

APPENDIX T
November 1, 2000

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MEMORANDUM

Subject: Contribution of Small High Tech Firms to *The New Economy*

The New Economy as the Dominant Sector of the U.S. GDP.

The decade of the 1990s has seen the rapid growth of the high-technology sector on all fronts:

- Internet-dot com companies from B2C to B2B to portals to personal home pages
- Wireless telecommunications—with digital clarity, Internet and global links
- Personal computers—with scanners, camera, color printers and wireless links
- Shrink-wrap software—from office suites to games to specialized business tools
- Installed computers—from servers to networked business systems to supercomputers
- Embedded microprocessors and computers—from automobiles to home appliances to PDAs with wireless capability to intelligent factory robots
- Satellite communication—from TV dishes to global instant telecommunications
- Biotech—from genetic mapping to new life-saving products
- Medical devices—from non-invasive diabetes monitors to life-saving implants
- Materials—from “smart skins” for aircraft to improved fire-proof home insulation
- Environmental—from improved emission control systems to “brownfield” mitigation bacteria.
- Energy—from biomass co-generation plants to automated windmill generators to smarter, energy-efficient appliances
- Entertainment—from personal and networked computer/Internet games to CD-ROMs to DVDs to 3-D vision systems to streaming video Internet programs to 400 channels of TV to digital video cameras and editing systems for consumers.

As impressive as these new technologies are to the users, to the economists they provide a major shift in our economy. Many economists credit the high-tech sector with significant improvements in productivity which are permeating all industries and which are supporting the longest sustained economic growth period in our nation’s history.

Certainly, in their own industry sectors, the high-tech businesses have created remarkable growth, as shown by the following:

- The growth of the high-tech industries has outstripped the traditional industries in the U.S. economy. In 1999, the U.S. electronics, computer and software industries employed 5.0 million workers, compared to 2.6 million in the automobile and related industries (manufacturing, distribution and marketing, after-market, repair and services sectors, and rental), and 1.0 million in the chemicals industry. The high-tech

industries grew from 3.77 million employees in 1993 to 4.99 million employees in 1999, with most of this growth (1.13 million employees) in the services areas (IT and software and computer-related services).¹

- In the information technology area the growth of new, small companies providing software services and products has been explosive in the past decade. In 1997, there were 231,000 establishments in the new high-tech (computer programming, data processing and other computer-related services industries). This is more than three times greater than the Census Bureau's reported number of these establishments in 1994. These firms employed 2.2 million people and their addition to the GDP was \$134 billion. This industry is dominated by small firms, with the average employment less than five. Eighty percent of these firms had less than \$2 million in annual revenue.²
- The growth of the Information Technology sector has been remarkable in the recent past. In 1992, Information Technology employment represented just 2.92 percent of total U.S. employment, but accounted for 5.54 percent of total employment growth between 1992 and 1996. In recent years, this growth has been even higher, with the IT industries accounting for 11.57 percent of total employment growth between 1995 and 1996. In 1992, the IT sector employment was 39,095, and this grew to 518,525 in 1996, with all but 144,810 of that employment coming from small businesses.³
- The biotech industry grew from 79,000 employees in 1993 to 153,000 employees in 1999, with revenue increasing from \$8.1 billion to \$18.6 billion respectively.⁴
- In some regions of the country, the growth of the high-tech sectors dominated the traditional sectors. For example, in San Diego, the payroll of the high-tech (electronics, computers, wireless communications, Internet, biotech and life-sciences) industries grew from \$4.9 billion to \$8.6 billion over the period of 1990 to 1998 (a growth of \$3.7 billion), whereas the traditionally dominate visitor, agricultural and health services industries grew by only \$419 million, while the defense sector shrank by \$662 million.⁵ Similar growth has been observed in New York, Silicon Valley, the Route 128 area of Boston, Austin, Texas, and other high-tech regions.

¹ *Cyberstates, 4.0: U.S. High-Tech Employment, Appendix A.1*, 2000. AeA, 601 Pennsylvania Avenue, North Building, Suite 600, Washington, DC. 20004

² *The New High-Tech Entrepreneurs*, page 4, 1998. Nathan Associates, Inc., 2101 Wilson Blvd, Suite 1200, Arlington, VA 22210.

³ *Establishment Employment Change and Survival, 1992-1996, with Special Focus on Information Technology Industries*, Table 1(a), page 6, February 2000. Final Report prepared by Dr. Richard J. Boden, Jr., for the Office of Advocacy, U.S. Small Business Administration, Washington, DC 20416.

⁴ *Annual Biotechnology Industry Reports, 1993-1999*. Ernst & Young, LLP, New York.

⁵ *Developing High-Technology Communities: San Diego*, April 2000. Report by Innovation Associates, Inc., under contract to the Office of Advocacy, U.S. Small Business Administration, Washington, DC 20416.

The Contribution of Small Businesses to the Technology Growth.

A major shift occurred in the past two decades—small businesses became the dominant employer of high-tech innovators. The small business share of scientists and engineers has steadily increased as large businesses have downsized and reduced their investments in corporate research laboratories. The most recent data from the National Science Foundation shows that small businesses now employ more degreed scientists and engineers than large businesses, and more than the universities and federal labs combined.⁶ The 1995 employment data is shown in Table 1.

Table 1. Employment of degreed scientists and engineers in U.S.

<u>Organization</u>	<u>Percent Degreed Scientists and Engineers</u>
Small Businesses (< 500)	36 percent
Large Businesses (>500)	32 percent
Academic Institutions	18 percent
Government Laboratories	14 percent

This shift of research talent from large businesses and federal laboratories has been a result of at least two factors: 1) the downsizing of large firms to remain competitive in the global market, and 2) the entrepreneurial nature of the small innovative firms with focused research programs, stock option incentives to researchers, and availability of venture capital.⁷

Small businesses have always been major contributors to the innovation process since the founding of our country. The entrepreneurial spirit, coupled with strong patent laws, have made the U.S. the envy of the world in our ability to bring innovation to the marketplace. A 1995 report by the National Academy of Engineering provided valuable insights into the marketplace breakthroughs brought about by small companies. The report states:

“The principal economic function of small entrepreneurial high-tech companies is to probe, explore, and sometimes develop the frontiers of the U.S. economy—products, services, technologies, markets—in search of unrecognized and otherwise ignored opportunities for economic growth and development.”⁸

⁶ From NSF Internet web site at <http://srsstats.sbe.nsf.gov/>.

⁷ *A New View Of Government, University and Industry Partnerships*, Page 9, 2000. Office of Advocacy, U.S. Small Business Administration, Washington, DC 20416.

⁸ *Risk and Innovation: The Role and Importance of Small High-tech Companies in the U.S. Economy*, page 39, 1995. National Academy of Engineering Press, Washington, DC.

This report focused on the “chaos” created in the marketplace by new companies. History has shown us that large companies with entrenched market positions tend to resist major market changes (from Western Union bypassing the telephone, to the introduction of the personal computers by small startups). Small companies bring new products and services to the “early adopters” in markets, and test the market potential for innovations. Generally, these new innovations are subsequently brought to the mass markets by the larger companies, through acquisition of the small companies, licensing of the technologies, and/or further research and development of the products.

Past research from the Office of Advocacy documents the innovation productivity of small business is high as reported by the Office of Economic Research, Office of Advocacy, U.S. Small Business in the *1994 President’s Report on the State of Small Business*, Chapter 3, Innovation by Small Firms:⁹

- Small firms produce 55 percent of innovations. Small firms produce twice as many product innovations per employee as large firms, including the employees of firms that do not innovate. This is also true of significant innovations.
- Small firms obtain more patents per sales dollar, even though large firms are more likely to patent a discovery, implying that small firms have more discoveries.
- Large firms receive 26 percent of their research and development dollars from the federal government and are more dependent on federal R&D dollars than small firms, which receive only 11 percent of their R&D funds from the federal government.
- A federal R&D dollar to a small firm is more than four times as likely to be used for basic research as a federal R&D dollar to a large firm.
- The rate of return on R&D expenditures is 26 percent for both small and large firms, but only 14 percent for firms not involved with a university. The estimated rates of return on total R&D for firms with a university relationship are 30 percent for large firms and 44 percent for small firms.
- Among the important innovations by U.S. small firms in the 20th century are the airplane, audio tape recorder, double-knit fabric, fiber optic examining equipment, heart valve, optical scanner, pacemaker, personal computer, soft contact lenses, the zipper, and digital wireless communication.

Future Challenges for the Office of Advocacy in the New Economy.

The only certainty about the New Economy is that it will bring change. And that change will involve new and unforeseen regulatory issues in a variety of federal agencies. Further, most of those regulations will impact small businesses and the ability of small

⁹ For more details, see the Office of Advocacy’s Internet home page at: <http://www.sba.gov/ADVO/stats/fact1.html>

high-tech businesses to bring these new innovations to the marketplace. The related certainty is that small, high-tech companies do not have adequate representation in Washington to ensure that their voice is heard on issues of importance to them. It is therefore, incumbent upon the future of the Office of Advocacy to anticipate that the requirement for technological competence will grow. The Office of Advocacy has often been the early warning system to alert the small, high-tech companies that new legislation and/or regulations are on the horizon.