Science, Technology and Engineering Education
In 21st Century Diplomacy and Development

Andrew Reynolds
Deputy Science & Technology Adviser
To the Secretary of State at the U.S. Department of State

Let me begin by joining others in saying how much I appreciate what Dick Larson and Liz are doing in this program. I know you all join me in that sentiment. It has been an amazing two and a half days, I must say, and I have learned a great deal.

I appreciate the opportunity to speak. I come with perhaps what you might call a 30,000-foot perspective this morning, from the view of Washington. The State Department and the Agency for International Development are working in the very medium and the initiative that you all have devoted your lives to making possible– which is the greater education for the greater good of the larger group of people that have been denied such education over time. I will take you through a number of slides pretty quickly, because there are too many, but let's start.

The first slide summarizes what I would like to cover today, not in any depth, but just to give you a snapshot. Project Horizon is a strategic planning exercise looking at the year 2025. We really have to look ahead of the headlights and not constantly in the rear-view mirror, or we are doomed to repeat mistakes. I will tell you, the world that we see in 2025 is not necessarily a pretty one. It gives the imperative to you even more, as educators, to continue in your hard work.

I want to say this about science and technology: It has been my experience that people collectively use the terminology S & T, science and technology, and they really take the engineer for granted. I think that is a mistake because in many developing countries, it is the engineer who must lead first, in helping to build infrastructure, in the form of schools, and provide lighting, and power and water. This infrastructure is critical for education, as well as the research bench, for better living, better health standards, and so forth.

The next slide offers a nice collection of definitions that I have extracted from the National Academy of Sciences, and National Academy of Engineering. I particularly like this quote from Theodore Von Karman, the brilliant Hungarian, aerospace engineer who came to the United States and is really the founding father of the Jet Propulsion Laboratory in California. Do not take the engineer for granted. Here, in this august institution, I think it is particularly fitting to make that case. I am the squeaky wheel in the State Department and in the A.I.D. for the engineering community. I constantly remind people that engineers are seminal to success.

This is just a small perspective of where we think we are going. The point of this slide is particularly important and is really the pivotal point of my presentation to you today. Never before has our international relations environment been informed so greatly by science and engineering and education. Never before have we been compelled to pay so much attention to these disciplines as seminal ingredients in our international relations

and our development. I can show you many examples in these slides where successive Secretaries of State, since we have opened our office in September of 2000, have seen the importance of science and technology.

To bring it to the present time, our current president delivered a speech at the National Academy of Sciences in April last year. The speech was pivotal to demonstrating that this administration had a significant world view, an appreciation for science and technology and engineering as never before seen. The appointments to the Cabinet, as well as other senior officials, including that of John Holdren, the science advisor to the President – whom many people in this room also know very well – demonstrate that world view across the board. More directly for our institution, Secretary Clinton has also expressed this sentiment. We move into our cosmos, our construct, our ecology, where we are doing everything possible to integrate development and diplomacy as a unified process in the United States government. Our joint strategic goals, illustrated in this slide, I am glad to say, are relatively bipartisan because they began back in the Albright Administration of the State Department and continued through to Colin Powell, Condi Rice and now, Secretary Clinton. So we have built continuity into this joint strategic planning, which is extremely important. I can tell you that bringing together the cultures of the State Department and the Agency for International Development is very difficult. They have two very different histories, and two very different cultures. But this slide points out the strategic goals that we work upon together and work through to demonstrate where our foreign policy and development policy must go.

As seen in the next slide, I have divided those six joint strategic goals into areas where science, engineering and technology can inform, empower and advance. The "hard power" category addresses national security, where science, engineering and technology mean so much, be it in arms control, be it in the export of dual-use technologies, or the policing of technology in the world. The "smart power" concept and the "soft power" concept probably are inspired, if by any single person, by Joe Nye at the Kennedy School, who has worked in and out of administrations for many years. What I am trying to do is show you how these strategic goals are informed and empowered by science, engineering and technology as a general proposition.

This advocacy is part of the reason our office is there in the State Department. Science and technology had become sub-critical in the 1990s, with too few people with scientific and engineering disciplines to really understand and inform how international relations, foreign policy, and development policy should be carried forward. Just as a metric, the Agency for International Development had 15,000 people in the year 1975. In the year 2000, they had 2,000 people. Most of those people were in Washington, just monitoring and administering contracts. What we are doing now is rebuilding A.I.D. at the same time as we are rebuilding the State Department's capacity to follow science and technology.

To continue, the "soft power" points, of course, are humanitarian assistance and promoting international understanding, both empowered by science, engineering and technology. Our consular affairs and management structures, too, are benefiting from advanced technologies and advanced scientific and engineering assets. We have the largest US government physical infrastructure around the world because of our embassies

and our missions – in total an even larger number than the Defense Department, in some ways.

This next slide tells you about our mission as an office. I will not go over it except to say that we rebuild and build capacity in people, in terms of partnerships with the outside world, in like-minded ways. We also look to strategic planning, which I will focus upon later. This is a list of many reports in the past that have all pointed to the need to look strategically at the future through the S&T lens. The next slide summarizes Project Horizon, and it is one of the pivot points of my presentation, because it is forward-looking. It is the notion that in our environment at the State Department, and in many of your environments, our world is built on five, ten, and 15-minute intervals – the very short term. Our world is certainly five, ten and 15 minutes, and maybe five, ten and 15 hours most of the time. It is a 24-7 cycle because somewhere around the world, our embassies are working with their host countries. There may be a crisis, and we have to be on call, like doctors, in that sense. While you may have every ambition and hope to sit down in your day-to-day living in the State Department or in A.I.D. and concentrate on something that might take three or five years to realize, often you come through the door, and there is a fire on your desk. So you put the fire out.

In this world of fast cycles – 24-7, five, ten, and 15 minutes – it is also important to try to be "*contemplative*," to take a deep breath, and look at the future. We chose 2025 when we organized Project Horizon in the year 2006, as a milestone. The Defense Department was also looking at that milestone, as was our intelligence community, with the idea that we should think about the world at 2025, anticipate where we are going to some extent, and prepare for that day. The important thing about this exercise was, it was very inter-agency, with 15 agencies— civil agencies, the Defense Department and the intelligence community— in the room, as well as a select number of NGOs and business community and civil society representatives. It was all open and based on a set of possible scenarios.

The objective function of Horizon was, if this is the future we see at 2025, which I will describe briefly in a minute, how do we prepare for it? What are the critical assets that our U.S. government must develop to be ready? This was done through a very interesting survey of 200 notable people in this field of horizon scanning and strategic planning. The drivers identified in the survey and illustrated in this slide were all distilled into several major dimensions, which in essence framed this scenario-based exercise. The drivers presented a challenge to the nation, state power and influence. They addressed the gap in the global standard of living. They addressed economic competitiveness and threats, because in the end, the State Department and the Defense Department represent the national security community - we have to worry about the fate of the nation and threats to the nation.

This is probably as pivotal a slide as any that I will show you, in this context (see slide #12). These were the 15 major drivers, major factors, expected to characterize our world in 2025, based on these expert interviews. I highlight in red, for obvious reasons, two drivers, one for science and technology competition in the world and the other for advances in science and technology, including disruptive technology, which follows closely what Michael was using metaphorically in "disruptive education." Disruptive technologies are serious concerns for peaceful nations. In a world of ubiquity, where

science and engineering are, indeed, global now, there are also sinister players who would like to use technology against civil society. This is all part of our greater challenge. Those two points are really the most important to take away. Notice that everyone talks about these issues, these drivers, but to focus on your proposition, the greater education for the greater good for the largest number of people, this will all come into play.

The next slide summarizes the Horizon scenario set (see slide #13). We actually constructed 16 scenarios, but we could not game them all. It would have been impossible. So we selected five. The five are in what you might call an "electron cloud, that is created in a future but uncertain space. That is a metaphor I like to use. They are boundary scenarios. Maybe the world will be somewhere within the five, taken holistically, taken collectively. But I can tell you, as a general matter, that the dominant theme in all these scenarios is that with increasing population and pressure on natural resources and the environment, the global commons of the earth are under serious duress by 2025. That is an important point because that is part of the education process we have to undertake, as well.

In short, all these scenarios look to an assault on the global commons. And there is real concern that the international institutions governing those spaces, and the governance community, are not (and will not be) adequate to address those issues in a serious and significant way. Remember, this Horizon exercise was gamed with those five scenarios, in three different workshops, with three different populations, drawn from the 15 agencies, the NGOs and the business community. They mapped their exercises individually. Then we mapped them collectively to come up with these answers. Again, the overall objective of Horizon was, if this is the future we face, what government assets will be needed to be ready for that future? There are ten associated recommendations (They are there for you to read in slides #14 and #15).

The first recommendation calls for a quadrennial strategic review, akin to the Defense Quadrennial Review, which is done every four years. The whole-of- government really needs to conduct strategic planning in that way, on a regular cycle. We do not do that at present. We do strategic planning ad hoc, very ad hoc. As seen in these recommendations, we need ubiquitous and seamless information sharing, domain foresight, fusion groups, and capabilities for global health engagement. In the case of an H5N1 crisis, are we ready? Similarly, we need global hazards planning and response capabilities, such as those we practiced in Indonesia in 2004, and most recently in Haiti. Are we ready with the assets we need to bring to the point of need, for response and recovery?

For this audience, note the next recommendations: a human resources model for global affairs and a "Global Affairs Learning Consortium." Now doesn't that have a significant resonance to you, maybe? That was very government-specific. How do we, in the federal government, empower our own workforce and build a culture that looks to global affairs, and horizon scanning, and foresight? We do not have it. We do it in the strategic planning exercises, but they are ad hoc, as well. We assemble people for one exercise and then you move away and go back to your day job. Our advocacy, and mine particularly, is that we need a culture of committed civil servants, for example, who work

in this career path and are not worried about five-, ten- and 15-minute fires on the desk every day, who have the ability to think outside the box and to look into the crystal ball darkly. Thus arises the public-private partnership framework, the next recommendation, which, of course, is also very important.

The tenth and last recommendation is a real sweet spot for us. We have never used our science, technology, and engineering assets in a strategic sense. We are always very ad hoc. We have a meeting with Indonesia. We have a meeting with Brazil. We have agreements for cooperation, numerous agreements that we utilize for building greater S and T cooperation, education cooperation. But we do not use them as strategically as we might. That is what Project Horizon was telling us to do.

I am glad to say that there is continuity, a bipartisan nature to foreign affairs. Condoleezza Rice's advisory committee took the Horizon outcome, which was a general conclusion for federal government, and said, "How does it apply to the State Department and the AID?" First and foremost, we need to expand our workforce and bring more science and engineering expertise and literacy into our workforce. This is very important for us and for our mission.

The advisory committee also called for better knowledge management. There in the slide you see "Harness 21st-century technology and knowledge management." This continuity, I am pleased to say, has been picked up by the current administration. But just as an interlude, before we go into more detail about the Obama administration, here in the next slide are some of the issues that we address every day, that we think about in the context of horizon scanning, if you will. Many of them are familiar to you. I think there is a richness about this list. I like to have a discussion when I am doing this. If you have a question about any one of these, I would be happy to go somewhat deeper into them.

Notice that that the issues are represented for the short term, the one-, three-, five-year time frames. Then you move into the long term, and you begin to see how Horizon themes come forward. Look at demographics, the megacity issue. Think about the megacities in the world today. Most of them are in the developing world. The infrastructure is inadequate. In fact, there is no infrastructure in many cases. Many of them are located in seismically active areas. Haiti was a precursor to something that could be very much larger, for example, in Istanbul where you have very active faults. The world is always in upheaval. Remember, folks, we do not have any control over Mother Nature. So engineers and infrastructure are needed at the leading edge of a civil society that is growing and urbanizing as never before.

The issue of food, fiber and fuel competition is something we know well, as are alternative energy technologies. I speak to the "adaptation" issue with a capital A, because the climate is going to grind on, and it is going to change as it sees fit. We have huge economic momentum in the industrial system that we have created, so we must begin to pay attention to adaptation, while we try to substitute alternative energy sources and go for deeper conservation in much of what we have before us.

Then, of course, a topic I am sure of very great interest you, is this whole evolution to the next-generation Internet. I take those characterizations in the slide from John Kao's great

book, *Innovation Nation,* which Michael knows very well. We talked about this. There are multilateral organizations and mechanisms that are very much engaged in these and other issues. Just last week, I was attending the Commission on Science and Technology for Development under the United Nations Commission for Trade and Development in Geneva. We have two mandates in that commission. The first centers on traditional science and technology for development. In this case, we are working at present on the theme of distributed renewable energy technologies for developing countries. The second mandate is the follow-up to the World Summit on Information Society, to ensure that global access to the Internet is continuously facilitated by member countries and international organizations. Talking about the gap in broadband access is really the area of greatest concern, obviously. You know that better than I.

The next slide depicts the current foreign policy environment. Secretary Clinton laid out this architecture - these pillars - last summer. In the terminology— "multi-polar" versus "multi-partner world"— the emphasis is not polarity; the emphasis is partnership. That is a new, refreshing turn of phrase. Of course, we are seeing our attempts to engage Iran and North Korea and others falling short, in some cases. Nonetheless, it is a pillar of this administration's foreign policy and is really critical.

The next slide is also critical because it returns us back to the sweet spot of joint strategic planning. I will also outline the Quadrennial Development and Diplomacy Review for you.

Because global health and global response to natural hazards require that all forces, all assets of our national power, come together and work, we need to ensure that civilian and military efforts operate even more synergistically together for efforts in places like Afghanistan and Iraq. Of course, we always must say American values are integral to our specific policies.

This slide addresses the new Quadrennial Diplomacy and Development Review, which, in many ways, has roots from Project Horizon. This administration saw that as a good idea and embraced it last summer. A.I.D. and State Department senior management are going through an arduous process to consider this list of various questions. This is a "hard love" exercise, where you say: "What is good? Keep it. Improve it. What is bad? Get rid of it." So if we really mean what we say about this QDDR exercise, it will create a reform movement. We hope so. Its final process is moving to conclusion now. Policy gaps and organizational change are all cross-cutting themes in the exercise. This is very important because it is so current, and we have been waiting for it.

This leads us to the next slide about the National Security Strategy, in terms of the structure of the United States Government – and really, many governments – starting from executive leadership. The president has a national security strategy, which defines the broad parameters of our domestic and our foreign policy. The speech President Obama made at West Point last Saturday really gave us the first clear idea of what principles will be priorities in this current administration. I think the most important new thing, in my experience, is this: saying we cannot be a good advocate abroad unless we are strong at home. Therefore, the president's, and this administration's, domestic policy is to rebuild the infrastructure, to go to a less consuming, less polluting, more efficient

energy infrastructure in time, to start the process. Above all, it is a priority that we refurbish, strengthen and reform our education system. That is a centerpiece of our national security strategy, I am glad to say.

Another priority in the Obama National Security Strategy is engagement of our world through our diplomats and developers, support of international development, and rebuilding alliances and promoting human rights at home and abroad. This obviously stems from Secretary Clinton's speech, as well. We will see the new national security strategy most likely released this week, for all to see in its complete form, but the President gave us this very nice foreshadowing.

So now back to content of this slide because a year ago the President made this rather seminal speech in Cairo. I have talked to many of you about it here this week. The vision was there in this speech, but sometimes the follow-up in the action has been short of the mark. I would say that this is a difficult process, because the president set a vision, and then the machinery must go to work. This is not unlike what we were hearing this morning with your distinguished panel, about the discussion of an online freshman year versus a resident freshman year. And boy, there are economies in the administrative side that I really appreciate, such as the moat and the bridge analogy of the 70 universities in the area. But I just highlight a few of the important things that President Obama said in Cairo, particularly with the interest of the Muslim majority nations in mind, to reset the terms of engagement and to reach out the hand of cooperation and partnership between our many communities, including in education and business.

The President spoke about mutual interest. He spoke about educational exchange programs and scholarships, and a new corps of business volunteers. On science and technology, he spoke about envoys going out as special representatives for him and Secretary of State to enlist and understand other nations' needs. He spoke about priorities in science, technology and education. That process has gone rather well, I would say. We will come back to some of these issues later.

In the next slide I want you to see that a very important turning point after the President's speech has been a total embrace by our public diplomacy, and our department as a whole, of the fact that science and technology are now underutilized assets in this enterprise of international relations. Everyone feels very comfortable about science and technology cooperation, and we have always taken it for granted. But we have never really given it the champion viewpoint, and publicized it, and demonstrated how important it has been in normalizing relations with so many countries through thick and thin.

A new emphasis that speaks to these things is now at the center of our foreign policy and our development policy. Nationally, we are working in a people-to-people modality. It is just what you are doing here as this LINC networking community. It is meeting with counterparts. It can be facilitated electronically and online, and we are doing that, as well, but it is also about meeting people on their own soil, leveraging existing platforms, and ensuring that the content fits, culturally, with a diverse counterpart. Above all, it is about strengthening the institutions. Education, of course, is fundamental to this, as is networking and e-learning. I can tell you, social networking is now a major theme in the State Department and A.I.D. and we are mobilizing resources to do this better.

We have a Secretary of State who speaks about social networking and empowerment of women. You remember, "It takes a village," in her mind. So we have, in essence, a real push to come into the 21st century in the State Department because many would still accuse us of being rather 19th-century in the way we do our business, particularly with regard to our computer systems. As you see in this slide, these are just a few of the virtual platforms that we will be stimulating. We have already established this, but we will go even further.

Of course, we have to put in truth in advertising: MIT and OpenCourseWare are right at the center of many of the things we do. We stood up in Iraq with a Virtual Science Library in 2006, when our scientists and engineers could not meet on a regular basis due to security problems on the ground. The Iraqi Virtual Science Library is a tremendous success. It opens access for Iraq scientists and engineers in universities and ministries to tens of millions of documents, research papers and current information, including OpenCourseWare. Those platforms are something we will be reinforcing more generally in the next phase of our outreach for science, technology and social networking, including with more Muslim and other countries.

The Secretary and her Undersecretary for Public Affairs, Judith McHale, are very much in tune with youth and women and empowerment of less fortunate communities. Why can't we use some of these good news stories to greater effect than we have in the past? We can do more of this and publicize it, particularly when we are working with counterparts in foreign countries who have become leaders in business and in universities, as educators. It is an important thing to speak to the public in foreign countries and say, "Your leadership is needed in science and engineering. This is a part of your culture as well."

This is the sampling of what we now call the "New Beginnings" initiative that the president launched in Cairo on June 4th, last year. There are some very significant ideas illustrated in the next slide. I have just taken a few. The science envoys - Bruce Alberts, Elias Zerhouni, and Ahmed Zewail - have already made trips to the Middle East and Indonesia. They are bringing back information from governments, universities, and other communities in those countries to help us understand where we could concentrate our collaboration in the next phase. We have just announced with Egypt a science year in 2011, I am glad to say, which will focus on education, and STEM particularly, with youth and in universities. The program will bring more scholarships, including greater connectivity to the GLORIAD, which some of you may know. That is a scientific ring for high-density data exchange.

Our office happened to lead the next initiative, illustrated here, in March 2008: the Geospatial Sciences for Sustainable Development in Africa. I like to count it under the new initiatives column, as well. We were out in front, using remote sensing, geospatial sciences and GIS for sustainable development issues, the analysis of issues, urbanization, food security, land use management, watershed, and the compelling issues that arise and are pointed to as flashpoints coming at us. We can get started now, and use imagery as deftly as possible, as quickly as possible, and do it regionally because information and communication technologies (ICTs) have empowered us to do so.

The Summit on Entrepreneurship referred to in the next slide has just occurred. The president actually delivered the keynote speech. It was, again, an outgrowth of the Cairo Initiative to bring the business community together in public and private partnerships on the entrepreneurship side. So we develop a continuum in our ecology, comprising basic science, applied technology, engineering and education, from the bench to the market. Within that is Partners for a New Beginning and eMentor Corps online. We are building a portable website on the State Department website for eMentor, so anyone can come in and look for a venture capital contact, financial manager, or a planner. That is the idea: using e-networking and e-government in a much more nimble way, and for the benefit of a larger audience. There is a technology and innovation fund that the President also spoke about. It is just being organized under our Overseas Private Investment Corporation.

Our mission is on the rise. The administration realizes that what we were saying for the last ten years has to be redoubled and strengthened. We need more scientists and engineers in our midst. At A.I.D.we need to push more scientific literacy and capacity– in the form of officers– to our missions and our embassies where we lost a great deal of critical mass in the last 25 years.

I have a few final thoughts, and I hope that leaves a few minutes for questions you may have. I took notes from the first couple of days. I think Cliff Missen really has something here, because the broadband divide will remain for a great deal of time. I noted the large investment of private capital in Africa. The fact that there are more mobile phones on that continent than anywhere else in the world is remarkable, but broadband access to empower education is another matter. I do not know if Cliff is here today, but I will tell you that his is really a sweet idea, and it is obviously at work. He has been very successful in Africa, and you saw from his map that he is working elsewhere.

I think Andy DiPaolo had a very nice turn of phrase there, as did the gentleman this morning. And then, Milton Chen— I really like his metaphor, "weapons of mass instruction." That is a good takeaway and turn of phrase. Then, of course, ending up with Dr. Vest, I think he said it all: "The uncommon education for the common man" as a driving motivation in his own life. Then this whole notion of why e-education matters, and how it can empower so quickly, because of the great devotion of people like you. Finally, of course, Dr. Vest ended up by saying, "Then came another great thought," LINC and BLOSSOMS.

In this context, and for me, Colin Powell's rule 13 stands out: "Perpetual optimism is a force multiplier." He had 13 rules -that is the one that keeps me going every day, and I hope you, too, as well. Thank you very much.