

## **State of the School Address** **September 18, 2018**

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Good afternoon to everyone and a warm welcome to the another State of the School Address!

We live in truly unprecedented times. The times call for us, an engineering school of high standing, to continue engaging in two important functions: to serve and to lead. These are not contradictory- serving is a form of leading, and leading a requirement of serving.

In his new book, “The strange world of things”, our esteemed Dornsife colleague Antonio Damasio talks about the concept of homeostasis for individual organisms (and for humans): That every organism is seeking a state of homeostasis, one of internal equilibrium that maximizes harmony and happiness. Emotions and feelings are indicators of how far or how close we are in reaching this state.

I am more and more inclined to think that organizations are also characterized by a form of homeostasis- let’s call it a mission or a vision. Such homeostasis in fact dictates the culture surrounding us. And which culture, Damasio states, is characterized by its drive to be “enduring and prevailing”.

What, then, is the homeostasis of our own Viterbi school? One that wants to be enduring and prevailing? And what role do we as faculty and staff play in this? In today’s turbulent world, this becomes an even more crucial question. The recent events were just a strong reminder. For an answer, I gave you a hint before. Serving our constituencies- and Leading in thought, scholarship, innovation and impact. We are here to serve- and we are here to lead.

Society has bestowed upon educational institutions of higher learning (and certainly upon engineering schools) many privileges (from non-profit status to tenure for protection of free expression and to thought leadership). This places a corresponding burden to all of us: To serve all of our constituencies- and to lead today’s rapidly,



exponentially changing world, with all the nuances that it brings. To go from Me.Inc to Us.Inc.

About 10 years ago, I articulated the idea that we should view ourselves as servant of our constituencies. What are our constituencies? Fundamentally, and essentially, our students. And, by extension, parents, alumni, and supporters. But our constituencies are also larger entities, not as well defined: academia, industry and the society at-large. Closer to home, and for staff, faculty is an important constituency- and vice versa: faculty should consider staff as its own important constituency, as well.

How well we are serving our constituencies can only be checked by transparency and accountability. This fundamental understanding reflects two key facts: In our school, our offices and functions are a monopoly. There is one dean, one office of faculty affairs, one office of budget and HR, one department of say Biomedical Engineering, one chair of the same. And it is only by having a fundamental and deep commitment to service- from all our constituencies- one that is transparent and accountable, that we can constantly strive for a state consistent with our aspirations and with our goals. A state of homeostasis, in which all of our constituencies would be proud to say: I am fortunate to be associated with USC Viterbi. I am fortunate to be a Viterbi student- Viterbi staff- Viterbi faculty- Viterbi alumnus- Viterbi supporter. And that society-at-large will say- we are fortunate for Viterbi's existence, and for it being enduring and prevailing.

Serving our constituencies- transparently and accountably. It is one of two of our fundamental duties.

But we must also lead- and lead in an exponentially changing world. As your handout shows, this requires us to reinvent ourselves every year- by having a mindset of growth, and by constantly questioning fixed mindsets. Indeed, leading is in another deep sense, serving.

Now, in our exponentially changing era there are no longer any steady states, not even steady states in growth. Our era brings disruption, which requires agility and adaptability – and new mindsets. In today's world this requires commitment, courage, stamina and constant innovative thinking.

In his book “Thank You for Being Late,” Pulitzer-prize winning columnist Thomas Friedman describes our era as “times of accelerations,” where nearly everything is in flux and the challenges and opportunities are greater than ever. Consider: Taking 30 linear steps will take you halfway across the room. But when the steps you take are exponential (say the next step is twice the previous one), then 30 exponential steps will take you around the Earth 26 times! These are the times we are living in.

According to Friedman:

“We are living through one of the greatest inflection points in history – perhaps unequaled since Gutenberg, a German blacksmith and printer, launched the printing revolution in Europe, paving the way for the Reformation. The three largest forces on the planet – technology, globalization and climate change – are all accelerating at once. As a result, so many aspects of our societies, workplaces and geopolitics are being reshaped and need to be reimagined.”

Indeed, what is becoming most important today is flow (changing and becoming) rather than stock (a static state of being). Which inevitably leads to the question of lifelong learning: Today and tomorrow we will need to know more, update what we know more often, and do more creative things, by being self-motivated. The question emerges: How do we change our mindset in that direction?

Consider: Increasingly, work is unbundled from jobs. In the not too distant future everyone may have to invent their job- according to their passion. Which then leads to the question, how do you make your passion productive? And this brings up the issues of talent, skill, empathy, and creativity; grit and self-motivation; passion, character, and cooperation; and what Friedman calls the new jobs of Stempathy. Where engineering and science become human-centric: From things to heads to hearts...

I believe, therefore, that we are rapidly entering an era in which knowledge and skills are not enough. We must also add to the mix mindsets too. In a bricks and mortars university, what is increasingly important is to cultivate new mindsets- mindsets of constant growth. Approaching things with the beginner’s mind, one of

curiosity and a fresh perspective, one that accepts impermanence and embraces change.

What could these mindsets be, in particular in our engineering school? Here is an attempt to summarize them: They are also on the post-cards on your table.

1. Superb Technical Skills and Knowledge to Lead the Exponential Changes
2. Engineering + X where X is anything (particularly, human-centric)
3. Innovation, to help create the new markets, the new jobs and to design the new self.
4. Cultural Awareness (with culture broadly interpreted), to help thrive in today's fast changing world.
5. And last but not least, awareness of the Impact of Engineering to Society (and the importance of ethical values and technology ethics).

To accomplish this objective we have articulated a four-pillared vision:

Attracting the best students, faculty and staff and providing for them the environment to flourish (People Thriving);  
Continuously adding value to curriculum, programs, infrastructure (Programs Enabling);  
Providing Thought Leadership in energy and sustainability, security and infrastructure, health and medicine, and the scientific and technological discovery (PAPERS Inspiring and Enlightening);  
And creating tangible Impact through Innovation, Practices and Values (Patents, practices, values).

Since this is SoS address, allow me to give you a glimpse on how we are we doing today in our commitment to **TALENT, VALUE, THOUGHT LEADERSHIP AND IMPACT.**

This year's freshman class was the most selective ever, with about 13,000 applicants – a 10 percent increase over last year - vying for about 410 freshman slots. The entering class is in fact much larger- we had 530 freshmen enrolled. Among them

we have 220 University Scholars, 74 National Merit Scholars, with students coming from 24 different countries and 47 different states.

We continuing leading in changing the conversation about engineering, what it is, who we are, and what we look like.

This year's freshman class is nearly 45 percent women (a historic high for the school, which exceeded last year's high of 44%). Today, more than one-third of USC Viterbi undergraduates are female – much higher than the 20% national average. The entering class is 23% URM; 17% first generation; and 16% international. Importantly and partly as a result of this diversity, our freshman class is the best in its history. (Of course, I said the same thing last year, and the year before, and I am sure will say the same next year...)

Our graduate programs are as robust as ever. At a time when most of our peers have reported a sizeable decrease in applicants to their programs, our master's pool increased 3 percent overall, while our Ph.D. applications jumped 13%, including a 17% increase for women and a 27% increase for underrepresented minorities. This year's incoming graduate class is comprised of 32% women!

Additionally, we now have 82 US veterans and active military enrolled in our graduate programs, a testimony to our outreach efforts.

We are indeed changing the conversation about engineering!

So too is the USC Chapter of the National Society of Black Engineers, which won the organization's coveted 2018 National Chapter of the Year. The national honor reflects USC NSBE's commitment to academic excellence, professional development, and community outreach.

This summer we hosted again the Viterbi Summer Institute (VSI) - a high-achievement program designed to enhance the transition to USC for engineering students from historically underrepresented backgrounds. Fifty incoming USC Viterbi students spent four weeks preparing for the complex coursework and academic rigor of Viterbi engineering.

We are also committed to serving the local community. Toward that end, we are piloting a school-wide volunteer initiative – 100,000 hours of heroic engineering. Using a mobile platform to explore volunteer opportunities and track engagement, students will commit to service projects, especially in our local community.

Imagine if every school in the nation committed to such an initiative (something, by the way, I am planning to start.) To change the conversation about engineering. To make engineering heroic engineering.

During the last several years, I have been the chair of the diversity committee of the Engineering Deans Council, in which capacity I helped lead a diversity initiative across the nation. As you may already know, this initiative is now signed by more than 215 deans nationwide. This remarkable commitment entails efforts from K-12 to Community Colleges and to faculty.

It is because of this mindset that the American Society for Engineering Education awarded USC Viterbi the ASEE President's Award for 2017. This is the first such honor for USC and one of few ever bestowed to an engineering school.

In the more conventional rankings, US News named our graduate program in the top 10 in the country- and in the top five among private schools (after MIT, Stanford, Caltech and CMU).

Our online graduate programs were ranked No. 1 in computer science and no. 2 in engineering in general. And our Games program, jointly with the School of Cinematic Arts, was ranked again the top program in the nation.

Consider also the MIT TR35, which every year singles out the world's 35 top innovators under the age of 35. In the last 10 years, 12 of our junior faculty (8 of whom are women) were singled out for this distinction. This year, we had yet another winner. Except, that it was now for Niki Bayat, PhD student in Chemical Engineering, who became the first USC doctoral student named as a TR-35 winner. We cannot be more proud of her distinction!

Our faculty continue to receive international recognition for their excellence in scholarship and research. They are leading their fields. Here are some distinctions since last April.

**Ellis Meng** received the IEEE EMBS Technical Achievement Award; **Mark Humayun** landed the IEEE Biomedical Engineering Award; **Milind Tambe** won the IJCAI John McCarthy Award; **Han Wang** received the Army Research Office Young Investigator Award; **Hao Li** landed the Office of Naval Research (ONR) Young Investigator Award; **Dong Song** was awarded the Society for Brain Mapping and Therapeutics (SBMT) Young Investigator Award; **Mahdi Soltanolkotabi** received a Google Faculty Research Award; **Burcin Becerik-Gerber** won the FIATECH Celebration of Engineering & Technology Innovation Award; **Krishna Nayak** was named a Society for Cardiovascular Magnetic Resonance Fellow; **Megan McCain** was selected as BMES Young Innovators of Cellular and Molecular Bioengineering; **Eun Ji Chung** received the NIH New Innovator Award; **Yan Liu** was named a New Voices of National Academies of Science Engineering and Medicine, one of only 20.

Other honorees include **George Ban-Weiss** who received the American Geophysical Union Global Environmental Change Early Career Award; **Rehan Kapadia**, NAE FOE; **Nenad Medvidovic** won the ICOSA Best Paper Award; **Shri Narayanan** was named an Association for Psychological Science (APS) Fellow; **Craig Knoblock** received the IJCAI Donald E. Walker Distinguished Service Award; **Jonathan May** and **Kevin Knight** penned the Outstanding Service Award and the 2017 IEEE SMC Systems Science and Engineering Award for MBSE TC Leadership; ACL 2018 Best Demo Paper; **Roger Ghanem** was named an IACM Fellow; **Azad Madni** received the 2018 INCOSE award; and **Barath Raghavan** received a VMware Early Career Faculty Grant.

In the past faculty recruitment cycle, we hired a number of tenured, tenure-track, teaching and research faculty- out of a pool of 1324 applicants. **Manuel Monge** joins us as assistant professor of EE-EP after developing ultra-high-bandwidth brain-machine interfaces at Neuralink Corp.; **Stefanos Nikolaidis** joins us as assistant professor of CS to work on algorithms that leverage mathematical models of human behavior to support deployed robotic systems in real-world

collaborative settings; **Constantine Sideris**, whose research interests include analog and RF integrated circuits and computational electromagnetics for biomedical applications, wireless communications, and silicon photonics, joins us as assistant professor of EE-S; **Jennifer Treweek** will join us in Spring 2019 as WiSE Gabilan Assistant Professor of BME to develop new tools and techniques for probing difficult-to-study circuits, such as the neuropeptide signaling pathways that convey chronic stress disorders. **Carlos Pantano-Rubino**, who uses computational approaches to understand the essential physical behavior of complex flows that impact areas as diverse as transportation and planetary exploration, will join us in Spring 2019 as Professor of AME; **Chia Wade Hsu** will join us in Fall 2019 as an assistant professor of EE-EP to work on developing new non-invasive imaging approaches with biomedical applications; and **Mercedeh Khajavikhan**, who was the first to demonstrate “thresholdless” lasing, which enables extremely efficient light sources at the nanoscale, will join us in Spring 2019 as Associate Professor of EE-EP.

In addition to brilliant research, some of our professors bring valuable real-world experience that greatly benefits students. **Garrett Reisman**, former director of Space Operations at SpaceX and a former NASA astronaut, recently joined the Department of Astronautical Engineering as a full-time faculty member. Garrett participated in three space shuttle missions and spent three months on the International Space Station. A mechanical engineering Ph.D. from Caltech, he will teach undergraduate- and graduate-level astronautical students. Garrett is also expected to provide support to our student-run groups. As you may recall, last year our student team broke the student world record by launching a student-made rocket to 144,000 feet!

The USC Michelson Center for Convergent Bioscience, opened its doors last November. Housed in a state-of-the art 190,000 sq. ft building – the biggest and most complex structure ever constructed on the University Park Campus – Michelson brings together, under one roof, researchers from USC Viterbi, and USC Dornsife. Honoring our own late colleague John O’Brien, we also dedicated a \$15M nanofabrication facility in that same building.

More recently, the Agilent Center of Excellence in Biomedical Characterization (COE) has opened inside the Michelson Center, thanks to efforts of Dornsife and Viterbi colleagues. Professor Rich Roberts will serve as co-director of COE with professor of chemistry Valery Fokin. The center will unite USC's scientific and research expertise with Agilent's cutting-edge technologies to improve diagnostics of cancer and diabetes, among other diseases, and to fuel drug discovery.

Cultivating hands-on and collaboration mindsets will be now supported by the new Maker Space at the Science and Engineering Library following a \$6M naming gift by our BoC Chair Jim Baum. This student-centric facility will provide a central area for hands-on experimentation, design and entrepreneurship. Construction is slated to begin later this year. This so-called Baum shelter (his name) will help advance our wonderful students and student teams, such as: The USC AeroDesign Team, which took first place at the AIAA international Design Build Fly competition; the USC Car Racing team; potential other teams include the Hyperloop, Solar Car, the Rocket Lab, and so many other student-led organization and activities. From the USC's Society of Petroleum Engineers chapter, which recently received the 2018 Outstanding Student Chapter Award – the first time the local chapter earned the prestigious designation to the BMES Student Chapter - which won the 2018 Outstanding Achievement Award.

This Fall, Professor Burcin Becerik created an innovative new one-year-long, one-of-a-kind course – known as **Innovation in Engineering Design for Global Challenges**- with key theme to create life-saving or life-improving engineering innovations. Run in collaboration with UNICEF, the United Nations High Commissioner for Refugees, Engineers Without Borders, the Vatican and the Min Family Engineering Challenge, this course could eventually make a real contribution in bettering the lives of the estimated 68.5 million people currently living as refugees. 26 USC students – many from USC Viterbi – just spent 10 days in Greece to partner with refugees living in camps on the island of Lesbos; Our jet-lagged students only returned last night. In Greece, they began identifying life-saving or life-improving innovations, such as new approaches to clean water and energy, to help the most vulnerable and hardest-to-reach people impacted by the refugee crisis.

Earlier this year, the Min Family Challenge took place in hurricane-battered southeastern Texas, where 17 students and alumni came up with startup ideas on how to aid victims of natural disasters like Hurricane Harvey. Our aspiring entrepreneurs put forth several interesting projects, including an easily deployable solar-powered water purification system; an early-warning system for earthquakes; and a portable, power-efficient cell tower that restores internet access and cell service.

You may know by now the definition of technology I find most apt: Leveraging Phenomena for Useful Purposes. Brilliant technological advances have been motivated by a variety of needs and purposes. But an increasing subset among them involves moral purposes, purposes that help society at-large, purposes associated with what we would like to call Heroic Engineering- a term coined by our BoC member Megan Smith, the third CTO of the US Government.

Such a mindset has found a fertile ground in the USC Viterbi School of Engineering. Consider:

- The NAE Grand Challenges Scholars Program, co-founded by Duke University, Olin College and USC Viterbi in 2009, and now spreading globally, has societal impact as one of its five objectives. It is now a signature program of the NAE.
- Two years ago, the Min Family established at USC Viterbi the Min Family Engineering Challenge, to address the solution of societal problems through social entrepreneurship. I just mentioned the important activities last year and this.
- The USC student chapter of Engineers Without Border has been actively involved for several years in solving problems for disadvantaged communities.
- Professors Shri Narayanan and Yan Liu are using AI to address the vexing opioid problem. Researchers at ISI tackle how information technology can help combat human trafficking. While CAIS, the Center of AI for Society, a vibrant partnership with the Dvorak-Peck Scholl of Social Work, now at its third year, co-led by CS Professor Milind Tambe, is a global trailblazer on the use of AI for social good- from preventing HIV infection in homeless youth to the protection of endangered animal species.

The hue of moral purpose colors many of the Viterbi engineering students and faculty today, a brilliant canvas full of spirit, remarkable skill and intellect, diversity and aptitude, which is changing the conversation about engineering. And as I mentioned, we will challenge this and future cohorts by asking them to volunteer 100,000 hours per year, 100,000 hours per year of heroic engineering.

The iPodia Alliance, our innovative “classrooms-without-borders” initiative that supports no-distance peer learning across physical, temporal, institutional, and cultural boundaries, now counts 14 global universities spanning five continents, with the Shanghai Jiao-Tong University the newest member. And in collaboration with the Global Challenges Scholars Program (GCSP) at the National Academy of Engineering, we are now in the process of developing a set of new iPodia courses with partner schools to prepare engineering students with key GCSP competencies. The first GCSP-iPodia course on “secure cyberspace” is planned for Spring 2019.

Engineering is at a most privileged position because it is the enabling discipline of our times. Because it leverages phenomena for useful purposes. All kinds of phenomena: Physical, Chemical, Geological, Biological, Behavioral and Social. And here at USC Viterbi we have termed this as Engineering + (X). Indeed, engineering has become the most enabling discipline to all disciplines, the sciences, and the arts.

Such partnerships in research abound. However, I wanted again to single out, in particular, the use of Improv in our Engineering Writing Program to help our students learn to communicate and better express themselves– to make eye contact rather than ground contact... Call this Engineering + Theater – Act II.

Our Engineering Writing Program continues its efforts to engage our students with the community through curriculum. The program has begun a new partnership, through the Provost’s Homelessness Initiative, to work with local homeless shelters to write and communicate their ideas to help address this prominent challenge in our community.

ISI is a most spectacular organization that advances many Engineering+X research, from advancing information processing, to computer and communications technologies- with synergies and applications across many disciplines. Under Craig

Knoblock's leadership, with Prem Natarajan on an one-year leave, our crown jewel research institute continues being a trailblazer in advancing computer science in creative and groundbreaking ways and in service to the nation. Just this past year, ISI's research expenditures have surpassed a record \$100M for the third year in a row + ranging from machine learning to cyber security and to Quantum Computing.

As it celebrates its 46th anniversary, ISI continues to push the boundaries. Earlier this year, IARPA awarded the institute \$16.7 million to develop an automated information translation and summarization tool to quickly translate obscure languages. And at ISI's new Boston office, recent hire and experimental physicist Jonathan Habif leads the Laboratory for Quantum-Limited Information (QLIlab) to understand and demonstrate the fundamental physical limits for extracting information from physical signals.

With the Maseeh Entrepreneurship Prize Competition, or MEPC; and the Startup Garage, USC Viterbi students and faculty have more opportunities than ever to develop innovative business models, explore technology commercialization, and create inventions with impact. This year, a new program funded by Amazon will support students in developing voice-enabled applications. We are also launching Project SUNRISE, in partnership with the LA County Department of Health Services and with a theme of "Preventive Health for Vulnerable Populations" to inspire our students to develop solutions for disadvantaged communities.

Four years ago, USC became home to a new National Science Foundation Innovation Corps Node (one of only nine in the nation) aimed at helping deep technology university spinoffs succeed. Our Node, led by Andrea Belz, has reinforced USC at the center of the Silicon Beach technology ecosystem. It has now been renewed to 2022.

To date the Node has taught customer and business model development to over 400 teams from over 30 universities and 3 countries. In the process USC Viterbi has helped raise grants and private investment totaling roughly \$100 million to teams from Southern California.

The support of so many of our initiatives has been possible in large part due to the indefatigable efforts of our Advancement office, in partnership with many faculty and leaders. To date, we have raised more than \$460 million toward our campaign goal of \$500, which is within reach and we are hopeful that will be reached this year. I believe that – for an engineering school – actually for ANY school, for that matter – that is quite an accomplishment. It is certainly the reflection of the fact that many outside constituencies want to help USC Viterbi (all of you) to continue its ascent, to help hug the exponential. This is your achievement and you should be very proud.

Such success has allowed us to achieve several important priorities, such as funding for research centers and academic departments, and for chairs, fellowships, scholarships and other programs.

We are a few weeks away from our fourth annual Scholarship and Fellowship event on Oct. 17 – a chance for our donors and students to connect face-to-face. It is an uplifting event, well attended by students who wouldn't – and couldn't – be here if it weren't for the kindness of our benefactors ... and by donors who collectively express their joy in being able to provide opportunities for these wonderfully talented students.

That day we will also be unveiling our Scholarship and Fellowship Wall in RTH- a lasting testament to the individuals who have made so many things possible for so many students.

So, as you can see from this short review, and in the midst of new challenges, the State of the School is strong. It is strong because of all that you do as faculty and staff. And as we move forward in our exponential world, remember the need for constant reinvention and for a mindset of growth- of thinking and acting forwards and outwards.

In turbulent times, it is easy to get sidetracked and lose focus. But such focus is quickly regained when we all remember that *we are here to serve (transparently and accountably) and we are here to lead (the exponential and acceleration times)*. How we balance these two tremendous duties successfully, with purpose and moral fortitude and with joy is our homeostasis- the Viterbi homeostasis.

Thank you and fight on!