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THE WHITE HOUSE

Office of the Press Secretary
(New York, New York)

For Immediate Release February 15, 1996

REMARKS BY THE PRESIDENT IN EDUCATION TECHNOLOGY DISCUSSION WITH STUDENTS, TEACHERS AND BUSINESS LEADERS

Christopher Columbus School
Union City, New Jersey

10:45 A.M. EST

THE PRESIDENT: Thank you very much, Carol. Good morning, Secretary Riley. You look great long distance there -- (laughter) -- glad you're in the Cabinet. Good Morning, Bob Fazio, and thank you again for what you said and for the remarkable work you have done here.

I want to say hello to Senator Lautenberg and Congressman Menendez, who had so much to do with starting this technology effort in this school system; and to Jim Cullen at Bell Atlantic, and the others who are here from the private sector; and the teachers, the parents and especially the students who are here; and the students from the 65 schools in Hudson, Bergen and Morris Counties who are with us today. Thanks to technology, I want to say hello to all of you.

I have been looking forward to this for some time. And the Vice President and I have had some very exciting conversations about what we would see here and what all of you have done here. And I want to just begin by thanking all of you for making this kind of partnership work and by proving what I said in the State of the Union -- that we have an obligation if we want all Americans to have the opportunities that this new information and technology age offers; we have an obligation to make sure that all of our children have access to world-class education through the finest technology. And you are doing that. And I'm very, very proud of you and I'm very excited to listen to all of you and what you have to say today.

But I would like to talk a little bit about what we are trying to do. What we are trying to do from the White House is to work in partnership with everybody in America who is concerned about this to see that by the year 2000 every classroom and every library in the entire United

States is hooked up to the Information Superhighway, that all our children have access to computers and the finest educational software, and all of our teachers have the kind of training and support that, obviously, you have provided here, and that there is a kind of connection that we see here.

I am very excited about the prospects that young people like those here at this table in this room will be able to learn things that I could never have even dreamed of as a child. And while I want districts like yours to be able to stand out and be proud, I think all of you want every child to have the opportunities that your children have.

And that's why I wanted to come here to announce what our next steps are. As I said in the State of the Union, when I outlined the importance of meeting the challenge of providing all of our children an education for the 21st century, one of the primary goals I set was making sure every classroom was hooked up to the Information Superhighway by the year 2000.

Today, I am proposing and will include in my budget to the Congress a $2-billion Technology Literacy Challenge that will put the future at the fingertips of every child in every classroom in the United States. Let me explain just briefly how it will work.

We'll basically do what you have done here in Union City on a national level. We will use the resources of state and local governments and school districts of the private sector, the schools, the students, the parents and the teachers. The proposal is part of the balanced budget plan, as I said I sent to Congress, and we will use these funds basically as Challenge grants to try to make sure that no school district, no matter how poor, no matter how urban or rural, will be denied the opportunity to do what your children have been able to do because of your vision and work.

I ask for all the people in this country who will support this effort to get active, to get involved. Companies like Bell Atlantic can do a great deal, but they can also use a lot more help. And, obviously, none of this will happen unless the schools and the parents support the endeavor.

So we're going to try to do our part. We want to support you. And we look forward to the day when we can have a conversation like this and every school child in America can be a part of it.

Now, I'd like to turn this over to our high-tech Vice President who has educated me -- between the Vice President and my daughter, I'm about to figure out this modern age. (Laughter.) And I want to thank them both, and introduce the Vice President and thank him for all the work he has done in this important area.

THE VICE PRESIDENT: Well, thank you, Mr. President, and to all the distinguished guests that you've already acknowledged here at Christopher Columbus and at the Bergen Academy hooked up by this video link.

You know, Frank Lautenberg and Bob Menendez can remember, as I do, what it felt like

in the 1960s when President John Kennedy said, our nation will send someone to the moon and return him safely before the end of the decade. Once that goal was set, everybody who could play a part in reaching that goal did his or her part. And it all came together. And we watched the early launches and steady progress of the initiative. And then, as is often the case when America has leadership and a clear goal, we reached that goal. But I remember what it felt like.

Well, now, President Clinton has given our nation a goal of connecting every classroom and every library to the Information Superhighway by the end of this decade, by the end of this century. And we see here at Christopher Columbus some of the early experiments to demonstrate how it works, not just to make the connection electronically, but to the curiosity of these children. And you see a student body that was struggling now having the highest attendance and scores 10 percent above the state average, because your leaders here paid attention to the basics and then used this new capacity, the Information Superhighway, to rethink the way the classroom operates, to rethink the relationship between the teachers and the parents and the student. And the results are here to see.

President Clinton instructed his staff to make certain that this national initiative he's launching here today is modern in every respect according to reinvented principles, with flexibility to the states and local governments. It's an exciting departure. And it feels to me the same way it did when President Kennedy announced that goal of going to the moon and back. And because of the nuts and bolts details of this $2-billion Challenge initiative that the President is announcing here today, we are actually going to meet this goal.

Next month the President and I will be in California on what's called "Net Day." Twenty percent of the schools there will be hooked up to the Information Superhighway on one day. There will be other announcements, just as there were in the early years of the space program, one right after another, each taking us closer to the goal. But that goal again is not only the electronic link, it is the link to the students and their parents and the teachers. And that's what we want to hear about now.

THE PRESIDENT: Thank you.

Let me just say one other word and then we'll go back to the planned rotation. Bob Fazio said something that sparked a warm response in me and reminded me that technology is only as good as the people who are using it. And in the service of education, it's only as good as the educators who are committed to educating our children. And he introduced himself as the instructional leader of this school.

Having worked now for almost 20 years in the field of education reform and having had the opportunity as a governor to travel all across America, to go into many of our country's finest schools, it wasn't so many years ago that there were almost no principals in America who would have introduced themselves as the instructional leaders of their schools. They thought of themselves as managers, people who kept order and make sure the books balanced and did all kinds of things that were unrelated, almost, to what was going on in the classroom. And the reason this technology initiative is working here is because, from the principal to the teachers,

people understand what the mission is. And I wanted to thank you.

That was a statement that people that haven't spent a lot of time in classrooms might not have even paid any attention to, but, to me, it meant more than anything else you said. And I thank you for that because it's important for all us who are trying to put this equipment at the fingertips of our educators to remember that what happens then is the magic between the teachers, the children and the parents. And I thank you for what you said.

Q Thank you, Mr. President.

THE PRESIDENT: Mr. Vice President, who is going to go next?

Q I'd like to call upon Ela Mesguer, who is a teacher, to tell us why technology is so important to us here at Columbus School. You can add the technology, but if you don't have the curriculum to go along with the technology and you don't have the support, we know that it can't work.

So, Ela Mesguer.

Q I think we have the successful formula at Christopher Columbus School, starting with a strong leader like Mr. Bob Fazio, where an open mind and the future vision is helping where we are going with curriculums that really connect and can be equally connected to the Internet and to CD ROMs and to interactive television, working with centers of science and museums.

We have the element of creativity and dedication on the part of the faculty. And our goal is our students. We want them to learn. And what is unique about our school is that our school is a school for all students, not a school for a select few. It is normal kids, multi -- (inaudible) -- from all socioeconomic backgrounds. And we have proven that with this formula of technology, creativity, dedication and allowing our students to be self-learners and self-researchers, it works. And that's what I'm most excited about. We are a school -- an urban school. I am so proud that we have you here. I am honestly nervous, and I'm not usually nervous. (Laughter.)

THE PRESIDENT: You're doing great.

Q But I just want to say, hearing your plan is so exciting because it means a lot to Union City and the children here because they don't have the economic situation that other districts might have, so they can be connected at home with their own computers. So this will provide us an opportunity to continue on our quest to navigate beyond the -- (inaudible.) So I thank you so much for this opportunity.

THE PRESIDENT: Thank you.

VICE PRESIDENT GORE: Erika, did you want to add something to this?

Q Well, the need for technology -- (inaudible) -- you need a door to the mind. It prepares you for your future, because now colleges are urging people to be computer literate, and by starting in the grammar schools like this you're getting a further head start in high school right now. I think technology has come a long way and it's going to take us very far.

THE PRESIDENT: Let me ask you something. Why do you think that students here are doing better now -- like on test scores and things like that -- than they would have done if there had been no technology here? What do you think the most important thing is about technology?

Q Well, I think the most important part about it is that it's, like you said before, right at your fingertips. You know that something will be there for somebody -- sometimes the information needs to get updated on the computer, it's always being updated and being changed. So I think by using computers everybody has more time to study and it's quicker and they're doing better. It has nothing to do with high class and lower class and things like that.

THE PRESIDENT: That's right. Do you think that having access to the computer makes all children believe that they're equal, that they can have equal aspirations because it's an equalizer across income, isn't it?

Q Yes, it is.

THE PRESIDENT: Is it also more fun?

Q Yes.

THE PRESIDENT: Do you think that something to do with why people learn more, because it's more fun? (Laughter.)

Q Yes, I do.

THE PRESIDENT: That's not bad, that's okay. You can say that. (Laughter.) It doesn't have to be hard, it can be fun.

VICE PRESIDENT GORE: Mr. President, George Gonzalez has come here from Bergen Academy.

And what difference does it make in your work as a teacher?

Q Okay, like everybody answered before, it has been a process. It's a process that has lasted since 1982, starting in 1982. And somebody with a vision like Dr. Greco -- (phonetic) -- over there, he told us, we're going to create a high knowledge school of the future.

So that was the vision. And then he created a plan, and he said the plan is to create

partnerships, number one, with corporations. We supply tools, technological tools like Bell Atlantic, Citicorp. Then, number two, the second partnership would be corporation, more businesses, more institutions that supply the context of where we're going to use that technology. Number three, educational institutions to share the resources. And number four would be the professional community in our area, to keep them up-to-date with the technological changes.

So I would say today, 1996, I think his dream became reality. And I don't think you have better opportunity than this one to congratulate Dr. Greco and thank him for the opportunity that he gave me.

Now, to answer your question how I feel as a teacher, the knowledge as a teacher, that's I think is one -- (inaudible) -- they want to be more excited and it changes every day. No one day is the same. I wake up every morning not knowing what's going to happen. (Laughter.)

THE PRESIDENT: It is like our job. (Laughter.)

Q I'm competing with maybe hundreds of thousands of developers, and they're developing something new every day, and I have to come out with the -- (inaudible.) So I gave up being a teacher about 10 years ago and said, I can't handle it anymore. So instead of being a teacher, I became a facilitator, a team mate. So we face the challenge, we're all going to work together, let's solve the problem. So for me, it has been the greatest thing that ever happened. And later on we're going to take you for a tour to the most amazing classroom that you're going to find in this country. I can guarantee you that.

And for this tour, it's created a great opportunity to, what you said, to bring to the service our best role is being able to display the work and compare with peers across the planet. So not only the classrooms here, it's everywhere on the planet. So I think that's one of the best things that ever happened to us.

THE VICE PRESIDENT: Now, is Andrew one of your students?

Q We have two -- we have Kathy and Kathy, maybe you want to say some words on how we use --

Q At the Academy we stress the connection to -- and at each grade level we have a -- project. And that project usually has an -- so in 9th grade, all the students -- (inaudible) -- where we simulate corporations. We divide up into different groups and we do research and we produce a product, and we take it from the manufacturing state to finally to the advertisement and selling our product.

And after we do all that research, using now the Internet, we can think that the entire world -- because we like to present our work to each other, to our own Academy and the community. But now with the Internet we can share our work globally, and that kind of connection with other students across the world is helping us to get more information and kind of share what we've done.

Q Just to almost break the walls of our school, instead of being enclosed in the building, with the Internet we can almost go out into the community. And as Mr. Gonzales said, one of the goals of Dr. Greco was to allow institutions to come to our school and ask us for the -- content. One thing that students in our school can do is we can work with corporations, and we are presently working with corporations to solve real-life problems, giving the students a very unique experience.

Presently, a group, including myself, are working with scientists and engineers at the Smithsonian Institute to develop a biovisualization and 3-D gallery to display on the Internet. What these galleries will include are --

THE VICE PRESIDENT: Did you say biovisualization and 3-D gallery?

Q Yes. (Laughter.)

THE VICE PRESIDENT: Okay, just checking. (Laughter.)

THE PRESIDENT: Tell us what biovisualization is. For all of us mere mortals, we'd like to know what that means. (Laughter.)

Q Well, basically, what they include are specimens from the Smithsonian Archives that would be reproduced by the students in additional formats. And including all their background information, where the fossils may have been found, what the model may have been -- this information will be displayed in the Internet to be accessible throughout the world. And this allows the Smithsonian to sort of open up their whole entire archives which is more than a million specimens, instead of the minute percent that is presently on display. And all this is possible by the -- facilities in our school.

Q So that is what we -- we're going to take you for a tour. Before I make a mistake, I have to thank every one of my coworkers there for all the effort. And here is my colleague who is going to take you for a tour.

Q Thank you, Mr. Gonzalez. It's my pleasure to take you all on a virtual tour over here at the Academy. I'm standing beside students, Erika and Josh, who are currently part of the information technology class. They're creating pages that will be placed on-line on the Internet dedicated to SIC Kids, a special interest group for students interested in computer graphics and their applications.

In the back of all that, we have a 3-D laser digitizer. This machine allows us to digitize complex 3-dimensional surfaces and generate data points from them. These data points can then be imported into a CAD, or computer-aided design program, and edited and manipulated in 3-D space. The CAD model can then be imported into our stereo lithography machine where we can generate a prototype or it can print out 3-dimensional copy.

Our data can also be imported into our computer animation software that runs on our -- graphics machine. Here the student can apply materials and textures and also motion characteristics to enhance the 3-D visualization process.

Our data can also be imported into our virtual reality suite. Here our student is taking a virtual tour in a gallery in space. This is a project that was designed by another Academy student, Lester Vexy (phonetic), and it includes models, information and images to educate the user about the history of space travel.

Meredith Carr is currently analyzing a Smithsonian CAD model that was imported from our 3-D laser digitizer.

Meredith, can you explain a little bit about your project?

Q Good morning, Mr. President, Mr. Vice President. I've been working, along with Andy and some other students here, with researchers at the Smithsonian Institute. We've taken jaw fragments from monkey skulls that have never been found whole, and we're able to digitize them and bring them into programs where we can edit them and try to assemble the entire skull as it has never been seen before. Once that's done, we can take them into rendering programs and animate them so they can be visualized properly so anyone could really see it as if it were an actual model.

After that, as Andy mentioned, we can put it on the Internet, so that researchers and scientists and students all over the world have access to this information.

Q Thank you, Meredith.

We can collaborate directly with the Smithsonian Institute and other entities using our video-teleconferencing software. The benefit of this is that our students can communicate directly with other researchers and scientists around the world. Chris Greeley is hard at work providing contents on our Web Server dedicating a series of pages to environmental studies.

Chris, could you please explain a little bit about your project.

Q Good morning, everyone. Environmental studies is an interdisciplinary project that we're running here at the Academy, developed by the junior class. Basically, the purpose of this project is to allow students to gain an in-depth knowledge of the environmental issues concerning such topics as beach erosion and pollution, animal overpopulation, and the Superfund policy.

Students gain insight into their topics by going out into the local community and by talking with experts in their chosen field. Through this project we hope to be able to share everything we've learned with students everywhere all across the world.

Q Thank you, Chris.

Mr. President, Mr. Vice President, we hope this virtual tour has given you some insight as to the technological capabilities we have here at the Academy for the Advancement of Science and Technology. I'm going to turn it over to you now at the Christopher Columbus School.

Q Mr. President, piggy-backing off the Bergen Academy, I'd like to show you a live demonstration -- one of our students, Danny, who is sitting at the roundtable, will show you a demonstration.

(A demonstration is given.)

THE PRESIDENT: That's great.

Q Well, as you can see, Mr. President, things have changed since you were last in the classroom, and three years ago when I walked into Christopher Columbus School, I didn't know how to turn a computer on. And I think it's important for us to talk a little bit about how technology has changed us all as professionals.

THE VICE PRESIDENT: Luciano, what about from a parent's perspective? Is it true that this has enabled you to communicate with teachers about the students?

Q First of all, I want to make sure I am breathing, I want to make sure -- (laughter). It is true I want to thank you, Mr. President and Mr. Vice President, and all of you from coming to Union City -- the town that I love like I love my country.

When I came in 1990 from El Salvador, we never expected, my wife and I, that our kid could have the benefits of high technology in education. (Inaudible.) It is a privilege for me to be with the President of the strongest nation around the world. I want to thank all the ones who made possible the -- Explore, especially Bell Atlantic, the Board of Education of Union City, the Mayor Mr. Menendez -- and everyone who made -- Explore possible.

With this program, we see education through -- light. We the parents, for us, the most difficult thing is how to motivate our kids to go to school. And this program is not only helping to improve education, but this program also brought the motivation and the possible change to the life -- (inaudible.)

As you continue, Mr. President, as our president into the new century as a bridge between this century into the next century, we are sure that we can count on your support to make this technology available for all the kids of our great nation. Thank you.

THE PRESIDENT: Thank you very much.

THE VICE PRESIDENT: Thank you very much. I think there's a parent, Mr. President, from Bergen Academy, Louis Clements. Would you share your perspective as a parent on how it's changed the way the school there operates?

Q Good morning, Mr. President, Mr. Vice President.

THE PRESIDENT: Good morning.

Q The Academy here has offered things to students, my son included, which I have never dreamed possible in a public high school. The technologies that they offer here are far-reaching in all disciplines. The students use computers in their daily life to perform homework tasks, to explore new avenues. the very rich technical and academic program here at the academy is unparalleled in other schools due to technology, largely due to technology, that is, and the dedication of the staff here.

The parents work very closely with the Academy. Parents organization, we have probably 75 to 80 percent regular participation with parents and faculty and administration of the school trying to help supplement their program here with another dimension, if you will, in providing outside programs. But we work very closely with the faculty and administration to, again, bring additional programs for the students.

THE PRESIDENT: Thank you very much, Lou, and thank you, Mr. Calles. I want to just comment very briefly. I think if every school in America had 75 to 80 percent parental participation, we wouldn't have half the problems we've got and we'd have a lot more computers in the schools a lot faster. I thank you for that.

And I wanted to say to you, Mr. Calles, one of the things that you said that meant a great deal to me personally was that you thought it had helped at home, too -- the atmosphere of education. I mean, I gather you feel that you have a higher level of security about your child's education and you feel more involved in it because of this technology project.

Q That's right because sometimes they start their homework in the school and then finish it at home. We can share the computer. They teach us, also, because I haven't had -- computer. And now I have a computer also, and my wife also, and by brother also. So it's a change in the family.

THE VICE PRESIDENT: What do you use it for?

Q Well, my wife, sometimes she types some letters on it. And sometimes I want to type something -- and communicate with -- through the e-mail. So we are in touch.

THE PRESIDENT: Do you have a lot of parents who communicate through e-mail now?

Q Yes, Mr. President. It's really forged -- it's broken down the walls, and now it gives me the opportunity to go into their home. A lot of our parents work -- single-parent families -- they don't have time to come to school during the day. Now I'm able to go into their home at nighttime and say, guess what, Jose was a problem in school today and I want it to stop. (Laughter.)

THE PRESIDENT: I'd like to call on Jim Cohen, the Vice Chairman of Bell Atlantic. Bell Atlantic has been an indispensable part in this project here at Christopher Columbus in Union City. I want to thank you, but I'd like for you to talk about your role, why you did it, and what you think the future holds.

Q Thanks, Mr. President, Mr. Vice President. I'm absolutely delighted and very proud to be here representing the hundreds of Bell Atlantic people who have worked directly on this project and the thousands in our nation's capitol on up to Northern New Jersey who have worked on these technologies.

I think what we have heard so far today and what we've seen is actually the product of four or five very important elements that form a strong partnership, an enduring partnership that in the end has a singular objective -- delivering improved education to our children.

From my perspective, it does indeed begin with a vision of people like Dr. John Greco from the Bergen Academy; people like Congressman Bob Menendez with whom we worked on the state level back in 1991 and 1992 for fiber optics investment; Tom Highton, superintendent; Bob Fazio, obviously, the education leader of this building; and hundreds and thousands of others. Step one, a genuine vision.

Step two, a plan. Now this is not a plan developed by Bell Atlantic or anyone else in the private sector. It's a plan developed by the community as a product of that vision.

Three, the plan and its implementation and all the commitment, the support and the participation of the community itself, of the education community here in Union City, and of the parents that we've heard from, and many others.

Fourth, as you've seen quite clearly this morning, it also involves as an absolutely key element, the energy and enthusiasm of the students who in fact do see the walls broken down, do see connections throughout the globe, are able to communicate, are able to compare their work, are able to access not just the text and the voice examples that we've seen here so far, but ultimately will be able to access live video, digital video and will be able to converse with one another, not just by voice or data or e-mail, but in fact by video. The -- suddenly becoming reality.

And, finally, in exactly this sequence the private sector is part of the partnership. The private sector, obviously, in the case of Bell Atlantic here, and as you suggested earlier, Mr. President, has provided some of the funding. We have provided some of the traning. But I think most importantly we have provided a very committed group of Bell Atlantic people here in the local and state community who have been part of their community in a long-term commitment and partnership to the success of this particular application.

And then, obviously, we have provided the technologies to make these connections so that students can be connected to data bases, to the kinds of applications that we saw earlier. And I would emphasize from a parental point of view, as Mr. Calles suggested, we've provided

connections at home. And with everything that we're doing, it seems to me that connection through a high-capacity ISDN line to individual homes allows the kind of communication.

We're not only breaking through physical walls, we're breaking through the walls of time that say education ends at 3:00 p.m. and parents are not involved. This is a very, very important connection. And, of course, we've maintained that connection for three years so that the students who were originally in 7th grade now in 9th grade have the connections, have the computers and continue this education process.

So, finally, I guess I would just point out that the obvious, that while this is a wonderful and striking example of improvement in education, it is literally just the beginning. And you have not mentioned this, but in the Communications Act that you signed last week, under the direction of Reed Hunt and the FCC there is a very promising new initiative to provide these kinds of services to achieve the objective that you outlined, provide services to education institutions and to libraries, and in the final analysis creating, I think, wonderful successes in education and the bottom line, as someone pointed out earlier, allowing students to learn, teachers to coach and facilitate, principals to be the education leaders, and allowing students to actually have fun learning.

VICE PRESIDENT GORE: I just wanted to add a point here, because the President insisted that that language be added to the bill and be a part of the final bill, or else he would veto it.

THE PRESIDENT: Explain to everybody what is in it, though, so that --

VICE PRESIDENT GORE: The telecommunications bill, as Mr. Cullen just described, will complete the Information Superhighway much sooner than anyone thought was possible. And the President insisted on a provision in that legislation that allows for discounts to schools and libraries to connect to the Information Superhighway, and allows for rate-based designs that make it possible to connect schools very cheaply.

Now, this is really a one-two punch by the President. The first punch -- well, the goal -- outlining the goal was the main thing. But the first punch was getting the telecommunications bill enacted and signed into law after a long, long struggle. The second punch is here today. These Challenge grants make it possible, with $2 billion from the federal government already in the budget, to build the kind of public-private partnerships that Bell Atlantic has entered into with local government and others -- the school district here in New Jersey -- and to take this model that's produced this spectacular result here, the Bergen Academy, and take it nationwide.

Now, Jim, don't you think that your counterparts in the communications industry, and Bell Atlantic, itself, are going to be interested in rushing to form these partnerships, to get these schools connected one by one?

Q Absolutely. I think it's fair to say that we have been doing a great deal of that. I'm a New Jerseyan and former president here in New Jersey, and I can assure that we've done

a lot of that here in New Jersey. But getting that into the communications law that was signed is a great additional stimulus.

And in addition to everything that you've mentioned, Mr. Vice President, it also brings more private participants in, because in order to create rates that are attractive for schools and libraries, it gets funding from all telecommunications providers in this marketplace. So with everyone in, and relatively small funding from each, this is a tremendous stimulus to achieving the objectives.

THE PRESIDENT: Jim, I want to hear from Congressman Menendez and Senator Lautenberg and the Mayor and Secretary Riley about their perspectives on this and their involvement with it, because they all have been involved. But just before I do, I'd like to ask you to just touch once more on something that has come up several times today that comes up in other places where I've been.

I was in Concord, New Hampshire, several days ago, two days after they connected all the schools in their community
-- and that is the challenge of making sure that children have access and their parents have access, to computers and to being hooked in when they're at home. How important do you think that is? Could you say again very briefly what steps you took to do that, just to emphasize that for the people that are listening here because this is one thing that's going to require an extra amount of effort in several places in the United States to get this done. And so if you could just -- and maybe, Bob, you might want to comment a little bit -- but if you could just talk briefly about it and then we'll go to our public officials.

Q In a few words, Mr. President, the vision of the Information Superhighway is much broader and much bigger than what we see here today, but it is suggested by the involvement and the connection of parents. And the vision of the Information Superhighway is to do all of the things that we've just talked about -- targeting the schools, K to 12; targeting the libraries -- and, in addition, provide a reasonable set of long-term ground rules and incentives for companies like Bell Atlantic and others in the communications industry to invest in this country, in our networks, in fiber, in software platforms; and deliver it not only to the schools, as we're seeing today, but most importantly, as you're suggesting, deliver it very rapidly to homes, to small businesses.

Large businesses have this capability today. Obviously, we need it to homes, we need it to businesses, as well and, I would just point out, the benefits extend well beyond education. The benefits extend to health care services and many other things, as well. So that this, in the final analysis, will be bigger than we're suggesting here; will involve parents and will, in effect, leave people literally on-line for voice data and video 24 hours a day.

Mr. Fazio may have problems from midnight to 6:00 a.m. with some of that, but it is technically possible. (Laughter.)

THE PRESIDENT: But it's important to hammer that home. I mean, the ultimate vision of this is that the reach of the Information Superhighway will equal the reach of telephones and

television here. It will be in every house.

Q Mr. President, our good Mayor Walter is in the process right now of giving us the public library next door to where you'll be visiting in a few minutes. In our vision here, to piggy-back off and replicate this school throughout our district, is to take that public library and give it accessibility to parents. We need to get computers in that library, keep it open until midnight, get these children off the street, working on-line, having a safe haven, a place where they can go and work in a safe environment. And that's our goal and we're in the process right now of putting that plan together.

THE PRESIDENT: Congressman and Senator and Mayor?

CONGRESSMAN MENENDEZ: Well, Mr. President, Mr. Vice President, we welcome you here not only today, but we welcome your challenge and your vision for the next millennium. And that's what this discussion is all about. And we've only seen the tip of the iceberg of what is possible. The possibilities are only limited by our imagination.

And so the vision that you present for us today, and that the Vice President has worked so ably with you, is a vision understanding that we can make our students today be competitive in the global economy of tomorrow. The new millennium sounds so far away, but we are four short years away from it. And the fact of the matter is, is that a vision unmatched by action remains only a dream. Today we've seen some of the possibility. And here in New Jersey, Mr. President, Mr. Vice President, at the Christopher Columbus School, at the Bergen Academy, we're not only willing to take a ride with you on the Superhighway, we're already on the way and we're willing to work with you to make sure that the rest of the country joins us.

THE PRESIDENT: Great. Senator?

SENATOR LAUTENBERG: Mr. President, Mr. Vice President, obviously, you've enforced your view of what America ought to look like in terms of education over many, many occasions. And your being here today confirms that belief that we ought to continue to expand our -- for our young people now.

I come out of the computer business. Few in New Jersey realize that in the United States Senate we have two Hall of Famers: Bill Bradley, of course, is well known; but I'm a member of the information processing hall of fame -- (laughter.)
Mr. President, I don't have a lot of young people chasing me for autographs, but maybe some day.

But what I saw in my first days in the United States Senate -- this was 1983 -- persuaded me to write a bill called the Computer Education Bill, that assured that every classroom would have screens and computers available for the student. Now, we're talking about something way beyond that, as this point. But I went to a school in Newark, New Jersey, where there was a terrible deficiency between the number of students and computer availability. And I saw one youngster who was a difficult behavioral problem in class, and this boy became engaged with the

computer, able to move at his own pace, not feel left out because he was behind, able to accelerate past some of the other students in his particular specialty. And they said it changed his whole mode of being.

And it told me something, that the young people that we have today in America are as fine a group as this country has ever seen. They think, they're alert, they're way ahead of their counterparts at a period of time that I remember. The fact of the matter is, given the tools, the computer availability, the expanse of information will propel these young people into leadership roles, Mr. President. I can feel them almost breathing down my back for my job -- (laughter) -- I assume Congressman Menendez may even feel it there. But we have so much talent and so much ability.

Mr. President and Mr. Vice President, I want to thank both of you for your initiatives, for you vision about what America can be as we approach the next century. This Challenge grant tells it all in my view, because you've talked about Goals 2000 and other programs that enhance the educational opportunity in America, and that's where we're going to win out. It's more powerful than oil or mineral resources. It's the minds of our young people, and if we can continue as we have to provide the stimulation nutrition to develop those minds, Mr. President, you're going to be remembered for many things, but this will be among your crowning achievements. And thank you for being here.

THE PRESIDENT: Mayor, I'd like to let you speak last, so let me interject here and call on Secretary Riley out there in cyberspace to ask if he has any comments.

SECRETARY RILEY: Thank you, Mr. President. Let me say just a word about the role of government. I think government clearly has an important role in what we're talking about. One is a role of leadership, and then a role of support, and then a role of getting out of the way. I think it's so important for government to challenge this country as you're doing Mr. President, Mr. Vice President, just by this conference and other things, to share the vision that if we're going to have real education in the future it's going to have to involve technology, literacy and then some.

The other thing in terms of support, I think it's so important for government to play a role in pulling partners together. Other levels of government, private industry, as you discussed there, all of the other factors of the community with education, pulling those factors together and then providing what support we can. And then, as I say, getting out of the way. I'm pleased that all of the programs that have been started under your administration -- Goals 2000, School-To-Work, all of the reauthorizations of Title I, Safe and Drug Free Schools, challenge grants, whatever -- all of them have plenty of room for local people to use those funds for technology. I think that's very important.

THE PRESIDENT: Thank you very much. And thank you for your leadership to make sure that's exactly what we did.

Mr. Mayor?

MAYOR WALTER: Mr. President, Mr. Vice President, welcome to Union City. I want to thank you for the initiative of talking about government getting involved in our Informational Highway. We in Union City a long time ago decided that a large corporation that needs to be tapped is local government. Local government has a major role in working with school boards. And you who travel our country need to remind every mayor that it is their job and their obligation to work along with the heads of the school board, like I did with Dave Anton, our president of our school board -- working together to meet the challenges to help get it going, and then pull away, because sometimes we in government find reasons why things don't work and don't spend as much time making it work.

Mr. Fazio just recently spoke about an initiative we hope to get going with our libraries. We talked about it with the president of the school board. We envision changing our libraries to a different concept, a concept open on a regular basis, as we've done with our schools, and letting everything from our youngest of children to our senior citizens to come and to enjoy that highway.

And how about the job creativity of having some of our students who obviously talk about teaching their parents, help teach our senior citizens and help other residents -- help me learn about what's out there on the computer? So I think if we start to work with our libraries and local government and see them as areas where we can bring in all of our people and tie everyone in -- and remember, we learn an awful lot from our children. And I thank you and the Vice President for caring about our children.

THE PRESIDENT: Thank you.

Mr. Vice President?

THE VICE PRESIDENT: Well, it's an exciting demonstration that we've had here today, and it's a sign of things to come in the near-term future. And as the President said, not too long from now every school, every classroom, every library will be hooked up to the Information Superhighway. And then, not too long after that, every home will be.

We've been dedicated to a principle called "universal service" since the beginning of the telephone era. And almost all homes have telephone service. But that definition of universal service has changed over the years from a party line to a single line. And it's about to change again. Universal service in the future has to mean a connection that will make it possible to send pictures like the ones we've been seeing from Bergen Academy, and e-mail and the communication that makes possible parent-teacher conferences over the computer connection line.

The President made possible the legislation, signed it, that is going to lead this vision into reality. And today, with these challenge grants, he's facilitating the formation of these public-private partnerships in every state and in every community to hasten the day when every school can have the kind of exciting additions to their curriculum that we've seen from these students here at Christopher Columbus and Bergen Academy.

So, for my part, I just want to thank everybody for showing us firsthand the future.

Q Mr. President, Mr. Vice President, our friends from Bergen Academy would like for you to come join us in our auditorium across the street to continue on with this wonderful conversation.

THE PRESIDENT: We will do that. But before we get up from this table I want to leave you with one final thought to muse about, and I hope not only all of you, but all the people who will read or see about this -- as President, I have said repeatedly, I believe -- when it comes to the American people I have to great objectives, and that is to do everything that we can do to make the American Dream available to every person who is willing to work for it; and secondly, to do it in a way that brings the American people together instead of divide them.

Technology has been a big part of this debate. Technology clearly here is uniting us and moving us forward. Erika said it -- it doesn't matter where you come from, doesn't matter who your family is -- and Luciano said it -- you can be an immigrant family, you can bring a computer there, you can have access to the information. People, all people can have high expectations for themselves, no matter what their income background, no matter what their roots are, they can do that. This is bringing us together and moving us forward.

If you look beyond the schooling years, there are lot of people who are afraid that technology is doing the reverse. In our economy, where we have global information and global markets and breath-taking changes in productivity, you read every day -- and I have talked about it in my State of the Union address -- we have almost eight million new jobs, but half the country hasn't gotten a raise and a lot of people are wondering what will happen to them if their big company becomes a smaller company because of information productivity.

What I want the American people to see about this is that when we complete the work of bringing the Information Superhighway to all education and to all of our people. It will empower everybody and it will close the circle and it will enable us to use these great new forces of the modern world to bring all of America together and to move all of America forward.

You can't turn around and go back. This will carry us forward. And I think it's a very, very great thing for our country. And some day, when Erika is about our age thinking about her children and her grandchildren, we will look upon what you are doing as the beginning of great new era of American society that goes even far beyond education and proves that we can make this technology our friend and reinforce the American Dream and give everybody a chance to live up to their own dreams.

And you are real pioneers, and I'm very grateful to you. Thank you, everybody. (Applause.)

END 11:45 A.M. EST

REMARKS BY VICE PRESIDENT AL GORE
COUNCIL ON COMPETITIVENESS INNOVATION SUMMIT
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Friday, March 13, 1998

It's great to be back with the Council on Competitiveness, and it's great to be back at MIT. I was honored to deliver the commencement address here two years ago. And I always enjoy returning to Cambridge, where I spent so many happy days as a student at a school down the road.

I recall that the last time I delivered a formal address at MIT was when I had the honor of speaking at commencement a couple of years ago. I'm reminded that, on that occasion, I told the story of how MIT's founder returned in 1882 to deliver the commencement address and dropped dead while delivering his speech. As terrible as that is, I was comforted by the thought that no matter how poorly I did, I would only be MIT's second stiffest commencement speaker.

* * * * *

Let me say how grateful I am to the Council on Competitiveness -- not just for convening this critical national summit, but also for your important work, all year long, in helping us to understand the dramatic changes taking place in our economy and society. As someone with a longtime interest both in innovation and in its considerable economic benefits, I've followed the Council's work very closely since its founding a dozen years ago. And I am convinced that only by bringing together business, labor, academia, and government at all levels -- only by mobilizing everyone with a stake in our economic future -- can we truly make the most of this moment in our history. This is an impressive gathering -- and a necessary one as well.

It's no exaggeration to say that we meet at the dawn of a true Innovation Age. Consider these facts: it's estimated that the entire store of human knowledge now doubles every five years. For example, we are just a few years away from the complete sequencing of the human genome -- giving us, for the very first time, the full instruction manual for the human body. Within a couple of years, microchips will routinely contain one billion transistors per chip, the size of a fingernail -- and the patterns etched onto them will be as complicated as a roadmap of the entire planet. Within six months, a brand new low-earth orbiting systems will make it possible to make a cell phone call from any point on the earth's surface to any other point -- other systems will soon follow. And within three years, we will be able to have wireless Internet access from anywhere on Earth. We are on the verge of fulfilling Hawthorne's vision in the middle of the last century. Fifteen years after the invention of the telegraph he wrote, "By means of electricity, the world of matter has become a great nerve, vibrating thousands of miles in a breathless point of time . . . the round globe is a vast . . . brain, instinct with intelligence!"

Often, it is easy to chart the exact benefits of a new breakthrough -- to our health, to our hard disk drives, to our pocketbooks. But today, I want to talk about innovation in a broader context. I want to talk about innovation not merely as a material goal, but as an ethic, as a constant concern. MIT's motto -- "Mens et Manus," mind and hand -- sums up this challenge. True innovation encompasses not only the labor of our hands, but also the labor of our minds. If America industry is to keep growing and thriving, we must be willing to think and act anew -- to keep pushing the boundaries of knowledge and discovery -- to reshape our economy by redefining the way we view our world.

At a few precious moments in our history, we have literally redefined the way we view our world. More than 500 years ago, Columbus set sail. By discovering the New World, he gave us a new vision of Earth. A century later, Galileo first turned a telescope toward the sky and shattered centuries old-notions about the mechanics of our solar system.

The discoveries of the age of exploration unleashed the greatest explosion of trade and commerce the world had ever seen. New lands brought new ideas -- and the need for new inventions. Europe's contact with other cultures and customs -- while certainly not always mutually positive -- stimulated new thinking in the Old World.

Almost half a millennium after Columbus, we broke free from the grasp of our planet with the Apollo program. Yet one of the most important effects of those missions came not in how we viewed our distant Moon, but in how we viewed ourselves and the planet we call home.

Dominating a wall of my office in the White House just down the hall from the Oval Office -- I call it the Square Office -- is a photograph of our planet taken by the astronauts aboard Apollo 17. For some, it is hard to recall the significance of those first images of Earth from space when they appeared nearly three decades ago. But those images of our planet -- the first time we had ever seen what we looked like from a distance -- had a powerful impact. As the British astrophysicist Fred Hoyle predicted in 1948, "Once a photograph of the Earth, taken from outside, is available -- once the sheer isolation of the Earth becomes plain -- a new idea as powerful as any in history will be let loose." It wasn't until the Apollo missions twenty years later that we found out the truth of that prophecy.

Like a child's first glimpse of herself in a mirror, those photographs from the frosty reaches of space changed our own self-image. We saw a world that was not as vast, expansive, or incomprehensible as we had thought -- but surprisingly smaller, more interconnected, more fragile and communal.

As the great poet Archibald Macleish wrote after the first of these images, "To see the earth as we see it now, small and blue and beautiful in that eternal silence where it floats, is to see ourselves as riders on the earth together, brothers on the bright loveliness in the unending night -- brothers who see now they are truly brothers." This new image, this new understanding, shifted centuries of human understanding, and brought about dramatic results.

Certainly, such a quantum leap in our worldview does not occur very often. When they do, it often takes decades to know where they will lead. But in spirit, it is little different from the work many of you do, each and every day -- pushing the ever-expanding boundaries of knowledge and discovery -- creating and innovating for the ultimate benefit of all our people. For, at its heart, what innovation means is looking at the world in new and different ways. Our challenge is to create the right climate for that kind of innovation, both small and large -- and to harness its enormous economic potential in the 21st Century.

We've already come a long way. With help from so many of you, we are building a new economy -- one that is takes innovation as its starting point, not a mere by-product. The new economy is driven by innovation -- information and technology are its fuels. The new economy values the productivity and creativity of our people above all else. The new economy is connected to the global marketplace -- where we zap dollars and data around the world at the speed of light.

Today, the American economy is once again the envy of the world. Interest rates and inflation are at record lows. Investment and modernization are rising. We have 15 million new jobs, and the lowest unemployment in a generation.

Today, a full third of our GDP growth now comes from information technology. Our fast-growing environmental technology industry is already bigger than our steel, textile, or aerospace industries. More Americans build semiconductors than construction machinery. More Americans spend their days processing data than refining petroleum. More Americans make computers than make cars.

Perhaps more importantly, today there is far less difference between the two. Open up a car today and it doesn't look a lot different than most computers. In fact, today's Ford Taurus has more computing power than the Apollo landing capsules that landed on the Moon. And those that build those cars do so in ways that emphasize quality, performance, and innovation.

* PAPERLESS 777

* TELESCOPING LEAD TIME FOR NEW CAR DEVELOPMENT, FROM 7 to 5 to 3...HEADED FOR 1

* BIG THREE -- EXTRANET -- PNVG

Clearly, we are becoming not just an Information Society, but an Innovation Society as well. In the old economy, growth depended largely on capital and labor. Now, as the economist Paul Romer -- whom I met with just yesterday -- has argued, the true engines of growth are ideas and the technologies they create. Romer and others are teaching us that innovation is not something that happens outside the economy, as traditional economic theory had held. Innovation occurs inside the economy -- and it is essential for economies to grow. Ideas build on one another and each one opens the door to a thousand new roads of innovation.

Though we've had computers for a long time, we are just now seeing the convergence of technology which lets us use them to their full potential. We know from history that sometimes for innovations to bring about productivity gains organizations must adjust to new circumstances. During the Industrial Age, the effects of new electric motors took time to show results in productivity. Part of the reason was that our factories were still constructed in a vertical fashion in order to take advantage of obsolete steam energy. But once we rethought the way our factories worked and flattened them out; once the architecture and infrastructure was in place to use electric motors, the results in productivity were astounding.

And the similarities between that time and our present transformation run deep. The steam factories relied on centralized power emanating from a single source. These factories were replaced when alternating currents allowed us to distrbute energy over long distances enabled us to distribute power -- and when electric motors enabled us to distribute sources of mechanical energy throughout a factory. So too today, the old top-down organizations which relied on hierarchies and a centralized source of intelligence and decision-making are being replaced by distributed intelligence. Today's technology is allowing us to tap a higher fraction of the potential of our people; allowing us to reach those who, in previous years, would have been left out of the world of innovation. We never know where we will find the person responsible for the next great scientific or intellectual breakthrough. It could be a janitor right here at MIT!

There is simply no question that if we want to make the most of the 21st Century, and the new economy -- if we want to achieve the full promise of American business -- we must do everything we can to fuel new innovation and discovery. We must build partnerships that encourage, support, and reward cutting-edge ideas -- and keep our economy strong enough and efficient enough to take advantage of them right away.

As far as I'm concerned, we can never do enough to promote innovation -- and for me, that had been a long crusade. As a Congressman, I co-authored legislation that created the Small Business Innovation Research initiative, which helps America's small businesses turn new technologies into new products. I also sponsored legislation which provided some of the earliest funding for developing the Human Genome Project and the Internet. And over the past five years, thanks to President Clinton, we've done an enormous amount to encourage innovation. Today, the facts are clear: for a quarter of a century, and for most of the 1980's, the number of patent applications for inventions filed by Americans hovered between 60,000 and 70,000 a year. The past few years have seen that number rise above 100,000. Similarly, we have increased the number of patent awards by 50% from the early 1980's.

We plan to seize that promise by continuing the bold new economic strategy with which we have kept pace with the new economy: eliminating the deficit; opening foreign markets to our products; and investing more in America's future.

First, we will balance the budget, and we will do it this year. The budget the President

just proposed to Congress takes a deficit that used to have eleven zeroes and makes it, simply, zero. Especially for young industries with little immediate revenue and extensive research and development needs, it is critical to free up large and steady supplies of capital. Companies shouldn't have to compete in credit markets with an 800-pound gorilla named Uncle Sam -- so we put Uncle Sam on a strict diet of fiscal discipline. By making tough choices based on hard numbers, we have freed up hundreds of billions of dollars in capital to finance private investments.

There is another reason for our emphasis on deficit reduction. Forget about the gold standard; the new economy operates on the information standard. Financial markets around the world make decisions about a government's fiscal policies every day through millions of transactions; and the future implications of policy changes are judged and acted upon in the present. If financial markets see a fiscal train wreck coming, they don't wait for the crash to get out of the railroad business. Likewise, by taking a responsible approach -- by rejecting second-hand smoke and rear view mirrors -- we have earned a premium. Investment capital has flowed to our shores, and will continue to flow to the innovators and entrepreneurs in our economy.

The second component of our economic strategy is to keep opening markets for American products overseas -- to reach the 96% of the world's consumers who live outside our borders. We've already signed more than 200 new trade agreements in the past five years. And increasingly, we are seeing our geopolitical relationships defined not by military conflict, but by economic cooperation.

The third part of our economic strategy is making targeted investments in the future. To fill the high-brainpower jobs in biotechnology and information technology, we need more education, more job training, and more computers in our classrooms and schools. That is why education is our number-one priority -- and that is why we fought for and won the largest increase in education opportunity in 30 years.

Of course, while investing in the future means teaching about old discoveries, it also means making new ones. Even as we have shrunk the deficit, we have increased NIH funding every single year. Now we are proposing a new 21st Century Research Fund for path-breaking scientific inquiry -- the largest investment in civilian research and development in American history. And this fund will include the largest ever increases in the budgets of the National Institutes of Health and the National Science Foundation. We are investing not just in targeted research, but also in the undirected research that often yields the biggest long-term gains -- and often would not occur without federal investment. Of course, it takes private sector investment as well. That's why we have proposed an extension of America's $2.2 billion Research and Experimentation tax credit, which is critical to our most innovative industries.

Part of our strategy of promoting innovation has been unshackling the dynamism of the new economy from the heavy hand of old government thinking. We are fighting hard in Congress to streamline the patent law and make the patent office a truly performance-based

organization with increased flexibility and a focus on results. We cut 350,000 government workers to give us the smallest federal government -- as a percentage of the workforce -- since the New Deal. We eliminated 200 outdated government programs, slashed more than 16000 pages of red tape, and saved he American people $137 billion. We not only made government smaller, we made it better and more effective for those it should serve.

We are paying special attention to the growth and development of the Internet. We have an aggressive strategy to foster electronic commerce. Trade and commerce on the Internet are now doubling or tripling every year -- and in just a few years will be generating hundreds of billions of dollars in sales of goods and services. We want to establish an environment in which electronic commerce can grow and flourish, so every computer can be a window open to every business, large and small, everywhere in the world. That means minimal government, no new taxes, and no cumbersome regulation. We are working to make the Internet a global free-trade zone, to take advantage of its full potential for prosperity.

And our 21st Century Research Fund invests hundreds of millions of dollars to help speed the development of the Next Generation Internet. Think about how today's Internet has revolutionized your life and business. Just imagine what the next generation, moving 1,000 times faster, could help us achieve.

I believe very strongly that our approach is the right one for America's future competitiveness. Thanks to your hard work, it is hard to even compare our economic strength and standing to that of five years ago. Without chronic deficits to weigh us down -- and with a bold new investment plan for the 21st Century -- mark my words, we have only just begun to innovate.

But while every company must be poised to innovate and to act and think anew, we must also do so as a country, and as a community. For me, that single, stunning picture of the planet Earth on my office wall serves as a constant reminder of how much there is to learn and discover -- about the world and about ourselves. And today, I want to issue a challenge that I hope will advance that knowledge and discovery, and give us a richer understanding of the world we inhabit.

Five centuries ago, according to historians, a Spanish sailor named Rodrigo de Triana -- standing in the forecastle of Columbus' ship, the Pinta -- caught a first glimpse of the New World. Today, a clearer view of our own world could help us reach new heights of understanding and insight. That's why today I am proposing that NASA launch a satellite named Triana -- a spacecraft which would provide the very first live, continuous images of the entire Earth from space. It will bring into the digital age those remarkable pictures we received of our Earth a generation ago.

[START VIDEO]

Aboard Apollo 11 and on his rendezvous with history, Michael Collins said, "Houston, I've got the world in my window." Triana will provide a permanent window onto our world

for the good of all humanity.

Triana would be located at what scientists call the L1 point -- the point, about 1 million miles away, where the Earth's and the Sun's gravitational attractions are balanced. That balance is also critical to Triana's mission -- to both pull us out to explore the depths of space, and to pull us back to better understand our Earth.

The unique, full-color view of Earth to be captured by this satellite for the first time will complement existing space-based Earth observations of clouds and their movement. And it would track the global implications of events like hurricanes and storms as they occur. Today, we have to stitch together the pictures from multiple satellites. But with Triana, for the first time ever, the full illuminated portion of Earth will be viewed constantly with a single satellite.

The Triana's live, continuous, round-the-clock, high-resolution images of the globe will be available to television broadcasters and over the Internet. I call this broadcast the Earth - Satellite Picture Access Network or Earth - SPAN. Along with its potential uses in science and education, the Earth - SPAN broadcast from Triana could be used for monitoring and predicting the weather in real-time.

Under Dan Goldin's powerful leadership, NASA has put a premium on doing things faster, better, and cheaper. That's why I propose that Triana be launched in two years as an example of this initiative. As a nation, Triana would help us do what you as innovators do individually every day -- to step back from the smaller concerns of everyday existence and take the broader view which leads to new understanding, new ideas, new innovation. As Socrates said, 2,500 years ago, "Man must rise above the Earth, to the top of the atmosphere and beyond, for only thus will he fully understand the world in which he lives."

The astronaut Rusty Schweickart once described the feeling of looking homeward while orbiting the moon. "You realize that on that small spot, that little blue and white thing, is everything that matters to you. All of history and music, and poetry and art and war and death and birth and love, tears, joy, games, all of it is on that little spot out there that you can cover with your thumb." With Triana, that same experience could be available to all of us.

My hope is that Triana will serve as a scientific resource, and as a source of new information and ideas about space and Earth. But like the pictures from Apollo 17, it can also be a metaphor for what we must seek in our own businesses, and in our own lives -- ways to shatter our preconceptions; ways to construct new paradigms; and ways to take that first, fresh look at a new idea or a new world.

Daniel Boorstin, the great former Librarian of Congress, wrote that "The most promising words ever written on the maps of human knowledge are terra incognita -- unknown territory." That is the territory you are helping us to explore, and we have already seen the fruits of your labor. I am proud to say that you have a ready and willing partner in this administration, and that we will do everything we can to keep growth and innovation high, and

productivity strong. So let us continue to blaze new paths to American competitiveness. Let us continue to search for uncharted territories -- be they near or far. In the spirit of this great institution, let us apply our hands, our minds, and our hearts to that endeavor. For that is how we will build the 21st Century and the new economy of our dreams.

Remarks as Delivered by
Vice President Al Gore

Commencement Exercises
Massachusetts Institute of Technology
Cambridge, MA
June 7, 1996

Dr. Gray, President Vest, members of the MIT Board and faculty, Mayor Sheila Russell, parents and families, alumni and alumnae, students, and especially those of you who are graduating seniors:

Thank you for inviting me this morning. It is truly an honor to be MIT's Commencement speaker. It's a pleasure to return to this city where I myself graduated 27 years ago, from a school just up the river.

That school, Harvard, and MIT have had a long and sometimes tumultuous relationship. In the early days, beginning in the 1860s, Harvard tried to absorb MIT. But this school's founder and very first President, William Barton Rogers, fought back. He was adamant that an institution devoted to fostering scientific knowledge **and** a liberal education must remain independent.

Many things have changed since those days. For example, tuition for first-year students in 1866 was $100.

President Barton, incidentally, literally gave his life for this institution. When he returned after his retirement to deliver the commencement speech in 1882, right in the middle of his speech, he died. As a result, I have the rare comfort of knowing that whatever your reaction today, I will not be remembered as the stiffest speaker in your school's history. I am fully prepared, however, to be remembered as the second stiffest.

In preparing for this speech, I engaged in a dialogue with the graduating class by way of the Internet and your university's computer network, the Athena system. More than 100 of you responded in some detail, and I thank you very much. For those of you who didn't respond, I know who you are. I read every response thoroughly -- on the World Wide Web -- and I learned a great deal. Among other things, several of you emphasized the fact that MIT not only educates scientists and engineers but also architects, linguists, designers, economists, even poets.

Nevertheless, because this is MIT, I want to share some thoughts today about the relationship between science and technology on the one hand and humankind and society on the other.

When Winston Churchill spoke here in 1949, he spoke about the relationship of science and society. Ten years later, in a celebrated lecture in England, scientist and writer C.P. Snow introduced the concept of the "two cultures." In his subsequent book, entitled *Two Cultures*, he wrote that the culture of science and the culture of society's literary arts "had almost ceased to communicate at all." He noted that the popular culture in England and America spoke the same cultural language. But both "had about as much communication with MIT as though the scientists spoke nothing but Tibetan."

Why is there such a gulf between science and society?

This schism between science and the rest of society -- which began at least as early as Galileo's trial in 1633 and continued with the trial of John Scopes in 1925 in my home state of Tennessee -- has not narrowed since the publication of Snow's famous book.

Indeed, eighteen months ago, Sheila Tobias examined this schism and concluded that it has grown worse. "Science illiteracy has entered a second, more pernicious stage, fueling widespread opposition to science," she said, noting that physicist and science historian Gerald Holton has written that this new opposition to science "threatens to topple the Enlightenment-based tradition on which scientific discourse and democratic politics are based."

Two cultures separated by a great divide.

One of the consequences of the widening of this divide is that the metaphors of science are no longer migrating into our popular culture at the rate they once did. In the early decades of the scientific revolution, during the 17th century, there was an explosion of new metaphors that crossed the permeable boundary between science and culture. It was more common in that era for individuals to be fully conversant in both science and the rest of culture. And there was less to master before the scientific revolution speeded up. John Stuart Mill was described as "the last man to know everything." In that age, people generally acquired an intuitive sense of Newtonian physics, and spoke of the universe as an apparatus that ran like clockwork. They spoke of social organizations resembling machines. Later on, Charles Darwin's theory of natural selection supplied metaphors for competition in economics and life, and still later supplied the language for a social movement that misused his theory and borrowed his name.

But now, in the second half of the 20th century, while the number of new discoveries flowing out of the still accelerating scientific revolution is at least a thousand-fold greater, the flow of these metaphors into the rest of society has slowed to a trickle.

I believe it is time for a new effort to build bridges between these two cultures. I agree with my late friend Jerry Weisner, who said in his inaugural address as President of MIT in 1971, that it is our responsibility "to understand what our learning and discoveries may do to man and society, and to transmit that knowledge to new generations -- to . . . leaders who may be wiser than we in applying it, or wiser in judging how slowly or rapidly these technologies may be absorbed."

I am convinced that a more robust discourse between science and society could empower us to fruitfully apply some powerful new metaphors from science in an effort to better understand society and better understand the relationship between science and technology and our society.

Let me illustrate what I mean with an example. I have a friend who's an MIT graduate, named Danny Hillis. A few years ago, he patiently explained to me the workings of a massively parallel supercomputer by pointing out that the first computers relied on a central processing unit surrounded by a field of memory. To find the answer to a particular problem, the CPU would send out to the memory to retrieve data, then bring it to the center for processing. The result would then be placed back in the memory. Three trips, back and forth, consuming precious time and generating unwanted heat.

The architectural breakthrough associated with massive parallelism was to break up the power of the CPU and distribute it throughout the memory field in the form of smaller, separate processors, each co-located with the memory it processes. When a task has to be performed, all of the processors begin to work simultaneously and process a small quantity of information. Then all of the separate parts of the answer are sent simultaneously to the center where they are assembled. One trip. Less time and heat.

When you think about it, the metaphor of massive parallelism, or "distributed intelligence," offers a nice explanation for why our representative democracy is superior to a governmental system run by a dictator or a king. Where totalitarian regimes rely on a central processor to dictate all commands, representative democracies depend on the power and insight of people spread throughout the society, each located adjacent to the part of society in which he or she is most interested.

Or take capitalism. The Soviet Union's economy collapsed because it relied on a central processor to make all economic decisions. It didn't work very well. Innovation withered and corruption took root. The North Korean economy continues to rely on a central processor, and today its people are starving. But capitalist economies distribute the power to those located outside the center -- entrepreneurs and consumers, who make their own decisions independent of each other, and those accumulated activities create a stable system that marries supply and demand and keeps prices stable.

To take a third example, many of the latest techniques from the world of management -- as graduates of the Sloan School know very well -- rely on the same principles of distributed intelligence, even if they don't call it that. By distributing intelligence and information and responsibility to workers on the front lines, organizations are transforming themselves, serving customers better, and producing greater value.

Each of these examples relies for its success on the same basic architecture. Instead of insisting that all decisions be made in a single place, the power is widely distributed throughout the organization. Each individual's portion of the answer is then assembled as part of a collective conclusion. In capitalism, it's called supply and demand. In representative democracy it's called self-determination. In each case it is essential that all the individuals involved share some basic characteristics: for example, the freedom to obtain information that flows unimpeded throughout the system.

In organizations that are based on this design, it is crucial that all the individuals who are part of the organization feel a sense of cohesion that is based on a common understanding of the organization's guiding vision. It is crucial that they all understand the organization's basic goals, and that they all share the same basic values upon which a decision can be based, whether it is made by the CEO or a clerk behind a word processor.

Some organizations find this cohesion deceptively easy to establish, simply because they're new, and everyone involved has been present at the creation and is eager to accomplish the goals easily kept in mind until the initial burst of enthusiasm wanes. For example, NASA put a man on the moon and returned him safely in less than 10 years. It was an inspiring sprint. But once that goal was achieved, the organization's culture began to quickly erode and has had recently to be painstakingly rebuilt.

Likewise, some of the institutions of government created in the burst of enthusiasm we call the New Deal were remarkably successful until the first generation of managers passed from the scene, and then we began to see bureaucratic rigor mortis set in.

The challenge for any organization is not simply to establish these conditions and gain the advantages of distributed intelligence, but to nurture and sustain this creative state. There's no better example of how to do that than the U.S. Constitution, with its checks and balances and careful design intended to sustain the creativity of self-government, even after more than 200 years. Our Constitution is, in a sense, the software guiding the operations of a massively parallel system for processing political decisions.

Our Founders rejected the idea of a pure democracy, not as some suppose because the information technologies of the 18th century simply couldn't accommodate a plebiscite on every question. Rather, as the Federalist Papers make clear, they insisted upon the importance of a reflective process, with an intermediate institution placed between the people and the exercise of power -- an institution capable of reasoned debate and deliberation, which would cool passions and distill judgment and look beyond the present moment to the future consequences of the decisions made.

Many people feel that valuable processes like these in our society are threatened by the still accelerating scientific and technological revolution. They wonder in this case, for example, about the impact of television and 30-second commercials on our ability to be deliberative and reflective in our political decisions as a nation. Passionate beliefs held by a temporary majority, when powered by the extra force of new technology, may not be cooled or slowed down at all by the institutions of our self-government.

This concern that science and technology now regularly unleash forces that threaten to seriously damage some delicate balances important to the fabric of society is one of the principal issues our society must resolve in order to establish a healthier relationship between the two cultures.

Until recently, this dialogue was difficult to even begin because of a philosophical preference in the scientific method for narrow specialization, which often resulted in the splitting of large questions into smaller and smaller component parts, each of which was then analyzed by expert specialists -- independent of those studying the other component parts. Not only was communication difficult between scientists and generalists. It was difficult between specialists in one field and specialists in another field. The often frustrating result was a tendency to ignore important relationships between the different parts that made up a whole.

As Goethe said in anger and frustration, "How often do they strive to divide that which, despite everything, would always remain single and whole."

In more recent decades, there has been a new appreciation within science for the study of whole systems. Here at MIT in the early 1960s, for example, the System Dynamics Group was founded by Jay Forrester, a professor of electrical engineering. And the new emphasis on systems creates new possibilities for a fruitful dialogue between the two cultures.

For example, both cultures can describe how the invention of nuclear weapons radically transformed the age-old habit of war. The destructive consequences of all-out war between superpowers became unthinkable, and a "cold war" emerged in its place. In the same way, a large cluster of new technologies that enhance our capacity to exploit the earth for sustenance has radically transformed the relationship between humankind and the global environment. For example, the air we are breathing in this great court contains six times as many chlorine atoms in each lungful than it did when these buildings were constructed. The same is true of the air at the North Pole and the South Pole and the Equator and everywhere on earth.

The concentration of chlorine in the entire atmosphere of the earth has increased sixfold in only a few decades because of a single new family of chemicals invented in the 1930s and used in large quantities only since World War II -- chlorofluorocarbons. There are, so far as we know, no direct health consequences of breathing six times as many chlorine atoms. But the impact on the earth's environmental system is quite harmful. The hole in the stratospheric ozone layer and the increased irradiation of the earth's surface by ultraviolet rays is a direct consequence of this new technology.

Similarly, the burning of fossil fuels by five and a half billion people and the destruction of forest land at an unprecedented rate worldwide is now leading to the rapid accumulation of carbon dioxide and other greenhouse gases in the atmosphere of the earth. The resulting global climate change is increasing global temperatures, threatening the disruption of the climate balance we are used to that has remained relatively stable for thousands of years. It is also causing the rise of sea level at six millimeters per year, the retreat of nearly every mountain glacier in the world, the rapid disintegration of important ice shelves in Antarctica, and the disruption of important ecosystems upon which much of the diversity of life on earth depends.

A third potentially destabilizing set of new technologies is what is commonly called genetic engineering. One graduating MIT senior wrote that recombinant DNA technology represents "a powerful tool for countless therapies. However it could also be very harmful in the wrong hands."

In all these examples, there is a clear sense that what is needed and what is at risk is balance. The new capacities conferred by new discoveries in science and technology clearly have a promising potential for good and beneficial effects, but simultaneously provoke widespread and deep concern that the use of these new powers can be disruptive and harmful. Another graduating senior expressed his concerns in these words: "I believe that technology in any form is a new power that can potentially disrupt society. With the current pace of advances, our society is undergoing a destabilizing revolution constantly. Maintaining the delicate balance that we have achieved between individual liberty and societal needs requires diligence and a watchful eye. Failure to do this will lead to either chaos (Lord of the Flies), or tyranny (1984)."

How can we create a richer, more productive dialogue about these possibilities that is accessible to men and women who inhabit both of "the two cultures?"

Let me suggest a second metaphor that is based on a new discovery in science, which I believe has explanatory power directly relevant to the society's need for a discussion of this problem: "Complexity Theory" is a new science useful for describing what are called non-linear systems that exist "at the edge of chaos." By that definition, our society certainly qualifies as a complex system.

Here is how the author Mitchell Waldrop describes the phenomenon: "Complex systems have somehow acquired the ability to bring order and chaos into a special kind of balance. This balance point -- the edge of chaos -- is where the components never quite lock into place, and yet never dissolve into turbulence either. The edge of chaos is where life has enough stability to sustain itself and enough creativity to deserve the name of life.

"The edge of chaos is where centuries of slavery and segregation suddenly give way to the civil rights movement of the 1950s and 1960s; where seventy years of Soviet communism suddenly give way to political turmoil and ferment; the edge of chaos is the constantly shifting battle zone between stagnation and anarchy, the one place where a complex system can be spontaneous, adaptive, and alive."

There are a number of societies in our modern world which appear to be in a state of equilibrium and balance, but move suddenly toward chaos or totalitarian stagnation.

Consider, for example, Somalia. The clans which organized traditional Somali society often engaged in confrontation at the boundaries of their respective territories, in clashes which consisted largely of symbolic conflict with few casualties.

The introduction of automatic weapons in large numbers and then the mounting of machine guns on light pickup trucks -- a combination that became known as "technicals" -- tragically transformed the consequences of these once symbolic conflicts, and the entire system slipped out of equilibrium and into utter chaos.

To take a second example, in Sarajevo, the stadium that was the centerpiece of the world's celebration of peaceful competition at the 1984 Winter Olympics became a cemetery a few short years later when that society slipped into chaos.

In the 1930s, fragile democracies in Germany and Italy moved not toward anarchy and chaos but toward totalitarianism with horrific consequences for much of the world.

The challenge for modern societies -- including our own -- is of course to avoid either extreme -- either chaos or stagnation -- by maintaining the essential balance between stability and creativity.

And part of the challenge is how to integrate the changes that flow out of new technologies and new scientific knowledge, the new powers and enhanced capabilities, and use them as a source of energy for adaptive change that benefits society as a whole.

There is a model for understanding how such change occurs that I have found helpful.

Nineteen years ago, as a freshman Congressman, I met a scientist named Ilya Prigogine who had just won the Nobel Prize for Chemistry for describing how systems can adapt to sudden and dramatic change.

He described characteristics of what are called "open systems" -- meaning systems where energy or matter (or both) flow in and through and out the other side. When the flow of energy in such a system suddenly and dramatically increases, the system responds in a two-step process: first, it breaks down; second, it reorganizes at a higher degree of complexity.

Societies can behave the same way, when there is a sudden and dramatic increase in the flow of energy through the society -- automobiles in place of horses and buggies, massive waves of immigration, new trading relationships with new flows of products, surges of new information with the introduction of new technologies like television or the Internet. First, long-stable patterns break down. Then new ones emerge at a higher degree of complexity.

Societies are vulnerable to misinterpreting the first stage as a descent into chaos and then overreacting with the imposition of a rigid, stagnating order.

The science historian Gerald Holton wrote, "History has shown repeatedly that a disaffection with science and its view of the world can turn into far more sinister movements." So while we are right to raise questions about the challenges to our society posed by new technologies -- as many of you did in your e-mails to me -- we must strongly reject the neo-Luddite voices in our society seen in their most extreme and repugnant form in the writings and actions of the Unabomber.

By contrast, the conditions that maximize a society's ability to integrate rapid change in a healthy pattern include: the maintenance of the free flow of information; the maintenance of strong intermediate institutions such as families, schools, places of worships, civic associations, and communities; and the avoidance of gross inequities. As one graduating senior put it, "I fear that technological advances, if done in the wrong way, will cut off the poor or anyone who doesn't have access to these changes."

If individuals within a society are left behind when others gain new powers and capacities, they can lose their attachment to the society, begin to feel powerless and then define their relationship to the whole in terms of anger and alienation.

For four years President Clinton and I have been working to ensure that as we enter this new age, our nation addresses the challenge of maintaining a free flow of information, avoiding gross inequities in the access to such knowledge, and in sustaining the private institutions that promote dissemination of this learning.

Just last week, the President announced a new plan to put two years of college in the grasp of all Americans -- young and old -- with a refundable tax credit that would make tuition free at most community colleges. We have also proposed new tax deductions for educational costs, lessened the cost of student loans, and promoted an ambitious plan to have every classroom and library in the country connected to the information superhighway by the year 2000.

New information technologies have a special power to engender dramatic change in society. For example, the invention of print technology in the 15th century distributed large quantities of civic information, thereby creating the conditions which made possible the emergence of the nation-state and eventually representative democracy.

In our day, the new technologies of radio and television broadcasting have dramatically increased the flow of information throughout the world. In Tianenmen Square, fax machines and CNN were seen by Chinese authorities as deadly threats to civic order. The Ayatollah Khomeini spread his revolution inside Iran with audio cassette tapes and telephone lines. The Internet will soon distribute a million times the information accessible in print to billions of people on every continent.

As another member of the graduating class says, "Each of us may speak with equal voice and be easily heard by any who choose to listen. The powerful or rich no longer have the monopoly on mass communications."

Along with the Internet, the most important new tool we now have to extend our ability to create new personal paradigms of understanding is the computer. Computers can magnify our ability to cope with the information explosion in four important ways:

First, they can sift through vast quantities of data, searching for the needles in the haystacks that are directly relevant to the questions of interest to us.

Second, they can form these data into patterns that are far more accessible to our brains than endless bits of information strung together sequentially.

Third, they can artificially alter the scale and speed of the world to make images too large or too small for our comprehension just the right size for us to understand. Processes that are extremely slow can be speeded up for our inspection, and processes that occur naturally at the blink of an eye can be slowed down for our convenient analysis.

And finally, the largest and most powerful of these machines have led to the emergence of a completely new form of knowledge creation. In addition to inductive reasoning and deductive reasoning, we now have a new variety that blends aspects of the first two. "Computational science" can create artificial realities within which experiments can be conducted.

How will society adapt to the dramatic changes that will accompany this new revolution?

The reemergence in our world of rigid, stultifying, fundamentalist ideologies can be seen as one extreme in reaction to the vast increase in data that is now washing through world civilization.

At the opposite extreme, the fear of chaos was expressed by another graduating senior on the Athena system: "Free speech uncontrolled can break down our social norms and common beliefs, allowing extreme opinions to find and strengthen each other or allowing unsubstantiated unfounded 'truths' to be disseminated without challenge or resistance."

Hers is a concern I share. For example, I believe we have an obligation to assist parents who want to exercise responsibility for protecting young children from materials which they as parents believe their children are not ready for.

But let me also state my clear and unequivocal view that a fear of chaos cannot justify unwarranted censorship of free speech, whether that speech occurs in newspapers, on the broadcast airwaves -- or over the Internet.

Our best reaction to the speech we loathe is to speak out, to reject, to respond, even with emotion and fervor, but to censor -- no. That has not been our way for 200 years, and it should not become our way now.

In 1962, the great historian of science, Thomas Kuhn, described the way in which our understanding of the world evolves when faced with a sudden increase in the amount of information. More precisely, he showed how well-established theories collapse under the weight of new facts and observations which cannot be explained, and then accumulate to the point where the once useful theory is clearly obsolete. As new facts continue to accumulate, a new threshold is reached, beyond which a new pattern is suddenly perceptible and a new theory explaining this pattern emerges.

It is an important process not only at the societal level but for each of us as individuals as we try to make sense of the growing mountain of information placed at our disposal.

But while the breakthroughs in understanding that we need in order to adapt to change may be facilitated by the new capabilities computers and the Internet make possible, they will not be *caused* by computers and they will not take place *inside* computers. They will only take place in our *lives*. They will only have meaning in relation to human *values*.

The noise level in our civilization is rising. The flood of information on every subject makes the task of understanding change more difficult than ever. The temptation to rely on new technologies as a substitute for reflective thought is a dangerous trap.

How many of you have tried to see the hidden three-dimensional images in modern computer-generated pictures called, by one brand name, the "Magic Eye?" Could I see a show of hands? For those of you who have not seen these novelty pictures, they consist of complex patterns that seem like busy, partly incoherent designs, and they are intended to be viewed in a special way. My children taught me the technique. You hold them close to your eye and focus on a distant point beyond and through the plane of the image. Then you wait until your brain has processed the information in the image, which then reveals a three-dimensional picture that comes into sharper focus when you slowly move the image back, keeping your eyes focused beyond the plane.

The most important breakthroughs and advances in understanding can only come when we take the time to look beyond the surface of the problems we face and focus on what is most important in our lives. The same is true for you today.

If you are seeking a deeper understanding of what your life is all about, you will not find that meaning on the surface of your life. You must look beyond and through your life, and focus on a distant point far from this plane and be patient.

Nor can you understand your life in isolation from its context: your family, your community, your nation, your world, and the fabric of existence of which you are a part. If you are seeking healing in your life, healing is to be found in these relationships. If you are seeking spiritual meaning in your life, you will not find it by thinking of what you want to do next, but rather by reflecting on your whole life in its largest context.

If you are pursuing happiness, it will not be found in a set of rigid nostrums, nor in the undisciplined pursuit of pleasures, but is more likely to be found by living your life with enough stability to faithfully discharge your responsibilities to others, and also with enough spontaneity to adapt continually to the new challenges you will encounter and to seize the new opportunities inherent in a life with creativity and balance.

That is my wish for you. God bless you, and good luck.

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