State of the School  
Fall 2012

I am very pleased to welcome you to our traditional fall luncheon and the “State of the School” address of the Viterbi School of Engineering.

Summer is always a very dangerous time for my communication staff- and the dean’s office team. That’s when I start consuming assorted books and articles. If you are among my legion of Twitter followers — OK, only 328 of you, the last I checked! — you may have picked up my penetrating insights on the state of American soccer- but more seriously my appreciation of a new book by Oxford quantum physicist David Deutsch, called “The Beginning of Infinity.”

Now I know what you’re thinking. Last year it was “From (very) Good to Great”, this year it’s “The Beginning of Infinity.” Yes, you are into something, that this is how I view the school’s trajectory! But I also wanted to highlight a couple of profound points which resonated deeply with me:

1) Problems (I prefer to say, challenges) are inevitable.
2) But all problems are soluble. (As a chemical engineer I was fascinated that the word Deutsch used is not the more conventional “solvable”, but “soluble”, which essentially means dissolved, disappear, dissipate.)

In the above context, by challenges I don’t mean those driven by our imperfections. As you know, we don’t have those in the school! Our mantra of “constantly improving quality” and “excellence in all our endeavors” have banished such challenges, I hope! What Deutsch (and I) mean are those that come with new endeavors, new advances. Such challenges are inevitable- they are the collisions of ideas. But, and here comes Deutsch’s optimism, which I share wholeheartedly, they are all soluble- through science and engineering and technology. These will be solved- and progressively faster in today’s world- and then they will give rise to new challenges, as we move on to new endeavors- and subsequently to new solutions. This is the exciting and exhilarating part of our evolution, and it is the path that our own discipline and our own mission and our own school are forging, for the collective benefit.

David Deutsch’s is a profoundly optimistic view of the world. And I fully agree with him. Let me give you an old example. In 1798, the famous English scholar Robert Malthus argued that the coming 19th century “would see a permanent end of human progress.” The human population was exploding and there simply wasn’t enough food to go around. Malthus was quite right about one of those things: population did, in fact, explode. And it keeps exploding decade after decade. What he didn’t count on, however, was this explosion in humans would coincide with an even greater explosion in food production.

Someone- I would bet it was an engineer- discovered some new knowledge – new methods of producing of food. And that challenge was resolved at least then.
More than two hundred years later we face new sets of challenges— we will always have them. The National Academy of Engineering codified 14 of them into the so-called Grand Challenges, in which USC Viterbi has been a national, and now a global, leader. Perhaps, they are as daunting as Malthus’s old challenge. But science and engineering will, as surely as we know that the earth rotates, provide solutions, by creating new knowledge, and new possibilities— until new challenges come into view, to be solved again with the same power. So that when the 21st century Malthuses prophets doom, whether because of energy crises, climate change, peak oil, cyber terrorism, access to clean water, reverse engineering the brain or personalized learning, we can turn to them and say: problems are soluble.

We live in unprecedented times. In the words of NAE President Chuck Vest: “We live in the most exciting era for science and technology in human history.” Indeed, the spectacular advances driven by Moore’s law have spawned and continue spawning great innovation, with deeply technological roots, that empowers society in unprecedented ways.

This is a theme to which I have returned to time and again (before I even read The Beginning of Infinity): the notion of “engineering empowering society.” And it’s a rather extraordinary thing how this manifests itself.

Last July, the famous comedian Patton Oswalt gave a talk at a gathering of comedians and Hollywood executives. During the talk, he held up his iPhone and said: “In my hand right now I’m holding more filmmaking technology than Orson Welles had when he filmed Citizen Kane. I’m holding almost the same amount of cinematography, post-editing, sound editing, and broadcast capabilities as you have at your TV network.”

Technology, Science and Engineering have empowered the individual— they are much more in control of their own destiny. Today, there are quite literally millions of ways in which engineering is empowering society.

Engineering empowering society, also termed Engineering+, or as our new CS chair Gaurav Sukhatme aptly translated into CS-language, Engineering+++ (the more pluses the better!) is what permeates the philosophy of our School. It reflects the enabling and innovation power of our discipline, its extraordinary interdisciplinary potential, its convergence with the sciences, medicine, the arts, even the social sciences. It is one of our deepest aspirations of the Viterbi School to be among the world leaders in enabling this power. It is really the equivalent of “All Problems Are Soluble”.

For engineering to empower society, however, society must empower engineering: In a complimentary and symmetric way. What this really means is that we need to attract, nourish and grow the talent, in all its diverse forms, and in the right environment to propel engineering to solve new challenges and open new frontiers.

I have found parallels of this in the “Beginning of Infinity”. You wouldn’t expect otherwise! Deutsch seeks to explain how knowledge evolves. His answer is simple— and
profound: Just like Darwin’s biological principles, it requires two overarching processes: variation and selection. Variation means to allow new, different and diverse ideas to spawn and be contemplated; and selection allows the rigorous testing and criticism of all the various alternatives, with finally bestowing to the best idea, that which passes the most critical tests, the identity of the new knowledge. Which is new, that is, until another novel out of the box idea appears which displaces the previous and becomes the new knowledge. And in our times, this happens with exponentially increasing speed.

From this simple but profound explanation draws a powerful conclusion: For new knowledge to be created the environment must be created that nourishes this spirit, of free, diverse and unencumbered exploration and research (Variation); and of free, diverse and unencumbered criticism and testing (Selection). Universities are the crucibles of such creation. And we at the Viterbi School aspire to be among the world leaders in enabling this environment and the creation of new knowledge to flourish, among our students and among our faculty.

The moment is pivotal. Tom Friedman of the New York Times recently wrote that in today’s hyperconnected world, being best or among the very best is essential; being average will not result in an average job. And at least in the developed countries, good jobs will be based on innovation. I translate: Being best or among the best requires the creation of such knowledge, such innovation. Being average, will simply not cut it.

So:
There will always be challenges.
But all challenges are soluble (through engineering and technology).
Because Engineering is empowering society- but also require society to empower engineering.
And we need talent and the nourishing environment to enhance “Variation” and accelerate “Selection” so that we can create new knowledge and tools and become associated with the next big innovation.

These tenets form the compass for the direction of the Viterbi School- for it to go from Very Good to Great. Or, as President Nikias has said, to help USC ascent to “undisputed elite status.” As we have been strategizing about meeting this challenge in the school, we concluded last year that it must be based on four pillars:

1. Be the global attractor of top talent, whether students, faculty or staff, from anywhere in the world; and create the environment for them to flourish.
2. Continuously add value in our curriculum, our programs, and our infrastructure.
3. Lead globally to advance solutions to world challenges, from sustainability, to health, to security to the elevation of the world’s standard of living.
4. Use engineering+ to be the catalyst for the innovations that will fuel the economic growth of Los Angeles, Southern California, the United States, and the world.
So this state of the school is to give you a brief glimpse of recent progress along many of these fronts.

In attracting and nourishing top talent I have much good news to report:

- Consider the new freshman class: We exceeded again considerably our enrollment targets and the class is as strong as it has ever been. Thirty four percent were named university scholars, 58 are national merit scholars. The average SAT has increased 47 points since the new test was introduced in 2006.

- Further fueling the Society empowering Engineering tenet, 38% percent of the entering freshmen are women; with students represented from 14 different countries; 33 different states; and having incredibly diverse backgrounds and interests, which enhance our student’s co-curricular experiences tremendously. (I met a Presidential scholar, a freshman last week: A BmE freshman, who is essentially a sophomore, grew up in Palos Verdes, speaks Mandarin, Hindi and Spanish, and will do a BmE major with a Business minor, and conduct research as an UG in wireless health. I was just blown away.)

- The last few years, the rate of return of freshmen engineers to sophomores has been consistently in the 91-92% range. While the six-year graduation rate of student who entered engineering as freshmen is close to 90% (this means from the entire USC).

- Our Undergraduates are bright, engaged and will challenge us. We need to make sure that they receive the best UG engineering education anywhere. Students groups from the American Society of Civil Engineers and from Aerospace Engineering received national distinctions. So, let us make sure that promises made are promises met. Let me repeat that: promises made are promises met. People are watching us and marvel at our ascent- but they want to solidify their opinion.

- The strong branding of the school globally has resulted in a new record high number of applications to our MS program, which last year reached almost 10,300 for about the same number of admits and enrollments. This unprecedented increase augurs well for the continuous increases in quality and selectivity of our MS programs.

- On the Ph.D. side, we had another strong recruiting year with close to 200 new PhD students enrolled this Fall. Our recent graduating class of 162 Ph.D.s is also probably the highest ever and close to our goal of each TT faculty graduating one PhD student per year. In addition, we have seen gains in the number of women, domestic students and underrepresented minorities. So, things are strong on that front as well.

- Consider, now, faculty achievements. In the last four years, the Viterbi School had seven of its TT faculty inducted in the National Academy of Engineering. Next Sunday, Professor Mike Waterman, who holds a joint appointment in Computer Science and Biology, will be inducted into the NAE in its annual meeting in DC. This distinction clearly puts USC in the same elite place as MIT, Stanford and a small number of other elite universities.

- Last month, the MIT Technology Review announced its annual TR35 list. This is a prestigious list of the top 35 young technology innovators in the world under the age of 35 - including universities, research labs and corporations. Burcin Becerik-Gerber, Assistant Professor in the Sonny Astani Department of Civil and Environmental
Engineering, was selected as one of the 35 in the world. And in the last four years, six Viterbi junior faculty (of which four women) have earned that distinction! It is a testament to the outstanding caliber of our junior faculty- and places the Viterbi School among the very top in the world in this category.

- I would be remiss if I did not mention yet another unprecedented faculty honor: Last Spring, seven USC Viterbi junior faculty were recognized as Young Investigators by the four research agencies of the Department of Defense (DoD). These magnificent seven received a total of 8 awards (There is no math error in that sentence: One person, Andrea Hodge, won two such awards!). Only the University of Michigan had as many awardees in these categories, and that also included the natural sciences, not only engineering, which was only the case at USC.

I should also mention a few other distinctions:

- Prof. Andy Molisch was awarded the 2012 @IEEEorg Eric Sumner Award in wireless communications.
- Andrew Viterbi received the Royal Academy of Engineering’s International Medal.
- Behnam Jafarpour was the recipient of the SPE Petroleum Engineering Junior Faculty Research Initiation Award, while Iraj Ershaghi was given the Honorary Member Award of the same society.
- Mike Kassner just received the Meritorious Public Service Medal medal of the US Navy.
- Costas Sioutas received the Haagen Schmidt Award.
- Terence Langdon received the 2012 Acta Materialia Gold Medal.
- Solomon Golomb who celebrated his 80th birthday earlier this year by receiving the 2012 William Procter Prize for Scientific Achievement, the 2012 Phi Kappa Phi Lifetime Achievement Award, and be elected as an AMS Fellow.

These were among the 68 such distinctions our faculty received last year.

The University announced last Fall a transformative faculty initiative. We always aim to recruit faculty with transformative potential- and the Provost’s initiative underscores this ambition. I am very pleased to welcome to the Viterbi School a number of senior faculty who joined us recently and who are raising the bar of excellence: Scott Frazer, new Provost Professor of BmE, jointly with the Dornsife College, who comes to us from Caltech; Lucio Soibleman, new chair of CEE who comes to us from CMU; Julie Higle, the first department chair in recent Viterbi history, who is the new ISE chair; and Mahta Moghaddam, Professor of EE, who joins us from The University of Michigan. They are joining an outstanding cohort of junior faculty in all departments.
Our staff continue to respond and serve the Viterbi School with unprecedented commitment, going beyond the call of duty and showing a unique loyalty to the School. I am very proud of the staff we have.

The second pillar of our ambition is to continuously add value to our curriculum, our programs, and our infrastructure: To help creating the environment for creating new knowledge.

- Last fall, we launched for the first time a program between the USC Viterbi School of Engineering and the USC Keck School of Medicine called HTE@USC (Health, Technology and Engineering at USC). HTE@USC will jointly train medical students in a technology-bent curriculum and engineering Ph.D. students with clinical immersion and understanding. These 12 students — engineers thinking like doctors, doctors thinking like engineers — may be producing the next generation of medical devices to support our 76 million retiring Baby Boomers and seniors.
  - As HTE co-director Terry Sanger put it: “I want engineers to learn how to use a stethoscope . . . They need to learn to use the stethoscope to understand why it has 100 percent market penetration. Why this nearly 200-year-old device has never been supplanted. Until they understand that, they can’t possibly design devices that have meaning in the clinic.”

- The intersection of engineering and the arts is another fertile ground, particularly in a place like Los Angeles, with Hollywood. Our USC Games program, a joint initiative between Viterbi’s Department of Computer Science and the Cinema School’s Interactive Media Division has been named No. 1 in the nation for the third straight year by Princeton Review.
  - As our own Professor Mike Zyda told the LA Times: "The great thing about having students make games in academia is that they can think outside of the boxes that the commercial industry is bound by. When the commercial industry invests in a new title, they have to get a huge return. Students can take big risks. It's an interesting model for innovation."

- We are re-inventing the classroom itself. Imagine a future where a classroom at USC Viterbi is not just a classroom in Los Angeles. It is a global classroom. Imagine a day in the life of a USC student: they walk into their 8 a.m. class, say hello to their friends from Mumbai, Technion in Israel or Aachen in Germany. At 1 p.m., they walk into class and greet their friends from Sao Paolo. And at 6 p.m., they’re debating digital innovation with their friends from PKU in Beijing and KAIST in Korea.

In each case student groups, spanning multiple countries and multiple elite engineering schools, are joined by interactive video on the internet. This reality has already started with our iPodia program, led by Steven Lu, which is in effect since Spring 2010. Last July we announced the first globe-spanning such alliance, the iPodia Alliance. It includes the schools of engineering at USC, Peking University, National Taiwan University, Technion, IIT Mumbai, Aachen in Germany and the Korean Institute for Advanced Studies (KAIST), all elite engineering schools.
worldwide. We are also currently pursuing the University of Sao Paolo in Brazil. This alliance expands the definition of a classroom to global dimensions. It lies at the intersection of engineering education, globalization and technology. And it is a much different version of distance learning, one which is interactive, pedagogical (by inverting the lecture), and global. To be clear, none of this would have been possible without the existing infrastructure, resources and 40-year track record in distance education of our DEN@Viterbi. DEN, celebrating its 40th year with an open house event on October 3, remains one of the nation’s oldest and distinguished pioneers in online education. iPodia is but the latest and most innovative manifestation of that.

- Recognizing the importance of big data, we have proceeded in the creation of a new graduate program on Informatics, headed by Herb Schorr. Informatics will play a pivotal role in the future of practically every scientific and professional activity, from cybersecurity to data mining. We now have the program to harness it.

The third of our pillars is to lead globally to advance solutions to world challenges, from sustainability, to health, to security to the elevation of the world’s standard of living. There will always be challenges, but all challenges are soluble.

- One example of this is Behrokh Khoshnevis’ work in 3D printing. Shelter has long been one of humanity’s most fundamental needs. This technology, known as Contour Crafting, holds the promise of building a house in a single day. Over half a million viewers watched Professor Khoshnevis’ most recent Tedx talk, where he articulated his vision of replacing entire slums in India with robotically constructed designs at a fraction of the cost.

- Another key example is Ted Berger’s work in reverse-engineering the human brain. As noted in The New York Times two weeks ago, these efforts, first successfully tested on rats and now on primates, are the “first demonstration… of the sort of brain prosthesis that could eventually help people with damage from dementia, strokes or other brain injuries.”

- And going beyond Moore’s law, the USC-Lockheed Quantum Computing Center, located at ISI and using a DWAVE 128 qbit chip, is the first academic center in the world to explore the potential of this chip for solving massive computational problems in optimization. The preliminary results are very encouraging- we look forward to the next generation chip, which will move the processing capacity to 512 qbits and open new unprecedented opportunities in computing. The vision of solving Big Data with Quantum Computing may not be that far away.

- USC Viterbi has played a key role in the grand challenges articulated by the National Academy of Engineering in 2008. Each fall into four distinct categories:
  - Health
  - Sustainability
  - Security
• Joy of Living

These are all multidisciplinary — and they are all enabling: they address and solve societal needs that transcend countries and boundaries. The Viterbi School has been a pioneer in promoting these challenges. In October 2010, we hosted the second Annual Summit on the Grand Challenges, together with Duke University, Olin College of Engineering and CalTech. We are now working on the next event, which will be global and will be held in London in March 2013, co-sponsored by the NAE, the Royal Academy of Engineering and the Chinese Academy of Engineering. This unprecedented partnership will carry yet to another scale the enabling power of engineering.

Which brings us to the fourth pillar: use engineering+ to be the catalyst for the innovations that will fuel the economic growth of Los Angeles, Southern California, the United States, and the world. (There will be a test at the end of the talk on what are the four pillars!)

- Being associated with the next big innovation is one of the goals of USC Viterbi. And we’ve been very pleased with the Viterbi entries in the Maseeh Entrepreneurship Prize Competition, now entering its third year. The competing start-ups have been working alongside industry mentors to create the best business plan idea — one that also fits within one of the 14 NAE Grand Challenges.

In the case of last year’s winner, Claritrac, it was engineering better medicines: 1 in 8 women are diagnosed in their lifetime with breast cancer. So when a lump or a lesion shows up, how does a doctor decide whether it’s benign or cancerous? Claritrac’s plan was to avoid the trauma of open surgery — to improve upon existing, less invasive techniques like needle-based biopsies. Claritrac brought light to the end of the needle. And now, through the MEPC, ClariTrac has received $50,000 in seed money to just for that purpose. Initiatives like the Maseeh Prize are part of a larger ecosystem of entrepreneurship and innovation we’re building at USC. Next Wednesday, October 3, in fact, will be the kick-off of the new Viterbi Student Institute for Innovation (VSI2), highlighted by a conversation with Mike Abbott, venture partner with Kleiner Perkins Caufield & Byers and ex-CTO of Twitter. Under the direction of Peter Beerel and Ashish Soni, VSI2 will be the umbrella for new start-up speaker series, the DOE-backed FLOW Clean Energy Business Challenge, a Viterbi Virtual Lab, bi-monthly pitch days, mentoring programs and a number of other student-centric activities in this field.

On the subject of engineering+, I should tell you that tomorrow is an exciting day for both the USC Viterbi School and Keck School of Medicine. After 25 years of work, Mark Humayun’s Argus 2 artificial retina may be approved as the first commercially available artificial retina in the United States. His company, Second Sight (itself a spin-off of the Alfred Mann Institute) has already seen the artificial retina approved in Europe, and if given the FDA’s blessing, may mean for the American blind community what the cochlear implant has meant for the American deaf community. Just last week, Mark was
named among the top 1% of physicians by US News and World Report. (I suppose he is not in the 99%! )

All problems are soluble… Engineering empowering society- and society empowering engineering… Creating the environment that will nourish variation and selection, and the creation of new knowledge and new ideas… Our four pillars… to go from Very Good to Great!

(As I said, there will be a test at the end of the speech!)

In our discussion last year, progress to achieve our goals cannot be possible without a solid financial plan. First, I am pleased to tell you that this year’s budget is strong (and hopefully will remain so). But looking to the future, we want to build the financial foundation that would allows to accomplish our goals.

Two years ago, President Nikias announced a historic $6 billion fundraising campaign. Progress along the campaign has been remarkable. On April 24, 2013, at our annual Viterbi Awards, this School will announce the kick-off of its own campaign, with a goal of one half-a-billion dollars. I have not done any research on the matter, but I am pretty sure that this is the largest campaign ever for an engineering school. Coming at the end in 2008 of a 7-year $300M campaign, which was successfully completed, this ambitious goal, if reached, will help catapult Viterbi to the greatness we all aspire.

Now, it’s worth asking – what does half a billion dollars get you these days? If you’re software mogul, Larry Ellison, it’s the price of purchasing the Hawaiian island of Lanai (or at least 98 percent of it). If you’re the two candidates in the 2012 election, it’s roughly the cost of the presidential arms race in television ads (at least so far to date, according to the Huffington Post).

But for USC Viterbi it means a heck of a lot. It will fund the hiring of new transformative faculty, the endowment of student scholarships and faculty chairs, the completion of the naming of our departments and centers, the creation of new research facilities and the launch of new academic programs. It means the realization of the new 190,000 sq foot Building for the Convergence of Molecular Science and Engineering – a remarkable intersection between molecular science and engineering, building upon the shared strengths of USC Viterbi and the USC Dornsife College of Letters, Arts and Sciences.

Reaching that goal will be no small challenge. We have already raised 20% of our goal and look forward to announcing exciting new philanthropic contributions, here and overseas. For this goal we have created volunteer leadership boards, not only here but also in China and in India, whose inaugural meetings will happen later in the Fall Semester. A global school like Viterbi will rely on global reach and the support of our friends and alums from throughout the globe.
So, the State of the School is climbing the ascending direction of our four pillars. The timing is right: Because we live in the most exciting times for science and engineering in human history. **We aspire to play an important leadership role, worldwide, to enable engineering to empower society, and in the process to go from Very Good to Great!**

Thank you for your help and support in making this exciting vision a reality.