- Draft Minutes -
Engineering College Council Meeting
March 13, 2015
New York City, NY

Members Present: Jim Becker, Dan Bernstein, Najib Canaan, Lance Collins, Michael Even, Greg Galvin, Virginia Giddings, Michael Goguen, Kent Goklen, Frank Huband, Brian Kushner, Marcus Loo, Ivan Lustig, James McCormick, Don Morel, Howard Morgan, Jack Neafsey, Evelyn Pearson, Justin Rattner, James Ricotta, Robert Shaw, Elissa Sterry, Duane Stiller, Joseph Thanhauser, Craig Wheeler, Todd Zion

Emeriti Present: Dick Aubrecht, Jay Carter, James Hauslein

The meeting presentations and materials can be found at:
https://confluence.cornell.edu/display/ECC/2015+Spring+ECC+Meeting

Username: eccmeeting@gmail.com
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Welcome and Introductions
Duane Stiller, Chair, welcomed the Council to the Spring'15 ECC Meeting and announced that the focus of the meeting would be Cornell Tech, Jacobs Institute and Cornell College of Engineering in 2035. He asked participants to help the presenters envision the world 20 years in the future.

Chair Stiller reminded the Council that they had received an email with the new operating guidelines and asked if there were any questions, suggestions or comments. Receiving none he stated that all council members would now be moved to three year terms, with cohorts being developed to stagger terms. All council members were informed that they would receive information regarding the end of their term. Two terms could be served back to back, council members would then take a mandatory one year break before being eligible to be asked to serve another three year term. Two young alumni will be added to the council and members will be considered for emeritus status after 12 years of service.

Cornell Tech in 2035
Dan Huttenlocher, Dean and Vice Provost of Cornell Tech

The presentation opened with the statement that Cornell Tech creates "pioneering leaders and technologies for the digital age". Cornell (Ithaca) has always focused on academic excellence and impact on society. Cornell Tech integrates engagement in society to a greater degree in recognition that digital technologies are informed by society and society is equally affected by innovation in digital technologies. Cornell Tech seeks engagement with society on a higher level than is currently done in any other university.

Four principles of the culture at Cornell Tech are Innovation, Design, Code, and Devices. These are unlikely to change in 20 years. The culture at Cornell Tech is rooted in but not constrained by disciplines.

Cornell Tech focuses on:

- Learning by building, which is deliberately different than learning by doing.
- Fostering real-world impact by both faculty and students. This is the infrastructure that is being built but no one knows what that is going to look like. Taking a 20 year time horizon.

  Traditional universities have huge infrastructure and support for research, primarily from the federal government. We do not have much infrastructure to support faculty engagement in building companies or engaging with not-for-profits to create an impact on the real world. Cornell Tech is trying to create infrastructure to foster this kind of engagement.

- Fast moving (act, reflect). Dean Huttenlocher stated that he prayed that this will still be part of Tech in 20 years, academia tends to move slowly, which has its strengths but also limitations. Faculty hold a "post-mortem" every semester, on all projects, purposefully looking and reflecting on the how to improve future actions.

Cornell Tech is a new organization that integrates programs from multiple disciplines. It is focused on the digital age, which includes engineering but also includes computer science, the business school and the law school. There is a new development with a one year program for practicing lawyers who have just received their JD but need specialized expertise. The program will give participants a real understanding of intellectual property laws, national and internal regulations, and corporate law, including start-ups.

- Offer distance learning but provide a community for collaboration.
- Environment that fosters entrepreneurial urgency.

All of these principles feed into the goal of Leadership for the 21st Century

Masters Studio: All students participate in teams with co-curriculum. At Cornell Tech, MEng in Computer Science and MS in Information Systems students work in teams with MBA candidates, building real products and designing software that they then pitch to companies. The focus is not to create entrepreneurs but to develop graduate students who are successful in a dynamic environment.

Discussion about entrepreneurship:

- Regarding start-up companies, why isn't this the goal? New York City is an incubator for entrepreneurship. Regardless of whether or not this is a goal of Cornell Tech the environment is producing entrepreneurs. The tour and reception with students at Cornell Tech proved this.

- It is good for some to fail, then you try again. This should be promoted.

Not all students will become entrepreneurs. Not all great ideas will come out of start-ups. There have to be other options for students.

- There should be personal, individual entrepreneurial experience, but do not want to turn off students who are interested in a different path.

Create an even playing field between option of start-ups and the option of going to an established "big company."

- Cornell Tech provides an awesome environment to incubate entrepreneurship.

Nothing happens quickly, there is a need to prepare students to maintain their entrepreneurial spirit when there is a long process to actualize their goal.

In 20 Years:

- Thousands of students and hundreds of faculty in tens of programs
- Over 1000 startups, nonprofits, and existing companies building on Cornell Tech
- Leading schools adopting our masters curricula and research environment
- Three integrated, complementary Cornell campuses

Jacobs Institute in 2035
Adam Shwartz, Director

The Jacobs Institute creates a sandbox for change and spearheads innovation by promoting and leveraging a synergy between Cornell Tech, Cornell and the Israel Institute of Technology. The Jacobs Institute shares the same vision as Cornell Tech but also has a unique mission to drive innovation first at Cornell Tech, then at Cornell and Technion and finally to have other universities adopt this model. Change occurs at an even faster rate at the Institute and this pushes change at Cornell Tech, Technion and Cornell.

An example of how the Jacobs Institute is innovative is the Runway Post Doctoral Startup Program. Through a unique one to two year program, the Institute helps academics learn to become entrepreneurs. The outcomes have been extremely positive, Runway post-doc driven projects have resulted in more than 10 patents (filed or being filed), $5 million in venture funding and three companies.

Director Shwartz presented a slide that illustrated the exponential rate of increase in technological advance that illustrated why it is very difficult for him to predict more than 10 years into the future.

The Institute Today:
The faculty hold collaborative appointments with Cornell or Technion and are leading scientists with entrepreneurial experience and industry engagement. One of the challenges is how to bring together a global faculty with both cultural and logistical challenges. This requires restructuring of

traditional concepts of academic collaboration; students and faculty must feel that cross campus collaboration is natural.

Other collaborative efforts include how to utilize infrastructure that already exists at other locations like Weill, Technion and Cornell. Coordination of strategic planning is also important as synergy effects hiring decisions.

Five Years in the Future: 2020

Multiple new initiatives will have been executed including:
Sizeable collaborations across campuses that include faculty, research graduate students, seminars and workshops. Distance learning will utilize remote classes across sites with shared planning and execution of online modules rather than shared courses. This is an important area as there have been no improvements in video technology for classrooms in the last ten years. The trend in education is in the direction of smaller units/modules that can be used to build different courses in different places at different times.

The Institute seeks to leverage innovation from the parent organizations, by rolling out concepts developed at Technion and Cornell. Ideally Cornell Tech, Cornell and Technion will have adopted some of the Jacobs Institutes experiments and innovations so that the Institute can move on to the next thing.

There will be a new structure for collaborative appointments at Cornell Tech, Weill Medical College, Cornell and Technion. For example it will be possible to hire faculty who need the digital environment at Cornell Tech but utilize labs at both Weill and Cornell. This will require changes in both culture and logistics.

Also needed is a new structure for establishing non-tenure track positions, technology changes so rapidly, and the role of industry research is so important to digital technology, that there needs to be a mechanism for including non-academics who have industry experience.

In order to achieve these initiatives, strategic planning needs to be coordinated between institutions. This is starting to a degree but needs to be institutionalized.

2035, All Speculation

Unknown: How will we approach education in 30 years?

Some things can be learned by reading and listening.
Some things are learned by doing.
Some things are learned by doing them thousands of times, like art.

The generation that we are educating is very impatient. The traditional approach to education is that is the responsibility of faculty to develop excellent course material and to teach this information to students to the best of their ability. This is completely different from being responsible for student learning. Accomplishing student learning in the digital age requires a

different approach; sharing design, teaching and learning at the modular level can replace a system that requires each faculty member at each university to individually create course curriculum. Speculating that the problem of transportation will be solved in 2035 it will be possible to share multiple resources and develop a cross campus field structure. In order to be ready for this, synergy must be in place.

Another question for discussion is the predominance of disciplines. There will always be a need for disciplines but something different will need to be developed to address the need for cross discipline education.

The hub structure is another example of how Jacobs does things in a very different way. Innovation hubs are based on industries that are strong in New York City but where there is a danger of losing leadership because the digital revolution in that domain has not yet occurred. How do you build a program from the top down? This is not taking engineering and biology and creating a program in bioengineering. The approach is looking at health and considering what a student needs to know in order to revolutionize health using digital tools.

There are two unusual things about these programs. The first is how we go about designing a program and who participates in the construction, which has consequences regarding the amount of time it takes to develop a new program. Without disciplinary boundaries, aversion to risk and a goal of experimentation the Jacobs Institute can move very quickly to address the evolving needs of industry. Instead of taking several years to develop a multi-disciplinary program Jacobs can experiment and have programs in place in a matter of months.

To summarize and propose these topics for discussion on global trends in technology:

Software has risen as the major component of technology. This trend will continue for a few more years, but the main things that you need to pay attention to are the need for hardware development, which has lagged behind.

The study of humans, how and why we do things will stay with us until 2035 and beyond. For a very good reason this is starting to appear as a major part of the studies at Cornell Tech and the Jacobs Institute.

Cornell in 2035
Lance Collins, Dean of Engineering

One of the issues that the three of us spend a lot of time on is the tight coupling of all the campuses, while at the same time allowing the New York campuses to do what they were established to do.

The College of Engineering Today
In US News and World report rankings, which are often used when discussing how we are doing, the college ranking varies from 8 to 13. Typically "reputational rankings" are higher than formulaic rankings that look at averages across certain categories like research expenditures.

Those of you who attended the last meeting have heard the strategic plan for moving the college forward. To summarize, the plan calls for:

- Paradigm Shift in Undergraduate Education: a real focus not just on engineering fundamentals but allowing students to take what they learn and put it into practice.
- Leveraging Cornell Tech Campus
- Research Thrusts: Advanced Materials; Bioengineering; Complex Systems, Network Science and Computation; Energy Institute

High level snapshot of the College:
Currently the College of Engineering has 230 faculty, 3000 undergraduates, 1000 M.Eng students and 900 PhD candidates. Looking at diversity 16.4% of faculty, 39.3% of undergraduates and 31% of all graduate students are women. We can be proud of the fact that the number of women undergraduates in the college is nearly double the national average. The percentages for Under Represented Minorities are 6.5%, 13.3%, and 6.8% respectively. This is roughly equivalent to the national averages. The Cornell Tech campus should help improve these numbers.

The diversity numbers are similar to what is seen at the other Ivy League schools and MIT. The national numbers drop significantly. While rankings do not take these numbers in to account they are a part of how the college values itself. The trend lines for the college are all moving in the right direction.

Research Expenditures are $139,000,000 total and this averages to $686,000 per faculty member. The top schools average around $1,000,000. Faculty members with NAE membership is 11.1%. This is a healthy number. The university with the highest number of NAE members is Stanford which hovers around 18% and for comparison MIT is at 12%.

The College in 2035
Faculty will grow to 360. This includes growth of faculty at Cornell Tech. Lance explained that he did not predict any growth in the undergraduate population as this number is set by the Provost and is totally outside the control of the college. He pointed out a notable increase in the number of PhD students to 2000. This number relates to the predicted increase in faculty. Research expenditures should increase to $360,000,000, averaging 1,000,000 per faculty member. This growth will come through capturing additional federal growth and a growth in corporate research funding. The college has put in place a structure that supports faculty in developing Research Centers and significant growth in this area is anticipated.

How do we get there?
Faculty growth is based on increasing faculty at Cornell Tech to 60 and hiring additional faculty at Cornell Ithaca. When things are healthy the college of engineering generally hires on average 12-15 faculty members per year. Recruiting and retaining this level of talent will be extremely difficult moving forward. The college does a good job identifying talent but sometimes loses to a university with a higher ranking. Cornell also struggles with dual career issues as Ithaca offers fewer high end employment opportunities than major universities that are located in big cities.

Ways to fund this growth:
There will be the Cornell "Someone's Name" College of Engineering. This will happen in the next 20 years and this will increase our growth enormously.

"NYC wrestles tech leadership from Silicon Valley."
This is possible. NYC is a huge market and Cornell Tech is positioned to take advantage of this.

"Ithaca leads the tech boom in upstate NY. Tompkins County has the lowest unemployment rate in NY State". Upstate NY has been struggling economically for years. The way out of this is technology. There have been a lot of discussions around this topic with business leaders. This as an exciting opportunity for the college.

"Cornell Tech ignites `Engagement and Entrepreneurship' across both campuses"
Ithaca has established an incubator in the downtown, funded by the state. There is already a startup incubator in Collegetown for students, which funds about 12 projects a year. The entrepreneurial fire has been ignited in Ithaca. This has become part of the college culture and is no longer questioned as an important direction for the college. An entrepreneurial ecosystem in Cornell will greatly assist the dual career problem by providing more opportunities for high end jobs in Ithaca.

"5-Year Tech Degree; Summer Internships and `Study Abroad' in NYC for Ithaca Undergraduates."
The goal is for students of any means to be able to enter Cornell and have a pipeline to Cornell Tech and the opportunities offered there. Students can start in Ithaca, end up in NYC and enter into the tech ecosystem in the city. Undergrads in Ithaca with a one year M.Eng in NYC. Taking it a step further Cornell Tech is drilling down to the K-12 level. This can result in a flow of students from NYC to Ithaca and loop back to the City. This will positively impact diversity.

4-Campus Health Initiative (WCMC, CT, Ithaca, Technion)
Important new thrusts in the college. Growing integration of health issues between Ithaca and Weill. As Cornell Tech grows,their Healthy Life hub, this connection will build. Technion also has a very strong bioengineering focus.

"Cornell Achieves Carbon Neutrality Through Combined Effort of Energy Institute, ACSF and Built Environment Hub"
Somehow Cornell is going to be carbon neutral by 2035. We don't have the technology to do this now but it has to be developed. Lake source cooling did a lot to alleviate the carbon load but heating is still a major issue and college is looking to geothermal heating as an answer.

Ultimately the prediction is that Cornell will be in the top three engineering universities in the world with MIT and Stanford.

Leading in to the break Duane Stiller asked Dr Patrick Prendergast, Provost & President, Trinity College Dublin, the University of Dublin, if as a guest he had any observations to share: Commitment of group like this to what Cornell and engineering are trying to achieve is inspiring. This kind of commitment is rare. Cornell has a huge advantage that so many successful graduates come back and engage at this level.

Open Discussion with Presenters

Lance Collins, Joseph Silbert Dean of Engineering, Dan Huttenlocher, Dean and Vice Provost, Cornell Tech, Adam Shwartz, Director, Jacobs Institute

Duane Stiller opened the discussion by asking Lance, Dan and Adam "what question keeps you up at night?"

Lance: Faculty hiring. Where the rubber meets the road with every university is if you attract the finest faculty you will attract the finest students. Doing this in such a way as to accomplish the missions of the various campuses in the complex environment we have created makes a difficult situation even more challenging.

Question: There seems to be an assumption that the traditional 4 year resident college model survives this innovation. For various reason, including technical and economic factors, this may not be the case. There will be alternate ways that the undergraduate and graduate experience can be delivered. Will brick and mortar institutions still be relevant?

Lance stated that he has strong feelings about this topic. Does e-learning make the brick and mortar institutions a thing of the past? Certain kinds of learning will be delivered electronically, and this will continue to advance and improve. It may end up that what we call "hybrid classes" will be the best option. Lance personally believes that the brick and mortar institutions will always exist. They act as a magnet for excellence and create a community of faculty and students that is unique. Certain types of learning requires hands-on, side by side interactions that cannot be delivered electronically.

Dan Huttenlocher: The biggest thing that keeps him up at night is that Cornell Tech becomes like any other institution. The real challenge of realizing the opportunity of Cornell Tech is to continue to innovate and be different than other university campuses. The flip side is the goal of having integrated campuses across Cornell and in partnership with Technion. Relating back to what Lance said, faculty hiring is a huge piece of ensuring that Cornell Tech does not become like every other institution.

Adam Shwartz stated that it is his job to ensure that this does not happen, so Dan can sleep well at night. Adam asked to continue the discussion about the future of education. The biggest question is education, almost every piece you touch is a question mark. It is not clear why the four year undergraduate degree exists. Not clear that it is serving any purpose other than tradition. There are so many questions about how we create the next generation of useful citizens that I do not know precisely where to begin answering this question.

Another huge challenge for everyone engaged in higher education is the growing cost of education. How to offer a broader education when the cost structures continue to rise is a huge challenge. For the CS M.Eng degree they are admitting students without a CS bachelor degree because there is such a great need for cross training. I can imagine a world were students at Cornell Tech will not have a bachelor's degree.

Summary of Comments Made During the Open Discussion:

- How do you become adaptable to anything that the future might bring? This question must be asked by every institution.
- It is important to predict where technology is going in the next 7-10 years. Look at current trends and try to predict opportunities in technological trends, consider what you have and think about what you can accomplish.
- How do you build a culture of constantly looking for what comes next? Looking around the bend, which companies have to do, needs to be integrated.

Dan Huttenlocher responded to the comments that Cornell Tech made three bets on where digital is going to have the greatest impact: biological, social and the physical world. This is the genesis of the programs at Cornell Tech and the hubs at the Jacobs Institute.

- Becoming one of the top three institutions in the world is an exciting goal; how do you achieve this? It seems that the answer is to increase collaboration, offer a greater degree of experiential learning, and one way that this is enabled is by hiring the best faculty. Can we be more creative in hiring? Fundamentally if Cornell cannot find a way to win the talent war none of these goals will be achieved.
- How much does money matter in acquiring top faculty?

Lance responded that hiring strategies are different between the campuses, in Ithaca money is a huge factor. The better you are the more attractive you become. This requires investment in talent.

It is increasingly expensive to hire new faculty. Cornell Tech is hiring at all levels but hiring a higher fraction of senior faculty. These faculty are like free agents in sports and carry their own brand.

- True engineering fundamentals change more slowly than advances in digital technology. More rapid change does occur relative to how the fundamentals are applied to the world around us. The fundamentals learned at Cornell serve graduates well. How do we make sure that there is a focus on how fundamentals relate to the real world?

Adam Shwartz stated that educational institutions must ask what value their education brings to the student. We must leverage the hi-tech as motivation to learn the fundamentals.

Lance commented that Cornell is not shying away from teaching the fundamentals. The way we teach them will evolve. As electronic tools develop there will be a richer environment for teaching the fundamentals.

- How, in practice, will you implement this objective, what is the mechanism that will be utilized to achieve this goal?

Lance: You have to have the talent. Higher education is based on bringing in research experts and teaching them how to teach. This traditional method of developing teachers works, but is not perfect. This is more than technology, it is learning to teach in a new way.

Take Away from the Morning:
Duane Stiller asked the group to create a list of priorities that arose from the discussion. He then asked the group to vote on which were the most important. Talent and money received the highest priority.

2015-2035
"Serious Thinking"

1. Agility
2. Culture
3. **Talent**
4. Inventing/re-imagining
5. Startup
6. **$$$$**
7. Legacy
8. Leadership
9. Goals/metrics

Breakout Question #1
How do we put entrepreneurship into action on the Ithaca campus?
Notes from discussion:

- Create a two directional pipeline between Ithaca and Cornell Tech
- Cornell Tech is fairly narrowly defined (CS, IS), at least at the moment, a wider variety of technical innovations are evolving in Ithaca that are not on the radar at Cornell Tech.
- How do we help students in Ithaca who really want to do something entrepreneurial, how do we get advice and counsel to them?
- Bring groups of people like members of the ECC, and the entrepreneurs that were identified when Cornell Tech was proposed. We know the names of all the people who might be willing to come for a week to act as mentors to students.
- Is there infrastructure, housing, etc. that could accommodate longer stays so that entrepreneurs can truly interact with and mentor students?
- Create more structure for this interaction, more hands on, real life experience, and spend more substantive time with students.
- As faculty is refreshed in Ithaca, screen for applicants that have a bent towards commercializing research.

Breakout Question #2
How do we create integrated and complementary cultures between Ithaca and NYC?

Flip board notes from discussion:

- Culture reflects values
- Common set of values
    - Academic excellence
    - Interdisciplinary collaboration
    - Outreach: contribute to society
    - Develop students who will take on big problems
    - Excellence in teaching
    - Intellectual engagement: lifelong learning
    - Egalitarian
- Exchange people, information, ideas
- Consider values in hiring and appointments
- Seek a radical change in education.

Breakout Question #3

What should both campuses be doing to enhance the collective reputation of the University?

- Need to start with a bolder vision and more audacious goal.
- We are going to be #1, not one of three and not number three.
- What does it mean to be #1? It does not being the same as Stanford and MIT.
- Enormous opportunity to leapfrog and get ahead.
- Part of being #1 is having a measurable impact on society.
- Remember that we are always benchmarking against what others think.
- Communication needs to be consistent and continuous.
- Cornell should be the first choice for companies to hire entrepreneurs.
- The definition of #1 must include measurable impact, define these goals.

After this discussion, Duane Stiller adjourned the ECC into Executive Session. The next Engineering College Council Meeting is scheduled for October 29-30, 2015, in Ithaca.