



**Testimony of**

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**To**

**The U.S.-China Economic Security Review Commission**

**On**

**Offshoring of Software & High Technology Jobs**

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I'd like to begin by thanking Commissioners Ellsworth and Becker for inviting me and the IEEE-USA to testify before the Commission to testify on the subject of offshoring of software and high technology jobs — an increasingly important issue with serious implications for individual Americans, the future economic and technological competitiveness of the United States and its security.

My name is Ron Hira and I am an Assistant Professor of Public Policy at Rochester Institute of Technology. I am testifying today on behalf of the Institute of Electrical and Electronics Engineers – United States of America (IEEE-USA). I am currently the Vice President for Career

Activities of IEEE-USA's and have previously served as Chair of its R&D Policy Committee and Career and Workforce Policy Committees.

The Institute of Electrical and Electronics Engineers (IEEE) is a transnational technical and professional society made up of more than 380,000 individual members in 150 countries. The IEEE's primary purposes are to advance the theory and practice of electrical, electronics, computer and software engineering, improve the careers of our members and increase their ability to innovate and create wealth for the benefit of the societies in which they live and work.

IEEE-USA was established in 1973 to promote the professional careers and technology policy interests of IEEE's 225,000 U.S. members.

Seventy percent of IEEE-USA's members work for private businesses, primarily in the aerospace and defense, bio-medical technology, computers and communications, electrical and electronics equipment manufacturing and electric power industries. Thirty percent of these industry members work for firms with 500 or fewer employees. Ten percent of our members work for Federal, state and local governments. Another ten percent teach at American schools of engineering or work at non-profit research organizations. The remaining ten percent are self-employed and work as consultants to businesses and government.

### **Offshore Outsourcing And Offshoring Of Technology Jobs Is Having A Significant Impact On The US Workforce**

I applaud the Commission's efforts at estimating the number of jobs that have been offshored. The commissioned paper by Professors Bronfenbrenner and Luce was an important contribution to the public discussion. Nevertheless, no one nor organization has reliable figures on exactly how many information technology and engineering jobs have moved offshore but its negative impacts on the US technology labor market are already observable. Some of these effects include job displacement, wage depression, and discouraging young people from studying these disciplines in universities.

US electrical and electronics engineers and computer scientists have experienced higher levels of unemployment over the past four years compared to any similar time-span since IEEE-USA was established. In 2003, for the first time in history, the unemployment rate for electrical and electronics engineers exceeded the national average. There are many reasons for the persistently high levels of unemployment for our nation's innovators, including the dot-com and telecom busts and the general business climate against hiring, as well as others. However, it is apparent that offshoring is a significant and growing cause of low demand for US high technology workers. While hiring seems to have picked up in 2004, it was not robust enough to offset the losses in previous years.

The poor labor market for electrical and electronics engineers and computer scientists is also causing wage depression. For the first time in the 31 years that IEEE-USA has been surveying our members, compensation actually *declined* in 2003.

Lastly, the poor labor market has caused young people to shy away from technology disciplines such as computer science in significant numbers. The Computing Research Association's Taulbee Survey found a more than 20% drop in BS degree enrollments in computer science programs across the country. Even at top schools like MIT, the drop in electrical engineering and computer science enrollments was 33% over a two year time-span. Students are responding in a rationally.

All of these developments are alarming, but they should not be surprising because they match what we would expect to find when high-skill jobs are offshored.

### **Offshoring's Effects Are Alarming But Not Surprising**

Many economists believe that the amount of offshoring has little or no effect on the overall number of US jobs and the unemployment rate, at least in the medium run. They use a full employment model, so they assume that the US labor market clears eventually. However, most economists agree that offshoring causes the following: 1) job displacement for US workers; 2) a change in the mix of US occupations; and, 3) wage pressure for US jobs that are now tradable across borders.

There is little disagreement that some US workers will lose their jobs as their work shifts overseas. The *hope* is that displaced workers will be reemployed rapidly and at substantially the same wages. It appears that this process, sometimes called 'adjustment', is not happening rapidly, or not at all, for thousands of displaced technology workers. The reason seems to be the unusually low levels of job creation in the economy over the past few years. Many have called our most recent recovery from recession, a job-less one. Unfortunately, there are few good explanations for why the recovery has not generated the number of jobs we would expect. Some have said that it is due to productivity increases, but that explanation is simply a tautology.

The latest Bureau of Labor Statistics' Displaced Worker Survey, released in January 2004, provides us some insight into the reemployment rates for workers. For workers who were displaced between 2001-2003, it shows that 35% were unemployed in January 2004, and of the 65% who were employed, only 43% earned at least as much as they did before displacement. So, the empirical data do not support the economists' hope that displaced workers will be reemployed rapidly and at substantially the same wages.

These results are mostly consistent with longer term results from the displaced worker surveys conducted from 1979 onwards. A large share of displaced workers remain unemployed for extended periods of time, and even for those lucky enough to find work many take substantial pay cuts.

The second effect that economists predict is offshoring will cause a change in the mix of US occupations as some jobs migrate to more efficient (i.e., lower cost labor) locations. As the US loses its engineering and other high skill jobs to more efficient locations, Americans will simply move into other occupations. However, there is no guarantee that the new blend of US occupations will be better after offshoring. In fact, no economist is able to explain the types of new jobs that will be created. Most, including Federal Reserve Chairman Alan Greenspan, have

only given vague answers about the jobs of the future needing higher skills. If we relinquish our engineering and computer programming jobs, will we be able to replace them with better jobs? This is a key policy question that no one can answer.

It is also a very practical question that I get asked at nearly every IEEE meeting I attend. Invariably, someone asks, “What new job should I be training for? What skill sets do I need?” Unfortunately, I have no good answer for them, and I have yet to find a good one from anyone else.

The third predicted effect is wage depression in jobs that are now tradable across borders. As I mentioned earlier, these are already apparent in the IEEE-USA latest surveys.

All of these effects, plus the lack of reliable data, are understandably creating a high degree of insecurity amongst US technology workers.

At the macroeconomic level, there is an on-going debate amongst economists whether offshoring is good for America. Nobel Laureate, Professor Paul Samuelson’s recent article in the Journal of Economic Perspectives points out the very plausible situations where offshoring can actually make America worse off. Drs. Ralph Gomory and William Baumol quantified when these situations occur in their 2001 book, “Global Trade and Conflicting National Interest.” So contrary to the conventional wisdom, more trade does not guarantee a better outcome for America.

Keep in mind that these models are generally developed around simplifying assumptions. For example, they use two- or three-goods models and a limited number of trading partners. They do not explicitly take into account technological innovation and more importantly national security of offshoring.

### **The Types Of Jobs Moving Offshore Are Increasing In Scale And Scope And Up The Skill Ladder**

Some have argued that only low level jobs are moving overseas. As one major news magazine put it, why should the US be concerned if ‘mind-numbing’ computer coding moves offshore. They argue that it simply frees up American workers to do more interesting tasks. This may comfort some, but the empirical evidence does not support the notion that only low level tasks are moving offshore.

It is clear that high-level engineering design has begun to move offshore. Many top technology firms, such as Microsoft, Intel, Google and others, have created research & development centers in low-cost countries. Venture capital firms, what some consider the lifeblood of future innovation, are increasingly asking the firms they fund to offshore as much as possible. I participated on the keynote plenary panel discussion in Silicon Valley at last summer’s IEEE Hot Chips conference, a conference that brings together designers of the most advanced integrated circuits. Offshoring is an important enough issue even for the most advanced electronics designers to have it as a special event at their annual conference. On the panel with me were two venture capitalists, Carl Everett from Accel Partners and Vinod Dham from NewPath Ventures,

both of whom said that they were pressing the start-up firms they fund, firms that design advanced electronics, to offshore as much work as possible. Another method for assessing the types of jobs moving offshore is by searching the job openings posted on the websites of major technology corporations such as Intel and Oracle. It shows a number of high level engineering openings at their Chinese operations. Many of these openings require advanced degrees and experience.

We are also seeing high-level non-engineering support functions move offshore. Professors Martin Kenney and Rafiq Dossani completed a revealing case study of a major US high-technology firm. The firm began to move some of its financial operations to its office in Bangalore in 2001, and it was so successful that they eventually made the office the headquarters for many finance functions serving the companies offices around the world. Many of these functions are require the highest skill levels. In their study, Kenney and Dossani found that moving the function to Bangalore reduced costs, reduced headcount and improved quality. Plus, they found that the company was able to ramp up the offshore process much more rapidly than they had even planned.

There is no doubt that there will be failures along the way, but it is clear that the overwhelming trend is for work to move offshore.

### **The Offshore Outsourcing Companies Are Not Small Players, They Are Market Leaders**

I have compared the financial reports for major IT services companies, and the results are striking. A summary table is included at the end of this testimony. It shows that two of the major Indian IT services companies, Infosys and Wipro, have market valuations that are higher than any other US based company, including Electronic Data Systems (EDS), Computer Sciences Corporation, and Affiliated Computer Services. For example, in 2003, EDS had \$21 billion in revenue and about a \$9 billion market valuation. Infosys had only \$1 billion in revenue but a \$12 billion market valuation.

The Indian IT offshore outsourcers are not small players, they are the market leaders. And they are growing rapidly. Infosys added as many employees in the last quarter, approximately 5,000, as it did in all of the previous fiscal year. It is not unusual to see reports of plans to double staffs. It is not simply coincidence that the IT job market in India is red hot, while the US market languishes. Many of the jobs being filled in India are substituting for US workers.

The Indian IT companies are able to earn significantly higher profit margins than their US counterparts, and therefore command higher price-to-sales and price-to-earnings ratios. The Indian firms have higher profit margins because: 1) they are using a higher proportion of offshore labor, 2) tax incentives provided by the Indian government, and 3) lax US government guest-worker visa programs that are exploited by the companies.

The profit margins on work that is performed offshore are higher, and since the Indian companies have a larger share of their staff located overseas, the earn higher profit margins than their US counterparts.

Adding to the profit margins, are Indian government tax holidays on any software or Business Process Outsourcing (BPO) export. This is apparent in the effective tax rates for Infosys and Wipro, which were between 13% and 14%, while most US companies had tax rates of approximately 35%.

Lastly, US government guest-worker visa policies have been helping Indian IT firms win business. The two primary visa programs being exploited are the H-1B and L-1.

The Indian IT firms use the H-1B and L-1 visa programs as a key part of their business model. The vast majority of their employees in the US are on one of these two work permits. They hire very few American citizens or permanent residents.

Conceptually, the H-1B visa program is designed to allow companies to hire foreign workers when American workers cannot be found with the necessary skills. In reality, they do not first have to see an American worker and can prefer a worker on an H-1B. The L-1 visa program was designed to allow companies to transfer workers with management roles or highly specialized knowledge from one branch of their company, located outside of the US, to an American facility. Both programs are being used in ways not intended by Congress. It is not just an issue of displacing US high-tech workers with H-1B and L-1 foreign workers with similar skills and at lower wages, the H-1B and L-1 programs are actually facilitating the export of US jobs and innovation.

Through these programs, enterprising foreign workers are brought into the US where they are trained by some of the best companies in the world and gain valuable experience and business contacts in their field. Then many of them go home to establish or work for new entrepreneurial businesses that compete in the US market. Former H-1B and L-1 employees have significantly enhanced the competitiveness of India's IT services industry, for example. Moreover, as confirmed in a recent study by Hal Salzman of the Center for Industrial Competitiveness at the University of Massachusetts, H-1B workers are being hired specifically to help offshore companies liaison contracts within the US.

IEEE-USA would be pleased to work with industry in support of balanced reforms of the permanent immigration system. But so far the only immigration reform that industry has advanced is to expand the H-1b visa caps and exceptions, while also working to limit both H-1B and L-1 visa workforce protections. H-1B and L-1 visas may help employers find low-cost workers, but they do so in a manner that is unfair to both American and foreign workers. They are, in effect, a subsidy promoting the movement of American jobs overseas. Moreover, they undermine efforts to entice American students to embark on careers in engineering or the sciences by dimming the students' chances of finding and retaining technical jobs whose rewards are commensurate with opportunities in other employment sectors.

Due to their relatively low profit margins, US-based companies such as EDS and CSC, are being forced to adopt the market leaders' business models. For example, EDS announced they were moving 20,000 jobs from high-cost to low-cost countries.

Indian IT firms, concerned about the entry of even lower cost providers from China, are setting up operations there.

### **Companies Are Acting Rationally, But So Are Workers**

By offshoring, company executives are pursuing what they believe is in the best interest of their shareholders. They believe that offshoring will improve their profits by cutting costs.

They should not be vilified for doing offshoring, since it is what they are expected to do. On the other hand, workers too are acting rationally by voicing their concerns about how offshoring will affect their livelihoods.

But as I said earlier, even mainstream economists agree that offshoring does not guarantee that the US will be better off. What is good for companies' bottom lines may not necessarily be good for America. We should be focused on designing policies that ensure the very best outcome for America.

Unfortunately, the offshore outsourcing of high-skill jobs has a number of characteristics that make it hard to compensate those who are adversely affected:

1. It is often difficult to directly identify workers who have been displaced, many of whom may not even know that they have been displaced because of trade. Companies are increasingly reluctant to reveal their plans for fear of the bad publicity that will result. Many workers are too intimidated to publicly identify themselves. They fear losing the severance package offered by their employers or that they will be blacklisted if they speak out.
2. Even if we could identify those who have been adversely affected by trade, it is not clear how we should compensate them. Do we offer subsidized re-training in some other profession?
3. Re-training and other types of assistance programs are very difficult to implement. Is it realistic to expect an electrical engineer with 20 years of experience to spend four years studying to become a nurse?

In sum, we think it is entirely misleading to describe offshore outsourcing as a "Win-Win" proposition for America and other countries, as free trade advocates so often do. The burden should be placed on those advocates to demonstrate how workers who have been adversely affected will be compensated and helped to become productive citizens once again.

These advocates assume, as part of their argument, that displaced American workers will be re-deployed. Instead of assuming, we should ensure that such workers are redeployed in equally high skill and highly paid positions.

### **The Importance Of Standards In Information Technology**

The commissioners asked me to address the issue of software standards and R&D. Software makers and programmers have long understood the critical role that standards play in the information technology industries. The software industry is characterized by:

- ❖ network externalities – as more users adopt a particular technology, the payoff rises exponentially,
- ❖ high switching costs – it is very expensive for a user to switch from technology to another. This encourages lock-in to a particular technology and creates a high barrier of entry for competitors
- ❖ economies of scale –allows others to build innovative parts on top of the standards. Standard interfaces enable interchangeability.

For all of these reasons, standard setting is often a contentious issue. Proprietary standards that are widely adopted can enable a company to gain and more importantly sustain a competitive advantage, excluding competitors. It can also enable the company with the standard a competitive advantage in the value-added products and services that are built on top of the standard.

Maintaining leadership in software is not only important in its own right, but also because software has become the heart of R&D. I recently wrote an article on R&D trends for IEEE Spectrum. In our interviews with top R&D managers, my co-author, Harry Goldstein, and I found managers saying that they are software is taking up an ever larger chunk of development budgets and is the key for product differentiation. For example, Swedish telecommunications giant LM Ericsson spends about 85 percent of its R&D budget on software. The US needs the very best software engineers to grow the information technology industry but also for every other major technology sector.

### **Technological Innovation, Economic Growth and National Security Implications**

America's economic competitiveness and national security is increasingly dependent on the superiority of our technology and technical know-how. There is a widespread belief -- almost a blind faith among policy makers -- that as communications, semiconductor manufacturing, electronic devices and other key technological capabilities are off-loaded to other countries, the United States will just move on to the next field, to the next "big thing."

Many observers, including government officials, argue that the next "big thing" is going to be nanotechnology, and that nanotechnology is going to generate enormous economic benefits and create many new jobs. We can only speculate on the impact that nanotechnology will have on the economy and jobs, and hope that it will be significant as some predict. However, we should not be complacent. As a nation, we are not alone in our pursuit of the frontiers of nanotechnology. China is currently the second largest producer of technical papers in nanoscience and nanotechnology, even ahead of Japan. With great cost advantages in addition to this advanced technical knowledge, we should anticipate that China will compete strongly for new nanotechnology jobs and manufacturing opportunities. China has also been increasing its science and engineering human capital at all levels, especially with a rapid increase in the number of Doctorate holders.

History tells us that technological catch-up can happen much faster than expected. Whether it was the Russia and China gaining Atomic capabilities very soon after us or the Russians beating us to space with Sputnik. We are not guaranteed our technological lead.

U.S. manufacturing has also been hit hard by offshore outsourcing. This has important and serious consequences for US engineers and for technological innovation, economic growth and national security. Some wonder whether manufacturing matters very much since it only accounts for about 13% of the Gross Domestic Product. However, from a technological innovation point of view, manufacturing matters greatly. According to my recent calculations, As of 2003 nearly 41% of American engineers work in the manufacturing. According to the National Science Foundation, the manufacturing sector accounts for a disproportionately high, 62%, of all research and development (R&D) in the US. With, the prevailing management approach to locate R&D as close to manufacturing production as possible, it is inevitable that as manufacturing moves overseas, both engineering work and R&D will follow.

More than a year ago, I dubbed the dialogue on offshore outsourcing as the *New Competitiveness Debate* because I think there are many lessons to be learned from the manufacturing competitiveness debate of the 1980s. The most important one is that it takes time and creativity to generate policy responses. There were many significant policy changes that improved the competitive position of the US including the creation of the Technology Administration. Many of the ideas came from the state and local levels, what policy academics often call the “laboratories of innovation.” Some might even be called protectionist, like voluntary quotas in the steel, automobile *and* semiconductor industries.

The key difference between the New Competitiveness Debate and the one in the 1980’s is that workers are being adversely affected *rather* than companies. That changes the feasible region and constraints on potential practical and politically palatable solutions, and I suspect makes it much more difficult to move forward. Many companies will succeed by substituting foreign for US labor.

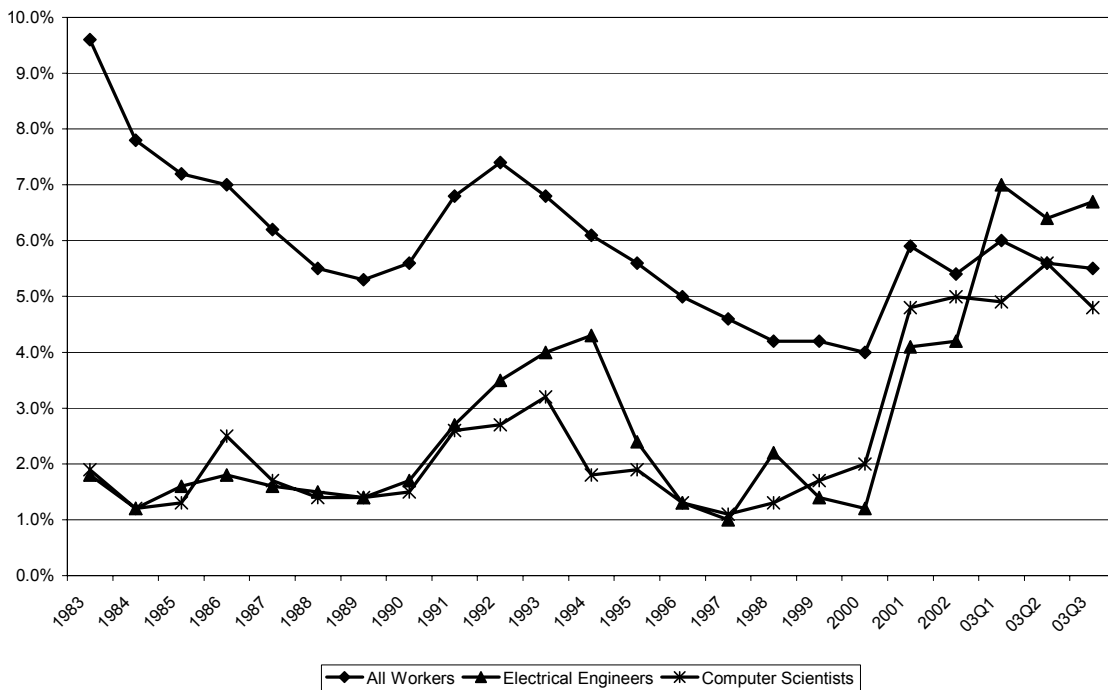
### **Policy Recommendations**

The economic and employment challenges we will face caused by offshoring are complex. There are no easy answers or silver bullets in terms of public policy recommendations. However, there are some practical and immediate steps that we can take.

1. The federal government must begin regularly tracking the volume and nature of the jobs that are moving offshore. We are pleased that Congressman Wolf earmarked a \$2 million study in last year’s omnibus spending bill. This should be viewed as one step though, and more agencies should follow. ***We also commend Sen. Joseph Lieberman for his report "Data Dearth in Offshoring Outsourcing: Policymaking Requires Facts", which is available on-line at (<http://lieberman.senate.gov/newsroom/whitepapers/Offshoredata.pdf>).***
2. Companies should be required to give adequate notice of their intentions to move work offshore so that the displaced employees can make appropriate plans to minimize the financial hardship, and government support agencies can prepare to provide the necessary transition assistance.

3. Congress should rethink how U.S. workforce assistance programs can be designed to help displaced high-tech workers become productive again. We are in a new era of work and lifelong learning, and new and more flexible methods are needed to provide meaningful assistance.
4. Congress should strengthen H-1B and L-1 workforce protections and their enforcement to ensure that the programs serve their respective purposes without adversely affecting employment opportunities for U.S. high-tech workers.
5. Fundamental changes in U.S. immigration law, such as those incorporated in the recent Chile and Singapore Free Trade Agreements, should be made by Congress, and not by trade negotiators.
6. Congress should take affirmative steps to ensure that the U.S. retains the domestic human resource and production capabilities needed to develop and utilize technologies deemed critical to U.S. national and homeland security.
7. As globalization narrows U.S. technology leadership, the Department of Defense and other government security agencies will need to enhance their ability to acquire and assimilate foreign technologies.
8. The U.S. needs a coordinated national strategy designed to sustain its technological leadership and promote job creation in response to the concerted strategies being used by other countries to attract U.S. industries and jobs. Senator Lieberman's proposal to create a Presidential Commission on the implications of outsourcing is a step in the right direction.

**Unemployment Rates for Selected Occupations: 1983 - Present**



**Source: IEEE-USA from Bureau of Labor Statistics**

Name	Country	Market Capitalization (US\$millions)	Trailing Twelve Months Sales \$	Price to Sales	Sales Growth % 1 Year	Net Profit Margin 5 Yr Avg %	Effective Tax Rate 5 Yr Avg
Infosys Technologies Limited (ADR)	India	\$12,135	\$1,164	10.42	40.96	28.7	14.01
Wipro Limited (ADR)	India	\$10,512	\$1,395	7.53	36.37	19.5	13.42
Electronic Data Systems	US	\$8,633	\$21,834	0.40	0.55	3.6	35.87
Computer Sciences Corporation	US	\$8,107	\$14,949	0.54	30.15	3.4	30.55
Affiliated Computer Services	US	\$6,404	\$4,106	1.56	8.43	8.2	38.64
Cognizant Technology Solutions	US	\$3,215	\$465	6.92	60.74	13.7	31.23
Satyam Computer (ADR)	India	\$2,892	\$620	4.67	23.34	2.7	14.02
Perot Systems Corp.	US	\$1,431	\$1,618	0.88	9.65	4.2	54.37

**Source: Reuters News Services Retrieved August 29<sup>th</sup>, 2004**