

Maritime College

State University of New York

Good afternoon. My name is Dr. Richard Burke, and for the past ten years I have had the privilege of directing engineering programs at the **Maritime College of the State University of New York**. Recently I have become the director of the **Global Maritime Center for Research, Development, Education and Training** at Maritime College.

Maritime College, part of the State University of New York system, serves New York City by offering relevant, applicable, career-focused education programs. Often called “a hidden jewel,” an image that we are working hard to change, Maritime College is the premier college of its type in the country for preparing students for careers in the global maritime industry. Our graduates include Astronaut Scott Kelly, Michael Toner, retired president of General Dynamics Marine Systems, and Captain James DeSimone, COO of the Staten Island Ferry.

One hundred and thirty-eight years ago Maritime College was founded in and by the City of New York as the New York Nautical School to train students for demanding careers as ships’ officers because those officers were crucial to New York’s prominence in world trade. In 1932, with the help of Governor Franklin Roosevelt, the College acquired its present day campus at Fort Schuyler, in the Throggs Neck area of the Bronx.

We started teaching engineering subjects in 1908, with the arrival of our first steam-powered training ship, the U.S.S. *Newport*. After the Second World War the College was authorized to grant degrees, and Maritime College became the flagship of the nation’s seven maritime academies. We now offer five nationally-accredited engineering degree programs, and have more than five hundred full-time engineering students. About two thirds of those students are also engaged in training to become U.S. Coast Guard-licensed officers in the Merchant Marine. I will tell you without false modesty that our graduates have built an enviable record of job placement and career success¹.

To the matter of how we teach engineering, let me give you these points:

- We educate our students to be **practicing engineers**; that is, to work in industry, government, or the military, and to design, construct, manufacture and operate the things that the economy needs. While it is important to teach the faculty members of the future, practicing engineers keep the economy moving. Incidentally, these are very good jobs, and many of them are going unfilled.

¹ *Payscale.com* published a study during the summer of 2011 that ranked Maritime College’s engineering programs fifth nationally in terms of starting and mid-career salaries. Approximately 18% of graduates go on active duty with the Navy, Marine Corps or Coast Guard, and nearly all of the remaining graduates are fully employed within three months of graduation.

- The sea is a demanding environment, and a ship is the finest engineering laboratory in the world. Our students have to demonstrate **both learning and doing**. It is necessary but not sufficient for engineers to understand theory. They must also be capable of doing what is necessary to design, build, maintain, repair, operate and improve systems that we rely upon. It is no accident that in every major hospital in the New York area, the senior facility executives and engineering managers include our alumni and the alumni of similar engineering programs. If your life depends upon it, you need an engineer who can get the job done.
- We work hard to **use appropriate technologies** for learning and doing as well as in our professional work. We make heavy use of simulation of ships' engine rooms and wheelhouses to achieve realistic scenarios that could not be easily or safely reproduced at sea. We are experimenting with electronic teaching materials on tablets that address the age-old difficulty of three-dimensional visualization of complex systems. As we develop more interactive materials we are looking to bridge the gap between engineering school and life-long learning. Often, however, there is no substitute for the real thing, and we have been fortunate to recently receive a \$1.2 million gift of a main propulsion diesel engine laboratory from Wartsila, a global supplier of power plant equipment.
- We do not know what the technologies of tomorrow will demand, so to be prepared we must carefully and thoroughly **teach the basics** to our students. Only those who understand the foundations of their profession will be able to grow and learn as new technologies enter the state of the art. In my career I have seen the principal calculation tool go from a bamboo slide rule to a two-pound laptop computer, but these would be useless without understanding the enduring principles of engineering science. For this reason, the STEM subjects taught in primary and secondary schools are absolutely crucial. Algebra and physics may not be the coolest things to do, but they are the basis of our way of life and they are the keys to productive and satisfying careers.
- Lastly, **character and motivation** cannot be neglected. Nature poses an inflexible standard of performance on engineers – if the engineer designing a bridge does not do a good job, the bridge falls down, and such an event cannot be rationalized. We have to develop the character of our students to meet such tests. Perhaps this is why engineering serves society as the entry-level profession, historically appealing to new immigrant groups and students who are among the first in their families to receive higher education. Character counts in engineering. In spite of the heavy responsibility, engineering is both fun and creative, and when students are shown this they become energized. This too is our job as educators.

Thank you for this opportunity to speak to you.

Center for Urban Science & Progress (CUSP) Talking Points

- On April 23, 2012, Mayor Bloomberg announced the launch of the Center for Urban Science and Progress (CUSP) to be established in downtown Brooklyn. This applied science research institute was proposed by New York University and Polytechnic Institute of NYU (NYU-Poly), and developed in collaboration with corporate partners and world-class universities, including CUNY.
- CUSP will confront the array of challenges facing cities including: infrastructure, energy efficiency, green house gas emissions, transportation congestion, public safety, public health, natural resource management, communications, security, housing, and education. New York City will function as a “living laboratory” for CUSP researchers and students.
- Steven E. Koonin (former DOE Undersecretary of Energy for Science) has been appointed as Director
- Academic partners of NYU and NYU-Poly:
 - Carnegie Mellon University
 - City University of New York
 - University of Toronto
 - University of Warwick
 - Indian Institute of Technology Bombay
- Corporate Partners:

IBM	Cisco
Siemens	Con Edison
National	Grid Xerox
Arup	IDEO
AECOM	
- CUSP will present many opportunities for CUNY faculty and students to become involved in collaborative research projects and educational initiatives. Listed below are several key faculty members and institutes that were involved in the planning process for the Center:
 - **CUNY Energy Institute** – *Dr. Sanjoy Banerjee, Director*
Clean energy technologies and energy storage
 - **Environmental Crossroads Initiative** – *Dr. Charles J. Vörösmarty, Director*
Water resources, evolution of human water systems, and environmental sensing
 - **CUNY Institute for Sustainable Cities** – *Dr. William Solecki, Director*
Coastal concerns, consumption, and climate change in urban areas
 - **CUNY Institute for Urban Systems, Sustainable Building Initiative** – *Dr. Michael Bobker, Director*
Greening commercial properties, energy & construction management
 - **CUNY Institute for Software Design and Development** – *Dr. Ted Brown, Director*
Developing software to improve energy performance and efficiency of commercial buildings
- In addition to encouraging the ongoing engagement of all interested faculty and students in CUSP programming and projects, CUNY has committed faculty lines to hiring 2 (as yet to be determined) senior college faculty who will hold positions both on a CUNY campus and at CUSP.

The Center for Urban Science and Progress

The Science of Cities is essential to our planet's future. New York City stands to be at the center of that future.

The Center for Urban Science and Progress (CUSP)—an applied science and engineering institute created by NYU as a consortium of world-class universities, global technology corporations, and innovative urban designers—will focus on the challenges that an increasingly urbanized planet will face in the coming decades: how to accommodate more people in cities, safely, prosperously and sustainably.

Successfully translating cutting edge research into market-ready global solutions will be advanced by a partnership of global institutions fluent in both scholarship and industry. The CUSP consortium distinguishes itself both in the global breadth of its accomplished academic partners, and by the commitment of a range of corporate partners at the apex of their industries.

Each of the academic partners of NYU and NYU-Poly—City University of New York, Carnegie Mellon University, University of Toronto, University of Warwick and Indian Institute of Technology-Bombay—houses vigorous applied-science and engineering programs with particular strengths in this leading-edge topic of urban systems. Each has a solid track record of research commercialization and industry collaborations and partnerships. Each nurtures a culture of entrepreneurship on campus – through incubator programs, funding contests, classroom instruction, mentorship programs, and other supports. Hundreds of start-ups have launched from or been nurtured at these institutions.

CUSP's founding industrial partners are some of the most prominent companies in the world. They include Cisco, IBM, Siemens, Xerox, Consolidated Edison, National Grid, IDEO, ARUP, and AECOM. They bring global experience conceptualizing and commercializing smart city solutions.

The research and discoveries of CUSP will position New York City at the vanguard of the emerging economic sector of *urban science and engineering*. The size of this potential markets is huge—by one estimate \$100 billion worldwide in the rest of this decade alone. CUSP will give rise to a new tech cluster with dozens of new businesses and thousands of new jobs and leverage New York's existing competitive advantages of concentration, creativity and capital.

New York City as the Test Bed for Urban Solutions

Key to CUSP's aims will be an emphasis on partnering with New York region agencies, authorities, and utilities to make the city a "living laboratory" where research on urban systems and infrastructure can be prototyped in real-world settings. New technologies, systems, materials, and processes will yield not only smarter ways for government to manage its operations, but will increase the city's capacity for growth and sustainability.

NYU and the partners of CUSP believe this will be the hallmark synergy between its applied science program and New York as its host city. New York City will benefit from the opportunity

to be an early adopter of these innovations. But it will benefit doubly from commercial expansion as entrepreneurs and major corporations build businesses that will export these new urban solutions to a global market.

The result? London will no longer be just a competitor of New York's; it will be a customer.

Downtown Brooklyn as CUSP's Home

"Every city is becoming a laboratory for new urban technologies. But Brooklyn is arguably the best civic laboratory in the world."

*--Dr. Anthony Townsend
Research Director, Institute For The Future*

CUSP, which will be located in Downtown Brooklyn, is a response not only to enormous and important urban challenges but also to the very specific challenge issued this past year by the Bloomberg Administration to create an applied science institute in New York City, making the city a world capital of emerging technology and generating new jobs as it solves the world's most pressing problems. It will take advantage of the existing academic and research presence of NYU-Poly – where NYU is already making a \$75 million investment in faculty and facilities – as well as the ambitions and potential of MetroTech. In addition to its proximity to NYU-Poly, a defining aspect of this proposal is the belief that smart, sustainable cities of the future will require not only technical prowess, but also access to an inspiring environment where research mixes with commerce, entrepreneurship and creativity.

From its very inception, NYU has embraced its city, and more recently – with the acquisition of NYU-Poly – NYU has embraced engineering in New York City. In focusing on innovation and commercialization in urban science, in creating its locus in Downtown Brooklyn, in using New York as a "living laboratory," and in bringing together this outstanding partnership in NYC and focusing its skills and talent on applied urban science and engineering, we not only honor our origins, we embrace the excitement that comes from tackling one of the 21st Century's hardest, most important societal challenges in the world's greatest city.



MANHATTAN COLLEGE

Text of Testimony before New York City Council
Committee on Higher Education, jointly with the Committee on Technology

Oversight: How New York City Engineering Schools Prepare their Students for the Future

Wednesday, May 9, 2012

Manhattan College
School of Engineering
4513 Manhattan College Parkway
Riverdale, NY 10471

Thank you for inviting the Manhattan College School of Engineering to participate in this hearing.

Overview of Manhattan College (excerpted from *RENEWING THE PROMISE Self-Study 2012* prepared for The Middle States Association of Colleges and Schools, Commission on Higher Education)

From the founding by the Brothers of the Christian Schools (the de La Salle Christian Brothers) in May 1853, Manhattan College has been an institution with a sponsoring board of trustees comprising secular independent members and representatives of the religious teaching Institute of the de La Salle Christian Brothers. It also combined excellence in the traditional liberal arts and sciences with professional and technical education in a single collegiate institute. The mission of Manhattan College is to provide a contemporary, person-centered educational experience that prepares graduates for lives of personal development, professional success, civic engagement, and service to their fellow human beings.

Over the past three years, 35% of Manhattan's incoming freshmen have been first generation students. Currently, around 24% of the students are from racial and ethnic minorities, with the largest percentage of those reporting classified as Hispanic/Latino. As of fall 2011, the College enrollment was 2991 full-time undergraduates and 420 graduate students.

The School of Engineering

One hundred and twenty years ago in 1892 engineering was developed out of a science program in coordination with liberal arts. Today all five of the undergraduate engineering programs – chemical, civil, computer, electrical, and mechanical - and the masters of environmental engineering program are accredited by the Engineering Accreditation Commission (EAC) of ABET, Inc., and have robust and growing enrollments. As the largest school at Manhattan College, engineering has about 870 full-time undergraduate students, about 160 full- and part-time graduate students, 38 full-time tenured, tenure-track, or visiting faculty members, and 12 administrative and professional staff. In fall 2011, the school's undergraduate population was about 19.6% female and 16.1% underrepresented minorities (URM: African-Americans, Hispanic, and Native Americans). Nationally, for the same programs as found at Manhattan College, the percentages were 16.2% and 16.8%, respectively, for females and URM. As of May 8, 2012, the demographics for the incoming Class of 2016 for the college are about 47% female and 25% URM. For engineering, the demographics are about 19% for females and 17% for URM.

Manhattan College is primarily an undergraduate teaching institution, but is classified as a master's degree granting college or university. It is not a "Research 1" institution; instead the faculty members focus on the education of the students. A normal teaching load for a faculty member is seven courses per academic year; however, the heavy teaching load does not preclude research and other scholarly activity. The commitment to the students' education is reflected in the engineering school mission to prepare each student for a productive and rewarding career in engineering or a related profession, a mission that is consistent with that of the college and its Lasallian heritage. The school takes pride in its ability to recruit, retain until graduation, and prepare students for jobs in industry, private practice, and government agencies, and for entry into masters, doctorate, or other professional programs. A recent analysis of the Class of 2012 showed that 80% of those entering in fall 2008 were registered for spring term 2012, an exceptional persistence rate. A survey of the Class of 2010 conducted by the college in spring 2011 showed that of those answering the survey about 92% of the engineering students indicated they had a job or were in graduate school.

The School of Engineering promotes engineering careers to local high school students. The school has partnered or otherwise interacted with the Bronx Engineering and Technical Academy, IN-Tech Academy, Roosevelt High School, Saunders Trades and Technical High School, Yonkers High School, and Riverside High School to help attract more females and minorities into engineering. Faculty members conduct summer programs directed towards females, URM, and traditional students. These programs are supported by Manhattan College, the Yonkers Public Schools, the ACE Mentor Program (which originated at Manhattan College under the leadership of alumnus Dr. Charles Thornton), the New York Building Foundation, the American Society of Civil Engineers-Metropolitan Section, General Contractors Association, and

other corporate and private donors. During the school year, Manhattan College hosts an ACE Mentor Program team on campus and the school helped initiate the new ACE program at Riverside High School.

The subject of this hearing is *How New York City Engineering Schools Prepare their Students for the Future*. At Manhattan College, the students are prepared following some basic concepts: they will be ethically sound, they will be technically prepared, and they will be able to work from the first day on the job or in graduate school. Because the school is part of a Lasallian liberal arts college, the students have the benefit of learning ethics from specialists in the Religious Studies department as well as from the engineering faculty. Through the Lasallian heritage of community and service, the students learn how to interact with one-another, work in teams, communicate with each other, faculty and administration, and grow from a group of high school students into a cadre of young professionals. Because all of the BS programs are accredited by the EAC of ABET, the basic education is very similar to what one would find at any other accredited program in the US. That is not to say the curricula in the programs is stagnant, however. In fact, the different programs have integrated sustainability, green building, alternative energy, power supply and management, construction management, and cosmetic engineering into their respective curricula. There is only so much one can be taught at the undergraduate level within a four year program. Instead, students are encouraged to prepare themselves to participate in life-long learning which typically means completion of a master's degree. It is in a master's degree program where many of the new, cutting edge concepts and technologies are introduced to the student. The majority of the credits in a master's degree program are electives which are renewed and refreshed every year. A good example of a new idea is the cosmetics engineering option in the masters of science (MS) degree program in chemical engineering. This option was started in response to suggestions by industrial advisors and has proven to be popular. As another example, the masters of engineering in environmental engineering program is the only EAC of ABET accredited master's degree of its type in New York State, and only one of five such programs in the entire US.

Most Manhattan College masters students follow a 30 credit coursework-only plan because they are preparing for or are already employed in engineering jobs. Others opt for professional paper and thesis plans. However, a number of Manhattan College engineering graduates directly enter Ph.D. graduate programs at other institutions such as Princeton, Johns Hopkins, and Northeastern, to name a few. It is on this point that the school sees a great opportunity for its students in the two new programs/campuses initiated by the City under Mayor Bloomberg with lead schools of Cornell and NYU. The Manhattan College engineering BS and MS graduates will have added opportunities for graduate education through these new programs/campuses, opportunities that will further allow them to participate in the larger community of New York City and provide the service to humanity we expect from our graduates.

Since 1893, Manhattan College engineers have played an integral part in the building of New York City. From robotics to the environment, computing to infrastructure design, the school of engineering opens an incredible range of possibilities for the future engineer. The Manhattan College School of Engineering will continue to prepare ethically sound, technically competent, and ready-to-work graduates from its BS and MS programs with the expectation that these graduates will provide service to the larger community of New York City through traditional engineering professions, other professional opportunities, and new cutting-edge technology.

Again, thank you for inviting the Manhattan College School of Engineering to participate in this hearing.

Remarks on Engineering Education in NYC
to the Higher Education Committee, 5/9/2012
by Dr. Alfred Spector, Google, Inc.

Mr. Chairman and Committee members,

I am Alfred Spector, and I am here today in my role as Vice President of Research at Google. I am a computer scientist, a member of the US National Academy of Engineering, and I have previously been a university professor, an entrepreneur, and an executive at IBM in both product and research roles. I reside in the New York City metro region and work out of Google's New York City office, along with about 3,000 colleagues. As an international company, Google does research and engineering in many locations, but our NYC team is our 2nd largest, and based in the old Port Authority building in Chelsea, one of the largest in the city. In 2011, we grew by more than 750 people and we continue to hire actively.

The primary goal of Google's researchers is to advance computer science and thus enable continuing progress in our mission, which is "to organize the world's information and make it universally accessible and useful." As just one example of our work, we are focusing hard on developing techniques to allow machines not only to understand documents, images, and videos on the web, but also a consumer's goals in locating and understanding information. But, our team has also led our work in translation, speech recognition, auction pricing, and many other interesting projects.

One thing is for sure: the power of both personal devices, networks, and the so-called clouds of computational resources to which they connect will continue to grow in capability and availability. Simultaneously, the cost of computing will continue its decline. Computational clouds, over time, could contain billions of processing elements, giving almost everyone on-demand access to computing capabilities that were almost inconceivable a decade ago. In a quick search while writing this testimony, I have found many Android tablet computers on the web that go for less than \$75.00—less than many textbooks, yet capable of storing

vast numbers of them. This continuing growth in computational power will remain the underlying fuel for vast advances in software technology.

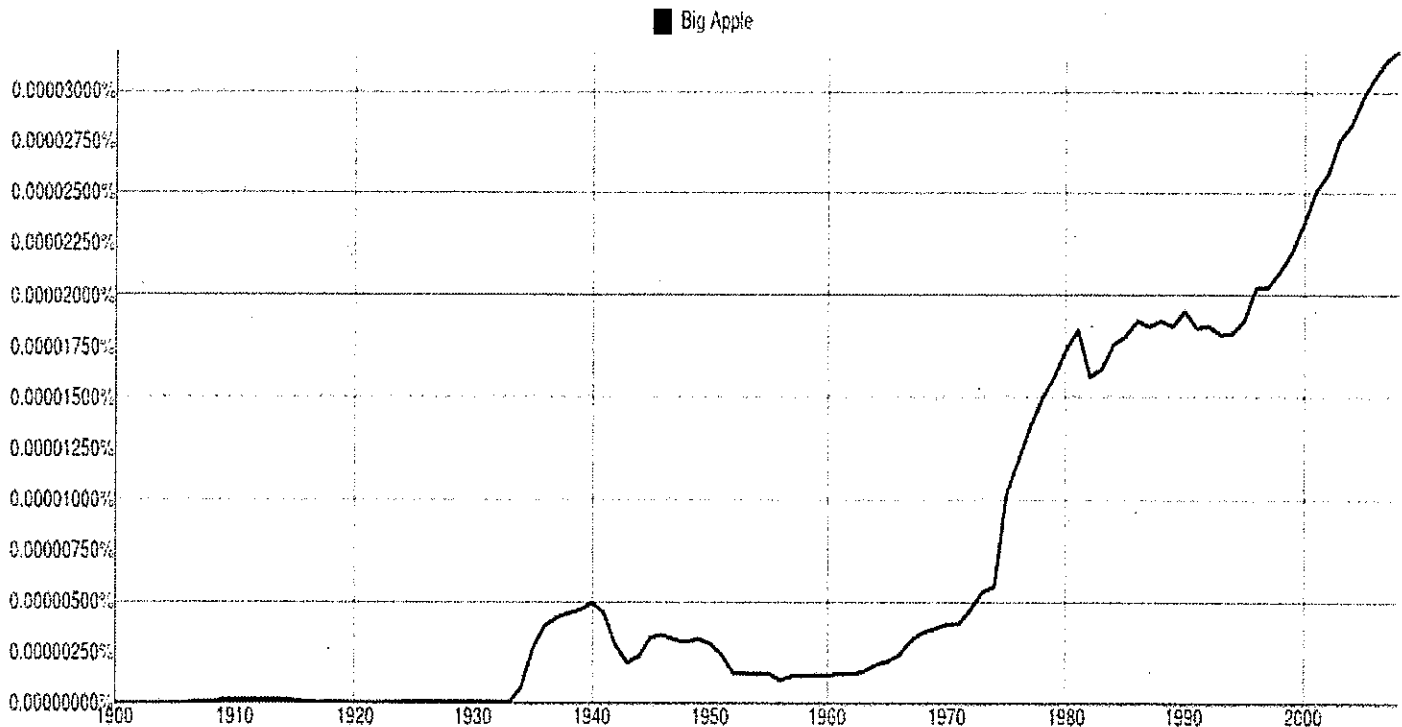
More importantly, the impact of ever more sophisticated technology will continue to be very significant, even by the standards to which we have already grown accustomed. Computers have benefited most every aspect of life, but now, even areas we thought were somewhat far afield are being impacted.

I talk about the mathematical formulation, "CS+X, for all disciplines X", as a shorthand expression of the nexus at which so much innovation is occurring. To me, the implication of this is that every discipline will be increasingly impacted by computer science, and computer scientists will increasingly be part of a much more interdisciplinary world.

Here's a fun example, based on work Google's been doing to support work in CS + Social Sciences, or in this case, what Lieberman and Michel have termed, "Culturomics." This screen image, which I took this morning from a publicly available tool called the "Google Ngram Viewer," shows the results of counting the occurrences of the 2-Gram, "Big Apple" in the corpus of millions of American books published between 1900-2010. Note how the prevalence takes off, just after the early 70's Big Apple promotion by the New York Convention and Visitors Bureau.

Google books Ngram Viewer

Graph these *case-sensitive* comma-separated phrases: between and from the corpus with smoothing of .



Search in Google Books:

<input type="button" value="1900 - 1966"/>	<input type="button" value="1967 - 2000"/>	<input type="button" value="2001 - 2003"/>	<input type="button" value="2004 - 2006"/>	<input type="button" value="2007 - 2008"/>	<input type="button" value="Big Apple (American English)"/>
--	--	--	--	--	---

Run your own experiment! Raw data is available for download [here](#).

© 2010 Google - [About Google](#) - [About Google Books](#) - [About Google Books Ngram Viewer](#)

For the problems we have at Google, innovation requires a thorough grounding in engineering and the computer sciences, and a great passion to innovate. Very roughly, the degrees of all our scientists and engineers are nearly balanced among the Ph.D.s, the Masters Degrees, and Bachelors degrees—a breakdown that represents the challenging nature of our problems. The vast majority of these

degrees are in engineering, including computer science. As an example of specific numbers in our research and engineering team, we have more than 115, 150, and 200 Ph.D.'s, Masters, and Bachelors, respectively, from 6 of the universities in the New York metro area. These are Columbia, Cornell, NYU, Princeton, Stonybrook, and Yale.

Turning to our intern program, which incidentally Glassdoor ranks #1 in the nation, we've hired more than 1200 interns in North America for the summer of 2012, with more than 150 in NYC. About 90 of our interns are from the six aforementioned schools.

Given this perspective—on the potential and the importance of the field, I feel the following are important to schools that teach engineering.

First, I emphasize that talented graduates will land jobs that are challenging, remunerative, and quite beneficial to the world around them. There is fundamentally no limit whatsoever as to what information technology can provide to mankind, nor is there any limit to what we can conceive of building. While there were concerns in the earlier part of the decade about the off-shoring of U.S. technology jobs, there remains a growing need for talented engineers in this country. In fact, this is evidenced now by growing enrollments and graduations. As just one example, even at Harvard which is thought of as a quintessentially liberal arts program, the number of majors in Computer Science and Engineering has doubled in the past 5 years, with growth in all of their areas.

Second, I note that our universities must make greater efforts to encourage new types of students to enter these engineering-related disciplines fields. When the right introductory courses are given, more students—including women and members of minorities under-represented in the field—realize the breadth and excitement of the opportunities. And our field can only reach its full potential if we are to have a variety of perspectives from people with diverse backgrounds. I myself became a computer science not because of any plan when I left high school. I arrived at the discipline because I was studying economics and applied mathematics, and I learned to program in a mathematics class. So, I applaud the movement in many computer science programs to make introductory courses

both better and more accessible. This can be done in the other engineering disciplines also.

Third, I emphasize a duality of the education goals that our universities must provide: On the one hand, it is essential that they educate all students with enough science, technology, education, and math so all can partake of an ever-more technical world. For example, I'm a very strong believer that a large percentage of students should consider computer science as a "minor," so that they can be a part of that CS+X hybrid I referred to earlier. But, on the other hand, it is equally true that the education for those who will be at the core of the engineering and computer science fields should be deep and of the utmost excellence. The fields reward those who are very well-trained and hardworking. I might add that a rigorous college or graduate degree in engineering or computer science will not provide too much time for goofing off.

Fourth, I'd like to suggest that all our education establishments pay great attention to integrating computational approaches, and engineering modes of thinking, broadly into *the curriculum of most disciplines*. If you accept my premise that CS+X is the new norm, it is not sufficient for students to take one computer science or engineering class. It is much better that modern modes of thinking, including computer programming, be integrated into most parts of curriculum. Such additions can make all areas, including English, History, Economics, Art even more effectively taught and provide the future tools all will need. Again, referring back to Harvard, I think this is a key reason why Harvard just increased the role of Engineering and the Applied Sciences in its undergraduate programs.

Fifth, I'd like to emphasize the role of innovation and entrepreneurship in education. Engineering and computer science are about inventing the future. So, students should become involved in fundamentally new and exciting opportunities throughout their education: For example, starting with the First Robotics League or similar activities in middle and secondary school and then continuing with student projects and internships in college. Our universities should encourage this energy—a energy very much like that of our fast-moving

city.

Finally, I'd like to mention the impact of information technology on education and to encourage our universities to participate actively in its advancement—to improve quality, the number of students who can be reached, **and** to lower cost. Information technologies have the ability to provide educational materials at very low marginal cost, to connect students with each other and with teachers using social networking and other communication technologies, and eventually to support great personalization of the educational experience. Information technology can provide forms of distance education that are ever more compelling and effective. Google's Drs. Peter Norvig and Sebastian Thrun taught an online course last fall on Artificial Intelligence with 160,000 sign-ups and 23,000 completions. Why now? I believe that technologies such as tablets, video-distribution, video-conferencing, and social networking have just reached the point of maturation that this will now take off. At Google, we have many technologies that are extremely useful in this field, and I'm sure you'll see rapid, continuing advances by our whole industry.

From our point of view, the availability of a talented workforce, trained in engineering and computer science, is absolutely essential to our continued growth in New York. And, we know it is important to our sister firms in technology. But most importantly, it will be valuable to almost every part of our economy, given the growing impact of engineering, and particularly, information technology. It is important that New York City grows its capacity and quality for engineering education.

9 May 2012 by Iqram Magdon-Ismael

RE: Oversight: How New York City Engineering Schools Prepare their Students for the Future

Every engineer deserves a chance. I consider every school an Engineering School, and I believe money can help engineers innovate. To help New York City Engineering Schools prepare their students for the Future, I propose that we start an institution in Manhattan called the International Institute of Technology (The Institution). The Institution's motto could be "nutritius creationis," which translates to "foster creation", and its mission could be to endeavor to provide the best resources to every individual. Here are some suggested lyrics for a school Anthem.

Listen.

Listen with your eyes, your ears, and your heart,
Immerse yourself, in the works of your art.
Listen and realize, what's true to your heart,
We all come together, for the betterment of art.

I will now suggest some inaugural principles for the International Institute of Technology, which can be amended and enforced by a group of individuals the New York City Council deems capable.

The International Institute of Technology Inaugural Principles

I. A Board of Trustees must be appointed to govern The Institution. This Board must appoint a President of The Institution and assign the President with clear duties and responsibilities.

II. The Institution must aspire to be substantially endowed.

III. The Board of Trustees must continuously employ a faculty of mentors such as computer scientists, chemical engineers, electrical engineers, writers, philosophers, designers, musicians, dancers, servers, researchers, socialites, psychologists, anthropologists, architects, carpenters, fashionistas, historians, politicians, financiers, statisticians, physicists, chefs, painters, actors, athletes, lawyers and doctors to help facilitate thorough learning and creativity.

With an International Institute of Technology built upon the three principles outlined above, I think we can help Students in New York City realize their full Engineering potential.^[1]

Here are some specific ideas I have that may help Students prepare, which would align nicely with the The Institution's mission.

1. Provide unrestricted, fast & free internet connectivity and computers with headphones and Spotify access (or access to a comparable music service) that can be rented for free, wherever possible in New York City such as schools, households, libraries, recreation centers, public parks, and other public facilities. In certain facilities, allow Students to work and listen 24/7.
2. Help Students afford healthy nutritious food, because good nutrition leads to good engineering.
3. Build a public technology museum that showcases cutting edge technology

advancements such as robots, spaceships, electric cars, artificial hearts, and cancer & other disease treatments.

4. Host free technology talks for the public and invite speakers from around the world.
5. Put well stocked Kindles (or similar devices) in libraries and allow them to be checked-out.
6. Build public centers for creation where groups of Students can use the tools provided to work on their art such as music, pottery, medicine, hardware and software.
7. Support Student run educational companies fairly and arduously.
8. Build a beautiful Campus for the International Institute of Technology where Students and Faculty can work with each other to achieve their life goals. Any person of any age can apply any number of times to be a Student or a Faculty member. Applicants must pay an expensive fee and submit a statement of purpose in order to be considered. New Students and Faculty are chosen by members of the Institution through a fair and open process judged by the merits. All accepted Students and Faculty members are automatically given the immigration status required to travel and reside in America, and they are granted equal access to every resource made available by the Institution such as research laboratories, athletic facilities, mentors, music rooms, dance halls, conference rooms, classrooms, audio engineering tools, and internet. Curriculum, budgets and evaluation criteria are decided by Faculty and Students collectively, and presentations of work are happen periodically.

Finally,

9. Allow immigrants with US Citizenship Status to run for President of America. This will improve New York City's chances of attracting the best Engineering talent.

If we make New York City an environment where engineers can thrive off the resources we support and establish, we will further Engineering endlessly and become a source of inspiration to all other cities, states and countries in the world and therefore prepare New York City Engineering Students for the future.

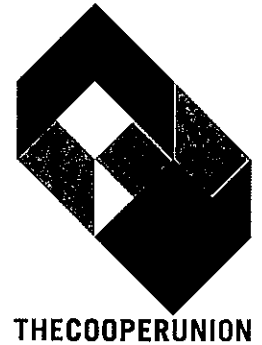
I hope you seek my opinion when making decisions pertaining to this subject matter.

Thank you.



References

1. Statement is inspired by Microsoft's Mission, "At Microsoft, our mission and values are to help people and businesses throughout the world to realize their full potential." from <http://www.microsoft.com/enable/microsoft/mission.aspx> on 9 May 2012.



C.V. Starr
Research Foundation

The Cooper Union
for the Advancement
of Science and Art

Cooper Square
New York NY 10003-7120
T 212.353.4291
F 212.353.4031
www.cooper.edu

May 9, 2012

“How New York City Engineering Schools Prepare their Students for the Future.”

Testimony before New York City Council’s Committee on Higher Education and Committee on Technology

Good afternoon and thanks to both committees for the opportunity to speak on this topic. My name is Yash Risbud and I am the Director of the C. V. Starr Research Foundation at The Cooper Union for the Advancement of Science and Art (The Cooper Union). I am here today with Robert Marano, President and CEO of InDorse Technologies. We are proud to represent Jamshed Bharucha, President of The Cooper Union, and Simon Ben-Avi, Acting Dean of the Albert Nerken School of Engineering. Both Rob and I are Cooper alumni and adjunct professors, so this topic is something near and dear to both of us.

We at The Cooper Union envision a simple goal: provide students the opportunity for life-long learning via “close contact with a distinguished, creative faculty and fostering rigorous, humanistic learning that is enhanced by the process of design and augmented by the urban setting.” To that end, our faculty deliver a combination in mastering theory across key, foundational engineering topics and in exercising that newly formed understanding with application to “real world” engineering challenges and problems.

Our classroom interaction focuses on the fundamentals of the studies of both engineering and humanities. All Cooper Union students learn that interactive and factual observation leads to problem formulation, and subsequently a problem solution coupled to what resources are available. Theoretical and applied technical courses are essential to mastering engineering, but only effective with the proper balance of humanities and the liberal arts, including topics such as art history, economics, foreign language and poetry.

Inherent to a major portion of engineering studies at The Cooper Union remains the interaction between academia and industry. Engineering courses taught in the latter years rely heavily upon the application of theory to deliver tangible engineering results against clear cut specifications. Our faculty relies upon industry participation via seminars and mentorship to our students as they explore the application of theory to the real, physical world.

Engineering has been at the heart of the current technology revolution. Many of our students not only dream of being the next entrepreneurs, they are doing something about it. They apply their specific, newly learned engineering talents and balance them with learning the skills of project management, corporate financial analysis, marketing planning, staff planning, and developing pitch decks to raise capital from potential investors.

Cooper Union has also formed among its faculty, staff, students and alumni the Cooper Union Entrepreneurs Society in order to complement and further extend the curriculum with entrepreneurial activities and seminars on seminal topics critical for any entrepreneur to understand before they expend any resources or money.

Engineering education requires a rigorous attention to theoretical detail, the discipline to study and make connections across disciplines, understand the application of engineering to the world around us, and ultimately interface engineering into human society. Four years remain not a sufficient time to equip our engineering students with every facet of knowledge and proven attempts to demonstrate retention, but by our creative interaction of classroom studies, industry interplay and outreach, and continued dialog with our family of engineering alumni, The Cooper Union has demonstrated to continue to deliver our students, New York City's children, ready and able to serve as contributing engineers for our City's present and future.

Thank you for your time and we welcome any questions you may have for us.



NEW YORK INSTITUTE OF TECHNOLOGY

New York City Council Hearing
Wednesday, May 9, 2012

How New York City Engineering Schools Prepare their Students for the Future

Good afternoon! On behalf of NYIT President Dr. Edward Guiliano, we thank you for the opportunity to share with the City Councils members of both the Higher Education and Technology Committees how NYIT and, in particular, its School of Engineering and Computing Sciences are preparing its students for the future.

Considering the global challenges in sustainability, public health, interconnected economies, safety and security, and new social dynamics, we at NYIT believe future engineers and technologists need to gain an education that instills in them such skills and knowledge as:

- Multi-disciplinary understanding
- Virtual team-work
- Global perspective and cultural appreciation
- Private-public-global partnerships
- Lifelong learning to keep pace with ever-faster evolving technology

The NYIT School of Engineering and Computing Sciences prides itself on educating engineers with the aforementioned attributes who are prepared to take on 21st century challenges, whether working for government, industry, NGOs, small businesses, or international corporations. Currently the school is educating 2635 students where 600 of them are pursuing their Graduate degrees. The school is guided by the three tenets embraced by NYIT's mission: the professional preparation of our students, applications-oriented research, and access to opportunity for all qualified students.

Given the interconnected nature of global economies, NYIT, being a global university, is educating engineering students who are prepared to begin or continue their professional careers anywhere in the world. Our graduates demonstrate the global awareness, competence, and engagement needed to compete globally, collaborate across cultures, and effectively participate in social and business settings locally and internationally. Upon graduation, our engineering students:

- Articulate the global interconnectedness of issues, processes, trends, and systems
- Apply this learning in general knowledge as global citizens and, in their academic specializations, as global professionals

- Adapt their own oral, written, visual, and digital communication, as appropriate, to different cultures to enable effective sharing of information and beliefs
- Interact and work effectively and appropriately in teams with people from different nationalities and cultures, either locally or internationally
- Evaluate social, cultural, and linguistic diversity to develop a nonjudgmental and open attitude toward difference

As a global university where commerce, culture, intellectual pursuit, and academics come together, NYIT aims at energizing students and faculty to promote innovation and transform its campuses into “idea centers” that will attract investors and entrepreneurs to the New York metropolitan region from all over the world. Moreover, NYIT not only provides hands-on experience and problem-based education to its students, but it also offers them experiential opportunities to work in close collaboration with industry, thus addressing the demand for job-ready graduates.

NYIT’s forward-thinking approach to applied research is demonstrated by the fact that it was the birthplace of 3-D computer animation that paved the way for the creation of several of today’s leading animation film studios. NYIT has a cutting-edge motion capture laboratory and developed the first solar home and solar electric vehicle charging station installation on Long Island. Numerous patents in computer graphics and animation, high definition television, packet video and internet access systems, hybrid electric vehicles, and optical sensors also originated at NYIT. This tradition of being at the forefront of innovation continues as we prepare our students for the future.

Following the examples of Silicon Valley, San Diego Biotech Region, and Route 128 around Boston, it has been proven that synergistic partnerships between the academic and private sectors result in the creation of innovation centers, technology hubs, and high-tech business incubation. MIT, Harvard, Boston University, and Stanford have shown that technology-oriented private universities play a major role in the creation of these high-tech economy centers. NYIT has undertaken several initiatives to pioneer such high-tech incubation movement within New York City’s five boroughs. This is evidenced by NYIT being the single educational institution in the New York metropolitan area, and one of only four organizations out of 715, to receive funding from the New York State Regional Economic Development Council for technology initiatives to drive future economic growth in NY.

With partial funding from the New York State Empire State Development and a commitment from the senior administration of NYIT, the School of Engineering and Computing Sciences is creating a new Entrepreneurship and Technical Innovation Center (ETIC), that will facilitate industry-academe partnerships in three critical emerging areas: Bioengineering and Health Analytics; IT and Cyber Security, and Energy and Clean Technologies. NYIT is well positioned to be a leader in these areas, particularly with cross-disciplinary support from its six other schools and colleges: the School of Architecture and Design, the School of Health Professions, the School of Management, the School of Education, the College of Arts and Sciences, and the New York College of Osteopathic Medicine at NYIT. The School of Engineering and Computing Sciences will play a central role in this endeavor as it is able to build synergies with the other schools through projects in energy and water, global health, biomedical engineering,

data analytics, biometrics and bioinformatics, green building and design, and multimedia technology.

In a recent state-wide entrepreneurship competition, NYIT was the only university that had two teams receive awards. NYIT is reaching out in a deliberate effort to broaden its partnerships and create opportunities for the development of industry/state/academic collaborations. New and ongoing research partnerships include the NYIT Golden-I Third Eye project, where NYIT faculty and students are collaborating with Motorola Solutions, Kopin Corporation, Reality Mobile, IPS, and others to develop innovative applications for a cutting-edge, wireless headset computer, and a voice-activated head motion-controlled drone with real-time video streaming. During the Golden-I national competition in the fall of 2011, an NYIT student team was selected as one of the top three teams for innovative design. Our students are also involved in many government and industry-supported projects related to health, security, and sustainability. Projects in the green area include the reduction of the carbon footprint of NYIT campus locations, City of New Rochelle municipal buildings and hybrid sanitation truck fleet, and biodiesel conversion.

Avenues to increase the collaborative efforts of higher education and industry require a true public-private partnership, including support from New York City government. This will inspire the city's youth and encourage innovators to retain young talent and attract new business ventures to the area. This support will also counter the perception, stated in the Ewing Marion Kauffman Foundation's report of 2008, indicating that one of the reasons New York is not an area for the start of high-tech firms is that there isn't a top-tier engineering program in the metro area. That perception is one that is already changing (and we are pleased that NYIT has taken the lead) but we need to create a new entrepreneurship and technical innovation ecosystem in New York City. The spark of innovation and the spirit of entrepreneurship are waiting to be ignited in our students and the public, supported with adequate resources. With a population of more than 8 million people, New York has the human capital needed to lead the nation and the world. Let's build Silicon Alley together, here and now.

NYIT is the college of choice for more than 14,000 students currently enrolled in more than 50 programs of study leading to undergraduate, graduate and professional degrees from seven schools and colleges, including engineering, architecture, business, health professions, and medicine. A private, independent college, NYIT embraces an educational philosophy of career-oriented, professional education and supports applications oriented research to benefit the greater global community. Students attend classes at NYIT's Manhattan and Long Island campuses, as well as online and in a number of programs throughout the world. For additional information, visit nyit.edu.

Respectfully,

Rahmat Shoureshi, Ph.D.
Provost and Vice President for Academic Affairs

Nada Anid, Ph.D.
Dean, School of Engineering and Computing Sciences

City College Grove School of Engineering, May 9, 2012
New York City Council: Committee on Higher Education and Committee on Technology

Good afternoon. My name is Joseph Barba. I am a professor of electrical engineering and the dean of the Grove School of Engineering at the City College of New York. I am also an alumnus of the School. Joining me are Professor Ardie Walser, Associate Dean for Academic Affairs, and Mr. Jeremy Cortez, a sophomore electrical engineering student.

I want to thank the City Council Higher Education Committee and particularly the Chair, Councilman Ydanis Rodriguez, for inviting us to present a brief overview of the Grove School of Engineering and how it prepares its students for the future as well as to answer any of your questions regarding the School.

The City College of New York (CCNY), established in 1847, is the oldest campus of the City University of New York (CUNY) system and continues to be CUNY's flagship college. The City College is one of 23 campuses in CUNY. The CUNY system has approximately 250,000 students in over 300 majors leading to associate, baccalaureate, and graduate degrees. Over 4,000 courses are offered to CUNY students.

The CCNY Grove School of Engineering (GSOE) is the principal entity for engineering education within CUNY. The origins of the GSOE date back to 1916, when the Board of Trustees authorized a curriculum leading to the Diploma of Junior Civil Engineer. In 1919, the School of Technology was established. In 1962, the Board of Higher Education approved a change in the name of the School of Technology to the School of Engineering and Architecture. Later, in July 1968, the Board of Higher Education approved the separation of the School of Engineering and the School of Architecture. In November 2005, the CUNY Board of Trustees approved a change in the name of the School of Engineering to the Grove School of Engineering.

Today, the GSOE offers bachelor's of engineering (B.E.) degrees in:

- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Mechanical Engineering

And bachelor's of science (B.S.) degrees in:

- Computer Science
- Earth System Science and Environmental Engineering

As well as master's of engineering (M.E.) degrees in:

- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Science
- Electrical Engineering
- Mechanical Engineering

And the master's of science (M.S.) degree in:

- Computer Science

Since September of 1963, under the auspices of the Graduate Center of CUNY, the GSOE has offered advanced study leading to the degree of Doctor of Philosophy in Chemical, Civil, Electrical, and Mechanical Engineering, as well as in Computer Science.

Beginning in the fall of 2008, CCNY became a Ph.D. granting institution, offering the Doctor of Philosophy degree (M.Phil./Ph.D.) in Biomedical, Chemical, Civil, Electrical, and Mechanical Engineering. The CUNY Graduate Center continues to offer the Doctor of Philosophy in Computer Science.

Accreditation is the assurance that a collegiate program has met certain standards necessary to produce graduates who are ready to enter their professions. **ABET**, incorporated as the **Accreditation Board for Engineering and Technology; Inc.**, is the recognized non-governmental organization that accredits post-secondary education programs in applied science, computing, engineering, and engineering technology. ABET accreditation is an assurance that the professionals that serve us have a solid educational foundation and are capable of leading the way in innovation, emerging technologies, and in anticipating the welfare and safety needs of the public.

Students who graduate from ABET accredited programs have access to enhanced opportunities in areas such as employment, mobility, and providing a positive impact on society.

In August of 2011, the Computing Accreditation Commission and the Engineering Accreditation Commission of ABET released the findings of the Grove School accreditation review, which was held in October of 2010. All eight engineering programs were fully accredited for the maximum six years.

The curriculum of each engineering program is supervised and maintained by its own faculty. To ensure that the content of the curriculum remains relevant in a fast changing world, advice is obtained from:

- 1) The programs' external advisory boards, which is comprised of academics and industry representatives.
- 2) Research faculty who filter their cutting-edge research into the curriculum.

Approximately 50% of the new students entering the GSOE this year were transfer students. ABET requires the GSOE to have in place mechanisms to insure that transfer students are as well prepared as students entering the School as freshmen. Ways that the GSOE insures this are by:

- Maintaining a database of course equivalencies for CUNY, domestic and international academic institutions;
- Conducting a periodic review of course equivalencies listed in the GSOE database;
- Conducting a periodic review of all courses comprising the seven GSOE joint degree programs with Hostos and LaGuardia Community Colleges

For continuing students, there are several offices in the GSOE that have been established to insure that our undergraduate students receive intensive academic support and the professional development needed for successful careers.

The Office of Student Development (OSD) focuses on lower division students (students with fewer than 45 credits) by providing academic monitoring and advising, conducting the new student orientation, providing tutorial and counseling services, participating in pre-college outreach, conducting career and professional development, arranging cooperative education and internship referrals, working with departments and student organizations to bring in industry speakers, and organizing School-wide special student events.

The OSD also oversees the engineering student societies, organizations, and clubs to ensure close inter/intra collaborations that offer a wide range of academic, professional, social, and other community-building activities throughout the academic year. Students participate in international career-related experiences such as working on engineering projects in developing countries through our Engineers Without Borders student organization, while others participate in design competitions external to the classroom, such as the Concrete Canoe, Human Powered Vehicle and the American Institute of Aeronautics and Astronautics design-and-fly competitions. Students are encouraged through advisement and early leadership development to participate in these endeavors to help broaden their exposure and experiences in engineering design and so that they can further develop some of the skills that are needed to be competitive in the work environment. Many of our students also attend professional development conferences (regionally, nationally, and internationally) through their academic departments or professional student organizations such as the national Society of Hispanic Professional Engineers (SHPE), the National Society of Black Engineers (NSBE), and the Society of Women Engineers (SWE). A list of GSOE student organizations is attached.

The Office of Undergraduate Affairs (OUA) is the primary source in the Grove School of Engineering for information on issues concerning the School's academic policies, admissions, and curriculum and graduation requirements.

A major role of the OUA is the advisement of engineering and computer science students in conjunction with the OSD. Students with 45 credits or more are advised by a faculty member in their program, along with a professional counselor from the OUA.

In addition to advisement responsibilities, the counselors in the OUA also ensure that students have the proper prerequisites for courses and verify that graduating seniors have fulfilled all degree requirements. They also perform transfer credit evaluations for students from other academic institutions who wish to transfer to the GSOE. The OUA also maintains articulation and joint-degree programs and insure they are current.

It has been recognized that early exposure to science & engineering research has a profound impact on students' professional and career development. In acknowledgement of this important finding, the GSOE established the Student Research & Scholarship Center (SRSC) in 2008 to provide students with early exposure to research experiences.

The mission of the SRSC is to work in close collaboration with GSOE faculty to promote student participation in research. Working in collaboration with the OSD, the SRSC offers a research-training program to prepare students, particularly freshmen, for successful research experiences. The SRSC is also instrumental in recruiting students for academic scholarships and research internships. One way the SRSC promotes student research is by publishing the *Journal of Student Research* to showcase students' research achievements and faculty mentoring efforts.

Students participating in undergraduate research are exposed to cutting-edge research and make use of the latest technology tools of their profession. Through the SRSC and their professors, students have the opportunity to participate in national and international research internships at other academic institutions, national laboratories, and in industry. These experiences prepare students for research careers and/or graduate studies.

As an example, during the summer of 2011, three engineering students from the GSOE spent eight weeks at the IBM China Research Lab (IBM-CRL) in Beijing. They participated in IBM's Global Research Intern Program, which provides students the opportunity to work side-by-side with IBM engineers and scientists to address the most current research questions. In addition to valuable professional experience, the internship provided the students with a unique opportunity to work and live in a foreign country. Seven of our students were selected to participate in this prestigious IBM program and will spend the coming summer in China or Zurich.

Additionally, faculty in the GSOE have funded grants from national agencies and foundations to promote student research, strengthen the student engineering pipeline and specifically targeting underrepresented minority students. Examples include the NSF funded CUNY-wide New York City Louis Stokes Alliance for Minority Participation (LSAMP), the NOAA funded Remote Sensing Science and Technology Center (NOAA-CREST), the NSF funded Science, Technology, Engineering and Mathematics Talent Expansion Program (STEP), the NSF funded Partnerships for Research and Education in Materials (PREM), the NIH funded Minority Scholars Program, and the newly awarded DOE funded Alliance for the Continuous Innovative Learning Environments in STEM. Attached is a copy of the article entitled "STEM Initiatives at City College of New York: a Formula for Success," that appeared in the April 4, 2012 issue of *Hispanic Outlook*, and highlights three of these programs.

The GSOE also offers pre-college STEM recruitment and pipeline programs. Pre-college programs include:

- The STEM Institute, a 6-week summer program for high school students by the GSOE
- The Transportation Institute summer program for high school students
- The Weather Camp, offered by the NOAA-CREST Center
- Pre-college events hosted by our various engineering student organizations

Flyers describing two of these programs are attached.

In recent years our faculty and students have participated in entrepreneurial activities. The GSOE undergraduate-focused "Entrepreneurship Program at the City College of New York" was established in 2010 to leverage the resources and rich history of the Grove School of Engineering

while introducing New York City to a "West Coast" model of garage-based/skunkworks research and development. The program is made possible through the generous endowment of the Kaylie Prize in Entrepreneurship by Mr. Harvey Kaylie (CCNY EE '60), president and founder of Brooklyn-based Mini-Circuits.

Interested students submit an idea with a team of no more than five students, including one engineer and at least two different disciplines, in the fall semester. Five semifinalist teams are selected by an external judging panel consisting of established entrepreneurs, venture capitalists, and IP lawyers to determine the novelty and impact of the product. These students receive a prize and enroll in a design course where they will develop a pre-alpha prototype of their product and a business plan describing the value of this product. The student teams have 24/7 access to the InnoLab, the brand new CCNY Physical Entrepreneurship Lab, sponsored by Mr. Irwin Zahn (ME '48.)

At the end of the spring semester, the semifinalist teams demonstrate their device/product and explain the business model at a gala event. Following the presentation, an external panel of judges select the winning team. The winning team receives \$50,000 in stipends and housing to spend the summer developing their product. This year approximately 150 students entered the competition. Attached is the program for this year's gala with the five semifinalists teams and the external judges.

Another component of the GSOE's entrepreneurial education is the Aziz Ahmad Leadership Lecture series on entrepreneurship, generously supported by Mr. Aziz Ahmad (EE '82), co-founder, President and CEO of UTC. Visiting professionals with expertise in investing, management, design, production, and intellectual property give seminars, which, in their entirety, provide students with comprehensive exposure to business and entrepreneurship. Speakers have included Mr. Mike Millegan, President of Verizon Global Wholesale; Mr. Savio S. Chan, President and CEO of US-China Partners and Mr. Martin Bloch, President of Frequency Electronics, Inc.

To prepare students for entry into the workforce, City College sponsors the Professional Recruiting Program through its Career Services Center. At the end of their junior year, students are provided with a series of professional development workshops and employment search coaching and/or placement. Besides resume referral to companies for full-time employment opportunities, the Career Services Center also hosts company recruiters on campus who interview graduating students for full-time employment opportunities. In addition, all students, including freshmen, are encouraged to participate in the College's Career Fairs. The one held in the Fall is geared towards engineering and the sciences while the one held in Spring is for all academic majors, including engineering. Engineering students are encouraged as part of their academic culture to participate in these career fairs early in their academic life. At these career fairs, students also learn about and apply for internship opportunities with companies with whom the College has relationships.

This concludes my brief description on how the CCNY Grove School of Engineering prepares its students for the future. We would be happy to answer any questions you may have. Thank you.

Attachments

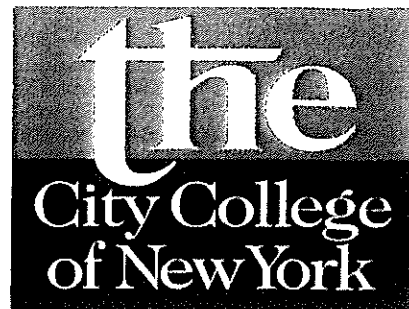


GROVE SCHOOL OF ENGINEERING

Engineering Student Club Listing (2011 - 2012)

1. American Institute of Aeronautics & Astronautics (AIAA)
2. American Institute of Chemical Engineers (AIChE)
3. American Nuclear Society (ANS)
4. American Society of Civil Engineers (ASCE)
5. American Society of Heating, Refrigerating & Air-Conditioning Engineers (ASHRAE)
6. American Society of Mechanical Engineers (ASME)
7. Arab American Engineering Club (AAEC)
8. Art of Science and Engineering (ASE)
9. Association for Computing Machinery (ACM)
10. Biomedical Engineering Society (BMES)
11. CCNY Aerospace Club
12. CCNY Chapter of American Society of Engineering Education (ASEE)
13. Chi Epsilon
14. Concrete Canoe Club
15. DFI Student Club
16. Engineering World Health
17. Engineers Without Borders (EWB)
18. Entrepreneurship Club
19. Eta Kappa Nu (HKN)
20. Genomics and Bioinformatics Club
21. Graduate Chapter of IEEE
22. Institute of Electrical and Electronics Engineers (IEEE)
23. Korean-American Scientist and Engineers Association (KSEA)
24. Latin American Engineering Student Association (LAESA-SHPE)
25. National Society of Black Engineers (NSBE)
26. National Society of Professional Engineers (NSPE)
27. NOAA CREST Club
28. Omega Chi Epsilon
29. Pi Tau Sigma
30. Robotics Club
31. Rocket Propulsion Club
32. Society of Automotive Engineers (SAE)
33. Society of Women Engineers (SWE)
34. Steel Bridge Club
35. Students for Alternative Sources of Energy (SASE)
36. Sustainable Energy Now Club
37. Tau Beta Pi

STEM INITIATIVES AT CITY COLLEGE OF NEW YORK: A FORMULA FOR SUCCESS



by Paul Hoogeveen

As the largest urban college in the U.S., and as a leading Hispanic-Serving Institution, City College of New York (CCNY) has a strong history of creating programs that have increased the participation and retention rates of Hispanics, as well as women and other underrepresented groups. This is especially true of several initiatives at CCNY aimed at improving participation in the STEM disciplines. Many are designed to not just improve participation at the undergraduate level but to open the pipeline at every level, through post-graduate work.

At the end of 2011, a promising new partnership between CCNY and Stanford University suffered a setback when Stanford pulled out of its bid to build a new \$2.5 billion applied science and engineering school on Roosevelt Island. (The contract was ultimately awarded to Cornell University in conjunction with Technion-Israel Institute of Technology.) Nevertheless, Stanford and CCNY have pledged to continue working together and will be developing a more modest partnership in 2012, with the aim of establishing an on-campus Stanford presence at City College.

While disappointing, this setback does not diminish the significance of CCNY's impressive array of initiatives aimed at supporting minority

participation and retention in STEMs. Among these initiatives are three that particularly stand out, whether for their ambitious goals or for their proven success: the brand-new Alliance for the Continuous Innovative Learning Environments in STEM (CILES) Initiative, to be

year, but having established highly successful methodologies for improving minority participation in STEM.

These initiatives were developed to address an ongoing issue in the STEM disciplines. Minorities, while already underrepresented in

higher learning relative to their numbers in the general population, are even more underrepresented in science and engineering. Hispanics are particularly underrepresented; while they represent more than 16 percent of the nation's population, fewer than 14 percent of engineering degrees awarded by U.S. colleges and universities in 2008 went to Hispanics. As Hispanics continue to gain an ever-increasing share of the overall population, the issue of underrepresentation in STEM disciplines takes on greater urgency.

CILES Initiative

One of the newest STEM initiatives at CCNY, the CILES program, the Alliance for the Continuous Innovative Learning Environments in

STEM, will be run in partnership with two CUNY community colleges, Hostos and LaGuardia. Funded by a five-year, \$4 million grant through the U.S. Department of Education, it will be primarily housed at the City University of New York CREST center (the Cooperative Remote Sensing



CILES will address several objectives, including improving articulation programs designed to help STEM students transfer to CCNY from Hostos and LaGuardia

implemented in the fall of 2012; Partnerships for Research and Education in Materials (PREM), established in partnership with the University of Chicago and aimed at supporting minority participation in materials research; and lastly, the NIH Minority Scholars program, now in its final

Science and Technology Center). Six new classrooms, two at each campus, will also be constructed to support the program.

CILES will address several objectives, including improving articulation programs designed to help STEM students transfer to CCNY from Hostos and LaGuardia; attracting students to the STEM fields via outreach at elementary and high schools; and supporting students' learning needs at every stage of the process, from high school through graduate school. In terms of numbers, the initial goal is ambitious: increase the number of majors in earth system science and environmental engineering from 81 to 160 by fall 2016.

Dr. Jorge González, NOAA-CREST Professor of Mechanical Engineering at CCNY, said of the new initiative: "That is the key of the program – to improve retention of the student undergraduate population in STEM and at the same time open the pipeline all the way to high school. Part of the reason is we've learned that about half of our undergrad population is coming from transfers from community colleges. And since they are coming here anyway, we'll do it such in a way that they'll have a real chance to succeed."

"CILES is focused initially on environmental sciences and engineering as model cases," he said, explaining that these are rapidly growing fields at present. "From there, we will expand immediately into biomedical engineering."

A major goal of the CILES program is to create a more seamless, continuous learning experience that breaks down the barriers that can cause students to leave STEM areas. Toward that end, González said, CILES curriculum will be revised to emphasize critical thinking, hands-on work and an interdisciplinary approach. Labs will be developed in a parallel way across all three campuses, to facilitate a seamless experience. And both students and faculty will be trained to utilize virtual learning environments, which will further cement a sense of continuity and a collaborative learning process.

To sum up the central theme of CILES, González stated: "We're saying, 'Can we really put all this together into a very central program

that identifies the students that are interested in these fields, and supports them all the way from the time they are thinking of applying until they graduate here at the CCNY campus?'"

PREM: Establishing a Research Collaborative and Training Educators

"At City College, overall we're about 60 percent underrepresented minorities – African-American and Hispanic," said Dr. Jeffrey Morris, professor of chemical engineering at CCNY. "But in engineering, we're a total of 34 percent. When you get to the Ph.D. level, that figure declines to about 5 percent of the total graduate population in the overall engineering college."

Enter PREM, Partnerships for Research and

Research. (In CCNY's case, that partnership was formed with the University of Chicago.)

One of the National Science Foundation's primary goals with PREM is to improve the quality and quantity of opportunities research opportunities for both faculty members and students at MSIs that have received PREM awards. According to Morris, CCNY is already showing promising results toward that end.

"We have two women Hispanic Ph.D.s – one who's gone on to a faculty position at our sister CUNY school New York Tech, and one who's gone on to a post-doc at the University of Chicago," he said. "And we've just recruited two African-American men into chemical engineering, out of eight entering Ph.D.s. I think we're doing very well relative to the numbers."

Morris also discussed two ways in which CCNY is utilizing PREM finds to approach the specific needs of underrepresented students at CCNY: living stipends and outreach programs. First, he pointed out that students in underrepresented groups often face significant financial challenges and need to work while studying – a factor that can impact both academic performance and completion rates, especially at the graduate level.

"People fail to see the opportunities at the end of the tunnel," said Morris. "One of the things that we're able to do because of the funding we have is to offer undergraduates stipends which allow students to work in research labs. They're working on research projects, they're intellectually engaged on the project they want, but they're paid at a level that allows them to not need another external job."

Morris also explained how CCNY-UChicago PREM has also developed a pilot outreach program using the mathematics and engineering high school conveniently located on the CCNY campus.

"We were very lucky in the development of our outreach programs to high schools. This was a peer-teaching program where chemical engineering undergraduates were trained to give lectures and demonstrations. They went into classrooms, worked with students, and had some level of feedback on the



CCNY President Lisa S. Coico

Education in Materials, a program now in its third year at CCNY aimed at improving minority participation in materials research by establishing research partnerships between minority-serving institutions and centers supported by the National Science Foundation Division of Materials

quality of the teaching from the abilities of the students both before and after. The peer teaching has been nice because these are people who are not very different in age, and very often not that different in high school background."

From there, said Morris, he and other members of the PREM program fleshed out a broader outreach program.

"We developed a high school teachers' academy, with help from one of the teachers at the high school, in terms of thinking about how to



Dr. Jorge González, NOAA-CREST Professor of Mechanical Engineering, CCNY

structure the system, and in terms of knowing what high school teachers tend to be looking for in a summer academy," he explained. "We brought in teachers from very different schools around the city. We let them help us understand how what we do can be used to drive high school laboratory modules, and to bring the excitement of these scientific issues to a place where they can be used in a high school lab, but are also inexpensive enough to be used across a broad range of schools."

According to Morris, CCNY's PREM program, while still somewhat new, is already proving successful. "We've made an extremely large effort to reach out and involve minorities as much as possible," he said. "In the PREM program, to date we've graduated four Ph.D.s and of those, two were Hispanic women."

NIH Minority Scholars Program: A Successful Experiment

For the Grove School of Engineering at CCNY, the year 2012 sees not only the beginning of new

initiatives like CHES, but also the end of a highly successful program: the National Institutes of Health Minority Scholars program. According to Dr. Sheldon Weinbaum, professor emeritus of biomedical engineering at CCNY, two institutions (including CCNY) received the first NIH grant for the program when it was first launched in 2002, but CCNY was the only one to receive a renewal.

"When we started, we had something in the order of 25 undergraduates," he added. "As of right now, we have about 190 undergraduates. The Ph.D. program has 37 students."

Weinbaum, like his colleagues in other programs, pointed out that many of CCNY's students come from economically disadvantaged backgrounds. With the inception of NIH Minority Scholars program, the Biomedical Engineering Department (also formed in 2002) set a goal to enable its minority students to perform at the level of a top-tier institution and even pursue graduate studies. They accomplished this primarily through two interventions that were later carried into other STEM initiatives at CCNY: living stipends that freed students from the need to work and allowed them to focus on their education, and establishment of an intensive research experience requiring significant time spent on lab work – which created something parallel to a Ph.D.-level experience for undergraduates.

In the first NIH grant's run, Weinbaum's new department met with moderate success, but with undergraduate retention at 54 percent at the end of 2006, the department decided to implement something fairly unique at the time – a near-peer mentoring system in which graduated students were paired with undergraduates. It proved to be the missing ingredient, and by 2011, undergraduate retention rose to 74 percent. What's more, the CCNY Biomedical Engineering Department ranked first in student and faculty diversity and seventh in research productivity.

"We also got an award this year from National Association of Multicultural Engineering: the Outstanding Collegiate Retention Award," Weinbaum added.

With the second and last NIH grant expiring this year, the Biomedical Engineering Department isn't waiting for new funding to fall into its lap. According to Weinbaum, the department has applied for a grant from the Howard Hughes Medical Institute.

City College has done much to improve its physical infrastructure in support of its students in STEM programs (and students in all its programs, for that matter). CCNY President Lisa S.

Coico is particularly proud of the recently established Tech Center, which provides more than 300 workstations for students, as well as opportunities to create virtual learning environments for faculty.


But beyond the new facilities, and beyond hopes of a new partnership with a top-tier institution like Stanford, lies a well-established culture of commitment to continuously improving access to higher education for minorities and women. And within this culture initiatives such as CILES, PREM and the NIH Minority Scholars



Dr. Sheldon Weinbaum, professor emeritus, biomedical engineering, CCNY

program share some common threads, such as outreach into the educational community; a seamless educational experience at all levels; and student support through mentoring and close collaboration. It's a formula for success that warrants both positive scrutiny and greater recognition.





Macomb Community College

Education • Enrichment • Economic Development

Macomb Community College, located in the NE area of Metro Detroit, seeks two **Instructors of Mathematics**, # 001236.

For requirements and online application, visit www.macomb.edu/jobs. Concerns, 586.445.7885. Apply by 4/30/12.

EEO Employer
MI Relay Center 1.800.649.3777

PROGRAM ELIGIBILITY

Students will be nominated and screened by sponsoring high school on the basis of:

- Demonstrating "Ganas" – Spanish for *commitment to succeed* – in science, engineering or mathematics
- Successful completion of academic instruction in math and science at student's grade level
- A High School Average of 90 or better
- Math and Science Regents score(s) of 90 or better
- Good record of school attendance
- Willingness to participate in different aspects of the program until graduation from high school and to continue to maintain contact with the program throughout college

APPLYING TO THE STEM INSTITUTE

To apply to The STEM Institute, please visit:
<http://ccny.cuny.edu/engineering/stem>

or

contact Mr. Marte at marte@ccny.cuny.edu for an application.

Also visit us at:

<http://www.facebook.com/steminstccny>

Mail complete applications to:

Otto Marte, Assistant Director
Grove School of Engineering
The City College of New York
140th Street & Convent Avenue, T-2M1
New York, NY 10031
Tel: (212) 650-6190
Fax: (212) 650-8139

AVAILABLE COURSES FOR SUMMER 2012:

Group A: Calculus I (1 elective HS credit) & Robotics Design (Non-credit) Pre-requisite: Pre-Calculus (10th & 11th Graders) and US Citizenship or Permanent Resident

Group B: Calculus I (1 elective HS credit) & College Critical Writing & Reading (1 elective HS credit)

Pre-requisite: Pre-Calculus (10th & 11th Graders)

Group C: College Pre-Calculus (1 elective HS credit) & General College Physics (1 elective HS credit). Pre-requisite: College Advanced Algebra or being placed by STEM Placement exam. (10th & 11th Graders)

Group D: Honor HS Geometry (1 elective HS credit) & one of the following (All 1 elective HS credit):

1. General Chemistry
2. College Critical Writing & Reading

Pre-requisite: Advanced Algebra (9th - 11th Grades)

Group E: Advanced College Algebra & one of the following (All 1 elective HS credit):

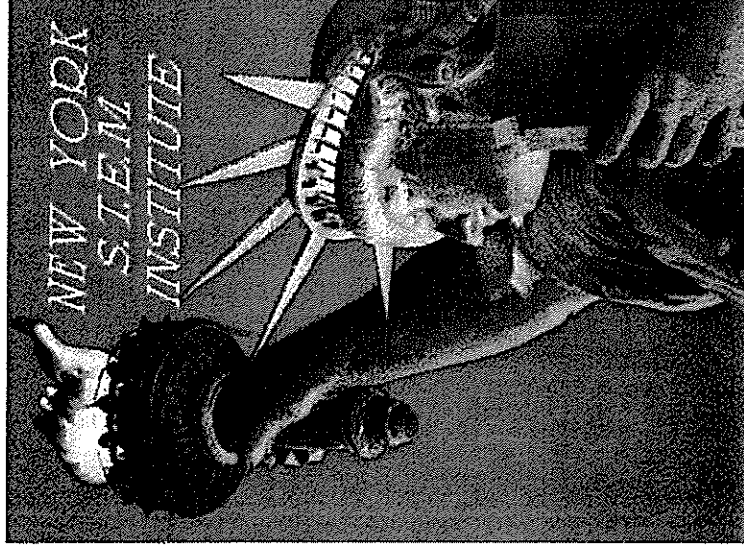
1. General Chemistry
2. College Critical Writing & Reading

Pre-requisite: Non-ESL students for choice 2 ONLY (9th - 11th Grades)

Group F: Engineering 103 (Intro to Computer Methods) (Non-credit) & Research in one of the following areas: 1. Electrical Engineering, 2. Civil Engineering, 3. Mechanical Engineering,

4. Science (Biology, Chemistry or Physics)

Pre-requisite: Calculus and US citizenship for Research ONLY (11th & 12th Graders)



**The Science, Technology,
Engineering & Mathematics
(STEM) Institute**



**Application Deadline
March 16th, 2012**

**GAIN COLLEGE RESEARCH
EXPERIENCE WHILE STILL IN HIGH
SCHOOL! Also, Meet NASA, ARMY
scientists, astronauts, and distinguish
Professors. In addition learn about
Scholarships Opportunity!!!**

BACKGROUND

Research shows that many successful high school students do not maintain the same level of academic excellence during their early college years because they are under-prepared for the unique challenges of the college environment. The STEM Institute was founded in 1992 with the support of NASA and CASHEE to ensure that Hispanic, female, and other minority students continue to achieve academic excellence throughout their pre-college, undergraduate, and graduate years by means of continuous programmatic support.

The STEM Institute prepares students for the greater demands of college-level study and helps them adjust to campus life. It offers academic and tutoring support services designed to help students prepare for these new challenges.

COST

The STEM Institute is a **FREE** program. Students who are accepted will receive free textbooks and supplies. Public transportation, breakfast and lunch will be provided free of charge for eligible students **ONLY if funds will be available.**

BENEFITS

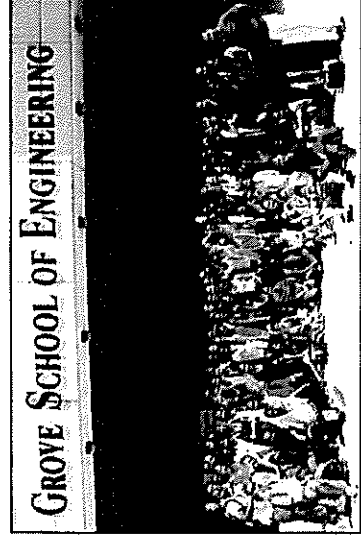
Students who successfully complete the program will receive **one elective high school credit** depending on the courses they enroll in. Courses vary each summer and focus teamwork, creative hands-on experiences and critical thinking skills. Courses are supervised by the program assistant director and a team of CCNY instructors and Ph.D. students teach the courses.

ABOUT THE STEM INSTITUTE

The STEM Institute is a challenging academic enrichment program designed to encourage minority students in grade 9-11 to maximize their academic potential by providing them with an educational program in college-level study. The STEM Institute offers courses in the physical sciences, mathematics, English, engineering and computer programming. A select group of students are also offered the opportunity to conduct research with faculty at The Grove School of Engineering. All students who participate are encouraged to pursue careers in the field of engineering, technology, science, business, and mathematics.

The STEM Institute is a collaborative initiative between the AMNH, AEOP/UNITE, STEP Program, the Biomedical Engineering, NOAA CREST programs at The City College of New York, Grove School of Engineering, the New York City Department of Education, and the Center for the Advancement of Hispanics in Science and Engineering Education (CAHSEE).

SUMMER 2011 PARTICIPANTS



DATES OF THE STEM INSTITUTE

The STEM Institute is offered during the New York City Public High School summer session. This year the program will be offered:

June 28 to August 4, 2012
Monday to Friday
9:00 am – 4:00 pm

Tutoring sessions will be offered daily from 8:00-9:00 am and from 4:00-5:00 pm.

PROGRAM COMPONENTS

- **A Unique Classroom Experience:** Students learn from engineering, science, and mathematics faculty at The City College of New York, as well as High School teachers.
- **Career Information Sessions:** Students are provided with exposure to science and mathematics as applied to the industry. As part of the program representatives from the faculty at The City College of New York and outside corporations visit the students to speak to them about the different career choices available in engineering and other science-related disciplines.
- **Parental Involvement:** A parent and student orientation session is held before the program begins, in order to discuss the roles and responsibilities of both parents and students.
- **College Information Sessions:** Students who participate in The STEM Institute take part in information sessions on the college application process, scholarships and research opportunities.



NOAA CREST

Weather Camp

Dates: July 23 - August 3 ~ still accepting applications!

See last year's [Video](#) from Channel One!

The City University of New York weathercamp is a two week program for high school students from the New York City metropolitan area, and is offered free of charge to 6-12 students selected via an application process. If you are interested and will have completed the 9th grade by the summer, don't hesitate to contact the camp director (listed below) and fill out an application: your chances are better than you think!

The first week is a day camp on the campus of the City College of New York. Concepts of meteorology are demonstrated by hands-on activities whenever possible, and applied to weather observations both locally and around the country. Experts on such topics as severe storms and climate will speak and answer questions. We also visit a local broadcast meteorologist and see how a live forecast is put together.

During the second week the camp moves to Long Island to be near the local National Weather Service (NWS) office located on the campus of Brookhaven National Laboratories. We will camp within walking distance of a beach on the north shore of Long Island, and each morning will go to the National Weather Service office (NWS) for in depth study of weather phenomena, with the afternoons devoted to field observations of the sea breeze effect, the urban heat island, the surface environment and clouds. There are opportunities to go inside the radar dome, or to help launch weather balloons. A hotel stay mid-week will host a discussion of careers in meteorology. If you have never been camping before or have had a bad experience, please read about the weather camp [camping experience](#); nearly every camper has said this was the best part!

If you are interested in the weather, this is a once in a lifetime experience you do not want to miss!

We are part of a larger consortium of weather camps, headed by Howard University and in the planning stages for funding by the National Science Foundation. Applications can be downloaded by clicking [clicking here](#). We continue to accept qualified applications until filled up, so if you missed the

April 16 deadline, just send it in anyway and you may still be accepted - can't hurt.

All questions about the particular aspects of this camp should be directed to the New York [camp director](#).

A complete description of previous year's weather camp activities with pictures is in the following pdf files: [2009](#) [2010](#).

A story on the 2011 Weather Camp put together by CBS Channel One is [here](#).

The Weathercamp team would like to acknowledge the contributions of three New York City Teachers who served as consultants in the creation of the camp: Susan Kelly, Ruben Worrel, and Mike Passow.





**TITLE II B MATH GRANT
DISTRICT 30
ACADEMIC YEAR 2012-2013**

CCNY - NOAA-CREST CENTER GRADUATE COURSE

Dennis Walcott
Chancellor

Helena Ureta Conti
MSP Grant Coordinator
Queens ISC -4TH Floor
28-11 Queens Plaza North
Long Island City, NY 11101

Hconti@schools.nyc.gov
718-391-8165

**TWO WEEK GRADUATE STEM SUMMER INSTITUTE
3-credit STEM Course Offered
Remote Sensing of the Environment
Teachers 7-12 Preferred
Accepting K-6 Teachers**

Dear Teachers of the Title II B Math Grant:

The Title II B Math grant is offering a series of free 2-week Summer Institutes, with 3 graduate STEM credits each at NOAA-CREST, a research center on the campus of the **City College of New York** to teachers interested in weather, climate, remote sensing, and computer modeling and how to use Simple Math to Predict Anything. The first summer of 2010 consisted of "Weather and Climate" and the second one was on "Remote Sensing of the Environment". The third summer to be held in August 2012, we will offer a course on "Computer Models are Easy: How to use Simple Math to Predict Anything". Teachers who are accepted will receive free tuition and fees, free materials, and 3 graduate STEM credits per year. Teachers that attend all three courses, for total 9 graduate credits, will receive a Certificate of Completion at the end of the three years.

The Second course offered in the summer of 2011 on Remote Sensing of the Environment will be held weekdays from **Monday, August 13, 2011 through Wednesday, August 21, 2011** at CCNY from 10 am - 4:30 pm, with lunch break. City College of New York (building and room TBA). The topics will include application of mathematical models to study/predict motion, single and multi-species population growth, gridded models and waves, climate models etc.. Theory and hands-on activities will be combined with class discussion of the related mathematical modeling. Algebra skills are required; some calculus knowledge is helpful but not necessary. Calculator and motion detector will be provided.

The course will be taught by Dr. Brian Vant-Hull: brianvh@ce.cuny.edu.

Please submit attached application form and letter of recommendation from your school principal to Hconti@schools.nyc.gov by **Wednesday June 15, 2011**.

**PLEASE PRINT Title IIB Mathematics Partnership Grant
APPLICATION**

CCNY - NOAA-CREST CENTER GRADUATE COURSE

TWO WEEK GRADUATE STEM SUMMER INSTITUTE

3-credit STEM Course Offered

Remote Sensing of the Environment

Teachers 7-12 Preferred

Accepting K-6 Teachers

The class will meet at CCNY on August 13, 14, 15, 16, 17, 20, 21, 2012

Hours: 10:00 a.m. – 4:30 p.m.

Check Present Level of Teaching Position: Elementary Middle High School

School At Which Presently Employed: _____ School Phone: _____

Grade Currently Teaching: _____

Email Address: _____

Name: _____

Home Address: _____

Home or Cell Phone: _____

Present Certification: _____ Date of Certification _____

Certification Subject Area: _____ Provisional Permanent

Please answer the following questions:

1. I am presently certified in mathematics Yes No

2. I am presently teaching mathematics Yes No

Please email application to Hconti@schools.nyc.gov along with a recommendation letter from your principal no later than Wednesday, June 15, 2011



GROVE SCHOOL OF ENGINEERING

Second Annual
Kaylie Prize in Entrepreneurship
Awards Dinner

May 3, 2012

Steinman Hall, Lecture Hall & Lobby

- 5:30 p.m. Steinman Lecture Hall
Welcome and Introduction - Dean Joseph Barba
Remarks - President Lisa Staiano-Coico
Remarks - Mr. Harvey Kaylie
Introduction of Students and Judges - Professor Dan Steingart
- 5:40 p.m. Team Presentations
- 6:30 p.m. Dinner - Steinman Lobby (open seating)
- 7:20 p.m. Announcement of Kaylie Prize Winners - Mr. Kaylie

Judges:

- Elizabeth Fastiggi: Entrepreneur and Private Equity Investor
- Harvey Kaylie: President and Founder of Mini-Circuits
- Sergey Nazarov: Founder and General Partner at QED Capital
- Jon Santiago: Co-Founder and Director at HTINK
- Katherine Snyder: Editor at Bloomberg News
- David Tannenbaum: Chief Operating Office at ThinkNear

The Kaylie Prize for Entrepreneurship was established in 2010 through an endowment given to City College by alumnus Harvey Kaylie, '60. Mr. Kaylie is president and founder of Mini-Circuits, a Brooklyn-based RF and microwave electronic components design, manufacture, and distribution company. Established in 1969, the company has grown into a global leader in RF, IF, and microwave components for commercial, industrial, space, and military applications.

Student Teams

VISTA Wearable

This team is using vibration actuators in combinations with ultrasonic detectors and GPS to use touch as a way of supplementing visual cues for the visually impaired. Lei Ai, Psychology (Ph.D.)

- Javier Montesino, Computer Engineering
- Frank Palmer, Computer Engineering
- Cindy Rodriguez, Computer Science
- Daniel Zuleta, Computer Engineering

Nanofils

This team is leveraging a novel nanoparticle developed in Professor Couzis's lab to make long lasting, more effective, low cost water filtration (including organisms).

- Howie Chu, Chemical Engineering
- Francisco Guzman, Chemical Engineering
- Rahul Jayamohanlathika, Chemical Engineering
- Alex Skuratovsky, Applied Mathematics
- Muhammed Uzair, Biomedical Engineering

Julintani

This team is working on a protocol and system for making it easier to give money to non-profits (e.g. micro donations).

- Johnny Huang, Computer Science
- Jeff LeBlanc, Chemical Engineering (Ph.D.)
- Franqueli Mendez, Computer Science (MS)
- Elliot Schrock, Mathematics (MA)
- Crae Sosa, Chemical Engineering

NExT UI

This is a new take on "mind control" using waveforms from the brain, leveraging advanced tech from Professor Parra's lab.

- Mohammad Arafat, Biomedical Engineering
- John Ettikkalavil, Biomedical Engineering (MA)
- Jaeseung Hahn, Biomedical Engineering
- Ana Kodra, Psychology

Cor Vitalis

This team is designing a pumping mechanism for an artificial heart that does not destroy blood cells.

- Nathali Bertran, Master of Engineering
- Mike Cinelli, Chemistry
- Nigel Gebodh, Biomedical Engineering
- Samuel Kupfer, Biomedical Engineering
- Sara Morsi, Biomedical Engineering



COLUMBIA | ENGINEERING

The Fu Foundation School of Engineering and Applied Science

Testimony of Feniosky Peña-Mora, Dean

**The Fu Foundation School of Engineering and Applied Science
Columbia University**

Before the New York City Council

Committee on Higher Education

and

Committee on Technology

**Regarding How New York City Engineering Schools
Prepare their Students for the Future**

On behalf of Columbia University and The Fu Foundation School of Engineering and Applied Science, I would like to thank the Committee on Higher Education and the Committee on Technology for holding this hearing jointly to examine the question of how New York City Engineering Schools prepare their students for the future. I am grateful for the opportunity to share with you this afternoon the philosophy of engineering education that defines Columbia Engineering. Last month I was invited to present a talk on the future of engineering education in North America at the 33rd Annual Convention of Pan American engineers. I was privileged to share with them, as I am sharing with you, this philosophy of engineering education.

At Columbia Engineering, we have created an educational paradigm that can be represented by two Greek letters, "pi" and "phi." Think of this paradigm

as similar to π , with two columns supporting a crossbeam, in the proportions of the golden ratio, ϕ .

Some engineering philosophies look more like the capital letter "I," with great depth in the technical subject matter but not much breadth. Others are like the capital letter "T," which has depth and some breadth. A "pi according to phi" engineering education encompasses much more than rigorous mastery in the fundamentals of an engineering discipline represented by the first supporting column.

It is the perfect proportion that emphasizes, as the second supporting column of pi, knowledge gained through research experiences, entrepreneurship programs, community-based service-learning, internships, externships, and global experiences abroad. These experiences are essential for today's engineers and applied scientists to understand how engineering is making a difference in the real world. These co-curricular and extra-curricular activities all add to the strength of the second support column.

The over-arching crossbeam between pi's two support columns is the knowledge gained in the study of the liberal arts. Columbia's Core Curriculum provides students with wide-ranging perspectives on transformative ideas in literature, philosophy, history, music, art, and science. Using methods developed by Socrates, it hones critical thinking skills so essential to engineering, learning to define the problem, examine the evidence, analyze the information, and, ultimately, address the problem.

It is only through an understanding of the humanities that the engineer of today and tomorrow will contextualize the combination of the knowledge gained in the academic discipline and the enriching experiences that

complement it. Hence, the future engineer is best served by the educational philosophy of “ π according to ϕ .”

I would like to highlight several additional facts that, when taken in conjunction with our engineering education philosophy, ensure that Columbia is educating the next generation of engineers and applied scientists to become innovative, socially responsible leaders in industry, government, and academia, and who strive to improve the human condition, locally, nationally and globally.

We are building on a legacy of educating engineers and applied scientists that goes back to the founding of Columbia as King’s College in 1754. Columbia alumni include John Stevens, Class of 1768, whose technology made early steamboats and locomotives possible; DeWitt Clinton, Class of 1786, who shaped the history of New York City as mayor and, as governor, was the force responsible for the Erie Canal that created a waterway linking New York City to mid-America; and William Barclay Parsons, Class of 1882, who, as the chief designer and engineer of New York City’s first subway system, the Broadway line, revolutionized mass transportation within the city. At the same time, as the chief engineer and designer of China’s 1,000-kilometer railway route from Canton to Hankow, he may be considered one of Columbia’s first global engineering leaders. And the firm he founded, Parsons Brinckerhoff, is now one of the world’s leading global engineering and construction management organizations. Current Columbia Engineering alumni lead Boeing Commercial, Citigroup, and Xerox, and hundreds of other national and international companies, while others have embraced the entrepreneurial spirit and are forming successful companies, one after another.

And, as we are about to welcome a new class of alumni following their graduation next week, we are also getting ready to welcome the Class of 2016. This new class has been chosen from a record breaking number of applications from the widest application pool we have ever seen, with a selectivity rate of 9.4%. Of the admitted class, 45% are women and 34% are underrepresented minorities—Hispanics, African Americans, Native Americans and Pacific Islanders. Of this group, 18% are first generation college.

We offer admission on a need-blind basis so that every student admitted is guaranteed to have his or her financial needs met. That results in more than 56% of our students receiving some financial aid, with an average Columbia University grant of more than \$36,000 per year. And for households where the calculated income is less than \$60,000, there is no parental contribution required. Our school also boasts an enviable graduation rate of 90% within 4 years; 96% within five years; and 97% within 6 years. This is all the more amazing when you consider the rigorous curriculum and the many co-curricular and extra-curricular activities in which our students participate. Equally impressive is the fact that, for students who entered in the Fall of 2010, the retention rate from first year to sophomore was an amazing 98%.

Over the years, Columbia Engineering's fundamental philosophy of engineering education has not changed; but the components that make up each element of "pi" engineering have been transformed by the passage of time. Beginning in the first year, our students take a required design course, we call it the Gateway course, which acquaints them with each of the engineering and applied sciences disciplines that we teach. And it gives them the opportunity to work on group projects that are real-world problems. They develop substantive engineering skills as they are encouraged to think

creatively, to work collaboratively, and to solve real problems. They have created a wheel chair swing and redesigned the Richard Rodgers Amphitheater in Marcus Garvey Park in Harlem.

When our students reach their senior year, they are responsible for a senior design project within their major, one that brings to bear all the knowledge and soft skills they have acquired since their first year at Columbia Engineering. These senior design projects often result in patent applications, especially in the areas of biomedical engineering, mechanical engineering, and electrical engineering. From neonatal transport systems that prevent hypothermia to a gantry arm for victims of spinal muscular atrophy, our students actually solve real-world problems, and do so in a way that improves the human condition.

In addition to the rigorous curriculum, our students are able to choose from many co-curricular and extra-curricular activities that complement their education within the classroom. They can select one of hundreds of different research opportunities, some with our most senior faculty. Our undergraduate students can work on research projects from green roofs and tracking electricity consumption in the City to developing novel biomaterials for tissue regeneration and applying photonic packet switching to high performance computing.

We also offer a minor in entrepreneurship and support a vibrant entrepreneurial spirit among the students. In fact, this year, we created a residential program, Res. Inc., a living-learning environment that fosters innovation and entrepreneurship by creating a residential community of nearly 70 engineering students interested in starting new ventures.

We offer internships and externships, some of which are international, with companies in diverse industries. And we believe that having a global experience is highly desirable for every student. Faculty-led international trips during winter break give students an understanding of different countries and cultures as they interact with other students and with companies around the world. In addition, many students volunteer with Engineers Without Borders. The Columbia chapter is working in Ghana, where they are concentrating on sanitation and water management; in Uganda, where they are implementing a multi-function Energy Platform (MFP) pilot program to provide power for agricultural processing, electricity generation, and irrigation; and in Morocco, where they are building two footbridges over the Tagawowt River.

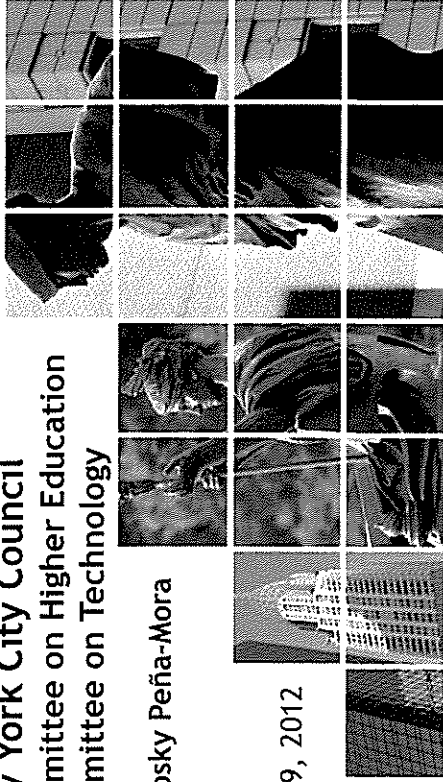
The mission of our School is to educate talented students who aspire to become innovative, socially responsible leaders in industry, government, and academia, students who strive to improve the human condition, locally, nationally and globally. We do this by balancing fundamental principles with real-world applications, and an emphasis on interdisciplinary education and entrepreneurship. I am privileged to be able to come before you today and to assure you that we at Columbia Engineering are preparing our students to be the engineering and applied science leaders of tomorrow.

On behalf of Columbia University and Columbia Engineering, thank you for your time and for your interest in the educational future of our students.

**New York City Council
Committee on Higher Education
Committee on Technology**

**Feniosky Peña-Mora
Dean**

May 9, 2012



Educational Paradigms

I Great depth but not
much breadth

T Both depth and
breadth

“π” according to “φ”

L Rigorous mastery of the
fundamentals of engineering or
applied science discipline

J Research, internships,
entrepreneurial programs,
community-based service learning,
technical and liberal arts minors

“π” according to “φ”



Liberal arts and humanities form
the overarching crossbeam
that gives broader context to
engineering and applied science
expertise

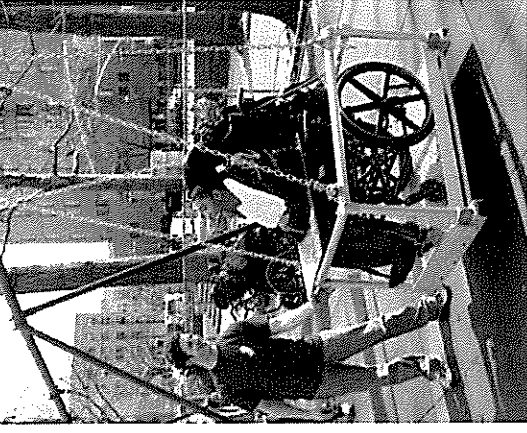
“ π ” according to “ φ ”

φ

The golden ratio determines the relationship among the elements

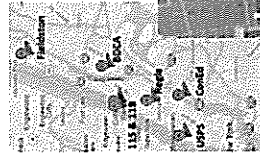
π

Application of “ π ” according to “ φ ”



- ## Wheel Chair Swing
- In Marcus Garvey Park
 - Conceived, designed and built by Columbia SEAS students in 2008
 - One of several community projects in the immediate area of PS 79

Application of “ π ” according to “ φ ”

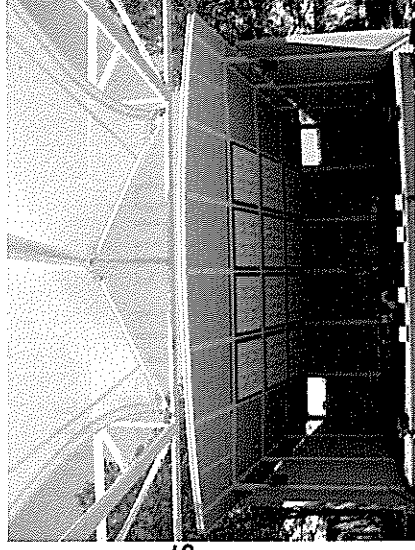


Green Roofs Project

7 sites in NYC have green roofs
2 at Columbia, Fieldston School, U.S.
Postal Service Morgan Distribution Hub,
Con Edison Learning Facility, Regis High
School, and Bronx Design and
Construction Academy (BDCA).

- Students work with professors to:
- estimate rain runoff retention, detention and evapotranspiration;
 - measure water quality parameters;
 - determine what combination of green roof substrate components will lead to more successful water retention and quality improvement

Application of “ π ” according to “ φ ”



Renovation and Restoration of Richard Rodgers Amphitheater in Marcus Garvey Park

Worked with Carla McIntosh, president of the MGP Alliance and architects for NYC Parks and Recreation to restore the amphitheater, opened to the community in June, 2011

Application of “ π ” according to “ φ ”

Students work with professors on projects such as improving the power supply through smart grid technology

Map of energy use by building in New York City, developed by Prof. Vijay Modi



Application of “ π ” according to “ φ ”

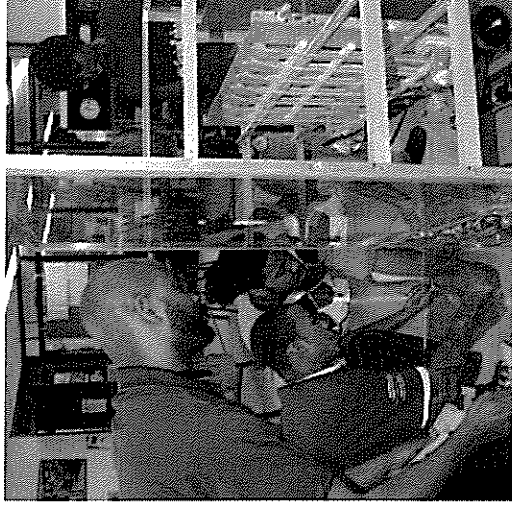
- Mastering the technical skill
- Understanding societal needs on a global scale
- Researching the problem
- Employing entrepreneurial skills
- Leading a team



Application of “ π ” according to “ φ ”

Morris High School Robotics Team

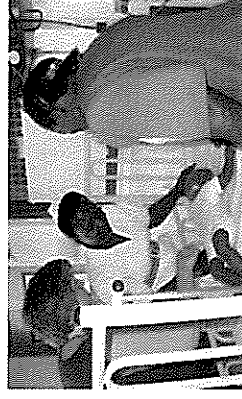
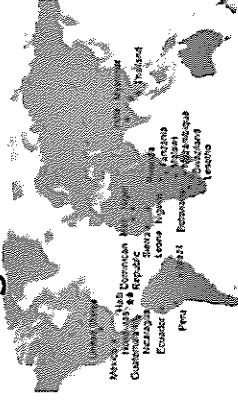
- Uses Mechanical Engineering lab
- Mentored for 10+ years by Bob Stark, lab manager
- Faculty and SEAS students work with these Bronx high schoolers so they can compete in national FIRST competitions sponsored by Dean Kamen



Application of “ π ” according to “ φ ”

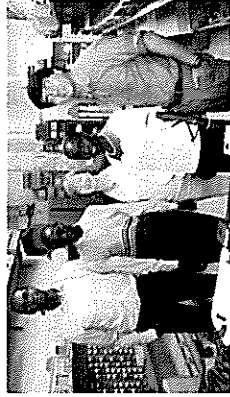
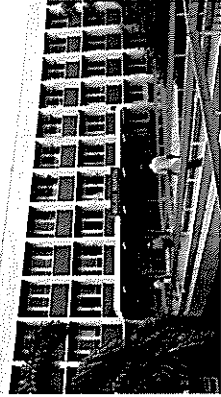
Global Health Technologies

- Develop reliable, low-cost and low maintenance medical devices
- Social, economical, ethical, cultural issues in developing nations
- Form business models for devices beyond a single Senior Design cycle
- Collaborating with Columbia Business School, Mailman School of Public Health



Application of “ π ” according to “ φ ”

- Working with Mulago Hospital- Kampala, Uganda
- Developing basic diagnostics and therapeutics for neonatal care
- Clinical advisors from both Uganda and U.S.
- Initial evaluation of device designs during trip to Uganda

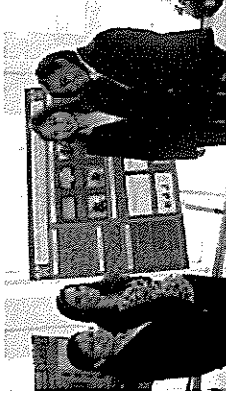
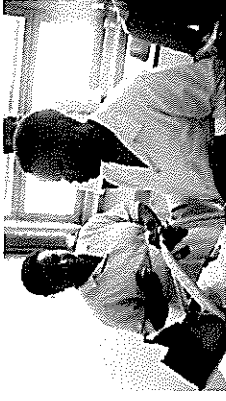


Application of “ π ” according to “ φ ” BundledUp - Neonatal Transport

Problem: Neonatal hypothermia occurs during transport from rural areas to hospitals

Design Solution:
A combined heating-insulating transport system

- Device utilizes phase change material to passively heat neonate
- Demonstrated to staff at rural district hospitals during 2011 Uganda trip



Interdisciplinary Minor in Entrepreneurship

Engineering for Developing Communities

Student social entrepreneurship teams work on new venture ideas for global developing countries



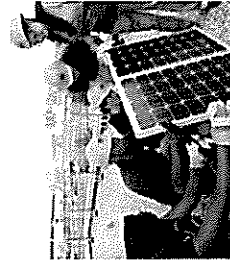
Managing Technological Innovation and Entrepreneurship

More than 100 students per year work on new venture ideas and comprehensive business plans



Science, Technology, & Society

More than 75 students per year work with urban community leaders to develop capacity in Harlem community through social entrepreneurship



Pitchfests & Venture Competitions



Venture Competition 1st Place Winner: Solar Pillow

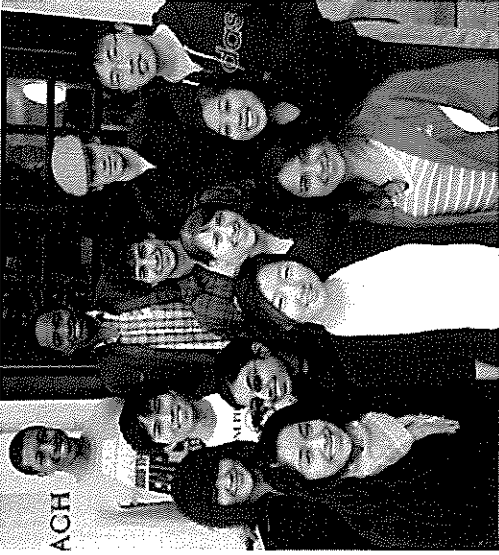
Collapsible lantern powered by rechargeable battery and PV cells

Pitchfests:

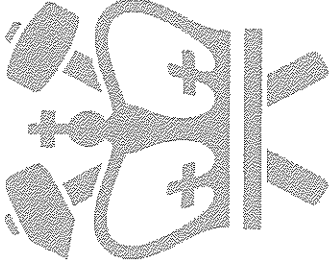
More than 200 students University-wide compete for funding annually, including interdisciplinary teams such as this one, featuring a Business School student and an Engineering student who created a new social media web site, FanDome.com.



Res. Inc. Living-Learning Environment



Res. Inc. is a newly-created Living-Learning environment that fosters innovation and entrepreneurship by creating a residential community of engineering students interested in starting new ventures.



**THE COUNCIL
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: _____

(PLEASE PRINT)

Name: Dr. Nada Anid

Address: _____

I represent: New York Institute of Technology

Address: 1855 Broadway, NY, NY

**THE COUNCIL
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: _____

(PLEASE PRINT)

Name: Rahmat Showre shi

Address: 1855 Broadway, NY

I represent: New York Institute of Tech (NYIT)

Address: 1755 Broadway, NY

**THE COUNCIL
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: _____

(PLEASE PRINT)

Name: IQRAM MAGDON-ISMAIL

Address: 177 W 26 STREET APT. 300, 10001

I represent: VENMO

Address: 289 7th AVE, UNIT 4F 10001

Please complete this card and return to the Sergeant-at-Arms

**THE COUNCIL
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: _____

(PLEASE PRINT)

Name: YASH RISHOD

Address: 41 COOPER SQUARE SUITE 205

I represent: COOPER UNION

Address: Same as above

**THE COUNCIL
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: _____

(PLEASE PRINT)

Name: RICHARD BURKE

Address: 6 Pennyfield Ave, Bronx, NY 10465

I represent: Manhatten College, SUNY

Address: Same

**THE COUNCIL
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: 5/9/2012

(PLEASE PRINT)

Name: WALTER MATYSTIK

Address: 314 Marietta Manhattan NY 10132

I represent: MANHATTAN COLLEGE

Address: 4513 MANHATTAN College Parkway

BRONX, N.Y. 10471

Please complete this card and return to the Sergeant-at-Arms

**THE COUNCIL
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: 9 May 2012

(PLEASE PRINT)

Name: Tim J. Ward

Address: Manhattan College

I represent: Manhattan College

Address: 4513 Manhattan College Parkway Bronx NY

**THE COUNCIL
THE CITY OF NEW YORK**

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: _____

(PLEASE PRINT)

Name: FENIOSKY PENA-MORA

Address: 2828 BROADWAY

I represent: COLUMBIA UNIVERSITY

Address: 116TH STREET

**THE COUNCIL Panel 10 of
THE CITY OF NEW YORK CUNY**

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: 5/9/12

(PLEASE PRINT)

Name: Dr. Lisa Coico, President

Address: City College

I represent: CUNY

Address: _____

Please complete this card and return to the Sergeant-at-Arms

THE COUNCIL
THE CITY OF NEW YORK

CUNY Panel
2 of 4

Appearance Card

[]

I intend to appear and speak on Int. No. _____ Res. No. _____
 in favor in opposition

Date: 5/9/12

(PLEASE PRINT)

Name: Dr. Joe Barber, Dean

Address: Grove School of Engineering

I represent: City College

Address: _____

Please complete this card and return to the Sergeant-at-Arms

THE COUNCIL
THE CITY OF NEW YORK

CUNY Panel
3 of 4

Appearance Card

[]

I intend to appear and speak on Int. No. _____ Res. No. _____
 in favor in opposition

Date: 5/9/12

(PLEASE PRINT)

Name: Dr. Ardie Walscr, Associate Dean,

Address: Grove School of Engineering

I represent: City College

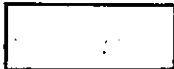
Address: _____

Please complete this card and return to the Sergeant-at-Arms

THE COUNCIL
THE CITY OF NEW YORK

Copy Panel
4 of 4

Appearance Card



I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: 5/9/12

(PLEASE PRINT)

Name: Jeremy Corkez, Student

Address: Grove School of Engineering

I represent: City College

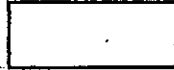
Address: _____

◆ Please complete this card and return to the Sergeant-at-Arms ◆

THE COUNCIL
THE CITY OF NEW YORK

22

Appearance Card



I intend to appear and speak on Int. No. _____ Res. No. _____

in favor in opposition

Date: 5-9-2012

(PLEASE PRINT)

Name: Alfred Spector

Address: 111 Eighth Ave, NY NY 10011

I represent: Google inc.

Address: _____

◆ Please complete this card and return to the Sergeant-at-Arms ◆