of additional responsibilities to the NRC. For one thing, there are a number of newly independent countries that inherited Soviet-built nuclear power plants. Those nations are mindful not only of the design and operational problems that led to the Chernobyl disaster, but also of the inadequate regulation of nuclear energy in the former Soviet Union. Accordingly, these newly independent states are looking to the United States for advice in setting up regulatory bodies of their own, some modeled on the NRC. We have been providing and continue to provide such assistance to these countries, using funds from the U.S. Agency for International Development (U.S. AID) and other sources to strengthen both the authority and capabilities of their regulatory bodies.

The inadequacies of nuclear regulation in the former Soviet Union have heightened awareness, not just in the U.S., but around the world, of how important it is that regulators have the authority, independence, and resources to do their job. In response to that awareness, I have proposed the formation of an international body of nuclear regulators to focus specifically on the regulatory agenda. This past January, I hosted the initial meeting of a working group of seven nations--France, Germany, Spain, Canada, Japan, the United Kingdom, and the U.S.--to plan for the establishment of a permanent organization. Next Tuesday, I and the other members of this working group will be heading to Paris, where we will establish ourselves as a formal entity, and exchange our first papers on a series of topics related to international nuclear safety.

As some of you may know, one of the legacies of Chernobyl has been a large number of cancers, especially in children. We have been helping Ukraine and Belarus as they monitor the health of their children, and as they deal with various issues related to childhood thyroid cancer and leukemia. Together with the National Cancer Institute and the U.S. Department of Energy, we are involved in performing studies in these countries.

In the last several years, there have been twice-yearly meetings between Vice President Albert Gore and Russian Prime Minister Viktor Chernomyrdin to discuss a range of issues of common interest. These include the safety of Russian reactors, the development of new generating stations to replace aging and potentially dangerous nuclear plants, and, as I mentioned, the disposition of plutonium from dismantled weapons. The Secretary of Energy and I have been participants in those meetings.

My purpose is not to address or to suggest solutions to all these issues tonight at your graduation ceremony, but only to give you an idea of the kinds of challenges one federal agency, the NRC, faces, and a sense of my own operational vision--which, in this context, is to reaffirm the fundamental health and safety mission of the U.S. Nuclear Regulatory Commission, to regulate effectively, and to position the agency for change. To say it another way, I have given you a peek inside my laboratory, and some insight into my "experiment." I also hope that this provides for you a sense of where a scientific career can lead.

In my case, a doctorate in physics provided a stepping-stone to a senior policy and executive job in the Federal Government, as an agency head. Some of you also may choose to pursue careers in science, technology, and public policy. Your paths may not exactly parallel mine, but, I am sure, they will lead to multifaceted challenges, and great personal fulfillment. Some of you will work in the arts, others in criminal justice; some of you will continue on toward another academic degree. Whatever your next step, remember that the parameters you set now will be crucial in shaping your future progress. What will you count as the measure of your success? Will it be in terms of your personal affluence? Your involvement in social issues? Your advancement of a branch of science? Your service to your fellow-experimenters? No one who follows you will be able to replicate your experiment exactly, but be sure that your results will influence many. What will be your operational vision, and what will be your legacy?

You have spent a great deal of effort in preparation for this moment, and it finally has arrived. The laboratory doors are open. You have your tools and your materials. Your parents and your teachers have prepared you for this commencement as well as they know how; and they, and I, are full of pride as we watch you begin the rest of your collective life experiment. I, for one, will be waiting eagerly to view your results, and to read the record of your achievements. I wish for each of you the full measure of success. Thank you.