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Hearing on China's High Technology Development
Panel 1 – China's Global Technology Competitiveness

Thank you for inviting me to present to you this morning.

The area that we have been asked to comment on today is China's Global Technology Competitiveness. This is a daunting subject to tackle in any bounded way, so I decided to summarize my thoughts on three main areas of China's competitiveness.

a. China's competitiveness relative to the outsourcing of technology jobs from the U.S., Europe and Japan to China, particularly in manufacturing.
b. China's competitiveness as it relates to creating true technology innovations and becoming a world leader in establishing technology standards.
c. China's competitiveness as it relates to access to capital, both foreign direct investment and liquidity in the local financial markets. This is absolutely critical to the achievement of real innovation.

I will address each of these in turn. First, let me provide you a brief context for my comments.

My career in the technology industry dates to 1979, and I have been fortunate to be able to establish business operations in Europe, Japan, China, India, and other countries during my career. While I lived in Japan from 1989 to 1993, I spent two years as the head of the American Electronics Association's Industry Committee. At that time, there was great concern in the U.S. technology ranks that the Japanese were going to overtake U.S. leadership in semiconductors, consumer electronics, large-scale computing, and ultimately software. Various projects such as the 5th Generation Computing Project and TRON were trumpeted with great fanfare by the Japanese ministries.

It is instructive to look at Japan, if only to understand the clear differences between the threat to U.S. competitiveness that Japan represented in 1990 and that China represents today and in the future. The Japanese threat was primarily due to an extreme level of vertical integration in huge corporations such as NEC, Hitachi, Fujitsu, Sony, Matsushita, and their excellence in driving costs down in areas such as semiconductor memory, storage devices, display screens, as well as a very large market in Japan based entirely on proprietary computer architectures. This was still a world where technology existed in "walled gardens" that a large company (IBM, Fujitsu, and DEC) could dominate vertically with proprietary systems. While this helped the large Japanese companies in Japan, it greatly limited their ability to export many of their complex products and systems.

Clearly, the Japanese did not come to dominate the world's technology landscape, although many Japanese companies today are major players in technology. The overall growth of the technology markets and their rate of change made it difficult for the Japanese companies that specialized in large-scale process manufacturing to be nimble enough to respond to market changes. As the technology

sector has become more consumer-driven and less enterprise-driven, you are now seeing the resurgence of several of the large Japanese technology providers, but again, primarily in complex process-driven market segments.

Fifteen years later, the "walled gardens" of the computer industry have largely been torn down. While there are certain technology franchises that continue to dominate a particular area (Microsoft, Intel are the classic examples), the vast majority of the rest of the technology industry now must innovate around a series of "standards" established by either standards body (IEEE), or the market (Apple's Ipod). The market today favors the nimble and the ability to take a standard and relentlessly innovate at the edge of that standard. Many of the factors that lead to the original form of outsourcing were in response to Japanese advantages in large-scale production and cost efficiencies. The next wave of outsourcing, product design and development, is driven by the dramatically reduced cycle time that a company has today to make a product profitable.

Now let's turn to China specifically.

First of all, it is important to put the rapid development that we see in China over the last 25 years in the proper historical context. There are numerous historical references to China's innovations through the centuries that I will not attempt to recreate here. Suffice it to say that the Chinese culture and society have consistently been world leaders in the creation and adoption of technology and there is absolutely no reason to believe that with unlimited access to risk and human capital this won't continue for the foreseeable future.

China's Competitiveness in Outsourcing

As it relates to the outsourcing of technology jobs, virtually all of the computers, cell phones, televisions, DVD players, tool and die equipment, and simple chemical reagents used in the U.S. are now manufactured offshore, and if it involves silicon, the odds are it is manufactured in a Chinese facility. The first wave of manufacturing outsourcing worldwide has been estimated to total over $400 billion and represents the value associated with primarily labor-intensive items. China and India have been the most talked about beneficiaries of this wave which was motivated primarily based on a country's cost competitiveness on labor and an available, talented, pool of workers. The return on equity which dominated the equation was a return on financial equity.

The many U.S. companies that have taken greatest advantage of this wave were clearly thinking initially of cost savings, many of them driven to compete with highly efficient Japanese manufacturers as mentioned above. They actually helped put into business the companies such as Flextronics, Solectron, Quanta, TSMC, among many others, as manufacturing partners. The idea was that these "partners" would focus on cost reduction and that the large brand name companies such as IBM, Compaq, HP, and Cisco would continue to create original reference designs and transfer those designs to these "partners" for manufacturing. But these partners did not stand still and were not satisfied with the low gross margins and price competitiveness of historical contract manufacturing. They began to identify other places in the value chain of the technology world where they might best add value. The answer was product design.

From Manufacturing to Design and Ultimately – Brand

Today, throughout the manufacturing plants in Szhenzen, Hangzhou, Shanghai, and Fujian, there is not only simple manufacturing, but a significant amount of real original design work. This is obvious when you look at the current key designers of laptop computers (Quanta in Taipei, Taiwan), cell phones (Cellon – China, Flextronics – China, Bird – China), digital television chips (Grace, SMIC – China), among dozens of other industries. The dollars associated with the next wave of outsourcing will be measured in trillions and will focus on skill-intensive manufacturing and return on intellectual capital. It will be marked by reducing the time to market of new products and services and even tighter integration across the supply chain.

The reasons for this should not be a major surprise. The traditional contract manufacturing companies operate at gross margins between 2 and 8%, depending on their product mix and efficiency. Design work yields gross margins between 7 and 14%, again depending on the product line and market. The migration from contract manufacturing to product design is inevitable due to the much better economics.

A couple of examples here are instructive. Quanta, a Taiwanese company, started life as a motherboard manufacturer. Over time, Quanta evolved to an integrated supplier of laptop computers, estimated to manufacture nearly 25% of the world's laptop computers. Quanta moved up the value chain into design, with over 1500 designers in Taiwan and China and plans to go to over 7000 within a few years. The laptop computer "brands" of IBM, HP, and Dell (for computers sold under the Dell label in China) are examples of the laptops that Quanta produces.

Another excellent example of a major company that those outside of the technology industry are not familiar with is Flextronics. Flextronics has evolved from a pure U.S-based contract manufacturer in the 1980s to a global force in the design and manufacture of cell phones and other high value consumer devices. Over 2000 design engineers work in the Flextronics facilities in China, designing products for companies such as Motorola, Sony, Ericsson, and Siemens. For the first time this year, Nokia has begun to outsource both design and manufacturing of a portion of its cell phone line. It is estimated that Flextronics is now the second largest manufacturer of cell phones and the third largest designer of mobile devices in the world.

What enabled these companies to so rapidly evolve into leading design houses from a base in contract manufacturing? Several key factors were critical for this, not necessarily listed in priority order:

a. An extremely aggressive focus by the Chinese government in the 1980s to establish world class technology education centers across the Chinese university system.
b. Technology markets have evolved from being driven by the enterprise to being driven by consumers (this has huge further implications for China's competitiveness that will be discussed later).
c. Technology product cycle time has decreased dramatically causing firms to release new products into the market on 9 to 12 month cycles from what was every 18 to 24 months in the 1995 time frame. This has serious implications for design efficiency and time to market of new products.

d. Standardization of products. A larger and large percentage of products in the technology sector have become standard-based products which facilitates design at the edge of a product or technology around a standardized core.
e. Increasingly sophisticated design tools. The increasing capability of CAD/CAM design tools and their ubiquity has allowed many organizations to quickly come up the curve on design. The larger branded companies have perfected design transfer to their supply chain which also facilitates the ability of new players to add value in the design process.
f. Internet. The Internet has been a powerful enabling force. China and India were able to leverage the massive telecommunications overbuild into a "free ride" on the modernization train, since the Internet broke down and eliminated many geographic barriers for human collaboration.
g. Economics. The attractive economics of moving up the value chain to design from simple packaging and assembly drove job creation and influenced government policy.

Now that you have these companies participating in the design and manufacturing phases of the value chain, the end user brand becomes primarily a marketing and sales channel organization. Again, this is where a great deal of value exists, and so it should be no surprise that we see a number of companies moving from manufacturing and design to marketing their own brands and creating their distribution channels. We have started to see the first major Chinese companies establish global brands from an initial base in contract manufacturing. Haier, the leading Chinese consumer electronics firm, is the best example. They started as an OEM manufacturer for several Japanese electronics firms, evolved into TV and DVD design, and are now marketing as a branded entity in the U.S. and Europe. They have become the world's fifth largest supplier of consumer electronics equipment from a cold start in 1984.

The major difference between China and other countries that have developed a strong contract manufacturing base is that that China itself is a large and attractive market which creates great incentive for the Chinese firms to pursue the domestic market directly. The Chinese domestic market is large enough to provide an extraordinary base for companies in the consumer market to leverage that base into a leading global competitive position. Haier is clearly doing this in consumer electronics, and Huawei is doing this in telecommunications. The acquisition of IBM's PC business by Lenovo is an excellent example of a Chinese manufacturing powerhouse now extending its brand reach overseas. This is just the tip of the iceberg.

In addition, there have been major investments by leading U.S. and European companies in China, focused not on local R&D specific to the Chinese market, but rather global R&D. Philips Electronics will have 1300 R&D staff in China by the end of 2006. General Electric will have 1200 global R&D engineers in China by the end of 2006 and another 1000 by 2008. Dow Chemical has launched a 2500 person global R&D facility in the Shanghai area for completion in 2007. In total, over 700 foreign R&D facilities exist today in China, funded primarily by the U.S., Japan, Europe, and Taiwan. These R&D centers will employ over 500,000 researchers and engineers when fully operational.

So to recap thus far, you have the following ingredients in China to foster innovation:

a. A strong history of technical innovation.
b. Excellent educational infrastructure with a heavy emphasis on technical skills (as an anecdote, Bill Gates of Microsoft will say that if you want to find the smartest people in Microsoft you have to visit Microsoft's Beijing research center).

c. A strong base of companies that grew up in a brutally competitive cost-driven market.
d. Huge financial incentives to expand in the value chain to brand from design and manufacturing.
e. Many technologies becoming more standards-based enabling greater innovation off that base and rewarding rapid time to market.
f. A domestic market that is fast growing and wealthy enough to create and sustain world class companies.
g. Chinese companies being accepted as "brands" in the technology markets worldwide.

It is worth commenting further on Education and its impact on China's increasing competitiveness. There is no end of articles detailing the high percentage of Chinese and Indian students in technical studies in U.S. universities. Many of the leading U.S. companies today would be lost without the foreign students that came to the U.S. to study and then stayed to start careers and seek their fortunes. For the first time the U.S. has real competition in being the most attractive market for those graduates to pursue their dreams. This is a profound change in how the best and the brightest graduates of the U.S. university system see their futures.

More important is the impact of the sheer numbers of talented, highly trained technical graduates leaving Chinese universities. In 2005, China will graduate over 325,000 engineers, roughly five times the number in the U.S. There are currently more than twice as many researchers in Chinese national laboratories as in the U.S. equivalent institutions.

But the educational advantages that China is leveraging are not only in the technical areas. China today has over two hundred and fifty million people paying to take English-as-a-second-language coursework, a number that is expected to grow to three hundred and fifty million people by 2008. Every Chinese student studies English from first grade through high school. It is somewhat ironic that there will be far more English-speaking people in China than in the U.S. within several years.

A comprehensive discussion on the ills of the U.S. education infrastructure is beyond the scope of this paper. However, it must be recognized that without addressing how we educate our children in the U.S. that our global competitiveness will inevitably decline, and far more rapidly than we would like to believe.

The Final Catalyst – Access to Venture Capital

There has been a great deal written about the Chinese culture and its tolerance for risk and failure, attributes that have been lauded consistently in the U.S. for the past 50 years. The U.S. has certainly benefited from this in the technology area, as initially there was no particular reason why so many breakthrough technologies were created in the U.S. instead of in Europe. However, the great flexibility of the U.S. markets, and their tolerance for risk were unique and really stood apart on the world stage. Other countries that offered this tolerance of risk such as Singapore, Taiwan, and Israel, were simply too small to have a major impact on the world's technology markets, with relatively few exceptions (such as foundries in Taiwan such as UMC, TSMC).

China is different. It is a very large country with vast intellectual resources and a middle class that by some estimates now totals over 100 million Chinese families which places it second only to the U.S. In addition, the impact of the overseas Chinese populations ability to provide capital, jobs, and inspiration,

cannot be overestimated. The educational infrastructure that has been created in the last 30 years alone is impressive. Nearly 1.2 million Chinese students applied in 2004 to take the national examination for graduate programs in China. It is estimated that over 200,000 graduate students will complete their coursework this year in China's universities.

The supply of intellectual capital combined with a huge and growing domestic market makes for an intoxicating mix. With the entry to WTO, China has also been making significant improvements to its financial markets and accounting transparency, which is enabling the final major ingredient to an explosion of innovation to come into China – Risk Capital.

Risk Capital, or Venture Capital, has been one of the U.S.'s secret weapons for several decades. Other countries have tried to create incentives for a similar capital structure, focused on the "cult of the entrepreneur" to flourish, but with very few exceptions, this has failed. It will not fail in China.

Total Venture Capital raised for investment in China will exceed $2B in 2005 representing approximately 10% of the total amount of venture capital expected to be raised this year. This does not include the additional $5 to $10 billion dollars being raised to invest in buyout funds and other forms of private equity in China. This also doesn't include the very robust amount of capital from overseas Chinese that is being transferred back into investments in China. The Venture Capital dollars will continue to increase for the next few years. To put these numbers in context, in 1995, the total Venture Capital raised for investments in U.S. companies in the technology area was approximately $10B. We expect to see the investment level of venture capital funds for China reach 1995 U.S. levels within 10 years. Venture Capital has funded many of the innovative technologies that we take for granted today. Intel, Cisco, Apple, Microsoft, Oracle, PeopleSoft, Juniper, Qualcomm, Yahoo, Google, AOL, Verisign, Network Appliance, and Broadcom would not exist without venture capital financing. The external source of capital and the internal granting of ownership through stock options in these companies is what have attracted the best and brightest in U.S. industry to the technology sector during the past 30 years.

This money is now being targeted toward creating the next generation of great Chinese companies, using U.S. pension and endowment dollars. Over 300 U.S. venture capitalists visited China in 2004, and over 100 investments have been made by U.S. venture firms in Chinese companies (mostly through offshore entities) in the last two years. The "China story" has been well accepted by the U.S. capital markets with 20% of the NASDAQ IPOs last year being Chinese companies. However, now many Chinese companies are considering initial listings on the Hong Kong or Shanghai Stock Exchanges. This is another area that is beyond the scope of this paper to thoroughly discuss, but there are significant implications for the U.S. capital markets should a credible alternative to the NYSE and NASDAQ emerges in China.

This does not mean to imply that it is either easy to raise money to invest in China at this time, or to successfully deploy the capital into local Chinese companies. What the capital flows do reflect is a growing appreciation for China's ability to innovate at a global level and increasing comfort with both the financial risk in the market and the execution risk of the business. The financial risk is being mitigated by the efforts of the Chinese government, and the execution risk by the large number of Chinese returning from overseas to either start companies or join the management of existing Chinese companies. This now numbers in the thousands of highly experienced Chinese executives each year.

It is my opinion that China must be encouraged to continue to make reforms and move toward being full member in word and action of the global technology market. We have to acknowledge that given the size of the domestic Chinese market that they will want to have a say in establishing standards for that market. We should expect this and simultaneously encourage their participation in standards bodies around the world. We can also expect over time for the Chinese to have greater appreciation and adherence to intellectual property laws as they begin to create their own proprietary intellectual property and their local entrepreneurs push the government to enforce the laws.

In summary, China sits at the first table of the world's innovators today. The combination of the market opportunity, the education system and extremely talented and well-trained work force, and the emerging access to virtually unlimited venture capital and private equity dollars, guarantees that China will become a major innovative force in the global economy.

Thank you again for the opportunity to present to this panel.