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“The World is Waiting... Are You Ready?”

### Mission

**iFEST** exists to advance global entrepreneurship in the sciences, engineering, and medicine by bringing together young entrepreneurs and mentors around the world. To this end, we empower talented technology students from the US and overseas with the international experience, labs, teamwork skills, contacts, and knowledge they need to pursue their dreams and achieve their entrepreneurial goals in the global marketplace.

### iFEST International Innovation Camps: Summary

In partnership with the Rensselaer Polytechnic Institute (RPI), the US National Science Foundation (NSF), and colleagues at the Ministry of Science and Technology of China (MOST), the Indo-US Science & Technology Forum (IUSSTF), the Ministries of Education, Science, and Technology of Korea (MEST) and the Nippon, iFEST will launch **International Innovation Camps** for gifted undergraduate students and their mentors from the US, China, India, Korea, and Japan over an estimated 25 day period in the summer of 2010.

The main goal of the International Innovation Camp is to provide hands-on research based learning in the lab and creative transnational entrepreneurial teamwork experiences to apply what students have learned, which will empower them to better navigate their own career paths in the real world. Our overall objective is to generate new ideas and teams which enable new globally scalable start-ups. To get there, we must cultivate the rising generation of innovation and entrepreneurship - - and inspire, teach, and connect gifted students and their mentors in a collaborative transnational setting. We will accomplish these aims through early exposure at the undergraduate level to entrepreneurship coursework, management training, hands-on project based learning, and involvement in laboratory intensive teamwork under the supervision of experienced mentors. Future programs will include students and mentors from not only the US, China, India, Japan, and Korea, but perhaps also the UK, Germany, Israel, Singapore, Russia, Brazil, and other countries in both developed and developing economic conditions.

The **iFEST International Innovation Camp** will achieve its goal for young people to acquire the entrepreneurship, experience, contacts, and tools needed to navigate their careers in an increasingly global economy by providing the following:

- **Authentic Research Experience** – Students will conduct discipline-specific laboratory research in IT/Computer Engineering, Software, Nanotechnologies, Biomedical & Life Sciences, Clean Technologies, and Robotics related topics in a real world setting under expert guidance and supervision;
- **International Team Building** – Students will work together in transnational teams in a collaborative effort to explore new ideas and solutions at the intersection of global technology start-up opportunities, and high impact science and engineering disciplines;
- **Hands-on Entrepreneurship Experience** – Students will work together on real world problems using entrepreneurship coursework and exercises, and with experienced mentors will develop viable strategies, prototypes, and business plans to address the real world problems in their labs;
- **International Presentation and Communication** – Students will work in their teams toward a final presentation before a panel of high-profile innovation and start-up experts; and
- **Substantive International Exchange** – Students will be mentored and encouraged to build lasting relationships and teamwork in a content rich setting as they further develop their understanding of global opportunities and the means to pursue their entrepreneurial dreams in the global marketplace.

In the US, we will recruit from a talent pool of award winning students, based on national and international science and engineering competitions, e.g. the National Collegiate Inventors Competition, the National Science Foundation's Research Experience for Undergraduates (REU) and other NSF programs, undergraduate student alumni of the Intel Science Talent Search, International Science & Engineering Fair, Toshiba's ExploraVision, Lemelson-MIT's InvenTeams, the Davidson Institute's Fellowship and other gifted student programs, Oracle's ThinkQuest, Physics-, Biology-, and Chemistry-Olympiads, programs for American minority populations, women science and engineering students, and many others. Mentors from the US will be drawn from among these programs and the excellent entrepreneurial alumni of RPI. In China, India, Korea, and Japan, the students and mentors will be nominated from national talent pools developed by partners in those countries, in consultation with iFEST and RPI.

The time is right for the iFEST International Innovations Camps to unleash the next generation of technology driven creativity and entrepreneurship, and build constructive bridges between the US, India, China, Japan, and Korea that harness common interests in free enterprise, innovation, and economic growth. The International Innovation Camp at RPI will bring world class scientists, engineers, entrepreneurs, investors, and business leaders together with the students and mentors to learn about the start-up process and how to scale up creative new ideas for global markets.

The **intellectual merit** of the Camp program will be based on the technical problem solving development, many industrial and applied in nature, of the research projects undertaken by the students each day in the labs at RPI. **The broader impacts** of the Camp include the real world R&D training experience coupled with the entrepreneurial learning, international collaborations, teamwork, communication, and cultural exchange opportunities for the US students and their mentors working with their foreign peers. This approach will reflect the future directions of the S&T workforce. Moreover, the long run vision is focused on building a community of Camp alumni who can pursue international R&D and entrepreneurship cooperation over the long term, including participation in the East Asia-Pacific Summer Institutes (EAPSI) program offered by NSF, as one example.

The first Innovation Camp between these countries is slated to take place at RPI in Summer, 2010. Based on the success of university venues in hosting previous prototypical summer programs (see <http://www.sciencestorm.com/award/9810525.html> and <http://kusec.ksf.or.kr/>), a strong technical university such as RPI works best as the first host venue. For their part, the professors at the RPI facilities selected as host labs for the students and their mentors, will benefit from:

- **Discretionary Financial Support** – Hosting professors obtain \$10,000 in discretionary funding, and their post-doc and graduate students acting as Lab Supervisors will receive a Leadership Stipend of \$2,000 for their time during the camp;
- **Student Recruitment** – The gifted students will be well positioned for recruitment to RPI graduate programs. Professors have total right of review and refusal to any student or mentor;
- **Summer Leadership and Teaching Experience** – Graduate students and post-docs serving as Lab Supervisors can hone their lab leadership, teaching, and teamwork skills overseeing students in cooperation with experienced mentors.
- **Mentoring and Networking Experience** – Professors and Lab Supervisors have the chance to work with hand-picked mentors who have cutting edge research and industrial experience. Also, all will enjoy a focused networking and coaching session with innovative thought leaders (such as Vinton Cerf, John E. Kelly III, David S. Rose, Alpheus Bingham, Eric Lander, and Craig Venter) in an exclusive program focused on creativity, innovation, pitching, and mentoring for breakthroughs.
- **Participation in the Camp Alumni Group** – Professors and Lab Supervisors will be able to interact and do follow-up work with the students and mentors through the Camp Alumni Group, facilitated online using an email listserv, Facebook and Second Life resources, and also via follow-up iFEST programs.

The Camp will organize the students and veteran mentors in small international 3-6 person teams divided between nationalities to work together on projects in the laboratory and the field, all in the English language. The teams will enjoy at least 70 hours of hands-on research and development working on projects in RPI's Multidisciplinary Design Lab ([www.mdl.rpi.edu](http://www.mdl.rpi.edu)), the Center for Biotechnology and Interdisciplinary Studies ([www.rpi.edu/research/biotech/index.html](http://www.rpi.edu/research/biotech/index.html)), The Center for Automation Technologies and Systems ([www.cats.rpi.edu/index.html](http://www.cats.rpi.edu/index.html)), the Smart Lighting Engineering Research Center ([smartlighting.rpi.edu](http://smartlighting.rpi.edu)), and other RPI facilities. Each team will participate in entrepreneurial exercises, programs in the city of New York, and there will be a special focus on the

long term value of ethical business building practices. The camp will conclude with final presentations from each team, which will be critiqued and evaluated by a panel of leading experts. Representatives of the national and international media as well as sponsoring institutions and government agencies will observe the final sessions and interact with the students and mentors.

After the Camp, there will be an opportunity for summative and yearly downstream evaluations coordinated via the Alumni Group with listserv, website and Web 2.0 online community resources. Post-Camp, the Alumni Group will help participants stay connected, follow up on their projects, and benefit from ongoing mentoring and coaching. Given that the camp students and mentors will be selected through competitive processes, outreach to under-served populations (such as girls and minorities) especially in the United States will be essential, in order to broaden grass roots learning opportunities. The Camp will include cultural site visits and weekend field trips as relationship building opportunities, in addition to the lab work and entrepreneurship exercises at RPI.

### **International Innovation Camp: Goals and Benefits**

The primary goal of the iFEST International Innovation Camp program is to provide an opportunity for US and foreign engineering and science undergrads, mentors, as well as professors, graduate students and others to work together on authentic science, technology, and entrepreneurial innovation projects in an international context. The students will gain from hands-on research based problem solving in the lab and creative transnational entrepreneurial teamwork experiences to apply what they have learned, which will prepare them to better navigate their own career paths in the real world. In the long run, our overall objective is to generate new ideas and international teams which can lead to new globally scalable start-ups. To get there, we must cultivate the rising generation of innovation and entrepreneurship by inspiring and connecting gifted undergraduate students and their mentors in a collaborative transnational setting. The Camp will achieve our objectives by helping them gain the entrepreneurship, experience, contacts, and tools needed to navigate their careers in an increasingly global economy by providing the following:

- **Authentic Research Experience** – *Students will conduct discipline-specific laboratory research in IT/Computer Engineering, Computer Science/Software, New Materials & Nanotechnologies, Biomedical & Life Sciences, Clean Technologies, and Robotics related topics focused on real world problems and applications derived from RPI's industrial partners, under expert guidance and supervision;*
- **International Team Building** – *Students will work together in transnational teams in a collaborative effort to explore new ideas at the intersection of global technology start-up opportunities, and high impact science and engineering disciplines;*
- **Hands-on Entrepreneurship Experience** – *Using project based learning tools, students will work together on real world problems using entrepreneurship coursework and exercises, and with experienced mentors will develop viable strategies, prototypes, business models and plans to address the real world problems in their labs;*
- **International Presentation and Communication** – *Students will work in their teams toward a final presentation before a panel of high-profile innovation experts; and*
- **Substantive International Exchange** – *Students, mentors, and other participants will benefit from teamwork based on the content rich character of the camps, evening and weekend outings, field trips, cultural presentations, and unstructured free time together with peers from the three participating countries. Students will be mentored and encouraged to build lasting relationships as they further develop their understanding of global opportunities and the means to pursue their entrepreneurial dreams in the global marketplace.*

Benefits will include encouragement of grass roots international scientific and engineering cooperation, early exposure to the joys of innovation and creativity, a content rich summertime research experience outside the standard curriculum demands, improved prospects for the future workforces of the three participating nations, and greater awareness of the professional possibilities of pursuing science, entrepreneurship, and innovation in the globalizing workplace and in higher education. For the graduate students and professors who host teams, benefits include useful summer leadership and supervisory experience – inasmuch as graduate students and post-docs serving as Lab Supervisors can hone their lab leadership, teaching, and teamwork skills overseeing students in cooperation with experienced mentors. This also benefits their lead professors and future employers.

Outcomes from the Camp will include at a minimum international undergraduate research experiences, involvement in innovative projects pursued by teams of students and mentors, learning about entrepreneurship, the R&D process, start-up careers, and improved awareness of international technical, innovation, and cultural cooperation for all students and mentors. Optimally, with sustained interactions between the students and the mentors, we expect some viable business concepts to emerge, and be worth pursuit and investment in follow-up programs. These follow-up plans include future International Innovation Camps at RPI, and also Camps overseas in China, India, Japan, Korea, and other nations. We are acting on the belief that over time, the Camps in the US and overseas will spawn new high growth technology start-ups - - based on the lab-intensive teamwork, problem-solving, and mentoring that takes place at the Camp - - which will be suitable for investor consideration and eventually be scalable on a global basis.

In terms of the **intellectual merit** of this proposal, it is useful to think of the Camp as a demonstration pilot program or even an exploratory way of offering introductory international training for students who will soon join the global science and technology workforce, in an easy to manage and safe domestic locale. The research projects undertaken by the students each day in the labs at RPI are not merely instructional. They are derived from real world problems culled from industry and other sponsors of RPI research and development, demonstrating the intellectual foundations of the Camp program via the learning and contributions of the student teams.

The **broader impacts** of the Camp will include the opportunity for a relevant transnational research and informal education experience for the US students and their mentors. Although there are a few models or precedents, the Camp is a new and different program that will provide a substantive introductory real world research and engineering experience, blended with international teamwork and entrepreneurial coursework over several weeks in the summer of 2010. It will also offer a chance for mentoring to begin at the Camp, and continue beyond the completion of the Camp itself. Also, it will complement the formal science and engineering curricula of the students at their home universities. Given that it is a summer experience, it will be less likely to interfere with the demands of the students' undergraduate course loads.

#### **Prior Art**

Good precedents for the iFEST International Innovation Camp exist, based on recent programs involving iFEST personnel. In 1998, with grant support from the National Science Foundation (NSF), iFEST co-Founder Mike Snyder led an American delegation to participate in the 1<sup>st</sup> Asia-Pacific Economic Cooperation Forum (APEC) Youth Science Festival at Seoul National University. The US delegation consisted of 20 high school students and 5 university professors with educational experience who served as mentors and chaperones. The entire US delegation had a very positive and memorable experience at the 1<sup>st</sup> APEC Festival. During this Festival, the Korean host organizers assumed most of the financial and organizing burdens totaling approximately \$1.5 million. Its success led to the 2<sup>nd</sup> APEC Youth Science Festival in Singapore in 2000 and the 3<sup>rd</sup> Festival in Beijing in 2004 (see <http://www.sciencestorm.com/award/9810525.html> for the first festival, [http://www.apec.org/apec/news\\_media/2004\\_media\\_releases/050804\\_youthsciencefest.html](http://www.apec.org/apec/news_media/2004_media_releases/050804_youthsciencefest.html) for the second festival, and <http://www.mfa.gov.cn/ce/cero/rom/kjwh/t154861.htm> for the third festival).

Further precedent was set in 2002 through the Korean-US Science and Engineering Summer Camp (KUSEC) with another grant from NSF to Snyder as Primary Investigator, with additional cooperation and funding from the Korean Science and Engineering Foundation and the Korean Advanced Institute of Science and Technology (KAIST) and other sponsors (see the website at <http://kusec.ksf.or.kr/>). There are other examples scattered here and there within the United States and overseas, that are focused on high school students for the most part. There are summer research programs for college students, but with the demands of higher education, there are few that are held in the same transnational manner as the International Innovation Camp will be organized.

In spite of the promise of these models, there is not enough focus being given to building transnational platforms and connections at the nexus of technical problem based learning, entrepreneurship, and innovation required for our students to pursue success in the global marketplace. iFEST seeks to build on these and other models by organizing annual summertime international innovation camps between the US, China, India, Korea, and Japan in 2010, with other countries invited in future years. The camps will include active participation onsite of professors, graduate students, post-doctoral researchers, scientists, investors, inventors, businesspeople, and entrepreneurs -- who will serve as mentors, instructors, and role models.

### **International Innovation Camps: New and Unique**

The iFEST International Innovation Camp concept is fundamentally new and different. In relation to past reference points, KUSEC drew on many positive experiences from the 1st and 2nd APEC Youth Science Festivals held in Seoul, South Korea in 1998 and Singapore in 2000, but it was notably distinct from the APEC Youth Science Festivals. APEC Youth Science Festivals emphasize the cross-cultural experiences and exposure to international science and technology in general. Institutionally, the APEC Festivals are more focused on improving public understanding of science and technology than on stimulating new knowledge experiences via research or project based learning. In addition, the KUSEC program and other models are primarily focused on strengthening the basic science, mathematics, and engineering interests of high school age students.

Most of the existing programs are domestically oriented, with some international participation in a few cases. Based in West Virginia, the National Youth Science Camp is an example of a well established annual summer program with a focus on science and engineering education, aimed at graduating seniors before they go on to college. In addition, the Center for Excellence in Education is well known for its partnership with MIT in holding the Research Science Institute (RSI) for upper class high school students every summer. The RSI hosts approximately 60 US students and up to 15 foreign students for six weeks at MIT. It is worth noting that the Center has begun to experiment with an RSI based in Shanghai, aimed only at domestic Chinese student participants.

The iFEST camp program is aimed at these same goals, but in addition will go beyond to focus even more on laboratory-intensive experiences coupled with entrepreneurial applications in an explicitly transnational setting. The bottom line is that there are few opportunities for US undergraduate students, mentors, and grad students to work together and enlarge their research and engineering capabilities, in or out of the classroom. There are even fewer opportunities to do so in an international context, located in the US or overseas. Fewer still are the opportunities to link innovation and entrepreneurship to international student learning experiences in technical fields. Although an exhaustive survey may be needed, a preliminary scan shows that while there are notable domestic models for the International Innovation Camps, there are only a few summer programs in the international science and engineering space. Moreover, there is no coordinated program that explicitly integrates hand-on research and engineering, innovation, entrepreneurship, and international learning for students and mentors in the way the iFEST Camps seek to do.

### **Camp Venue(s) and Dates**

The first iFEST Camp for US, Indian, and Chinese participants is slated to take place in 2010, at the RPI campus in Troy, New York. Further details about the RPI labs, professors, and other facilities appear below. It is worth noting that if the Camp at RPI is successful, we plan to also build a similar summer program overseas for 2011, at a leading national university, most likely in Asia. The expectation is that RPI will continue to be involved in the program, and develop plans to include their undergraduate and graduate students and professors in the talent pool from which overseas International Innovation Camps will draw upon for students and mentors. iFEST is establishing a network of host universities, companies, foundations, and interested government agencies with which to partner for future growth of the International Innovation Camps in the USA and overseas.

The dates for the first International Innovation Camp are based upon the academic calendars for foreign and American college students, and the availability and openness of university facilities at RPI in the US. Working with its partners in Asia, and especially RPI (as host venue) iFEST expects to hold the first International Innovation Camp over the course of about 25 days during the July 11-August 4, 2010 timeframe.

### **Building International Teams from the Recruitment Network**

For the first Camp at RPI, teams will consist of one or two students each from the US and overseas countries and one or two mentors, ideally a mentor mix drawn from all countries. Regarding the mentors, it is likely that they may come largely from the US but with experience or heritage connected to China, India, Korea, or Japan to help inspire and guide each team. We will do our best to ensure that the student per country ratio will be balanced. There will be a total of three to six students and up to two mentors for each team. There will be multiple teams, based and organized around discipline specific technical projects in relevant laboratories at RPI. We may recruit 10 students from each country, and a total of 10 to 12 mentors for the Camp. Total guest population for the first camp at RPI will be 50 students, and 10 to 12 mentors, for a grand total of 60 to 62 daily student and mentor participants on campus.

Based on a unique nominating network developed by iFEST (see list of organizations below), we will actively recruit from groups that encourage students to pursue engineering and scientific careers. Leadership development potential for researchers and mentors will also be cultivated through this program. Moreover, the participation of researchers, graduate students, post-docs, entrepreneurs, and other adults as mentors and chaperones will be designed to encourage their roles for students and the other mentor/speaking participants, as well as for the communication of science and technology to society at large.

Students selected for the Camps will possess pre-qualified abilities and demonstrated interests in science and engineering. Mentors may be teachers, professors, graduates of RPI, postdoctoral researchers, business people, or other practitioners with some technical experience. Guest lecturers and speakers will include Nobel Prize winners, world-class scientists, as well as US and non-US entrepreneurs. Parents will not be actively discouraged from attending the activities, but will not be encouraged to do so, and must cover their own expenses and play no formal role in the Camp. Other domestic and overseas leaders may be invited to attend as observers.

The nominations for students and mentors will be received from partner organizations and reviewed by a panel of science, engineering, and education experts, assembled by iFEST and RPI. University level contests such as the Collegiate Inventors Competition operated by the National Inventors Hall of Fame Foundation, the National Science Foundation (NSF) Research Experience for Undergraduates (REU) and the NSF Partnerships for International Research and Education (PIRE) programs, as well as other similar programs make up the initial partners for recruiting nominations for US undergraduate students. These contests often have significant roles for mentors, and we plan to take advantage of that in building our mentor talent pool. In addition, RPI students and alumni will be invited to submit nominations. To broaden our recruiting for American participation in the International Innovation Camps, we will also gather US student and mentor nominees nationwide from the contest winning alumni of the following organizations and programs:

Society for Science: Administrator of Intel Science Talent Search <[www.societyforscience.org](http://www.societyforscience.org)> Junior Engineering Technical Society, Inc. (JETS): Administrator of Tests of Engineering Aptitude, Mathematics and Science (TEAMS) <[www.asee.org/jets](http://www.asee.org/jets)> National Science Teachers Association (NSTA): Administrator of the Annual Duracell/ NSTA Scholarship Competition and Toshiba/NSTA ExploraVision <[www.nsta.org](http://www.nsta.org)> Lemelson-MIT Program: Administrator of Lemelson-MIT InventTeams High School Invention Grants <[www.inventteams.org](http://www.inventteams.org)> Davidson Institute for Talent Development: Administrator of the Davidson Fellows Scholarships and the Davidson Academy for Gifted and Talented Students <[www.davidsongifted.org](http://www.davidsongifted.org)> Oracle Education Foundation: Administrator of ThinkQuest Internet Challenge <[www.thinkquest.org](http://www.thinkquest.org)> American Indian Science and Engineering Society (AISES): Administrator of the National American Indian Science & Engineering Fair <[www.aises.org](http://www.aises.org)> National Society of Black Engineers (NSBE): Administrator of the NSBE Scientific Design Competition <[www.nsbe.org](http://www.nsbe.org)> National Action Council for Minorities in Engineering, Inc. (NACME): Administrator of TechForce Preengineering Prize <[www.nacme.org](http://www.nacme.org)> Society for Advancement of Chicanos and Native American in Science (SACNAS): Administrator of the SACNAS Distinguished Scientist, Mentor, and K-12 Educator Awards <[www.sacnas.org](http://www.sacnas.org)> Academy of Applied Sciences (AAS): Administrator of the Junior Science and Humanities Symposium <[www.jsbs.org](http://www.jsbs.org)> For Inspiration and Recognition of Science and Technology (FIRST): Administrator of the FIRST Robotics Competition <[www.usfirst.org](http://www.usfirst.org)> American Chemical Society: Administrator of the US National Chemistry Olympiad <[www.chemistry.org](http://www.chemistry.org)> American Association of Physics Teachers: Organizer of the US Physics Team which participates in the International Physics Olympiad <[www.aapt.org](http://www.aapt.org)> Center for Excellence in Education: Administrator of the Research Science Institute and the USA Biology Olympiad <[www.cee.org](http://www.cee.org)> Other institutions such as the National Organization for Black Chemists and Chemical Engineers (NOBCChE), the Association for Women in Science (AWIS), the Women's Engineering Program Advocacy Network (WEPAN), the Society for Women Engineers (SWE), and the Puerto Rico-NSF Systemic Partnership at the University of Puerto Rico, inasmuch as such organizations fit with our plans for participation in the nomination process.

For selecting student and adult mentors from the Chinese side, iFEST and RPI will work with officials from the Ministry of Science and Technology and their designated subsidiary institutions such as the National Natural Science Foundation of China (NSFC) and the China Association for Science and Technology (CAST), to field a delegation of students and mentors. In the Indian case, we will work with the Indo-US Science and Technology Forum, the Department of Science and Technology and their designated groups in India to gather an Indian delegation of students and mentors. Working with the Forum and the Department of S&T in India, we may also advertise and use the network of Indian Institutes of Technology and the non-profit group known as TiE (see [www.tie.org](http://www.tie.org)) to reach out to find the best students and mentors. We will also work with MEST and the National Research Foundation (NRF) of Korea to assemble a delegation from that country. Similarly, we plan to work with your Foundation and other Japanese organizations to recruit students from within Japan. Although RPI and iFEST will help and consult with them throughout the process, the partner agencies in China, India, Korea, and Japan will ultimately be responsible for the selection of student and adult mentor participants from their nations.

### **The Nomination Process**

Nominations will begin to be solicited in January, 2010 from the recruiting networks in the US, as well as overseas. In addition to the organizations iFEST and RPI work with, we will also advertise on our respective websites, and via our respective associations, listservs, and communities. The nomination process is expected to last for two months, with a **submission deadline of March 7, 2010**. Those students and mentors who wish to be considered as candidates will submit a resume/CV or equivalent summary of their educational, career, and research progress, and a questionnaire describing their qualifications, and their interests and goals (in English). They must also submit transcript or other evidence of student status. They will also submit 2-3 recommendation letters, also in the English language. An electronic cover page and general information form, available on the iFEST and RPI websites will also be submitted. Electronic submission of these documents will be encouraged, but we will also be open to receipt in paper format via regular mail.

### Selection Criteria

For the US side, iFEST and RPI will work together with each of the partner organizations to gather nominations of students and mentors from each organization's science and engineering competitions. The nominations will then be sent out, after a brief initial screening by iFEST for completeness and to eliminate any candidates who happen to be nominated from two or more organizations. Then the nomination packages will be sent to a review panel for evaluation. The panel will include several experts, assembled by iFEST and RPI, and agreeable to sponsors. This panel may be chaired by a senior expert from RPI, schedule permitting, and will assemble at a place and time to be determined, in order to agree on the best students and mentors. For selecting students and mentors, it is planned that the panel will meet at RPI one day in early April before the camp to try to make their selections by consensus (or anonymous voting/ranking if necessary) according to the following criteria:

Demonstrated interest in science, engineering or entrepreneurship, as evidenced by essay, research project, publication, poster, or some other means evidenced in a competitive context or in a nominating organizations' contest;

Demonstrated competence or literacy in any basic or applied scientific or engineering field;

Demonstrated ability to communicate and teach science or engineering, serve as team leaders/advisors, and inspire young people as evidenced by merit in the nominating organizations' programs (mentors only);

Range of demonstrated experience across basic and applied scientific and engineering fields;

Qualifying undergraduate enrollment (students only);

US Citizenship or permanent resident status.

There will be a special effort made in the nomination process to focus on selecting meritorious students and members from the US side in a way that reflects the lab technical topics, for team building purposes. This can be done through a quota system if there are enough student and mentor nominees. We recognize that in order to do this, it will be necessary to have a large, robust, high quality nationwide talent pool built from the members of the nominating network of organizations noted above. Based on our institutional experiences, the iFEST and RPI partnership offers unique promise in this regard.

The review panel making selections will consist of researchers, engineers, educators, entrepreneurs, and other experts, with experience in selection processes similar to this program. Some of the potential panelists may be selected from within the US, or from overseas. Potential panelists may include:

Dr. Robert Chernow, RPI (formerly of the Kauffman Foundation);

Mr. Mike Snyder, iFEST

Dr. Wai-Yee Chan, Georgetown University & NIH;

Dr. Pradeep Mehta, RPI & Paper Battery Co.;

Dr. George "Pinky" Nelson, Western Washington University; Dr. Richard Dasher, Stanford University;

Dr. Mark Saul, Templeton Foundation (Consultant);

Based on the panelists' deliberations, there will be a list of finalist students, and a list of alternates to be used in case of cancellations, which iFEST will use to contact candidates for the US delegation and confirm their availability, institutional/parental approval, and interest in participating in the International Innovation Camp. A similar list, with alternates, will result from deliberations over the mentors. Based on plans developed in the exploratory stage of the discussions with Asian partners, they will undertake a similar selection process for their student and mentor participants. Finally, the winners will be notified at least four months before the Camp begins. If they agree to participate, they receive the equivalent of a fully paid scholarship. Also, overseas students will receive a letter of invitation from iFEST and RPI that they may use to obtain a visa from the US consulate to enter the country and join the camp.

### **Program Content Summary**

The Camp program will focus heavily on building up international collaborative learning environments and integrated exposure to science, engineering, and start-up development projects with an eye toward innovative and even entrepreneurial outcomes. Through the learning experience fostered by the camp program, we plan for **technical training, new idea development, hands-on research experiences, and possible start-up business concepts to be created collaboratively among the participating students and mentors** with significant coaching and supervision.

The Camps will include specific learning modules, many of which are based on teaching already performed at RPI. We will also use the latest exercises and empirical examples, built in cooperation with experts from US and international centers of excellence, as well as local scientific, industrial, and educational partners. Activities at the camp will be structured around the thematic topics in the labs.

The learning objectives of the research portion of the Camps will include early exposure to authentic research at RPI, and when possible also through site visits to nearby industrial laboratories. Students will gain an initial understanding about a particular innovation-related topic, as well as translational scientific and engineering research processes. In addition, students will be required to participate in a final presentation about their research and project teamwork, including determining what future related research questions or inventions that may be relevant in the innovation space. Presentations of the deliverables such as posters, prototypes, demonstrations, models, and business concepts will be scheduled for the concluding session of the program. We will invite journalists and media representatives to attend the final presentation sessions. We will also invite leaders of sponsoring organizations, companies, and government agencies to observe the final presentations.

In addition, planning and preparatory visits will be used to identify appropriate nearby industrial R&D sites and researchers who are open to share with the students and mentors their non-proprietary work or an interesting aspect of their research initiatives. Working in teams in the labs, iFEST and RPI will provide:

- An authentic research and development experience. We expect students to be involved in the research lab and related activities for no less than 70 hours, at RPI. RPI and iFEST hope that future Camps will see the experience grow to include up to 100 hours of laboratory and field experience.
- A safe innovation environment for undergraduate students. Students will not be placed without appropriate safeguards in research and engineering that include exposure to hazardous chemicals, biological agents, electrical tools, equipment, or machinery.
- An engaging advanced research topic that would help students to understand the broader societal implications of entrepreneurship, research, and innovation.

Based on previous experience, we know the intergenerational mentoring approach has been successful in dealing both with the safety and supervision issues, as well as to provide an opportunity for researchers and instructors to enjoy an enriching and substantive international experience. Mentoring also allows for start-up veterans to serve as inspirational mentors coaching the young people and sharing the excitement about their fields. RPI and iFEST will plan and execute research and innovative activities through teams built around the following thematic areas:

1. Information Technology/Computer Science and Electrical Engineering
2. Biotechnology and Bioengineering
3. Robotics
4. Clean Technology/Alternative Energy
5. New Materials/Nanotechnology

Other topical areas may be added as appropriate. The US and foreign students will be working in the Camps in teams under the supervision of professors and their post-docs and graduate students at different research labs and institutions specializing in these subjects. Also, in order to leverage the experience, we will reach out to find other interested colleagues and researchers at nearby universities, museums, industry labs, and other relevant sites who would be open to hosting a site visit.

The Camp activities will include industrial site visits, language training, cultural presentations, workshops and lectures, technical and cultural field trips, outdoor experiments/labs, collaborative work with local students and scientific institutions, learning games and simulations, panel discussions of research topics, as well as the concluding presentations from the lab specific project teams. Crosscutting topics, in addition to scientific and engineering themes, to be included in the Camps programs (taking place in both classroom training and lab settings) will include:

- How to Conduct Internet Science and Engineering Literature Searches.
- Previewing Scientific Databases on the Internet.
- Intellectual Property Rights.
- Business and Scientific Ethics.
- How to Write Clear Reports and Design Posters.
- The Difference between Scientific and Business Presentations.
- How to Write a Business Plan based on new S&T Developments.
- How to Draft a Pro Forma (Back of the Envelope) Budget.
- How Science and Innovation are Carried Out and Funded at the National Policy Level.

At the Camps, there will also be invited talks from entrepreneurial leaders, industry and investment experts, technology community leaders, Nobel laureate scientists, and possibly policymakers. After the talks, there will be time for discussion and questions from the students and mentors. Some of the speakers may also be included as experts in the final presentation panels.

The final presentation session will be an exciting focus of the teams at the Camp, where the labwork and the entrepreneurial coursework and exercises converge. The teams' progress will be demonstrated and team presentations will be open to questions and constructive criticism. Moreover, we plan to invite local, national, and foreign journalists and media representatives to attend the final presentation sessions at the Camp. Access to the teams for media interviews will be allowed, depending on agreement of the team members and the hosting lab professors.

#### **Hosting Labs at Rensselaer Polytechnic Institute**

The first Innovation Camp between the US and overseas partners will be hosted by RPI, the oldest science and engineering focused school in the English speaking world. As a strong technical university noted for world-class labs with a unique undergraduate research focus, RPI is ideal for the host venue. Professors at the RPI facilities selected as host labs for the US and overseas students and their mentors, will benefit from some discretionary financial support. Professors who open their labs obtain \$10,000 in discretionary funding, and their post-doc or graduate students acting as Lab Supervisors will receive a Leadership Stipend of \$2,000 for their time during the camp. In addition, the gifted American and foreign students will be well positioned for recruitment to RPI graduate programs. Professors at RPI will have the right of review and refusal to any

student or mentor. Professors may also nominate their own gifted undergraduate students to join the Camp. For their part, the graduate students and post-docs benefit from an international summer leadership and teaching experience at the Camp. The graduate students and post-docs serving as Lab Supervisors will be able to hone their lab leadership, teaching, and teamwork skills overseeing students in cooperation with experienced mentors.

The mentoring and networking experience of the Camp is also a unique attraction. Professors and Lab Supervisors have the chance to work with hand-picked mentors who, in many cases, have deep international research and industrial experience. In addition, the Camp will enjoy a focused networking and coaching session with innovative and experienced thought leaders (such as Vinton Cerf, John E. Kelly III, David S. Rose, Fred Wilson, Alpheus Bingham, Eric Lander, and Craig Venter) in an exclusive program focused on creativity, innovation, pitching, communication, and mentoring for breakthroughs.

Opening a busy lab in the summer to undergraduate students from the US and Asia - - and engaging in the planning required for the International Innovation Camps - - is clearly above and beyond the call for most elite US professors and their grad students. However, based on the benefits and advantages of a short but content rich program at the Camps, RPI and iFEST are pleased to identify the following labs and professors who are enthusiastically willing to open their labs and make their unique science and engineering facilities available as host labs for the teams of students and their mentors.

#### 1. O.T. Swanson Multidisciplinary Design Laboratory; School of Engineering

Professor Mark Steiner, Director

<http://mdl.rpi.edu>

The O.T. Swanson Multidisciplinary Design Laboratory (the Design Lab) provides clinical real-world research and engineering experiences that teach integration of discipline-specific knowledge with practice on challenging multidisciplinary design projects. The Design Lab joins together a multitude of resources, programs, courses, curricula, faculty, and staff from across RPI. Because the Design Lab works each semester primarily with senior engineering students from computer systems, electrical, industrial, and mechanical engineering it is ideal for hosting multiple teams of students (six students each, drawn equally from each country) and at least one mentor for each team for the first International Innovation Camp.

The Design Lab deploys pre-qualified student teams on sponsored research projects for Albany International, Apieron, Boeing, Comfortex, Fleetcross, GE, IBM, Northrop Grumman, Gerber Scientific, GM, Morgan Stanley, NYISO, Harris Communications, Schick, and others. The Design Lab also integrates the social sciences into the Engineering Curriculum at RPI, and in affiliation with the Partners for the Advancement of Collaborative Engineering Education (PACE), provides the entire RPI community with advanced engineering, design, and management related software. The Manufacturing Network at RPI (see <http://www.eng.rpi.edu/manufacturing/>) is an integral part of the Design Lab. For the Innovation Camp, undergraduate students from the US and Asia will work in Design Lab and enjoy hands-on project based learning on topics (see below) in the Haas Tech Center and Advanced Manufacturing Laboratory.

The Design Lab serves as a working forum for invention and entrepreneurship, which will serve as a platform for regional leaders to work with the international teams. For example, at the Camp the Design Lab will host Burt Swersey (NCIIA 2007 Olympus Innovation Award winner) for presentations and exercises in his Inventor's Studio in the Lab. His course is offered every semester at RPI, and has led to numerous patents and entrepreneurs who have started new businesses. The Design Lab works closely with the Center for Advanced Automation Technology to develop new tools and applications in mechanical engineering, focused on robotics, artificial intelligence, haptics, and other fields. In addition, the Design Lab actively teaches invention and entrepreneurship, and supports campus wide entrepreneurship initiatives integrating concepts into project-based design experiences.

Through projects drawn from the real world, the Design Lab will allow the student teams to gain experience in cross-disciplinary problem-solving, engineering, research and development. The Camp at RPI will benefit from the Design Lab's world class engineering design program, known for producing exceptionally resourceful graduates, who achieve technical excellence through innovation and entrepreneurship.

As part of the Design Lab program, students will help to address some of the world's ongoing challenges and learn about entrepreneurship and innovation as they acquire real-world problem solving skills. The projects for the student teams at the Camp will include the following:

#### ***Distributed Shared Immersive Visualization Environment***

IBM, Sony, and Toshiba jointly developed the Cell Broadband Engine (CBE) chip for computationally intensive tasks. Today, the chip is used in the Sony Playstation 3 (PS3). The objective of this project is to develop new applications of the CBE that are not typically part of computer games. Previous work showed the feasibility of a vision-based industrial inspection system that detected eroded steam turbine blades. One of the methods for determining the quality of a blade was based on the feature extracted by the 2D Fourier transform. The team will implement codes in Matlab running on a PC and will seek to write codes for the CBE. IBM wants to study the 2D Fourier transformation approach further. At the Camp, one team will extend the work and develop a fully functional prototype using a PS3. In addition, the team will research other applications of this technique, and explore developing demonstration projects based on their work in the Design Lab, if possible. The team will also research possible connections, cross-utilities, and portability to other extant virtual environments (such as Second Life, Intel's ScienceSim, Sony's Home, Gaia Online, etc.) for enterprise development and education uses, and include all relevant ramifications in its final presentation.

#### ***Sustainable Design***

A sustainable product has a designed life cycle for the purposes of furthering its functional life or reclaiming its value for future products, so that minimal waste is generated. While there are some generally accepted methods and guidelines to increase the recycle-ability and reduce the number of parts (DFx, value analysis, modular methodologies, axiomatic design, etc.), these have yet to yield proven designs that are more sustainable than other designs. Ongoing research has identified a set of sustainability metrics that could be used to "score" a product or family of products for sustainability. In order to test and validate these new metrics, the scoring model must be iterated through case studies of well-known designs. The team of students at the camp will work on this task and aim to develop tools that will form the basis of the new metrics, and also apply the metrics to several design problems underway at the Design Lab.

#### ***Pollution Capturing Wind Turbine***

The data suggest that decades of human activity has led to significant increases in carbon dioxide and methane in the atmosphere. Although the complete picture of the effect of increased concentration of these greenhouse gases is complex, most scientists agree that the current global warming is in large measure caused by increasing levels of greenhouse gases, and ways to restrain the emission of these gases must be developed. The industrial partner in this project has filed an application for a provisional patent for an approach to remove pollutants from air that is based on pollutant absorbing surfaces attached to wind turbines. This project involves experiments and analyses to gauge the feasibility of the invention with an initial focus on methane absorption in association with Savonius vertical axis wind turbines. There will be work on materials research and engineering which will be included in the focus of a team at the Camp, with the goal of testing and finding a range of materials that serve this purpose, and integrating them into a real world prototype working turbine.

### ***Document Processing, Database Development, and Integration***

Morgan Stanley maintains over four million documents containing 26 terabytes of information. These documents were prepared using MS Excel, Power Point, Word and Adobe PDF. New documents are added to the repository every day. This is not an uncommon problem for large firms and public institutions, therefore it is useful for one team at the Camp to work on a new system. Therefore, to utilize the stored information more efficiently, the team will develop a scalable document processing system using a variety of software tools and architectures. The team may also work on integration of various databases to improve data retrieval, display, and search functions. For example, FleetCross Holdings, Inc. provides custom database, software, and network solutions to the *Transportation and Equipment Industry*. Their customized parts and service referencing systems for vehicles, equipment, and parts cross reference are utilized by both fleet and parts sales organizations throughout the industry. End users are service technicians, parts personnel, procurement officers, and inventory managers.

Currently the users often need to access multiple systems to get information they need. This is a common problem for large firms like FleetCross and Morgan Stanley. The team's object will be to develop a means to integrate their vehicle related information systems seamlessly so that the end users will be able to find and read information more easily and quickly. Previous work in this area has involved developing a method for detecting duplicated PowerPoint files consisting of the same slides in the same order. But in the future, these problems will require development of methods for detecting similar PowerPoint or other files and a Graphical User Interface (GUI) that allows the user to review and search through the results easily.

### ***Erosion and Aero Probe Field Testing***

As energy is extracted from the steam flow in a low pressure steam turbine, the steam eventually decreases in temperature and pressure resulting in a two phase flow. The water droplets suspended in the steam cause erosion to the turbine's buckets, resulting in lower efficiency. Monitoring the erosion rate is an issue. In past work, a number of methods for measuring and evaluating erosion have been investigated and experiments conducted. The most promising of these has been the use of a boroscope with a digital camera for image capture for inserting into a turbine in a maintenance mode. The goal of this project is to transition the experimental apparatus into a practical configuration that can be installed on a 1/3 scale test turbine. Then the team will try to make it portable. To understand and improve the performance of steam turbines it is extremely useful to measure actual steam flows in operating machines at utility sites. Such measurements are typically done with pneumatic probes. To determine the steam Mach number and flow direction at a given location in a turbine, four differential measurements and one absolute pressure measurement must be recorded. This requires leak-free connections between the probe ports, the digital pressure meters, and the various valves for purging the gas lines. It also requires that the analog signals from the pressure meters be conditioned and noise sources be eliminated. Currently, when field tests are done, the individual system components are assembled at the turbine site. The integrated system is then tested and often leaks, erosion, and electrical problems are discovered that are fixed before measurements can begin. The goal of this project is to integrate erosion monitoring and create a preassembled Field Test Unit (FTU) that can be transported to the customer site and be ready to take data. This will require software development, image capture refinement including lighting, and complete design of packaging for the equipment. The team of students will seek to design a prototype, and test it in the field.

## 2. Center for Biotechnology and Interdisciplinary Studies

Prof. Glenn M. Monastersky, Director of Operation

<http://www.rpi.edu/research/biotech/index.html>

The Center for Biotechnology and Interdisciplinary Studies is a recently established research and training center for the biosciences bringing researchers and students from many technical disciplines working together focused on problems in biomedicine, agriculture, and other fields of research and development. This new center at RPI ranks among the world's most advanced research facilities focused on the application of engineering and the physical and information sciences to the life sciences.

The Center is a 218,000-square-foot, \$80 million facility on the RPI campus. With its high-tech and expansive laboratories, it provides a platform for collaboration among many diverse academic and research disciplines to enhance discovery and encourage innovation. Research and/or office space includes room for approximately 400 faculty, staff, and students. RPI is rapidly recruiting world-class investigators to lead research in the focal areas. Each focal area will be supported by a constellation of "star" faculty, junior faculty, and others who are experts in their fields. These constellation groupings provide for communities of distinguished researchers and the programmatic resources to ensure their success.

The Center houses faculty and researchers engaged in interdisciplinary research, and hosts world-class programs and symposia. It exemplifies a new research paradigm, as no department offices reside in the building; rather, it is occupied by researchers and their laboratories. The core research facilities within the Center contain laboratories for molecular biology, analytical biochemistry, microbiology, imaging, histology, tissue and cell culture, proteomics, and scientific computing and visualization. The Center contains an 800 MHz Nuclear Magnetic Resonance (NMR) spectrometer and the computing and visualization infrastructure needed to model molecular structure at the atomic level. In addition, the Center will become home to a new \$22.5 million Gen\*NY\*sis Center for Bioengineering and Medicine funded by New York State. RPI has received significant Federal funding to support the creation of a new Center for Quantitative and Computational Bioscience to be housed in this facility.

### ***Biocatalysis and Metabolic Engineering***

The International Innovation Camp will provide two teams (because of technical constraints only three students will be on each team, in this case) with lab intensive learning, mentoring, and problem solving at the Center focused using analytical tools to better understand biocatalysis and metabolic processes for novel molecular synthesis. The teams will use state of the art understanding of biocatalysis and metabolic engineering tools seeking to elucidate and perhaps control the complex interplay and regulation of multi-enzyme processes. The steps and understanding required for the students to perform complex chemical reactions that can produce costly or difficult to manufacture substances, perhaps at an economical and efficient scale. Often considered integral to synthetic biology, this rapidly growing area shows promise for the creation of new techniques for developing useful bioactive macromolecules and polymers.

The work of the teams will be aimed at understanding and taking advantage of natural metabolic processes found in cellular pathways for chemical transformation, energy transfer, and supramolecular construction. This technology has become increasingly important to chemical and pharmaceutical companies for numerous commercial applications in healthcare and industrial chemical processes. The teams require capabilities and collaboration across disciplines and capabilities in a wet lab setting working with a variety of tools. Although the US and overseas students will meet basic pre-requisites, the teams will be trained as needed on the Center's advanced equipment and tools, and gather data to document their researches into the chemical biology underlying identifiable natural metabolic pathways and biocatalysis.

A particular focus for the team will be in pharmaceutical and nanoscience applications of biocatalysis and metabolic engineering. For example, the teams will focus on bioactive carbohydrates, particularly the complex polysaccharide heparin. Heparin is a major clinical anticoagulant with more than 500 million doses used worldwide each year. Heparin and related molecules exhibit a large number of newly discovered biological activities and have great therapeutic potential. Glycoprotein, proteoglycans, and other glycoconjugates are prepared by fermentation using recombinant technology, extraction from tissues, or by chemical and enzymatic synthesis. After determining the structure of these molecules, the teams will study their biological activities. By establishing a structure-activity relationship, these molecules often become lead compounds for new drug development.

Mapping of the mouse glycome is underway with a focus on heparan sulfate proteoglycans. Heparan sulfate is being isolated from tissues obtained from wild type and knock out mice, missing various isoforms of enzymes involved in heparin sulfate biosynthesis. Mouse embryonic stem cell proteoglycan glycomics are also being studied. The structures of these sulfated polysaccharides are being determined, and biochips and microarrays containing heparin sulfate from these tissues are being prepared as a tool for glycomic screening. If possible, the teams will use the microarrays to perform the screening studies and document their results.

The teams may also conduct biochemistry and structural biology studies which focus on the preparation, purification, and characterization of carbohydrates and glycoconjugates. The team will seek to develop methods to purify these glycoconjugates and determine their structure by microsequencing using mass spectrometry (MS). The teams may also explore the kinetics and thermodynamics of protein-carbohydrate interactions, relying primarily on isothermal titration calorimetry and surface plasmon resonance (SPR) spectrometry. X-ray crystallography and nuclear magnetic resonance (NMR) solution structure analysis are used in conjunction with molecular modeling to determine the molecular contacts in the protein carbohydrate complex.

The teams may also use chemical and enzymatic synthesis to prepare target carbohydrates for biological evaluation. An artificial Golgi is also being used to study the parameters affecting glycan biosynthesis in the cell. The group's current focus is to prepare acidic carbohydrates. Targets include: sialic acid C-glycoside analogues as vaccines and glycosaminoglycan oligosaccharides for therapeutic evaluation by high throughput activity screening. Using the various approaches at the Center, the teams will be able to deliver useful data that may help guide drug discovery and other therapeutic studies.

### 3. Center for Automation Technologies and Systems

Prof. John Wen, Director

<http://www.cats.rpi.edu/index.html>

The Center for Automation Technologies and Systems (CATS) at RPI is a New York state designated research and education center under the NYSTAR program, focused on combining quantitative analyses with creative engineering solutions at the large scale level as well as the micro- and nano-scales. CATS is known around the world for its industrial-university partnerships, and professors and students work which has led to successful start-ups and numerous useful technologies in industry and also in the US space program at NASA. CATS is a leading center of excellence at RPI focused on robotics, automation, artificial intelligence, micro-electromechanical systems (MEMS), biomechanical micro-engineering, and related frontiers of research and mechanical engineering. State of the art labs and cooperation with other facilities at RPI and peers around the world is a hallmark of the CATS community. For example, CATS maintains working cooperative relationships with the following centers and facilities around the RPI campus system, including:

- [Flexible Manufacturing Center](#) (FMC)
- [Multidisciplinary Design Laboratory](#) (MDL)
- [Center for Future Energy Systems](#) (CFES)
- [Scientific Computing and Research Center](#) (SCOREC)
- [Fuel Cell Center](#)
- [Center for Polymer Synthesis](#)
- [Center for Terahertz Research](#)
- [Center for Integrated Electronics](#) (CIE)
- [Rensselaer Office of Entrepreneurship](#)
- [Career Development Center](#) (CDC)
- [Education for Working Professionals](#) (EWP)

CATS also maintains ongoing relationships and exchanges with numerous world-class engineering and robotics research, measurement, and training centers in the US and around the world. For example, CATS has long-standing partnerships with:

- [National Institute of Standards and Technology, Manufacturing Engineering Laboratory](#) (NIST/MEL)
- [Chinese Academy of Sciences \(CAS\), Institute of Automation \(IA\), and Laboratory for Complex Systems and Intelligent Science](#)
- [Technical University of Eindhoven](#) (Focused on micro- and nano-scale engineering)

As part of the International Innovation Camp at RPI, CATS will host one student team working in the general area of dynamical systems modeling, network control, and planning with applications to vibration suppression, robot manipulation, electro-mechanical systems, advanced material design, projectiles, network flow and power control, and systems integration.

### ***Controller Area Network and Remote Controlled Vehicles***

A growing number of automobiles use multiple microcontrollers for providing sophisticated functions. Controller Area Network (CAN) is one of the standard protocols for managing communication among microcontrollers and modules. The goal of this project is to develop course materials that teach the CAN technology and its role in automotive applications in ECSE-4790 Microprocessor Systems, a senior-level engineering course. Previous teams have developed the course materials that utilized a remote controlled car. Future teams will create additional lab experiments that will use real components. For example, during emergency situations involving hostage standoffs, kidnapping, or other potentially life-threatening scenarios, police use many tactical techniques to investigate and resolve the situation. Among these is the use of an "eyeball" camera that is thrown into a room and remotely controlled to observe the room and its inhabitants. The goal of this project is to design and construct a low cost remote controlled motorized vehicle with the eyeball camera that can improve their capabilities. The vehicle will include attachments for the camera (including a pan/tilt capability), the ability to mount lights, and a remotely-controlled tear gas canister dispenser that can be used to precisely deliver this agent when needed. The team of students will design, build, and test a robust prototype that uses the CAN technology in a real world and sometimes unpredictable setting.

#### 4. Smart Lighting Engineering Research Center

Prof. Ken Connor, Director of Education (and also Professor of Electrical Engineering)

<http://smartlighting.rpi.edu/>

The Smart Lighting Engineering Research Center (ERC) advances LED technology by making substantial progress in novel materials, device technologies and system applications. The main goal at the Smart Lighting ERC is to demonstrate revolutionary lighting systems with controllability and tunability for, but not limited to, bio-imaging, high-efficiency displays and illumination devices, safer transportation and novel modes of communications. Innovations at The Smart Lighting ERC will be rapidly commercialized through industrial partnerships, while securing intellectual property. Another long term goal of the ERC is to bring more intelligent and innovative young people to science and engineering education through focused outreach educational programs.

The Smart Lighting ERC is funded by an \$18.5 million, five-year award from the National Science Foundation Generation Three Engineering Research Center Program. The Smart Lighting ERC is also the only ERC centered in New York state. The ERC also benefits from active partnerships with other schools, in particular the University of New Mexico and nearby Boston University.

The RPI facilities provide an unparalleled vertically integrated array of fabrication, processing, characterization, and system assessment tools. The wealth of experimental methods of the combined Smart Lighting ERC facilities is extensive and unique. The operation of the shared ERC Central Laboratories at RPI is guided by:

1. Rapid access to facilities and equipment by partners, enabled by expedited training schedules;
2. Initial supervised usage of equipment by visiting personnel until they are fully cleared;
3. Stringent maintenance and high availability of equipment by skilled technical support personnel including one laboratory manager.

The program offers students at the Camp real-world, hands-on technical experience focused on ongoing research and development at the Smart Lighting labs at RPI. A sample research focus for the team in ERC labs at the Camp stems from the fact that light consumes a lot less energy than other wireless networking technologies like WiFi, and it is more localized - providing an opportunity leading to more energy-efficient communications. For example, LEDs use about 15 percent as much electricity as light bulbs of equivalent brightness. At present, about 22 percent of the world's electricity is used for lighting, but it could be reduced to 11 percent if all existing lamps were replaced with LEDs. Smart lighting is the only technology that can make a huge dent in electricity consumption, but for now at least, it is expensive. While a 100-watt bulb costs less than \$1, an equivalent LED lamp can cost as much as \$80. This may change as commercial and industrial users with high power costs increase their use of LED lamps, leading to increased production by lighting companies and a lower price per lamp. Moreover, the cost will come down faster as customers realize LED lamps could double as a data network. This presents exciting prospects for economies of scope, as the research is developed and challenges are addressed in depth by the team. Therefore, the team will explore how LED data networks could find applications beyond homes and offices.

In addition, the team at the ERC may study automotive applications, such as smart traffic signals designed to make the transportation system more safe by developing traffic lights that would prohibit cars from running a red light. Some recent examples of other projects students may work on at the Camp include:

- The impact of the 9/11 attacks on critical infrastructure interdependence;
- Subsurface sensing and imaging for bridge decks and pavements; and
- Sensitivity analysis on a linear programming model of world trade.

During the Camp, the student team will focus on applying knowledge to actual problems and research situations, networking with faculty in research labs, and establishing support groups consisting of faculty and other students. The students will gain critical leadership and team building skills, making industry connections that could lead to future opportunities, and gaining experience in performing real-world projects. The student teams will receive hands-on research and communication experience, and obtain knowledge of conducting research that could be applicable to graduate studies. Through the teamwork at the ERC, students will be able to improve critical thinking skills and creativity in developing solutions to key industrial and social problems common in the US, China, India, Korea, Japan and everywhere else around the world.

### **Special Focus: the Long Term Value of Ethical Business Building**

RPI and iFEST are united by the vision that sustainable innovation and entrepreneurial business practices, depend on ethical values that resist short term profit-making at the expense of building great companies over the long term. History shows that if entrepreneurs focus on building great companies, then significant profits will follow. Indeed, for many entrepreneurs, the money is incidental to realizing a great idea. This vision will be reflected in a special session for the International Innovation Camp which will encourage the students, mentors, and others to take a step back and reflect on their goals, strategic plans, and working level tactics. To help them do this, we plan to bring in several well known and thoughtful practitioners and scholars who can help illustrate the long term value of ethical and moral practices to the financial sustainability of the firm.

At the Camps, we will encourage the students to think about the health of the total enterprise. We believe that our emphasis on ethics in this session will enable students to reason about the role of morals in business in a complex, dynamic, and global environment. Key frameworks and concepts of moral reasoning that we will touch on include the morality of the marketplace, the social contract, stakeholder analysis, harms and benefits analysis, rights and duties analysis, principles and rules, the process of reflective equilibrium, and moral and institutional leadership. In the case of rapid business growth within China, India, Japan, and Korea these principles and a longer term perspective are especially relevant as we confront recurring boom and bust business cycles.

Current economic events suggest this approach is a wise investment during the Camp for the students from the US and Asia, who are likely to be among the business and technology leaders of the future. The financial downturn afflicting the global economy at present is a strong reason to help these young future leaders and their mentors come together to expand their practical knowledge, and also learn wisdom to help them avoid common cyclical thought-based mistakes in their careers. To help them do this, we plan to bring in successful entrepreneurs such as Christos Papoutsy (Hollis Engineering-Cooper Electronics & Helleniccomserve.com), Sundeep Dugar (Sphaera), and Anil Singh-Molares (EchoMundi). We also plan to hear from and engage expert speakers such as Jeffery Seglin (New York Times & Emerson College), *Good to Great* author Jim Collins (formerly of Stanford U.), and noted scholars S. Venkataraman, Ming-Jer Chen, and Saras Saravathy (all three from the Ethics and Entrepreneurship Program at the Darden School at U. of Virginia).

In this special session, our ultimate goal is to lay the groundwork for a stronger long term outlook on start-ups. We seek to show the interconnections among ethics, value creation, innovation breakthroughs and entrepreneurial advances, via exercises catalyzed by the wisdom and experience of these experts. For example, in one given exercise each speaker will be invited to lay out a situation and then have the students and mentors in their teams discuss and devise the most ethical course, based on the moral principles taught in the session. Then the teams will present their solutions and offer assessments. Other exercises may be developed as well. We believe this will be a very stimulating and integral part of the Camp experience for the participants, which will help them stick with the startup process.

### **Preparation and Logistics**

No trivial matter, the preparation and logistics for the Camp at RPI will be handled with an eye on enabling the students' and mentors' overall experience before, during, and after the Camp. Before the camp, all travel arrangements will be handled by travel agencies under contract to iFEST, RPI, and our overseas partners. We will work with our partners to provide letters of invitation for visa application purposes. Moreover, iFEST has experience and access to State Department officials for resolution of problems in an emergency.

RPI is a beautiful campus on high ground above the city of Troy and the Hudson River. The ambiance for the International Innovation Camps will be perfect in the summer of upstate New York. We will work with the housing authorities at RPI to make dormitories available, and also ensure access to cafeterias and cafes on campus for the students and mentors. We will also work to ensure computer access and access to the library, as needed, for the students. We will also follow all safety procedures and provide standard access to health facilities for the students and mentors. We will have a waiver that the students will be required to sign, indemnifying both RPI and iFEST in the event of some problem. In addition, we will make appropriate insurance arrangements, working with RPI insurance carriers.

Prior to the Camps, selected students will be given assignments in each of their lab-specific team subjects, including lab pre-requisites and reading assignments relevant to their participation. Students will have a chance to virtually meet online with their teams and make preparations for their summer program during the Camp. Team assignments should be a natural fit based on their demonstrated interests and experience in science and engineering to date. Instructions and guidelines for the projects will be provided via phone, email, and the Camp website. RPI and iFEST will identify and match up the adult mentors who will work with students on each team during this pre-camp research period. The mentors will also be consulted in the preparation of curriculum and assignments that will lead up to the science and engineering activities at the Camps. Then this will be done with the overseas participants through iFEST partner organizations there. The on-line pre-camp studies will start at least four months prior to the Camp, with establishment of listserv and email connections and some assignments in advance.

Orientation to the event (see below), the culture, and their foreign peers will be important for the young people and their mentors, in order to optimize the benefits of their participation. After arrival, there will be a chance to rest and then begin to meet with peers at an opening reception, before the opening ceremonies the next day.

After the Camp concludes, iFEST and RPI will work with our young US and Asian colleagues to facilitate their safe departure, and return home.

### **Orientation**

For the foreign Camp participants' entry into the US, they will travel from their homes to an Asian origination airport, in order to depart their home country together on one flight from each country. Then each national delegation will arrive in the United States at Albany International Airport (or JFK New York to help foreign delegations pass through customs), and be met by iFEST and RPI staff. Members of the US delegation will be gathered from the airport as they arrive singly or in groups, when possible. From the airport, all will be transported by bus and/or van to gather at the host venue facilities at RPI, for a brief rest period. Then there will be a brief welcome and initial dormitory orientation, just prior to the welcoming reception. The longer more thorough orientation for all participants and staff will take place the next day, after a modest opening ceremony.

In addition to its educational and career objectives, the orientation session is aimed to prepare the students and mentors for the camp by allowing them to ask questions, obtain instruction, meet for the first time together, and ensure that the minds of all are prepared. They will also have their first opportunity to meet all iFEST and RPI staff and other key persons, such as local civic and business leaders.

At the orientation, iFEST and RPI staff will provide students and adults with information about the host campus venue and practical details, focusing on safety and health first. Then we will introduce basic information about culture, science and engineering research and infrastructure, educational institutions, as well as suggestions on how to handle emergency situations and other problems such as communications or cultural conflicts. Students will also have this opportunity to rehearse any scientific/cultural presentations such as a song or other group activities.

During the orientation session, a pre-camp survey will be given to students and mentors to assess what they expect to gain from this experience and what they can contribute to innovation, the international scientific and business communities, and their home institutions. It will be valuable to look back post-camp on their preconception of the activities, participants from the other country, and contrast that with their real experiences which will be documented in the follow-up survey and evaluation at the end of the Camp.

### **Learning Outside the Camp**

The International Innovation Camp works as a platform for future international technical and entrepreneurship cooperation among the US and overseas participants as well as other interested students, researchers, and science educators from around the world. Preparation for the Camp, and the Camp itself, is sufficient to stimulate the participants' initial research and learning experience. However, in order to maximize the research capacity and expand the cooperative learning of the Camp beyond its spatial and time boundaries, iFEST will facilitate sharing this experience with students, instructors, and other stakeholders from around the world through the Internet, using the iFEST and RPI websites and also virtual worlds, such as Second Life. We will also explore strategies for attracting a wider audience off-site. The use of media strategies along with information technology such as our websites, a Listserv, Blogs, Video-Blogs, RSS newsfeeds, a Facebook group, and an International Innovation Island in Second Life can help leverage the experience for other students and stakeholders thereby encouraging a continuous learning process, both during and after the Camp.

The official website of the Camp will be launched at least four months prior to the Camp, hosted on an RPI server. Selected students and advisors from the US and participating countries will receive instructions on the pre-camp activities, such as preparation procedures and pre-camp research assignments. The content of the website and its Second Life incarnation will be developed by iFEST, RPI, and overseas partners. The students will also be able to add to these online venues.

Through the website, students can access any official notices, useful materials, technical journals and business portals for their projects. Moreover, the results of their projects will be shared on the website as well. The website and the International Innovation Island in Second Life will play major roles in sharing research, cultural, presentation, and personal experiences among participants and the rest of the world.

The use of information technology is crucial to leveraging the Camp's success. It will help promote cooperative learning in international settings beyond the physical camp. The experience and skills gained from the Camp will enhance the students' abilities to work in the international scientific and industrial environment and will help them think about their path for acquiring skills and overseas experience as they begin to navigate their careers and pursue their entrepreneurial goals.

### **Off Campus Activities including Field Trips**

Activities during the first Camp will include visits to local cultural and historical sites to learn about the unique character of the host venue's region, as well as the US in general. In addition to the substantive work of the students and their mentors at the camp, RPI and iFEST will develop a schedule of off campus tours, sightseeing, and site visits to laboratories, industrial firms, government agencies, and market institutions that will round out the international experience for all the participants. Proximity to both New York and Boston will be leveraged with visits to key institutions (NYSE, MIT, etc.) in both cities. There will be time set aside for cultural experiences and field trips on the weekends and some evenings, and we will allow for some unstructured down time for all students and mentors.

The Camp activities are intended to be relaxing and fun, stimulate creativity, and be a complement to the team learning in the labs. Summer seasonal holiday and local festival programs will also present opportunities for broader cultural learning. These activities will also help cement the international team building and cooperative bilateral exchange. Overall, the activities will focus on introducing all the Camp participants to local and national interests and business constituencies in ways that help make the connection between innovation, entrepreneurship, community growth, and the global economy.

### **New York Program**

RPI offers unique proximity to the City of New York City, just a short 2.5 hour bus ride away. The program of the International Innovation Camp will take advantage of that geography to expand and leverage the experience at the Camp for the students, and also exploit the national and foreign media presence in New York. Working with iFEST colleagues and RPI alumni in Manhattan, we will arrange for the student teams to make presentations and perform visual demonstrations for an audience of generalists and journalists at national television news outlets, as well as newspapers, magazines, and internet publications. In this way, we hope that the Camp will successfully demonstrate to the United States and the rest of the world via the wide media lens that the potential level of trust and cooperation among young American, Indian, Chinese, Korean, and Japanese students and their mentors is high enough to bring our countries and our people together to work in a more purposeful and mutually beneficial manner. The Camp can serve as proof of concept that working together toward the resolution of pressing global problems via creative capitalism and international cooperation is one constructive path forward. It is certainly better than not working together, among other alternatives.

Therefore, over three days near the end of the Camp, we plan to take the students and mentors to New York where we will give them a brief yet in-depth introduction to the leading center of global commerce today. As part of the program, we will take the Camp participants to visit key institutions and listen to presentations from leaders at the United Nations (including the relevant countries' missions to the UN), the New York Stock Exchange, City Hall, the NASDAQ NY offices, Goldman-Sachs, the Ford and Rockefeller Foundations, the New York Academy of Sciences, the Council on Foreign Relations, Columbia University, the Fashion Institute of Technology, Endeavor, and TIAA-CREF headquarters. In addition, we will also arrange enjoyable site visits to notable art and science museums, Time Square, Rockefeller Center, Liberty Island, the World Trade Center Memorial, Wall Street, the Empire State Building, and Chinatown for example. We expect this part of the program will take place over the last full weekend of the Camp, leading up to the concluding presentations.

### **Follow-up and Evaluations**

Developments after the International Innovation Camp will be the true measure of success in reaching our goals. We will plan a program of follow up after the events for the students, mentors, and other participants. The follow up plans for each camp will include post-camp communications, evaluations, follow through on business model development, enablement of further technical and business related collaborations, and development of an official Camp alumni group and networks using an email listserv, the Camp website, a Facebook Group, and the International Innovation Island in Second Life.

There will be an emphasis on follow up in the post-camp interaction among the students and adults, which will be built in even before the start of the Camps. RPI and iFEST will include information about that interaction in the orientation, as a part of the introductory discussions. Through business model development, the Camp aims to encourage students to actually prepare to start a small business with their proposals - - something that might lead to an Apprentice-type program. This will be done where appropriate, depending on the ambitions of each team and the receptivity of their mentors and host lab professors. We will encourage the students to continue their work on their research and technical collaboration after their return, and have them collaboratively update their project team deliverables online with their peers. The students will focus on data collection, modeling, and business model development during the camp, then ongoing activities that will guide them through the analysis, evaluation, and documentation stages. Including follow-up plans from the beginning in the orientation also increases the likelihood that it will be realized after the Camp concludes.

We will build on the alumni focus to the iFEST Camp program. That is, we will create a functioning official International Innovation Camp alumni group and network. Also, iFEST will invite some of the students who participated in one camp to participate in the next one hosted by RPI or a university overseas, and so on year after year. iFEST will develop and implement workable plans for what information and activities take place via the Alumni Group in the months between the Camps, both domestic and overseas, to increase the impact of the program.

After the Camps, RPI and iFEST will implement a long term communications strategy that includes the use of email listservs, the Camp website, blogs, a group on Facebook, the International Innovation Island in Second Life, and other Internet enabled technologies to establish a community of participants and partners that transcends national boundaries. This community will also serve as a resource, and will allow iFEST to periodically gather data on what the alumni are working on and where they are, over the course of their careers after the Camp. Surveys to gather those data will be fielded via the listserv on an ongoing basis. We will focus on building up the alumni of student and adult participants through periodic reunions, as well.

As noted earlier in the summary of the orientation process, there will be an opportunity to field brief surveys to Camp participants to document their learning at the Camp. At the conclusion, before departure of the delegations, a final summative evaluation will be administered to the students and mentors, to gauge the overall experience, interactions in their lab-specific teams, and learn from their suggestions. In addition, whereas the formative survey administered during the orientation allowed for the collection of baseline data, the final survey will permit us to revisit that baseline and determine what new knowledge and experiences have been accrued by students and mentors through the Camp. We will also field a questionnaire to the RPI host lab personnel and RPI Professors in particular, to better understand the same things from their perspective.

**About iFEST** iFEST is a newly established institution based in the US, legally recognized under Internal Revenue code 501(c)3, devoted to cultivating the rising generation of entrepreneurship and innovation, working together across international borders. Cooperative exchange programs to host regular study visits and dialog for US and Chinese policymakers concerned with rapidly advancing innovation, economic growth, and related issues are among the first targets for iFEST. The foundation offers specific mechanisms that will cultivate the next generation of international innovation and entrepreneurship. The iFEST vision is to unleash the creative economic and technical capacity of the rising generation by:

1. **Enhancing the abilities of young people to acquire the entrepreneurship, experience, knowledge, and tools needed to navigate an increasingly global economic future;**
2. **Improving international policy dialog on the policies and practices required for innovation and entrepreneurship; and**
3. **Broadening the base of support for transnational cooperation via common interests in entrepreneurship, economic growth, science, and technology.**

iFEST is based on the principle that, the outcomes of entrepreneurship, scientific research, and innovation in any open economy are transformative beyond the share of the economic output generated. Its focus is on global problem solving. More information can be found at [www.ifest.info](http://www.ifest.info).

### **About Rensselaer Polytechnic Institute**

The Rensselaer Polytechnic Institute (RPI), is a private research university located on a scenic bluff overlooking the Hudson River in Troy, New York about 150 miles north of New York City. RPI was founded in 1824 by Stephen Van Rensselaer for the "application of science to the common purposes of life" and is the oldest technological university in the English-speaking world. The institute is known for its success in the transfer of technology from the laboratory to the marketplace. RPI is also well known for producing numerous entrepreneurial scientists and engineers who have led major national public and private research and development projects, including the NASA space program and notably the Apollo missions to place US astronauts on the moon.

RPI's mission has evolved and grown over the years while retaining its focus on the scientific and technological roots upon which the school was founded. Adopted by the Board of Trustees in 1995, RPI's current mission is to "educate the leaders of tomorrow for technologically based careers. We celebrate discovery, and the responsible application of technology, to create knowledge and global prosperity." There are at present about 5,200 undergraduate students, and 1,200 graduate students along with approximately 500 faculty at RPI. Respected and renowned physicist, Dr. Shirley Ann Jackson is the current President of the university. More information about Rensselaer can be found on the web at [www.rpi.edu](http://www.rpi.edu).

**Program Budget (US & Japan only) Nippon**

**I.**

A. Staffing (including salaries and non-salary benefits):		
RPI Program Director (30 days @ \$500 per day)		\$15,000
RPI Staff Support, from the Design Lab (80 days @ \$200 per day)		\$16,000
iFEST Program Director (70 days @ \$500 per day)		\$35,000
iFEST Program Assistant (30 days @ \$200 per day)		\$6,000
B. iFEST & RPI Office Expenses		
Telecommunications		\$450
Supplies and Photocopying		\$400
Postage and Courier Service		\$150
C. iFEST & RPI Staff Preparatory Travel, Lodging and Subsistence		
		\$4,000
D. Outreach Costs (advertising, campus visits, web, etc.)		
		\$2,500
E. Camp Insurance Rider Costs		
		\$2,000
F. RPI Professor and Grad Student -- Lab Hosting Costs (6 @ \$12000)		
		\$72,000
G. Speaker Travel Expenses and Related Costs (15 @ \$500) H.		
Follow-up and Alumni Group Administration Costs		\$7,500
		\$5,000

**II. US Delegation Expenses**

A. Travel for US students and mentors* to RPI (estimated):		
Roundtrip airfare coach class (15 @ \$500)		\$7,500
Lodging & subsistence (15 x 25 days @ \$50 per day)		\$18,750
Airport Ground Transportation (2 days @ \$500 per day)		\$1,000
B. New York City Trip Expenses (Lodging, Subsistence, Local Trans.)		
		\$9,000
C. Boston Trip Expenses (Lodging, Subsistence, Local Trans.)		
		\$6,000

**III. Japanese**

A. Travel for Japanese Delegation to RPI (estimated): <b>Delegation Expenses (including Roundtrip airfare subsidy)</b>		
Roundtrip airfare coach class (12 @ \$1500)		\$18,000
Lodging & subsistence (12 x 25 days @ \$50 per day)		\$15,000
Airport Ground Transportation (2 days @ \$500 per day)		\$1,000
B. New York City Trip Expenses (Lodging, Subsistence, Local Trans.)		
		\$6,900
C. Boston Trip Expenses (Lodging, Subsistence, Local Trans.)		
		\$4,600

Total Estimated Direct Expenses	\$208,250	\$45,500
Indirect Costs and Contingencies (15 percent)	\$20,438	\$6,825
<b>Total Grant Requests</b>	<b>\$228,688</b>	<b>\$52,325</b>