- Minutes -
Engineering College Council Meeting
April 8, 2016
Ithaca, NY

Members Present: Jim Becker, Najib Canaan, Lance Collins, Frank DeCosta, Michael Even, Sarah Fischell, Greg Galvin, Virginia Giddings, Rana Glasgal, Kent Goklen, Andrea Ippolito, Michele Kaliski, Brian Kushner, Marcus Loo, Jonathan Ludwig, Ivan Lustig, James McCormick, Howard Morgan, Kyle Mork, Richard Ong, Evelyn Taylor Pearson, Susie Riley, Bob Shaw, Daniel Simpkins, Duane Stiller, John Swanson, Joseph Thanhauser, Andrew Verhalen, Craig Wheeler, Eric Young, Todd Zion

Emeriti Present: Dick Aubrecht, Jay Carter

The meeting presentations and materials can be found at:
https://confluence.cornell.edu/display/ECC/2016+Spring+ECC+Meeting

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Welcome and Introductions

Greg Galvin, ECC Chair, welcomed the Council to the Spring '16 ECC Meeting. Lance Collins, Dean of Engineering, announced that the focus of the meeting would be an overview of Complex Systems, Network Science and Computation in the college. He also welcomed the new members to the Council: Rana Glasgal, Northeastern University; Kyle Mork, Energy Corporation of America; Susie Riley, Aquto; and Andrew Verhalen, Matrix Partners.

Complex Systems, Network Science and Computation Overview

Presented by Lance Collins, Dean of Engineering

Lance discussed the fourth in the series of the college's thrust areas. He noted that both Stanford and MIT have stellar programs in these areas. However, he believes that Cornell Tech has the power to shake up the system.

He also discussed the college's enabling goals:

1. *To recruit, retain and enable a diverse community of exceptional faculty, students and staff.* He noted that we have made tremendous strides in diversity thanks to the DPE programs in the college. DPE creates an environment that helps students thrive. He also pointed out that the number of women faculty in the College has increased significantly.

2. *To educate undergraduate and graduate students to become global leaders.*
   The college has a rigorous educational program where students can participate in a variety of programs including: the Kessler program, project teams, and the business

minor. Students have access to the full complement of skills so that they will be successful.

3. *To be world leaders in important areas of research.*
    a. *to sustain and expand our leadership role in advanced materials; complex systems, network science and computation.*
    b. *to be the premier research university in the emerging areas of: bioengineering; energy and the environment.*

   Lance noted that we have preeminence in the areas of advanced materials, complex systems, network science and computation. The areas of growth include: bioengineering (BME was recently named the Nancy E. and Peter C. Meinig School of Biomedical Engineering); Cornell Neurotech (launched with a multimillion gift from Stephen Mong ’92 MEN ’93, MBA ‘02); the naming of the Robert Frederick Smith School of Chemical and Biomolecular Engineering ($50 million gift from Robert Smith ’86 ChE). This gift will support CBE, as well as African-American and female students in the college. Energy and the environment is another area of growth. Cornell’s Energy Institute is Cornell Engineering’s lead organization for technology-based research and education in energy. Lance is co-chair of the Sr. Leadership Climate Action Group (Kyu-Whang, Vice President for Infrastructure, Properties and Planning is also co-chair).

4. *To increase our interactions with industry; and create a fertile environment for entrepreneurial activities for faculty and students.*
   Lance indicated that another one of his priorities is to increase our interactions with large, medium and small industries. As a result of Cornell Tech, our entrepreneurial activities have increased significantly.

<u>Complex Systems, Network Science and Computation</u>
Moderated by Greg Galvin, MS ’82, Ph.D. ’84, MBA ’93, Chair, Engineering College Council

David Shmoys, Laibe/Acheson Professor of Business Management & Leadership Studies; Director, School of Operations Research and Information Engineering; Associate Director, Institute for Computational Sustainability

David Shmoys gave a presentation on “Smarter Tools for (Citi) Bike Sharing: Analytics for Managing a Complex Systems”. Shmoys noted that we live in a complex world, but someone has to model it. He pointed out that bike sharing is emerging worldwide. The Citi Bike project was launched in May 2013 through Cornell Tech. He added that bike-sharing systems are now in place in Brooklyn and Manhattan. The Citi Bike system has become a part of the fabric of New York City. Thanks to Cornell’s research, this system is serving commuters better. Citi Bike deploys 6,000 bikes throughout the city, at 380 stations (more than 1 million rides per month; more than 10 million rides in 2015). In the morning, commuters pick up a bike near their home and drop it off near their job. Shmoys pointed out that near home, supplies dwindle, while midtown stations fill up, sometimes leaving few places to dock. During the day, similar imbalances occur across town. The solution is to "rebalance," using trucks to move bikes from crowded locations to empty ones. Shmoys and his team have developed algorithms and data analysis tools to help rebalance the Citi Bike system as efficiently as possible. He indicated that at first massive quantities of data needed to be analyzed to determine usage patterns and to determine how many bikes would be found at each station at key times during the day. The next step was to determine how many bikes should be at each station at key times, so riders would find bikes available as well as open docks to put them in at the end of a ride. He pointed out that system traffic (departing and arriving traffic, varies during the work week and weekends). The system generates a map showing dispatchers where bikes are needed the most, given the current state and expected usage. Shmoys noted that deciding how many bikes to take from one station and how to get them there is a complicated problem to solve. He added that it's a problem of rebalancing with optimization. The computer must calculate many possible solutions across the entire city and choose the one with the best overall result. They discovered that trailers can move more bikes per hour than trucks. They developed additional algorithms to pair nearby locations that are often out of balance, for example pairing one at 44th Street and Fifth Avenue with one at Grand Central Station, sending trailers back and forth between them. He added that although it is nearly impossible to keep the entire system balanced, this ensures people are not too far from an empty dock or a bike, and the Citi Bike smartphone app shows them where these are. They are developing a system to choose the best locations for new bike-sharing sites, based on data from taxi usage and neighborhood boundaries. Shmoys indicated that the problem intrigues computer scientists, and many are working on rebalancing bike-sharing systems in major cities around the world. He summarized by stating that data now exists to build sophisticated models of complex operational systems. He is focused on managing operations and is also working on systems design, which is a combination of data, math and analytics.

Shmoys noted that this is a profit-seeking project not subsidized by the city. They're considering using an incentive structure to increase profits, which must be approved by the NYC Council. He concluded by stating that this is a tremendous opportunity for their students (UG teams, and two of his Ph.D. students are involved in this project). This provides real engineering experiences.

Steven Strogatz, Jacob Gould Schurman Professor of Applied Mathematics, Department of Mathematics

Steven Strogatz gave a presentation on "Complex systems as networks". He pointed out that NY State's power grid is a classic example of network science. The grid is the result of thousands of random events as new generators and cables were added to meet the populations growing demands. They found that it is a small world and even though there are numerous plants over a wide area, it only took a few hops to get from any one to any other. Strogatz heard that every neuron in your brain is just a few synapses away from every other neuron, and now we can prove that this is right. He indicated that there is only one nervous system that has been fully mapped and that is the nervous system of a worm called C. Elegans, which was also found to be a small world. What goes around, comes around faster than one realizes.

Strogatz discussed the concept of six degrees of separation, mathematical explorations of the small-world phenomenon in social networks (popularly known as “six degrees of separation”), and its generalization to other complex networks in nature and technology. He pointed out that when scientists began exploring six degrees, they made some profound discoveries. Nature has a hidden blueprint, a structure that connects us all. The world is more highly, more globally connected than we ever thought. Scientists are now exploring whether the power of 6 degrees can defeat terrorism, predict pandemics, and perhaps even cure cancer. And if it does, the one person we can thank is Hollywood actor Kevin Bacon. He explained that testing six degrees is at the heart of understanding our complex society. A decade ago, the idea began intriguing a small group of researchers trying to explain the world using mathematics which eventually led to a new science of network. Steve Strogatz was one of the founders of the science. The world is simultaneously very small, with everyone only a few steps from everyone else, and yet very clustered. Solving this paradox was the key to understanding this secret of six degrees.

Strogatz noted that scientists investigating six degrees have discovered that random links in hubs make the world small, allowing everything to travel far and fast on the network. Just a single random link has an enormous effect. And add just a few more links, and distance in the stadium as all but disappeared. The world doesn't gradually gets smaller. It drops off a cliff. A key part of the six degrees effect is that all of us knows someone who has moved away and has now forged a link between us and geographically distant communities. That random connection is bringing the whole world together. And it's happening all across the world with everybody. Duncan Watts and Steve Strogatz had a theory, and decided to prove it by studying real networks. Strogatz pointed out that the problem was no one had thought it worth mapping any, except one. We don't normally associate Hollywood with the real world. But for the scientists, it offered the first possibility of testing their ideas. More than a million actors have worked in Hollywood on half a million films which meant there was a huge network of connections. In the mid 90's some college students devised a trivia game based around the idea of linking every actor to just one star-- Kevin Bacon. Rodney Dangerfield was in Caddyshack with Bill Murray. And Bill Murray was in She's Having a Baby with Kevin Bacon.

During that time, Brett Tjaden, a computer science student, thought it would be fun to turn the Kevin Bacon game into a website -- the Oracle of Bacon of Virginia website. Strogatz wrote a program that would extract the path from every actor or actress to Kevin Bacon. Before he knew it, a couple of the websites picked up on it and made it their pick of the week, which brought in a tremendous number of visitors. Brett Tjaden helped turn Kevin Bacon into a cult figure and the inspiration for a major scientific breakthrough. Without even knowing it, Kevin Bacon had inspired the first real evidence that small worlds existed. But to prove their theory was universal, Watts and Strogatz needed to find small worlds in networks without people. This could be good or bad depending on what's spreading on the network.

Strogatz also noted that the small world problem was first studied empirically by Stanley Milgram. Participants from around the world were asked to send a package to Vidal. The participants had never met him, and weren't allowed to look him up on the internet. They could only send a package to someone they knew (family or friends, people they knew on a first name basis). On average it took 6 steps to reach the target (the movie, *6 Degrees of Separation* was based on this theory). This universally applicable. Small world poses a math problem. There are 6-7 billion people on earth. We each know of 1,000 people. How can a network be both very small and very clustered? They tend to be geographically clustered. Real networks, which are "small worlds", are considered to be big data questions. To test their theory in 1998, they used the movie data base to test this. He added that the C elegans is the only creature whose genome has been completely mapped. Real networks of movie actors, power grid and C elegans were studied to determine average degrees of separation. Small worlds are much more clustered than random.

Conclusion: Understanding six degrees may be the planet's best hope of dealing with some of our most complex problems. Everything appears to be connected in ways that were unpredictable just 10 years ago, or even 5 years ago. All the major problems in science today depend on understanding networks. Network science is the foundation of the 21st century.

Kavita Bala, Professor, Computer Science Department and Program of Computer Graphics

Kavita Bala gave a presentation on "The Visual Anthropologist". Her presentation focused on the visual world: "a picture is worth a thousand words". She pointed out that the amount of data we are recording is huge. We are uploading 1.8 billion images a day. She noted that visual anthropology is concerned with understanding, "What is the world made of? How do we live"? (What do we wear?, What do we eat? Who are our friends?) How does our behavior change over time?" The reason for this research now is due to the confluence of data, massive computing, and deep learning. She also pointed out that this information at scale is important and involves visual recognition, exploratory visual data analysis and finding trends. Bala added that the world is made up of things and materials (stuff), and there are people who live in places.

Bala noted that computers are being programed to recognize materials and scenes (stuff: i.e, there is a vacuum cleaner on a rug near a wood floor with paper), to understand scenes (i.e., a living room, with a ceiling, a wall, mat, floor, sofa, chair, window etc.), and to recognize the materials in the scenes (fabric sofa, plastic chair, fur mat, wood floor, etc.). This deep learning technique will provide 85% accuracy. Bala indicated that researchers would like to push that learning to robots. Humans are about 98% accurate. She pointed out that recognizing objects (fine grain recognition) can be done by taking a photo, then determining the product. The challenge for the computer is that it needs to do this by using different solutions. It uses deep learning to learn a joint embedding. It does this by learning a projection into joint embedding. This is done by embedding iconic and in context and inputting “in the wild query”. Results: “What is it?” in context then project and retrieve the iconic image. The learning happens between the iconic and what is in context. The computer needs to be trained in and out of context. Bala added that this takes place through deep learning of defined data.

Bala also discussed deep learning of people and places. She gave the example of “what do people wear? She indicated that 6 million images of clothing people wear were collected, as well as images of 8M people from 36 cities, with 27K annotated with clothing attributes, 12 attributes each. They studied their attributes and clusters. If you look at that data and study clusters that depend on place and time, as well as clusters that don’t depend on place or time, you come up with trends: and find unique events based on data received (i.e., during World Cup in Brazil, there was a strong trend of clothing during world cup).

<u>Panel Discussion with faculty regarding future of Complex Systems, Network Science and Computation</u>

Moderated by Greg Galvin, MS ’82, PhD ’84, MBA ’93; Chair, Engineering College Council

Carla Gomes, Professor, Computer Science Department and Director, Institute for Computational Sustainability

Carla Gomes gave a presentation on the new field of Computational Sustainability at Cornell. She indicated that researchers in computing, information science, and many other disciplines are working together to support sustainable development. Computational sustainability strives to develop new computational models, methods, and tools to help balance environmental, economic, and societal needs for a sustainable future. She discussed the amazing collaboration with the Cornell Lab of Ornithology which has a very exciting eBird program where the public can submit bird observations. This program has revolutionized the way that the birding community reports and accesses information about birds and provides rich data to relay patterns of bird movements (spatial and temporal scales). For the first time, this data can give us models to assist in conservation with the Nature Conservancy. Their models can predict when birds are flying over certain geographical areas. For example, farmers can water their rice fields at certain times of the year when birds are migrating. Gomes pointed out that senior students work on different computational problems such as the Elephant Listening Project that monitors elephant activity at numerous forest clearings throughout Central Africa, as well as uses acoustic methods to estimate elephant density in those areas. This project is focused on acoustic communication because forest elephants are very difficult to observe visually everywhere except during their brief visits to forest clearings However, all three species of elephant (Asian, African savannah and African forest) make calls with fundamental frequencies below the lower limit of human hearing (20 Hz), in the range called infrasound. These infrasonic calls can travel far through the environment. They are only in the early stages of decoding this language and understanding the meaning of specific signals so that we can use these to study forest elephants and help in their conservation. She concluded that computational sustainability opens up fundamentally new intellectual territory with great potential to advance the state of art of computer science and related disciplines and to provide unique societal benefits.

Roseanna Zia, Assistant Professor and James C. and Rebecca Q. Morgan Sesquicentennial Faculty Fellow, Robert Frederick Smith School of Chemical and Biomolecular Engineering

Roseanna Zia gave an overview of her research program that involves three primary thrusts: to develop predictive theory and computational models for studying the structure and dynamics of kinetically arrested systems such as colloidal gels and glasses; to discover and develop fundamental models for the active and passive transport of particles inside 3D-microscopically confined and concentrated complex fluids, with a view toward a model of intracellular transport inside eukaryotic cells; and to develop non-equilibrium fluctuation dissipation relations universally applicable for a range of complex media, ranging from flowing dispersions to glassy arrest. Zia indicated that her research focuses on the transport processes in micro-scale flows, complex fluids, and other soft matter. Her work combines theory and computational modeling with the aim of advancing fundamental knowledge of fluid dynamics and its applications to predicting and controlling the behavior of complex soft matter She already has made important strides in each of these areas, including the 2013 Zia pointed out that this matter can become both fluid and solid (e.g., shampoo, butter, etc.). She added that the latter part of last century focused on the macro scale. However, currently research on complex fluids is focused on understanding particles that require different theoretical machinery and combine different approaches. There have been huge achievements from the macro to micro scale, from nanometers to millimeters. She explained the use of microscopy to view the modification of fluids. Zia's research using her 3D confined colloid model is an area where there are significant opportunities for win-win type interactions with biomedical engineering and molecular and cell biology experts at Cornell.

Eilyan Bitar, Assistant Professor, School of Electrical and Computer Engineering and David D. Croll Sesquicentennial Faculty Fellow

Eilyan Bitar gave an overview of his research which focuses on modern power systems, control, optimization, and market mechanism design. He designs next generation engineering algorithms to help protect the evolving smart grid. He noted that the goal of his research is to develop algorithmic tools to efficiently manage the variability that renewable energy resources have on power system operations at scale. He pointed out that solar panels, wind turbines, electric vehicles and other green power sources are proliferating rapidly, but their reliable integration into the existing electric grid is another story. This comprehensive reimaging of the power grid involves the coordinated integration of small-scale distributed energy resources. Specifically, this work aims to develop distributionally robust control algorithms to enable the near-optimal dispatch of uncertain power networks; and design stochastic market clearing mechanisms to provide a competitive medium through which renewable power producers can sell their variable supply on equal footing with conventional power producers and flexible demand". Bitar's research involves the study of a new architecture to enable what he calls a grid with an intelligent periphery" – a version of the so-called smart grid – along with coordination strategies and mathematical models to simulate how such a reorganized grid would work. Bitar indicated that "The uncoordinated proliferation of distributed energy resources will wreak havoc at scale," Bitar said. "Certain components of the legacy power system will fail; the existing distribution infrastructure isn't equipped to accommodate, for instance, a large number of electric vehicles plugging into the grid at the same time under the same transformer … but, imagine taking all these new resources and coordinating their control."

Bitar pointed out that the way the power grid works now, large plants deliver power to substations, where electricity is provided on demand to homes. The fluctuating electric loads at each substation interact over a complex transmission network, but nearly everything that happens below the substation level is left uncoordinated. Electricity is an example of a commodity with inelastic demand – in the U.S., people are used to having it all the time, whenever they want. Bitar thinks that mindset will need to change slightly.
All the talk of the smart grid wouldn't be nearly so complex if solar and wind, for example, were a reliable supply. But those resources are variable, and the gaps must be compensated by traditional bulk power generation, effectively defeating the purpose of a renewable source. He added that in an intelligent grid, this variability in supply would be balanced through the coordination of flexible distributed energy resources at the periphery of the system. Power would be produced locally and consumed locally, giving rise to self-sufficient communities or cities, called microgrids. Such an approach would decrease the need to transmit bulk power hundreds of miles to counterbalance fluctuations in renewable sources.

Bitar added that the architecture of such a system, which requires sensors and actuators in appliances, electric vehicles and the like, isn't the hard part. The hard part is the design of algorithms to efficiently manage the deluge of information produced by those sensors in order to coordinate the simultaneous control of millions of distributed energy resources on fast time scales. Much of this coordination will involve using flexibility in demand to compensate for variability in supply. He pointed out that traditionally the power systems work on algorithms. Wind and solar energy are largely uncontrollable. How do you match to control? How do you design algorithms to harness these resources. Renewals are variable and that requires storage. Charging of automobiles is a fascinating control problem.

Questions for the Panelists:

What type of quantitative research is being done for students to have real world experience and what type of social skills are we giving our students to be prepared to communicate in the outside world?

Roseanna Zia responded that she poses real world problems to both her graduate and undergraduate students. She makes videos of their solutions and posts them. She added that this year's students are also viewing last year's videos. She noted that her students also do blogs. Her graduate students are also required to go to 2-4 conferences a year to present their research.

Elyian Bitar responded that he has asked his undergraduate students to work on real world problems and to create algorithms to solve them.

Carla Gomes responded that she gives a course through the Lab of O and they work on real world problems. She added that Bell Labs is one of the most fascinating research lab she knows of because of their approach to real world problems, which is to solve problems by developing methodologies to solve them, which is empowering to students.

Comment: With respect to the electric system, there's lot of emphasis on moving away from the grid to a more distributed system. Is the work here to figure out how to make the system simpler and more resilient and susciptible to geopolitical forces?

Eliyan Bitar responded that revitzalizng the energy system is being implemented to avoid this. NYC is actively revitalizing its energy system.

Lance noted that Excelon is working on this with respect to transmission lines. Over time, it's becoming harder to implement this over state lines. There's a movement toward localizing sources, and only dealing with local systems.

Carla added that we should move towards redundancy, although there are many computational challenges with this.

Comment: Economic growth until now has been linear. His thesis is based on Darwin, and chaos and complexity. Is agent-based modelling being considered?

Carla Gomes indicated that it's often serendipity. We think in terms of abstractions, for example the Turing machine, which captures a simple mathematical model. We have to have the highest level of expertise to explore an area to determine what projects we should do. For example, we chose bird conservation, because we have access to the highest level of expertise in bird studies at Cornell's Lab of O.

Steve Strogatz added that it would be great to have funding in the area of computation. Somehow, se need to keep this going somehow, because funding from NSF grants always run out.

David Shmoys noted that an Operations Research (OR) education gives you an education on how modeling works, then the application of those models to real world application. OR has great expertise to give these courses.

Lance reiterated that the College of Engineering is a fantastic, but humble place. However, if we had been humble with our Cornell Tech proposal, we would not have won. We were able to stay within our value system without being too humble. He emphasized that we should tell our story to let people know what we are doing. It's a lost of opportunity if the outside world isn't aware of this.

Breakout Sessions

During the afternoon, the following questions were addressed:

- Do you recognize Cornell as having strength in this area?
- How do we strengthen our brand?
- How do you brand something when it is excellent, but diffuse?
- How do we leverage Cornell Tech in this regard?

Feedback from Breakout Group led by Dan Simpkins:

How do we strengthen our brand?

- Create a step-by-step process
- Communications is key to providing a brand:
- First: Need to have something tangible.
- Create a center that encompasses these various items. Tom Friedman said that to name it is to own it. Create a center, something tangible -- then we can brand it. "Visual anthropology" is a fantastic name. Create a center and name it, and make it marketable.

- Once you have a brand, develop evidenced based stories to promote it. Need to package it well, and package it broadly. The university could do more in this area.
- Then you need to distribute it to the constituents (prospective undergraduate students and graduate students, new and current faculty. The power of social media. Steve Strogatz has 20,000+ followers. Giving talks at conferences is also good. Giving more lectures on these topics, videotaping them and then creating links to these lectures. We need to use our PR machine more often.
- Inform peers of Lance, other deans, about what we are doing. They need a clear awareness of our strengths.
- Need to leverage the constituents more, including the ECC, as well as current students.
- Use Cornell Tech to get the message the out.

<u>Feedback from Breakout Group led by Susie Riley:</u>

How do we leverage Cornell Tech in this regard?

- It's like starting a company. You need a branding exercise. Susie decided to come to Cornell for its interdisciplinary research and numerous opportunities. You can take great classes at other schools, as well as in the College. This is our strength and we should brand this.
- They tried to come up with various names, such as, "complex systems". They did not like the phrase "big data:" It is really the application of data that's unique. However, they liked the word "data", but not "big".
- The College needs a clear definition and description of what we are doing. Need three or fewer words to describe this.
- Suggested promoting awareness around our faculty to the public. We should be leveraging to our peers, the NAE, etc. Need to have a faculty nominating our faculty for awards and academies.
- Cornell Tech is an incredible opportunity. It is in NYC and we have access to talent, fashion, food, etc. The West Coast does not have the richness of NYC.
- They suggested having Cornell Tech students be interns in industry in NYC. We should make participating in an internship a key part of their education, and then have them co-author articles on their research and case studies with these corporations. This would help the public gain awareness, and perceive Cornell Tech as solving social problems. When people Google this, this would help us gain more publicity.
- Exchanging ideas due to the social environment can create opportunities. If we start in NYC, this can spread and can be the focal point.

<u>Feedback from Breakout Group led by Andrea Ippolito:</u>

How do you brand something when it is excellent, but diffuse?

- Our commercial strategy needs to be improved. We want to have an impact on the organization that can help us achieve this.
- Start with capabilities. Breaking the rules. Need to incentivize our faculty to be involved in entrepreneurship. This could be part of their tenure track evaluation (as well as the entrepreneurship of their PhD students).
- When we train new faculty, we need to give them the tools to communicate and network with industry. Encourage faculty to attend non-traditional conferences. Need to brand this in a crisp, clear way.
- Need to build more forums on and off campus to discuss these complex issues.
- Cornell Tech and Weill Medical should collaborate to create opportunities. We need to tell our story better and give our faculty the tools and training to do. This will bring more research dollars.
- We need to do a better job engaging our Cornell alumni who are working on complex systems.
- Macro trends – government funding is going down. We need to go to commercial sources.
- Lance pointed out that Alan Alda leads a Center for Communicating Science that holds workshops for faculty, Ph.D.s and postdocs who want to learn how to communicate their research more effectively to the public, government officials, funding agencies, the media and others. They use improv techniques to inspire faculty communications.
- The consensus was that we take this to the next level. We need more specificity and need to segment our audience. The College is consider supplementing what Dawn McWilliams is doing with an outside company to continue these efforts.
- We need a steady drumbeat of telling our best stories -- connecting them to real world experience to build our brand.

<u>Feedback from Breakout Group led by Jay Carter:</u>
How do we leverage Cornell Tech in this regard?

- Their group reflected on Mission and Goals as described by Lance at this meeting. The consensus was that for the Engineering College that was great. But how about us taking this mission and goals down to the next level. Take it down to Complex Systems, Materials, etc. and that would help get more specificity to what we are doing.

- We need to segment our audience and customize the messages for each group (faculty, students, industry).
- Consider supplementing what Dawn McWilliams is doing, potentially with an outside marketing communications company.
- With respect to Cornell Tech, rather than saying Complex Systems and other things, what would happen if we called our initiatives Connective Media, Healthier Living, and the Built Environment? Those are the three hubs for Cornell Tech. Then we could say enabled by Complex Systems, etc. If we had more dialogue focused that way, the outside marketplace, industry and even students to associate and see that linkage with Cornell Tech.
- Need a steady drumbeat telling those stories. Picking those new best stories and whenever possible connecting them to real world experiences. For example Uber which is apparently run by Cornell Complex Systems, and a number of people we have in Facebook, Google and Citibank running things. Need to get those stories out there as part of that drumbeat which creates brand awareness

At the conclusion of the meeting, Lance requested that the Council send him a list of ideas to improve our branding. It was suggested that new wording for our research be used that is more commercial. Creating a brand means making an association between what it is and what it does. The public needs simpler names that catch the essence of research areas. We need also need to embrace "breaking the rules". At the beginning of ever talk, the expression, "breaking the rules", should be used and his will create a buzz. Lance adjourned the meeting by thanking the Council for their valuable input.