

An Open Invitation to Develop

A Strategic **Partnership** and a **Co-Laboratory** for the **Inspiring Technology**

by:

Stephen Chih-Yang Lu, Ph.D.

David Packard Chair Professor, University of Southern California, USA; and
YangTze Distinguished Professor, Tianjin University, China

1. Background

We propose to form a strategic partnership and establish a co-**L**aboratory for **I**nspiring **T**echnology (**LITE**) to support the intellectual pursuits and commercial advancements of this new concept. Driven by the new Inspiring Technology concept*, this **LITE** program will perform applied research, product innovation, technology transfer, and human resource development, with the ultimate goal of helping the participants and sponsoring companies to achieve its organization vision and product mission.

This document is an open invitation to interested organizations to join this collaborative endeavor. It consists of brief answers to a set of key questions below.

2. What is the Inspiring Technology?

The Inspiring Technology is a new concept that can lead to the development of the next generation products, which overcomes some fundamental limitations of those existing product development approaches. All existing products to date are developed with the basic assumption that human (i.e., users) is a *hierarchical* system – a well-established view by the Western medical community. Product functions are defined according to the Newtonian framework, with the primary goal of *replacing* or subsidizing some specific human functions with added speed, ease and convenience. Ironically, as these products become more powerful and/or affordable, a human being himself becomes less capable. Worse yet, due to the hierarchical paradigm in human factor design, these products sooner or later become a health hazard to their users. It is clear that this established product paradigm has reached its fundamental limitation, which, in turn, will restrict the future growth of industries that are based on product development and manufacturing.

The Inspiring Technology concept was conceived to overcome the above limitation. The core idea behind this new concept comes from a different assumption about the human system, which is the foundation of all product design. Unlike the Western approach that treats human as a hierarchical system, the Inspiring Technology takes the Oriental

* The exact term and basic concept of Inspiring Technology were first proposed and coined by Stephen C-Y. Lu in 2000. “Inspiring Technology” and “Inspiring Product” are both trademarked by Lu in 2002.

thinking which models a human as a fractal^{**} system that interacts with the environment in a holistic^{***} manner. The implications of this different assumption are very profound, especially in challenging our innovation in developing the next generation products in terms of what they can, and should, do for the human.

For example, the fractal viewpoint opens many new possibilities of product functional specifications. As soon as a product appears in the proximity of a human, it becomes an integral part of the fractal system, and hence can proactively “*inspire*” the user, while performing its traditional functions. As well, the holistic framework expands the innovation possibility in human-product interactions. A product can adapt itself automatically to different temporal and environmental conditions, and hence offer users different usage experiences that are completely individualized to the user. Putting all these possibilities together, it becomes feasible to invent new products that have totally adaptive behaviors and can work as an integral part of their user (i.e., the human) systems – a possibility that is unattainable by any conventional thinking.

The Inspiring Technology, based on the above fractal and holistic viewpoint, calls for the ability of a product to proactively interact with its users and environments with closed-loop, online feedbacks. Such ability requires research and development in human systems modeling, sensor devices development, and innovative integration with new product design methodologies. The rapid advancements of scientific understandings of traditional Chinese medicine (TCM), micro/nano technologies and materials, embedded sensor devices, and new product development methodologies make the realization of Inspiring Technology a reality, rather than a dream, in the near future. The result, which we collectively call Inspiring Product, will be a new kind of intelligent artifacts that extends the human frontier to cross over and integrate the biological and technological boundaries. The Inspiring Product can be realized in all kinds of consumer products, such as IT, sport, health, transportation, entertainment, etc., and will lead to many new industries and open significant new markets in the future. For our strategic collaboration with sponsoring companies, for example, we can focus on inspiring products in the consumer electronics, computer and communication (i.e., 3C) industries.

3. Why do we need a global partnership to develop the Inspiring Technology?

The fundamental impact of Inspiring Technology and the commercial potential of Inspiring Product are truly global, and hence call for a global partnership for its research, development, realization and commercialization.

Philosophically speaking, this concept represents an innovative integration of the thousands-year old practice, perfected by the Chinese, with the most advanced modern

^{**} In layman’s terms, a fractal system is a repeating structure, by which a system always contains another system that has a similar structure between its containee and container. For example, Traditional Chinese Medicine (TCM) believes that human hands (i.e., a containee) have a corresponding map of the whole body (i.e., a container).

^{***} In layman’s terms, the word “holistic” here means that the interactions between a product and its users are always time, location, orientation, and history dependent. This holistic view, plus the fractal structure above, provides a possible rationale for many traditional Oriental practices, such as Chinese Feng-Shui.

technology, dominated by the United States, to open up a leapfrog opportunity for existing product industries. Therefore, collaboration between technology talents in the Chinese regions and the United States (at USC) is certainly fitting for this topic.

Practically speaking, since we focus on Inspiring 3C products at this stage, we intend to fully utilize those existing infrastructures and invested resources available from current 3C industry leaders. The fact that many worldwide manufacturing bases for existing 3C products are invested by Chinese industries makes the collaboration with a Chinese global electronics industry leader justifiable. Inspiring products represent the best opportunity for Chinese electronics OEMs to develop their own product brandings in the global markets.

4. Who are the partners of this strategic collaboration?

The charter partners of this collaboration include (1). Tianjin University in Mainland of China, and University of Southern California in the United States.

Tianjin University (TJU) was founded in 1895 (as BeiYang University), and is the first university in the history of modern Chinese higher education. Our strategic partner is the College of Precision Instrument and Optical-Electronic Engineering (PI&OEE) at TJU. Officially designated by the State Education Commission of China as the most leading academic unit in this subject, PI&OEE has many key national laboratories and research centers, such as Precision Measuring & Testing Techniques and Instruments, Opto-electronic Information Engineering, Precision Instrumentation, Modern Optical Instruments, Opto-electrical Measurement and Control, Laser Technology and Biomedical Engineering. Many of these topics relate to Inspiring Technology and have strong overlaps with technology and business interests of Lite-On. Over 200 PI&OEE faculty train the best undergraduate and postgraduate students in this area in China. Dr. Lu holds the position of YangTze Distinguished Professor at PI&OEE/TJU for a five-year term (2003-2007). With the financial supports from the University, Prof. Lu is establishing an Inspiring Technology Laboratory at PI&OEE/TJU with a close link to his research group at USC. The PI&OEE faculty is working to extend their expertise in measurements, devices, and sensing of engineered artifacts to that of biological systems, as a new strategic direction for the College to support the Inspiring Technology.

University of Southern California (USC) is the largest private research university in the western United States. USC's Engineering School currently ranks No. 8 among all American universities. Our strategic partner is the Product Development Engineering (PDE) Center established by Professor Lu. The PDE Center works with many leading USC research laboratories in collaborative engineering, rapid prototyping, optical electronics, bioengineering, multi-media, and information technologies. PDE at USC also partners with the Art Center College of Design in Pasadena, California – the world's most renowned design school. As well, it offers a Master of Science degree in Product Development Engineering, which can be obtained remotely through USC's modern Distance Education Network. Prof. Lu's current research interests are in the "Engineering as Collaborative Negotiation" paradigm, and innovative concepts and

technologies for new product developments. His group is conducting basic research of Inspiring Technology, especially in human systems modeling and prototype developments of a few Inspiring products. This group is closely linked to the new Inspiring Technology Laboratory at TJU.

We invite interested organizations and companies to join this strategic collaboration.

5. What are the win-win opportunities for the strategic partners?

We look for strategic partners who have excellent technology expertise and can offer complementary strengths required for the Inspiring Technology. Working together on a common vision, many win-win opportunities can be realized for each participant.

For the sponsoring organizations:

- Use the Inspiring Technology concept as a key driver to continuously challenge its engineers' innovation in new product designs and corporate cultures
- Work with PI&OEE at TJU to leverage technical expertise and to develop the best human resources to support the growth of its China and worldwide operations
- Work with PDE at USC to learn systematic methods of technical innovations, such as the TRIZ Science of Invention, to empower its engineering capabilities

For PI&OEE at TJU:

- Use the Inspiring Technology concept as a key driver to evolve its current technical strengths to a new subject area with a leading position in China
- Work with the Lite-On Group to further integrate its basic research, technology transfer, and education programs with the industrial needs in China
- Work with the PDE at USC to develop a new research area with creative researchers to elevate its academic reputation recognized by the world

For PDE at USC:

- Use complementary strengths and resources from Lite-On and TJU to facilitate the rapid realization and commercialization of its Inspiring Technology concept
- Work with the Lite-On Group to further integrate its PDE basic research, technology transfer, and education programs with real-world industrial needs
- Work with PI&OEE at TJU to establish a leading research and education focus for the Yangtze Professorship program by the Chinese Ministry of Education

6. What is a Co-Laboratory and why it is needed?

The term “Co-Laboratory” comes from the combined meaning of “collaborate” and “laboratory”. In spite, it can be interpreted as “collaborating laboratories”. In practice, it refers to a selected group of physical laboratories virtually co-located on the WWW via modern Internet technologies.

By its definition, a Co-Laboratory requires some existing technical units that are committed to collaborating with each other continuously and intensively to realize a

common vision. The remote interaction capabilities offered by the Internet are used to facilitate and complement traditional face-to-face and/or synchronized interactions, hence increase the frequency and bandwidth of collaboration among partners. It is important to note that the Internet-based interaction is intended to supplement and extend, rather than replace and reduce, the physical interaction.

Our chief goal is to establish the collaboration partnership, as proposed in this document, and then, based on the collaboration needs of this partnership, to implement required IT infrastructure at partner sites as one of the many means to support and enhance the interaction. In other words, our partnership programs drive the requirements of the IT infrastructure, rather than the other way around.

7. What are the scopes of the proposed collaboration?

The following steps, which collectively define the scope of the proposed collaboration, will be taken by all partners to realize Inspiring Technology and build Inspiring Products:

- Investigate various human system architectures to establish a fractal and holistic system model of human systems
- Understand how different energy interacts with human systems to define proper energy sources and interaction mechanisms
- Study means to measure human system responses to identify needed measurement functions and sensor devices
- Define the different states of human system inspiration to set the operational targets for designing inspiring products
- Set inspiring requirements for new product developments to obtain design specifications for specific inspiring products
- Develop the specific inspiring products and to proof them in the real-world through market successes

Specifically, partners will contribute their complementary strengths at academic and industrial laboratories to perform the following categories of tasks:

Research will be mainly conducted at TJU and USC, and will focus on the following three areas:

- A fractal and holistic human systems model (jointly led by USC and TJU)
- New measurement technologies and sensor devices (led by TJU)
- Innovative product development methodologies (led by USC)

Technology Transfer will take place continuously between TJU/USC and sponsoring companies by the following means:

- TJU/USC researchers will constantly provide company engineers with the latest findings on above three research areas through reports and meetings
- When research results fit well with company's technical interests, their engineers can directly participate in the research projects at TJU/USC

- TJU/USC professors will deliver technical seminars and training sessions to company engineers on subjects of interests, such as innovation methods, TRIZ, etc.

Product Prototype will be the main responsibility of company engineers, supported TJU/USC researchers, through the following means:

- TJU/USC researchers will propose “preliminary” Inspiring Product ideas ready to be prototyped for reviewing by company engineers
- Company engineers and TJU/USC professors will jointly decide on specific prototype projects based on technology feasibility and business justifications
- Company engineers will be responsible for actual prototype developments in close consultations with TJU/USC researchers
- Company engineers and TJU/USC professors will jointly evaluate the prototype results for possible next steps

Human Resource Development is another important component of this strategic collaboration, with the goal of educating and recruiting the best students in related subject areas from TJU/USC to join the workforce of sponsoring companies’ operations in China and worldwide. The following methods are proposed to meet the needs of the sponsors:

- Company will provide scholarship opportunities to a selected group of graduate students and post-docs at TJU/USC to work on research projects
- Company will provide internship opportunities to TJU/USC students during semesters and summers
- TJU/USC professors will actively assist in company promotion and student recruitments on campus
- TJU/USC professors and research staffs will provide professional consulting services to company to fulfill their specific technical needs

8. What are the specific collaboration mechanisms for this partnership?

The scopes of collaboration as specified above require close and continuous interactions among many people from different locations. These interactions can be achieved via both physical and virtual meetings.

Many face-to-face technical meetings can take place via on-site visits, arranged on an as-needed base. In addition to these site visits, we propose to host two (2) two-day meetings at TJU campus each year to report and review our results and progresses. One of these two meetings can be devoted for close-door discussions among partners; and the other meeting can be organized a Technology Open House where we introduce and showcase our results to interested outside communities. Formal arrangements and agendas will be proposed by TJU/USC and approved by sponsoring companies in advance.

Another very important component of our interaction mechanisms is virtual meetings via dedicated Internet facilities among the three sites. This will provide engineers and researchers an instantaneous and continuous means of communications around the clock

and throughout the calendar. However, some investments on tele-collaboration facilities and integrations with existing Internet facilities will be required (see below).

9. What are the resources and infrastructure requirements for this collaboration?

In addition to research, technical and administrative personnel, the infrastructure requirements for this collaboration include: laboratory space and equipments, tele-collaboration facilities, and accesses to the fast Internet. To jump-start the program, each partner is responsible for staffing its own personnel and utilizing its own physical space. The fast Internet accesses are generally available at university sites to support the required tele-collaboration facilities.

Since the company sites most likely already have modern tele-collaboration facilities, additional infrastructure investments are needed to add compatible facilities at the TJU and USC sites. These facilities may include: large-screen projectors, smart boards, Internet cameras, audio equipments, and other hardware and software to support synchronized and an-synchronized remote collaborations. With the fact that some sponsoring companies manufacture most of these facilities, they can be acquired with minimal cash expenses.

10. What are the privileges and responsibilities of the partners?

The Inspiring Technology, when properly developed and actively promoted, will have a great impact on the engineering R&D communities in the world in general, and in China in particular. Working together to initiate this collaboration, the three charter partners will be recognized for their vision, innovation, and excellence by the world and the Chinese communities at large. Especially, due to the relationship between this collaboration and the highly recognized YangTze Scholarships program organized by the Chinese Ministry of Education, the sponsoring company's participation will bring many goodwill and reorganizations by the political, academic, industry and business communities in China. TJU/USC are committed to bring these recognitions to the sponsoring companies to assist their developments in China.

Furthermore, as a chartered member of this collaboration, each partner enjoys the following unique privileges that are exclusive of other organizations:

- The first “rights-to-know” research results relate to the core concepts of Inspiring Technology
- The first “rights-to-review” potential prototyping ideas related to Inspiring Technology
- The first “rights-to-refuse” product development opportunities relate to Inspiring Technology and Product
- The first “rights-to-share” complementary research and technical expertise relate to Inspiring Technology and Product
- The first “rights-to-negotiate” all intellectual property rights (IPRs) resulted from this collaboration

- The first “rights-to-enjoy” all commercial benefits resulted from R&D of this collaboration

Specific shares of IPRs and commercial ventures will be negotiated in good faith based on specific cases according to the policies and practices of each participating partner.

In return to the rights of above privileges, each partner will make contributions to the Co-Laboratory for Inspiring Technology to support and execute this collaboration. The respective responsibilities are suggested as follows:

TJU/USC will contribute the following resources:

- \$2,000,000 RMB research fund****
- 200 square meters of laboratory space (at TJU)
- 5 faculty members (at TJU)
- 5 post-doctoral researchers (at TJU)
- 10 graduate students at the Ph.D. level (at TJU)
- 100 square meters of laboratory space (at USC)
- 2 faculty members (at USC)
- 1 visiting scholar or post-doctor (at USC)
- 4 graduate students at both Master and Ph.D. levels (at USC)

Each sponsoring company will contribute to the following resources:

- \$????? RMB matching fund to support research projects of this collaboration
- Scholarships for TJU/USC students involved with this collaboration
- Internship opportunities for TJU/USC students involved with this collaboration
- Donations of required tele-collaboration facilities (except for the Internet accesses) at TJU and USC sites
- Required time from related technical managers and staffs

11. Where can I obtain further information?

For further information about the Inspiring Technology and the Inspiring Technology research program, please visit <http://mspde.usc.edu/inspiring>

For details about how to join this strategic collaboration as a partner, please contact:

Professor Stephen C-Y. Lu, Ph.D.

Tel: 213-740-9616; Fax: 213-740-8071

Email: sclu@usc.edu; website: <http://stephenlu.usc.edu>

**** This cash support has been officially committed by the Tianjin University to support Lu’s YangTze Professorship at TJU, and will be fully utilized by this collaboration to develop the Inspiring Technology and Product.